D2.5 – Ex-Ante Pilot Audits and Pilot Deployment Plan

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Executive Summary

The present document is the Deliverable D2.5 entitled as "*Ex-Ante Pilot Audits and Pilot Deployment Plan*" of the BEYOND project. The document presents all the available information concerning the description of the demo landscape and their assets, the available datasets to be utilized in the project demonstration activities and the deployment planning so far, for each one of the four demos (the Greek, the Spanish, the Finnish and the Serbian). The depicted information can act as a baseline for the development of the use cases to be demonstrated in the BEYOND pilots.

The BEYOND partners responsible for the demonstration activities were asked to provide information regarding:

- The description of the demo cases to be delivered in WP7 named "*Demonstration and Impact Assessment*";
- Information about the demo sites including a listing of the available demo assets (hardware and software);
- Information on the retail, network and the city generally, based on the pilots that are to be developed and assessed in each demo;
- An exhaustive listing of the available datasets per demo involving a variety of useful specifications regarding specific features, the level of availability and IPR issues;
- An initial pilot assessment and deployment plan which will be further analysed during the WP7 activities.

The deliverable takes into account the individual characteristics of each demo and, in correlation with D2.1 named as "*End-user & Business requirements analysis for big data-driven innovative services & ecosystems – a*" as well as the system architecture described in D2.6 named as "*BEYOND Framework Architecture including functional, technical and communication specifications*", they can present a concrete description of the BEYOND solutions to be deployed, tested and assessed during the project activities.

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List of Acronyms

Acronym	Full term
BEMS	Building Energy Management System
DR	Demand response
IPR	Intellectual Property Rights
ESCO	Energy Service Company
DSO	Distribution System Operator
EV	Electric Vehicle
VPP	Virtual Power Plant
EPC	Energy Performance Contract
IoT	Internet of Things
DHW	Domestic Hot Water
G2V	Grid to Vehicle
PV	Photovoltaic
SCADA	Supervisory Control and Data Acquisition
RES	Renewable Energy Sources
HV/MV/LV	High/Medium/Low Voltage
GIS	Geographic Information System
CRM	Customer Relationship Management
DER	Distributed Energy Resource
HEMS	Home Energy Management System
SRI	Smartness Readiness Indicator
eDEC	Enhanced Display Energy Certificate
IAQ	Indoor Air Quality
API	Application Programming Interface
SECAP	Sustainable Energy and Climate Action Plan
MQTT	Message Queuing Telemetry Transport
VOC	Volatile Organic Compounds

1 Introduction

1.1 Scope and objectives of the deliverable

The present document aims to provide a preliminary but articulated view of all the BEYOND demos. It involves the demo survey conducted for each pilot before the deployment, in order to list all the available assets for the realization of the project demonstrations. To be more specific, the purpose is to involve description of the demo cases for each demo, as well as descriptions of the demo regions and buildings, the available hardware and software, a background of the local retails and networks, and more importantly, the availability and landscaping of the datasets that are to be utilized in the project activities.

The objective of this activity is to kick-off the activities of structuring each pilot's deployment, in order to have an early overview of possible barriers and enablers that could be taken into account in the set up of the project Use Cases and requirements that was performed in parallel.

1.2 Structure of the deliverable

The document involves the following contents:

- Chapter 1 is introductory and involves, the scope and structure of the deliverable, as well as its relation to other Tasks.
- Chapter 2 describes the methodology that was followed for the collection of the information for each demo.
- Chapter 3 contains the information regarding the Greek demo.
- Chapter 4 contains the information regarding the Spanish demo.
- Chapter 5 contains the information regarding the Finnish demo.
- Chapter 6 contains the information regarding the Serbian demo.
- Chapter 7 includes the validation activities and the deployment planning
- Chapter 8 includes a summary of the task activities as well as any conclusions derived.
- The ANNEX consists of a table with all the information related to the available datasets for each demo.

Chapters 3-6, as mentioned, include all the available information for each demo, and specifically:

- A description of the demo cases that will be tested in each demo;
- The needs and opportunities to be served by the BEYOND solution;
- A brief description of the demonstration area;
- A more detailed description of the demo site;

- The key technical components (hardware and software);
- Information concerning the city, the retail or the network according to the selection of the demo cases to be tested in each demo;
- The drivers and boundaries;
- The data availability including the available datasets and the ones that need to become available for the realization of the demo activities.

1.3 Relation to other Tasks and Deliverables

This document is aimed to provide the ex-ante demo surveys, the data landscaping and the deployment planning of each pilot for the purposes of T2.4. The results of these will feed the activities of WP7 dedicated to the implementation of the BEYOND solutions in each demo realization, since it will in advance show aspects and threats related to data availability.

Moreover, this deliverable will provide input to most of the other tasks and deliverables of WP2. Specifically, the data availability can clear things up regarding the activities of T2.5 which will design and deliver the final architecture of the BEYOND project.

2 Methodology

2.1 Approach to gather information from the demo sites

The chosen approach took into account that the task activities were being performed in parallel with the activities of T2.1 (dedicated to the determination of the use cases and business requirements with a technical and not demo orientation). From the point of view of each demonstrator, there is a clear view of the needs and opportunities regarding the project solutions. More importantly, there is a clear understanding of the available assets and datasets that will be utilized for the purposes of the demonstration.

The partners who are responsible for each pilot were, thus, asked to provide such kind of information to enhance the initial description of the demo cases that was included in the Grant Agreement. This information initialized a conversation among demo and technical partners considering various aspects of the deployment planning which will be further analysed during the WP7 activities.

The demo partners were asked to provide information concerning their pilots in consolidated versions of the document which worked as a source of ideas for the other demos, too. The collection of information was performed in a series of phases which enabled the exchange of ideas.

Once the type equipment was identified for each demo, an important sub-task was to perform the data landscaping of each demo. For its purposes, an extra file was made for the listing of the available datasets as well as plenty characteristics for each one of them including specific descriptions, features, availability and rights. This work does not only support the holistic approach and presentation of the pilot survey, but will prove crucial to the deployment planning, the early overcoming of lack of data, barriers on data sharing etc.

2.2 Phases in the interaction with the demo partners

The deliverable preparation consisted of four phases for the collection of the information concerning the project demos. In each phase, the demo partners were asked to fill in specific sections of consolidated versions of the deliverable in order to boost the collaboration among the demonstrators.

The four phases were the following:

- **Phase 1 - Description and specialization of the Demo Cases that were initially described in the Grant Agreement:** Some Demo Cases will be tested more than one demo, but the demo partners were asked to provide more demo-specific information if possible.

- **Phase 2 - Description of the demo landscapes and sites**: The demo partners provided general and more detailed information concerning their sites including the building descriptions with photos, listing of the various hardware and software assets along with their respective specifications.
- **Phase 3 - Data landscaping**: The demo partners were asked to list and describe all the available datasets that will be needed for the realization and testing of the demo cases. The list includes exhaustive information with features, availability and the respective rights for sharing and exploitation.
- **Phase 4- Pilot deployment plan**: The demo partners provided a plan for the validation and deployment of the demo activities linked to the respective tasks of the WP7 which is dedicated to the demonstration and assessment of the BEYOND solutions. The complete deployment plan was provided by SUITE5 based on the respective feedback from the demo partners.

3 Overview of the Greek demo

3.1 BEYOND Demo Cases to be tested in the Greek Demo

3.1.1 Energy Performance Optimization and Self-Consumption Maximization through the application of the digital twin concept in buildings – Data sharing between buildings and ESCOs involved in Energy Performance Contracting

This demo case will enable direct data sharing between different types of buildings located in Athens (commercial as well as residential) and MYTILINEOS. Such data will include real-time BEMS, generation and IoT information from myriads of devices in buildings with more detailed data generation capabilities. MYTLINEOS will take over the detailed analysis (flexibility extraction) and optimization of building assets, through real-time energy consumption optimization (human-centric control of major building loads) and self-consumption maximization (real-time matching of demand and supply utilizing the flexibility offered from the demand side). The aim is to increase the energy performance of such buildings with the utilization of the Building Digital Twins application that will be configured by VTT during the project implementation.

3.1.2 Personalized Energy Analytics and Energy Efficiency Optimization Guidance, including Human-Centric features for well-being of occupants - Data sharing between buildings, Energy Retailers and ESCOs

Capitalizing on the previous demo case, this one will move one step beyond and will realize advanced and innovative energy service concepts for selected customers of MYTILINEOS focusing on personalized energy efficiency guidance, demand response, smart home automation and non-energy services for security, comfort and well-being, in collaboration with IGM (ESCO) that will facilitate the transformation of retailers' business model towards a service-oriented one through data sharing and business synergies between Retailers and ESCOs. Data streams from building systems and IoT devices (metering, control, ambience sensing) will be fed into the BEYOND Big Data Platform and Analytics Toolkit towards analysing the flexibility of individual consumers and generating personalized insights on how they can save energy and optimize their energy performance through the respective application that will be developed by SUITE5. In turn, targeted guidance will be provided by retailers to consumers, through the collaboration with ESCOs holding the expertise for Energy Efficiency measures, for manual interventions over their devices and loads, while in limited cases, the demo case will experiment with advanced human-centric automation concepts for properly balancing energy consumption with individual preferences regarding comfort, security and well-being.

3.1.3 Real-time Building Energy Performance and Smart Readiness Certification – Data sharing between buildings, Energy Retailers and ESCOs

This demo case will enable direct and real-time interactions between buildings and their systems (sharing real-time BEMS, generation and IoT information from myriads of devices in their buildings) with energy retailers and ESCOs involved in the project. MYTILINEOS will take over the detailed analysis of data streams coming from the building systems regarding energy consumption and occupancy, along with weather data coming from open sources. This will enable real-time energy performance certification (applying innovative operational rating and appropriate normalization methodologies and approaches) of buildings based on real-life data streams (instead of aggregated data batches), that can point out specific areas of improvement and act as an enabler for further optimizing the performance of buildings from an energy point of view.

3.1.4 Building Portfolio Management Optimization for Energy Efficiency through Portfolio Energy Analytics and better-suited Billing Strategies - Data sharing between buildings and Energy Retailers

The realization of this demo case will be based on the validation of a complete toolbox for energy retailers for comprehensive portfolio analysis, towards optimizing a series of business objectives. In more detail the Portfolio Analysis toolbox will utilize smart meter and consumption data from buildings belonging to the portfolio of Protergia, the energy unit of MYTILINEOS, involved in the demo activities of the project, together with weather data, energy market/ price data and customer data (demographic, location-based, smart home/ IoT data). It will offer a holistic view and respective insights over the customer portfolio of Protergia (buildings belonging in the portfolio of MYTILINEOS) towards (i) significantly reducing imbalances caused by forecasting errors, thus avoiding extremely high imbalance charges; (ii) examining advanced billing concepts (e.g. dynamic energy pricing) by segmenting, clustering and analysing consumption behaviours, inferring the elasticity of specific clusters against varying energy pricing levels and deploying highly effective implicit demand response strategies, towards optimizing the performance of their portfolio while hedging against non-anticipated imbalances; (iii) monitoring their compliance to Energy Efficiency obligations imposed by the European Commission and adopted by the Member States and designing appropriate portfolio management/ energy efficiency strategies and campaigns to achieve the anticipated targets; and (iv) analysing spatio-temporal patterns of their portfolio, identifying trends and outliers and receiving valuable knowledge for the design and delivery of added value services per individual customer or clusters of them to satisfy their needs for energy cost reduction through targeted innovative energy service bundles.

3.1.5 Optimal VPP configuration and Consumer-Centric Demand Response Optimization Module – Data sharing between buildings and aggregators as well as between aggregators and DSOs

The realization of the demo case is based on the validation of a novel module for aggregators that will facilitate the management of demand and flexibility profiles to forecast and decide upon the optimal management of flexibility sources (demand, generation, storage, EVs). Sub-metering data from local prosumers/clients of MYTILINEOS, IoT and sensing data from prosumer premises, local generation data, local storage data, EV charging stations data, weather data, along with information provided by CUERVA regarding flexibility requirements and characteristics will comprise the main inputs for the AI analytics that will be performed within the tool, which will embed all functionalities pertaining to the tool chain for segmenting and classifying flexibility profiles at different spatio-temporal granularity and clustering/managing them in order to establish optimal Virtual Power Plant (VPP) composition for the delivery of grid services to DSOs. Its main innovation will be that rather than matching the assumed flexibility profile to a generic class and then extracting flexibility estimations, it will cluster and segment flexibility sources and profiles based on their actual, locally estimated flexibility (incorporating where available detailed information about low-level devices existing at the demand side and how they are used by consumers).

Specially focusing on the case of the Greek demo, the demo case will build on top of the baseline personal data analytics of BEYOND to enable the realization of consumer-centric demand response programmes. Detailed comfort profiles will be advanced to context-aware demand flexibility profiles to enable the realization of novel automated control (demand response) programmes over specific devices (lights, heating/cooling) and clusters of consumers, towards shedding or shifting demand away from peak hours and, thus, satisfying in real-time emerging requirements for improving the performance of buildings according to the grid requirements, without compromising comfort of consumers or significantly affecting their daily schedules.

3.1.6 Advanced renovation support for accurate energy-efficient design of buildings towards optimized investment decision-making and de-risking – Data sharing between buildings and ESCOs/ Construction Companies

This demo case will focus on significantly reducing the gap between predicted and actual energy performance of buildings during the design of renovation projects. BEMS data from the buildings involved in the Greek demonstrator (offered by the customers of MYTILINEOS) and low-level intra-building sensing, metering, actuating data (IoT devices) will enable the definition of accurate occupants' behaviour and comfort profiles (based on baseline personal AI analytics available in the BEYOND toolkit). Such profiles will be made available to IGM to introduce them in iterative simulation loops of alternative renovation scenarios of selected buildings (performed the respective Renovation Decision Support tool developed by VTT), thus replacing generic routines and schedules currently used, with real data coming from the actual operation of the building-to-be-renovated. Additional analytics will be performed over simulation results to identify energy performance outliers and enable further devising renovation approaches and scenarios to achieve (in a highly accurate manner) optimal balancing between anticipated energy performance, renovation project costs and indoor air quality/ occupants' comfort. The demo case will validate highly accurate results for the anticipated energy performance of to-be-renovated buildings. On the other hand, it will validate significant benefits for IGM (as an ESCO) through facilitating further penetration of the Energy Performance Contracting (EPC) model for ESCOs, allowing for the reduction of uncertainty and respective risks of EPC business models, due to the reduction of the performance gap between predicted and actual energy performance of buildings, which in many cases can lead to a total project failure, since ESCOs fund such projects themselves and are paid back by the savings achieved; so any significant deviation between actual and predicted values of savings may drastically affect the payback and overall (investment) success of renovation projects.

3.2 Needs and Opportunities to be served by the implementation of the BEYOND solution

Table 3-1: Needs and opportunities for the Greek demo

Needs	Opportunities
The realization of the Energy-as-a-Service business model and the transformation of MYTILINEOS from a pure commodity provider to an energy service provider through enhanced product offerings.	IoT infrastructure, BEYOND Big Data Platform and AI analytics toolkit
Increase of the buildings' energy performance.	Utilization of the Building Digital Twins application that will be configured during the project's implementation.
Better estimation of portfolio performance – Reduction of imbalance charges related to incorrect forecasting as well as increase in the revenues in the long run.	IoT infrastructure, Beyond Big Data Platform and AI analytics toolkit

3.3 Brief description of the demonstration area

Artemidos Building (MYTILINEOS Headquarters in Maroussi)

An office building located in the district of Maroussi hosting approx. **600 employees** and covering a total area **of 12.000 m²**. The building is powered with electricity only.

FIGURE 3-1: ARTEMIDOS BUILDING

FIGURE 3-2: ARTEMIDOS OFFICES

Marinou Antypa Building (MYTILINEOS offices)

FIGURE 3-3: MARINOU ANTYPA BUILDING

An office building located in the district of **Neo Irakleio**, **hosting approx. 150 employees and 40 visitors** (on a daily basis), while covering a total area **of 2.101 m^2.** The building is powered with electricity only.

Pilot buildings included in the Greek pilot are partially already equipped with the **required sensors and smart meters/actuators** to ensure the smooth operation of the BEYOND framework.

FIGURE 3-4: MARINOU ANTYPA BUILDING

Residential Premises

More sophisticated services will be provided to carefully selected buildings that will enable the realization of human-centric energy performance optimization concepts. These Testbeds are located in the region of Attica.

The residential premises consist of over **50 residential dwellings**, hosting approximately 170 residents, familiar with concepts of energy services and smart technologies. The dwellings cover a total area of 4,500 m^2 are powered with electricity only. Half of the building premises will set the residential pilot test bed at the Greek demo site.

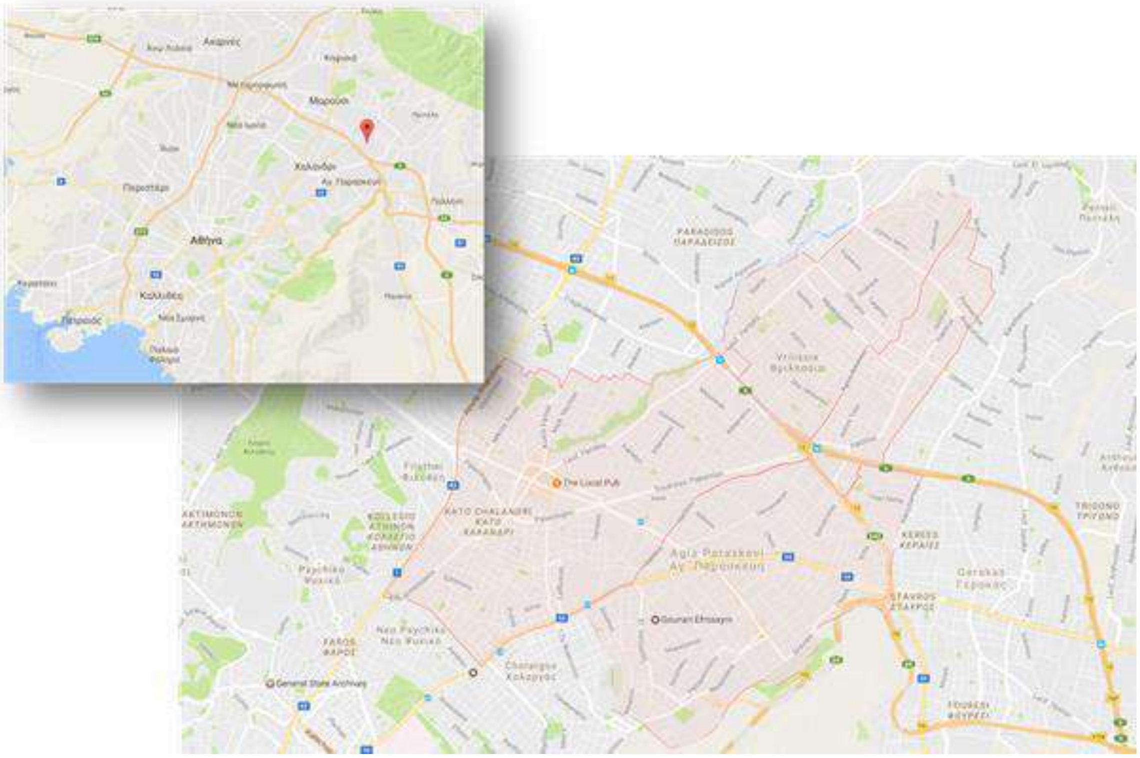

FIGURE 3-5: MAP OF THE GREEK DEMO

3.4 Detailed description of demonstration sites (Buildings and Building Assets)

- ***Basic Information***

  Commercial Buildings:

  Marinou Antypa Building

  Year of Construction: 1993

  Recent Renovation: 2006

  Gross Floor Area: 2.101 m^2

  Number of stories: 4 including ground floor

  Operating periods: approximately from 7:00 to 21:00

  Energy performance certificate: Available

  Energy Service Contract: Indefinitely period.

  Artemidos Building

  Year of Construction: 1985 and two additional structures in 2018

Recent Renovation: 2011

Gross Floor Area: 12.000 m^2

Number of stories: 5 including ground floor

Operating periods: approximately from 7:00 to 21:00

Energy performance certificate: Available

Energy Service Contract: Indefinitely period.

- ***Energy info***

  Carrier: Protergia

  Annual consumption:

  Commercial Buildings ***~ 1,4 GWh***

  Residential Buildings ***~ 4 MWh*** *per dwelling*

  Annual Cost:

  Commercial Buildings ***~ 110.000 €***

  Residential Buildings ***~ 300 - 600 €*** *per dwelling*

- ***IoT Devices***

  Smart Metering Energy Devices

  Ambient Sensing and Occupancy Sensing Devices

3.5 Key technical components

Hardware:

TABLE 3-2: KEY HARDWARE COMPONENTS OF THE GREEK DEMO

Main components	Technical Specifications
Heating Systems	**Residential** Manufacturer: IMIT Siemens Rielo Erriva ABB Campini Type of heat Generator: Hot Water Radiators – Individual & Central Energy Source: Diesel / Gas DHW: Yes Nominal Power: N/A **Commercial (Artemidos and Marinou Antipa buildings)** Manufacturer: Interclima / Carrier Type of heat Generator: Fan Coils – Individual Energy Source: Electricity / Gas DHW: No Nominal Power: N/A
Cooling systems	**Residential** Manufacturer: DAIKINA Fujitsu Kerosun Toyotomi Mitsubishi Bluesky Panasonic Type of cooling System: Air Conditioner - Individual Energy Source: Electricity Nominal Power:N/A **Commercial (Artemidos and Marinou Antipa buildings)** Manufacturer: Interclima / Carrier

	Type of cooling System: Fan Coils - Individual Energy Source: Electricity Nominal Power: N/A
Renewable energy sources	N/A
Energy storage	N/A
Lighting devices	**Residential** Type: LED, Incandescent, Fluorescent, Halogen, Compact Fluorescent Dimming Capability: Mostly on/off but some of the bulbs have dimming capability Smart controls: Remotely Connectivity: Via Platform of H2020 Project Data collection: On a daily basis **Commercial (Artemidos and Marinou Antipa buildings)** Type: Fluorescent Dimming Capability: on/off Smart controls: Remotely Connectivity: Via Platform of H2020 Project Data collection: On a daily basis
EV Charging Points	Current Status: 2 AC Charging Stations with single output of 22kW, located in headquarters of MYTILINEOS, in Maroussi. 2 AC Charging Stations with dual output of 22kW per socket, located in Marina Zea, in Piraeus. Future Expansions: 19 AC Charging Stations with dual output of 22kW per socket, located in the broader area of the Municipality of Athens. The project will be completed by the end of April. G2V and V2G capability not available. Connectivity and data collection: via dedicated platform.
IoT Devices	Smart Metering Energy Devices (Z-Wave Plus Aeotec Clamp Power Meter - Three Clamps (60A), connected and stored data on a cloud based platform, new installations in approximately 20 premises are expected during BEYOND Ambient Sensing and Occupancy Sensing Devices

	- Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence), connected and stored data on a cloud based platform, new installations in approximately 20 premises are expected during BEYOND
Smart metering	• Devices installed in approximately 20 premises in the broader area of Agia Paraskevi, covering multiple zones within each building (bedroom, kitchen, living room etc.) • Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence), connected and stored data on a cloud based platform • 1 record per hour, stored on a cloud based platform • Encrypted data sharing is available with connectivity enabled via dedicated platform. • New equipment covering the needs of approximately 20 premises is expected to ensure the smooth operation of the project.

Software:

TABLE 3-3: KEY SOFTWARE COMPONENTS OF THE GREEK DEMO

Main components	Technical Specifications
Portfolio System/ Client Database System/ CRM: Galaxy by Singular Logic	Program which includes all active as well as inactive customers of Protergia, the energy Unit of MYTILINEOS. More specifically for each customer the following data, among others, can be found and are updated at least on a monthly basis: • Energy Data – Consumption, Costs, Invoices • Demographic Data – Gender, Location of Premise, Type of Premise etc. • Contract Data - Status of contract, Duration etc.
Consumer portal: My Protergia	An application offered to the customers of Protergia which enables: • Energy Consumption overview – The customer can see the energy consumption in detail through ease to understand charts, compare the consumption to previous periods, or that of neighbors and more efficient users and find out whether they saved energy and how much. • Input of Meter Readings – The customer can monitor their meter reading history and enter the readings themselves

	to receive a monthly clearance bill that reflects their actual use. • Energy Efficiency Tips – The customer gets smart tips and useful information to help them save even more energy.
UtilitEE H2020 solution	The UtilitEE solution is developed around a combination of ICT technologies to support the project's context-aware, human-centric behavioural change framework. At the base of the solution lies a customisable IoT system employing off-the-shelf metering, sensorial, and actuating equipment for the continuous monitoring of the end user premises, supported by a cloud-based information management system responsible for preprocessing and storing the collected raw data. The raw data pre-processing aims at ensuring the quality of the information through the implementation of self-learning cleansing algorithms. These algorithms eliminate incorrect values which can degrade the accuracy of the UtilitEE modelling mechanisms. In addition to that and to prevent data loss due to disruptions of network connection or IoT equipment malfunctions, a sensor health monitoring tool was developed, to support the maintenance activities performed by the system's business stakeholders.
BEMS	Fancoils-KKM • 2006 • HVAC system installed in several zones of the main buildings of Protergia. • Distributed control • Integrated sensors (temperature, humidity) • Measurements performed (sensing values) • How can recorded data be accessed? Via MYTILINEOS' CRM system on a monthly basis as an energy consumption depiction. • Control Intelligence (manual control, fixed (clock) control) • Smart Grid Integration (none) • Reporting capabilities (e.g. non-real-time total energy reporting per energy carrier)
HEMS	• Manufacturer - Technical partners of H2020 UtilitEE Project • 2017

	• Energy Consumption and ambient data are monitored via IoT devices installed in premises. • Centralized control • Integrated sensors (occupancy, luminance, temperature, humidity) • The data related to energy consumption and ambient activities are updated on an hourly basis. • The recorded data can be accessed via designated platform. They are stored on cloud. • Control Intelligence (manual control, fixed (clock) control, occupancy-based control, sensor measurement-based control) • Smart Grid Integration: none • Reporting capabilities: non-real-time on batch

3.6 Retail information

Retailer Portfolio

- *Number of connections:* ***~265.000***
- *Residential & Commercial (High Value Small Medium Enterprises, Major Accounts)*
- *Connections per region:* ***N/A***
- *Anticipated market share in the next 2 years:* ***~9%***
- *Smart meters availability:* ***in several residential and commercial premises.***
- *Total Energy Sales / Consumption of portfolio:* ***~3.4 TWh***
- MYTILINEOS is committed to a 30% reduction in MYTILINEOS' emissions by 2030 and to net zero emissions by 2050.
- Energy Efficiency measures: energy efficiency related services (net metering, emobility, energy consumption and reduction services, energy tips and suggestions via our communication channels)
- Latest annual imbalance charges: N/A

Retailer Systems

- *Portfolio System/ Client Database System/ CRM:* ***Galaxy by Singular Logic***

  Program which includes all active as well as inactive customers of Protergia, the energy Unit of MYTILINEOS. More specifically for each customer the *following data, among others, can be found and are updated at least on a monthly basis:*

Energy Data – Consumption, Costs, Invoices

Demographic Data – Gender, Location of Premise, Type of Premise etc.

Contract Data - Status of contract, Duration etc.

- *Energy Management System: **IEBS ETRM***

  No further details available at the moment.

- *Consumer portal: **My Protergia***

  An application offered to the customers of Protergia which enables:

  ***Energy Consumption overview –** The customer can see the energy consumption in detail through ease to understand charts, compare the consumption to previous periods, or that of neighbors and more efficient users and find out whether they saved energy and how much.*

  ***Input of Meter Readings –** The customer can monitor their meter reading history and enter the readings themselves to receive a monthly clearance bill that reflects their actual use.*

  ***Energy Efficiency Tips –** The customer gets smart tips and useful information to help them save even more energy.*

3.7 Drivers and boundaries

TABLE 3-4: DRIVERS AND BOUNDARIES OF THE GREEK DEMO

Drivers	Boundaries
Expansion of revenues via energy services offering	**Legal:** Compliance to GDPR forms related to access of all pilot user related data.
Reduction of losses that are due to lack in accurate forecasting of portfolio's demand response schemes.	**Business/Technical:** Access to Protergias' portfolio data

3.8 Data availability, characteristics and further needs

<u>Available datasets</u>

- Energy usage and demographic data via MYTILINEOS' portfolio management system
    - Energy in kWh
    - Power in kW
    - Address of Premise
    - Gender of Premise Owner
- Smart Metering Data via IoT devices installed in several premises of users participating in H2020 Projects
    - Ambient Data (Humidity, Luminance, Temperature)
    - Energy Data (Consumption, Load tracking)

Datasets to become available

New IoT devices are to be installed to ensure the active participation of users in the BEYOND Project and the avoidance of technical difficulties linked with the use of devices with no easy connectivity to the BEYOND Data Platform.

4 Overview of the Spanish demo

To cover all the demonstration cases in which CUERVA is involved, the following information is provided:

1. **Grid network infrastructure** regarding the Industrial Park of Profitegra and the industrial companies that will be part of the VPP for the Demo Cases related with informed decision making on buildings relevant energy infrastructure sizing and planning.
2. **Building infrastructure** from the CUERVA Headquarters for the Demo Cases related with real-time building energy performance.
3. Overall information regarding the portfolio of CUERVA **as retailer** for the Demo Cases related with building portfolio management optimization for energy efficiency through portfolio energy analytics and better suited billings strategies.

So, in order to provide the best conditions for the demonstration cases, **two independent demo-sites** have been chosen:

- CUERVA Headquarters
- Industrial Park of Profitegra

CUERVA Headquarters

Which will be assigned to the demo cases:

- Building Portfolio Management Optimization for Energy Efficiency through Portfolio Energy Analytics and better-suited Billing Strategies - Data sharing between buildings and Energy Retailers
- Personalized Energy Analytics and Energy Efficiency Optimization Guidance, including Human-Centric features for well-being of occupants - Data sharing between buildings, Energy Retailers and ESCOs
- Real-time Building Energy Performance and Smart Readiness Certification - Data sharing between buildings, Energy Retailers and ESCOs

Industrial Park of Profitegra

Which will cover the following demo-cases

- Informed decision-making on building-relevant energy infrastructure sizing and planning (electricity grid) - Data sharing between buildings and DSOs, where CUERVA will be working in strong collaboration with CIRCE in the whole Industrial Park sizing and planning with the expected future demand, with CUERVA´s main role of DSO of the Industrial Park.

- Optimal VPP configuration and Consumer-Centric Demand Response Optimization Module – Data sharing between buildings and aggregators as well as between aggregators and DSOs, where CUERVA will be working in an optimal VPP configuration, involving two industries and the office building, all of them located in the industrial park.

4.1 BEYOND Demo Cases to be tested in the Spanish Demo

4.1.1 Building Portfolio Management Optimization for Energy Efficiency through Portfolio Energy Analytics and better-suited Billing Strategies - Data sharing between buildings and Energy Retailers

The realization of this demo case will be based on the validation of a complete toolbox for energy retailers for comprehensive portfolio analysis, towards optimizing a series of business objectives. In more detail the Portfolio Analysis toolbox will utilize smart meter and consumption data from a building belonging in the portfolio of CUERVA involved in the demo activities of the project, together with weather data, energy market/ price data and customer data (demographic, location-based, smart home/ IoT data). It will offer a holistic view and respective insights over the customer portfolio of energy retailers (hundreds of thousands buildings belonging in the portfolio of CUERVA) towards (i) significantly reducing imbalances caused by forecasting errors, thus avoiding extremely high imbalance charges; (ii) examining advanced billing concepts (e.g. dynamic energy pricing) by segmenting, clustering and analysing consumption behaviours, inferring the elasticity of specific clusters against varying energy pricing levels and deploying highly effective implicit demand response strategies, towards optimizing the performance of their portfolio while hedging against non-anticipated imbalances; (iii) monitoring their compliance to Energy Efficiency obligations imposed by the European Commission and adopted by the Member States and designing appropriate portfolio management/ energy efficiency strategies and campaigns to achieve the anticipated targets; and (iv) analysing spatio-temporal patterns of their portfolio, identifying trends and outliers and receiving valuable knowledge for the design and delivery of added value services per individual customer or clusters of them to satisfy their needs for energy cost reduction through targeted innovative energy service bundles.

4.1.2 Personalized Energy Analytics and Energy Efficiency Optimization Guidance, including Human-Centric features for well-being of occupants - Data sharing between buildings, Energy retailers and ESCOs

Capitalizing on the previous demo case, this one will move one step beyond and will realize advanced and innovative energy service concepts for selected customers of CUERVA, focusing on personalized energy efficiency guidance, demand response, smart home automation and non-energy services for security, comfort and well-being, in collaboration with IGM (ESCO) that will facilitate the transformation of retailers' business model towards a service-oriented one through data sharing and business synergies between Retailers and ESCOs. Data streams from building systems and IoT devices (metering, control, ambience sensing) will be fed into the BEYOND Big Data Platform and Analytics Toolkit towards analysing the flexibility of individual consumers and generating personalized insights on how they can save energy and optimize their energy performance through the respective application that will be developed by SUITE5. In turn, targeted guidance will be provided by retailers to consumers, through the collaboration with ESCOs holding the expertise for Energy Efficiency measures, for manual interventions over their devices and loads, while in limited cases, the demo case will experiment with advanced human-centric automation concepts for properly balancing energy consumption with individual preferences regarding comfort, security and well-being.

4.1.3 Optimal VPP configuration and Consumer-Centric Demand Response Optimization Module – Data sharing between buildings and aggregators as well as between aggregators and DSOs

The realization of the demo case is based on the validation of a novel module for aggregators that will facilitate the management of demand and flexibility profiles in order to forecast and decide upon the optimal management of flexibility sources (demand, generation, storage, EVs). Smart metering data from building customers of CUERVA, sub metering data from two industrial companies located in the industrial park , IoT and sensing data from prosumer premises, local generation data, local storage data, EV charging stations data, weather data, along with information provided by CUERVA regarding flexibility requirements and characteristics will comprise the main inputs for the AI analytics that will be performed within the tool, which will embed all functionalities pertaining to the tool chain for segmenting and classifying flexibility profiles at different spatio-temporal granularity and clustering/ managing them in order to establish optimal Virtual Power Plant (VPP) composition for the delivery of grid services to DSOs. Its main innovation will be that rather than matching the assumed flexibility profile to a generic class and then extracting flexibility estimations, it will cluster and segment flexibility sources and profiles based on their actual, locally estimated flexibility (incorporating where available detailed information about low-level devices existing at the demand side and how they are used by consumers).

With regards to the Spanish demo, Smart metering data provided by local prosumers, together with distributed generation data (PV) and SCADA information from the DSO (CUERVA) will be jointly analysed to extract accurate demand and generation forecasts (in the short- and mid-term) and estimate anticipated events in the distribution network and the required flexibility to effectively address them. Such flexibility requirements will be communicated to the local aggregator (URBENER), together with smart metering, distributed generation and local storage information, allowing for (i) analysis of the flexibility that can be provided by each type of DER at different spatio-temporal granularity, (ii) segmentation and classification of the different types of flexibility according to their characteristics and capability to provide alternative services to the grid operator, (iii) optimal clustering of local flexibility sources and formulation of dynamic VPPs to address evolving distribution grid needs and requirements. Dynamic VPP schedules for flexibility activation will be communicated back to the DSO (CUERVA), allowing for the optimal scheduling of the distribution network operation with these additional flexibility amounts in hand. In turn, the DSO will generate the appropriate signals towards local prosumers and DERs (when required) to enable the provision of the available flexibility with the ultimate target to increase network resilience and operational efficiency, maximize RES integration, minimize power losses, increase power quality and safeguard network availability against anticipated congestions, imbalances or voltage violations.

4.1.4 Informed decision-making on building-relevant energy infrastructure sizing and planning (electricity grid) - Data sharing between buildings and DSOs

As part of this demo case, electricity grid planning algorithms that simulate the operation of the networks in appropriate horizons (related to regulatory regimes and asset lifetimes) will be developed to automatically calculate grid reliability, performance and quality metrics based on different infrastructure and assets installation setups, their characteristics and planned/unplanned events. The algorithms will incorporate functionality to assess the performance of the networks under various demand and generation uncertainties. Optimization algorithms will be appropriately configured to enable the study of optimal planning and sizing of grid assets such as new connections, charging points for EVs and battery storage, needs for expansion or enhancement, considering also needs for further investments. The algorithms will have the capability to embed all information arising from CUERVA (DSO) systems, flexibility analytics, short-, mid- and long-term forecasting analytics for demand and generation (referring industrial park supplied by CUERVA), along with batch static data coming from well-known repositories of open building data (statistical information about the building stock) in order to perform a comprehensive simulation-based analysis of performance and reliability metrics (utilizing and further enhancing the RTDS simulator of CIRCE for the delivery of the respective application) in specific parts of the electricity grid under alternative penetration scenarios for new energy infrastructure and assets that will be generated to satisfy the needs of the grid operator.

4.2 Needs and Opportunities to be served by the implementation of the BEYOND solution

TABLE 4-1: NEEDS AND OPPORTUNITIES FOR THE SPANISH DEMO

Needs	Opportunities
Energy efficiency optimization of buildings and reduction of grid imbalances.	IoT infrastructure, BEYOND Big Data Platform and AI analytics toolkit
Collaborate with aggregators in a way which enables the delivery of services in line with emerging customer needs and flexibility.	IoT infrastructure, BEYOND Big Data Platform and AI analytics toolkit
Improve the short/medium/long-term planning of the distribution networks for possible future scenarios in order to make quality forecasts.	Digital Twin. IoT infrastructure, BEYOND Big Data Platform and AI analytics toolkit
Promote the industries participation with DERs in new emerging flexibility markets.	IoT infrastructure, BEYOND Big Data Platform and AI analytics toolkit

4.3 Brief description of the demonstration area

4.3.1 Grid network infrastructure. Profitegra Industrial Park

A portion of the distribution network operated by Grupo CUERVA in the region of Granada is used as the main electricity infrastructure to set the Granada Smart Grid Living Lab owned by CUERVA and Turning Tables. The MV distribution grid is connected directly to the HV network by a substation also operated by Grupo CUERVA. This distribution network feeds the Profitegra Industrial Park.

In Profitegra, over 40 companies of different sectors (industrial, manufacturer, food operators, waste treatment, recycling, etc.) are located.

Figure 4-1: Profitegra Industrial Park (1)

Figure 4-2: Profitegra Industrial Park (2)

FIGURE 4-3: PROFITEGRA INDUSTRIAL PARK (3)

FIGURE 4-4: PROFITEGRA INDUSTRIAL PARK (4)

4.3.2 Building infrastructure. CUERVA Headquarters

CUERVA Headquarters are located in Churriana de la Vega (Granada). It is outside the Spanish distribution network. CUERVA has access to all the relevant information, they can install any device that could be interesting for the purposes of the project. Finally, CUERVA is the retailer for the building consumption.

FIGURE 4-5: THE CUERVA HEADQUARTERS LOCATION

- There is a PV plant monitored by CUERVA.
- Two EV Chargers also monitored by CUERVA.
- Office areas that can be useful for the demo cases assigned.

4.4 Detailed description of demonstration sites

4.4.1 Grid network infrastructure. Profitegra Industrial Park

Currently, the industrial park is connected to a 66/20 kV substation operated by CUERVA and has an installed power of 3,5MW (12900 MWh consumed yearly). Nevertheless, it is expected a connection in 132 kV in the last quarter of 2021 and an increase up to 7,5 MW of installed power due the expansion plans for the industrial park in the coming years.

In terms of renewable energies, around 500kWp of self-consumption PV installed in the industries whose inverters are monitored by CUERVA. Moreover, the MV network of the industrial park is highly monetarized, thus providing high resolution data. Finally, the deployment of 2 EV (22kW) are expected in 2021.

On the other hand, the industrial park is fed by a gas network and several of the companies established includes thermal demand (both heating and cooling) to carry out their industrial processes.

Infrastructure (summary)

- 66/20 kV Substation operated by CUERVA, expected the connexion in 132 kV in the next year
- High resolution data in the MV network
- 60 industrial supply points
- 3.5 MW of contracted power, 12900 MWh consumed yearly
- 4 MW increase expected in the next years
- Around 500 kWp of PV installed in the industries. All the inverters are monitored by CUERVA
- A complete digital twin model of the Medium Voltage Grid for the whole Industrial Park is available
- Smart metering technologies to monitor RES generation & storage at the distribution network
- SCADA & GIS data will be made available to create a lake of electrical data from the local network
- Deployment of 2 EV (22 kW) by 2021

4.4.2 Building Infrastructure. CUERVA Headquarters

General details of the building

- Surface: 495,3 m^2 (ground floor 354,1 m^2 + upper floor 141,2 m^2)
- Number of people usually work in the building: 70 approximately
- Number of floors: 2
- Number of rooms:
  - Ground floor: 2 meeting rooms; 2 large separate rooms; 1 office
  - Upper floor: 3 meeting rooms; 1 large room; 1 small room
- Period of daily use: M to T 8:00 to 18:00 and F 8:00 to 14:00

Office power (2020)

The following table shows the consumption of each circuit.

TABLE 4-2: THE CONSUMPTION OF EACH CIRCUIT IN THE CUERVA HEADQUARTERS

CIRCUIT	AVERAGE POWER (kW)	CONSUMPTION/YEAR (KWH)	PERCENTAGE OF TOTAL CONSUMPTION
Air-conditioning system	2,8703	25.925	38,51 %
Lighting system	1,0587	9.411	13,98 %
Electric vehicle	0,2646	3.124	4,64 %
Office sockets	0,8913	9.539	14,17 %
Office sockets under the table	0,9510	8.206	12,19 %
Computers	1,2354	11.114	16,51 %
TOTAL	**7,2704**	**63719**	**100%**

Self-consumption photovoltaic plant

A graph showing the generation of the photovoltaic plant in 2020 is attached.

- Production: 25782 kWh/year approximately

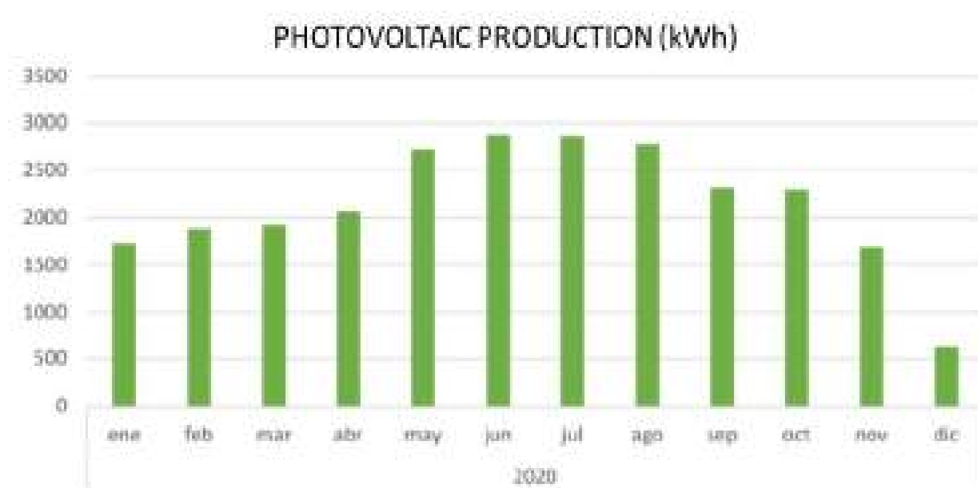

FIGURE 4-6: PV GENERATION OF THE SPANISH DEMO

4.5 Network information

Basic network information

- Length: 35 km of underground cable
- Number of sub-stations: 1 of 66/20 kV – operational start-up on June 1 of 132/20 kV
- Secondary sub-stations: 50 approximately
- Number and type of customers served:

TABLE 4-3: CUSTOMERS SERVED IN THE SPANISH DEMO

	NAME	BRIEF DESCRIPCTION	MAX. CONSUMPTION (KWH)
1	TORRES MORENTE, S.A.	Oil production, high consumption in 3 months of the year	1151
2	MOLDEADOS PLASTICOS ALBER S.L.	Manufacture of plastic containers and packaging	954
3	RECICLADOS BONIPLAST, S.L.	Recycling industry	485
4	PLASTICOS HITA, S.L.	Construction of non-residential buildings	544
5	ALMENDRAS DONAIRE SL	Almond production and drying	218
6	PENALVA Y LLEDO, S.A.	NORDWIK ice cream production	225
7	INDUSTRIAS ESPADAFOR	Beverage bottling	172
8	CAÑA NATURE, S.L.	Food products	256
9	PROYECTOS VIAS S.A.	Manufacturing industries	133
10	GRANEUMA. S.L.	Manufacture of tyres and inner tubes	104
11	NOVOPACK INGENIERIAS DEL EMBALAJE SL	Plastics manufacturing	92
12	BIOMASLINIC	Biomedical research	90
13	DIETÉTICA ESCOLAR ANDALUZA, SL .	Preparation of ready meals and dishes	51
14	INFORMÁTICA MEGASUR SL	Wholesale of computers, computer peripherals and software	185
15	STEELGRAN COMPONENTES SA	Manufacture of other electrical equipment	31
16	SIERRA NEVADA PAPELES Y PLASTICOS, S.L.	Wholesale trade in semi-finished products	60

17	FEYSOL NATURE SL	Honey food products	62
18	ROVI ESCUZAR SLU	Installations on construction sites	12
19	HORMIGONES Y CEMENTOS ALHAMBRA	Cement manufacture	30
20	GABIA METAL, S.L.	Aluminum production	44
21	JOCON INFRAESTRUCTURAS SL	Rentals of real estate	16
22	SISTEMAS TECNICOS DE CORTINAS, PANNO, S.L.	Manufacture of other metal products	33
23	JUMADI SL	Warehousing and storage	72
24	MAFA PRODUCTOS S.A	Construction of non-residential buildings	22
25	CONDUCTOS METALICOS GAMAT S.L.	Manufacture of other metal products	26
26	LABORATORIOS APINEVADA, S.L.	Construction of residential buildings	29
27	ACEITES MAZUECOS S.L.	Land preparation	3
28	ORITIA Y BOREAS, S.L.	Construction of non-residential buildings	17
29	PARQUE METROP.INDUST.Y TECNOL.DE GRANADA, S.L.	Construction of residential buildings	12
30	TRANS FRIO HIGUERAL S.L.	Carrier	8
31	AGRIHAT SLLL	Installations on construction sites	6
32	ACTIV. DE CONSULT. TECNICA INVESTI Y SERVICIOS,S.L.	Warehousing and storage	2
33	ALMENDRERA DE SUR S C A	Furniture manufacture	2
34	CARAVANAS Y REMOLQUES CARDONA SL	Sale of motor vehicles	5
35	DISTRIBUIDORA ELECTRICA BERMEJALES, S.L.	Electrical installations	2
36	DISTRIBUIDORA ELECTRICA BERMEJALES, S.L.	Warehousing and storage	3

- Latest annual peak demand: 5 MW
- Latest annual network downtime (for the power network): 2 hours

SCADA / Control Systems

- Description of SCADA systems and operations supported: SCADA tedisnet. Detection of events and faults in the network. Control of the operation of the network/switches of those that are remotely controlled.
- Data collected, stored and processed: status and measurement of the switches, transformer measurement (V, A, P, Q). The data is collected via API and is brought into the data lake at 1 minute granularity.
- Connectivity and data transmission: the SCADA follows the IEC-60870-104 protocol. Through this protocol, the measurements are collected as described above.

Other Systems

- Short Description of GIS Systems and operations supported: CUERVA has a GIS where all information / all assets of the distribution company are geo-referenced. Date of commissioning, type of asset, additional information on each asset is added. No support/no operation.
- Information about connectivity and data transmission of all above assets: there is no direct access to the GIS (we ask for information externally).

4.6 Key technical components

4.6.1 Grid network infrastructure. Profitegra Industrial Park

Hardware:

TABLE 4-4-4: KEY HARDWARE COMPONENTS OF THE PROFITEGRA INDUSTRIAL PARK

Main components	Technical Specifications
Smart metering	• All smart meters monitored. Two measurement technologies: - 17 clients with remote metering (5 min). - 20 customers with remote management meters system (15 min at transformer level and 1 hour at client level) • AMI infrastructure description: apart from the Smart meters of the clientele, some TCs within the Profitegra network have been monitored and remotely controlled.

	This allows to obtain measurements in real time and upload them to the SCADA. • Data collection (frequency) and storage: - V, I, P, Q per 15 min, on a cloud platform • Connectivity and data transmission: the information is dumped into a database (.xml and .json)

Software:

TABLE 4-4-5: KEY SOFTWARE COMPONENTS OF THE PROFITEGRA INDUSTRIAL PARK

Main components	Technical Specifications
SCADA	• Single line schematic • Monitoring and control devices of the transformation centre • Automatic line protections • Real time data of smart meters (transformation centre level) • Real time data of border points • Monitoring and control of PV and generation systems

4.6.2 Building Infrastructure. CUERVA Headquarters

Hardware:

TABLE 4-4: KEY HARDWARE COMPONENTS OF THE CUERVA HEADQUARTERS

Main components	Technical Specifications
Heating Systems	N/A
Cooling systems	N/A
Renewable energy sources	• Photovoltaic System PV • Power output electricity: 16 kWp (64 photovoltaic panels of 250 W each) • Annual Electricity Generation: 25782 kWh/year approximately • Self-consumption rate: 23 % • Connectivity and data collection:

	o The inverter is monitored (granularity 5 minutes). Moreover, there is consumption and production data through the telemetry fiscal meter. o Historical data available by 2020. All this data is stored in the Azure Datalake of CUERVA and some of it is processed in SQL Server for quick access.
Energy storage	N/A
Lighting devices	N/A
EV Charging Points	• Number: 2. <u>Tesla Charger</u> • Type: Gen 3 Tesla Wall Connector. G2V • Power output: 22 kW. The maximum power rating for the wall connector is 22 kW or 32 A with a three-phase supply 400 V AC. • Load capacity: 32 A <u>Ingerev Charger</u> • Type: GARAGE GW116. G2V • Power output: 7,6 kW • Load capacity: 16 A • Connectivity and data collection: updates and configuration via USB. Download reports via USB.
IoT Devices	N/A
Smart metering	• The fiscal meter measures the active and reactive power exported and imported per quadrant, with consumption, production and total balance (consumption-production) measurements. • Granularity of 15 minutes. Historical available from 2020. All this data is stored in the Azure Datalake of CUERVA and some of it is processed in SQL Server for quick access.

PV System

<u>Photovoltaic Panels (PV System)</u>

GENERAL SPECIFICATIONS			
Model		MSP250AS-30	
Manufacturer		MÜNCHEN SOLAR	
Type of PV cell		POLYCRYSTALLINES	
ELECTRICAL SPECIFICATIONS			
Maximum Power Voltage (Vmp)	31,02	Peak power (Wp)	250
Short-circuit current (A)	8,62	Open Circuit Voltage (V)	36,99
Peak power current (A)	8,06	Module efficiency (%)	15,4

Inverter (PV System)

General Specifications			
Model		SYMO 15.0-3-M	
Manufacturer		FRONIUS	
ELECTRICAL SPECIFICATIONS			
Nominal Power AC (W)	15000	Maximum DC Power (W)	250
Minimum DC Voltage (V)	220	Maximum DC Voltage (V)	36,99
Nominal DC Voltage (V)	400	Power factor	15,4
Performance (%)	97,8 %	Output type	Three-phase

Chargers

Sensors and measuring devices will be deployed to remotely manage the data.

Tesla Charger

Voltage and Wiring	**Nominal voltage:** • Single-phase 230 V AC: L1, neutral and ground to earth • Three-phase 230 V AC: L1, L2, L3 and mass to ground • 400 V AC three-phase: L1, L2, L3, neutral and mass to ground **Voltage range:** • 180 V to 264 V AC between terminals N and L1.
Current Output Range	32 A maximum

Frequency	50 Hz
Cable Length	2,6 m and 7,4 m
Operating Temperature	-30°C to 50 °C
Storage Temperature	-40°C to 85 °C
Protection level	IP 55: indoor and outdoor use
Certifications	CE

Ingerev Charger

Model	GARAGE GW116
Wiring	Single-phase
Power Output	3,7 kW
Current Output Range	16 A
Frequency	50 Hz
Cable Length	5 m
Floor/Wall	Wall
Power Socket	Schuko
Connector	IEC 62196-2 Type 2
Powermeter MID	Yes
Residual Current Device	Yes
Miniature Circuit Breaker	Yes

Software:

TABLE 4-5: KEY SOFTWARE COMPONENTS OF THE CUERVA HEADQUARTERS

Main components	Technical Specifications
BEMS	N/A
HEMS	N/A

4.7 Retail information

CUERVA provides the commercial management of a large part of its 16,000 network clients and another 2,000 clients outside its distribution area.

The following information will be provided by CUERVA for the achievement of the project's objectives:

- Contracted power
- Tariff
- National classification of economic activities code
- Consumption
- Billings
- Location
- Power contracted recommendations
- Other kind of data that might be interesting

Retail portfolio

- Number of connections: 16,000 network clients and another 2,000 clients outside its distribution area
- Type of clients: classified into 2 types:
  - B2B: Big clients (53 clients, consumption > 100.000 kW/year)
  - B2C: The rest of clients
- Smart meters availability: yes
- Total Energy Sales/ Consumption of portfolio: 18,21 GW/year

Retailer Systems

Portfolio/ Energy Management is done via the CRM system

- Clients databases:
  - Personal Information
  - Technical information of the installation
  - Billing and consumption data
- CRM: the entire database where all customer service and contracts are recorded for each customer with the information previously described.
- Consumer portal: The clients can access the entire database about their contracts.

Software:

TABLE 4-7: KEY SOFTWARE COMPONENTS OF THE SPANISH RETAIL

Main components	Technical Specifications
CRM from CUERVA	Program which includes all active as well as inactive customers of CUERVA:

	• Energy Data – Consumption, Costs, Invoices • Demographic Data – Gender, Location of Premise, Type of Premise etc. Contract Data - Status of contract, Duration etc.

4.8 Drivers and boundaries

Table 4-8: Drivers and boundaries of the Serbian demo

Drivers	Boundaries
Integration of renewables to face increased planning demands	Grid infrastructure limitation.
Optimal demand-driven network operation	Real-time and synchronized data collection.

4.9 Data availability and characteristics

Available datasets in Profitegra Industrial Park

- Network Information
    - V,I, P, Q
    - Grid topology
    - GIS
    - DERs location
    - Active Power Consumption
    - Real time generation data
    - historical generation data.
- General information of retailer
    - National classification of economic activities
    - contracted power
    - tariff
    - location
    - power contracted recommendations
    - billings
    - consumption.

Available datasets in CUERVA Headquarters

- Building infrastructure
- Electric Consumption in the building
- EV Chargers information

- PV information (V, I, P and Q from the inverters).

Retail information

- General information of the customers in CUERVA retailer's portfolio
    - National classification of economic activities
    - contracted power
    - tariff
    - location
    - power contracted recommendations

5 Overview of the Finnish demo

5.1 BEYOND Demo Cases to be tested in the Finnish Demo

5.1.1 Energy Performance Optimization and Self-Consumption Maximization through the application of the digital twin concept in buildings – Data sharing between buildings and ESCOs involved in Energy Performance Contracting

This demo case will enable direct data sharing between different types of buildings located in Helsinki and FVH, sharing real-time BEMS, generation and IoT information from myriads of devices in buildings with more detailed data generation capabilities. FVH will take over the detailed analysis (flexibility extraction) and optimization of building assets, through real-time energy consumption optimization (human-centric control of major building loads) and self-consumption maximization (real-time matching of demand and supply utilizing the flexibility offered from the demand side) with ultimate aim to increase the energy performance of such buildings with the utilization of the Building Digital Twins application that will be configured by VTT during the project implementation.

5.1.2 Predictive Maintenance Improvement through Digital Twins and Enhanced AI Analytics – Data sharing between buildings and ESCOs

This demo case will enable direct data sharing between different types of buildings located in Helsinki and FVH, sharing real-time BEMS and IoT information from myriads of sensors and actuators in buildings with more detailed data generation. FVH will take over the detailed analysis and optimization of building assets, through predictive maintenance services (enabling accurate fault diagnosis and characterization over critical systems and equipment, probability assessment of fault occurrence, early prediction of faults and facilitate increased reliability and efficiency of building assets). Analysis and optimization of building assets relies on Building Digital Twins application that will be configured by VTT in T6.1 during the project implementation.

5.1.3 Real-time Building Energy Performance and Smart Readiness Certification – Data sharing between buildings, Energy Retailers and ESCOs

This demo case will enable direct and real-time interactions between buildings and their systems (sharing real-time BEMS, generation and IoT information from myriads of devices in their buildings) with energy retailers and ESCOs involved in the project (MYTILINEOS, CUERVA, BEOELEK and IGM), with the latter taking over the detailed analysis of data streams coming from the building systems regarding energy consumption and occupancy, along with weather data coming from open sources to enable real-time energy performance certification (applying innovative operational rating and appropriate normalization methodologies and approaches) of buildings based on real-life data streams (instead of aggregated data batches), that can point out specific areas of improvement (through energy analytics described in the previous case) and act as an enabler for further optimizing the performance of buildings from an energy point of view. In Finnish context, FVH provides the data from Finnish buildings and systems to the ESCOs involved in the project. Also, it will be investigated if Helsinki city data model can be enriched with selected eDEC and SRI scores calculated in the project. SRI and eDEC modules are developed in T6.4.

5.1.4 Informed and Evident policy making (predictive modelling) at urban and macro-level enabled by detailed Impact Assessment for Holistic Energy Optimization – Data sharing between buildings and City Authorities

This demo case will capitalize on the baseline industrial data analytics in order to enhance the forecasting capabilities and simulation accuracy of the Crystal City tool of Artelys, towards providing better informed evidence the Helsinki City Authority (represented by FVH) for optimized energy policy making. Instead of forecasting the future energy performance of buildings (which constitute the major energy demand in urban contexts) based on high-level and low granularity metering data, this demo case will focus on equipping the Crystal City tool with building demand forecasts of higher accuracy to enhance its predictive capabilities and, thus, allow the tool to provide a more accurate representation of the environmental and energy state in specific urban contexts, subsequently enabling the better informed identification of local energy/ sustainability requirements and the design of more realistic policy measures to achieve mid- and long-term sustainability objectives. Demand (and generation) forecasting models for different types of buildings will be made available to the impact assessment tool (together with batch statistic data from well-known repositories of open building data and the Smart Urban Platform containing data about more than 36,000 buildings in the city area), to enable a more representative and realistic population of the tool's impact assessment (simulation) models and, subsequently, more accurate and robust predictions of the impact achieved by alternative policy scenarios designed for the city of Helsinki with the ultimate objective to support them in making the optimal decision for the timely and effective satisfaction of energy and sustainability objectives set out in action plans for the mid- and long-term. FVH provides data for Artelys for their analysis. The Impact Assessment Module is developed in T5.1. Furthermore, Demand (and generation) forecasting models for different types of buildings (developed in T4.2) will be made available to the impact assessment tool.

5.1.5 Advanced renovation support for accurate energy-efficient design of buildings towards optimized investment decision-making and de-risking – Data sharing between buildings and ESCOs/ Construction Companies

This demo case will focus on significantly reducing the gap between predicted and actual energy performance of buildings during the design of renovation projects. BEMS data from the buildings involved in the Finnish demonstrator (offered by the portfolio of buildings managed by FVH) and low-level intra-building sensing, metering, actuating data (IoT devices) will enable the definition of accurate occupants' behaviour and comfort profiles (based on baseline personal AI analytics available in the BEYOND toolkit). Such profiles will be made available to IGM to introduce them in iterative simulation loops of alternative renovation scenarios of selected buildings (performed the respective Renovation Decision Support tool developed by VTT), thus replacing generic routines and schedules currently used, with real data coming from the actual operation of the building-to-be-renovated. Additional analytics will be performed over simulation results to identify energy performance outliers and enable further devising renovation approaches and scenarios to achieve (in a highly accurate manner) optimal balancing between anticipated energy performance, renovation project costs and indoor air quality/ occupants' comfort. The demo case will validate highly accurate results for the anticipated energy performance of to-be-renovated buildings. On the other hand, it will validate significant benefits for IGM (as an ESCO) through facilitating further penetration of the Energy Performance Contracting (EPC) model for ESCOs, allowing for the reduction of uncertainty and respective risks of EPC business models, due to the reduction of the performance gap between predicted and actual energy performance of buildings, which in many cases can lead to a total project failure, since ESCOs fund such projects themselves and are paid back by the savings achieved; so any significant deviation between actual and predicted values of savings may drastically affect the payback and overall (investment) success of renovation projects.

5.2 Needs and Opportunities to be served by the implementation of the BEYOND solution

Table 5-1: Needs and opportunities for the Finnish demo

Needs	Opportunities
Increase of the buildings' energy performance.	Utilization of the Building Digital Twins application that will be configured during the project's implementation.
Better informed energy policy making by predictive modelling at urban and macro-level	Crystal City tool of Artelys
Analysis and optimization of energy usage in buildings based on occupancy rate	Visitor counters at Teollisuuskatu demo site
Evidence based predictive maintenance	Digital Twins and Enhanced AI Analytics
Energy efficiency optimization of buildings	IoT infrastructure, Beyond Big Data Platform and AI analytics toolkit, Building Digital Twins
Analysis and optimization of energy usage in city districts	Access to District level electricity data from Kalasatama (wealth of buildings)

5.3 Brief description of the demonstration area

Stadia, Teollisuuskatu 23

Stadia Vocational School is located in Vallila, a few minutes' walk from Kalasatama district. The building was constructed in 1946 and has floor area of 25 000m^2. Besides school facilities, the building has offices. The building is powered with district heating and cooling, and electricity.

FIGURE 5-1: STADIA VOCATIONAL SCHOOL

KYMP house

The City of Helsinki decided in 2015 to construct a new building for the use of the Urban Environment Division. Urban Environment House (KYMP) is located in Kalasatama district. The building was constructed in 2020 and has floor area of 40,000m^2. Besides school facilities, the building has offices. The building is powered with district heating and cooling, and electricity.

Figure 5-2: City of Helsinki Urban Environment House (KYMP)

Figure 5-3: City of Helsinki Urban Environment House, exterior

Kalasatama District

Kalasatama is being built by the sea, in the eastern part of the inner city. Kalasatama is one of the largest new areas being built in Helsinki, and construction is expected to last until the late 2030s. The former port and industrial area has already turned into a district of more than 10,000 people. Kalasatama is becoming a rather densely built-up area - about 25,000 inhabitants will come there. In addition, jobs are planned for Kalasatama for about 10,000 people.

FIGURE 5-4: KALASATAMA DISTRICT IN HELSINKI

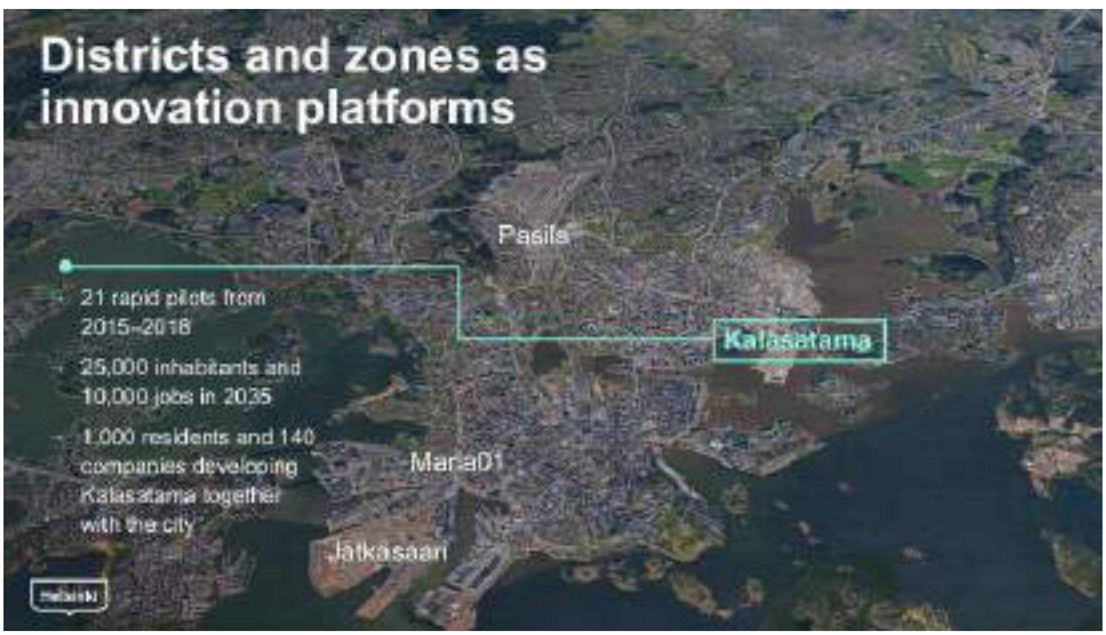

FIGURE 5-5: HELSINKI INNOVATION DISTRICTS

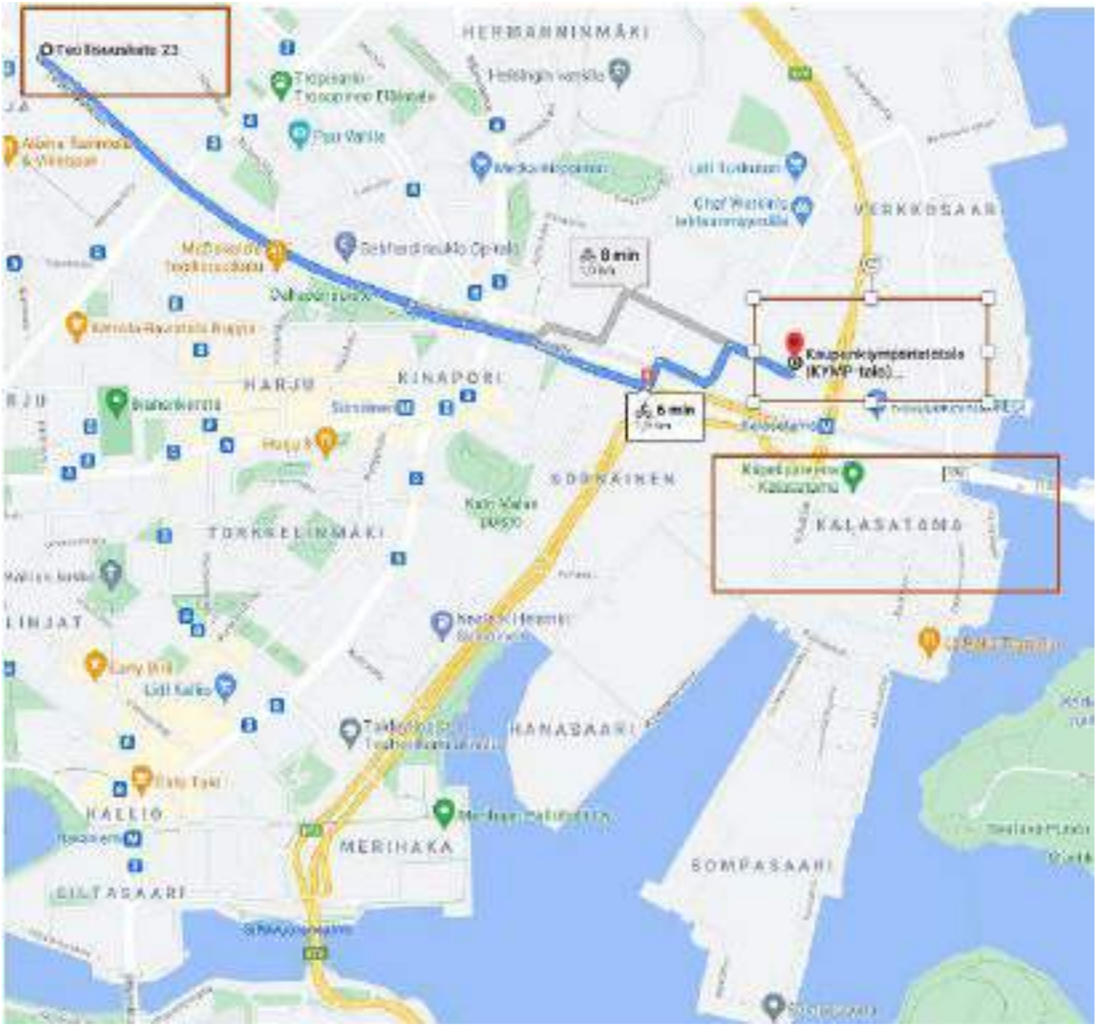

Figure 5-6: Finnish Pilots

5.4 Detailed description of demonstration sites (Buildings and Building Assets)

Stadia, Teollisuuskatu 23

- Basic information

Office and school building

Year of construction: 1946

Location: Teollisuuskatu 23

Gross floor area: 22498m^2+4644m^2

7/5 stories: 102122 m^3+21724 m^3

- Energy information

Carrier for District heating and electricity is Helsingin Energia Oy.

Access to annual numbers and costs from Carrier are not yet available for the project.

Individual data points for heating and electricity are already available.

Annual values can be formed from individual values, but not yet done.

Consumption data also available via Nuuka Open API.

KYMP house, Työpajankatu 8

- Basic information

Office building

Year of construction: 2020

Location: Työpajankatu 8

Gross floor area 35629 m^2

Volume: 7 stories: 209300 m^3

- Energy information

Carrier for District heating and electricity (10kV line) is Helsingin Energia Oy

Some consumption data is also available via Nuuka Open API.

Kalasatama District

Apart from the two pilot buildings, demo activities in Finland will connect to apartment buildings in the Kalasatama region which are defined as smart grid ready buildings. As part of the demonstration activities, FVH has subcontracted the development of API management in order to access Kalasatama district data in more detail. Energy consumption data (district heating) and near-real time sub-metered electricity data is expected from approximately 20 selected residential buildings to set a sound basis for district level planning.

More detail of the Kalasatama district assets will be updated and described in WP7 deliverables when information is available.

5.5 Key technical components

Hardware:

TABLE 5-2: KEY HARDWARE COMPONENTS OF THE FINNISH DEMO

Main components	Technical Specifications
Heating Systems	Stadia District heating system. Annual data calculations not yet available. Consumption data also available via Nuuka Open API. KYMP Separated heat exchanger for air condition L101LS01 (1500kW) Heating L103LS01 (450kW) Floor heating L104LS01 (15kW) Ice removal L105LS01 (200kW) Warm water L170LS01 (500kW) All heat exchangers have their own energy metering
Cooling systems	Stadia & KYMP District cooling • Primary energy factor: 0.17 • CO_2 emission factor based on calculated PEF: 62 g/kWh Cooling energy source: Baltic Sea
Renewable energy sources	Stadia None KYMP Rooftop solar panels 42kWp. Energy measurements are available.
Energy storage	None
Lighting devices	Stadia LED and T5 tube lighting. On demand (demand elasticity) control of lighting levels. KYMP KNX controlled LED lighting. Automatically controlled by presence, time and ambient light.
EV Charging Points	Stadia None

	KYMP 25 points and reserved capability to have a charger for every spot at the parking hall. Energy measurements are available.
IoT Devices	Stadia Visitor counters to all major doorways
Smart metering	Stadia The site automation system has been implemented by Siemens Building Technologies Oy's DDC-based control and monitoring equipment. Cold and warm water meter and main electricity meter data is provided from BEM via Nuuka api. KYMP Electricity measurement data is collected in building automation. Measurable entities include e.g. Total consumption by electrical center, Lighting share by center, HVAC share by center, District heating consumption, District cooling consumption, Elevator consumption by elevator, Stove consumption, Kitchen consumption, Solar electricity generation, Electric car charges. The main water meters L170VM-KV01.1 -01.2 of the property and the main hot water meter L170VM-LV01 are located in the heat distribution room on the K1 level. Hot water sub-measurements: J313VM-KV01 Emergency cooling of the server room, Parking garage V471VM-KV01.1 -01.2 Restaurant kitchen, A1409 Kitchen V471VM-LV01.1 -01.2 Restaurant kitchen, A1409 Kitchen V471VM-KV02 Café, A1106 Serving LV47. Water meters are connected to building automation. District heating energy measurements and district cooling energy measurements are located in the heat distribution room on the K1 level. District heating energy measurements: L171QQ01 the DH-energy measurement, L101QQ01 DH-energy measurement of IV and radiator system, L103QQ01 DH-energy measurement radiation heating network, L104QQ01 DH-energy measurement floor heating network, L105QQ01 DH-energy measurement Frost Protection Network, district cooling energy measurements: J371QQ01 DC energy measurement, J302QQ01 DC energy measurement Room cooling network. Energy meters are connected to building automation.

Software:

TABLE 5-3: KEY SOFTWARE COMPONENTS OF THE FINNISH DEMO

Main components	Technical Specifications
BEMS	Stadia • Manufacturer: Buildercom • Year of installation: 2016 • Types of technical systems/loads monitored/ controlled (ventilation, heating, air-conditioning, lighting, appliances, other): Heating, air conditioning, lighting, domestic water (hot & cold) • Centralized control • Integrated sensors: CO_2, temperature, ventilation flow values, heating flow values • Measurements performed in 5-60 min intervals • How can recorded data be accessed: Live data via Nuuka API partly in Nuuka public API • Control Intelligence (manual control, fixed (clock) control, occupancy-based control, sensor measurement-based control): Heating and ventilation are controlled via clock. Lights are controlled via clock and (electricity network) on demand • Smart Grid Integration (none, only for some sub-systems or smart grid readiness of the whole building): Smart grid integration for demand elasticity • Reporting capabilities (e.g., non-real-time total energy reporting per energy carrier/ real-time total energy reporting per energy carrier/ real-time energy reporting per energy carrier and technical system): Live energy data from main systems / segments KYMP • Manufacturer: Schneider EcoStruxure • Year of installation: 2020 • Types of technical systems/loads monitored/ controlled (ventilation, heating, air-conditioning, lighting, appliances, other): All major electric loads, heating, air conditioning, lighting, domestic water (hot & cold). • Centralized control • Integrated sensors: CO_2, temperature, ventilation flow values, heating flow values, IAQ 2,5 and 10ppm

	• Measurements performed in 5-60 min intervals • How can recorded data be accessed: Live data via Nuuka API partly in Nuuka public API • Control Intelligence (manual control, fixed (clock) control, occupancy-based control, sensor measurement-based control): Heating and ventilation are controlled via sensor input and clock. Lights are controlled via KNX by clock, presence and ambient (constant lighting levels at rooms with windows). • Smart Grid Integration (none, only for some sub-systems or smart grid readiness of the whole building): Smart grid integration for demand elasticity planned • Reporting capabilities (e.g., non-real-time total energy reporting per energy carrier/ real-time total energy reporting per energy carrier/ real-time energy reporting per energy carrier and technical system): Live energy data from main systems / segments

5.6 City information

5.6.1 Basic information

Helsinki, the capital of Finland has a population of 656 250. The city's urban area has a population of 1,525,800[1]. Population of greater Helsinki area of Finland is estimated to grow by over 20% by the year 2040[2]. Helsinki land area (including inland waters) is 217km^2 of which the city owns 137,2 km^2.

In December 2019, the total number of households was 339,786, and the average size was 1.7 persons[3]. There were 49,3% of one-person, 30,3% two-person, and 10,0% three person households. 85,7% of total 371,295 dwellings were in blocks of flats and 13.2% were in detached or terraced houses. 41,4% of the dwellings were owner-occupied and 47,4% were rented (11,2%, other). The following table presents the housing stock in Helsinki by construction year.

[1] https://www.stat.fi/til/vrm_en.html

[2] https://www.rakennuslehti.fi/2019/02/ennuste-vuodelle-2040-suomessa-on-vain-kolme-kaupunkiseutua-jotka-kasvavat-muu-maa-naivettyy/

[3] https://www.hel.fi/hel2/tietokeskus/julkaisut/pdf/21_06_09_Helsinki_facts_and_figures_2021.pdf

Table 5-4: Construction year of the Helsinki housing stock

Year	No. of dwellings	% of all dwellings
Before 1920	19,137	5.2
1920–1939	48,412	13.0
1940–1959	50,561	13.6
1960–1979	103,489	27.9
1980–1999	78,161	21.0
2000–2019	71,483	19.3

5.6.2 Energy information

The following paragraphs summarize Helsinki's SECAP targets[4]:

"Helsinki committed to the 2018 Global Covenant of Mayors for Climate and Energy (GCoM), the world's largest urban climate commitment. The commitment requires a Sustainable Energy and Climate Action Plan (SECAP) in accordance with the eligibility requirements of the GCoM Reporting Guidelines.

Helsinki's urban strategy 2017–2021 outlines that the city will achieve carbon neutrality by 2035, reducing emissions by at least 60% by 2030 and by at least 80% by 2035. Emission reduction work is guided by the Carbon Neutral Helsinki 2035 Operational Program (HNH Program) and adaptation work by the guidelines for adaptation to climate change, which serve as the starting point for the SECAP action plan.

The emission reduction impacts of the measures identified in the HNH program have been assessed in the SECAP Action Plan in ten sets of measures corresponding to the SECAP reporting framework. According to the review, the most significant measures affecting emissions have been selected for the review. The SECAP action plan presents the estimated baseline trajectory of Helsinki's emissions, i.e., BAU (Business as Usual), in which the city's emissions development is guided only by national measures and guidelines. The target path has taken into account the key mitigation measures identified in the HNH program.

[4] https://www.hel.fi/static/public/hela/Kaupunginhallitus/Suomi/Esitys/2021/Keha_2021-06-14_Khs_24_El/D9BAC172-A20F-CBCC-9741-79D689B00000/Liite.pdf

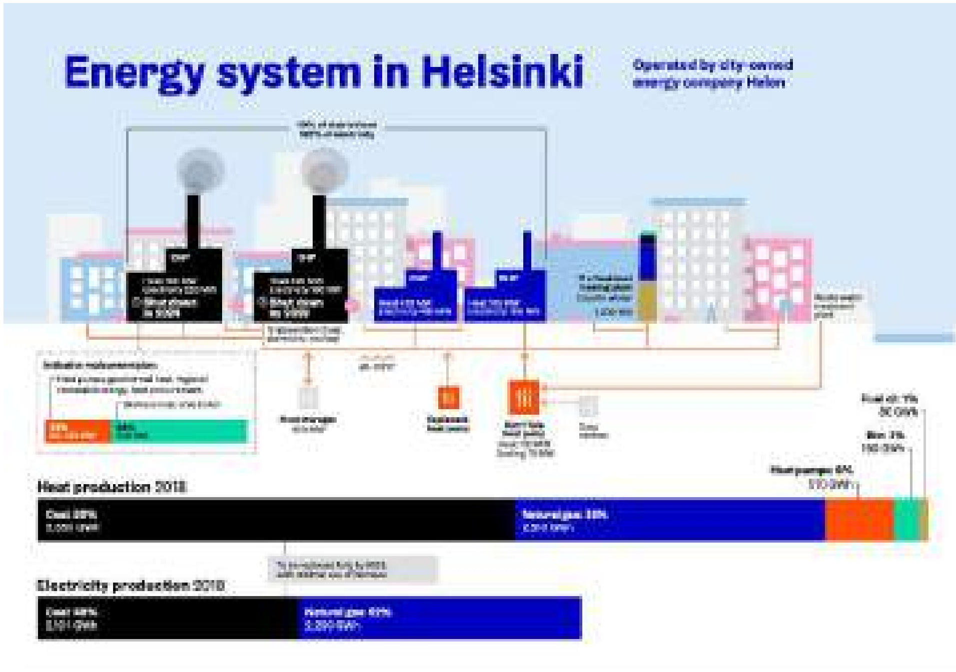

FIGURE 5-7: THE ENERGY SYSTEM IN HELSINKI

According to the SECAP calculation assumptions, if the baseline emission trend materializes, Helsinki's greenhouse gas emissions would decrease by approximately 27% by 2030 compared to 1990 levels. With the development of emissions according to the HNH program and the target scenario that takes into account Helen Ltd.'s carbon neutrality target, total emissions would decrease from the 1990 level by 81% by 2030. According to the Covenant commitment, emissions should fall by at least 40% from the base year level by 2030, so with the development in line with the target, Helsinki will clearly exceed the minimum target.

As the capital, Helsinki is a significant concentration of population, jobs, public and private investment, construction and administration, and research and development for the whole country. Helsinki is exposed to risks caused by weather and climate change, such as urban floods caused by heavy rains, the health effects of heat waves and increased seawater floods due to rising sea levels. The reflective effects of climate change, i.e., the chains of effects caused by weather and climate variations and climate change, which originate outside the city limits, can extend as far as Helsinki.

The City Government approved Helsinki's guidelines for adapting to climate change in May 2019. The guidelines are a plan by which Helsinki can adapt to climate change. Helsinki had previously included adaptation measures in various programs and created tools (e.g., stormwater program, green roof guidelines, green factor tool). Helsinki has also implemented the guidelines of the Helsinki Metropolitan Area's joint strategy for adaptation to climate change in its own work.

According to Helsinki's vision for adaptation, Helsinki will be a climate-sustainable and safe city in 2050, which has adapted to the changing climate in good time and prepared for extreme weather events. Helsinki has included adaptation in the city's planning and is constantly developing its operations. The benefits and costs of adaptation are examined from a macroeconomic perspective. The city promotes adaptation business opportunities.

In 2016, a climate-based social vulnerability survey was completed for the Helsinki Metropolitan Area, which analyzed the vulnerability of Helsinki's regional and various groups of people to floods and heat. Weather and climate change risks were assessed in Helsinki in 2018. The work identified the most significant climate risks and measures to manage them.

The SECAP plan has been approved and its refinement and implementation is monitored annually by the City Board. The implementation and refinement of the plan will also be reported every two years to the Global Covenant of Mayors European Monitoring System."

5.6.3 Software and tools used for urban planning and long-term forecasting/simulation

Currently, Helsinki energy system development is not modelled in urban planning in any aggregated or city-wide methods by the city. However, in recent city development projects, ESCOs have been performing simulations and modelling for the city. Helen, which is the energy (electricity and district heating) carrier and retailer in Helsinki, is likely to use modelling tools for development projects but the city does not have access to the information.

The land use and traffic planning of urban planning is done at the zoning plan level on the basis of spatial data, QGIS & MapInfo. On the town planning side, the design is done with MicroStation software. A new carbon emissions assessment tool for town planning has been recently developed and the tool is intended to be used for all zoning work. The tool provides an estimate of the climate emissions during the life cycle of the site for the next 50 years.

5.6.4 Smart City information

Innovation company Forum Virium Helsinki operates in three main focus areas: smart city, smart mobility, and open data & IoT. The city of Helsinki doesn't have a separate smart city roadmap but does have a digitalization strategy[5] and data strategy[6], which both guide smart city development in Helsinki.

In 2020, Helsinki was ranked the world's second-best smart city in the IMD Smart City Index survey[7]. The survey is the world's leading smart city comparison.

The City of Helsinki won the main prize in the digital city series in the global Year in Infrastructure Conference[8]. Helsinki nabbed the main prize with its Digital City Synergy project, in which the digital twin of Smart Kalasatama was one of the reasons for the win. In general, most well-known smart city initiative in Helsinki has been Fiksu Kalasatama[9] (Smart Kalasatama). The Smart Kalasatama project has made Kalasatama a model district for smart urban development and a pioneer of the climate goals of the City of Helsinki, and a district in which the smart solutions of the city are piloted first. Kalasatama area is also used in BEYOND's Finnish pilots.

5.6.5 Renewable energy in buildings

There are solar panels in at least 23 properties in the City of Helsinki's directly owned properties. The total capacity of the panels in these PV plants is 1250 kWp and they produce about 1,000 MWh of electricity per year. Most of the produced electricity is used in the property, very little goes to the grid.

Helsinki's installed panel capacity was approximately 15 MW in the last exploration. There is no measured data on annual energy, as the meters measure the electricity consumption of the entire site, where the panels are usually only a component.

5.6.6 Electricity storage in buildings

There is no electricity storage in facilities owned by the City of Helsinki. Helen has piloted energy storage, but it is still quite rare and no actual data can be derived from the pilots.

[5] https://digi.hel.fi/english/ds/digital-services-helsinki/

[6] https://digi.hel.fi/english/helsinki-city-data-strategy/

[7] https://www.imd.org/news/updates/singapore-helsinki-zurich-triumph-global-smart-city-index/

[8] https://yii.bentley.com/en/award-finalists#digitalcities

[9] https://fiksukalasatama.fi/en/

5.6.7 EV charging points

According to the "Carbon Neutral Helsinki 2035" action plan, in 2035 the share of electric cars must be 30% of Helsinki's vehicle fleet. In October 2020, there were 7,507 rechargeable hybrid cars and 1,379 electric cars in use in Helsinki, or a total of 8,886. In total, there are about 250,000 cars in use in Helsinki. The ratio of rechargeable cars to all cars in traffic is currently 3.6%.

There are about 200 public electric car charging points in Helsinki, of which 58 were commissioned at the beginning of 2020. The implementer of the public recharging points introduced at that time was selected through a call for tenders; the competition was won by Helen. There are also semi-public and private charging points in Helsinki. Semi-public charging points are located e.g., distribution stations and shopping centers. Private recharging points are located on properties most often in connection with homes and workplaces. The rule of thumb is that public charging points account for 10% of all charging points.

About 90% of electric car charges are performed at private charging points at home or at work. In order to increase the share of electric cars in Helsinki's car fleet, the implementation of charging points must be promoted in connection with new and supplementary construction. The proliferation of charging points for the existing building stock should also be encouraged. In Helsinki, the Kalasatama plot handover conditions require that at least 1/3 of the parking spaces be equipped with electric car charging devices. In addition, the conditions for the transfer of land require that all Parking spaces must be able to be easily equipped with charging devices. Charging point readiness means cabling to the parking space or other compliant electricity distribution system for later charging points for electric vehicles.

5.6.8 Open Data Hubs

Helsinki Region Infoshare is a joint open data service of the cities of the Helsinki metropolitan area. HRI.fi makes better use of public data in Helsinki region in the following domains:

Figure 5-8: Public data domains utilized in the Helsinki Region Infoshare

At the national level, avoidata.fi gathers all data opened by the government:

Figure 5-9: National public data domains utilized by avoidata.fi

5.7 Drivers and boundaries

Table 5-5: Drivers and boundaries of the Finnish demo

Drivers	Boundaries
Favourable and stable political environment (The city of Helsinki's digitalization and data strategies)	Real-time and synchronized data collection.
Technological developments in artificial intelligence and increased processing power and automation	Compliance to GDPR forms related to access of all pilot user related data.

Pilots supporting Helsinki's SECAP targets	Data quality
Legally supportive environment e.g., EPBD (844/2018) and EED (20122/27/EU)	

5.8 Data availability, characteristics and further needs

The asset analysis presented in the section is extensive and also includes assets that might not be made available for BEYOND platform. Hence, some of the assets listed are not relevant for BEYOND but they were part of broader analysis of the pilot buildings.

Available datasets in Teollisuuskatu 23

- BEMS data
  - Electricity (kWh) and District heat (MWh)
  - Cold water
  - Hot water

Available datasets in KYMP house

- BEMS data
  - Electricity (kWh) and District heat (MWh)
  - Indoor Air Quality in floor/room level. 2.5PPM and 10PPM
  - EV charging data available
  - PV data

Available datasets in Kalasatama District

- District heating (MWh)
- Variably sub-metered electricity (sauna, washer, lights, etc.)

Available datasets from other sources

- https://hri.fi/data/en_GB/showcase/helsingin-energia-ja-ilmastoatlas
  - Solar energy potential
  - Heating demand prediction
  - Geo-energy potential
  - Energy data of buildings
- Heating degree days describes the demand for energy needed to heat buildings. It is provided as open data by Finnish Meteorological Institute on monthly basis https://en.ilmatieteenlaitos.fi/heating-degree-days

Datasets to become available

- Visitor counters installed in summer 2020 by FVH

6 Overview of the Serbian demo

6.1 BEYOND Demo Cases to be tested in the Serbian Demo

6.1.1 Energy Performance Optimization and Self-Consumption Maximization through the application of the digital twin concept in buildings – Data sharing between buildings and ESCOs involved in Energy Performance Contracting

This demo case will enable direct data sharing between different types of buildings located in Belgrade (commercial as well as residential) and BEOELEK, sharing real-time BEMS, generation and IoT information from myriads of devices in buildings with more detailed data generation capabilities. BEOELEK will take over the detailed analysis (flexibility extraction) and optimization of building assets, through real-time energy consumption optimization (human-centric control of major building loads) and self-consumption maximization (real-time matching of demand and supply utilizing the flexibility offered from the demand side). The aim is to increase the energy performance of such buildings with the utilization of the Building Digital Twins application that will be configured by VTT during the project implementation.

6.1.2 Building Portfolio Management Optimization for Energy Efficiency through Portfolio Energy Analytics and better-suited Billing Strategies - Data sharing between buildings and Energy Retailers

The realization of this demo case will be based on the validation of a complete toolbox for energy retailers for comprehensive portfolio analysis, towards optimizing a series of business objectives. In more detail the Portfolio Analysis toolbox will utilize smart meter and consumption data from buildings belonging in the portfolio of energy retailers involved in the demo activities of the project, together with weather data, energy market/ price data and customer data (demographic, location-based, smart home/ IoT data). It will offer a holistic view and respective insights over the customer portfolio of energy retailers (hundreds of thousands buildings belonging in the portfolio of BEOELEK) towards (i) significantly reducing imbalances caused by forecasting errors, thus avoiding extremely high imbalance charges; (ii) examining advanced billing concepts (e.g. dynamic energy pricing) by segmenting, clustering and analysing consumption behaviours, inferring the elasticity of specific clusters against varying energy pricing levels and deploying highly effective implicit demand response strategies, towards optimizing the performance of their portfolio while hedging against non-anticipated imbalances; (iii) monitoring their compliance to Energy Efficiency obligations imposed by the European Commission and adopted by the Member States and designing appropriate portfolio management/ energy efficiency strategies and campaigns to achieve the anticipated targets; and (iv) analysing spatio-temporal patterns of their portfolio, identifying trends and outliers and receiving valuable knowledge for the design and delivery of added value services per individual customer or clusters of them to satisfy their needs for energy cost reduction through targeted innovative energy service bundles.

6.1.3 Personalized Energy Analytics and Energy Efficiency Optimization Guidance, including Human-Centric features for well-being of occupants - Data sharing between buildings, Energy Retailers and ESCOs

Capitalizing on the previous demo case, this one will move one step beyond and will realize advanced and innovative energy service concepts for selected customers of BEOELEK, focusing on personalized energy efficiency guidance, demand response, smart home automation and non-energy services for security, comfort and well-being, in collaboration with IGM (ESCO) that will facilitate the transformation of retailers' business model towards a service-oriented one through data sharing and business synergies between Retailers and ESCOs. Data streams from building systems and IoT devices (metering, control, ambience sensing) will be fed into the BEYOND Big Data Platform and Analytics Toolkit towards analysing the flexibility of individual consumers and generating personalized insights on how they can save energy and optimize their energy performance through the respective application that will be developed by SUITE5. In turn, targeted guidance will be provided by retailers to consumers, through the collaboration with ESCOs holding the expertise for Energy Efficiency measures, for manual interventions over their devices and loads, while in limited cases, the demo case will experiment with advanced human-centric automation concepts for properly balancing energy consumption with individual preferences regarding comfort, security and well-being.

6.1.4 Real-time Building Energy Performance and Smart Readiness Certification – Data sharing between buildings, Energy Retailers and ESCOs

This demo case will enable direct and real-time interactions between buildings and their systems (sharing real-time BEMS, generation and IoT information from myriads of devices in their buildings) with energy retailers and ESCOs involved in the project such as BEOELEK. The latter will take over the detailed analysis of data streams coming from the building systems regarding energy consumption and occupancy, along with weather data coming from open sources to enable real-time energy performance certification (applying innovative operational rating and appropriate normalization methodologies and approaches) of buildings based on real-life data streams (instead of aggregated data batches), that can point out specific areas of improvement (through energy analytics described in the previous case) and act as an enabler for further optimizing the performance of buildings from an energy point of view.

6.1.5 Informed decision-making on building-relevant energy infrastructure sizing and planning (district heating network) - Data sharing between buildings and District Heating Network Operators

District heating network planning algorithms that simulate the operation of the network in appropriate horizons (related to regulatory regimes and asset lifetimes) will be developed to automatically calculate network performance and congestion metrics based on different infrastructure and assets installation setups, their characteristics and planned/unplanned events. The algorithms will incorporate functionality to assess the performance of the networks under various demand and generation uncertainties. Optimization algorithms will be appropriately configured to enable the study of optimal planning and sizing of network assets such as new connections, needs for expansion or enhancement, considering also needs for further investments. The algorithms will have the capability to embed all information arising from BEOELEK (network operator) systems, flexibility analytics, short-, mid- and long-term forecasting analytics for demand and generation (referring to the buildings belonging in the BEOELEK Portfolio and for which metering data and more detailed IoT and smart metering/ sub-metering data will be made available – approx. 330,000 customers), along with batch static data coming from well-known repositories of open building data (statistical information about the building stock) in order to perform a comprehensive simulation-based analysis of performance metrics (utilizing and further enhancing the DHC Route Optimizer tool of Artelys for the delivery of the respective application) under alternative network reinforcement and planning scenarios.

6.2 Needs and Opportunities to be served by the implementation of the BEYOND solution

TABLE 6-1: NEEDS AND OPPORTUNITIES FOR THE SERBIAN DEMO

Needs	Opportunities
Increase of sensor elements	Satisfaction of consumer expectations for integration of more sensors, covering more space and physical quantities.

Decentralized approach	Upgrading the current solution, which is connected to the main system for surveillance and control of heating substation, to the independent solution. Independent, decentralized solution, would become interesting for other people that care about energy management, cost savings and environment.
Possibility for customization	Homeowners require certain customization of the system. Possibility to connect more devices and create their own smart home system. Accommodation of new devices and appliances and other technology are important especially for people that belong to "Do-it-yourself (DIY)" group of people.
Local connection	Users that have recognized the benefits of energy management, through the cost savings, are keen to implement the same solution to other locations/properties that, for technical reasons, can`t be connected to the existing solution.
Easy installation	Significantly simplified installation procedure. Smart Home wireless technology.

6.3 Brief description of the demonstration area

The Serbian demo site contains diverse types of buildings namely:

Stepa Stepanovic Neighbourhood
Most buildings of the demo site form a residential building group comprising 44 buildings with 64 flats each in five stories and is situated in the "Stepa Stepanovic" neighbourhood of the city of Belgrade. Each building houses **400-500** tenants on average. Buildings that have a built area of **170,000 m^2** and an annual energy consumption equal to **12,400,000 kWh** (including electricity and district heating consumption). All buildings share a central district heating infrastructure which is collectively managed by BEOELEK. The buildings house almost **12,000 occupants**. Following the inclusion of the Stepa Stepanovic Residential Buildings as a pilot site in the **H2020 MOEEBIUS & H2020 HOLISDER** projects, a wide variety of sub-metering systems, sensors and controllers/ actuators (smart thermostats) have been installed in several apartments spaces of the building, **including temperature, humidity and**

VOC sensors, smart HVAC control systems and communication gateways to facilitate the applicability of smart energy services.

- 42 hectares of land
- 44 buildings with 4,616 apartments
- 434,000 m^2 of residential and business space
- 146 business premises
- Elementary school and Kindergarten
- 1,430 garages
- 3,300 open parking places
- 9.5 km of roads
- parks and green areas
- Sport grounds and playgrounds
- Accompanying public

FIGURE 6-1: STEPA STEPANOVIC NEIGHBOURHOOD

Generala Šefanika 29-31 (Building ID 3G)

FIGURE 6-2: GENERALA ŠEFANIKA 29-31

Generala Vladimira Kondića 5-7-9 (Building ID 6D)

FIGURE 6-3: GENERALA VLADIMIRA KONDIĆA 5-7-9

Elementary School „Danilo Kiš“

FIGURE 6-4: ELEMENTARY SCHOOL „DANILO KIŠ “

6.4 Detailed description of demonstration sites (Buildings and Building Assets)

Stepa Stepanovic's Serbian pilot location consists of two buildings and one school. All data collected from the pilot location through optical devices is sent to the MQTT broker also located at the pilot site. The data is sent as an MQTT message (Middleware also supports accepting data via MQTT endpoint). There is also an FTP backup server, which is linked to our MQTT broker and collects data, so we always have a backup in the event of a connection failure between MQTT and server, FTP takes over the role and it sends data to the main server.

Generala Štefanika 29-31

- Basic Information

  Year of Construction: 2013
  Total Building Surface: 4560 m^2
  Number of floors: 8 including ground floor

Number of offices/ apartments in the building: 2 offices + 68 apartments
Energy performance certificate: Available

- Energy info

Annual consumption:

Electricity **~ 500 MWh**

District heating **~ 235 MWh**

Annual Cost:

Electricity ~ **61,000** €

District heating **~ 20,000** €

Generala Vladimira Kondića 5-7-9

- Basic Information

Year of Construction: 2013
Total Building Surface: 6145 m^2
Number of floors: 8 including ground floor
Number of offices/ apartments in the building: 7 offices + 102 apartments

Energy performance certificate: Available

- Energy info

Annual consumption:

Electricity **~ 750MWh**

District heating **~ 300 MWh**

Annual Cost:
Electricity ~ **110,000** €

District heating **~ 25,000** €

Elementary School „Danilo Kiš“

- Basic Information

Year of Construction: 2014
Total Building Surface: 6114,65 m2
Number of floors: 4
Operating periods: approximately from 7:00 to 21:00

- Energy info:

Annual consumption:

Electricity **~ 200 MWh**

District heating **~ 260 MWh**

Annual Cost:

Electricity ~ **170,000** €

District heating **~ 25,000** €

Energy performance certificate: Available

- IoT Devices

  Smart Metering Energy Devices

  Room surveillance (ambient temperature and humidity sensors);

6.5 Key technical components

Hardware:

TABLE 6-2: KEY HARDWARE COMPONENTS OF THE SERBIAN DEMO

Main components	Technical Specifications
Heating Systems	JKP Beoelek – Heating plant Vozdovac, plant has three boilers. Two installed with power of 58 MW and one with 116 MW. For smart control we are using Siemens SCADA. Annual gas consumption 27898552 m^3. Annual production of energy 200883 MWh.
Cooling systems	Majority of apartments have individual AC (split system, inverter) units
Renewable energy sources	N/A
Energy storage	N/A
Lighting devices	Not automated
EV Charging Points	N/A
IoT Devices	DG100 Multi-service IoT Edge Gateway, DSH101-USB Wireless sensor hub, DWS112 Short range wireless sensor, DWS114 Short range wireless sensor,DWS130/131 Short range wireless sensors, DMS113 Wired sensor;
Smart metering	59 Substations in neighborhood Stepa Stepanovic, Data collection on hourly basis and historical data from 3+ years

DG100 Multi-service IoT Edge Gateway	Manufacturer: DECODE Specification: CPU ARM7; OS Linux; Connections Ethernet, WiFi, Bluetooth, Serial, USB, mikroBUS Power supply: 8~30V DC, typ. 1W Software: bundles for SimpleRF, modbus and MQTT Purpose: to provide integration of IoT sensors to cloud services via MQTT
DSH101-USB Wireless sensor hub	Manufacturer: DECODE Specification: USB 1.1 and 2.0 interface standard, SimpleRF sensor interface Power supply: from USB port Purpose: interface between multiple sensors and DG100 GTW as host device
DWS112 Short range wireless sensor	Manufacturer: DECODE Specification: Frequency 868MHz, Protocol SimpleRF, Output power 10mW, Outdoor range 300m Power supply: CR2032 battery, Battery life 1year @ 600s heartbeat Sensing element: BME280 Purpose: measuring of Temperature, Humidity, Pressure Range: (-40.0 ~ 85.0 C), (0 ~ 100%), (300 ~ 1100hPa)
DWS114 Short range wireless sensor	Manufacturer: DECODE Specification: Frequency 868MHz, Protocol SimpleRF, Output power 10mW, Outdoor range 300m Power supply: CR2032 battery, Battery life 1year @ 600s heartbeat Sensing element: OPT3001 Purpose: measuring of Ambient light (human eye response) Range: 1 ~ 65535lux
DWS130/131 Short range wireless sensors	Manufacturer: DECODE Specification: Frequency 868MHz, Protocol SimpleRF, Output power 10mW, Outdoor range 300m Power supply: CR2032 battery, Battery life 1year @ 600s heartbeat Sensing element: dry contact or reed switch Purpose: detecting of Switch input or Alarm reed switch
DMS113 Wired sensor	Manufacturer: DECODE Specification: Interface Half duplex RS-485, Protocol Modbus RTU, Speed 1200~115200bps Power supply: 4.5~28VDC, max. 200mW Sensing element: BME680 Purpose: measuring of Temperature, Humidity, Pressure, AIQ Range: (-40.0 ~ 85.0 C), (0 ~ 100%), (300 ~ 1100hPa), (0-500)

Software:

TABLE 6-3: KEY SOFTWARE COMPONENTS OF THE SERBIAN DEMO

Main components	Technical Specifications
BEMS	N/A
HEMS	N/A
Mobile application	Flutter (Android&iOS versions)
Web application	PHP, Laravel, HTML, VueJS, Axios
Database	MSQL
Server	Apache, Debian
Web API	Weather service API, Cassandra reporting API, MQTT API…
3D BIM	Building plans for all buildings are converted to 3D building information model.

6.6 Network information

Basic network information

- Length: 55 km
- Number of sub-stations: 596
- Number and type of customers served is estimated to be around 500.000
- Latest annual peak demand 131 MWh
- Latest annual network downtime (for the power network)

6.7 Drivers and boundaries

TABLE 6-4: DRIVERS AND BOUNDARIES OF THE SERBIAN DEMO

Drivers	Boundaries
End users are interested in taking part in project	Centralized energy market, very basic electricity bill based on fixed prices
There is interest in using different tools in tracking and controlling energy costs	Data quality and real time collection
Raised awareness for energy savings, people seek more personalized services	Lack of clear information and knowledge in Demand Response and Flexibility schemes
	Difficult to combine various energy sources

6.8 Data availability and characteristics

Stepa Stepanovic Neighborhood (residential, built surface 170.000 sqm)

- Installed power (kW)
- Calculated energy consumption (kWh)
- Historical consumption on building level (kWh) – monthly
- Historical data on Outdoor temperature and number of degree hours – on exact pilot location (°C) Hourly

Two residential buildings (Generala Stefaneka 29, Generala Vladimira Kondica 5)

- Heat consumption at substation level – monthly
- Heat consumption per apartment – monthly

Primary school "Danilo Kis"

- Heat consumption Monthly
- Water consumption m^3 Monthly
- Electricity consumption Monthly

7 BEYOND High-level Preliminary Deployment and Demonstration/ Validation Activities Planning

This section provides a high-level plan regarding the deployment activities to be undertaken during the BEYOND project and the anticipated demonstration and validation activities to be performed in the 4 demonstration sites, following the release of the BEYOND Data Analytics, Sharing and Matchmaking Service Bundles (scheduled for M18), the BEYOND Integrated Platform (v1.00 scheduled for M20) and the End-User Applications (to be delivered in M20, as well).

As already mentioned, the high-level plan presented in this section focuses on two main types of activities, namely the Deployment Activities and the Demonstration/ Validation Activities of the project. With regards to the former, the BEYOND Deployment Activities are mainly focused on the installation of the necessary equipment in the BEYOND Demo Sites (additional installation to complement existing data assets), along with the deployment of the BEYOND Integrated Platform (both Cloud-based platform and Private Infrastructure), so that demonstration and validation activities can commence. In this context, deployment activities involve the following aspects and actions that need to be satisfied as part of the high-level plan discussed in this section:

- Ex-ante auditing and assessment of data assets available in the demo buildings.
- Identification of additional equipment (sensors, IoT, meters, actuators and gateways) that need to be installed to enrich data availability and facilitate the realization of the aforementioned use cases.
- Procurement of the required equipment.
- Installation and configuration of the procured equipment in the demo buildings and initial functional testing.
- Installation of the BEYOND Private Infrastructure (if required) in the demo site premises and establishment of its communication with the BEYOND Cloud-based Platform.

On the Demonstration/ Validation Activities' side the following actions are included and scheduled in the high-level plan:

- Integration of field devices, systems and assets with the BEYOND Big Data Platform for the launch of the data collection activities of the project and pre-validation of the respective requirements with regards to data upload, interoperability, API communication etc.
- Pre-validation of the Integrated Platform (all different service bundles) and End-user applications in both lab environments, but also in the pre-validation demonstration site provided by IGM for the detection of critical issues either at

functional or performance level (including acceptance and scalability tests, among others).

- Demonstration in real-life conditions and validation of the solution in operational environments in the demo sites of the projects, involving the coordination, execution and monitoring of the evolution of the 1st phase of demonstration activities, interim impact assessment, launch and execution of the 2nd phase of demonstration activities and final assessment of the impact achieved as part of the use cases implemented in each demonstration site.

The following figure presents a preliminary plan and high-level estimation of the timing of the different activities (and involved actions) that are included in the BEYOND deployment and demonstration/ validation phases. It is worthwhile mentioning that this plan will be re-assessed and revised as the project progresses, towards delivering a more detailed plan, tailored to the needs, specific conditions and possible barriers addressed in each individual demonstration site of the project, as part of deliverable D7.2 -Detailed Demonstration Activities Management Plan, which is due for M16 of the project and, apart from the planning of the demonstration activities, it will also touch upon the pre-validation and deployment activities and their respective planning in each demonstration site.

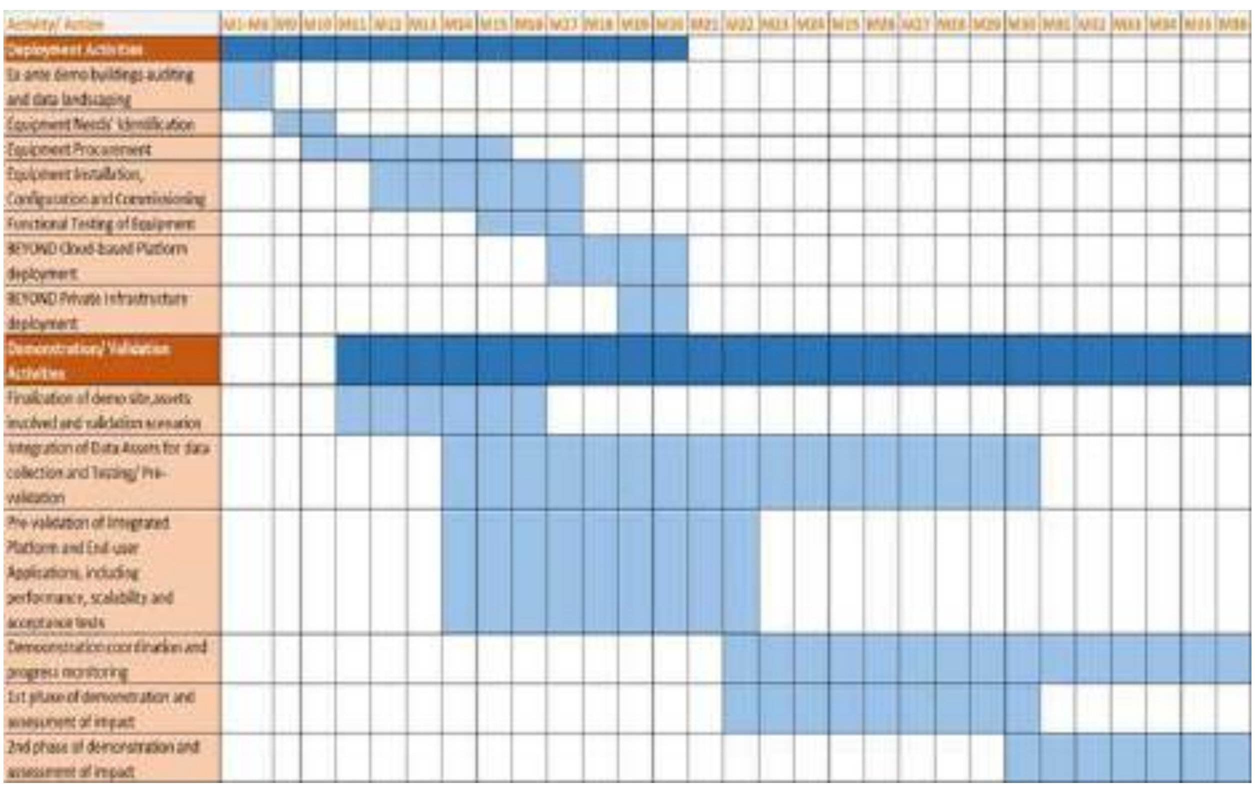

FIGURE 7-1: PRELIMINARY HIGH-LEVEL DEPLOYMENT AND DEMONSTRATION/ VALIDATION PLAN (ACROSS ALL BEYOND DEMONSTRATION SITES)

8 Conclusions

The deliverable provides a preliminary planning of the demonstration activities that will be further analysed and developed in WP7. It includes a description of each demo site along with respective information on their available assets which need to be taken into account for the demonstration.

An important part of the provided information is the data landscape where available datasets are listed per demo including specifications and features, level of availability and IPR. This list is a baseline and will be updated during the next months since each Use Case and the system architecture generally will enable a deeper understanding of the BEYOND solutions' input prerequisites. In that sense, the document could be characterized as living, since it will be updated with more datasets, some of which are available and some will need to become so.

In overall, the task document provides a demo-oriented overview of the BEYOND solutions' demonstration and its deployment. The collection of the respective information triggered the conversation for a more thorough and demo-oriented understanding and description of the use cases to be tested and assessed during the project activities. In collaboration with other deliverables developed in WP2, D2.5 presents the whole framework of the project from both a technical and demo point of view.

9 ANNEX

BEYOND Data Landscape

Data Asset Description		Data Asset Features								Data Asset Availability		Data Asset Rights	
Data Asset Title	**Description**	**Type**	**Format**	**Velocity**	**Temporal Coverage**	**Temporal Resolution**	**Spatial Coverage**	**Spatial Resolution**	**Veracity**	**Accessibility Method**	**Frequency of Updates**	**Privacy**	**Sharing Mode**
The title of the data asset	A brief description of the data asset - At least 2-3 lines to give an overview of the data	[Text / Image / Video / Audio / Other]	[csv, xml, json, other]	[Real-time, Near Real-time, Batch]	[From ... To...]	[The temporal "granularity" of the data, e.g. per minute / hour / day / month]	[Locations]	[The spatial "granularity" of the data, e.g. at district / zone / building / area level]	[Raw, Pre-processed, Processed Data asset]	[Through API, As downloadable file, As database extract, Other]	[Real-time, Every X minutes / hours, Daily, Weekly, Monthly, Yearly, other]	[Confidential (not to be shared at all) / Private (to be shared with appropriate licensing) / Public (available to all)]	[Encrypted Data Sharing / Unencrypted Data Sharing / Secure Multi-party Computations (with data always on-premise at providers' side) / Encrypted Intelligence Sharing / Unencrypted Intelligence Sharing]
Temperature	Room temperature [°C]	Text	csv	Near Real-time	2013	per 15 min	Finland	Building	Raw	API	Hourly	Proprietary	Unencrypted data
Incoming air temperature	Incoming air temperature [°C]	Text	csv	Near Real-time	2013	per 5 min	Finland	Building	Raw	API	Hourly	Proprietary	Unencrypted data
Motor drive setting	Motor drive set value 0-100%	Text	csv	Near Real-time	2013	per 5 min	Finland	Building	Raw	API	Hourly	Proprietary	Unencrypted data
Convector water intake temperature	Incoming cooling water temperature	Text	csv	Near Real-time	2013	per 5 min	Finland	Building	Raw	API	Hourly	Proprietary	Unencrypted data
Visitor counter	Visitors coming in and out. Measurements from every exit.	Text	csv	Near Real-time	2021	per 60 seconds	Finland	Building	Raw	API	Hourly	Proprietary	Unencrypted data
Hot water consumption	Total hot water consumption in the building	Text	csv	Near Real-time	2020	per 60 seconds	Finland	Building	Raw	API	Hourly	Proprietary	Unencrypted data
Energy Consumption	Electricity (kWh) and District heat (MWh) consumption data Kalasatama district (several residential buildings)	Text		Near Real-time	2020	Per hour	Finland	Multiple buildings	Pre-processed	API	Hourly	Proprietary	Unencrypted data
Air quality	Indoor Air Quality in floorplans level	Text	csv	Near Real-time	2020	Records per 5 min	Finland	Building	Raw	API	Hourly	Proprietary	Unencrypted data

13	**Energy imported from the Grid (kWh)**	Metering Device (Eastron Plus, Active 3 Ph) Power Meter Three Clamps (SDM)	Other	xlsx	Batch	[1-1-2020 - today]	per hour	Attica Region	Building	Raw	As Database Extract	1 Months	Confidential	Encrypted Data Sharing (encrypted data to be uploaded in the Beyond core platform)
14	**Ambient Sensing and Occupancy Sensing - Residentials**	Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence)	Other	xlsx	Batch	[1-1-2020 - today]	per hour	Attica Region	Building	Raw	As Database Extract	3 Months	Confidential	Encrypted Data Sharing (encrypted data to be uploaded in the Beyond core platform)
15	**Marketing and Demographic Data from Portfolio**	Energy usage and [illegible] basic demographic data such as the location of the premise, the gender of the owner etc.	Other	xlsx	Batch	[1-1-2020 - today]	per day	Greece	Building	Raw	As Database Extract	15 Days	Confidential	Encrypted Data Sharing (encrypted data to be uploaded in the Beyond core platform)
16	**Voltage (V)**	Voltage at the supply points and the boundary points	Text number	csv	Near Real-time	2020	per 15 min	Spain	Network infrastructure	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
17	**Active power (MW)**	Active power at the supply point	Text number	csv	Near Real-time	2020	per 15 min	Spain	Network infrastructure	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
18	**Reactive power (MW)**	Reactive power at the supply point	Text number	csv	Near Real-time	2020	per 15 min	Spain	Network infrastructure	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
19	**Grid topology**	Full grid topology of the demo site	Text	csv	Batch	N/A	N/A	Spain	Network infrastructure	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
20	**GIS - Geographical Information System**	Full geographical information of the demo site	Text	csv	Batch	N/A	N/A	Spain	Network infrastructure	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
21	**DERs location**	All the distributed energy resources located in the grid. The information is fail available	Text	csv	Batch	N/A	N/A	Spain	Network infrastructure	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing

Active Power consumption (MWh)	Historical data of energy consumption	Text	csv	Batch	2020	per 1 hour	Spain	Network infrastructure	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
Real time generation data	Real time generation data from the transformers in the supply points	Text	csv	Near Real-time	2020	per 3 minutes	Spain	Network infrastructure	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
Historical generation data	Historical data regarding generation in the supply point	Text	csv	Batch	2020	on demand	Spain	Network infrastructure	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
General information about Cuerva retailers in the industrial park	National classification of economic activities, contracted power, tariff, location, power contracted recommendations, billing, consumption	Text	csv	Batch	N/A	N/A	Spain	ndustrial Park area	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
General information of the customers in Cuerva retailers portfolio	National classification of economic activities, contracted power, tariff, location, power contracted recommendations	Text	csv	Batch	N/A	N/A	Spain	tail retailers portfo	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
s Headquarters electric consu	Consumption in the building	Text	csv	Near Real-time	2020	per 15 minutes	Spain	Building	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
Headquarters EV chargers info	Consumption of the vehicle connected to the charger	Text	csv	Near Real-time	2020	per 15 minutes	Spain	Building	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
Headquarters generation info	Voltage, Current, Active and Reactive Power from the inverters	Text	csv	Near Real-time	2020	per 3 minutes	Spain	Building	Raw	As downloadable file	On demand	Confidential	Encrypted Data Sharing
Heat consumption at substation level for 6 apartments	(kWh)	Text	csv	Batch	2019	per 30 mins	Serbia	Apartment	Raw	s a downloadable fi	Daily	Confidential	Unencrypted data
Heat consumption for 6 apartments	(kWh)	Text	csv	Batch	2019	per 30 mins	Serbia	Apartment	Raw	s a downloadable fi	Daily	Confidential	Unencrypted data
Global electrical consumption for 6 apartments	Electricity (kWh)	Text	json	Near Real-time	2020	per 2 mins	Serbia	Apartment	Pre-processed	API	Real-time	Confidential	Unencrypted data
AC electricity consumption for 6 apartments	Electricity (kWh)	Text	json	Near Real-time	2020	per 2 mins	Serbia	Apartment	Pre-processed	API	Real-time	Confidential	Unencrypted data
Water heat consumption for 6 apartments	Electricity (kWh)	Text	json	Near Real-time	2020	per 2 mins	Serbia	Apartment	Pre-processed	API	Real-time	Confidential	Unencrypted data
Indoor temp for 6 apartments	Room temperature [°C]	Text	json	Near Real-time	2020	per 2 mins	Serbia	Apartment	Raw	API	Real-time	Confidential	Unencrypted data
Heat consumption at substation level for whole neighbourhood	(kWh)	Text	csv	Batch	2019	per 30 mins	Serbia	Apartment	Raw	s a downloadable fi	Daily	Confidential	Unencrypted data
Danilo Kis primary school Heat consumption at substation level	Consumption in the building	Text	csv	Batch	2019	per 30 mins	Serbia	Building	Raw	s a downloadable fi	Daily	Confidential	Unencrypted data
Danilo Kis school Global electricity consumption	Consumption in the building	Text	csv	Batch	[illegible]	per 30 mins	Serbia	Building	Raw	s a downloadable fi	Daily	Confidential	Unencrypted data