Danube Region Programme

ESINERGY

D.1.1.1: CONCEPT ON THE PILOT ACTION IMPLEMENTATION AND CO-WORKING GROUPS

SO 1 / Title:	Reducing the peak loads by pilot actions
Activity 1.1 Conceptualizing of the pilot actions and co-working group collaboration	PP11 is activity leader. In order to clarify information about the pilot scope, what will be tested, demonstrated, and territory information, the pilots' background information will be taken and the methodology of work. The concept will include the specific descriptions of each pilot action's subchapters as well as information on how the co-designing approach will be used. The details about the particular needs of these areas will be provided in the concept. The concept will outline the differences between the pilots and also the objectives of each pilot - why they are implemented and how they serve to other areas to benefit from it. There will be 8 pilot projects demonstrating the peak load reduction (HU: establishing the energy community for energy city yard and set up all legal conditions, AT: optimization of current equipment and energy components in the energy community, SI: charging station, HR: battery storage, DE: sensors for optimization of the existing energy equipment, BG: energy storage and energy management system, BIH: PV and battery system, UA: heat pumps).
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Table of contents

Introduction

This document is deliverable, prepared by the project partners in the frame of DRP0200232 "Empowerment of the stakeholders in the implementation of the Directive on the promotion of the use of energy from renewable sources in term of energy storages and energy networks stability (ESINERGY)", funded under the Danube Region Programme, Programme Specific Objective 2.1: Support greening the energy and transport sectors in the Danube Region by enhancing the integration of renewable energy sources.

ESINERGY project aims to solve one of the key issues in modern energy technology, this is to manage the imbalance between the generated power and the load into the electrical network, which is not adequate for the forthcoming needs such as rising consumption, energy demand etc.

This challenge affects in particular energy providers, grid operators, all energy prosumers e.g. municipalities, companies, farms, households and indirectly regional and national public authorities that should deal with it on the structural and systematic way within the planning potentials. In fact, they are affected to such an extent that the connection of further (larger) PV-systems is not possible in some areas because the grid already operates at its limit. Partners coming from 12 Danube programme countries will benefit from the investment and project activities. To diminish the barrier, they will jointly cooperate in a compromise between local autonomy and centralized decision making. The organizations seek a balance between the pressures to integrate globally and response from a local audience.

Project will introduce the pilot approaches to reduce the peak loads directly in electrical networks, so that the producers could use the energy for own purposes (heat pumps, energy storages, charging stations, energy communities which can balance quite well differences of generation and demand) and support self-supply. There will be 8 pilot projects demonstrating the peak load reduction (HU: establishing the Energy Community for energy city yard & set up all legal conditions, AT: optimization of current equipment and energy components in the energy community, SI: charging station, HR: battery storage, DE: sensors for optimization of existing energy equipment, BG: energy storage and energy management system, BIH: PV and battery system, UA: heat pumps). Afterwards, the policy planning referring to peak loads will be improved through transnational strategy so that the measures could be replicated in other areas.

In order to clarify information about the pilot scope, what will be tested, demonstrated, and territory information, the pilots' background information is taken and the methodology of work. The concept includes the specific descriptions of each pilot action's subchapters as well as information on how the co-designing approach is used. The details about the particular needs of these areas are provided in the concept. The concept outlines the differences between the pilots and also the objectives of each pilot (why they are implemented and how they serve to other areas to benefit from it).

In this activity also the co-working groups will be established. The groups will serve to bring together partners with diverse expertise and backgrounds, to leverage the collective knowledge and skills to achieve common goals in the terms of the joint development and implementation of the pilot actions, strategy and action plan and solution. PP10 is the leader of the co-working groups which will be a mixture of pilot and non-pilot partner to jointly interact. In this concept the co-working group's structure, meeting frequency, duration, and any other logistical details are defined.

This document identifies the key elements of the 8 pilot actions. It is finalized by PP11, with contributions from all pilot PPs. It contains the specific info on the pilots: equipment, target groups, territory, time plan, allocated funds and how it will be jointly co-developed and performed by partners.

The summary

There are 8 pilot projects demonstrating the peak load reduction:

N	PILOT SITE TITLE	COUNTRY	SHORT DESCRIPTION	PROJECT PARTNER INVOLVED
1	Establishment of an energy community	Hungary	Establishing the energy community for energy city yard and set up all legal conditions	Zala County Self-Government (PP9)
2	Campus Innovation Centre W.E.I.Z.	Austria	Optimization of current equipment and energy components in the energy community	Energy and Innovation Centre of Weiz (PP5)
3	Smart concept for solar electricity flow and use	Slovenia	Charging station	SMART HOUSE (PP2)
4	Battery system in Administrative building of MED	Croatia	Battery storage	Medjimurje County (PP4)
5	Monitoring & control of decentralized plants/assets	Germany	Sensors for optimization of the existing energy equipment	Electricity Company Hindelang (PP7)
6	Smart energy management trough smart battery in a small glass factory and museum	Bulgaria	Energy storage and energy management system	Union of Bulgarian Black Sea Local Authorities (PP11)
7	Goražde	Bosnia and Herzegovina	PV and battery system	JP Elektroprivreda BiH d.d. – Sarajevo (PP14)
8	Heat pumps for local hospital in Khotyn municipality (Ukraine)	Ukraine	Heat pumps	Association “Energy Efficient Cities of Ukraine” (PP16)

Through the results of the Pilot projects, knowledge will be accumulated about new possibilities for creative applications for large-scale energy storage.

The main objective of the pilot projects is to demonstrate various options for reducing peak loads. The main objective of the pilot models is to test different possibilities for increasing the share of RES and improving energy independence. Different approaches to reducing peak energy loads, optimizing the performance of photovoltaic systems and achieving energy independence through the use of renewable energy sources will be explored.

The pilot model in Hungary will explore the possibilities of creating a sustainable energy community by examining the organizational form, rules of operation, clarifying the processes of purchasing and sharing energy of the energy community.

The pilot model in Austria will explore a new energy storage system and create an intelligent monitoring platform. It is expected to receive important data on user behavior, possibilities for balancing and Peak-Shaving and researching the possibilities of a new battery system.

In Slovenia, the pilot model will explore V2B and V2G systems. Aiming to reduce peak loads through home and car batteries.

The pilot model in Croatia will explore the possibility of a "zero emission" building through the installation of an energy storage system and an energy management system. The model will work in sync with an already built photovoltaic system. This model is highly replicable in other buildings.

In Germany, the possibility of optimization of the local electricity grid through a "flexibility" potential determined local hydropower plant will be investigated.

In Bulgaria, the possibility of flexible consumption of electricity produced by a photovoltaic system through an energy management system and batteries will be explored. The facility is a small factory.

The topic of the Ukrainen pilot action is to demonstrate the potential of using alternative and renewable energy sources to reduce peak loads and increase the energy security of critical infrastructure institutions in Ukraine.

Description of the pilot sites

In order to clarify information about the pilots' scope, including what will be tested and demonstrated, as well as information on the territory, the pilots' background information and the methodology of work is presented. The goal includes the specific descriptions of each pilot action's subchapters, as well as information on how the co-designing approach will be used.

I. Pilot case: Establishment of an energy community

Location: Hungary

1.1. Background information

The location of the pilot activity is the energy-yard of Lentiszombathely. The site is owned by the Local Municipality of Lenti. The local municipality is responsible for the operation, maintenance of the building and the pieces of installed equipment. Near the site there is a community centre, a funeral home, a belfry and an e-bike charging station which are also owned by the local municipality.

The energy yard is a demonstration site to showcase renewable energy solutions to the public and to interested experts. (See next section.) The equipment was originally installed as part of the Interreg Central Europe funded RURES project and the Interreg Hungary-Croatia funded Energy Tour project.

As for energy prices, due to the current extreme high energy prices, residential customers have to pay a subsidised price of consumption until they reach the average consumption. For electric power the average consumption is 210 kWh/month (2523 kWh/year), for natural gas it is 144 m3/month (1729 m3/year). Above that level market prices will be billed. As about 3/4th of the residents consumes below the average, they don't feel the price explosion. However, municipalities procure their energy on the market, so in recent years they face 7-8x higher prices than before.

Regarding cost calculation, typically two options are available: a yearly lumpsum payment (based on the average of the previous year's consumption) or monthly consumption metering/payment. Smart metering and dynamic pricing are not yet available – however with the pending update of the EU's RED directive and related regulations, this will most probably change from year 2025.

1.2. National legislation

With regards to the legal framework for energy communities in Hungary, the EU Directive 2019/944 has been transposed and energy communities were enabled as of 1 January 2021 . The first energy communities were approved by the Hungarian Energy and Public Utility Regulatory Authority in autumn 2023. The law basically allows exchanging electric power among energy community members without any tax burden (i.e. VAT or income tax).

1.3. Specific territory of the pilot action

The pilot activity of PP9 is planned to be implemented in the town of Lenti. Lenti is situated in the south-western corner of Hungary, near the border with Slovenia, Croatia and Austria. The location of the pilot activity is in the suburban area of Lenti, called Lentiszombathely.

In Lentiszombathely an energy yard was established which is a demonstration centre of different renewable energy sources. The former school building and its yard was partly renovated.

Due to other investment in the near past, several pieces of equipment were established there:

- Solar cell system for energy consumption: 15 pieces of the solar cells of 275W, perform generation of electric energy of 4.000 kWh/year,
- Solar cell system for hot water consumption: establishing a solar collector of 10-16 m2,
- Vertical wind generator: 1000W, 1,8m wide x 2,7m high (settled 6 m above the surrounding landmarks),
- Vegetable oil fed mini power plant: small power plant operating with used vegetable oil, capacity of 5 kW,
- Solar benches and resting place.

The pilot site was selected because the energy yard provides an excellent background for demonstrating energy-related innovations. Since the purpose of the energy yard is to serve as a demonstration site, it also provides excellent replication opportunities for our pilot. Another reason for the selection was that the site is owned by the municipality. This makes it much easier to implement the demonstration activities. As the municipality is very open for innovation and experimenting, this setting will also make it easier to make changes or mid-way corrections, if necessary.

1.4. Topic of the pilot action

The aim is to create an energy community involving all the relevant actors:

- to propose the legal form, the organisational form of the energy community and its management,
- develop the rules of cooperation and accountability that will underpin the establishment of the energy community,
- clarify the energy purchase and sharing process,
- energy management: establishing a computerised background (data transmission, metering),
- agree on the relevant organisational issues.

On the site, there are various energy producing devices., as listed earlier. Near the site there is a community centre, a funeral home, a belfry and an e-bike charging station where the produced energy can be used. Other local stakeholders (residents, entrepreneurs) can also join the energy community, either as energy producers or consumers.

1.5. Target groups

- Local Municipality of Lenti: all the relevant sites are owned by the municipality.
- Educational institutions, business support organizations: the site was established basically for educational purposes. In addition to renewable energies, our pilot can show how an energy community works.
- Local residents, entrepreneurs: they can join the energy community either as consumer or producer.
- General public: the energy community can serve as a good practice for them. This way it is hoped that they will be inspired to establish or join an energy community in their own place of residence.

1.6. Detailed description of the pilot action

For a detailed narrative description of the pilot planning please see the sections above.

Indicative timeline:

- ✓ January / February: first consultations with the local municipality of Lenti
- ✓ 12 February, 2024: zoom meeting with the participation of Lenti pilot coordinator, IMRO (PP8) and Zala (PP9). Setting the common ground, agreeing on the next steps.
- ✓ February / March: procurement of the external experts (legal expert and engineer)
- ✓ February, 2024: collecting annual power consumption data to set the basis for technical planning
- ✓ February-March: informing local residents and entrepreneurs about our project through local media (TV, newspaper)
- ✓ March – November: elaboration of detailed implementation rules, involving the external experts, the local municipality and the power company grid operator (e.g. legal framework, financial conditions, public-private cooperation etc.)
- ✓ 19 March, 2024: personal on-site meeting with Lenti pilot coordinator, IMRO (PP8) and Zala (PP9). focusing on the involvement of further actors or stakeholders.
- ✓ 19 March, 2024: open day, introducing the pilot to interested residents and local entrepreneurs (i.e. possible energy community members)
- ✓ April-May: further meetings among project partners (technical and organisation planning)
- ✓ April-July: working with energy expert, legal specialist. Deciding on the legal form and drafting a founding document.
- ✓ Continued public communication during implementation
- ✓ June: preparation and submission of mid-term report
- ✓ Discussing the proposed operational framework (incl. founding document) with the relevant stakeholders.
- ✓ International peer review and incorporation of feedback from ESINERGY project partners in other countries.

- ✓ Autumn 2024: making final adjustments, preparing the legal registration of the new energy community.
- ✓ November 2024: communicating the completion and experiences of the ESINERGY pilot phase, preparing for starting the actual operation of the energy community.
- ✓ November 2024: preparation and submission of final validation report about pilot implementation

Technical components: not relevant for this pilot as no equipment will be installed.

However, in the future an info-room is planned to be created to demonstrate the operation of the energy yard and energy community. This involves establishing a digital kiosk (using a tablet), a static information board and an exhibition space (incl. some furniture, minor room upgrade, decoration, promotional materials). Total cost: 30,000 EUR

Breakdown of external costs required for the pilot action:

- ✓ Legal costs
- ✓ Cost of technical engineer

Information sharing with the stakeholders and the public is an integral part of this pilot. Already in step 0 (i.e. joint brainstorming about the focus of our energy community) interested local residents and stakeholders have been invited. Those who show interest for our energy community will be invited to all the follow-up meetings. Communication channels will include local media (TV and newspaper), social media (e.g. the Facebook page of the city), the city council meetings, direct e-mails with committed individuals. And last but not least, being a small community: the word of mouth.

Even if the pilot project will officially finish in November 2024, the info-room will keep on operating and thus promote the results of the pilot action on the long run. It will be available to all the guests who come and visit the energy-yard, such as interested residents, experts, entrepreneurs, school groups, city representatives etc.

Establishing an energy-community is a **high-risk activity** in itself. The concept is new, people don't know about it, no practical experiences exist in our country, the legal and regulatory framework is in an early phase of development, the national power supplier is reluctant to provide "non-experts" access to the power grid, technical requirements are not fully understood etc. Therefore, the main purpose of the pilot project is to collect practical experiences about tackling risks and challenges. For this reason, the process is designed in a flexible way, leaving enough room for mid-way corrections and adjustments. An important aspect to tackle the obstacles and solve problems is to communicate widely, involve stakeholders and work out solutions jointly. This will maximise the utilisation of the creative potential of contributors and maximise the sense of ownership of those who contribute to the process.

Is the pilot action feasible? The reason why we are implementing this pilot is to provide a real-world based answer to this question. The project team is very committed to making the pilot successful, and initial experiences and feedback from local stakeholders is also very promising. However, the definite answer can be only given in November 2024, when the pilot is completed. In an ideal case, after the completion of our pilot a functioning energy community will be established, which will keep on operating and growing after our project's lifetime. In the worst case, all the preparatory activities will still be implemented by the end of our pilot, and then they can then be used in the creation of other energy communities (and avoid the pitfalls that we have encountered).

The pilot initiative can help to promote the spread of renewable energy sources such as solar, wind, geothermal or hydroelectric power. This can reduce the load on the power grid and the harmful emissions. Energy communities usually enable flexible energy use, for example by optimising the timing of consumption. This can help to balance the peaks in energy demand and improve the stability of networks.

II. Pilot case: Campus Innovation Centre W.E.I.Z.

Location: **Austria**

2.1. Background information

Since the municipal structural reform in 2015, the municipal area of the municipality of Weiz covers a total of 17.5 km², the population as of January 1, 2021 was 11,756 inhabitants and the population density at the same time was 674 inhabitants per km². As the district capital, the municipality of Weiz is located in the center of the district (Weiz), in the east of Styria and in the southeast of Austria. The area is located near (45km) to the industrial city of Graz which is the capital city of Styria. The exact location could be derived from the figure below.

Weiz has a rather good infrastructure connection. With infrastructure the overall connection is covered. Regarding transport Weiz could be reached through highway and railway connections very easy. From the energy sector Weiz is located near to the 380kW system. This means that in Gleisdorf which is 11km distanced from Weiz the 380kV system will be stretched down to 110kV. The 110kV system then will used for the city of Weiz. This system is necessary in case the overall consumption of electricity in Weiz is around 110 GWH per year. The following chart will figure out the energy consumption of the city of different sources.

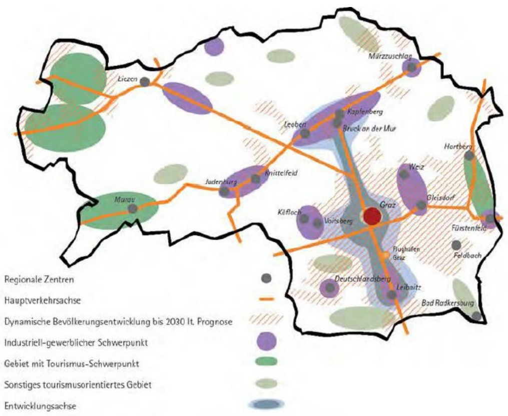


Figure 1: Location of the municipality Weiz

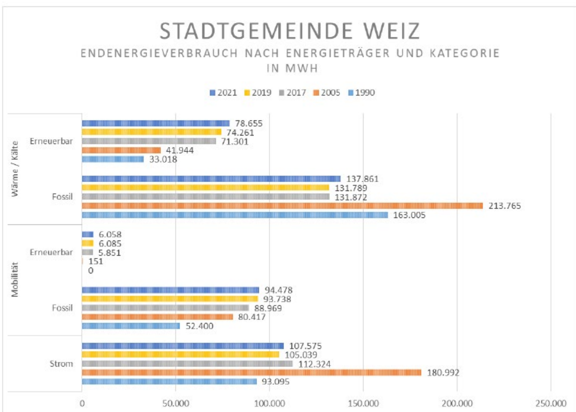


Figure 2: Energy consumption of the city of Weiz

2.2. National legislation

The new Renewable Energy Expansion Act (EAG) forms the basis for such an energy community. The legislative package largely came into force on July 28, 2021 and contains a large number of provisions that serve to implement the requirements of the Clean Energy Package for all Europeans (CEP). Regulations for renewable energy communities and citizen energy communities are an important part of the CEP and the EAG.

Until the liberalization of the Austrian electricity market on 1 October 2001, electricity was supplied exclusively by the large energy producers. The Electricity Industry and Organization Act and the Green Electricity Act made it possible for independent electricity producers to generate their own electricity and feed it into the grid. Former monopolists faced competition from municipal utilities, newly founded energy companies and small green electricity plants. These green electricity pioneers and energy farmers have now become an important and supporting pillar of the energy transition.

Private households are being equipped with "smart" electricity meters. However, consumers have the option of deactivating the "smart" functions and thus rejecting the smart meter ("opt-out"). The legal basis for the introduction of the smart meter comes from an EU directive. It stipulates that at least 80% of private households must be equipped with a smart meter. New legal regulations on smart meters are currently being drafted in Austria.

Energy prices in Austria are made up of 52.9 % for the energy price, 25.5 % for the price of using the infrastructure and 21.7 % for taxes. To support households in Austria with the increasing energy prices a subsidy is paid by the state called “Electricity price brake”. Till July in 2024 30 cents per kilowatt-hour are paid by the state and from July till December it is decreased to 15 cents per kilowatt-hour, but the first 10 cents per kilowatt-hour always must be paid by the households themselves.

2.3. Specific territory of the pilot action

In terms of the pilot action, W.E.I.Z will install the pilot action at or around the Innovation campus W.E.I.Z. In case of the campus the figure below shows the four buildings which are located at the campus. For the pilot action W.E.I.Z will use the building 1 to 3 in case that building 4 depends to the R&D institution Johanneum Research.

However, monitoring will support PV or storage systems which will be located also outside of the campus but within the city of Weiz. All systems which will be monitored are operated by W.E.I.Z.

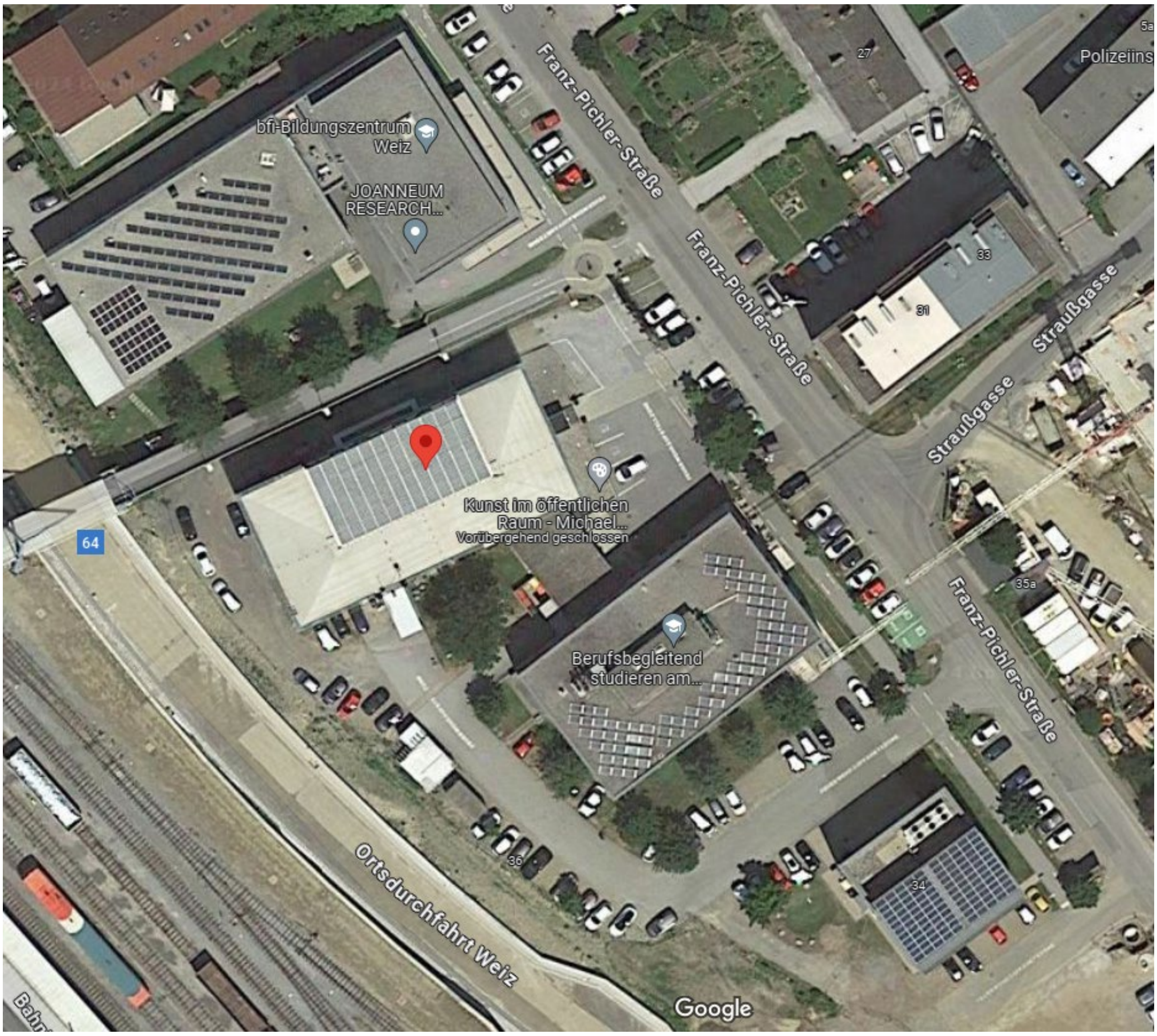


Figure 3: Location of the campus W.E.I.Z (Source: own design)

2.4. Topic of the pilot action

The topic of the pilot action is manifold. The innovation campus consists of four buildings which are mainly used as offices or laboratory offices. All buildings are equipped with PV Systems. The building itself will have potential to increase the PV power up to 100%. This means actually the campus and neighbour buildings have 120kWp installed. In the next years the plan is to upgrade the power up to 250kWp. Therefore, we would like to use standard PV systems mounted on the roof but also innovative systems for example PV systems mounted on the noise barrier of the campus and other innovative locations. Additionally, to the PV power upgrade the pilot should shift the harvested power into low load times. Therefore, storage systems will be required. The W.E.I.Z is planning to install a 100kW innovative storage system at the campus. With this new storage system, it will be possible to learn more about battery characteristics like number of load cycles, state of health (SOH), state of charge (SOC).

According to this requirement monitoring is utmost important. W.E.I.Z will set up a monitoring platform and integrate this monitoring and built a "smart city monitoring platform". Therein prosumer like PV systems as well as battery storage systems and other information data will be collected through the platform. The goal of the pilot actions will help to raise the awareness of the municipality and their inhabitants but also policy and decision makers will use the important data and visual aids of the monitoring platform.

Goals for the pilot actions:

- Receive meaningful data in case of monitoring prosumer, storage and consumer behaviours
  awareness of the municipality and their inhabitants
- Load balancing to increase self-balancing rate
- Peak-Shaving in case of innovative battery management system
- Monitoring and research of characteristics of a new battery system (Vanadium-Redox Flow)
- Develop innovative PV possibilities (defrostable PV modules)
- Set up energy communities with existing solar prosumers

2.5. Target groups

The primary target group which profits from this pilot actions will be the Innovation Campus W.E.I.Z which are operation the innovative PV systems as well as the smart grid nodes at the campus. The target group also includes the tenant companies which are located at the Campus W.E.I.Z. Actually, 300 people from 26 companies are working at this campus. All these companies will profit from the locally generated power and smart monitoring and control. Innovative control systems like peak shaving will guarantee lower energy costs and secure the workplace especially for small and medium sized companies.

Key stakeholder for the implementation of the pilot action is the owner of the Campus W.E.I.Z, the municipalities of Weiz, the facility management of the campus, the local energy network operator, equipment suppliers and regulation authorities. Other stakeholder may include research institutions, regional energy organizations, and other regional governments institutions (climate protection coordination unit).

2.6. Detailed description of the pilot action

The primary goal of the pilot is to monitor and optimise the energy management systems at the innovation campus W.E.I.Z. The pilot includes several components like PV-Systems, battery storage systems, smart grid energy nodes, smart energy counter, and more. Currently there is no common solution which organize the whole energy management system and so peak shaving or other optimization patterns are not possible deploy. To ensure this overall goal the pilot will focus on following components at the Innovation Campus:

Currently two buildings with in total xxx m² and an energy consumption of app. 315.000kWh are connected via an "smart grid energy node". This energy node or energy hub should finally connect all four buildings and share respectively optimise the energy consumption and production so that only the spare energy will be sourced from the official grid system. The current status quo is that we have connected two buildings to the "smart grid energy node". With this project it would be possible to install additional measuring equipment to use the data for the future monitoring platform. See below a rough figure of the smart energy node including existing PV Systems on the buildings of the W.E.I.Z as well as the planned spare capacity for future PV and storage systems.

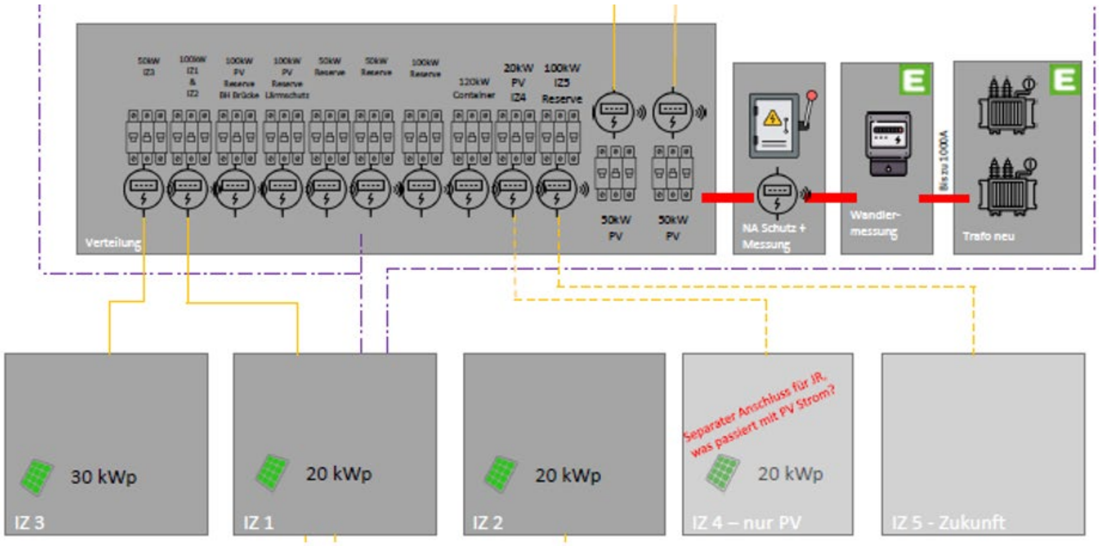


Figure 4: Smart energy node current status (Source: own design)

Within the smart energy node, it is possible to extend the PV capacity at the campus W.E.I.Z. The current capacity of the PV Systems on the roof of W.E.I.Z is 70kWp whereby 30kWp are a full feeder and could not be used till 2026. With the neighbour buildings the current usable power is 120kWp. In this project it will be discussed how much capacity will be possible to extend with the current status as well as which innovative systems (PV on noise barrier, PV on train station, ...). So, the pilot action will be to analyse the possible PV capacity standard and innovative and discuss how this could be achieved.

To optimize the usage of energy at the campus an energy management must be established. This project will invest in the necessary hard- and software to use the data for monitoring and visualization. Therefore, measuring devices, leakage sensors, climate and heater will be installed in different systems to optimize the different hardware. For example, the future storage system will be equipped with a heater and cooler so that the peak shaving could be guaranteed over the whole year even when the outside temperature is near to 40°C.

The mentioned battery storage system will be an innovative storage technology. The campus W.E.I.Z has decided to use a Vanadium-Redox-Flow system. Within this system it will be possible to operate the campus in a peak shaving operation as well as use the energy management to shift the energy in low load times or use it as a black out safety system. Beside the technical advantages the W.E.I.Z will learn about these new technologies and share the information through stakeholder events and others.

Finally, the campus in W.E.I.Z as well as the existing other PV Systems around will be virtually connected to an energy community. Through the community it will be possible to share the harvested energy to all participants in the community. This will be one of the first communities which has a storage system included.

- **Timeline and schedule** for the implementation of the pilot action: The storage system will be installed till latest mid of 2024. The campus itself but also the municipality will invest in PV and storage systems, the energy monitoring system will be implemented at the same time as the energy storage. PV systems depend on the 3rd party approval as well as on the financing of the municipality. Only the energy metering system and the technical support for the installation of the storage will be financed through the ESINERGY project.
- **Technical components**: The innovative storage system of 100kWh within a power of 26kW will be installed at the campus W.E.I.Z. The extension of app. 35kWp on the building W.E.I.Z III will be installed in 2025. The new PV System on the neighbour building will be established in 2026 with 40kWp

Innovative PV Systems depend on 3rd authorities to get approval:

✓ Possible further PV Systems could be installed at the train station with app. 100kWp.
✓ PV system on the noise barrier with a power of 20kWp
✓ Defrostable PV System on W.E.I.Z I with 20kWp
✓

- **Breakdown of the financial resources** required for the pilot action: Energy metering system and technical support for the installation of the storage will be financed through the project ESINERGY. Costs for PV and Storage will be covered by other financial sources.

- How information will be shared with **stakeholders and the public**: The project team will share the information through stakeholder meetings and events. Furthermore, the campus W.E.I.Z fosters the network of start-ups and medium sized companies so that many companies will visit the campus itself. With infotainment screens the monitored data will be shared with the visitors and stakeholders. The degree of innovation of the project on the W.E.I.Z. campus is based on the technologies used - the energy management system and the complex measurement and control technology - as well as the billing system.

The innovation is that the solution to be developed for optimizing self-consumption goes beyond the boundaries of the building and results in an energy community. This means that a self-consumption rate of 100% is also possible for large PV systems without putting a strain on the public network. The central role is played by the energy management system, which is responsible for self-consumption optimization and regulation.

Another key innovation factor in the project comes from considering the possibility of implementing an emergency power supply for several buildings involved based on renewable energy sources and incorporating battery storage.

The solution implemented at the W.E.I.Z campus differs from other solutions because the use of PV electricity does not take place exclusively within a building, but beyond its boundaries. The application of the solution for WEIZ, storage for peak load optimization and a cost-effective option for self-supply. In addition, the W.E.I.Z innovation centre uses good examples to provide impetus for imitators and thus for further local investments, which in turn could generate additional income and employment.

The present innovative approach and despite additional effort are intended to show that flexibility and energy efficiency measures in general, but especially for innovation centres, business parks and residential areas, are both economically and technically feasible.

Only through the integration of the central energy storage system it is possible to implement fully integrated, intelligent load management, which leads to a massive increase in the flexibility and efficiency of the system.

This means that, following the Weizer model, integrating electricity storage and new load management to increase efficiency at numerous locations also enables grid relief. The number of innovation centres and business parks in Austria and in the entire Danube region is very high, which is why this innovative integration has high market potential and multiplicatively. The system in question can and should therefore serve in the next few years as an innovative best-practice system and as a model for simplified technical but above all economic implementation at these locations in particular and to significantly increase the proportion of renewable energy sources as well as to reduce electricity costs contribute to reducing peak loads.

- How the **pilot action's results can be sustained or expanded**: With this project the initial investment could be done for measuring and monitoring equipment. This is the starting point to extend the PV and storage system so that new information could be collected and analysed. With the lessons learned the smart energy node will be extended by each new project.

- Identification and assessment of **potential risks and challenges**: In case that we use new and innovative technologies like the Vanadium Redox Flow Battery it is always a risk that the stacks my get a leakage. Therefore, we need the monitoring system to operate the battery in a safe mode. The innovative PV systems need higher investment cost than standard ones. The payback time will be a risk which we have to plan with our financial department.

- **Feasibility of the pilot action**: the pilot action is feasible in case that the campus W.E.I.Z is willing to extend the actual state of the art of energy management. The campus itself but also the municipality will invest in PV and storage systems, the energy management system and the technical expertise will be financed through the ESINERGY project the PV Systems and the storage will invested by the City of Weiz and the Innovation Centre of Weiz by themselves.

III. Pilot case: Smart concept for solar electricity flow and use

Location: **Slovenia**

3.1. Background information

The pilot investment of project partner 2 will be “Smart concept for solar electricity flow and use”. The investment will be located at the Martjanci 36, at the institution of Smart House. Energy supply of the building is almost 100% from RES. Building produced electricity from photovoltaic system (12kWp) and equipped with battery (25kWh). In this moment the production and consumption of the electricity in the building is not monitored and peak and base load times are not controlled.

Photovoltaic system produces electricity when the sun is shining and the electricity is used when there is a need in the building.

Picture 1: Located PP2 - Smart House, Martjanci 36

Picture 2: Photovoltaic system on the roof

Picture 3: Smart Charging system will be set up at the extension roof of the Smart house - in the Biofuture center

Picture 4: Batteries – 25kWh the

Smart charging station will allow testing Vehicle to building and Vehicle to Grid. Electric cars connected with smart charging and create a symbiosis with the energy storage and support each other.

3.2. National legislation

Slovenia is committed to accelerating the transition to clean energy. By 2030, it is necessary to fulfil the 27% share of renewable energy sources, which Slovenia will try to fulfil with additional measures to facilitate the issuance of permits for renewable energy projects, including wind and solar power plants.

The proposal for the Energy Act renews the concept of decarbonization planning at the local level - municipalities will have to prepare and adopt plans for abandoning the use of fossil fuels for heating, they will have to adopt goals in the field of efficient use of energy and renewable energy sources, and energy communities will have to plan for managing energy poverty at our area. Local energy concepts will be digitized to make it easier to monitor progress.

Electricity in Slovenia produced by power plants uses various renewable and non-renewable energies. The market in Slovenia is completely open, which means that all customers can freely choose their electricity supplier.

Net metering or self-supply of electricity is in practice a popular trend in Slovenia. It is a method of calculating produced and consumed electricity for owners of solar power plants in Slovenia. Until now, a friendly billing method has been in effect, which means that the produced surpluses are taken into account for the benefit of the user in months when production is lower than consumption. The surplus that the user makes during the summer is compensated by the deficits that it creates in the winter. In 2024, a new self-service billing system was introduced, which will replace the NET metering system. The duration of the accounting period and the method of accounting for the supplied electricity will be freely determined by the self-supply agreement and in the domain of the electricity supplier.

The payment of the network fee for the production and consumption of energy will be in accordance with the regulations of the Energy Agency, which govern the methodology of calculating the network fee. The new rules introduce the calculation of the network fee for the entire amount of electricity that was taken from the network or sent to it, and no longer just for the difference between the received and delivered electricity, changes in electricity billing for 2024.

The network fee will be paid for all electricity received and purchased in the current period, regardless of how much you return from your own device. The network fee will be covered to a greater extent by the tariff item for power, because the costs necessary for the operation and development of EE are mainly related to the peak load of the network. The new charging of the network fee will lead to a fairer distribution of network usage costs among all customers and will encourage users to use the network in periods when the network load is lower.

3.3. Specific territory of the pilot action

Pilot investment of project partner 2 will be located at Martjanci 36. The building has photovoltaic system and installed battery. At the moment the production and consumption of the electricity in the building is not monitored and the peak and base load times are not controlled.

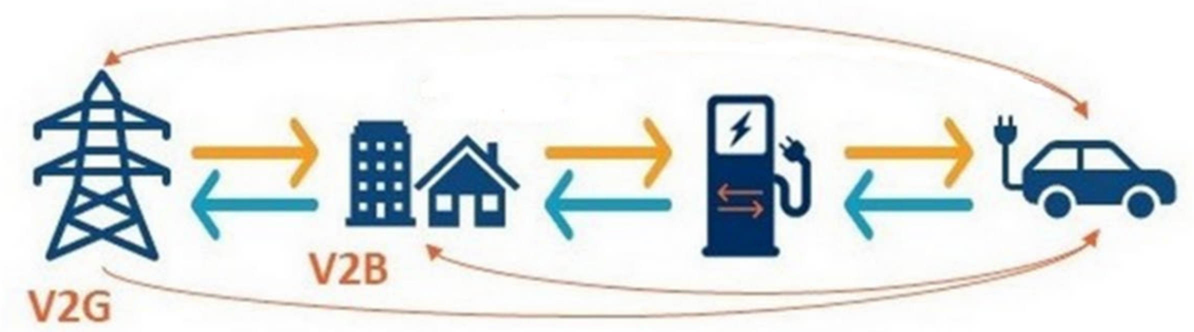
Potential for changes: The investment has a positive impact on the environment, because it increases the share of self-sufficiency from solar energy and thus contributes to the protection of the environment, through the saved share of CO2 emissions.

Challenges: The most important problem and challenge which pilot investment tackles, is the peak load of the electrical network and the approaches for reducing the peak loads, namely in the case of electricity production from the sun.

Why we use this territory: The partner chooses own area, because it has own building with the photovoltaic system and existing batteries, which will be used for the connection of the charging station. The foundations for a smart charging station are laid out, and as a partner we saw an opportunity in a pilot investment.

3.4. Topic of the pilot action

The V2B system and V2G system in future will reduce the peak loads and support self-supply with the help of batteries installed in the electric car. Bi-directional charging makes it possible to charge the EV battery and take the energy stored in the car's battery and push it back to the power grid. The pilot goal is the reduction of the peak loads.



Picture 5: Bi-directional charging

3.5. Target groups

The key benefits, which is why the investment by PP2 is planned, will gain the partners in the first place. Once the PP2 and LP provide presentations on the operation of the investment and the effects of the PP2 investment at the level Vehicle to Building system in terms of reducing peak loads on the electricity grid, the other partners can and will build their regional project on this basis. In any case, much more important target groups that will benefit from this investment are the regions/countries involved and the programme area. It is a great opportunity to transfer experiences and lessons learned from one region to other regions and to base the regional documents of all partners involved on the results of the investment to make in one region.

The identified key stakeholders are also the faculty (ASP2), sellers of electric cars, suppliers of charging stations, photovoltaic installers, energy organizations, municipalities, energy distribution companies, etc.

Roles in the implementation: The key stakeholder will support the project partner regarding the dissemination of the pilot investment, in the terms of providing the information and recommendation for the pilot installation. They will provide the technical knowledge and also gain the knowledge itself to improve their daily business.

3.6. Detailed description of the pilot action

For the Smart House institution (PP2) is opportunity to reduce the consumption of energy with the pilot investment. Smart charging system will create a symbiosis with electric car and share the energy with the building and with the grid.

When electric vehicle is not in used for driving purposes, they are waiting in the garage of the owners or in public parking lots, and the energy stored in the batteries would not be beneficial. The goal of this pilot is to use this energy for peak shaving and frequency regulation in vehicle-to-building/grid (V2B/V2G) technology.

PP2 will obtain data through electric cars connected with this smart charging system for the modification of national policies in the frame of the legislative and technical matters for the introduction of the V2G system.

Existing photovoltaic system and batteries will create an interaction with electric car in order to ensure peak shaving of consumption energy.

The Timeline of the pilot actions: Implementation will start in July 2024, testing and monitoring will last 12 months.

Equipment set is composed of:

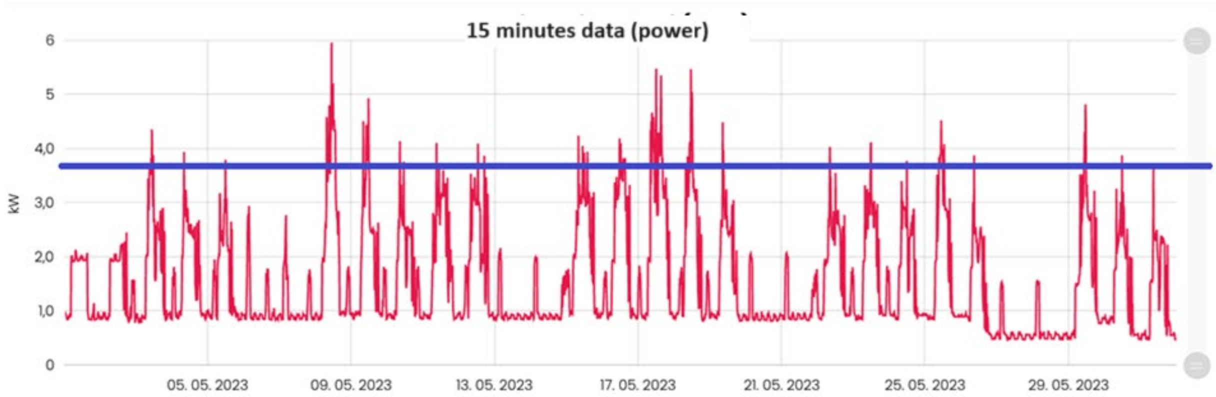
- installation (mechanical and electrical connections of electrical network of building (the existing batteries and the existing solar plants) to the charging station)
- work for installation and connection smart charging stations for electric cars (4 x AC T2 connection socket; min. output power 22kW; supply voltage AC 380 – 415V; Wi-fi and Bluetooth connection, charging communication app.)
- connection and management software solution for smart control and monitoring unit and preparation of algorithms.

The installed smart charging station with the developed algorithms will allow the charging station owner to monitor, manage and restrict the use of their devices/vehicles remotely to optimize energy consumption. Smart control and monitoring unit and preparation of algorithms and installation of smart management of purchased charging stations for electrics cars.

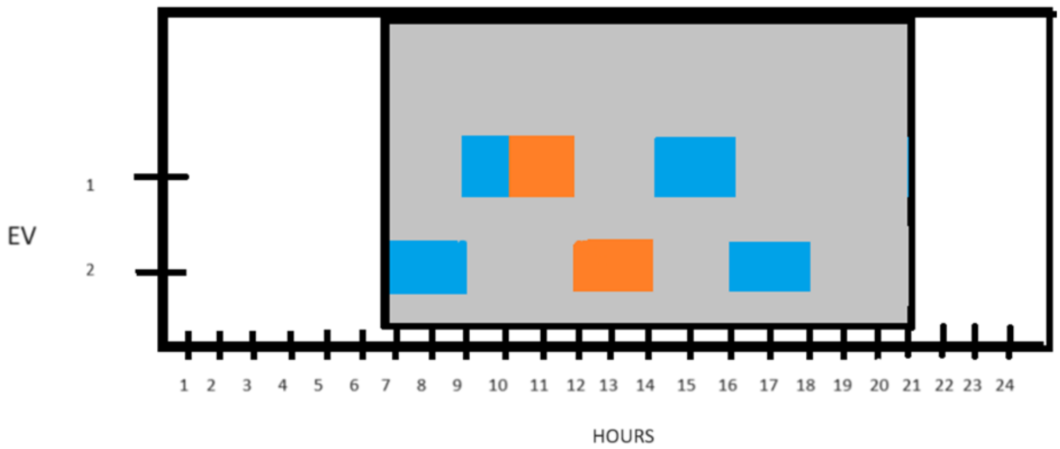
During the project the Focus Group with stakeholders will be established to carry out the communication activities (e.g. press article, pilot video demonstration). Implementation of pilot action will be live streamed on the project social media channel (YouTube, LinkedIn).

Project partner will organize one door open day event and invite different targets groups, such as energy prosumers, energy installer, designers, policy relevant bodies, energy distributors, energy operators, also households, companies and public bodies. This kind of event would demonstrate the pilot functioning and operation.

Important findings from the pilot will be the practical data that will be obtained through monitoring of the pilot investment operation. It would be the great opportunity to share/ to show the results of the pilot investment to target groups on the new calculation and exploit them for regulating the network fee.



unnecessary costs for expanding the electricity system. With V2G, the momentary electricity consumption spikes in the building can be balanced with the help of EVs and no extra energy needs to be consumed from the grid.

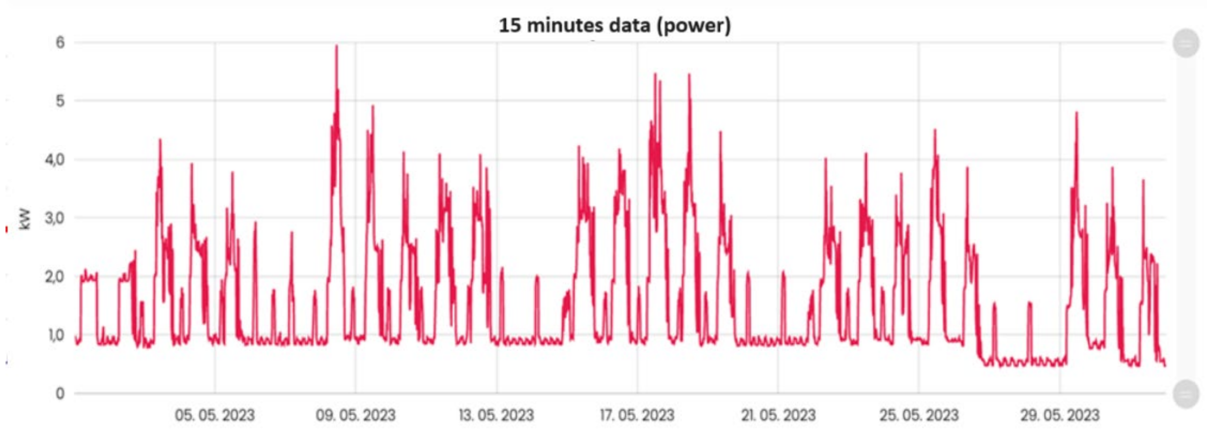


Picture 6: V2B protocol

Electric vehicle is charging at charge station

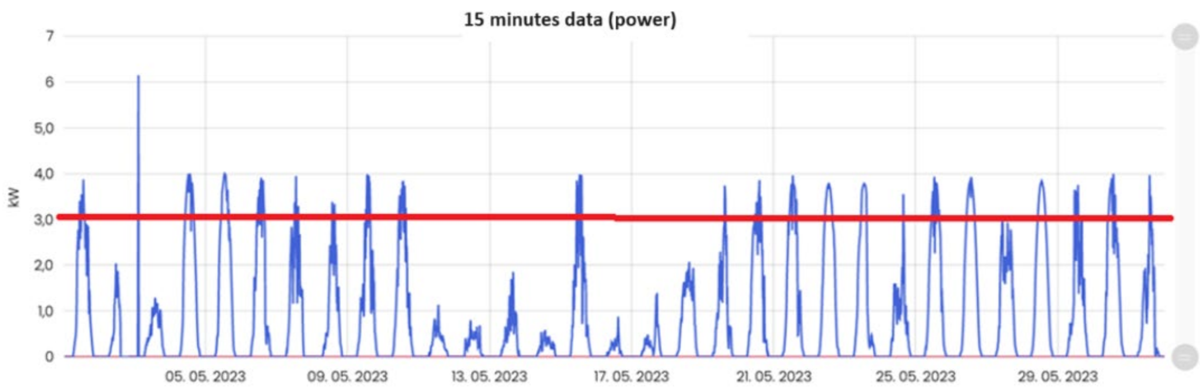
Energy of EV going to building

The 1st Electric vehicle start charging at charge station at 7 o´clock till 9. The second EV start charging at 9 till 10 o´clock. From 10 till 14 o´clock energy goes from electric car to building and this is the scene where we want to cut the peak load when is the rush hours of energy consumption of building.



Picture 7: Consumption (kW monthly – May 2023)

- Aim: to reduce peak loads under 4kW. We are looking for a 33% reduction in network load.



Picture 8: Production (kW monthly – May 2023)- PV system

- The load into the electricity network due to photovoltaic operation – can be expect a reduction from 4 kW to 3 kW. This is 25%.

Overall, the pilot action goal is reduction of the peak loads and support self-supply with the help of batteries installed in the electric car. The monitoring will be ensured also by the connection and management software solution for smart control and monitoring unit and preparation of algorithms. The installed smart charging station with developed algorithms will allow the charging station owner to monitor, manage and restrict the use of their devices remotely to optimize energy consumption.

During the pilot action implementation process, will be tested and demonstrated bi-directional charging and testing the principle of Vehicle to building (V2B) and Vehicle to Grid (V2G). With the investment, we want to achieve the goals we have set ourselves, namely to reduce energy consumption. Testing V2B and V2G processes requires a holistic approach that encompasses technical, regulatory, security and economic aspects. It is also important to cooperate with various stakeholders – photovoltaic providers and electric car providers.

Timeline of pilot investment:

- Public procurement in April/May
- Supplier selection and order
- Installation
- Testing period from July 2024 till June 2025
- Providing first data of testing.
- Technical support from stakeholders

IV. Pilot case: Battery system in Administrative building of MED

Location: **Croatia**

4.1. Background information

The pilot site is located in the Knowledge Centre of Medjimurje County in Čakovec, Medjimurje Energy Agency's (PP3) headquarters – a century-old building, where various solutions for energy efficiency and renewable energy utilization were incorporated over the years. After a 2008 building refurbishment, a 75-kW pyrolytic furnace replaced an inefficient gas boiler in 2016, marking the initial step in the building's journey to high energy efficiency. This transition, part of the RURES project funded by INTERREG Central Europe, included the installation of solar thermal collectors, calorimeters, a smart metering system, highly efficient LED lighting, and A+++ kitchen appliances. In 2022, further upgrades were made with a 20-kW PV system, a 37-kW air-to-water heat pump, and a 22-kW power charging station for electric vehicles.

4.2. National legislation

EU legislation on energy communities has been transferred into Croatian laws and bylaws as it was an obligation of all Member States in 2021. Since then, still no energy community has been successfully established and operational in Croatia due to challenges and regulatory barriers, grid integration issues and administrative complexities.

The Energy Act and the Electricity Market Act create the fundamental conditions for an electricity market in Croatia. Preparing and adopting Electricity Market Rules and other secondary legislative acts have created the condition for the operation and gradual opening of the market. There are two electricity markets in Croatia. Initially, the selected model was a bilateral market model in which electricity trading is carried out under bilateral contracts which are concluded between electricity market participants. By changes of Electricity Market Act the concept of balancing groups was introduced which enabled portfolio optimization of subjects grouped in a single balance group. Second electricity market is organized electricity market carried out by CROATIAN POWER EXCHANGE Ltd. (CROPEX). The law provides for a gradual dynamics of opening electricity markets in the Republic of Croatia. The market is completely opened as from 1 July

2008. A market participant in the Croatian electricity market is any producer, supplier, trader or eligible customer. A producer, supplier and trader must have a license for performing energy activity, issued by the Croatian Energy Regulatory Agency (HERA) and sign Electricity Market Participation Agreement with HROTE (https://www.hops.hr/en/electricity-market).

In relation to the energy crisis and to mitigate effects of inflation and rising energy prices, Croatian government created, and put into effect, Regulations on eliminating disturbances in the domestic energy market. With said regulations, electricity and natural gas prices were limited for consumers (households, business sector, and institutions, local and regional authorities). The regulations are currently valid and will last until the end of March 2024 at least.

As for electricity cost calculation regarding the pilot site, cost is calculated and billed on a monthly basis. On the last day of the month at midnight, the meter is read automatically.

4.3. Specific territory of the pilot action

Located in the Knowledge Centre of Medjimurje County in Čakovec, an ex-military complex, are 13 buildings, of which 9 were refurbished in recent years and are occupied by various organisations, such as MENEA (PP3), Tourist Board of Medjimurje County, Educational Centre for the Metal Industry – Metal Centre Čakovec, Međimurje University of Applied Sciences in Čakovec with associated student dormitory and Sustainable Development Centre, Public Institution for the Development of the Međimurje County REDEA, and business incubator Technology Innovation Centre which operates in three buildings.

The pilot site is an administrative building in the above-mentioned Knowledge Centre, which already serves as an example of good practice and with this pilot action it will become a magnificent state-of-the-art in renewable energy sources and energy efficiency. The owner of the building where the pilot site is located/pilot action is planned is PP4 - Medjimurje County, the regional authority.

Figure 1. Knowledge Centre of Medjimurje County in Čakovec and location of PP4 Pilot action

Figure 2. Administrative building in Knowledge Centre of Medjimurje County in Čakovec– PP4 Pilot site

4.4. Topic of the pilot action

The pilot site, already a model of good practice, will achieve energy independence through this pilot action with the installation of a battery storage system and an upgraded smart metering system. Network-supplied energy needs will be minimized or eliminated entirely. The building already has a smart metering system, which, after the battery storage system installation, needs an upgrade to monitor both overall consumption and production of electrical energy from the 20 kW PV power plant.

Goals and objectives of the pilot action are:

- To flatten load peaks during the period of high electricity demand:
  The objective is to reduce peak load demand on the grid
  Some of the benefits are: reduced risk of power outages and increased reliability of the energy supply; minimising the need for expensive peak energy generation, leading to reduced energy costs; enhancing overall efficiency of energy distribution systems.
- To demonstrate the benefits and potential of energy storage in optimizing energy usage:

The objective is to showcase how energy storage systems can optimise energy usage and improve efficiency.
Some of the benefits are that it promotes the understanding and acceptance of energy storage technologies and that it provides data and insights regarding strategic energy management decisions.

- To reduce costs:
  The objective is to lower energy costs through the use of stored energy during peak hours and optimised energy management.
  Some of the benefits are lower operational costs, the ability to reinvest resources that were saved into other investments or projects.
- To promote sustainable energy practices:
  The objective is to demonstrate and to encourage the use of sustainable energy practices through the integration of battery storage systems.
  One of the main benefits is that it reduces the carbon footprint and other environmental impacts associated with energy consumption.

The pilot action will involve evaluating the performance of the battery system, monitoring energy savings, and assessing the impact on reducing CO2 emissions.

The greatest benefit of the pilot action lies in the ability to replicate it in other buildings (in our region and other PP's regions) which will foster the implementation of energy efficiency (EE) and renewable energy sources (RES) measures and ensure further education of the local population and raise awareness on benefits of RES. Since the building where the pilot action will be utilized is public, it is accessible by wide range of users, resulting in wider impact on raising awareness. Of course, projects results will be published on the partners website and project website and project website (if applicable) therefor being available to a wider range of interested stakeholders throughout countries in the Danube programme area as well as other European countries.

4.5. Target groups

The primary target group that will benefit from this pilot action is the owner of the building as well as employees and associates of companies located in the building as well as ones working in Knowledge Centre of Medjimurje County.

- Building Owners/SMEs/Public sector institutions: Building owners/SMEs can experience financial savings by reducing energy consumption in the long term. Improved energy performance of buildings results in lower energy bills and maintenance costs, reducing operational expenses.
- Medjimurje County as regional authority and local authorities: Reducing energy consumption contributes to lower greenhouse gas emissions and improved air quality.
- DSO's; energy producers: Installing energy storage batteries at the grid level can bring numerous advantages. Batteries can help balance energy supply and demand, reduce peak loads, and stabilize the grid during fluctuations in production and consumption. This contributes to grid stability and better integration of renewable energy sources.

Energy storage batteries can help optimize energy usage within the building by storing excess energy during low-demand periods and releasing it during high-demand periods. This can result in reduced electricity costs and increased energy efficiency. Additionally, energy storage can provide backup power in case of grid outages, ensuring uninterrupted operation of critical systems. The implementation of energy storage technology in the building brings advantages in terms of improved energy management, increased reliability, and potential financial savings.

Stakeholders and their roles are identified as follows:

<table>
<tr><td>Category of stakeholders</td><td>Roles of the stakeholder</td><td>Approach and methods</td></tr>
<tr><td>State-owned entity – national fund (Energy Efficiency and Environmental protection Fund)</td><td rowspan="4">Participation in focus group and other project events, providing expert knowledge, consultation and dialogue, providing guidance on the topic where applicable</td><td rowspan="11">Direct approach via e-mails, in-person contact, invitation letter; method and tools: focus group meetings, questionnaires</td></tr>
<tr><td>National DSO (HEP ODS Ltd.)</td></tr>
<tr><td>Regional DSO (HEP ODS Ltd. Elektra Čakovec)</td></tr>
<tr><td>Research institution (Energy Institute Hrvoje Požar)</td></tr>
<tr><td>Local authorities (Towns – Čakovec, Mursko Središće, Prelog)</td><td rowspan="7">Participation in focus group and other project events, transfer of knowledge, potential/possibility to replicate pilot approach</td></tr>
<tr><td>Other – Tourism Board (Tourism Board of Medjimurje County –TZMŽ)</td></tr>
<tr><td>SME (Technology-Innovation Centre Medjimurje Ltd - TICM)</td></tr>
<tr><td>SME (Medjimurje, investment, Real-estate Ltd. - MIN)</td></tr>
<tr><td>Sectoral agency (Public institution for the development of Medjimurje County REDEA)</td></tr>
<tr><td>NGO (Energy citizen association Zeleni Prelog)</td></tr>
</table>

<u>4.6. Detailed description of the pilot action</u>

The pilot action you are planning: This pilot investment will expand the existing photovoltaic power plant on the building with a battery storage system. The primary goal of the battery storage system is to reduce the peak load from the distribution grid ('peak-load reduction'). The system will have the capability to store excess energy generated by the PV power plant and store electricity during off-peak hours. It will also serve as a backup power supply for user consumption in case of a power outage from the distribution grid. Additionally, to the battery storage system, the existing smart metering system in the building will be upgraded.

Timeline and schedule for the implementation of the pilot action: The investment (battery storage system and upgraded smart metering system) is expected to be implemented and installed in 3rd quarter of 2024. Project design documentation has been finalised, while the public procurement of the battery storage system and upgraded smart metering system are ongoing, and should be finished in June/early July 2024. Selected contractors for the pilot investment are planned to start work as soon as the procurement is done, all in accordance with relevant laws and regulations.

Technical components: The battery storage system will be built by interpolation on the existing distribution of the PV Power Plant of the Knowledge Centre, by connecting it to the distribution cabinet of the administrative building. The battery storage system will consist of a three-phase bidirectional inverter with a nominal power of 12 kW with output for uninterrupted power supply, battery bank consisting of 1 master module with rated power of 1,65 kW and rated capacity of

4,14 kWh, 5 slave modules with individual rated power of 1,64 kW and individual rated capacity of 4,14 kWh and equipment for measuring, connecting, communication and protection. The total planned battery capacity is 24,84 kWh. Maximum power of the battery is planned to be 9,85 kW.

Breakdown of the financial resources required for the pilot action: Financial resources required for this pilot action and other investment related expenditures are foreseen in the project budget of PP4 - project design documentation (main project design), upgrade of the smart metering system, battery storage system and pilot supervision of the pilot investment.

How information will be shared with stakeholders and the public: Information will be shared through web and social media posts to inform the stakeholders and the public about the current status of the pilot action. Additionally, stakeholders will be informed within project dissemination activities as well as in person at the pilot site once the system will reach full functionality.

Consideration of how the pilot action's results can be sustained or expanded: As a best practice example in Knowledge Centre of Medjimurje County pilot action could serve as an ice-breaker in investments in such pilots in other buildings in complex, especially ones equipped with PV power plants. Moreover, all public buildings owned by regional government (PP4) could follow the example and install battery systems in near future with appropriate funding schemes.

Identification and assessment of potential risks and challenges: Improperly installed battery systems or inadequately sized electrical systems can cause issues such as short circuits, overloads or voltage instability. Technical flaws or mistakes in system setup can result in faulty operation or equipment damage. Installing a battery system can require significant financial investment. There is a risk that the expected return on investment may not be achieved or may be lower than planned. Additionally, there is a risk of changes in battery technology prices or financial incentives that can impact the project's economic viability. To reduce risks, it is important to adhere to relevant safety guidelines and standards, use high-quality battery systems from reputable manufacturers, and ensure that the installation and maintenance of the system are carried out by trained professionals.

Is the pilot action feasible: The main project design proves the fulfilment of the basic requirements for construction and other prescribed and specified requirements and conditions (technical, financial, environmental aspects). By addressing these factors, the pilot action can be successfully implemented, providing valuable insights and benefits for future deployments.

V. Pilot case: Monitoring & control of decentralized plants/assets

Location: **Germany**

5.1. Background information

The German energy market is highly regulated. Many market roles, such as grid operators, metering point operators, electricity distribution, power plant operators and energy service providers, among others, are implemented to enable non-discriminatory competition. In this context, the many small, predominantly municipally-controlled local energy suppliers are particularly important. Energy communities are primarily implemented in the area of generation plants as investment communities; but energy communities have not yet been implemented in full accordance with the EU directive. However, local self-consumption is possible, and not only for individual self-consumption, but also, for example, as tenant electricity in buildings where the producer and consumer do not have to be the same legal entity (i.e. as a form of collective self-consumption).

The price of energy is relatively high by European standards, which is largely due to the current transformation of the energy system towards renewable energy. The private small customer sector is mainly billed monthly, but based on annual measurements, as smart meters are not yet in use. Only large consumers are measured in a high resolution and billed monthly, on a load profile basis. However, the smart meter rollout is imminent, which should enable both dynamic tariffs and the automated operation of devices owned by consumers according to energy prices, while considering consumer preferences. It can therefore be assumed that shorter billing cycles will also be introduced in the future; especially as the electricity supplier change process can also be completed within 24 hours. This will give access to cheaper prices for small consumers, reducing the burden they carry due to the cost of the energy transition, and empowering them to consume larger amounts of clean electricity while reducing the strain on the power grid.

5.2. Specific territory of the pilot action

The implementation of the pilot project does not refer to a building, as the consideration and optimization relates to the local power grid. In this network, electricity producers and electricity consumers are examined at different points. When it comes to electricity producers, the pilot's largest hydroelectric power station is to be improved in its generation forecast, both on a seasonal and daily dimension. Sensors are installed to measure weather data such as snow depth and to be able to predict how much water will be available later in the year. Existing flexibility potential of the power plant has not yet been used. This potential is to be quantified and analyzed as to how this flexibility potential can be used in the energy industry and whether it is possible to expand it or whether other technological solutions need to be used. In the consumer segment, particular attention is paid to charging infrastructure with higher performance classes. These already represent significant individual loads, and should also become increasingly relevant in the coming future, considering their treatment as mobile electricity storage devices. The consumption of charging infrastructure cannot yet be controlled; but this should be done in special situations relevant to the energy market. To this end, control technology is being installed in the pilot project and integrated into the grid management system. However, the distinction between generation and consumption will only become coherent when the local power grid in between can also be quantified and forecasted. Only then can local dynamic network bottlenecks be ruled out, or optimization considering to the upstream power network achieved. Accordingly, sensors are installed in local network stations to enable a real-time status analysis of the network area and to make predictions. Currently, the integration of renewable generation with around 75% of demand is still easily possible, but in the future, uncontrolled expansion of renewables and of the electrification of large consumption devices (e.g. EV charging infrastructure and heat pumps) will either cause bottlenecks or incur horrendous infrastructure costs. In addition, the proportionate costs for purchasing electricity from the upstream network are currently considerable, which is why the controlled expansion and operation of flexible producers and consumers is considered to have great local economic potential. There are various concrete solutions for this in existing national regulation, but the practical impact is not yet foreseeable and will be evaluated as part of the pilot project.

5.3. Topic of the pilot action

Currently, consumers, e.g. charging infrastructure, are not yet remotely controllable and integrated into the grid control system. Up to now, this has not been necessary from a legal and regulatory point of view, but in the case of prospective grid expansion, this leads to major technical challenges and corresponding cost increases. Another field of action is the flexibilisation of generation capacities and the derivation of storage requirements. Environmental data, such as snow depth, are necessary for forecasting seasonal generation in line with demand. Accordingly, sensors are to be installed and investigations are to be carried out to increase the storage potential at existing hydropower plants.

5.4. Target groups

In the first step, and if successfully applied, the investment contributes to the reduction of upstream grid costs. Since these costs are regulated, all electricity consumers in the area of the grid operator benefit from this. In addition, the requirements for the upstream network operator could be reduced and thus the network expansion could also be reduced in this area.

If, however, the distribution sector should also be given access to controllability of consumption devices, it would also be possible to intervene here as needed. In turn, increasing the contribution of the intervention as a whole. The power plant operator is the primary beneficiary of better forecasting of power plant deployment, provided that this can be used successfully from an economic point of view. In this specific case, the project partner is the power plant operator, as well as of the operator of the involved charging infrastructure.

5.5. Detailed description of the pilot action

- Remote control technology for grid and assets

The investment for the "Remote control technology for grid and assets" includes the installation of four measuring stations at significant energy distributions in the low-voltage system (each 3250€) to monitor the voltage quality, current, power and phase shift angle, in order to monitor the utilization of the power grid. This includes the assembly and procurement of a control cabinet, current transformers, voltage taps, current and voltage measuring devices as well as an LTE-capable master station to transmit the data to our control system.

- Meteorological station with uninterrupted power supply and data connection

In order to optimally adapt our schedules for our hydroelectric power plants to the consumption in the power grid, we need an accurate forecast. Due to the special location in the Alps, the local weather conditions can vary greatly, which is why weather data from public weather stations is not meaningful. The local amounts of snow in spring have a significant impact on production in our hydroelectric power plants. The investment "Meteorological station with uninterrupted power supply and data connection" includes the installation of a weather station (4000€ rainfall + 2000€ snow level control) at an altitude of 1.850m above our Water-reservoir in order to be able to better predict the expected amount of water and, therefore, energy.

- Local Hardware Demand Side Management

In order to not overload the power grid and to carry out the expansion only at the points where it is necessary, we must be able to regulate the loads in the power grid. We will set up a load management system for controllable loads at charging stations (€3000) and install a flexible control system on our power generator to enable demand-based generation (€6000).

Based on the pilot project tests, a concept can be drawn up for our entire grid and estimates can be made about the effects and potential. These findings will be shared bilaterally with other energy suppliers and at association level.

The biggest challenge is integrating new hardware and technology into the existing infrastructure. In addition, it may not be possible to answer forecasting questions using the established system. Accordingly, the installation of sensors is started promptly in order to identify interface problems at an early stage. New market players from the IT/AI start-up sector are being integrated for forecasting models.

VI. Pilot case: Smart energy management trough smart battery in a small glass factory and museum

Location: **Bulgaria**

6.1. Background information

The energy market in Bulgaria has been liberalized for all legal entities since 01.10.2020. There is still derogation for household consumers, as the electricity consumed by them is paid at regulated prices determined by the State Electricity Regulatory Commission. It has been agreed that household consumers will enter the free electricity market after 01.01.2026.

The development of the Energy Market is in accordance with the requirements of Directive (EU) 2019/944 of the European Parliament and the Council of June 5, 2019 regarding the general rules for the internal electricity market and amending Directive 2012/27/EU.

A free market is a prerequisite for optimizing consumers' electricity costs, but it also presents consumers with some challenges.

The main challenge is the fluctuation of the price of electricity within the day. Users have two trading options “day ahead” and “intraday”. As with both options, they must make an hourly calculation of the electricity consumption very accurately and to declare it accordingly. As in case of deviation from the estimated consumption of electricity, the user is subject to a fine.

In the next figure is presented a screenshot of the electricity prices from the website of the Bulgarian Independent Energy Exchange.

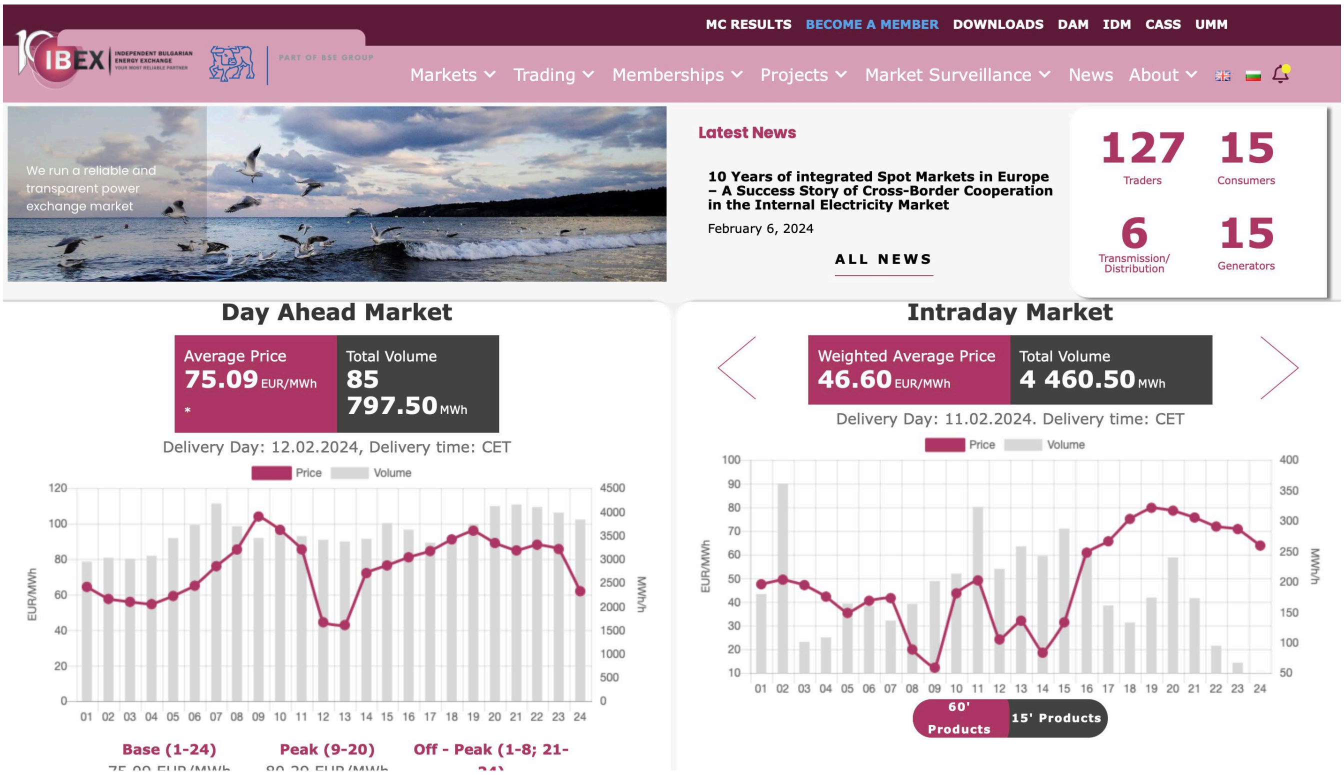
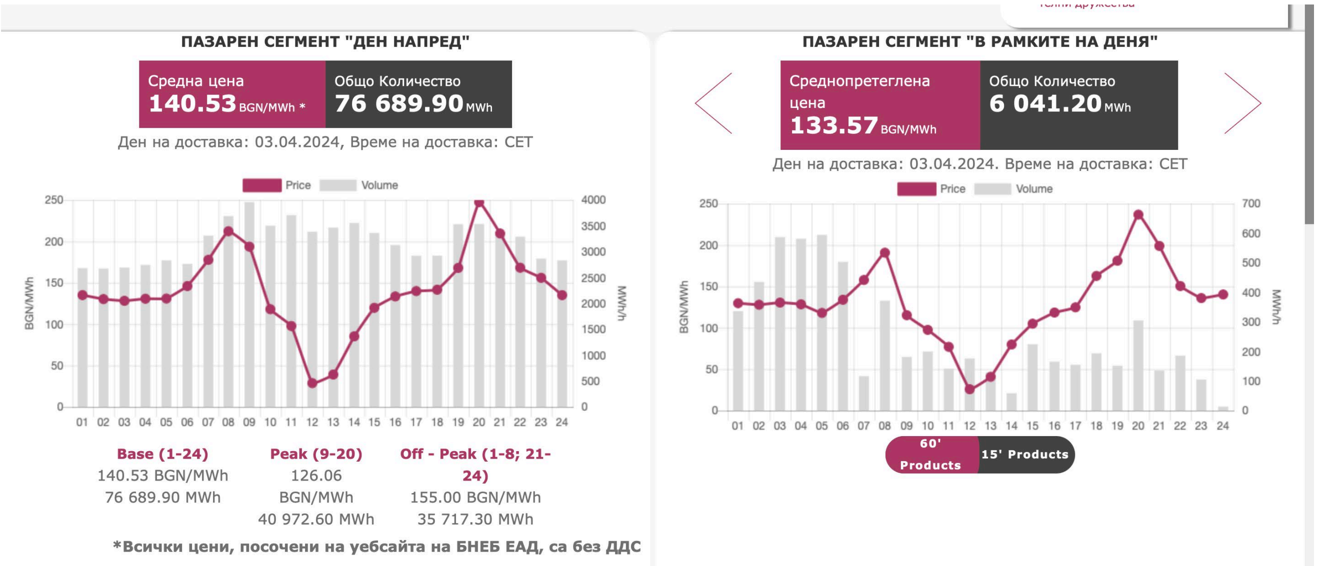
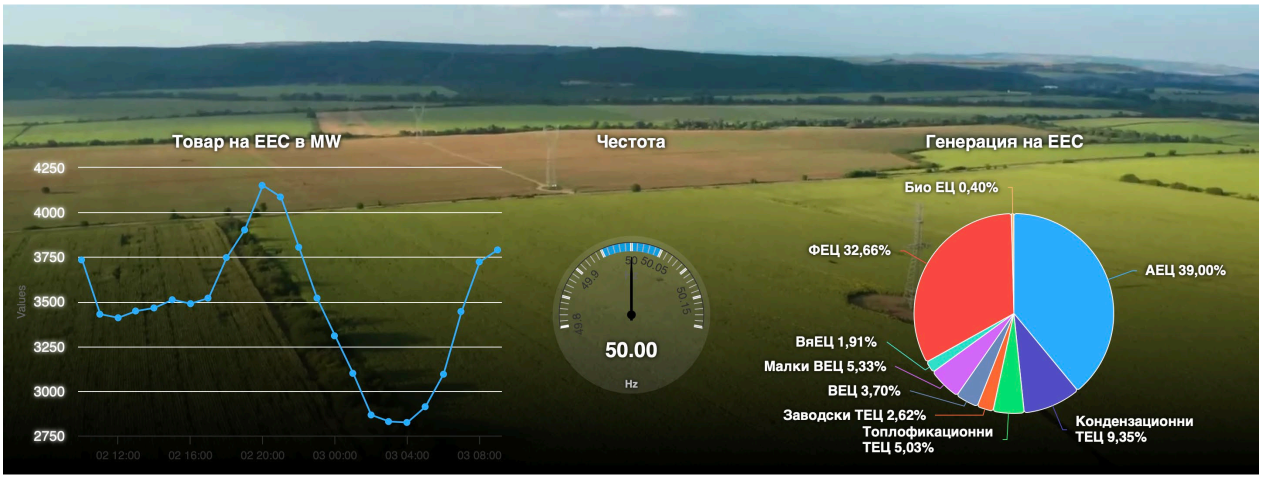


Figure 1 Screenshot of website of Independent Bulgarian energy exchange https://ibex.bg/en/

Visibly, the price difference in the "day ahead" segment is from BGN 83.73/MWh to BGN 203.41/MWh. i.e. the difference of about 2.5 times. And in the "within the day" segment, the price difference is from BGN 23.92/MWh to BGN 156.04/MWh, or the difference is 6.5 times. As the connection between the price of electricity and the method of its production is obvious.





As can be seen from the attached graphs, the price of electricity is lowest precisely during the day when the production from photovoltaic power plants is the highest. I.e. through smart management of a system for stored electricity, in addition to the economic effect, there will also be a significant environmental effect.

The task becomes even more complicated if there is a photovoltaic system installed for self-consumption.

With the current pilot model, PP11 UBBSLA aims to propose and verify different scenarios of battery charge and discharge management depending on different factors in order to achieve an optimal electricity price under different consumption scenarios.

Interest in the result is very high, especially given the electricity prices in 2022, with the gas crisis.

<u>6.2. National legislation</u>

To implement the EED, changes have been made to several national laws:

- Energy Efficiency Law, last amended March 2021
- Energy Law, last amended March 2021

In Bulgaria the EED obligations are also subject to secondary legislation under the Energy Efficiency Law as follows:

- Ordinance for the methodologies for setting the national energy efficiency target, the setting of the total cumulative target, the setting up of an energy savings obligation scheme and the allocation of the individual energy savings targets to the obligated parties.
- Ordinance for the eligible measures for obtaining energy savings in final consumption, the manner of proving the energy savings obtained the requirements to the methodologies for evaluation of energy savings and the manner for confirming energy savings.

Bulgaria's electricity transmission and distribution remains highly regulated. The high voltage transmission grid is operated by the state-owned Electricity System Operator EAD ('ESO') certified as an Independent System Operator in 2015 by the Energy and Water Regulatory Commission ('EWRC') being the national regulatory authority for utilities. Distribution is performed by three distribution companies, each licensed for specific territories.

Generation projects with installed capacity of 5 megawatts and above are connected to ESO's transmission grid, while projects with lower capacity connect to one of the licensed distribution operators. At present, Bulgarian legislation does not facilitate a formal tender process for securing grid connection for new renewable energy projects. Grid connection contracts are provided on a first come first served basis to greenfield projects.

6.3. Specific territory of the pilot action

Location: City of Beloslav, Varna Region, Bulgaria Saint Cyril and Methodius St. 55, GPS 43.194250, 27.712618

The factory has a photovoltaic system on the roof. But the energy costs for the production of glassware and the energy yield from a photovoltaic system diverge over time on a daily and seasonal basis. Consumers are electric arc furnaces, preheating furnaces, mixers of various mixtures, motors, packaging equipment, lighting, heating and cooling, etc. They are a relatively large energy consumer, and in addition to electricity, they also consume natural gas. Depending on the production program, different types of peak loads are obtained, which require a lot of energy for a certain period of time. Through a combination of energy management and battery resource utilization, peak loads are expected to be reduced and managed.

The museum is located on the shore of Beloslav Lake, on the place where the first Bulgarian glass factory was founded in 1893. Beloslav`s region is famous for its old traditions in glass manufacturing and processing. The museum keeps and develops the traditional methods of glass production and combines them with the latest achievements of technology.

Visitors could enter the furnaces where a seminar demonstration is made without interrupting the normal workflow – three units are crafted manually. Here guests may observe a manual glass production, a semi-automatic device for production of glass bottles and a robot handling the glass in the furnace. Visitors also have the opportunity to enter into a "glass cave" – a glass furnace attractively modified for observation of its inner parts where the natural and synthetic materials bind their properties under the power of fire and turn into glass mass. The glass masters craft this mass into items and have the opportunity to be creators: glass items are prepared and everyone could decorate them manually with a transparent paint and take them home as a souvenir from the visit.

Visitors also have the opportunity to participate in the creation of their own product. In the exhibition hall there are hundreds of vases, bowls, candle stands and different animals, each of them manually crafted as well as a large number of bottles in various colors and forms. Every visitor may choose the item that attracts them as a souvenir for the day of joining these people devoting their lives to glass processing and participating in the magic that creates the beauty.

Those who are not able to visit the Museum of glass in Beloslav, a special gallery was founded in Varna. "Inhom art glass" gallery is situated in the Sea garden near The Dolphinarium. Visitor could buy glass souvenirs crafted by Beloslav masters, glass paintings made by the artists Ivan Lambrov and prof. Stoyan Gaidov, stained glasses, etc.

Visitors could enter the furnaces where a seminar demonstration is made without interrupting the normal workflow – three units are crafted manually. Here guests may observe a manual glass

production, a semi-automatic device for production of glass bottles and a robot handling the glass in the furnace. Visitors also have the opportunity to enter into a "glass cave" – a glass furnace attractively modified for observation of its inner parts where the natural and synthetic materials bind their properties under the power of fire and turn into glass mass.

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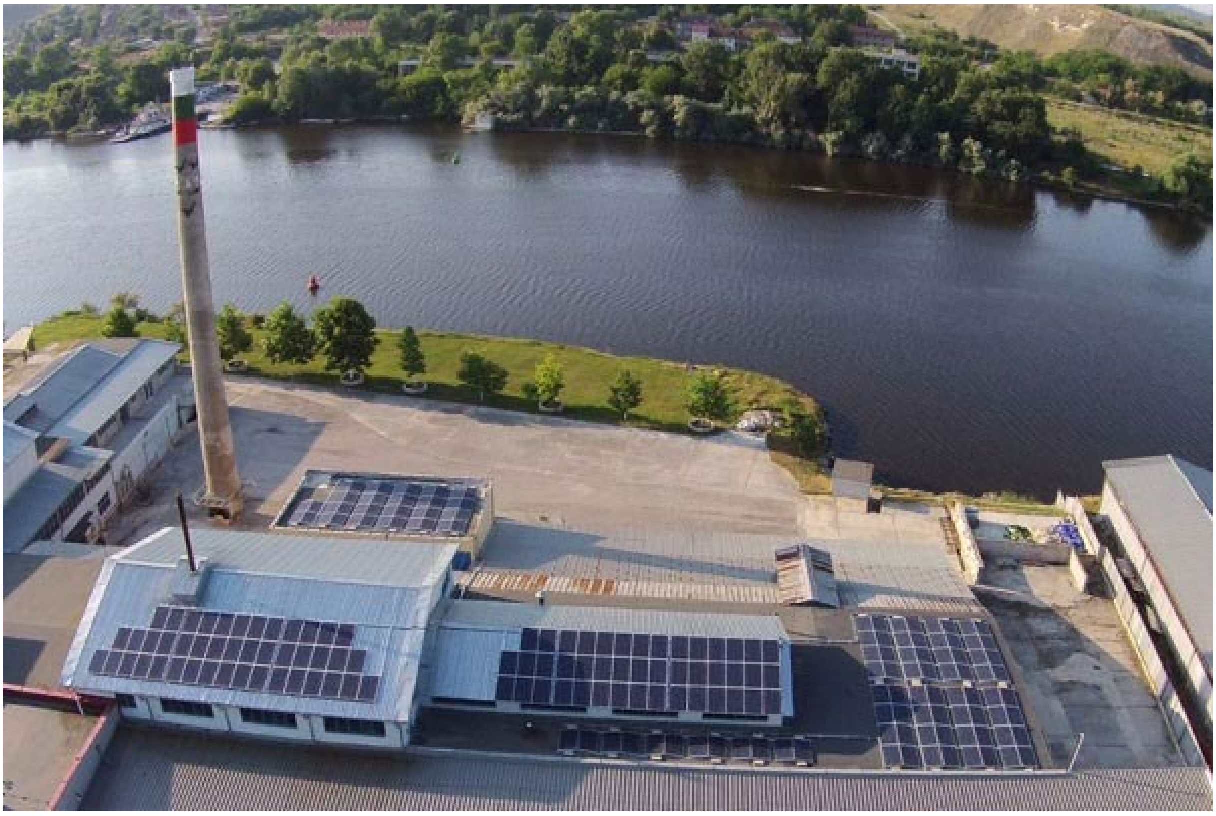


Figure 2 Small glass factory Beloslav

Figure 3 Equipment and energy consumers

The factory has installed a photovoltaic system with the following parameters:

- Installed power: 54.6 kWp
- Photovoltaic panels: Hanwha Q Cells Q.Pro-G3 260 Wp
- Inverters: 2 x SMA 15000TL
- Data logger: SMA Sunny Webbox
- Weather station: SMA Sunny Sensor Box
- Automatic switchboard: SMA MC-Box-6.3-11

According to the ESINERGY project, a system of batteries and control with the following parameters will be installed:

1.6.1. Smart battery system

INVERTOR

General		
	Type	Multyplus 48/3000/35
	Nominal Battery voltage	48V
	Power control	Yes
	Power Assist	Yes
	AC Input	Cos Φ>0,8

	Transfer switch	16 or 50
Inverter mode parameters		
	Input voltage range (V DC)	9,5-17V; 19-33V; 38-66V
	Input current (A DC)	250 / 125 / 65
	Output	230VAC 50Hz
	Continues output power 25°C VA	3000
	Continues output power 25°C W	2400
	Continues output power 40°C W	2200
	Continues output power 65°C W	1700
	Peak power W	6000
	Maximum continues Output current A ~	11
	Power factor range	0,8
	Maximum Output fault current	32A peak 1s
	Maximum efficiency (%)	93/94/95
	Zero load power (W)	20/20/25
	Zero load power in AES mode (W)	15/15/20
	Zero load power in Search mode (W)	8/10/12
CHARGER MODE PARAMETERS		
	AC input	187-265 VAC 45-65Hz, Power factor 1
	Charge voltage “absorption” VDC	14,4/28,8/57,6
	Charge voltage “float” VDC	13,8/27,6/55,2
	Storage mode VDC	13,2/26,4/52,8
	Charge current house battery (A)	120/70/35
	Charge current starter battery (A)	4
	Battery temperature sensor	Yes
General		
	Auxiliary output	Yes (16A)
	Programmable relay	Yes
	Protection	a-g
	VE.bus communication port	For parallel and three phase operation, remote monitoring and system integration
	General purpose com. Port	Yes
	Remote on/off	Yes
	Common Characteristic	Operating temp. range -40 to +65 °C (fan assisted cooling) Humidity (non-condensing): max 95%
Enclosure		
	Weght kg	18
	Dimensions mm	362x258x218
	Standards	
	Safety	EN-IEC 60335-1, ENIEC 60335 -2-29; IEC 62109-1
	Emission Immunity	EN 55014-1, EN 55014-2, EN-IEC 61000 – 2, EN-IEC 61000-3-3, IEC 61000-6-1, IEC 61000-6-2, IEC 61000-6-3

Battery

Battery specification		
	Voltage and capacity	LFP Smart 25,6/200- a
	Nominal voltage, V	25,6
	Nominal capacity @25°C, Ah	200
	Nominal capacity @0°C, Ah	80
	Nominal capacity @ -20°C, Ah	50
	Nominal energy @25°C, Wh	2560
	Cycle life (capacity >80% of nominal)	
	80% DoD, cycles	2500
	70% DoD, cycles	3000
	50% DoD, cycles	5000
Discharge		
	Maximum continuous discharge current, A	400
	Recommended continuous discharge current, A	< 200
	End of discharge, V	22,4
	Internal resistance. µΩ	1,5
Operating conditions		
	Operating temperature	Discharge: -20°C to +50 °C; Charge: - +5°C to +50°C
	Storage temperature	-45°C to +70 °C
	Humidity (non-condensing)	Max. 95%
	Protection class	IP22
	Charge	
	Charge voltage	Between 14V/28V and 14,4/28,8 V (14,2V/28,4 V recommended)
	Float voltage	13,5 V/ 27V
	Maximum charge current	400A
	Recommended charge current	<100 A
	Other	
	Max storage time @25°C	1 year
	BMS connection	Male +female cable with M8 circular connector, length 50cm
	Power connection (threaded inserts)	M8
	Dimensions, mm	237x650x163
	Weight	39kg
Standards		
	Safety	Cells: UL1973+IEC62619:2017+UL9540A Battery: IEC 62620:2014
		EN 60335-1:2012/AC:2014, EN-IEC 62368-1, 2020, IEC 61427-1:2013
	EMC	EN-IEC 61000-6-3:2007/A1:2012-EN 55014-1:2017/A11:2020
	Automotive	ECE R10-6

1.6.2. Energy management system

№	Equipment
1	Smart PLC controller
2	Program and visualisation software
3	Smart monitor
4	Cables

The problem UBBSLA aims to solve is smart management of electricity production and consumption. This will be implemented through a system of electricity storage and energy management of consumers. The management will control the peak power and the consumers, in relation to the price of electricity and the production of renewable energy sources. At present, no such administration has been built in the North-eastern region of Bulgaria.

The project will bring additional benefits both for the technical operation of the Association and for the final beneficiaries as well. As an umbrella organization, the UBBSLA has established strong partnerships with other civil society organizations, youth organizations, branch organizations and business networks in the region, etc.

In addition, the Association has previous experience in participating in other projects and initiatives funded by national and international donors, so the present proposal is an excellent solution to upgrade and enhance experience and capacities. Transnational cooperation will provide benefits for taking advantage of the solutions /pilot actions/ implemented by other partners to transmit them into the pilot territory.

6.4. Topic of the pilot action

The Pilot case aims to deliver a flexibility management system integrated with Glass factory load and batteries empowering energy storage at distributed and centralized levels to increase the share of renewables in the grid.

The main objectives of this deliverable are focused in complying with the technical specifications of all the pilots that will be part of the project. Including all the main general technical characteristics as topology, storage functionalities, services and equipment that will be included in the pilot.

Renewable energies change the way we produce and consume electricity. It also changes the way those who manage and distribute energy has to think about the electricity system – to always provide the best possible service for their costumers, meaning managing energy consumption vs price, and different business models, but changing habits are challenging, and often takes time.

The goal of the pilot is to greatly speed up this process, by showing that the technologies and solutions we have today, just have to be connected in new ways to solve the challenges of tomorrow.

Goal 1: Control energy consumption - The energy consumption is taken from the battery when the grid capacity is low or the energy price is high by doing peak reduction.

Goal 2: Better utilization of self-produced energy. - When using a battery in combination with solar production, the consumer gets better use of self-produced energy and less energy is delivered to the electricity grid.

The output and result from the pilot:

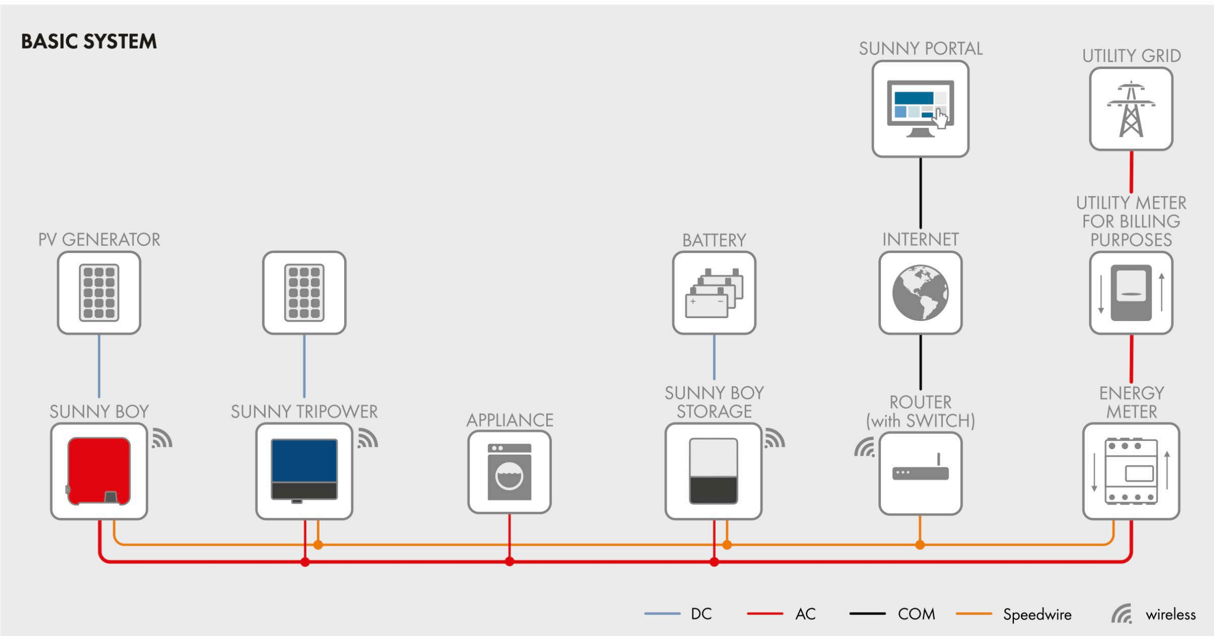
- Optimize energy consumption based on hourly rate.
- Optimize energy consumption based on effect/power.
- Optimize utilization of self-produced energy.

6.5. Target groups

The primary target group which profits from this pilot action will be the Beloslav glass factory, which benefits from the operation the innovative battery systems. The target group includes also the installer companies, students form Varna Technical University and electrical engineers. All these groups will profit from the opinion and data from smart monitoring and control.

Key stakeholder for the implementation of the pilot action is the owner of Beloslav glass factory, the municipality of Beloslav, the students from Varna Technical University, the local energy network operator and agency, equipment suppliers and regulation authorities. Other stakeholder may include research institutions, regional energy organizations, and other regional governmental institutions (climate protection coordination units)

6.6. Detailed description of the pilot action



Hybrid invertor

Deep Cycle Battery cluster 10 opzv 1000, 12V OPzV GEL Deep Cycle Batteries, 2v 1500ah battery, 2v 600ah OPzV Tubular Gel Battery, 2v 800ah OPzV Tubular Gel Sealed Battery, battery opzv

General		
	Type	Multyplus 48/3000/35

	Nominal Battery voltage	48V
	Power control	Yes
	Power Assist	Yes
	AC Input	Cos Φ>0,8
	Transfer switch	16 or 50
Inverter mode parameters		
	Input voltage range (V DC)	9,5-17V; 19-33V; 38-66V
	Input current (A DC)	250 / 125 / 65
	Output	230VAC 50Hz
	Continues output power 25°C VA	3000
	Continues output power 25°C W	2400
	Continues output power 40°C W	2200
	Continues output power 65°C W	1700
	Peak power W	6000
	Maximum continues Output current A ~	11
	Power factor range	0,8
	Maximum Output fault current	32A peak 1s
	Maximum efficiency (%)	93/94/95
	Zero load power (W)	20/20/25
	Zero load power in AES mode (W)	15/15/20
	Zero load power in Search mode (W)	8/10/12
CHARGER MODE PARAMETERS		
	AC input	187-265 VAC 45-65Hz, Power factor 1
	Charge voltage “absorption” VDC	14,4/28,8/57,6
	Charge voltage “float” VDC	13,8/27,6/55,2
	Storage mode VDC	13,2/26,4/52,8
	Charge current house battery (A)	120/70/35
	Charge current starter battery (A)	4
	Battery temperature sensor	Yes
General		

	Auxiliary output	Yes (16A)
	Programmable relay	Yes
	Protection	a-g
	VE.bus communication port	For parallel and three phase operation, remote monitoring and system integration
	General purpose com. Port	Yes
	Remote on/off	Yes
	Common Characteristic	Operating temp. range -40 to +65 °C (fan assisted cooling) Humidity (non-condensing): max 95%
Enclosure		
	Weght kg	18
	Dimensions mm	362x258x218
	Standards	
	Safety	EN-IEC 60335-1, ENIEC 60335 -2-29; IEC 62109-1
	Emission Immunity	EN 55014-1, EN 55014-2, EN-IEC 61000 –2, EN-IEC 61000-3-3, IEC 61000-6-1, IEC 61000-6-2, IEC 61000-6-3

Battery

Battery specification		
	Voltage and capacity	LFP Smart 25,6/200- a
	Nominal voltage, V	25,6
	Nominal capacity @25°C, Ah	200
	Nominal capacity @0°C, Ah	80
	Nominal capacity @ -20°C, Ah	50
	Nominal energy @25°C, Wh	2560
	Cycle life (capacity >80% of nominal)	
	80% DoD, cycles	2500
	70% DoD, cycles	3000

	50% DoD, cycles	5000
Discharge		
	Maximum continuous discharge current, A	400
	Recommended continuous discharge current, A	< 200
	End of discharge, V	22,4
	Internal resistance. μΩ	1,5
Operating conditions		
	Operating temperature	Discharge: -20°C to +50 °C; Charge: - +5°C to +50°C
	Storage temperature	-45°C to +70 °C
	Humidity (non-condensing)	Max. 95%
	Protection class	IP22
	Charge	
	Charge voltage	Between 14V/28V and 14,4/28,8 V (14,2V/28,4 V recommended)
	Float voltage	13,5 V/ 27V
	Maximum charge current	400A
	Recommended charge current	<100 A
	Other	
	Max storage time @25°C	1 year
	BMS connection	Male +female cable with M8 circular connector, length 50cm
	Power connection (threaded inserts)	M8
	Dimensions, mm	237x650x163
	Weight	39kg
Standards		
	Safety	Cells: UL1973+IEC62619:2017+UL9540A Battery: IEC 62620:2014
		EN 60335-1:2012/AC:2014, EN-IEC 62368-1, 2020, IEC 61427-1:2013
	EMC	EN-IEC 61000-6-3:2007/A1:2012-EN

		55014-1:2017/A11:2020
	Automotive	ECE R10-6

Smart PLC controller

Communication	Web browser Web browser (HTML5) Modbus TCP master/slave Modbus (UDP), WagoAppPlcModbus Library Modbus (RTU), WagoAppPlcModbus Library ETHERNET EtherNet/IP™ Adapter (slave) EtherNet/IP™ Scanner CANopen EtherCAT® Master OPC UA Server/Client OPC UA Pub/Sub (can be installed later) MQTT RS-232 serial interface RS-485 interface BACnet/IP, **requires an additional license** Telecontrol protocols, **requires an additional license** MicroBrowser (including visualization of CODESYS V2.3), requires an additional license
ETHERNET protocols	DHCP DNS FTP FTPS HTTP HTTPS SSH
Visualization	Web-Visu Target Visu
Operating system	Real-time Linux (with RT-Preempt patch)
Processor	ARM® Cortex® A9 Quad-Core 1.0 GHz
Programming environment	CODESYS V3.5, Firmware Release 24 or higher *e!COCKPIT* (based on CODESYS V3) up to Firmware Release 22

Baud rate (communication/fieldbus 1)	10/100 Mbit/s
Baud rate (communication/fieldbus 2)	1 MBd
Baud rate	ETHERNET: 10/100 Mbit/s; CAN: 1 MBd
Main memory (RAM)	2 GB, DDR3 SDRAM
Internal memory (flash)	4096MB
Internal memory (flash)	4 GB, eMMC
Non-volatile hardware memory	128kbyte
Interfaces (USB)	2 x USB 2.0 socket, type A; 1 x USB OTG socket, type C
Onboard I/Os	4 x DIO, configurable
Indicators	3-color LED – red, green, blue; 4 x red/green LED
Supply voltage	24 VDC, SELV (18 ... 31.2 V); LPS; with reverse voltage protection
Input current (max.) (24 V)	120mA
Operating power	2.9 W, without USB load; 9.4 W, with USB load

Timeline and schedule for the implementation of the pilot action

- Preparation of Technical specifications – March 2024
- Carrying out a procedure for selection of a company to purchase the equipment – April 2024
- Contractor selection – April 2024
- Implementation and commissioning – May-June 2024
- Database recruitment monitoring – June 2024 – December 2026 and after the project life

Technical components – kWp installed power, kWh installed battery, other technical information, the characterization of the heat pumps, charging stations, etc. Bear in mind: each pilot action has specifics, not all information needs to be considered under this point.

№	Equipment
1	Hybrid invertor (nominal power 5 kW, Protection - output short circuit - overload - battery voltage too high - battery voltage too low - temperature too high - 230 VAC on inverter output - input voltage ripple too high
2	Deep Cycle Battery cluster - Nom. capacity 200 (Ah at 20°C), Nominal Voltage- 12V
3	Charge regulator
4	Cables

Breakdown of the financial resources required for the pilot action

- Total budget – 30 000.00 EUR
- Smart battery system – 16 400.00 EUR
- Energy management system – 13 600.00. EUR

How information will be shared with stakeholders and the public: Seminars, website and trainings, focus group workshop, 1 SWOT analyse workshop, 1 finding measures workshops, webinar.

Consideration of how the pilot action's results can be sustained or expanded: With the development of the energy market and ever-increasing energy prices, interest in the results of the pilot model is expected to be very high. By the end of the project implementation, the model is expected to be replicated in at least two more enterprises.

Identification and assessment of potential risks and challenges: The main risk is a delay in equipment purchase. To avoid risk in the implementation of the pilot model, we will start procedure for equipment purchase in March 2024.

Is the pilot action feasible: The problem UBBSLA aim to solve is smart management of electricity production and consumption. This will be implemented through a system of electricity storage and energy management of consumers. The management will control the peak power and the consumers, in relation to the price of electricity and the production of renewable energy sources. At present, no such administration has been built in the North-Eastern region of Bulgaria.

The project will bring additional benefits both for the technical operation of the Association and for the final beneficiaries as well. As an umbrella organization, the UBBSLA has established strong partnerships with other civil society organizations, youth organizations, branch organizations and business networks in the region, etc.

In addition, the Association has previous experience in participating in other projects and initiatives funded by national and international donors, so the present proposal is an excellent solution to upgrade and enhance experience and capacities. Transnational cooperation will provide benefits for taking advantage of the solutions /pilot actions/ implemented by other partners to transmit them into the pilot territory.

The pilot model will provide data and knowledge for smart battery and consumer management. With the increased qualification, it will be possible to offer a solution for energy management of photovoltaic, battery and consumer systems. A similar solution can be implemented in any facility that consumes electricity. The potential for replication is very high as the installed system will provide opportunity for the users to self-manage and self-operate the energy consumption in a regular, smooth and easy to control way. This will lead to long-term benefits including the decrease of harmful emission, optimization of the energy costs, thus contributing the improvement of the wellbeing and quality of life of citizens.

VII. Pilot case: Goražde

Location: **Bosnia and Herzegovina**

7.1. Background information

Bosnia and Herzegovina has a great potential in renewable sources, especially solar potential, but the utilization of the potential has been rather low. The PV power plant will be installed on the roof of an existing office building, owned by JP Elektroprivreda BiH d.d. – Sarajevo – Subsidiary "Elektrodistribucija Sarajevo". Along with the PVPP, a battery system would be installed which would, in addition to the already installed EV charger, form a smart micro grid.

7.2. National legislation

The application of the set of laws on energy adopted in the Parliament of the Federation of Bosnia and Herzegovina will practically begin in 2024. These laws are the Law on Electricity, the Law on Energy and Regulation of Energy Activities in the Federation of Bosnia and Herzegovina, and the Law on the Use of Renewable Energy Sources and Efficient Cogeneration in the Federation of Bosnia and Herzegovina. The aforementioned laws harmonize BiH legislation with the legal acquis of the European Union and the Energy Community, thus continuing the process of electricity market liberalization and energy transition towards clean energy. The adoption of new laws also more precisely defines the rights and obligations of all market participants and simplifies the procedures for the construction and operation of production facilities that use renewable sources, primarily solar and wind, but also the introduction of new mechanisms for the protection of end customers. In addition, issues of common importance for the use of multiple forms of energy in the sectors of electricity, natural gas, oil derivatives, thermal energy, renewable energy sources, and energy efficiency in the Federation of Bosnia and Herzegovina will be systematically regulated. These solutions promote and regulate the production of electricity and heating and cooling energy from renewable sources and efficient cogeneration, as well as the use of renewable energy sources in transport for consumption on the domestic market, but also an increase in the share of total energy consumption. In this way, the citizens of BiH are allowed to participate in the decarbonisation of the energy sector more simply, with the possibility of supplementing the existing provisions related to guarantees of origin and balancing.

For the implementation of these three laws, it is necessary to adopt about 45 by-laws (ordinances, regulations, instructions). Most by-laws should be adopted in the period from six months to a year after the adoption of the law.

7.3. Specific territory of the pilot action

The PVPP and the battery system will be installed on the roof of an office building located in the city of Goražde (address Selvera Sijerčića 23, 73000 Goražde). The city of Goražde is located in southeast Bosnia, approximately 60 km from Sarajevo, the country capital. All systems will be operated and monitored by EPBiH. This city and the building was selected because of its energy consumption during the summer months (close to the PVPP production) and because it has an EV charger already installed next to the building. Also, for the last ten years EPBiH has conducted measurements of the solar potential using a pyranometer that is located on the roof of the proposed building.

7.4. Topic of the pilot action

This pilot investment will demonstrate the operation of one system that will be comprised of PVPPs, battery storage and EV charger that will optimise the energy profile of a consumer and will limit the impact that the PVPP operation has on the system. The pilot plant will be a system with a PV power plant with capacity of 10 kW, alongside with a 10-kWh battery system for storage. The generation profile of the PVPP itself is unmanageable and it can be expected that soon it will not be possible to balance the surplus electricity which occurs in the daily period when irradiation is high. Therefore, installing a PVPP and a battery storage system, alongside the existing EV charger, will help deliver electricity generated from the PVPP in a controlled way and it would reduce the need for balancing the PVPP production. The system will be connected to the internal electrical installations of the consumer (EV charger is already connected), as the energy produced will be used to satisfy own demand. The consumer would have multiple benefits, since it would get less energy from the grid (as it would partly satisfy its own demand via PVPP), thus decreasing the energy losses and peak demand of the grid, but and also by optimising the energy profile it would have increased energy security and reliability as well as increased energy efficiency. The photovoltaic power plant will be built on the roof of an office building owned by Elektroprivreda, and the plant will be used to meet its own consumption and affect the reduction of "peak load" depending on whether the customer's consumption curve matches the plant's production curve.

7.5. Target groups

The primary beneficiary that will benefit from the pilot action will be EPBiH, as is the owner of the building on which the system will be installed. Installation of the system will help increase the energy efficiency and energy security. However, since this project can easily be replicated, the results and conclusions from this project can benefit many other companies that will be able to replicate the results. Also, the local energy network operator will benefit from the reduced losses in the grid.

7.6. Detailed description of the pilot action

Construction of PV power plant on the roof alongside the battery system to be used for storage. The newly installed objects will, alongside the existing EV charger, form a smart micro grid.

- **Timeline and schedule** for the implementation of the pilot action: The plan is to prepare all the necessary documentation for a procurement and installation of the roof PVPP and battery system in the 1st quarter of the year and to conduct the procurement in the second. In the 3rd quarter, the installation and commissioning of the PVPP and battery system will be completed and then the trial operation may start in the 4th quarter.
- **Technical components** – kWp installed power, kWh installed battery, other technical information, the characterization of the heat pumps, charging stations, etc. Bear in mind: each pilot action has specifics, not all information needs to be considered under this point. The PVPP will have installed power of 14.85 kWp (10 kW) with the yearly production of approx. 16.000 kWh.

The battery system capacity will be 10 kWh. The EV charger station is already installed, with the installed **power of 46 kW.**

- **Breakdown of the financial resources** required for the pilot action: The required financial resources are 30.000 €.
- How information will be shared with stakeholders and the public: The project team will share the information through stakeholder meetings and events. Also, EPBiH will share the information with public using its own website and marketing options.
- Consideration of how the **pilot action's results can be sustained or expanded**: Pilot actions can be expanded to other buildings owned by EPBiH throughout the country, and also on other companies.
- Identification and assessment of **potential risks and challenges**, in the frame this please also identifies the mitigation measures, how you will solve the risks, obstacles, etc.: We don't foresee any risks associated with the project.
- Is the pilot action **feasible**? The pilot action is feasible as it will lead to more energy efficient consumption of the office building, and increased use of energy produced by PV plant due to the presence of the battery system. The connection of the PVPP is also feasible as it would be connected to the internal electrical installations of the building.

VIII. Pilot case: Heat pumps for local hospital in Khotyn municipality

Location: Ukraine

8.1. Background information

Khotyn is a city in Chernivtsi Oblast of western Ukraine, center of Khotyn municipality (includes city and 10 surrounding villages). Total area of the city is appr. 20km^2 and population 8,936 (2022 estimate). Khotyn is a member of Association "Energy Efficient Cities of Ukraine" and Covenant of Mayors signatory since 2016.

Figure 1: Location of the Khotyn municipality

According to the Program of Sustainable Energy Development and Energy Security of the Khotyn municipality for 2024-2026, the total energy balance of the municipality is 89,600.02 MWh, and the total volume of CO2 emissions is 32,580.59 tones (base year 2021).

At the same time, the share of electric energy in total energy balance is significant and amounts to 27%.

After the start of Russian full-scale invasion, the issue of energy security of “critical infrastructure objects” (hospitals, schools, kindergartens, water supply and purification facilities, etc.) gained considerable importance in Ukrainian municipalities. This problem has become particularly acute as a result of the aggressor's attacks on the energy infrastructure, as a result of which there were and still are interruptions in the state energy system. In these conditions, each municipality is obliged to plan and implement measures for reduction of peak loads, while ensuring the possibility of autonomous and uninterrupted work of critical infrastructure facilities.

Khotyn municipality considers solving the problem of reducing peak loads and ensuring autonomous operation for its own hospital, which is the largest health care facility within a radius of 100 km, as a top priority. It is planned to modernize the hospital's heating system, providing the opportunity to generate thermal energy for the needs of the basic therapeutic and rehabilitation corps through the heat pump technology. In combination with the installation of a local solar power plant in the hospital (the event is implemented as part of a separate project), it is planned to achieve a high level of energy security, significantly reduce peak loads on the power system and reduce the consumption of traditional energy.

Today, the energy sector of Ukraine is undergoing a period of transformation to market-based rules. Until 2019, Ukraine operated an inefficient monopolized model of relations in the field of electricity sales. In such a system, product pricing depended on centralized management, which had negative consequences for all participants in the process. To date, non-household consumers in Ukraine have fully market-based supplier selection conditions (electricity, gas). Accordingly, the cost of a unit of energy is not set centrally, but is subject to market regulation. As of March 2024, the cost of 1 kWh of electricity for non-household consumers is EUR 0.143, and the distribution price is EUR 0.042. Thus, the total cost of 1 kWh is EUR 0.185.

Price of 1m3 of gas is currently appr. EUR 0,345 and together with distribution services (EUR 0,053) total cost is EUR 0,398. Payment for consumed electricity and gas are made on a monthly basis, according to actual consumption.

According to experts' forecasts, the prices on electricity and gas in Ukraine will increase in the near future. The main reason is the need to finance the restoration of the energy infrastructure damaged and destroyed by enemy attacks. Thus, for the category of non-household consumers, the cost is expected to increase by up to 30% by the end of 2025.

8.2. Specific territory of the pilot action

The communal non-profit enterprise "Khotyn multidisciplinary hospital" is a health care institution based on communal (municipal) ownership. The founder of the hospital is Khotyn City Council. The hospital is licensed to provide 14 types of medical services (packages), in accordance with the standards established by the National Health Service of Ukraine. In 2023, medical services were provided to more than 8,000 patients. The total number of hospital staff is 393.

Installation of the heat pump is planned to be carried out on the therapeutic (900 m2) and connected rehabilitation (200m2) corpses of the hospital.

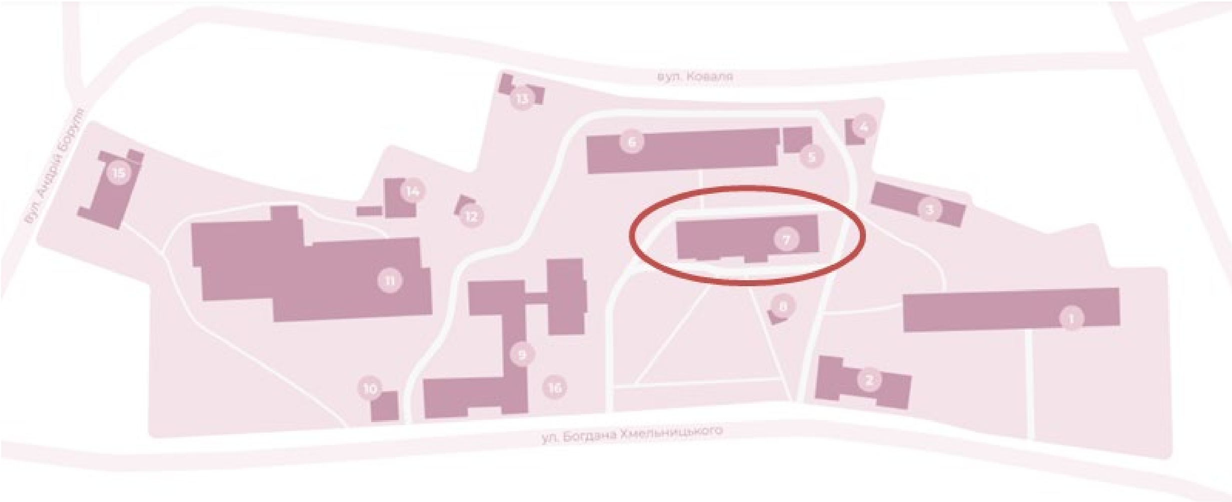


Figure 2: Location of the "pilot" buildings

Installation of the heat pump directly in the building will be carried out with reference to the existing location of the heat distribution unit. The indoor unit, which will include the controller, storage tank and pumps, will be installed directly in one of the ground floor room and integrated into the distribution node. Accordingly, the outdoor unit will be located outside next to this room and connected with the indoor unit.

Figure 3: Place of installation of the heat pump

8.3. Topic of the pilot action

The topic of the pilot action is to demonstrate the potential of using alternative and renewable energy sources to reduce peak loads and increase the energy security of critical infrastructure institutions in Ukraine. Here's an overview of how this investment can benefit Ukraine and the Danube program area:

- Demonstration of Viability: Implementing a pilot investment such as heat pumps combined with photovoltaic system for public buildings in Ukraine showcases the viability and effectiveness of this technology in the region. It serves as a practical demonstration of how heat pumps can contribute to energy efficiency, sustainability, and cost savings in public infrastructure. The success of the pilot project can encourage other municipalities within the EECU network (both Covenant signatories and EECU members, in total over 200 municipalities) and other project partners to replicate similar investments.

- Knowledge Sharing, Upscaling and Expansion: The experience gained from the pilot investment will be shared among the EECU network of municipalities. This sharing of experiences enables a faster and smoother replication process. The lessons learned from the initial pilot investment can be upscale by leveraging the network of municipalities and existing channels of communication within the EECU.
- Technical Assistance and Capacity Building: The EECU will provide technical assistance and capacity-building to support municipalities interested in replicating the combined heat pumps and PV power plant investment. This assistance can include guidance on feasibility studies, financial modelling, system design, installation, and maintenance.
- Economic and Environmental Benefits: Replicating and upscaling heat pump investments in Ukraine and the Danube program area shall bring substantial economic and environmental benefits. It will contribute to energy independence, reduce greenhouse gas emissions, create local jobs in the clean energy sector, and stimulate economic growth through energy savings. These benefits align with the broader goals of sustainable development and can enhance the overall well-being of the region in view of constant Russian missile attacks on energy infrastructure.

8.4. Target groups

The installation of heat pumps for the local hospital in Khotyn has several target groups, with the main one - Khotyn municipality which will benefit through: peak load reduction, contribution to climate commitments (Covenant of Mayors initiative), enhanced energy security and stability, lower energy costs.

In addition to the municipality, the target groups of this investment also are the personnel (393) and patients (appr. 8,000) of the local hospital. These people will experience the positive impacts of the heat pump installation through the better quality and sustainability of heat supply. Moreover, the action indirectly supports the provision of quality healthcare services by optimizing energy costs and ensuring a stable energy supply, ultimately benefiting the patients' overall experience and care.

Key stakeholder for the implementation of the pilot action is the owner of hospital (municipality), the administration of the hospital, the local energy network operator, equipment suppliers and regulation authorities.

8.5. Detailed description of the pilot action

Under this pilot, it is planned to modernize the existing heating system of the therapeutic & rehabilitation corps of the hospital by integrating a heat pump with a capacity of approximately 60 kW and additional related equipment. It is planned to use the "air-water" type of the heat pump. In this technology, the external unit of the heat pump is located outside and generates thermal energy due to contact with air. The internal unit is a storage tank with water (appr 1m3) and 2 heat exchangers inside. The first heat exchanger provides heating of the water inside the tank due to the coolant supplied from the external unit of the heat pump. The second heat exchanger is additional and it will provide additional heating of the water in the tank due to the operation of the existing boiler room, only in case the heat pump will not able to provide the required temperature inside the tank (during very low outside air temperature).

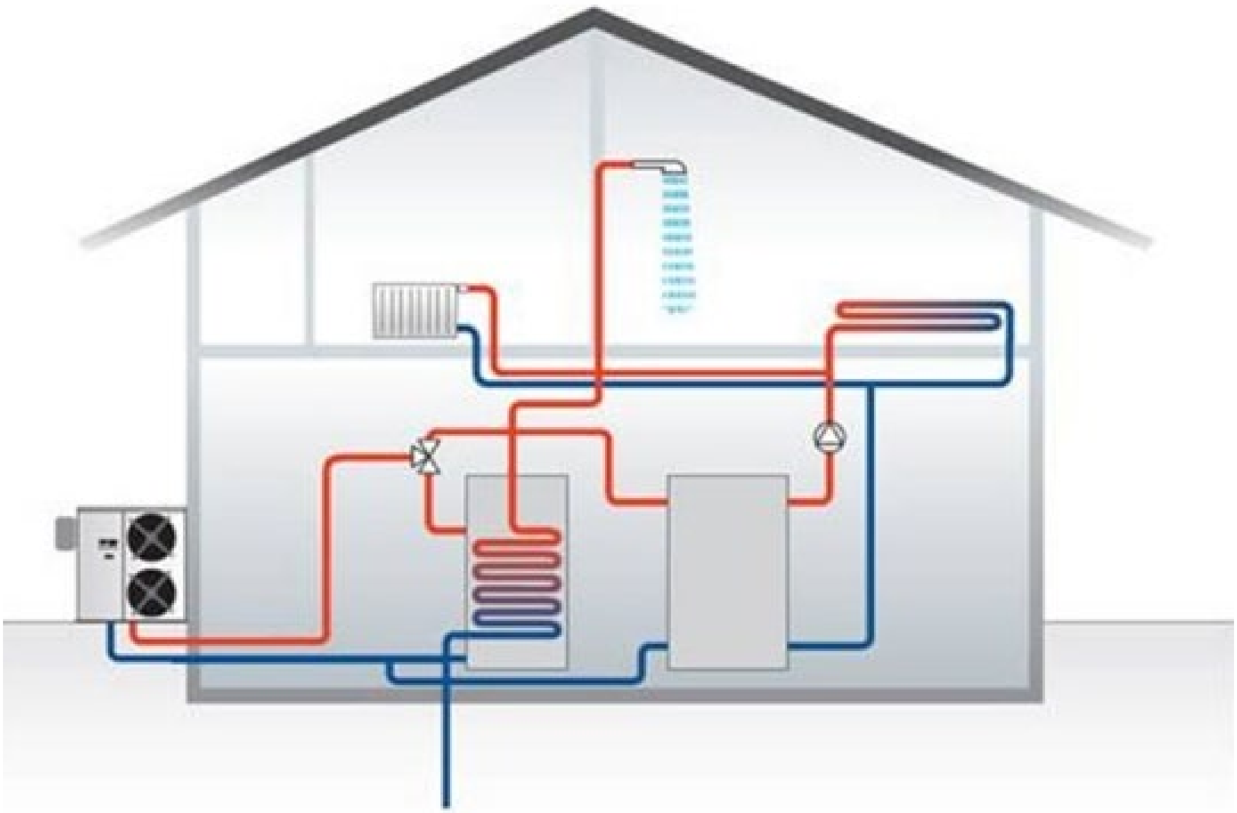


Figure 4: Schematic representation of the heating system of the building with a heat pump of "air-water" type

Electricity will be necessary for the uninterrupted operation of the heat pump. It is used to power the heat pump system and ensure circulation of the coolant. The average efficiency indicator is 4 kW of produced thermal energy per 1 kW of consumed electrical energy. At the same time, it is planned that the generation of electrical energy for the consumption needs of the heat pump and other needs of the hospital will be provided by its own solar power plant installed in the hospital as part of another project.

Timeline and schedule for the implementation: Most of the activities for installation and put in operation the heat pump planned to be completed in the 2nd project period (no later than October 2024), before the official beginning of the "heating season" in Ukraine.

The preliminary schedule of preparatory activities is:

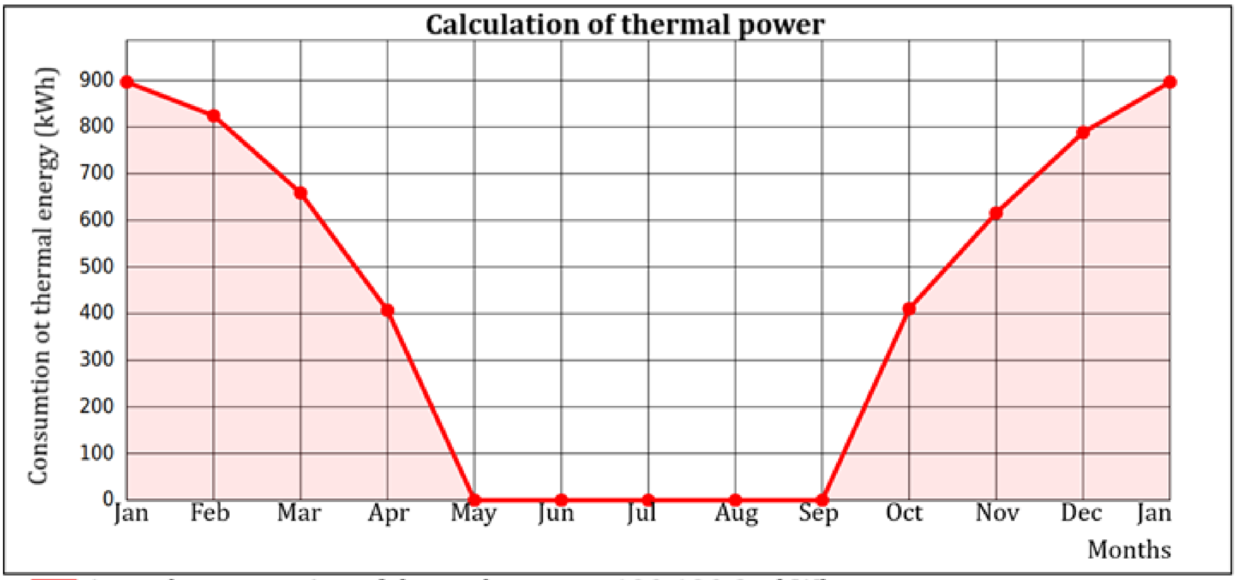
- Project technical design - June 2024
- Tender purchase announcement - July 2024

- Evaluation of tender proposals, contractor selection and contracting - August 2024
- Supply of equipment and execution of installation works - September-October 2024.

The installation of a solar power plant in the hospital is not an activity under the ESINERGY project and is carried out by the municipality separately. The scheduled completion date of these works is May 2024.

Technical components: The calculation of the necessary power of the heat pump was carried out on the basis of annual need in thermal energy for the therapeutic & rehabilitation corps. The following indicators were taken into account:

- ✓ total area of the building - 1200 m2
- ✓ energy efficiency class of the building: C
- ✓ minimum winter outdoor air temperature: -20 °C
- ✓ required heat carrier temperature in the heating system: 45 °C



Annual consumption of thermal energy	**139 129,2**	kWh per year
Calculated capacity of the heat pump	**60**	kW

Figure 5: Required heat pump power calculation

Based on the calculations, it was determined that the required power of the heat pump should be 60 kW, which, with an average COP (coefficient of performance) of 1:4, is able to fully meet the needs in thermal energy for heating and hot water supply.

Breakdown of the **financial resources** required for the pilot action: On the basis of expert study of the heat pumps market in Ukraine, it was determined that the cost of the necessary equipment and installation works can be approximately EUR 28,000 - 35,000 euros. At the same time, the budget of the project provides EUR 30,000, which makes possible to claim that the necessary equipment can be purchased and installed within the planned budget.

How information will be shared with **stakeholders and the public:** Communication with stakeholders will be ensured throughout the entire period of implementation of the pilot investment. In particular, the expert environment has already been involved for the purpose of preliminary assessment at the stage of concept development. In the future, technical design will be developed with the involvement of relevant experts. Hospital management, as well as municipal specialists, will be also actively involved by participating in a joint local working group.

Informing the public will be carried out through different communication resources (EECU's, municipality's and hospital's), as well as through the planned project communication activities. In addition, Khotyn, as a member city of EECU, will spread the information about the pilot among other municipalities through experience exchange events and mass media.

Consideration of how the pilot action's results can be **sustained or expanded**: Proposed pilot investment can demonstrate the feasibility and benefits of adopting heat pump technology as a sustainable and cost-effective alternative for critical infrastructure of Ukraine. It will provide valuable insights and findings regarding the performance, efficiency, and cost savings achieved through the use of heat pumps in combination with PV power plant, which is innovative and new technology for Ukrainian users. The successful implementation of the project in the hospital can be replicated in other public buildings, institutions, or even private residential buildings not only Ukraine but also in other regions. The positive outcomes and demonstrated benefits of heat pumps will provide evidence and justification for further investments, attracting additional funding, and encouraging public and private sector participation.

EECU will distribute the information through its network (both Covenant signatories and EECU members, in total over 200 municipalities) to encourage the replication of similar investments.

Identification and assessment of **potential risks and challenges**: Technical risks may consist in incorrect selection of technical solutions and their further implementation. It is planned to be minimized due to the involvement of competent specialists and experts at the stages of project designing and technical supervision.

Financial risk may arise in the form of the inability to finance the purchase and installation of all necessary equipment due to rapid inflationary processes that may arise due to the influence of war on the Ukrainian economy. It is planned to be overcome by attracting funds from the municipality as co-financing. Previously, the municipality expected to finance EUR 5,000 as its own co-financing. However, if necessary, this amount can be increased.

Security risks are the danger of loss or damage to equipment or a building due to the aggressor's actions. This is a common situation for any corner of Ukraine, but for the region in which Khotyn is located, it is much smaller due to the significant distance from the front line.

Is the pilot action feasible? The project is characterized by a high degree of feasibility, primarily due to the fact that it corresponds to the priorities of Ukrainian municipalities and the country as a whole. The feasibility of the project is also strengthened thanks to the positive involvement of all stakeholders, the presence of local co-financing from the municipality and the guarantee of further proper operation.

List of the KPIs and Methodology of measurement

N	PILOT SITE	Quantitative / Qualitative KPIs	Methodology of measurement of KPIs
1	**Establishment of an energy community** - Hungary	Quantitative KPIs: ▪ Annual energy production (kWh) ▪ Annual energy consumption (kWh) ▪ Number of persons involved in preparations ▪ Number of articles published in local media ▪ Number of energy community members Qualitative KPIs: ▪ Energy community ready to be launched as planned (i.e. with at least two energy community members) ▪ Energy community ready to be expanded (i.e. with further local residents and entrepreneurs) ▪ Quality of local stakeholder cooperation and information exchange ▪ Quality of cooperation and information exchange with ESINERGY project partners	✓ In the initial phase of the project implementation, information will be requested from the local municipality to provide data on the energy consumed by the community centre, funeral home, belfry and e-bike charging station. ✓ The number of persons involved in the preparation process (e.g. external stakeholders) will be collected as lists of participants. ✓ The number of media appearances will be collected.
2	**Campus Innovation Centre W.E.I.Z.** - Austria	▪ General KPIs ▪ Action implemented ▪ Estimated number of people/companies benefiting from the pilot action ▪ ▪ Specific KPIs ▪ Installed solar power in kWp ▪ Installed power of battery systems kWh ▪ Direct used energy from the PV System and storage system ▪ Energy efficiency of the innovative storage system (Redox-Flow)	✓ Action Implemented: documenting project milestones and completion of predefined tasks as outlined in the project plan. ✓ Estimated Number of People Benefiting: documenting the number of individuals benefiting based on the capacity of the PV and storage system. People who work at the campus or will be part of the energy community. ✓ Installed solar power in kWp: Continuous monitoring of the installed power on the buildings of the campus W.E.I.Z as well as on neighboring buildings. ✓ Installed storage capacity in kWh: Continuous monitoring of the installed capacity on the campus W.E.I.Z. ✓ Direct used energy from the PV System and storage system: Monitoring of the produced and consumed power. Calculation through and continuous energy management ✓ Energy efficiency of the innovative storage system (Redox-Flow): Through a monitoring equipment and data network it will be possible to calculate the internal consumption (pumps, heater, cooler, etc.) and outline the efficiency of the battery. ✓ Energy Consumption of the smart energy node: Metering and measuring of the consumed and produced energy node over at

			least two buildings. Calculation of the self-sufficiency degree
3	**Smart concept for solar electricity flow and use** - Slovenia	▪ The percentage (%) of network's peak load reduction achieved ▪ The amount of kilowatts (kW) of network's peak load reduction achieved ▪ the amount of energy (kWh) of energy returned from the car for the operation of the building.	The methodology of measurement of KPI will be very simple as everything is connected online. It will provide an insight into the data on the electrical network load via Mojelektro application (also the preliminary pilot site data were obtained through this application). Measurement, data recording and reading will take place via the established application, which is part of the pilot (which also controls the operation - those energy flow protocols) in connection with the Mojelektro application https://mojelektro.si
4	**Battery system in Administrative building of MED** - Croatia	▪ The percentage (%) of network's peak load reduction achieved ▪ The amount of kilowatts (kW) of network's peak load reduction achieved ▪ The amount of energy (kWh) used „internally" Quantitative KPIs ▪ Battery percentage - State of charge (SoC) ▪ Current percentage of charging/discharging power ▪ Percentage of energy stored in battery system from PV and from grid (monthly, annually)	Since there is an existing smart metering system already in operation, some consumption data after the pilot is installed will be comparable with the one before pilot. It is planned that the aforementioned system will display (on a joint platform, in common rooms in the building's premises) the balance of energy consumption and production, in real time and given time, at the pilot site. Other than already available/displayed data in the smart metering system (domestic hot water consumption, electric energy consumption, natural gas consumption) data will be added for existing renewable energy systems (production and consumption of energy from the PV power plant, heat pump, charging station for electric vehicles) and the newly installed battery storage system. Information about current status of the battery, such as battery percentage - state of charge, current percentage of charging/discharging power and percentage of energy stored in battery system from PV and from grid, will also be displayed and available at all time. Information available within the smart metering system will be used to gather data on energy consumption, which will then be used to calculate some of the described KPIs.
5	**Monitoring & control of decentralized plants/assets** - Germany	▪ number of installed hardware components - added value is the identification of the technical challenges and determination of the required hardware and measured values ▪ data availability in our systems forecast quality	✓ counting and photo documentation of the installed devices ✓ percentage failure rate of measured values ✓ deviation of the prediction from the actual
6	**Smart energy management trough smart battery in a small glass factory and**	▪ Energy management system – 1 system implemented ▪ Number of people/companies benefiting from the pilot action ▪ Installed power of battery systems kWh	✓ Smart battery system and Energy management system implemented: documenting project milestones and completion of predefined tasks as outlined in the project plan.

	museum - Bulgaria	▪ Data base ▪ Number of articles published in local media ▪ Number of energy community members ▪ Direct used energy from the PV System and storage system	✓ Estimated Number of People Benefiting: documenting the number of individuals benefiting based on the capacity of the PV and storage system. People who work at the campus or will be part of the energy community. ✓ Data base: Through a monitoring equipment and data network
7	**Goražde -** Bosnia and Herzegovina	▪ installed solar power in kWp ▪ production from PVPP in kWh ▪ installed power of battery system kWh ▪ direct used energy from the PV System and storage system ▪ energy used for EV charging in kWh ▪ all metered data of the consumer etc. By aligning the production curve with the consumption curve, there will be a decrease in peak load which will be shown in the metered data (decreased peak load value, decrease in consumed energy etc).	Through continuous monitoring of the system, and through evaluation of the metering data, as well as EV charger data, we can obtain data to calculate all the KPIs.
8	**Heat pumps for local hospital in Khotyn municipality** - Ukraine	General KPIs: ▪ Action implemented. ▪ Estimated number of people (personnel and patients) benefiting from the pilot action. Specific KPIs: ▪ Installed heat pumps power in kW. ▪ Annual amount of heat production by the heat pumps in kWh. ▪ Amount of traditional energy consumption decreasing due to operating the heat pumps in kWh. ▪ Decreasing of CO_2 emissions in tones.	General KPIs: ✓ Action implemented: documenting project milestones and completion of predefined tasks as outlined in the project plan. ✓ Estimated number of people (personnel and patients) benefiting from the pilot action: documented annual number of personnel and patients of the therapeutic and rehabilitation departments of the hospital. Specific KPIs: ✓Installed heat pumps power in kW: technical indicators of the installed equipment. ✓Annual amount of heat production by the heat pumps in kWh: monitoring of daily, monthly and annual volumes of the heat energy production, which will be carried out by the hospital's energy manager under the supervision of the municipal energy manager. ✓Amount of traditional energy consumption decreasing due to operating the heat pumps in kWh: Monitoring of monthly and annual energy consumption volumes on the existing hospital's boilerhouse and comparison of consumption before and after installation of the heat pump ✓Decreasing of CO_2 emissions in tones: comparison of CO_2 emissions caused by the energy consumption of the hospital's boilerhouse before and after the installation of the heat pump.

The establishment of the co-working group

In this chapter, we shift from theoretical constructs to practical strategies, focusing on the establishment of co-working groups that will define our project's success and provide opportunity to jointly cooperate for better and common results.

The approach is pragmatic, grouping partners based on similar pilot actions. This intentional structure blends the strengths of pilot partners from SI, HR, BG, BIH, UA, HU, AT, DE, incorporating both pilot and non-pilot partners.

Efficient physical and online meetings are the backbone of our collaboration.

Face-to-face interactions in physical meetings reflect stakeholder contributions to pilot actions. We delve into indicators, processes, and the invaluable support stakeholders offer.

Leadership from the Lead Partner (LP) and PP10 directs the formation of each thematic similar pilot site group.

The groups will meet for the purposes of:

- Development and implementation of pilot activities
- Development and implementation of the transnational strategy - Master Plan and action plan
- Development of solution that will be created after the implementation of the pilots.

The time plan of the meetings is presented in the annex to this document. The frequency of the meetings is also clarified in the same document.

Here follows detailed information and instruction:

2.1. Establishing Group Structure - form 4 distinct groups based on regional similarities:

1) SI+HR+BG+BIH
2) UA
3) HU
4) AT+DE

The parameter for similarity focuses on the nature of pilot actions. The groups will include both pilot and non-pilot partners. There will be online and physical meetings to interact.

2.2. Online Meetings: The online meeting for the co-working groups will be held as part of regular online meetings, which will be organized during the time between project meetings. It will be allocated 1 hour for Work Package (WP) and Management discussions followed by the dedicated:

1) 40-minute slots for 1st pilot group,
2) 15-minute each for 2nd pilot group,
3) 15-minute for 3rd pilot group,
4) 20-minute for 4th pilot group,

Each partner can participate in all group sessions that will follow one after each other. At least two groups should be attended, especially these ones for which you believe the pilot action could be transferred to your country or you have interest to hear more and contribute to the pilot improvements. After all group sessions 1 hour for focused discussions will be allocated, with moderators (PP10 and LP) taking notes. The online tools such as Miro or Zoom Digital Whiteboard can be used during the meetings.

The focus discussion will be each time defined prior the meeting, based also on the current priorities and needs, however, the mandatory topics are always: the general information, and the progress made in the frame of the pilots (stakeholder involvement process, technical details, KPIs, feedback questionnaires of the stakeholder and their role in the pilot action, how they can contribute to the pilot action, which are the stakeholders to be part of the Master plan enactment, pilot action replication, etc.), Master plan development and solution development.

2.3. Physical Meetings: Four Co-working groups will also meet during ordinary project meetings. The method of work will be similar to the one at the online meeting. The Co-working group sessions will be integrated into the agenda of the project meetings, the time correspond to this session depends on other sessions, but at least two-working hours will be given. Facilitate discussions during physical meetings will refer to the current interesting topic. The moderators will be LP and PP10 with the pre-defined guiding questions if needed. The partners are split into the group tables, and listen the presenters. Each group has the flip chart paper in front them and provide on it the feedback loop on each of the 4 pilot groups. The moderator of the group table presents their input.

Conclusions

This document describes the pilot models that will be implemented under the project. The aim is to demonstrate to the target groups that there are solutions that they can benefit from as end users. The pilot models cover a wide variety of target groups and possible solutions. The data and knowledge that will be accumulated from the operation of the pilot models will be valuable for the design and implementation of future sustainable energy solutions. Target audiences should be made aware of the technology that will benefit them and the ways in which energy users can become energy independent and gain an understanding of individual pilot solutions to directly or indirectly reduce peak loads.

The collaborative work groups will also participate in the pilot model studies. The groups will serve to bring together partners with diverse backgrounds and experiences to use collective knowledge and skills to achieve common goals in the context of the joint development and implementation of the pilot project.

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