

INVESTMENT FACT SHEET

Version 2

I.1 - Energy management of the Bracak Manor with PV and batteries integrated with existing energy systems

Project index number and acronym	CE1344 Store4HUC
Responsible partner (PP name and number)	PP8 - North-west Croatia Regional Energy Agency (REGEA)
Linked to pilot action (number and title)	O.T2.1- Pilot Actions in Historical urban centres
Project website	https://www.interreg-central.eu/Store4HUC
Delivery date	January 2022

Description and technical characteristics of the investment

The aim of the Bračak pilot project is the implementation of a central battery (bank) system, installation of a photovoltaic system, and integration of it to an advanced Energy management system (EMS). Bračak Manor is already equipped with wood pellets boiler for heating, micro-CHP for hot water and power production, air-water heat pump system for cooling and heating in transitional periods, wall insulation on the inside and energy efficient windows and doors, efficient lighting system, HVAC system, central EMS for monitoring of heating, cooling and energy consumption, rainwater harvesting for irrigation of green areas and wastewater treatment as well as electric vehicle charging station. The already existing systems will be combined with the new ones through an advanced energy management ICT system that will be built on top of the already existing central monitoring system as decision support for the system operators instructing how to run the micro-CHP and wood pellets boiler on one-day ahead scale, in the presence of the newly introduced photovoltaic and battery system. Photovoltaic system and the battery system are connected to the billing metering point of the Bračak manor where all produced energy is primarily used for own consumption and the surplus is stored in the battery system. If the production of electricity exceed the needs of Bračak Manor and the capacity of the battery system, then the surplus is delivered to the grid. The distribution system operator, as one of the stakeholders, was informed from the beginning about the implementation of the pilot project and its task was to issue the prior electricity approval required for the connection to the distribution network. After the public procurement for the execution of works, a Turnkey Contract was signed with the company Solaris pons d.o.o. and the official introduction to the work was held on November 2, 2020. During November, all preparatory and earthworks for the construction of the canopy were carried out, and a steel structure was delivered to the construction site and the construction of the canopy began and a steel structure was delivered to the construction site and the construction of the canopy began. The colour of the canopy was determined by the conservation office. The selected colour is RAL 9017. The roof surface (Figure 3) of the canopy is used to install photovoltaic modules. The canopy has a rectangular roof surface measuring 9,44 x 6,39 meters and a total of 36 photovoltaic monocrystalline modules with a capacity of 300Wp each is installed on it. All technical details of the photovoltaic modules are listed on page 58 of the electrical installation project. It is installed 4 rows with 9 modules, which ensure that the entire roof surface is covered with photovoltaic modules. This means that the peak power of the photovoltaic system is $36 \times 300\text{Wp} = 10,8 \text{ kWp}$. Each photovoltaic module has an associated micro inverter to reduce losses from possible shading during the day. The storage (battery system) is placed in the premises of the Bračak Manor, in the basement next to the stairs. Three-phase battery system has a capacity of 8,0 kWh, together with inverters / chargers and battery management equipment. All technical details of the battery system are listed on page 65 of the installation project. Some of them are: Max. active power battery 88,5%; Max. active power charging/discharging: 96%; Discharge depth: 100%; Communication: Web interface via Ethernet, external communication via Modbus TCP; Maximum output current: 11.0 A; Nominal output current 9,1A.

Investment costs (EUR) including a break-down of main cost items

Costs categories	Costs [€]*)
Installation project	9.765,10
Execution of works	43.543,85
Construction supervision	2.642,61
Total costs (including VAT)	55.951,56

Investment location

NUTS 3	Address (Street, house number, postal code, city, country)	GPS coordinates

The pilot Bracak Manor belongs to Krapina-Zagorje County (Code HR043)

Energy Center Bračak, Bračak 4, 49210 City of Zbok, Croatia

Latitude: 46.0168986
 Longitude: 15.9315849

Duration and process of investment implementation

Start date

End date

28.10.2020.

30.09.2021.

Major milestones of investment implementation

The procurement is carried out in accordance with the Public Procurement Act (OG 120/2016) of the Republic of Croatia, internal acts of the Agency and in accordance with the Interreg CENTRAL EUROPE Program Rules, and consists of:

- Procurement for the Installation Project for the construction of a free-standing canopy with a photovoltaic power plant and battery system with integration in the central monitoring system
- Procurement for Execution of works (photovoltaic power plant + battery system + central monitoring system)
- Procurement for the Construction Supervision.

The power plant construction procurement procedures are described below:

Procurement for the Installation Project for the construction of a free-standing canopy with a photovoltaic power plant and battery system with integration in the central monitoring system

Procurement for the Installation Project for constructing a free-standing canopy with a photovoltaic power plant and battery system with integration in the central monitoring system has begun with market research. Market research was conducted following the Interreg CENTRAL EUROPE Program Rules. As part of the market research, based on the terms of reference, a request for bids was sent to five different design offices and 5 were collected. After the market research was conducted, inquiries for offers were again sent to 5 design offices, and after the evaluation, a contract was signed with the most favorable bidder - Elekrik d.o.o. Since the Law on Protection and Preservation of Cultural Heritage in Croatia prohibits any action that could directly or indirectly change the properties, shape, meaning, and appearance of cultural property and it is obligatory to protect and preserve cultural goods in their pristine and original condition, and to pass on cultural goods to future generations the installation of a photovoltaic system on the roof of a building is impossible. For that reason, it was necessary to look for other solutions to accommodate a photovoltaic system. For the execution of the pilot project Bračak, the Conservation department suggested and accepted the construction of a canopy in the parking lot next to the manor on the same cadastral plot. To achieve that, it was necessary to obtain a building permit and meet special conditions for construction. All special conditions for construction and building permits are obtained and the designers designed the pilot project according to these instructions. Also, a fire protection study was made. Due to the procedure of obtaining a building permit, and meeting special construction conditions, the entire design process took a little longer.

Procurement for Execution of works (PV system + battery system + central monitoring system)

The Procurement for Execution of works (PV + battery system + central monitoring system) has begun with market research. Market research was conducted in accordance with the Interreg CENTRAL EUROPE Program rules. As a part of the market research, based on the Installation project a request for bids was sent to 5 different companies and 4 bids were collected. After the market research was conducted, on September 24 inquiries for offers were again sent to 5 different companies, and the deadline for submission of bids was October 9, 2020. As a part of the public procurement, each bidder had to prove his ability to perform professional activities, technical and professional ability, submit a guarantee for the proper performance of the contract, fill in the tender form and attach other documents in accordance with the procurement rules. After the evaluation, a Turnkey Contract was signed with the most favorable bidder - Solaris Pons d.o.o. within the simple procurement procedure with a lowest total price of 324.401,70 HRK including VAT (EUR 43.543,85 according to the middle exchange rate of EUR 1 = HRK 7.45). The execution of works officially began on November 2, 2020. During November, all preparatory and earthworks for the construction of the canopy were carried out. and the canopy was built during December and January.

On January 27, 2021, the contractor requested an extension of the deadline due to the unfavourable epidemiological - Covid 19 situation in Europe, which makes it difficult to deliver the equipment and materials necessary to complete the pilot project. The reason is that manufacturers work with reduced capacities and under special conditions, and due to the specifics of the project, and thus the designed equipment, it is available only directly from the manufacturer, and is delivered exclusively on order, not via the warehouse. This argument was

accepted by the construction supervision, and the deadline for the execution of works has been extended to April 30, 2021.

The second extension of the deadline (until 30.06.2021) was requested due to the unfavorable epidemiological situation in Europe and around the world, and the delivery of equipment and materials necessary for the completion of works on the installation of microinverters at the photovoltaic power plant was difficult. The works on the construction of the solar power plant have been completed, the solar power plant is in operation. The works were not performed within the deadline as defined in Annex II of the contract because no technical inspection was held, that is the conditions of the Contract were for the issued permit to be considered a successful completion of the works. On that occasion, the contractor received an extension until 30.09.2021.

Procurement for the Construction Supervision

Procurement for the Construction supervision was carried out by the simple procurement procedure in accordance with the Public Procurement Act (OG 120/2016) of the Republic of Croatia, internal acts of the Agency and in accordance with the Interreg CENTRAL EUROPE Program Rules. Construction supervision was carried out in accordance with the Croatian Construction Act (OG 153/3, 20/17, 39/19, 125/19), and Law on Works and Activities of Physical Planning and Construction (OG 78/15, 118/18, 110/19). As a part of the construction supervision, the following have been contracted: Professional supervision, Design supervision and Coordinator of safety at work. For each of them, inquiries for offers were sent to 3 different companies, and contracts have been concluded with the most favourable bidder. The total cost of construction supervision is 19.687,50 HRK (EUR 2.642,61 according to the middle exchange rate of EUR 1 = HRK 7.45).

Construction officially started on 28.10.2020, while the commissioning was done on November 2, 2020. Construction works were completed on 30.06.2021. Due to the need of obtaining a building permit for the installation of the photovoltaic system, whose proceedings lasted more than two months, the start of execution of works was slightly delayed. The works on the construction of the solar power plant have been completed, the solar power plant is in operation. The works were not performed within the deadline as defined in Annex II of the contract because no technical inspection was held, that is the conditions of the Contract were for the issued permit to be considered a successful completion of the works. On that occasion, the contractor received an extension until 30.09.2021. After eliminating all deficiencies, the Administrative Department for Physical Planning, Construction and Environmental Protection, Zabok issued on 23.11.2011. decision (Use permit, CLASS: UP / I-361-05 / 21-01 / 000097, REGISTRATION NUMBER: 2140 / 01-08-5-21-0011 dated 26.10.2021) which became final.

Ownership and durability of the investment (e.g. maintenance, financing)

The owner of investment is PP8 - North-west Croatia Regional Energy Agency - REGEA . Photovoltaic power plant and battery system are in one of the offices of REGEA in the Energy Center Bračak. REGEA will be responsible for financial repairs and maintenance of the photovoltaic power plant and battery system. The work of the Agency in the premises of the Energy Center Bračak is organized as follows: professional support to Krapina-Zagorje County in joint projects, participates in educational and promotional activities, cooperates with cities and municipalities, works on international projects, takes care of the Bračak Manor building and park. REGEA also organizes various events and gatherings in the Educational and Presentation Center which is part of the Bračak Manor. Projected annual production of the power plant is 11.340,00 kWh. In combination with the battery system, all the energy produced is used for the needs of the Bračak castle. In previous years, the building consumed an average of 24,312.67 kWh of electricity, and now this consumption will be reduced by 11,340.00 kWh or 46.4%. This electricity savings will also generate savings on electricity bills for HRK 23,739,21 per year. The battery storage and photovoltaic system as low carbon energy source provides a good showcase to the local authorities which benefit in terms of improved energy efficiency and increased use of renewable energy sources and lower energy costs. Bračak pilot project will serve as an innovative good-practice example over the next years and as a model for simplified technical and economic implementation in historical urban sites and will lead to a significant increase in the proportion of renewable energy sources in historic urban centres. The long-term goal is to show innovative materials and technologies in reconstruction as a demonstrative example to other similar historical urban sites and to show that despite of the strict conservation requirements the project of this type can be realised.

References to related pilot action (output fact sheet) and relevant deliverables (e.g. pilot action report, studies) and web-links.

If applicable, additional documentation, pictures or images to be provided as annex

This output fact sheet of pilot action is closely related with Deliverable D.T2.2.5 Final report of the HUC pilot action in Bracak (CRO) [and D.T2.2.4 Mid-term report on pilot action in HR.](#)



Figure 1: Preparatory works

Source: REGEA 2020



Figure 2: Canopy construction

Source: REGEA 2021.



Figure 3: Installed photovoltaic modules
Source: REGEA 2021.



Figure 4: The storage (battery system) is placed in the premises of the Bračak Manor, in the basement next to the stairs.

Source: REGEA 2021.