# OUTPUT FACT SHEET

## Pilot actions

Version 3

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| **Project index number and acronym** | CE1344 Store4HUC |
| **Output number and title** | O.T2.1- Pilot Actions in Historical urban centres |
| **Investment number and title (if applicable)** | I.1 - Energy management of the Bracak Manor with PV and batteries integrated with existing energy systems |
| **Responsible partner (PP name and number)** | North-west Croatia Regional Energy Agency – PP8 |
| **Project website** | https://www.interreg-central.eu/Store4HUC |
| **Delivery date** | March 2022 |

**Summary description of the pilot action (including investment, if applicable) explaining its experimental nature, demonstration character and transnational added value**

Bračak Manor was reconstructed and restored in 2017 in accordance with best practices in renewing heritage on the principle of energy efficiency and today is used as central place for organisations, companies and institutions interested in the renewable energy as well as small and medium companies (SME) from other sectors. It also serves as business incubator for young companies with favourable lease of business office spaces. The manor is a protected cultural and heritage monument listed in Register of Cultural Goods of the Republic of Croatia, and it is owned by the Krapina-Zagorje County. 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. The introduced energy management system will inherit the preview project - 3Smart (UNIZGFER, PP9). 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 X 300Wp = 10,8 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. The total investment with VAT was 55.951,56 EUR. Concerning the impact of the investment, at the time of writing this report, the pilot project is just finished the execution phase so the exact impact of the investment on energy and overall costs will be known after the few months of operation. 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. 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 exceeds 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. The battery storage and photovoltaic system as low carbon energy source will provide a good showcase to the local authorities which can benefit in terms of improved energy efficiency and increased use of renewable energy sources and lower energy costs. Bračak pilot project should serve as an innovative good-practice example over the next years and as a model for simplified technical and economic implementation in cultural heritage and may lead as lighthouse pilot to a significant increase in the proportion of renewable energy sources in historic urban centres in Krapina-Zagorje county. The long-term goal is to show innovative materials and technology in reconstruction as a demonstrative example for other similar examples of cultural heritage and show that despite of strict conservation requirements a project of this type is possible.

## NUTS region(s) concerned by the pilot action (relevant NUTS level)

NUTS regions concerning the pilot action is Croatia. The pilot Bracak Manor belongs to Krapina-Zagorje County (Code HR043).

## Investment costs (EUR), if applicable

| 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 |

## Expected impact and benefits of the pilot action for the concerned territory and target groups and leverage of additional funds (if applicable)

Bračak Manor has already been known as a place and an example of how to renovate a building under cultural heritage according to the highest standards of energy efficiency with the use of renewable energy. With the implementation of this pilot project, Bracak Manor (Energy Centre Bračak) will be even more positioned on the map of excellence in energy efficiency. Energy management of the versatile energy systems in the Bračak Manor including heating, cooling, energy production and storage will allow to investigate what are the economically and ecologically most favorable technology mixes on historical sites. Target groups will thus benefit from future renovations of historical urban sites because they will have the best example of which technology is most cost-effective. Also, stakeholders representing decision makers at all levels in the implementation of renewable energy sources in historical urban sites in the Krapina-Zagorje county will gain additional experience and knowledge that will allow all processes to be shorter in the future when implementing similar projects.
Mutual learning sessions of Store4HUC provided benefit to the participating audiences among the consortium via project meetings and stakeholders via deployment desk meetings. In Bračak the implementation measures have already started and are nearly finished. The transnational cooperation within Store4HUC allows to get higher visibility at regional, national, and European level.

## Sustainability of the pilot action results and transferability to other territories and stakeholders

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. At the Deployment desk meetings outputs and knowledge has already been transferred to stakeholders, who represent decision-makers at all levels in the implementation of renewable energy sources in historical urban sites in the Krapina-Zagorje county. Most stakeholders also participate in the process of issuing permits for the installation of storage systems and photovoltaic systems in the county, and this is the first of such projects in this part of Croatia. Given that this is the first pilot in this part of Croatia, stakeholders intend to gain the necessary experience and knowledge. This will allow all processes to be shorter in the future when implementing similar projects. As Krapina-Zagorje County is rich in cultural heritage that needs to be restored and put into operation, this pilot project can pave the way for the restoration of such cultural and historical sites.

**If applicable, contribution to/ compliance with:**

- **relevant regulatory requirements**
- **sustainable development - environmental effects. In case of risk of negative effects, mitigation measures introduced**
- **horizontal principles such as equal opportunities and non-descrimination**

Energy storages, and photovoltaic systems as well as the smart building management systems are important for the development of a sustainable energy system in HUCs and these systems play an important role in Energy transition. The biggest obstacle to the improvement and greater use of renewable energy sources and energy storages in buildings under cultural heritage is the insufficiently adapted legal framework to new technologies. Croatian Law on the Protection and Preservation of Cultural Property prohibits any action that could directly or indirectly change the properties, like the shape, the meaning, and the 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. Therefore, the installation of a photovoltaic system on the roof of a building is impossible and for that reason, it was necessary to look for other solutions to accommodate a photovoltaic system. Given the technologies available today, the legal framework needs to be adapted to simplify the procedures for installing energy storages and photovoltaic systems on historical urban sites. In Croatia, this would enable further integral renovation of buildings that are under cultural heritage, which would be adapted to modern requirements and needs. Historical urban sites would thus be modernised and would stop lagging in time. In this way, historical urban sites would become more comfortable to live in, and their market value would increase.

**References to relevant deliverables (e.g. pilot action report, studies), investment factsheet 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.