INVESTMENT FACT SHEET

I.2 - Sloping elevator in Cuneo

Version 2

Project index number and acronym	CE 1344- Store4HUC
Responsible partner (PP name and number)	City of Cuneo – PP07
Linked to pilot action (number and title)	A.I2.1 - Sloping elevator in Cuneo
Project website	https://www.interreg-central.eu/Content.Node/Store4HUC.html
Delivery date	09.2021

Description and technical characteristics of the investment

The energy efficiency project for the sloping elevator of the City of Cuneo is part of the pilot actions of the Store4HUC project and represents the Italian pilot intervention.

The project is a case study on the installation of an energy storage system connected to a photovoltaic array on a means of public transport. The innovating aspect of this energy efficiency action lies in the fact that the battery storage system will allow the reuse of the energy produced by the system itself during operation, which in turn will be integrated with the energy produced by a photovoltaic array, thanks to an on-site exchange of the energy that is not consumed or stored in the battery.

The energy efficiency works for the sloping elevator included:

- A newly built underground technical room, located next to the existing uphill station and designed to house all electrical equipment necessary for the operation of the energy storage system;
- A photovoltaic field with a peak power of about 8 kWp, consisting of 26 monocrystalline silicon modules placed on metal frames along the runway of the elevator, near the retaining wall of the installation;
- A lithium-iron-phosphate battery storage system combined with a three-phase inverter that allows the exchange of energy between the photovoltaic field, the national grid and the plant, which in turn self-produces energy during its operation;
- The integration of the new electrical equipment into the existing system and its interconnection to the grid.

The specific storage unit, consisting of a battery pack with electronic control equipment, has been installed to store the electrical power produced by the sloping elevator and photovoltaic field, and to make it available to the elevator system drive when necessary. Since it must be able to supply alternating currently available solar electricity, the storage unit is equipped with an inverter for DC to AC conversion. This type of device for energy storage is a “hybrid inverter”.

The size of the storage installed within the pilot project intervention - consisting of the inverter and its battery packs - was reduced to enable the installation in a small room. The sloping elevator energy efficiency project uses a hybrid inverter with multiple inputs to manage charging operations of both the PV field and the grid, and from the same power supply of the sloping elevator drive, when working in power generation mode.

The battery pack is made of long-life Lithium-Iron-Phosphate batteries composed of 7 modules with a capacity of 2.76 kWh/53 Ah and in total of 19.32 kWh.

The storage unit has been connected to the inverter on the production side while charging/discharging is managed by the control software of the converter (inverter). The storage system is intended to optimize direct self-consumption by storing the amount of the energy produced that would otherwise be fed into the grid for later use to limit the peaks of absorption and/or feed the load when the photovoltaic system is not operating. The storage system accumulates also the energy produced by the elevator when operating with unbalanced cabin and counterweight loads.

The inverter converts the direct current generated by the solar modules into alternating current which is supplied - in synch with the mains voltage - into the public electricity grid. Solar energy can be stored in the battery for future use.

The inverter automatically monitors the public electricity grid. In the event of abnormal behavior of the grid, the inverter immediately ceases to operate and interrupts the power supply to the electricity grid (e.g. grid failures, etc.). The inverter operates automatically to track the maximum possible power from the solar modules.

Depending on the operating point, the power generated by the photovoltaic system is either used for the elevator system utilized or stored in a battery and/or, if the storage units are fully charged and not operating, fed into the grid.
As soon as the energy provided by the solar modules becomes insufficient, the elevator uses power from the battery. Power can be drawn from the public grid to charge the battery, or the self-produced energy from the elevator system can be stored.

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

Costs categories	Costs
Works	70.113,66 €
Safety measures	1.461,88 €
Sum available for unexpected events	2.512,18 €
Project planning	8.881,60€
Tender	972,83 €
Analysis and testing procedures	2.213,08 €
VAT on works (10%)	7.157,55 €
TOTAL	**93.312,78 €**

Investment location

NUTS 3	Address (Street, house number, postal code, city, country)	GPS coordinates
ITC - Northwest Italy ITC1 – Piemonte ITC16 - Cuneo	Corso Guglielmo Marconi, 8, 12100 Cuneo CN, Italy	44.38760, 7.55075

Duration and process of investment implementation

Start date	End date
02.2020	11.2021

Major milestones of investment implementation

The major milestones of the investment specification have been:

- The start of the tender procedure for the project planning (February 2020)
- The phases of project planning, definitive and executive project, delivered in October 2020
- The first tender procedure for works, started in December 2020 and with a negative outcome, because no offers were sent
- The second tender procedure for works, started in February 2021, ended in April 2021 with the final awarding of works to the company
- The execution of works, started in May 2021 and ended in September 2021
- The bureaucratic procedures for the connection of the PV plant to the electric system, started in July 2021 and ended in October 2021
- The final testing of the structural parts of the intervention, done in November 2021
- The testing phase of the intervention, lasting from mid-October to mid-November 2021

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

The ownership of the intervention is appointed to the City of Cuneo, as the whole system of the sloping elevator. The maintenance of the system was already a task of the City of Cuneo that externalizes it to a public transport company. The economic support of the whole system, the new intervention included, is a service offered to the citizens by the Municipality of Cuneo.

The investment is forecasted to last at least 20 years, which is the average life-time of the different components of the system, such as the PV modules and the battery storage. It is not likely that the sloping elevator will fall into disuse because it is currently a very highly used means of transport and in the last years have proved to be increasingly used by the citizens. More services will be offered on that side of the city, therefore even in case of ageing of the components of the new intervention, it is very likely that they will be replaced with new ones instead of being abandoned, also in the view of a more sustainable city, as Cuneo is striving to become.

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

The investment has been part of the Cuneo pilot action on the sloping elevator, as one of the four pilot actions implemented within Store4HUC. The intervention, being peculiar for its nature as an intervention of energy efficiency on a free public transport, represents a case study within the whole partnership and also a unique case for Italy, too. Its implementation will thus serve the objective of the project of demonstrating the feasibility of storages integration in HUCs, as explained in the several documents related to the pilot action itself, such as the Pre-Investment Specification (DT.2.1.2, available here), the Mid-term Report (D.T.2.2.2, available here) and the Final report (D.T2.2.3). Not only, on a partnership level, the intervention and the pilot action will be used to prepare both the Transnational Evaluation Report (D.T2.3.3) and the Transnational strategy for the implementation and capitalization of energy storages in HUCs (D.T2.3.4).

Finally, the pilot action and its intervention have been used for the testing of the Module 1 of the EMS Tool and for the Autarky Rate Tool, giving additional information to the developers of the two tools for their amelioration and improvement (see D.T3.2.4, available here).

For additional information, see the pilot action video and intervention implementation video on the Youtube channel of the project.