LIFE SustainHuts

THIS IS A SUSTAINABLE HUT

LIFE15 CCA/ES/000058

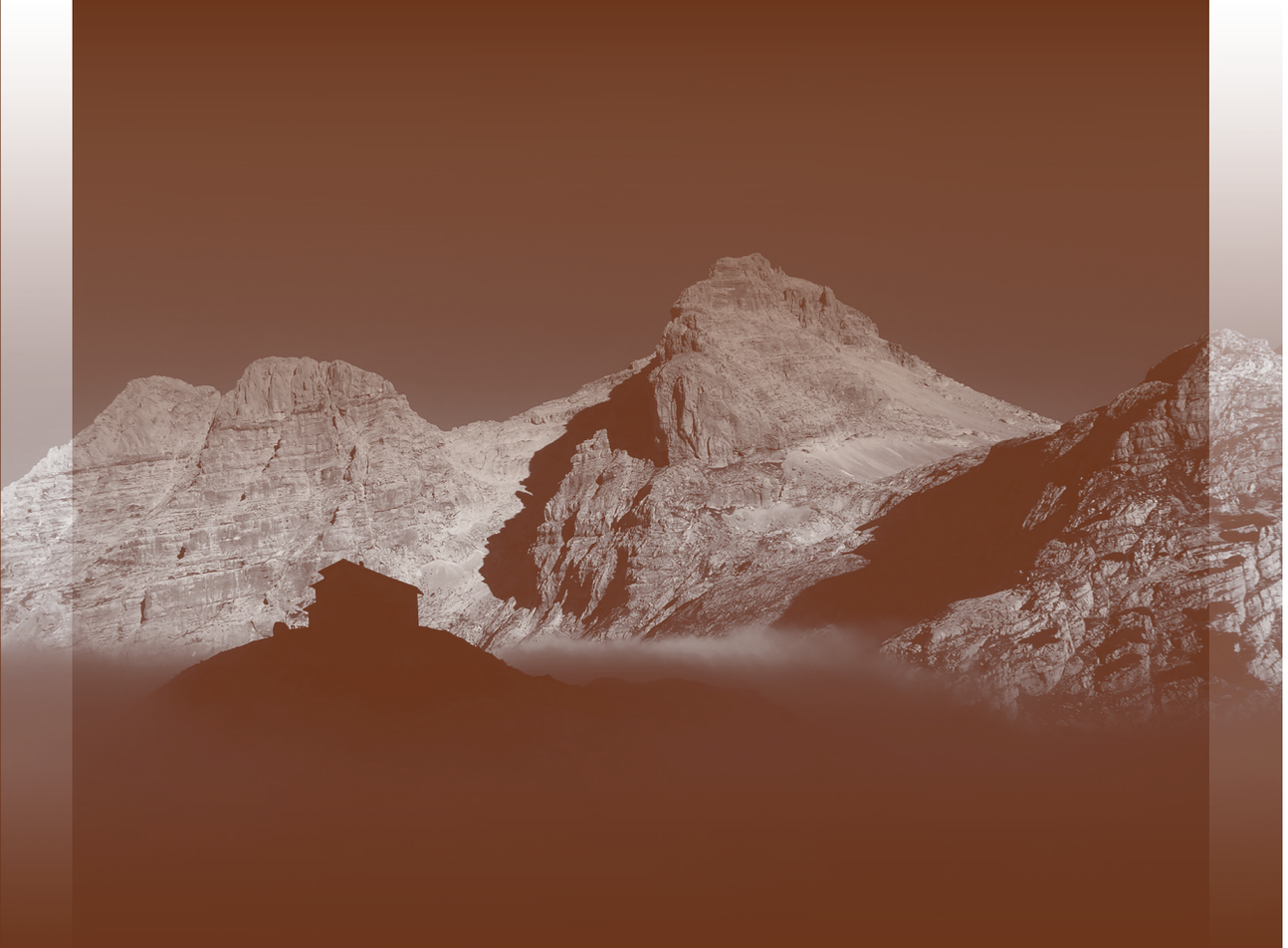
The LIFE SustainHuts project is financed by the EU LIFE Funding programme

SustainHuts

Life

Welcome to the

LIFE SustainHuts



POGAČNIKOV, JULIJSKE ALPE

Project Promoter and Coordinator

FUNDACIÓN HIDRÓGENO ARAGÓN
FOUNDATION FOR THE
DEVELOPMENT OF NEW HYDROGEN
TECHNOLOGIES IN ARAGÓN

Partners

SPAIN
FAM - ARAGONESE MOUNTAINEERING FEDERATION (FAM)

ITALY
CAI - ITALIAN ALPINE CLUB
ENVIRONMENT PARK - SCIENTIFIC AND TECHNOLOGICAL PARK

SLOVENIA
PZS - ALPINE ASSOCIATION OF SLOVENIA
RCVT - DEVELOPMENT CENTRE FOR HYDROGEN TECHNOLOGIES
UNIVERSITY OF LJUBLJANA

FRANCE
FFCAM - FRENCH FEDERATION OF ALPINE AND MOUNTAIN CLUBS

Total budget allocated for the project

1,974,285€

European Union's contribution through the LIFE Programme

1,116,543€

Project duration

JULY 2016 - OCTOBER 2021

The general objective of **LIFE** *is centred on contributing to the implementation, update and development of EU environmental and climate policies and legislation by co-financing a range of projects with European added value.*

About the

LIFE SustainHuts

This is a demonstrative project aimed at making high mountain huts more sustainable, with CO_2 emissions close to zero. **Unique and innovative solutions based on renewable energies are implemented in mountain huts, as well as actions geared to energy and efficiency optimization**. Thus, Local Authorities will have at their disposal several demonstration sites under real conditions. These will facilitate the setup and adoption of action plans to cut down emissions when building structures similar to mountain huts, -such as hotels in natural parks or other locations where environment is key, or in other tourist areas found in remote or isolated regions (*e.g. on islands*).

For a start, the technology to be used will be selected based on the generation of renewable energy (*photovoltaic, solar thermal, micro wind, hydro, pellet and wood stove generated energy*), the upgrading of current equipment (*water bearing stoves*), energy optimization (*automation, electrification, waste water treatment and water reclaim plants, innovative insulation*) as well as the use of cutting-edge seasonal storage systems of renewable energy using hydrogen.

All these technologies are to be installed in different mountain huts for demonstration, display and educational purposes on climate change adaptation.

The project's goal is to achieve an improvement of 20% in energy efficiency, a reduction in CO_2, polluting emissions by 10 tons per year per hut on average; a decrease in emissions by 0.06 tons per year per hut, as well as cutting down on the number of helicopter flights for fuel delivery, with estimated savings of 1.5 tons per year of kerosene fuel for all facilities, an amount equalling the fuel spent on 15 helicopter delivery flights. The **European Union** is implementing major measures to significantly reduce its greenhouse gas (GHG) emissions, and from this goal stems the policies. **LIFE** programme - the EU's instrument for financing environmental and climate action policies-.

Spain

What technologies make these huts sustainables?

LIZARA

ADVANCED AUTOMATION AND EFFICIENCY

Automation for the optimisation of battery charging and generator start-up management.

PHOTOVOLTAIC

Renovation of part of the existing photovoltaic system and expansion of the installed peak power.

THERMO-CHIMNEY

High efficiency chimney installation that allows heat recovery from wood combustion.

BACHIMAÑA

ELECTRIFICATION

Replacement of diesel boilers with electric heaters so that renewable electricity is harnessed in periods of surplus.

INSULATION AND ENERGY EFFICIENCY

Application of thermoprotective paint on the interior walls of rooms to avoid damp and improve thermal insulation.

H_2 STORAGE

Seasonal renewable energy storage using hydrogen.

MONTFALCÓ

PHOTOVOLTAIC

Renovation of part of the existing photovoltaic system, and expansion of the installed peak power.

ADVANCED AUTOMATION AND EFFICIENCY

Modification of the water supply installation, replacing the existing water pump with a more efficient one, and optimising its operation.

CAP DE LLAUSET

PHOTOVOLTAIC

Expansion of the installed peak power of photovoltaic panels by using the entire available roof area.

PELLET STOVE

Installation a biomass stove for heating, improving thermal efficiency.

INSULATION AND ENERGY EFFICIENCY

Installation of innovative and environmentally friendly insulation in the battery room to condition the temperature of the batteries and extend their service life.

ESTÓS

ADVANCED AUTOMATION AND EFFICIENCY

Exploitation of the surplus of the hydraulic turbine for battery charging.

PHOTOVOLTAIC

Renovation of part of the existing photovoltaic system, and expansion of the installed peak power.

PELLET STOVE

Installation of a biomass (*pellet*) stove for heating, improving the efficiency of thermal energy use.

INSULATION AND ENERGY EFFICIENCY

Installation of innovative and ecological insulation in several areas of the hut (*ground floor, stairs, rooms*) to improve the efficiency of the heating system.

GÓRIZ

PHOTOVOLTAIC

Extension of the photovoltaic installation of the hut, as well as the renovation of the existing battery bank.

Slovenia

KOCBEKOV

PHOTOVOLTAIC

Installation of a photovoltaic system consisting of photovoltaic panels and a lead-acid battery bank.

POGAČNIKOV

PHOTOVOLTAIC

Installation of a complete photovoltaic system consisting of photovoltaic panels and a bank of LiFePO4 batteries.

MICRO-WIND

Installation of a micro wind turbine to support the photovoltaic system for battery charging.

VALENTINA STANIČA

PHOTOVOLTAIC

Installation of a complete PV system consisting of photovoltaic panels, a lead-acid (*gel*) battery bank, and the control and energy management systems.

MICRO-WIND

Installation of a micro wind turbine to support the photovoltaic system for battery charging.

France

DENT PARRACHÉE

PHOTOVOLTAIC

Renovation of part of the existing PV installation, and extension of the installed peak power.

HYDRO TURBINE

Installation of a low-power hydraulic turbine to exploit a stream of water

WOOD STOVE

Installation of two wood stoves with air recirculation.

SOLAR THERMAL PANELS

Installation of solar thermal panels for heating and HSW

INSULATION

Several actions to improve thermal insulation in various rooms of the facility.

WATER TREATMENT PLANT

Connection of the hut to the water discharge network.

Italy

TORINO

PHOTOVOLTAIC

Installation of a photovoltaic array suitable for extreme climates.

WATER TREATMENT PLANT

Installation of 2 plants, one to collect water from the environment, and another one to reuse water and reduce the need for external water supply to the hut.

AVANCED AUTOMATION AND EFFICIENCY · WOOD STOVE · MICRO-WIND · HYDRO TURBINE · WATER TREATMENT PLANT · PELLET STOVE · ELECTRIFICATIOIN · INSULATION AND ENERGY EFFICIENCY · H_2 STORAGE · PHOTOVOLTAIC · THERMO-CHIMNEY · SOLAR THERMAL PANELS

LIFE SustainHuts

A journey to our mountains

DENT PARRACHÉE *2520 m*

TORINO *3375 m*

ESTÓS *1890 m*

POGAČNIKOV *2050 m*

BACHIMAÑA *2200 m*

KOCBEKOV *1808 m*

LIZARA *1540 m*

VALENTINA STANIČA *2332 m*

GÓRIZ *2200 m*

CAP DE LLAUSET *2425 m*

MONTFALCÓ *790 m*

Objectives

01

Design and simulation of renewable energy facilities, considering a range of diverse off-grid mountain environments.

02

Creation of a campaign for the assessment of resources, adapted to the extreme conditions of the mountain environment.

03

Extrapolation of the results to other mountain areas -by means of the development of guidelines allowing their reproducibility-, as well as to other off-grid installations.

04

Life cycle assessment analysis to determine the environmental impact of the new technologies applied in comparison with the current ones in use.

05

Continued exploitation of results and visibility of the project through the rollout of an After **LIFE** plan.

06

Generation of significant impact both at domestic and international levels.

07

Selection and installation of cutting edge insulating materials.

08

Design of a seasonal fully renewable hydrogen energy storage cycle, including: renewable hydrogen generation through water electrolysis, pressurized storage and hydrogen re-electrification for self-consumption in the hut.

09

Decrease in the overreliance on fossil fuels (*diesel and propane gas*), as these fuels are the usual energy sources found in these facilities.

10

Implementation and demonstration tasks in 11 mountain huts, at different altitudes, ranging from 800 metres high to over 3000 metres.

LIFE SustainHuts

Results

A methodology has been developed to assess the implementation of different renewable technologies and efficiency improvements in off-grid micro-grids, adapted to various countries and hut characteristics.

An insulation made from recycled sheep's wool has been identified, with excellent thermal and acoustic properties, which has been implemented in two applications: improving insulation in the living area, and in the cabin where there are batteries associated with photovoltaic generation.

A prototype seasonal energy storage system based on H_2 has been installed in Bachimaña (*Spain*). It has been able to store excess renewable energy for more than 8 months in the form of compressed H_2, which has been re-electrified to power the hut's micro-grid.

This system will be used mainly as an extended backup for the hut's battery system when the hydraulic turbine that supplies the hut is inoperative due to breakdown or maintenance.

The environmental impact achieved in the project through both the renovation or new installation of renewables, as well as through efficiency improvements is reflected in the following figures:

144 MWh
TOTAL CUMULATIVE RENEWABLE PRODUCTION BETWEEN ALL INSTALLED TECHNOLOGIES

29,400 litres
TOTAL AMOUNT OF DIESEL NOT CONSUMED

9,207 kg
TOTAL AMOUNT OF NATURAL GAS NOT CONSUMED

4,200 litres
TOTAL AMOUNT OF PROPANE GAS NOT CONSUMED

145 tonnes
TOTAL CUMULATIVE CO_2 EMISSIONS AVOIDED BETWEEN ALL HUTS

7.2 tonnes per year per hut
AVERAGE AVOIDED EMISSIONS

14 flights per year
NUMBER OF HELICOPTER TRIPS AVOIDED BETWEEN ALL HUTS

0.28 tonnes per year
CO_2 EMISSIONS AVOIDED BY REDUCING THE NUMBER OF HELICOPTER TRIPS

It has covered a wide range of installation typologies:

- ✓ HUTS OPEN **ALL YEAR ROUND**, OPEN ONLY DURING THE **SUMMER** MONTHS, OR CLOSED FOR A FEW MONTHS IN **WINTER**.
- ✓ **8** OF THE PROJECT'S HUTS ARE ONLY ACCESSIBLE ON FOOT, **2** OF THEM ARE ACCESSIBLE BY ROAD AND **1** OF THEM BY CABLEWAY
- ✓ THE ALTITUDE RANGES FROM **800 M** (MONTFALCÓ, ES) TO **3300 M** (RIFUGIO DI TORINO, IT)
- ✓ THE NUMBER OF VISITORS AND GUESTS IS VERY DIVERSE AMONG THE DIFFERENT HUTS.
- ✓ THERE IS A GREAT DIVERSITY IN BASELINE EMISSIONS, RANGING FOR EXAMPLE FROM FACILITIES EMITTING LESS THAN **2 TM/YEAR** OF CO_2 (SLOVENIAN HUTS) TO THOSE EMITTING CLOSE TO **100 TM/YEAR** OF CO_2 (ITALIAN HUT).

Sensitization and awarness-raising;

the perfect tandem for the dissemination of LIFE SustainHuts

The dissemination of the project is to be done by means of **a comprehensive 360º communication plan**, in order to reach out to users through a range of channels: **social networks, the web, newsletters, written press and digital media.**

On the one hand, special focus has been placed on outlook and awareness raising in order to disseminate the objectives and results of the project, as well as its underlying values supported and promoted by the **LIFE** program.

On the other hand, the dissemination of the project has also been aimed at raising awareness within the civil society, making it memorable while emphasizing the importance of using renewable energies to support sustainability and the preservation of our mountains.

These aspects were disseminated during the execution of the project in **4 working seminars** that allowed to show the progress and results: **Turin, Benasque, Ljubliana** and the last **on-line** at the end of the project. And additionally in **10 publications and articles** in specialised journals, and in more than **30 attendances to different congresses and events**.

TRIP TO THE IBONES DE BACHIMAÑA SUSTAINHUT WITH INFLUENCERS IN THE FIELD OF DISSEMINATION: ODILE RODRÍGUEZ DE LA FUENTE, RUBEN LIJO FROM THE YOUTUBE CHANNEL “SÍGUEME LA CORRIENTE” AND IGNACIO CRESPO FROM THE YOUTUBE CHANNEL S DE STENDHAL.

Lessons learned

For existing facilities, it is recommended **to understand in detail the energy management done by the hut keepers**, and customs and habits of the users.

The most immediate actions should be aimed at **assessing energy efficiency improvements** (*insulation, more efficient equipments, etc*).

Although there are no generic solutions, **the most robust and economical recommendation is to hybridise PV and wind**, with appropriate battery sizing.

Hydrogen is an excellent means of seasonal renewable energy storage, suitable for installations where there is an excess of energy at certain times of the year, and a shortage at others.

Difficult access (*via helicopter*) **makes full life-cycle planning of the technologies a vital component** to ensure successful installation and operation, both in terms of timing and economics. Installation must be carried out by competent personnel who are accustomed to this type of installation.

A thorough analysis of the required permits and the environmental classification of the area where the shelter is located **is essential for realistic planning** of the sustainable actions.

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PROF. DR. MITJA MORI RECEIVING 23. ENERGY DAYS, ENERGY AWARDS OF THE FINANCE NEWSPAPER

Project Promoter and Coordinator

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Partners

FEDERACIÓN ARAGONESA DE MONTAÑISMO

Univerza v Ljubljani
Fakulteta za strojništvo

fédération française des clubs alpins et de montagne

Razvojni center za vodikove tehnologije

PLANINSKA ZVEZA SLOVENIJE

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