

SUSTAINABLE BUILDING AND RENOVATION IN EUROPEAN MOUNTAIN AREAS

BACKGROUND Worldwide, the construction, use and renovation of houses accounts for about half the energy consumption. In Europe, heating rooms and water accounts for most of the energy used in housing. Fuel and gas are the most frequently used energy sources. Therefore construction and renovation have a

large energy reduction potential. But for many municipalities the transition to a new sustainable and energy-efficient way of building is a major challenge. With the MountEE project – sustainable public buildings, three European mountain areas show how it works.



PILOT 12 - AVIANO MUNICIPALITY

WHAT

The building used as “Health district” has been built on a sloping lot; it hosts facilities originally located in an old building with unbearable energy costs. It is a building on two levels with independent access from different public areas and with internal connections (stairs and a lift); thanks to a central entrance hall and some longitudinal corridors, there is a functional distribution on both levels. It has a garden and a flat roof used as a green roof.

FACTS

TYPE OF BUILDING (USE) // Clinics and offices with service rooms

YEAR // Raised floor: August 2013. Other parts are under completion.

SIZE // gross volume (rooms in use) = 2123,1 cu.m corresponding to a usable area of 495,7 sq.m

INVESTMENT // total amount of about € 1.227.000,00

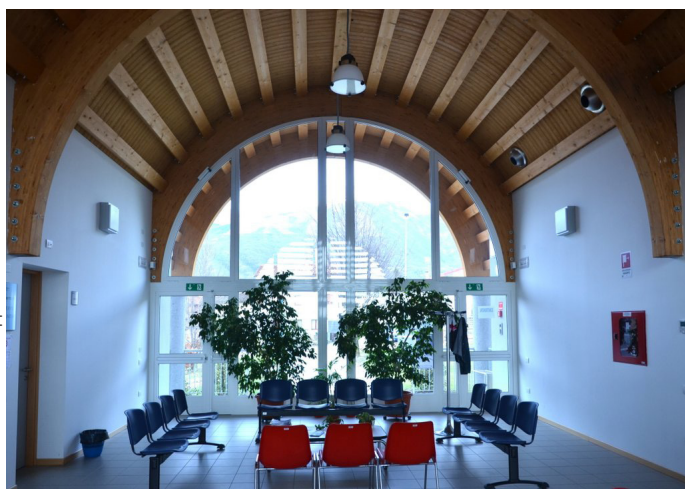
ENERGY DEMAND // EPgl expected for usable rooms = 17,9 kWh/cu.m a year

RENEWABLE ENERGY // Solar heating for ACS (2 modules) and photovoltaic system (rated output 5,04 kW)

VENTILATION SYSTEM // Mechanical ventilation system with heat recovery unit

AIR TIGHTNESS // Air tightness has not been taken into account.

BUILDING MATERIAL // Building structure: reinforced concrete; Insulations: EPS; frames: aluminium and PVC



HOW

The following modules of Mountee advice service have been tested:

Module 5 A: Real energy consumptions control – comparison with those expected during the planning process and with those expected in relation to the non-completion of the building; identification of the deviations and their causes; definition of actions and improvements.

Module 5 C: guidelines for writing a "Building Handbook" containing maintenance and corrective measures with reference to users' behaviour.

LESSONS LEARNED

It is not sufficient to establish a certain level of energy performance. Performance must be verified during their use; possible corrections or changes would be introduced if facts were different from expectations due to variations caused by users' behaviour. To this end, the installation of the necessary measuring instruments must be provided; it is important to pay attention to communication/ information factors towards managers and users. The efficiency of the system must be assured by the setting of a proper maintenance programme planned with the manager.



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PILOT 8 - CAVASSO MUNICIPALITY

WHAT

The intervention is aimed at the functional reconstruction of the existing Nursing Home in Cavasso Nuovo. It focuses on two main points: 1) the reorganization of the existing building: functional reorganization of the rooms, of the living areas and of the activity areas; 2) the creation of a new building in order to relieve the pressure on the present building and to realize a new Alzheimer nucleus: some beds that today are located in areas not easily accessible would be reallocated there and a new storage area easily accessible to means of transport would be created.

FACTS

TYPE OF BUILDING (USE) // NURSING HOME

YEAR // Final project 2013 – pending award of contract

SIZE // area of the new building in extension 2.350 sq.m.

INVESTMENT // total amount of about € 4.500.000 financed by FVG Region

ENERGY DEMAND // EPgl = 26 kWh/cu.m a year

RENEWABLE ENERGY // photovoltaic system of 15,34 Kwp

VENTILATION SYSTEM // cmv with pretreatment and high efficiency heat recovery

AIR TIGHTNESS // air barrier in the building infill walls

BUILDING MATERIAL // the building is made of reinforced concrete, bricks, EPS and natural fiber insulation



HOW

The following modules of Mountee advice service have been tested:

Module 1: Technical support during the drafting of tender documents and definition of the objectives to reach with the executive project: introduction of new rules in the tender notice in order to identify award criteria for offers that are similar to Mountee criteria; Module 2 – Support the tender selection procedure: to provide advice to the contracting authority during the offers selection. The offers will be evaluated using the method of the most economically advantageous tender.

LESSONS LEARNED

Necessity of verifying the entire transformation process through the verification of consistency during the different stages, in relation to defined choices and objectives. It is not sufficient to determine a level of energy performance; performance must be verified during its use, by introducing corrective measures or changes if data differ from expectations because of factors variations due to users' behaviour. To this end, necessary measuring instruments installation must be considered by paying attention to communication/ information factors towards managers and users.



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PILOT I - CIVIDALE MUNICIPALITY

WHAT

The Municipality bought a building forming part of a sports complex. The renovation is expected in order to define rooms and areas to commit to local associations involved in sports and cultural - recreational activities. The intervention must meet the criteria established in the MountEE project, with regard to the energy efficiency and the ecological optimization of materials. The overall quality levels (comfort factors) and the environmental levels of the intervention will be evaluated through the VEA Protocol and further criteria of the ITACA Protocol.

FACTS

TYPE OF BUILDING (USE) // Building used as seat or activity center of the local Associations

YEAR // Existing building (from 2000) in planning stage for renovation

SIZE // area of the building 1250 sq.m. total volume 5640 cu.m.

INVESTMENT // total amount of about € 1.600.000

ENERGY DEMAND // Primary energy estimated equal to 9,20 kWh/cu.m a year

RENEWABLE ENERGY // solar collectors for HDW and photovoltaic system of 50 Kwp

VENTILATION SYSTEM // cmv with heat recovery

AIR TIGHTNESS // air barrier in the interior building infill walls

BUILDING MATERIAL // the building is made of reinforced concrete, bricks, thermal acoustic insulations and other materials



HOW

The following modules of Mountee advice service have been tested:

Module 0: Green Energy Audit of the building for the renovation in relation to different standard values in order to define the fundamental objectives for the project and for the intervention, by guarantying high levels of comfort both in winter and in summer. Module 1: technical support for writing documents and evaluations during the tender notice. Guidelines for privileging the sustainability and for verifying the contribution of possible improvements and the ecological optimization of materials.

LESSONS LEARNED

The renovation process structured with a complete and articulated sequence of activities that are important for controlling the relations among the stages of the decisional process, the plan, the execution and the monitoring is the main objective. The following levels of communicability and information are important:

- Users that should operate by sharing principles and assumptions of efficiency to achieve the objectives;
- The community that could deal with the project and share the objectives, the procedures adopted and the evidence of "data and effects".



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PILOT 5 - COMEGLIANS MUNICIPALITY

WHAT

The objectives expected by the project can be summarized as follows: to bring the heating system up to modern standards in order to improve the energy efficiency. In particular, the Municipality Administration wants to divide the central heating system according to the current users (Town Hall: 2 accommodations, municipality offices, bar "L'Alpina". Clinic building: pharmacy, practice, private offices and municipality offices.) by placing a Calorie Counter System in order to distribute energy costs and to create energy costs savings. Mountee Criteria Ares related to the partial renovations have been used, by applying Module 5A.

FACTS

TYPE OF BUILDING (USE) // Public building seat of the Comeglians Municipality offices

YEAR // 2013- 2014 (renovation)

SIZE // 1180,60 sq.m. and 4964,70 cu.m. for both the buildings

INVESTMENT // 197724,07 € for the partial renovation

ENERGY DEMAND // EPI 59,93 + EPacs 12,85 = 72,78 kWh/cu.m. a year

RENEWABLE ENERGY // not used

VENTILATION SYSTEM // absent, natural ventilation

AIR TIGHTNESS // Not the object of the monitoring

BUILDING MATERIAL // Building in reinforced concrete, exterior walls in bricks and attics in hollow- core concrete



Photo © MountEE Gruppo 2



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HOW

The typical approach to an energy Audit has been implemented with the environmental aspects. The elaboration of a new energy model has been executed through the verification of the building envelope and of the systems in order to prevent the real consumption verification with the project previsions. In the EPC (Energy Performance Certificate) there are some energy consumption indicators; these values feel the effects of the evaluation method called "Standard" as reported in the UNI TS 11300 standard. .

LESSONS LEARNED

The energy Audit executed on the building allowed to make precise evaluations in order to improve the global performance thanks to the creation of working teams with different professional skills; it also contributed to further develop the ability of working as part of a team. It is very important, once decided the building uses, that the maintenance technician/manager of the systems intervene to calibrate the plant systems. .



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PILOT 13 - FORNI DI SOTTO MUNICIPALITY

WHAT

The building is located on an area where there was already another building; at the beginning the old building was considered suitable for renovation. However, after having verified its structural adequacy in relation to the seismic suitability, it has been judged economically advantageous to destroy and rebuild a new building. The building has been evaluated and verified, especially its geothermal system.

FACTS

TYPE OF BUILDING (USE) // Building used as a Day center for the elderly

YEAR // 31/12/2011 – the certificate of regular execution is pending

SIZE // area about 550 sq.m. – volume about 2700 cu.m.

INVESTMENT // The total amount of the contract is €1.368.610,00

ENERGY DEMAND // $EPI 59,93 + EP_{acs} 12,85 = 72,78$ kWh/cu.m. a year

RENEWABLE ENERGY // photovoltaic panels

VENTILATION SYSTEM // There is a ventilation system

AIR TIGHTNESS // It is not subject to monitoring

BUILDING MATERIAL // Building in reinforced concrete, exterior walls in bricks and attics in hollow-core concrete.



HOW

The test focused on the elaboration of an instrument in order to verify and validate the project. A list of the verifications has been created for a first analysis of the building envelope's elements and of the systems but also for a precise future verification of the building.

Moreover, some simplified indications have been elaborated in order to consent an evaluation of the efficiency of possible instrumental trials, which would be necessary in order to complete the energy testing operations..

LESSONS LEARNED

The verification of the planning choices even without the real use of the building demonstrated once again that it is necessary to implement post-execution verification systems. These verifications would allow to monitor the consumptions and a correct management of the building systems.

It is very important, once stabilized the building uses, that the maintenance technician/ manager of the systems could intervene in order to adapt the system to the building and to calibrate it to the users.



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PILOT 10 - MOGGIO MUNICIPALITY

WHAT

The objective consists in renovating different parties of the building envelope, even in bad condition, by reducing causes of degradation and by monitoring temperature in attics; MountEE criteria Ares concerning partial renovations are therefore taken into consideration. Modules 0 (Green Energy Audit of the building) and 1 (advice for the preparation of the invitation to tender) of advice service have been applied: in the last one, environmental sustainability features for building materials to be used have been considered.

FACTS

TYPE OF BUILDING (USE) // Headquarters of Forestry department in Moggio Udinese (UD)

YEAR // Creation 1985. Heat generator replacement 2011

SIZE // Area: about 470 sq.m – volume: about 1875 cu.m

INVESTMENT // Not yet defined

ENERGY DEMAND // EPI 118,05 + EPacs 32,03 = Total 150,08 kWh/cu.m. a year

RENEWABLE ENERGY // Precise biomass power generator systems (wood)

VENTILATION SYSTEM // absent, natural ventilation

AIR TIGHTNESS // Not subject to monitoring and /or evaluation

BUILDING MATERIAL // Building with reinforced concrete partitions, hollow-core concrete attics.



HOW

Energy audit allowed to identify specific interventions on the envelope which allow to improve the overall energy performance. The presence of meters dedicated to single consumption allow a partial control of the central system consumptions: monitoring concerning wood stoves in single areas is more complex. The implementation of MountEE Criteria ARES and of certain criteria of UNI/PdR 13:2015 standard, concerning interventions identified in the evaluation procedure of technical offer present in the invitation, allow a greater objectivity during the evaluation.

LESSONS LEARNED

Work done allowed to create working teams in which different professional experiences and skills should converge, in order to further develop working capacity in synergy. A great potential concerning the successive stages of auditing and writing of an invitation to tender proposal appeared; it allows to exactly define specific criteria to intervene on an energetically inefficient building. It is therefore necessary that clients, designers, tenants, installers and building companies recognize the importance of energy audit followed by a more accurate consumption monitoring



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PILOT 4 - HOTEL I30I INN - PIANCAVALLO

WHAT

The HOTEL I30I INN has been built through the renovation and the extension of an old guest house adjacent to the Ice Rink of Piancavallo in Aviano Municipality. In the hotel there are 95 beds located in 37 different rooms, all of them with a private bathroom spread over 4 levels. On the ground floor there are the reception, the administrative offices, the restaurant and a cafeteria. On the first floor there is a double-height common area and a small SPA. In the basement there are a ski storage room, some dressing rooms, the warehouses and the equipment rooms.

FACTS

TYPE OF BUILDING (USE) // Hotel with 95 beds.

YEAR // 2012 renovation and extension – 2009 replacement of boilers

SIZE // total area 2.460 sq.m. total volume 10.940 cu.m.

INVESTMENT // total amount of € 4.500.000 financed by the Region FVG

ENERGY DEMAND // necessary primary energy certified 40,05 kWh/cu.m. a year

RENEWABLE ENERGY // 14 flat solar collectors and a photovoltaic system of 5,94 kWp

VENTILATION SYSTEM // controlled mechanical ventilation with heat recovery

AIR TIGHTNESS // air barrier in the wood infill walls of the extension

BUILDING MATERIAL // reinforced concrete, wood, insulations in EPS and mineral wool



HOW

The following modules of Mountee advice service have been tested:

Module 5 A: Real energy consumptions control and comparison with those expected during the planning process and with those certified when works have been completed; identification of the deviations and their causes; definition of actions and improvements. Module 5 C: guidelines for writing a "Building Maintenance Handbook" in order to detect the necessary maintenance actions and users' behaviour to ensure over the time the energy saving performance and the environmental sustainability achieved.

LESSONS LEARNED

The main lesson learned is to understand the importance of verification and monitoring of the objectives defined during the planning stage. This action can be realised by monitoring the real consumption and performance. It is not sufficient to establish and to certify a certain level of energy performance, it must be verified during the operating stage because it can significantly change in relation to the user or the manager's behaviour up to nullify the expectations of improvement. To this end, the installation of the necessary measuring instruments must be provided.



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PILOT 7 - POLCENIGO MUNICIPALITY

WHAT

This is the new county town school, located in front of the old building around a central court that includes the outside as a garden; its structure is made of wood, therefore a low energy demand and a low environmental impact are guaranteed. Planimetric system composed of two different wings generally formed by 12 classrooms for ordinary teaching. The two parts have a double-pitched roof and they are rotated in correspondence of the entrance hall (the connection point), illuminated by the zenithal light of the skylight; two porticos allow access to the outside.

FACTS

TYPE OF BUILDING (USE) // Primary and Secondary School

YEAR // 2012

SIZE // total area 880 sq.m.

INVESTMENT // about € 1.070.000 with funds from FVG Region, PN province and Polcenigo Municipality

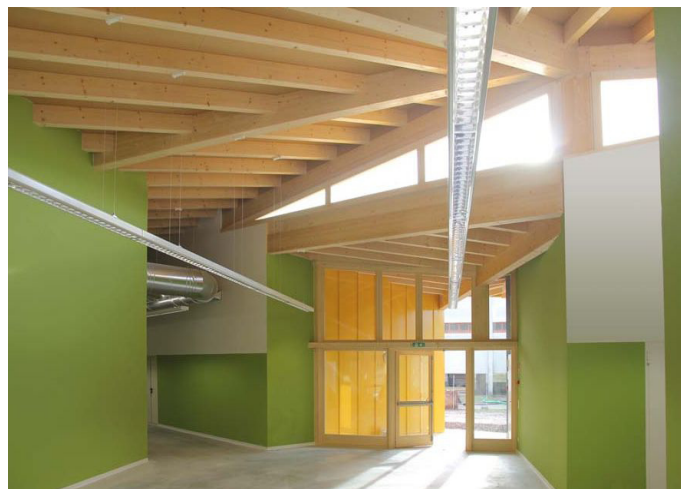
ENERGY DEMAND // primary energy (certified): 9,50 kWh/cu.m. a year

RENEWABLE ENERGY // solar panels 7,8 sq.m. for HDW production

VENTILATION SYSTEM // cmv with a heat recovery unit

AIR TIGHTNESS // air barrier in the wooden fillers of the envelope

BUILDING MATERIAL // wood, insulations made of different materials, window and door frames made of wood



HOW

The following modules of MountEE advice service have been tested:

Module 5 C: writing guidelines for the creation of a "Use and Maintenance Manual of the building", able to identify maintenance actions and users' behaviours necessary to ensure over the time energy saving and environmental sustainability achieved performances .

LESSONS LEARNED

The importance of verification and control of the objectives defined during the planning process, by monitoring consumption and real performances. It is not enough to guarantee the achievement of a determined energy performance level; it should be verified during its use, because it can significantly change in relation to users' behaviours, up to completely frustrate all the positive expectations. To this end, the installation of necessary measuring instruments should be provided for and due attention should be paid to communication/information factors towards both managers and users.



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PILOT 2 - SAGRADO MUNICIPALITY

WHAT

The pre-primary School of Sagrado has become one of MountEE pilot projects because it is one of the few examples in the region of new highly energy-efficient schools. The building, the insulators, and also the furniture are largely made of wood, and the architects paid a lot of attention to all building materials. The Administration would like to develop a plan for the cleaning of the building by using only products that are not harmful to humans and the environment. The Municipality wants to verify that the energy costs for the building management correspond to those provided for in the project.

FACTS

TYPE OF BUILDING (USE) // Pre-primary School

YEAR // The 4th of July 2011 – the 4th of July 2012

SIZE // about 744,38 sq.m. – volume: 3216,040 cu.m.

INVESTMENT // the total amount of the contract is of € 1.205.917,62

ENERGY DEMAND // $E_{Pi} 3,27 + E_{Pacs} 2,23$ = The total is 5,5 kW/cu.m. a year

RENEWABLE ENERGY // Solar panels for ACS productions

VENTILATION SYSTEM // cmv system for classrooms, entrance hall, canteen and for areas designed for teachers

AIR TIGHTNESS // has been made during the performance of the works

BUILDING MATERIAL // it is a wood building made of natural materials



HOW

The following modules of Mountee advice service have been tested:

Module 5 A: Real energy consumption control and proposal of improvements: real energy consumption control and proposal of improvements in order to verify if the building reached the expected and calculated energy consumption during the planning process. Module 5 B: Instructions about the use of cleaning products and about maintenance. Module 5 C: Support for writing a "Building Maintenance Handbook": support for writing a "Building Maintenance Handbook".

LESSONS LEARNED

The energy audit performed allowed to carry out specific considerations about management improvements, by showing how the monitoring through dedicated meters and a more accurate management system, with the different control systems related to the coordinated systems, can improve the energy efficiency by reducing energy consumption and by maintaining (if not by improving) comfort. After a building use is stabilized, it is important that the maintenance technician/manager of systems adopt measures in order to obtain a system calibrated both to the building and the users.



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Co-funded by the Intelligent Energy Europe Programme of the European Union

ABOUT MOUNTEE In accordance with the Energy Performance of Buildings Directive of the European Union (EPBD), all new constructions and existing buildings undergoing major renovation will have to meet Nearly Zero Energy Building standards (NZEB) by 2018. For many municipalities, especially in mountain regions, the

transition to NZEB is a major challenge. The MountEE project supports municipalities in three European mountain areas – Sweden, Alps and Pyrenees – in achieving the NZEB objectives, and will help to transform them into front runners. In six regions, 33 public buildings are renovated sustainably and energy-efficiently.

SUSTAINABLE BUILDING AND RENOVATION IN EUROPEAN MOUNTAIN AREAS

BACKGROUND Worldwide, the construction, use and renovation of houses accounts for about half the energy consumption. In Europe, heating rooms and water accounts for most of the energy used in housing. Fuel and gas are the most frequently used energy sources. Therefore construction and renovation have a

large energy reduction potential. But for many municipalities the transition to a new sustainable and energy-efficient way of building is a major challenge. With the MountEE project – sustainable public buildings, three European mountain areas show how it works.



PILOT 9 - TOLMEZZO MUNICIPALITY

WHAT

Headquarter building of the Regional Administration in Tolmezzo. The building is characterized by a high energy efficiency: its energy class is B, as the heating service is guaranteed by a vapour compression heat pump (nominal power: 151,50 kW). Good performances in summertime too (class II), even if there is not any controlled mechanical ventilation system; the entire building has a remote control system for summer/winter air-conditioning systems, lighting in common areas, protection systems against fire.

FACTS

TYPE OF BUILDING (USE) // Administration in an isolated building
YEAR // 2008
SIZE // 1955,90 sq.m
INVESTMENT // Regional resources
ENERGY DEMAND // EPI 11,53 kWh/cu.m. a year
RENEWABLE ENERGY // solar thermal and photovoltaic panels
VENTILATION SYSTEM // absent
AIR TIGHTNESS // Not subject to intervention
BUILDING MATERIAL // The structure of the roof is made of wood.



HOW

Real consumption verification is provided for in order to compare it with the one expected during the final and executive planning process through an Energy but also environmental Walkthrough Audit. By the standard calculation of the project, a simplified approach has been proposed. It has been decided, for example, not to analyze boundary conditions (change of climate data), which would have allowed to elaborate a calculation model similar to the real one. However, the possibility of comparing measured consumptions (energy bills) will be verified through a simplified analysis method..

LESSONS LEARNED

This experience allowed to evaluate only in part the importance of elaborating simplified evaluation instruments too (in accordance anyway with an Environmental Audit), thanks to which real consumptions can be monitored and therefore improvement scenarios can be hypothesized.

Energy and environmental Walkthrough audit performed on the pilot project allowed to carry out some accurate evaluations concerning management improvements. In particular, it shown how the monitoring through dedicated meters and a more accurate management system, with the different control systems which refer to coordinated systems, allow to improve energy efficiency, by both reducing consumptions and improving comfort.



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SERVICE

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