FROM THE ARCTIC CIRCLE TO THE MEDITERRANEAN: SUSTAINABLE CONSTRUCTION AND RENOVATION – HOW IT WORKS

FINAL REPORT MountEE

MountEE sustainable public building

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

CONTENTS

BACKGROUND

ABOUT HALF OF GLOBAL ENERGY CONSUMPTION IS ACCOUNTED FOR BY BUILDING CONSTRUCTION, USE AND RENOVATION

In Europe, most of the energy consumed in this sector is used for heating and hot water. The commonest sources of energy for domestic purposes are oil and gas. Construction and renovation thus have considerable potential for energy savings. The Energy Performance of Buildings Directive (EPBD) requires all new and renovated buildings to comply with the Nearly Net Zero Energy Building (NZEB) standard by 2018. For many municipalities, this transition is a major challenge: Most of them are lacking in knowhow, experience and funding. In mountain areas, municipalities often face additional challenges in the form of extremes of climate, poor accessibility, small entities, low population densities and an exodus of skilled workers.

FACTS AND FIGURES
RESULTS OF THE MOUNTEE PROJECT

650 TON
REDUCTION IN CARBON EMISSION

21
PUBLIC BUILDINGS RENOVATED

15
PUBLIC BUILDINGS NEWLY BUILT

123 MILL. EUROS
INVESTED IN SAVINGS IN PRIMARY ENERGY

5660 MWH
SAVINGS IN PRIMARY ENERGY

INTRODUCTION
SUSTAINABLE PUBLIC BUILDING IN EUROPE'S MOUNTAIN COMMUNITIES

The building of today is nice and cool in summer and nice and warm in winter. It consumes hardly any energy and, as it is built with local timber, stone or clay, it benefits the regional economy.

From 2012 to 2015, the MountEE project explored ways in which municipalities in Europe's mountain areas can create such a building culture. Seven partners, from Sweden in the north to the Alps and the Pyrenees in the south, collaborated in order to learn from one another and improve their strategies and construction methods. The 36 public buildings constructed or renovated in the framework of the project, including the new town hall in the Swedish town of Kiruna, the office building of the National Park in the French municipality of Olette and a school in the Italian municipality of Sagrado, are models to be copied. The key to success was a professional, holistic and structured construction process from beginning to end – with the help of the Local Authority Service Package for Sustainable Construction and the cooperation committees established in the partner regions in the course of the project.

WHY SUSTAINABLE CONSTRUCTION?

Construction and renovation involve extensive use of resources: land, raw materials for building materials, and energy for the manufacture, use and recycling of components. These resources are finite. Sustainable methods of construction and renovation are available, however, which take account of economic and social aspects, employ environment-friendly and regenerative materials and achieve levels of energy efficiency that make heating superfluous or possible with the help of renewables alone.

ECOLOGICAL ADVANTAGES

Buildings that require hardly any energy for heating and hot water emit fewer pollutants. The choice of construction materials, however, is also critical. In many cases, the materials used require a lot of energy for production (e.g. metal components) or transportation (wood from overseas). The use of ecological, regenerative and local construction materials helps mitigate climate change and strengthens the regional economy. Ecological and natural materials also reduce negative impacts on the health of both workers and users/residents.

SOCIAL ADVANTAGES

Sustainable buildings (private and public) with which users identify help strengthen the regional identity and promote social cohesion. Employing regional contractors creates and protects jobs and so contributes to a good quality of life in the region.

ECONOMIC ADVANTAGES

Many decision makers and investors still consider sustainable construction and renovation too expensive. That is because they fail to adopt a long-term view and planning horizon. It is true that the initial costs are often higher than for a conventional building, but the annual costs for energy, maintenance, etc. are lower. That is why sustainable buildings are becoming increasingly economical. In addition, the economy benefits from the use of regional construction materials like wood, stone or bricks and the inclusion of local actors.

«The advantages of sustainable building are not recognised.»

Sabine Erber *studied architecture and has been working in the field of energy-efficient construction at the Vorarlberg Energy Institute since 2007. She advises local authorities on how to plan energy-efficient and ecological buildings on the basis of the Local Authority* ***Service Package for Sustainable Construction*** *and manages international research projects in the field of energy-efficient buildings. She has been living in a passive house that she planned herself since 1999.*

WITH A HOLISTIC VIEW
INTERVIEW WITH SABINE ERBER

Ms Erber, you are an architect at the Vorarlberg Energy Institute in Austria. How do you see sustainable construction and renovation?
The objective is construction and renovation based on decisions in terms of quality and materials which are right and meaningful in the longer term. That naturally precludes solutions that are harmful to man and the environment and presupposes high formal and structural standards.

Where do you see the advantages in comparison with conventional construction?
The buildings offer a high level of comfort, with higher grade materials and fewer pollutants in the indoor air.

Where do you see the biggest challenges in comparison with conventional construction?
All planning decisions have to be taken at a very early stage and on an interdisciplinary basis. In addition, tradesmen are not used to providing a written declaration of the materials to be used and then actually using them.

Why is it that, in spite of all these advantages, conventional methods are still employed for construction and renovation?
Clients are put off by the higher initial costs. Also, the advantages are simply not recognised by many decision makers because of a lack of transparency in the field of quality assurance. It is hard enough in the case of a garment to see whether production was unecological, whether it contains any noxious agents and is durable. With a building, it is almost impossible for a layman to judge.

With its Energy Institute, the Austrian province of Vorarlberg has already gone a long way in the direction of sustainable construction and renovation. What were the advantages of involvement in the MountEE project?
We were able to benefit from the experiences of other partners. They apply different principles and methods, which we would never have discovered without this exchange. In addition, we had the opportunity to develop another service for municipalities comprising a cleaning concept and fine-tuning for the building management systems which offers real benefits following completion of the buildings.

WHAT AND WHO IS NEEDED FOR SUSTAINABLE CONSTRUCTION

The MountEE project has shown that many European municipalities want to construct or renovate public buildings like schools, town halls or events centres. They mostly have the technical tools. What is lacking are practicable strategies, applied knowledge and efficient cooperation platforms. Municipalities need the help of experts to be able to exploit the knowledge available on the development of regional strategies and financial instruments.

Co-operation solves problems right from the beginning.

The decisive step is to convince all actors in the building chain, like clients, architects, construction ecologists and the trades, of the importance of cooperation. For that reason, six *Regional Cooperation Committees* were established in the framework of the MountEE project in order to

- promote knowledge sharing in the field of sustainable construction and renovation
- improve existing conditions
- develop a joint regional strategy for sustainable construction and renovation (taking account of existing national/ regional codes)
- evaluate and develop financial instruments in collaboration with investors
- transfer knowledge to political decision makers
- offer training and workshops for all actors in the building chain

The *Regional Cooperation Committees* formed the backbone of the pilot regions. All the actors worked together on the planning and realisation of the pilot buildings. Through this governance approach, it was possible to raise awareness for sustainable construction and renovation to a higher level and ensure *across-the-board cooperation* in the partner regions.

Collaboration means problems can be resolved before the start of construction.

«It was very important to have a public framework for discussing the construction projects with all stakeholders.»

Camille Critin *works as an architect at the Council of Architecture, Urbanism and the Environment (CAUE) in the Isère region of France and supports local authorities with their construction projects.*

EXCHANGE GENERATES NEW IDEAS
INTERVIEW WITH CAMILLE CRITIN

Ms Critin, what did it take to convince you as an architect to sit on the regional cooperation committee?
That was not difficult, as overall support for local authorities with construction projects in the Isère region is the core activity of CAUE (French Council of Architecture, Urbanism and the Environment). Sustainability is at the focus of all our work, and that makes it meaningful to discuss the environmental aspects with all the actors in the building chain.

What advantages did the partnership bring for CAUE's everyday work?
For us it was important to sit down and talk to all the stakeholders and discuss various projects and approaches and so obtain new ideas. The variety of experience and skills of the participants (advisory bodies, government agencies, public owners, architects) generated an exciting platform for exchange and raised the level of knowledge of all concerned.

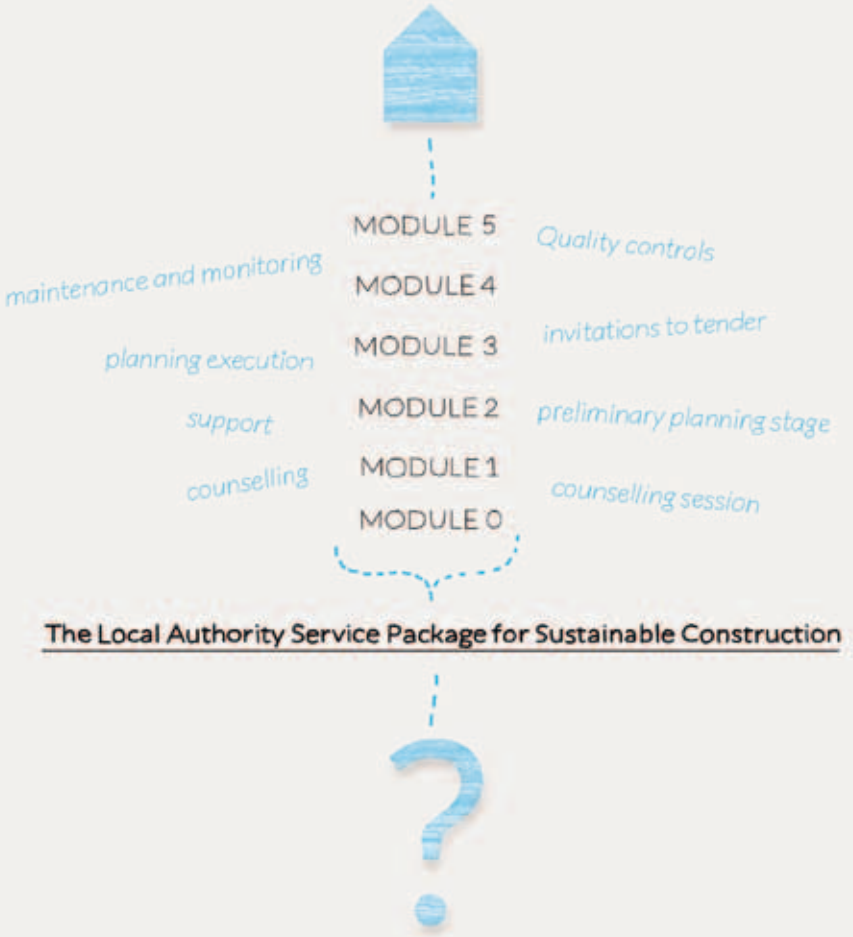
Were there any difficulties with regard to cooperation?
I found cooperation with all parties very fruitful. Sometimes it was difficult to attend every meeting as we have a tightly packed agenda.

One of the objectives of the cooperation committees was to influence sustainable construction/renovation strategies in the partner regions. How did that work out in the Isère region?
Through cooperation with the various partners and continuous exchange in the working groups, we are now in a position to better understand and take account of individual needs. That will make it easier for us to put future partnerships on track.

Has the cooperation committee generated a new construction culture in the region?
This form of cooperation has provided the whole thing with a framework and created great potential for influencing the region's future construction culture.

FROM THE IDEA TO THE BUILDING

The key to the success of a construction project is a professional, holistic and structured construction process from beginning to end – from the initial proposal and planning phase to the actual building work. The *Local Authority Service Package for Sustainable Construction* developed by Umweltverband Vorarlberg, the Vorarlberg Energy Institute and the Spektrum company is a useful tool. Throughout the process, a team of experts – construction ecologists, architects and ecological consultants – offer advice in the fields of energy, ecological construction, procurement, quality assurance and business management. Within the *MountEE* project, the offering was further developed and adapted to the situation in the various partner regions. The result was a total of 36 pilot buildings constructed.



THE LOCAL AUTHORITY SERVICE PACKAGE
FOR SUSTAINABLE CONSTRUCTION

MODULE 0
FREE KICK-OFF COUNSELLING SESSION

An initial non-binding talk is held to determine the client's needs and ideas.
Initial counselling

- on the advantages, opportunities and costs of sustainable construction/renovation
- on the content, scope, prerequisites and costs of the service package
- through presentation of similar examples of good practice
- on the practicalities of the proposed project

MODULE 1
COUNSELLING AND SUPPORT IN THE PRELIMINARY PLANNING STAGE

Ecological and energy-related specifications and objectives for the project are developed in collaboration with architects, planners, clients and other key actors in the municipality. The result of this module is a common ecological guideline that is binding for all planning work. Contents

Support with the architectural competition

- Formulation of energy-related and ecological goals in the competition documents
- Preliminary review of the projects submitted
- Public procurement law consulting
- Support with the architectural competition

Support with invitations to tender and the award of planning service contracts

- Formulation of specifications
- Support with the evaluation of bids
- Public procurement law support

In cooperation with the client's agents and the planning team

- Creation of an ecological programme
- Definition of target values
- Presentation before the relevant political body

Economic feasibility calculations taking account of lifecycle costs

MODULE 2
COUNSELLING AND SUPPORT WITH PLANNING AND INVITATIONS TO TENDER

The working drawings are optimised for ecological and energy-related aspects in collaboration with clients and planners. A materials and energy concept is developed as the basis for the tendering process. The concept includes proposals for the design of the building, the construction materials to be used and building management systems. Release of the invitations to tender is preceded by an ecological review of the bills of quantities, with ecological criteria for the choice of materials also provided. Results of the module: a project optimised in terms of energy and construction ecology as the basis for legally sound tendering procedures taking account of ecological criteria.
Contents

In cooperation with the client's agents and the planning team

- Design optimisation in terms of construction ecology
- Monitoring and plausibility checks for all tendering activities
- Development of ecological criteria for the choice of materials as part of the bills of quantities
- Approval of product declaration lists
- Public procurement law support with construction work tenders

Support provided by the planning teams on energy-related subjects

- Review and commentary on building management systems and insulation, connection details and thermal bridges
- Commentary on energy-related tendering, e.g ventilation, windows and the thermal building envelope

MODULE 3

COUNSELLING AND SUPPORT WITH PLANNING EXECUTION

When the contracts have been awarded, the tradesmen are invited to an info evening on the subject of the ecological specifications of the construction work. All construction materials and chemicals used on the site have to be declared on product declaration lists. Only declared chemicals and construction materials are admissible which have been checked on site by the ecological site surveyor.

Contents

- Information for tradesmen on the ecological specifications of the project
- Training and support for the ecological site surveyor
- Support in cases of contract problems

MODULE 4

QUALITY CONTROLS BY MUNICIPAL AND/OR EXTERNAL PERSONNEL

The main focus of this module is training for municipal and/or external personnel in quality assurance work throughout the construction process. The checks performed include indoor air quality tests, airtightness tests, room acoustics tests and thermography. On-site product checks are also performed. The result is a quality-tested, energy-efficient, eco-friendly and healthy municipal building.

Contents

On-site support

- Adjusting the building management system for optimum results
- Support with airtightness tests

Indoor air quality tests (VOC and formaldehyde, health and comfort)

MODULE 5

MAINTENANCE AND MONITORING

Experience shows that municipalities still need support when the construction or renovation phase is over, since the best building is worthless if it is not properly maintained. This MountEE project module helps municipalities to achieve the energy consumption figures shown in the calculations. Another goal is to ensure that the site clean-up and deep and regular maintenance cleaning of the building are performed with a view to minimising pollutant loads in the interior. Particular attention is paid to value protection, attractive surfaces and hygiene.

Contents

Energy assessment

- Detailed assessment of energy consumption
- Evaluation and weak point analysis
- Implementation of improvements

Sustainable cleaning

- Optimisation of the cleaning plans
- Support with the tendering process for site clean-up
- Creation of a cleaning and treatment concept for regular maintenance cleaning including criteria for cleaning agents and fibres

SERVICE FOR SUCCESS
INTERVIEW WITH DIETMAR LENZ

Mr Lenz, You played a key role in the development of the *Local Authority Service Package for Sustainable Construction.* What led to the development of this counselling service?
In 2000, Umweltverband Vorarlberg published a *Guide to Ecological Construction*. We originally thought that the guide would provide every municipality with a tool for sustainable construction. It turned out, however, that the municipalities need counselling and support along the whole sustainable building chain. That led to the development of the *Local Authority Service Package for Sustainable Construction.*

What are the specific benefits of the service package for municipalities?
From preliminary planning to final construction and beyond, the municipalities are supported by experts with regard to the energy-related and ecological aspects. As a result, sustainable construction is no more complicated for municipalities than conventional construction.

What does the cost-benefit analysis look like for municipalities?
Defining energy-related and ecological goals at an early stage in the planning process is the key to their economical implementation. It is true that the initial costs will be higher, but the goal is not to reduce the initial costs but to minimise the lifecycle costs of buildings. In addition, for an additional outlay of just 2%, municipalities benefit from buildings with low-pollutant materials and lower indoor air pollution levels.

A 5th module – Service and Maintenance – was introduced in the framework of the MountEE project. Why is support needed after the construction/renovation of the building?
When it comes to controlling building management systems, modern buildings have become highly complicated. Local facility managers are often incapable of defining the optimum settings, and the building management system planner is normally no longer available once the system has been commissioned. This where the Service and Maintenance module comes in, providing municipalities with support in the optimisation of energy consumption and costs. Municipalities are also helped to perform regular maintenance cleaning operations with a minimum of pollutant emissions.

In the context of the MountEE project, the service package has been applied to other mountain regions in Europe. With what results? Is it working, and if so, how?
In view of the differences in the framework conditions and cultures, a 1:1 transfer proved very difficult and did not really work. But once the partner regions had defined their needs and communicated the framework conditions in the individual case, we were able to share a lot of our experience with the partners. In the meantime, buildings and structures have been constructed in the partner regions in the context of the MountEE project that are fully comparable with the *Vorarlberg standard*.

«The Service Package is a planning advice and support tool.»

Dietmar Lenz** works for Umweltverband Vorarlberg (environmental association) and has been the head of ÖkoBeschaffungsService Vorarlberg (eco-procurement service) since 2001. He made a strong contribution to the development of the **Local Authority Service Package for Sustainable Construction.

PILOT REGIONS & PROJECTS

With the help of the *Local Authority Service Package for Sustainable Construction* and the *regional cooperation committees*, 15 buildings have so far been constructed and 21 renovated in the framework of the project.

PILOT REGIONS

1. The Countries of Norbotten and Västerbotten, Sweden
2. Dalarna Country, Sweden
3. Vorarlberg Province, Austria
4. Friaul-Julisch Giulia Region, Italy
5. Rhône-Alpes Region, France
6. Regional Park of the Catalan Pyrenees, France

THE COUNTIES OF NORRBOTTEN AND VÄSTERBOTTEN
SWEDEN

Norrbotten and Västerbotten are Sweden's largest counties, covering one third of the total area of the country. Norrbotten lies on the Arctic Circle and has 14 municipalities with a total of 250,000 inhabitants. Västerbotten has 15 municipalities with 260,000 inhabitants. Both counties have a very harsh climate.

Kebnekaise (2107 m), Sweden's highest peak, is located in Norrbotten, as is the country's deepest lake (Hornavan), which is 232 metres deep. Norrbotten County has 20 hydropower plants generating more than 14 TWh of electricity per year, which is 11 percent of Sweden's total output. In August 2010, the Swedish government created a pilot region for sustainable development comprising Norrbotten and two other counties, namely Skåne and Dalarna.

The scenery in Västerbotten is very varied, including the Baltic coast, endless expanses of forest and the mountains along the border with Norway. Umeå, the capital of Västerbotten, was the European Capital of Culture in 2014.

PILOT BUILDINGS — NEW

- Hedlunda Preschool in Umeå (Västerbotten)
- Vega School in Vännäs (Västerbotten)
- Patient hotel at Sunderby Hospital (Norrbotten)
- Kiruna Town Hall (Norrbotten)

PILOT BUILDINGS — RENOVATED

- Vuollerim 6000 Museum (Norrbotten)

NEW TOWN HALL IN KIRUNA

The new Kiruna Town Hall is a lighthouse project implemented in the framework of an urban relocation programme established to make more room for mining in the region. The request for proposals for the town hall took account of MountEE criteria like reusing parts of the old town hall, a 50% or more reduction in energy consumption and the choice of environment-friendly building materials in accordance with the *Sunda Hus* criteria.

The new Town Hall for the Kiruna relocation will be ready by 2016.

FACTS AND FIGURES

Type of building: Town hall, office building; **Date:** Begun 2015, completed 2016; **Floorspace:** 9700 m2, 3 storeys; **Investment volume:** 27 million euros; **Energy demand:** 56 kWh/m^2; **Renewable energies:** Central heating system with district heating using domestic waste and biomass; **Ventilation system:** Demand-controlled, highly energy-efficient fans, temperature metering, PIR; **Building materials:** Materials chosen on the basis of the Sunda Hus criteria and lifecycle analysis

HOW?

In cooperation with the LKAB mining company, Kiruna is working on an urban relocation programme, with the town hall as the first building to be replaced. The municipal authority was responsible for the tendering process and LKAB for the construction work. Nenet's MountEE team developed environmental and energy criteria, which had to be met in the tendering process.

LESSONS LEARNED

Cooperation with Kiruna municipality was fruitful but time-consuming because so many stakeholders – including politicians, LKAB, architects, etc. – had to be involved and convinced.

A lot of communication and information work on the subject of sustainability is needed from the very beginning.

The lifecycle cost analysis for building materials and the heating system was of great importance for the municipality and for LKAB.

SUCCESS STORY:
THE MORE, THE CHEAPER

Many buildings in the Norrbotten-Västerbotten region have been constructed to the passive house standard and achieve excellent environment and energy ratings – thanks to enthusiastic decision makers and consistent implementation of the vision of sustainable construction and renovation. The greatest success is to be seen in the fact that, as clients, businesses and tradesmen collect more and more experience, these buildings are becoming increasingly economical to construct. The positive results are additionally supported through programmes for monitoring energy performance and quality assurance along the whole building chain. Construction costs for the Vega School in Vännäs, for example, were 35 percent down on the previous project.

The use of metal for the internal structure reflects the importance of iron for Kiruna.

DALARNA COUNTY
SWEDEN

Dalarna is a sparsely populated area in the Swedish interior, with 280,000 inhabitants living on 29,000 square kilometres of land. The population increases significantly in the holiday season when millions of tourists come to enjoy the attractive scenery. Due to tourism and Dalarna's energy-intensive industries – metal industries, mining and the paper industry – the authorities placed a high priority on the energy problem. Along with Skåne and Norrbotten, the Swedish government selected Dalarna as a pilot region for sustainable development.

The administration board of the county, with its 15 municipalities, has been working since 2003 to establish new, common energy goals in various sectors. The project is being organised in the framework of "Energy Intelligent Dalarna" as a platform for all stakeholders in the energy sector. One result of this work is the development of energy action plans for the region as a whole and for the individual municipalities. Another result is the creation of an energy and climate strategy, on the basis of which Dalarna County can become a net exporter of renewable energy by 2050.

PILOT BUILDINGS – NEW

- Aspeboda Primary School
- Älvdalen Primary School
- Myrbacka Primary school, Vansbro
- Säter Preschool
- Apartment building Säter

PRIMARY SCHOOL ASPEBODA

Falun Municipality remains at the forefront of energy-efficient construction. When a new school was to be built in the village of Falun, the authority wanted to challenge current energy criteria. For example, the energy demand was set at 40 kwh/m^2, less than half of the level required by construction regulations. The school is now in use and the new requirements have been more than fulfilled, not least because the building is so well sealed. In an external evaluation it was found to be up to international standards.

The new school in Falun is a model of energy-efficient construction with regional wood.

FACTS AND FIGURES

Type of building (use): Primary School; **Year:** 2014; **Size:** 1252 m²; **Investment:** 25 million SEK, no kitchen in building; **Energy demand:** 36 kWh/(m²/Atemp); **Renewable Energy:** Biomass district heating from municipal heating company; **Ventilation System:** Heat recovery by exchanger (84%); **Air tightness:** 0,16 l/(sec, m²); **Building material:** Wood, in line with municipal timber building strategy

HOW?

One of the success factors was close and frequent communications, not least with school staff. Uniquely, both the purchasing and technical managers took part in all planning meetings. Energy balance was calculated both before and after the planning process. All parties involved knew from the start what performance levels were required. These targets were then monitored throughout the entire process. The entire school is built of wood, including the joists. For fire prevention, all wooden surfaces indoors had to be covered with plasterboard. All lighting is LED-based with automatic switch-off.

LESSONS LEARNED

Energy-efficient building need not entail increased costs. Slightly thicker walls, careful sealing and planning from energy efficiency right from the drawing-board can prove sufficient.

Connectivity for mobile phones may be a problem as low energy windows have a metal layer.

The municipality can improve its use of totally emission-free materials. The 2014 Wooden Buildings strategy is already being implemented and use of materials databases such as Basta or Sunda Hus is being planned for the future.

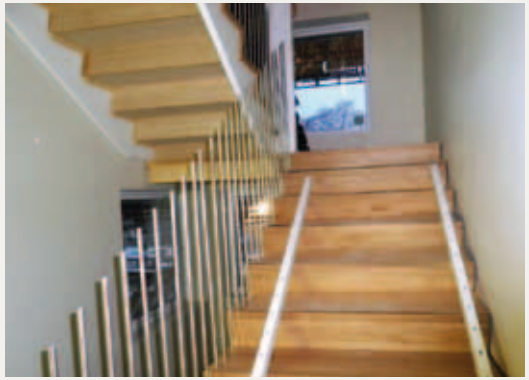
The municipality could use this unique building more in its communications work.

The sub-contractor maintained that a concrete joist system would have been cheaper and simpler.

SUCCESS STORY:
MUNICIPALITIES HELP MUNICIPALITIES

It is not easy to promote the exchange of experience between municipalities as few decision makers are willing to admit to shortcomings or a lack of knowledge. This obstacle was overcome through a programme of intensive cooperation in Dalarna County with its five MountEE pilot municipalities, with an atmosphere of cooperation and trust created as the key to success. Study trips were organised to enable the municipalities to lean about new ideas and group discussions held to consider and trigger improvements. On the basis of their positive experiences with the MountEE project, representatives of various municipalities set up their own network. The goal now is a continuous exchange of knowledge and experience in the field of sustainable construction and renovation and the development of support systems for small municipalities (e.g. service packages). The first meeting was held at the end of May.

The project shows that sustainable construction need not be more expensive.



The school's load-bearing structure is also made of wood.

VORARLBERG PROVINCE
AUSTRIA

Vorarlberg has 370,800 inhabitants and a population density of about 140 inhabitants per square kilometre. The smallest of Austria's provinces, it borders on Germany, Switzerland and Liechtenstein. It is one of Europe's most progressive regions in terms of sustainable construction, energy efficiency and environmental awareness among citizens, local decision makers and construction experts. The regional authority has plans to make Vorarlberg self-sufficient in energy by 2050. That explains Vorarlberg's role as lead region, from which partners in other European regions can learn.

PILOT BUILDINGS – NEW

- Lorüns Community Building

PILOT BUILDINGS – RENOVATED

- Mäder Primary School

LORÜNS COUNCIL OFFICES

In the framework of MountEE, a Service and Maintenance module was added to the Local Authority Service Package for Sustainable Construction. That permitted a proposal to be made for the evaluation of energy consumption and environment-friendly cleaning. The whole building has underfloor heating. The quality of the indoor air almost matches that of the outdoor air. In addition, the new council offices were built using sustainable construction methods and ecological building materials.

The Lorüns Council Offices won the Austrian klima:aktiv Award in Gold.

FACTS AND FIGURES

Type of building: Council offices; **Date:** 2012; **Floorspace:** 392 m²; **Investment volume:** € 800,000; **Energy demand:** 15 kWh/(m²TFAa); **Renewable energies:** Ground water heat pump; **Ventilation system:** High-efficiency ventilation system with heat recovery; **Building materials:** Wood with wood fibre and cellulose for the thermal insulation

HOW?

The key to success was the separate collection of energy consumption data and a calculation model taking account of individual user profiles. A second step involved manual data capture by the building owner comprising system settings, parameterisation and conditions in the surroundings at defined intervals. Following evaluation, with calculated data checked against the individual profiles, a weak point analysis was performed and the energy savings parameters adjusted accordingly.

LESSONS LEARNED

If the energy savings goals are to be achieved, it is important to monitor the key figures for heating, cooling, ventilation, electrical systems, etc. after commissioning. Only with the systems precisely adjusted to the building and user specifics can maximum energy savings be achieved. This test of module 5 confirmed that *follow-up monitoring* is just as important as sustainable building design.

SUCCESS STORY:
SERVICE PACKAGE — MODULE 5, SERVICE AND MAINTENANCE

With today's increasingly complex construction solutions and the effects of user behaviour on energy consumption, municipalities also require support after the construction or renovation phase to ensure that the calculated energy values can be achieved in practice. Module 5 was introduced in the framework of the MountEE project and tested on the pilot buildings. The results show that monitoring and optimisation can deliver 10 to 50 percent energy savings without any additional capital outlay. A further objective of Module 5 is to reduce the level of pollutants in the interior. Experience shows that here, too, due attention was paid to indoor air quality during construction. But if inappropriate cleaning agents are used after commissioning, the excellent air quality achieved is quickly compromised. The solution is a cleaning concept covering final clean-up, regular maintenance cleaning and deep cleaning.

The quality of the indoor air almost matches that of the outdoor air.

FRIULI-VENEZIA GIULIA REGION
ITALY

The region reaches from the shores of the Adriatic in the south to the mountains on the border with the Austrian province of Carinthia in the north and borders on Slovenia in the east. In the mountain areas of Friuli-Venezia Giulia, the small municipalities lack the knowhow, funds and common approaches needed to improve their overall building strategies.

Italy has a compulsory system of building classification based on energy performance. There are also some optional energy or sustainable classifications such as CasaClima, Leed (Green Building Council Italia) and ITACA (an Italian sustainable building tool). In October 2011, Italy introduced a building energy and sustainable performance assessment system called *Protocollo VEA*, which is based on ITACA and SB Tool, a general framework for rating the sustainable performance of buildings and projects.

PILOT BUILDINGS — NEW

- Retirement home in Cavasso

PILOT BUILDINGS — RENOVATED

- Club building in Cividale
- Sagrade Preschool
- Hotel 1301 Inn in Piancavallo
- Polcenigo Primary School
- Forestry authority headquarters in Moggio Udinese
- Administration building in Tolmezzio
- Social centre in Aviano
- Day centre for senior citizens in Forni di Sotto
- Multipurpose building in Comeglians

SAGRADO PRESCHOOL

The preschool is an outstanding model of energy-efficient construction in the region. The insulation materials, furniture and other major items are made of wood. The architects also attached great importance to the use of other ecological building materials. The operators developed a maintenance plan, in which only ecological cleaning agents are permitted. The Sagrado local authority is esponsible for continuous monitoring of the energy performance figures.

The wooden preschool took less than a year to build.

FACTS AND FIGURES

Type of building: Preschool; **Date:** 2012; **Floorspace:** 745 m²; **Investment volume:** 1.2 million euros; **Energy demand:** EPi 3.27 + EPacs 2.23 = a total of 5.5 kW/cu.m. per year; **Renewable energies:** Solar panels; **Ventilation system:** CMV system (Continuous Mandatory Ventilation)for classrooms, lobby, canteen and staffroom; **Building materials:** Wood

HOW?

The following service package modules were adapted and tested:

Module 5A Monitoring of energy consumption and improvement measures for achieving the planned performance figures

Module 5B Cleaning plan with ecological cleaning agents and methods

Module 5C Support with the creation of a user manual for the maintenance of energy-efficient buildings

LESSONS LEARNED

Energy performance monitoring led to significant improvements in the coordination of the individual systems and thus energy savings without any loss of comfort. When targeting the calculated energy performance figures, it is important to ensure that the parameters are adjusted to meet the needs of the building and its users so as to guarantee a pleasant indoor climate.

SUCCESS STORY:
REGIONAL COOPERATION COMMITTEE

In Friuli-Venezia Giulia, the MountEE project began as an adventure. A path had to be found over many mountains in pursuit of the goal of introducing a greater element of sustainability in the region's construction industry. A decisive factor was the foundation of a cooperation committee, which made it possible to develop a common sustainable construction strategy for the region. Involving banks led to the creation of new finance products, which will also be available in the future for funding sustainable construction and renovation. The pilot building constructed in the context of the MountEE project represented the first practical application of the principles of sustainable construction/ renovation in the region. That made all actors aware of the importance of cooperation and the exchange of knowledge and experience.

Wood was used for most construction materials and furniture.

5 RHÔNE-ALPES REGION
FRANCE

Rhône-Alpes is a hub of key French and European land routes. Its location makes it a region of great diversity, a geographic, climatological, sociological and cultural mosaic, with a total of 2879 municipalities. More than half of its area is located at elevations above 500 metres. The Rhône-Alpes region is a symbol of dynamism at the heart of the European Union and is one of the founders of *Four Motors for Europe*. Within this group, Rhône-Alpes is collaborating with Catalonia, Lombardy and Baden-Wurttemberg in the fields of university education, science, business, sport and culture.

Rhône-Alpes is also a dynamic region in demographic terms, with one of the highest birthrates in Europe. In the mountain areas, tourism is an important sector of the economy. These factors are driving demand in the construction and power generation industries.

PILOT BUILDINGS — NEW

- Administration building in Grésivaudan
- Administration building in Oisans
- St. Offenge Kindergarten

PILOT BUILDINGS — RENOVATED

- Montbonnot Arts Centre
- Art gallery in Saint-Alban-Leysse
- Festival hall/exhibition rooms in Montmélian
- Saint Alban Cultural Centre
- Malraux Cultural Centre, Chambéry

SAINT-OFFENGE KINDERGARTEN

The objective of the project – with two classrooms, a canteen with kitchen, and a daycare facility – was to construct a plus-energy building. The building envelope and airtightness are in compliance with the passive house standard. The kindergarten has two dual-flow VMC ventilation systems (one for the kitchen) and a wood-chip heating system. A PV array on the roof covers the energy demand of the whole building.

The kindergarten was built to the passive house standard.

FACTS AND FIGURES

Type of building: Kindergarten, canteen; **Date:** 2015; Floorspace: 670 m²; **Investment volume**: 1.8 million euros; **Energy demand:** 24.6 Wh/m²/an; **Renewable energies:** Wood chips, PV; **Ventilation system:** Q4 = 0.3 m³/h/m²PF; **Building materials:** imber frame on concrete slab

HOW?

The success of the project derives from seven factors:

- Strong client involvement from the start
- Inclusion of an energy performance AMO (assistance to the owner)
- Installation of a steering committee for the full term of the project
- Optimisation of energy performance based on three scenarios
- Use of renewable energies (with a total cost approach)
- Use of regional wood
- Strong focus on indoor air quality

LESSONS LEARNED

In order to achieve the targeted results, the clients were fully involved from the start, and various scenarios were developed together to ensure the economic and ecological success of the project. With the help of the cooperation committee, which provided support in various phases of the project, the goals were achieved step by step. This counselling and support at the local level made the project so successful.

SUCCESS STORY:
PUBLIC PROJECT PRESENTATION

Following the creation of a regional cooperation committee for the Rhône-Alpes region, the problem was to bind participants to the network in the long term and motivate them to attend meetings. The solution was found in the form of a public project presentation. Each client presented his or her MountEE pilot project based on the following criteria: integration of the building in the surroundings, sustainability in the choice of materials, energy efficiency and renewable energies, comfort (visual, acoustic, air quality) plus economic and social aspects. After a 20-minute presentation, all the participants were invited to discuss the project in the plenary. This platform generated improvements in the quality of the pilot buildings and also enabled participants to benefit from the experience and knowledge of others.

Great importance was attached to the use of ecological construction materials like wood.

6 REGIONAL PARK OF THE CATALAN PYRENEES
FRANCE

The Regional Natural Park of the Catalan Pyrenees is located in the eastern Pyrenees in the Languedoc-Roussillon region of southern France on the border with Catalonia (Spain) and Andorra. The regional park comprises 64 municipalities and extends over 120,000 hectares at an elevation of between 300 and 2900 metres. It has some 20,000 inhabitants, mostly living in small rural municipalities.

The climate reflects the influences of the mountains and the sea. With its geomorphology and geographic location, the area has very great potential in the field of renewable energies: hydropower, solar energy, geothermal energy and wood-based energy. The region has a rich history of energy production from renewable resources. The first hydropower plant was used to power the Yellow Train, a narrow-gauge railway running through parts of the Franco-Catalan Pyrenees. Then came the construction of two solar ovens in Mont-Louis and Odeillo and a thermodynamic solar power plant in Themis. At present, renewables cover 33 percent of local energy demand, with hydropower supplying a 72 percent share.

PILOT BUILDINGS — NEW

- Offices of the Natural Regional Park

PILOT BUILDINGS — RENOVATED

- Primary school in La Cabanasse
- Retirement home in La Cabanasse
- Canteen in La Cabanasse
- Mantet Council Offices
- La Carança Mountain Refuge

OFFICE BUILDING OF THE REGIONAL NATURAL PARK

The new offices of the Natural Park are housed in a traditional building. They serve as a showcase for sustainable renovation in the region, with a focus on energy efficiency, the use of renewable energies and regional and ecological materials, a *clean-construction site* process and protection of the on-site bat population. The building was designed by INCA/Betom architects.

Regional materials like wood and stone were employed for the building envelope.

FACTS AND FIGURES

Type of building: Office building; **Date:** 2014; Floorspace: 764 m²; **Investment volume:** 2.9 million euros; **Energy demand:** 62 kWh/m²/a; **Renewable energies:** Wood-chip heating; **Ventilation system:** Double flow ventilation; **Building materials:** Cellulose wadding, wood, stone

HOW?

In order to create a model building, a High Environmental Quality (HQE) process was implemented throughout the planning phase. The *Local Authority Service Package for Sustainable Construction* was integrated in the tendering process for choosing the tradesmen. The service package was also used to ensure achievement of all the sustainability goals in the construction phase (environment-friendly materials, waste management, etc.)

LESSONS LEARNED

The multiplicity of stakeholders made application of the service package difficult. That was also due to the fact that the planning process began prior to the launch of the MountEE project. Application of the service package from the start would have made many things much easier. The project management and tradesmen needed to be carefully coached and convinced in all phases of construction to ensure achievement of the sustainability goals.

SUCCESS STORY:
REGIONAL MATERIALS FOR REGIONAL BUILDINGS

The service package developed in the framework of the MountEE project was the key to the successful construction of the new office building for the Regional Natural Park. In that area, it is the first sustainable public building based on regional construction materials like wood or stone. The Deputy Manager of the Natural Park says, "The new office building for the Natural Park is a lighthouse project for the whole region and therefore had to have model character. We have succeeded in creating a sustainable building that harmonises with the landscape, takes account of local history and shows that the know-whow is available in our region, too."

The office building for the Natural Park is to serve as a model for the whole region.

LESSONS LEARNED

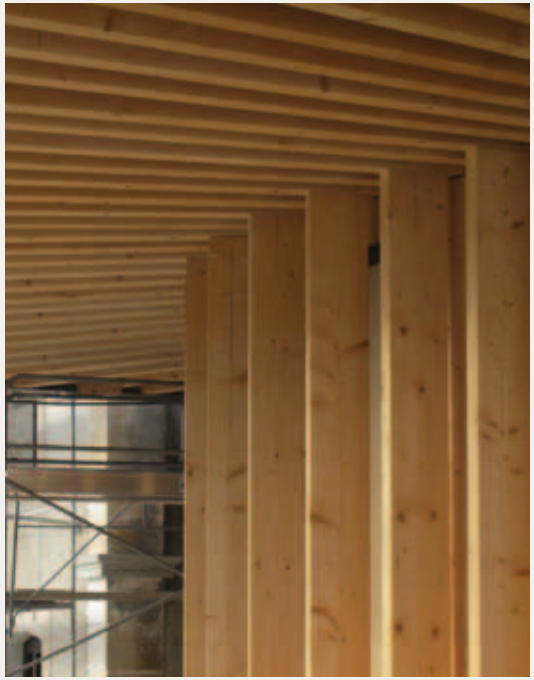
- Mountain municipalities are capable of handling sustainable construction and renovation, but they need help like the advisory support provided by the Local Authority Service Package for Sustainable Construction.
- Where cooperation committees are used to involve all actors in the building chain, like architects, energy managers, clients and tradesmen, scepticism and problems can be overcome before the construction work starts.
- The more experience municipalities have of handling construction and renovation projects, the more economical sustainable construction becomes.
- The pilot buildings show other municipalities how to be successful with sustainable construction using ecological materials. The exchange of knowledge between regions with a lot of experience and regions with little experience is one of the keys to success.
- The MountEE project showed that it is advantageous to use pilot buildings for workshops and training sessions in order to link theoretical and practical knowledge.
- The idea of organising public project hearings with the cooperation committees for debate and the exchange of experience met with a highly positive response on the part of participants.
- The pilot buildings have had an impact on building strategies in the partner regions.
- The lifecycle costs and regional effects of sustainable construction are often ignored in economic assessments of buildings.
- Knowledge transfer in the form of workshops, events, discussions, etc. is very important for stakeholder awareness building.

CONCLUSIONS AND RECOMMENDATIONS

- Political decision makers still have considerable deficits in their knowledge of sustainable construction and renovation, so that there is a need for ongoing awareness building.
- With the help of lifecycle cost analyses, decision makers can be convinced of the merits of sustainable construction and renovation, as the economics are always more attractive in the long term.
- Renovation is going to be a big thing in the future, as almost every municipality has problems with obsolete and inefficient buildings.
- Tradesmen need training in the use of ecological materials to avoid mistakes and achieve optimum results.
- Finance products targeted at the specificities of the NZEB standard need to be developed and implemented in cooperation with banks.
- The pilot buildings had a significant influence on sustainable building strategies in the regions because they made the issue more concrete for decision makers.

The building envelope is of particular importance for sustainable construction and renovation.

The project platform enabled less experienced regions to learn from others and also from their mistakes and thus make faster progress.



Wood has a bearing capacity that is 14 times higher than steel by weight and the compressive strength of reinforced concrete.

Study trips give decision makers a first-hand impression of the advantages of sustainable construction.

PROJECT PARTNERS

CIPRA

CIPRA, the International Commission for the Protection of the Alps, is an autonomous non-governmental, non-profit umbrella organisation that has been committed to the protection and sustainable development of the Alps since 1952. With its international executive office in Liechtenstein, its representatives in seven Alpine states and one region with around one hundred member organisations and institutions, CIPRA represents an important alpine-wide network. Thanks to this broad base, CIPRA is able to play a pioneering role in helping to solve current problems and challenges for a sustainable and ecological future for the Alps. The Alpine Convention, launched at CIPRA's initiative, was signed by the Alpine states as a treaty under international law in 1991 and is its guiding principle.

DALARNA COUNTY BOARD

The County Administrative Board is a regional government authority for the county of Dalarna, one of Sweden's 21 counties. It is an important link between the population and the municipal authorities on the one hand and the government, parliament and national authorities on the other. The board is a multifaceted authority comprising lawyers, architects, foresters, biologists and economists and is responsible for a wide range of activities, including implementation of national objectives, coordination of interests within the county, promotion of regional development, establishment of regional objectives and monitoring of legal regulations. In 2010 Dalarna was chosen by the Swedish government as one of three pilot counties for the country's energy and climate change transition.

NENET

Norrbotten Energy Agency AB (Nenet) is one of over 475 local and regional energy agencies in Europe. Nenet is working for increased use of renewable energy and energy-efficient and environmentally friendly technologies in Sweden – through networking, information dissemination, training, initiation of and participation in energy and environmental projects, and the production of regional and local statistics. Nenet has also participated in several international, national and regional energy projects for sustainable development. Nenet is owned by the municipalities of Norrbotten and Norrbotten County Council.

ARES

As a private-sector energy agency, the Agenzia Regionale per l'Edilizia Sostenibile (ARES) promotes sustainable and environment-friendly construction in the region and works for construction quality improvements. ARES continuously updates its analysis procedures and methods in line with the latest EU directives, national and regional legislation and current technical standards. The agency also performs studies, organises research and training activities and holds conferences.

RAEE

Rhônalpénergie-Environnement (RAEE) is the regional energy and environment agency of the Rhône-Alpes region of France. Created 30 years ago with the support of the Regional Council of Rhône-Alpes, the agency contributes to the promotion, co-ordination and development of activities in support of the rational use of energy, the promotion of renewable energies, environmental protection and application of the principles of sustainable development. The activities of RAEE are mainly targeted at local authorities and the public and social sector. The agency offers information, counselling and support. RAEE is a non-profit association comprising about 50 members from the Rhône-Alpes region, including regional and local authorities, energy producers, local energy distributors, associations in the fields of energy and the environment, federations in the fields of social housing, energy and services, and financial bodies, etc. At the national level RAEE is affiliated to RARE (Network of Regional Energy and Environment Agencies) and at the European level to FEDARENE.

PNR

The management authority of the Regional Natural Park of the Catalan Pyrenees (PNR) is a local public body covering 64 municipalities. The park was created in 2004 by the Languedoc-Roussillon regional authority, the Ministry of the Environment and local authorities. Its primary objective is development of the area in various ways: management and protection of the environment, enhancement of the natural and cultural heritage, sustainable tourism, environmental education, urban planning, energy efficiency and renewable energies, and the general promotion of sustainable development. The management authority's offering includes animation, technical services, studies and monitoring, stakeholder support, finance sourcing and the development of innovative activities for private and public partners. PNR also works in partnership with the larger territorial organisation GIP Terres Romanes, which represents a hundred municipalities, in the fields of sustainable housing, training and economic development.

AIDA

Alliance in the Alps was founded in 1997 as an association of local authorities and regions in seven countries of the Alps. Together with their inhabitants, the affiliated bodies work for the sustainable development of the Alpine living space. "Exchange – Address – Implement" is the motto for AIDA's activities, with the Alpine Convention as the basis and guiding principle for sustainable development. The network has just under 300 affiliated municipalities in the Alps, which are committed to mitigation measures for climate change, energy savings, increased efficiency, etc.

IMPRINT

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