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Architecture + Energy Consulting

Club Arc Alpin

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CAA project "Energy Efficiency of Mountain Huts"

The Alpine associations have been looking into how to optimally construct and equip their mountain huts for a long time now. The 1,000+ Alpine association huts in the Alps represent a substantial number of buildings with very specific construction and maintenance requirements.

For this reason, since 2011 the CAA has been funding a project to develop a tool which enables the Alpine associations to check the carbon footprints of their huts and to compare data on their energy consumption.
The project was completed in 2015. However, specialists will need to be trained to ensure that the Alpine associations use the tool effectively.

The tool was developed on the basis of fundamental data collected from four different huts in the Alps. These huts represented the entire range of issues being investigated in relation to the construction of mountain huts.

At the same time, CO2 data was collected for all relevant construction materials, modes of transport, energy sources and consumables in collaboration with the Karlsruhe Institute of Technology (KIT). Furthermore, a new method of calculating the heating degree days which best reflects the unique climatic conditions in the mountains had to be developed in order to assess all the sites in the Alps. This required a great deal of development work, as this data had never been calculated in this context before.

The newly developed tool is fully tailored to the specific needs of mountain buildings and covers all aspects of hut construction, from transport and the building work itself to the maintenance and supply of the huts, as well as their dismantling. It also provides a specific way of calculating the number of guests, giving a key indication of the extent to which each hut is being used. It is important to know whether the guests come in summer or winter and when the greatest number of day guests can be expected.

While buildings in the valley that can be evaluated normally are always designed to be used at full capacity throughout the year, we can precisely map out the unique usage patterns of mountain huts and consequently demonstrate how the building should be constructed and technically equipped.

This makes our tool vastly different from normal tools that are designed for use with buildings in lowland areas. Other tools do not need to include the transportation of all materials by road,

cable car and air into their calculations. These factors are extremely important in a tool for mountain buildings because they must be included in the calculations if the results are to reflect reality.

It is particularly important to consider the method used to supply properties with goods and materials because in many places properties can only be supplied by means of helicopter or cable car. Very few huts are accessible by road, and the majority of these can only be reached by vehicles during the summer months. The tool is able to precisely consider and evaluate the method of supply. As a result, substantiated data can be used to determine the most suitable way of reaching huts for supply, waste disposal and other transportation purposes.

Due to the open-ended design of the tool, all types of building commonly found in the Alps can be evaluated. In addition to the insulation value, CO2 calculations and quantity surveying are also automatically conducted and prepared for further calculations.

The calculations clearly show that the weight factor of the individual constructions is crucial when selecting appropriate materials and structures. Wood is clearly the best possible building material for use in the mountains, as no other material has been found to offer as many benefits. Solid components made from steel and concrete are only advantageous when constructing foundations.

The type of use, opening times and size of the hut determine whether it requires high-efficiency insulation. These factors influence the type of construction and energy production most suited to the location in question. Here, it is important to choose the best possible type of system by looking at the existing and planned parameters.

Huts that need a lot of power for operational purposes but, due to their location, are unable to easily cover their power requirements with solar energy and hydroelectricity are able to generate sufficient heat from their power generation systems (e.g. CHP plants) to make insulation less important than it is in huts that aimed fully at solar energy, for example.

The importance of waste water treatment should also not be underestimated when constructing huts. While outdoor toilets were possible in many locations 50 years ago, modern legal regulations require special systems in order to ensure that drinking water in the valleys is not contaminated in the mountains. This has had an enormous impact on the construction and operation of huts, since a modern membrane filter system may use a third of the total amount of electricity generated for the entire hut. These vast quantities of energy have a fundamental influence on the design of all the energy production and storage systems put in place.

It is difficult to compare huts because the primary key data is determined by the location of the hut, its exposure to sunlight and the availability of drinking water, as well as the possible use of water to generate electricity. The finished tool is now capable of defining and determining these very aspects for each location so that the best possible energy production, construction and waste water technologies can be identified and put together for every hut location.

Efficiency in the mountains not only means saving energy but, more importantly, using the resources available correctly to ensure that both the building and the system are designed as well as possible. Our goal must be to only use what we require. If, however, we have enough environmentally friendly energy available, there is no need to insist on saving energy.

This conclusion may seem surprising at first but it is important to remember that all the energy generated by a stand-alone, off-grid power system has to be used by the building for which it is being generated. The same therefore also applies to any surplus energy. This excess energy must be stored intelligently, and if this is not possible (due to the battery storage system and boiler being full), it must be used as expediently as possible.

In the future, the finished tool will enable us to better understand our existing portfolio of huts as well as the huts we are planning to construct, and to check the feasibility of the measures being envisaged.

The first training course for specialists in energy efficiency will be held next spring. After completing the training, these specialists should be in a position to directly support the Alpine associations and their sections, and show them the best methods of increasing efficiency.

In future, the tool should also allow us to identify the conditions under which existing systems should be adapted, and how the available resources can be used to get the best out of the portfolio of existing huts.

Efficiency lays the foundations for the future of our mountain huts.

Weinfelden, 12 December 2015

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