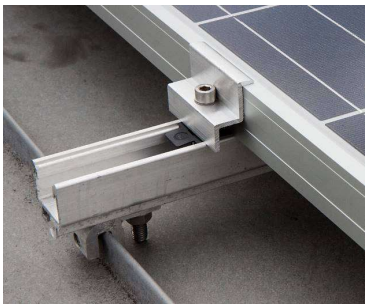


Monument School Innsbruck

Author: Pavel Sevela (University of Innsbruck)

PV system attached to the roof

Solar

What is the solution?

A PV-system with a size of around 10 by 3 meters with a peak power of 5 kW was installed at the south facing roof of the Monumental School (NMS Hötting), Innsbruck, Austria – a historically protected building - in the spring of 2014. The PV-array is made up of 20 pieces of photovoltaic (PV) modules “SOLARWATT Blue P60 250Wp”, an inverter “KOSTAL Piko 5.5” and “TIGO - Energy control, monitoring and safety system” including sensors for module temperature and global radiation.

Why does the solution work in terms of compatibility with conservation and technical aspects?

The realization of the mounting was restricted to follow the inclination of the roof surface due to the visibility and architectural reasons. The reduction of the solar energy yield (compared to the ideal inclination) due to the flat inclination of the roof is less than 5 %. Technically the mounting was done with special tin roof fold-clamps. This way, the mounting is reversible without any permanent consequences. The total height of the system is around 12 cm (measured from tin roof surface). The individual electronic MPP-tracking for each module (product name TIGO) makes it possible to utilize the maximum solar energy yield even in case of partial shading of the PV array. If one or several modules are shaded, the TIGO-system is able to choose a different MPP for those modules individually. This way the energy yield of the not shaded modules is not reduced. Moreover, this system allows a system shut-down of the DC-grid

in emergency case (e.g. fire) to avoid danger due to high voltage (e.g. 480 V in standard PV-arrays). As the PV-array was set up for research reasons within the 3ENCULT-project, the electrical behaviour and energy yield will be possible to observe and logg via online tool. For scientific reasons, the power of each module is logged (in order to see effects of partial shading) as well as the module temperature and the global solar radiation at the level of the module. The most important issue for decisions on PV-systems on listed buildings is the visibility in terms of format, colour and surface texture. On this school building, the roof covering is a tin roof, hence the frame of the modules was chosen to be an aluminium type in light colour. The chosen module type is SOLARWATT Blue P60 250Wp polycrystalline cells. In total, 20 modules were mounted in two rows at the lower part of the south facing roof. The surface of the front glazing is specially made of glass with diffuse reflecting finishing to avoid glare and minimize the visibility.

Description of the context:

A PV-test setup with reversible mounting system was placed on the original roof of the Monument school building NMS Hötting. This design process happened in collaboration with all involved parties (architect, local heritage authority, heritage authority Vienna (BD) and the building owner). The monument school NMS Hötting is listed as one of the most important examples of early modern architecture in Tyrol (1929-1931). From an architectural point of view, the architect of the school building (Franz Baumann) intended to realize the imagination of a flat roof. At the time of construction (in 1930) however, the technique for making flat roofs was not state of the art yet. The final solution was an inclined roof with a shallow slope. This way, the inclined roof is visible only from far distance. From the street or from any other close viewpoint, the roof surface appears hidden behind the roof-eaves. As demonstrated by figure 5, the roof with a slope of 13° (lower roof) and 15° (higher roof) is not visible to a person at ground level, from any viewpoint closer than a distance of around 60 m from the building. This was the main argument why, from the heritage point of view, it was permissible to place the PV-array on this roof.

Pros and cons of the solution:

The pros are the protection & reversibility, maintenance, energy efficiency, scalability of the solution, aesthetics and educative function for the pupils. The

cons are that the system is not rainproof and do not replace the roofing material.

Type of data available (level of information, simulation):

As the PV-array was set up for research reasons within the 3ENCULT-project, the electrical behavior and energy yield will be possible to observe and log via online tool. For scientific reasons, the power of each module is logged (in order to see effects of partial shading) as well as the module temperature and the global solar radiation at the level of the module. Life monitoring of the PV-array : http://www.tigoenergy.com/site.php?0c265458-9b59

Are there any related publications or pictures of the solution?

Figure 1a - PV-array on the south-facing roof

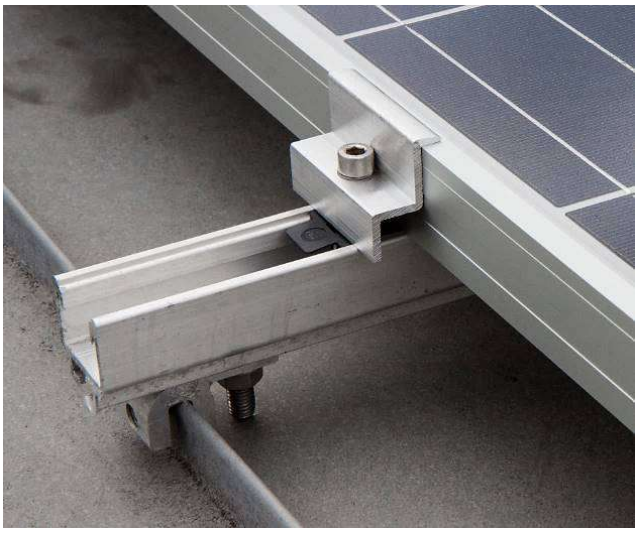


Figure 1b - reversible mounting by the tin roof fold-clamps

Figure 2 - View from the south at a distance of around 65 m

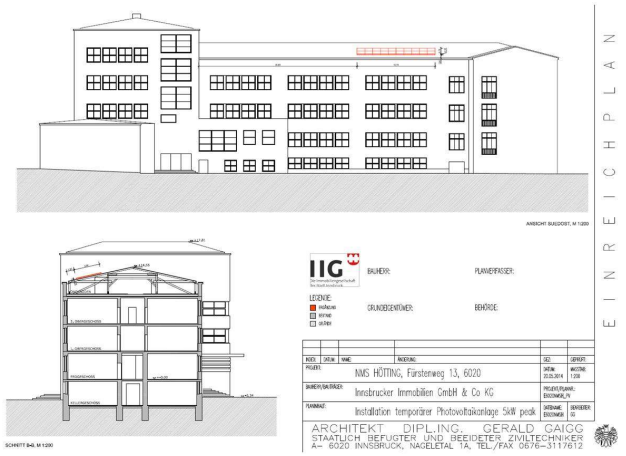


Figure 3 - Location of the PV-array (view from south-west and cross section)

Figure 4 - PV-array at the tin roof of Monument School NMS Hötting

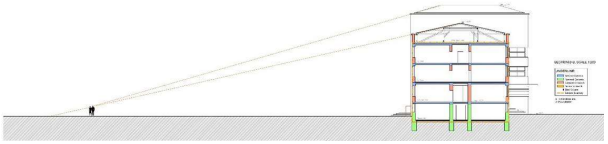
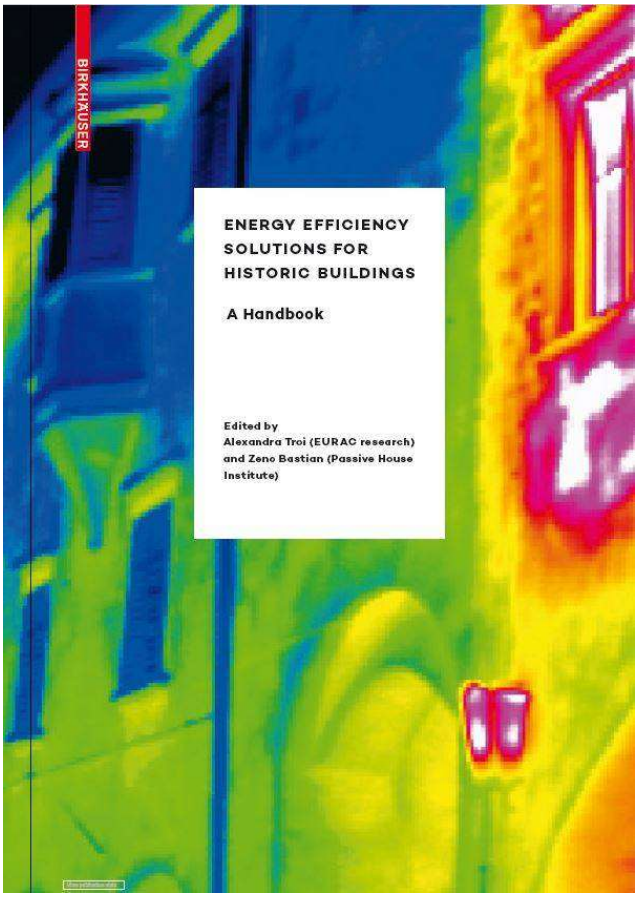


Figure 5 - Cross section (north to south) and point of view for roof visibility



Energy Efficiency Solutions for Historic Buildings, Troi, Alexandra (EURAC research) / Bastian, Zeno (Passive House Institute), ISBN 978-3-03821-650-6, December 2014