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Pilot project ‘Old school building’, Kohtla-Järve

ESTONIA

1 Project description

The brick school building, built in 1938/39 from Anton Lembit Soans, is a listed monument and property of the Town Government. The building consists of three floors in the main building and an added gym hall. Some parts of the building were reconstructed, but nevertheless it is still in a bad state and has to be refurbished.

Address: Spordi 2, Kohtla-Järve, Estonia

Building type: school building
Architect: Anton-Lembit-Soans
Year of construction: 1938/1939
Owner: Kohtla-Järve Town Government
Used as: premises for the vocational training of unemployed, art studios, a hostel, gym for an aerobic club

Number of floors: Main building 3 floors + basement, gym 1 floor + basement, tower 6 floors

Façade: bricks and plaster
Floor space: 3,594 m²
Heated area: 3,594 m²



Refurbishment
Start: August 2013
End: November 2013
Architect: Scandec Ehitus OÜ

Material
Façade: bricks, plaster

Roof: main building eternit plates; gym bearing metal girder with wooden trussing

Windows: a mixture of types; original with box-type windows

Shading system: no

Floor: concrete, wood

Ceiling: wooden beams, reinforced concrete

Inner Walls: solid brick wall and lath

Cellar: bricks and flagstone

Foundation: concrete

2 Initial situation

The building of the famous Estonian architect is representative for the school architecture of the period of the 30-40s of the 20th century. It is nowadays used as a gym for a gymnastic club, a hostel, and for art workshops. Some parts of the building have a tenant – a training centre for unemployed. It is planned to use the building in the future as a public "Oil Shale Mining and Processing Museum".

The Cultural Heritage number of the building is 13886 on the Regulation of the Minister of Culture No. 73 dated 13.11.1997, (RTL 1997, 214, 1130). The following expert´s report about the heritage value exists: "Special Terms for Refurbishment and Reconstruction of Heritage Buildings by Andrey Ksenofontov, Tallinn, 2010 approved 04.05.2011 by Madis Tuuder, inspector of National Heritage Board of Estonia (approval nr. 15563). The Property owner has to follow the national regulations concerning the maintenance and refurbishment of the building.

The building is partly renovated, but still in poor condition in total. The facades have the most urgent need of repair and restoration. But also the terraces, the roof, windows and the external doors of the building have to be refurbished. Most of the problems inside the building are caused by leaks and high humidity. The bearing structure and the floors are deteriorating. The ornamentation, balconies, railings, cornices and columns on the façades are also deteriorating. In order to prevent further decay, the roof and the windows must be restored and renovated.

Heating system / -production
Old: district heating with old radiators

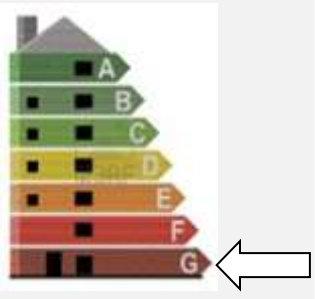
Building services
Electricity: electric wearing is in bad condition

Water / waste water: in bad condition

Energy consumption
Before, measured: 405,42 MWh/a

After, calculated: na
After, measured: na

Energy saving: na
CO2 saving: na



3 Motivation for the chosen measures

The gym is a separate part of the building where it is possible to work out energy efficiency measures valuable for the whole project. Here the windows account relatively for the biggest part of energy losses in the building. The original windows were box-type windows, but the original windows do not exist anymore. Almost all existing windows have been built after the 2nd WW, in their appearance and construction identical to the original ones. Some of the windows, mostly in the basement, are bricked up. So it was a big challenge to work out the best way for refurbishing the windows. For that reasons the windows were chosen to demonstrate the possible measures and their effects concerning the energy efficiency.

Furthermore there is a huge lack of knowledge in general in that sphere in Estonia and other Baltic Sea Countries. This project has led to information that is very valuable for heritage protection and for sustainable energy measures in Estonia as well as for other European countries. There are many new innovative measures to achieve positive energy effects by refurbishing of old windows, e.g. special glazing, films for glazing, special technologies for third glazing and others. The idea was to use the valuable knowledge about energy films, third glazing and other methods from Germany and to combine it with knowledge and technics from Estonia.

The project was planned and implemented in the following steps:

- An energy audit for the gym including measurements about the existing situation and a concept for the improvement of the energy efficiency
- A concept for window restoration, including descriptions and calculations for different measures
- Practical restoration of windows, including energy efficiency- Instructions for making old windows more energy efficient

The calculation for the 4 steps is:

- 10,000 € for engineering
- 50,000 € for the practical works including new innovative materials and technics

4 Costs & financing

1. Costs	**total costs** (in €)
Energy audit for the former school building	1,190.00
Examination of the technical condition of the gym	1,536.00
The general concept/construction project for the gym	4,971.55
Restoration work for the windows in the gym	50,650.92
Building inspection	840.00
sum 1	**59,188.47 €**

2. Financing	**funding sum** (in €)	**internal rate of return, interest rate** (in %)
Own money	8,878	
Bank credit	-	
Public funding	-	
Donations (BSR programme)	50,310	
sum 2	**59,188 €**	

5 History and historical value

Initially the research and planning of energy-efficient refurbishment measures as part of the Co_2olBricks project was intended to be done for a different historical building – the Kohtla-Järve Cultural Centre. However, this object received funding for its complete restoration from ERDF, totalling 1,800,000 €. Other options had been considered for the Co_2olBricks project and eventually a decision was made jointly with the Lead Partner to select the former school building, which is also listed as architectural heritage. The project budget included investment funding totalling 60,000 € to be used for implementation of certain refurbishment works which would result in a perceptible reduction of energy costs. Despite the fact that Estonian legislation does not require audits for protected historical buildings, an energy audit was implemented as part of the Co_2olBricks project. Consequently an analysis of the energy consumption and energy costs in this building was performed, the most problematic places were visualized through thermography, and

suggestions for their elimination were provided in order to achieve maximum energy efficiency of the building during renovation. As the refurbishment of the whole monument building requires considerable investments, it was decided that only one part of it – the gym – had to be examined in detail. The gym is used by children and the indoor climate is very important for their training. The reduction of humidity in this part of the building is also very essential and important for the future restoration. In the course of the international Co_2ol Bricks project partner workshop various options regarding possible works in the framework of this project were considered. As a result the workshop participants expressed their general opinion that there is a need to focus the attention on replacing the windows in the gym. Other suggestions included the improvement of the heating and lighting situation in the gym. Further activities of the project group concentrated on implementing these decisions in adherence to the given project budget.

According to the results of the thermography performed by Viru Energiaudiit NV OÜ, the greatest heat losses proceed through the shell of the building – external walls, windows, doors, intermediate floors and roof. The results of this energy audit were the basis for choosing energy saving measures to reduce the energy consumption of this building. The first of these measures was to improve the thermal resistance of the windows. The heat losses of a square meter of glass surface are from four to six times higher than the ones of a wall. This is especially important for the large window surfaces. The present windows have been preserved from the time of the building's construction or mostly from the time when it was renovated after the 2nd WW, during which the building was quite seriously damaged.

One of the advantages of old wooden windows is their authenticity and singularity. From the heat resistance point of view the main advantage of old windows, compared to the new ones, is a wider gap between the interior and exterior window frames (it is the air that holds the heat, not the glass) and the more massive window cases. The windows of the gym are considered historically valuable, but they do not meet the actual energy saving standards. At the moment the thermal conductivity of the gym windows is 2,1 W/m²K (for the whole building, according to the data from the energy audit, the average thermal conductivity of the windows is about 3,0 W/m²K). It was suggested to lower this value to 1.1 W/m²K. For the Estonian climate it is not advised to reduce the U-value to figures lower than 1.1W/m²K as this can cause condensate on the external surface of a double-glazed window. The heat thermal resistance of windows can also be improved by the use of curtains.

By increasing the thermal resistance of windows energy saving of 11 MWh/a can be reached, which leads to a payback period of 89 years. In the restoration project every window was examined and a table of damages was compiled for every window separately. This way of examination provides accurate data about the condition of the windows and allows to prepare a more accurate calculation of the refurbishment expenses.

According to this research, presented as part of the restoration project, the condition of the windows in the gym is mostly unsatisfactory. In order to renovate them and to improve their thermal resistance it was suggested to preserve only the external window frames and cases (but the glass panes should be replaced) and to replace interior windows with contemporary wooden double-glazed windows with selective glass. This is the most popular type of glass used for improving the thermal resistance of windows in Estonia. Selective glass blocks the heat radiating through the window from objects inside of the building, lets as much daylight as possible pass and prevents transmission of as much solar heat as possible. Use of selective glass in a double-glazed window reduces the loss of heat by up to 30%. Selective glass is usually installed on the internal side of a double-glazed window. Also the space between the glasses should be filled with argon, which provides additional thermal resistance compared with air-filled double-glazing. As for the external window frames the decayed parts should be replaced and new fragments similar to the existing ones should be produced. New metal fittings should be installed both on the external and internal window frames. To avoid the appearance of air humidity on the internal side of the external window, the air circulation between the glass surfaces should be improved. In the restoration project, it was advised not to install contemporary sealers on the external window in order to provide the essential air movement.