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// Akadeemia 5a – Serial refurbishment of a dormitory

Tallinn | Estonia

Short Description

Deep energy renovation of the TalTech (Technical University of Tallinn) dormitory (residential building) built in 1986 according to Sowjet-era building standards to nearly zero energy building by using prefabricated insulation elements.
https://www.youtube.com/watch?v=rcWYa7acUTY
https://www.youtube.com/watch?v=pPvIf9-G290

Year // duration

2018

Objective

Comprehensive refurbishment of the building applying the novel approach of industrial renovation with prefabricated elements und materials to achieve the nZEB target (PE ≤ 100 kWh/(m2·a)).

Initial situation

The building had exceeded its designed service life of 50 years. Energy losses caused high energy bills for the residents, and inadequate indoor climate mainly due to poor ventilation and resulting mould as well as deteriorated façade and balcony elements caused the university to stop renting out part of the units. The University decided to undertake the refurbishment in a way that shows society a way forward to a more climate-friendly and decarbonised building stock.

Implementation & measures

An audit to detail refurbishment demand and measures was conducted. 3D lasering was applied to determine the façade details and insufficiencies and the prefabrication of façade and insultation elements in the factory. Thermography was applied, too.
Measures included: Façade insulation, roof insulation, basement insulation, new windows, new mechanical ventilation with heat recovery, renovation of heating system (new pipes, radiators with thermostat), new ventilation systems (central ventilation with heat recovery, apartment-based ventilation), installation of PV panels and solar collectors. The outdated water supply and sewer systems were replaced. Heat supply is typically district heating.
Serial renovation means the energy-efficient refurbishment of existing buildings using off-site prefabricated façade or roof elements including the associated system technology (e.g. heat pump modules) and their installation on existing buildings. The off-site prefabricated elements have such a high degree of prefabrication that the time required on site is significantly reduced compared to conventional renovation. It is the expectation that prefabrication will increasingly be automatised and thus happen at an industrial scale. Therefore, the

term serial renovation and industrial renovation may be used synonymously according to the context.

Source: Taltech University

Results

It is the first apartment building in Estonia to be renovated to the nZEB standard. Full renovation (including interior finishing, new kitchen etc., 2018): 822 €/m2 closed net area (all works, including VAT). Heat losses were cut by up to ten times.
The measured primary energy use of the studied renovated building is 147 kWh/(m2·a). As the designed primary energy consumption was 95 kWh/(m2·a), the performance gap between measured and designed primary energy consumption is 34%. If the renovated building would be used according to standard use conditions and design methodology, the nZEB target (PE ≤ 100 kWh/(m2·a)) can be achieved. This shows that the building itself is built well but at the same time, if the existing heating pipe losses, DHW losses and user behaviour are added to the calculation, then it is not possible to reach the nZEB energy performance.

Parties involves

Technical University of Tallinn TalTech
Design bureau Sirkel and Mall Matek factory (prefabrication of modular façade and building components).

Beneficiary parties

University students living in the dormitory.
University administration / facility management.

Financing // Funding

Estonia's government has acknowledged the benefits of this technology and has announced a subsidy programme to support this kind of refurbishment.

Lessons Learned

In order to alleviate the labour shortage resulting from an increase in renovation volumes, there is a need to increase productivity and, in the long term, cost-efficiency. Industrial production in its simplest form is made possible by lightweight external wall and roof elements, which include the necessary building services system piping. Such solutions currently exist on larger markets where labour is more expensive.
A lack of experience applying an industrial approach to building reconstruction is one of the main challenges, so is availability of specialised work force and the awareness of residents.

Required framework conditions

Labour and material shortage are major challenges as prices for construction material have risen globally particularly during the pandemic and because there is a lack and draught of young professionals.

Possible multiplication effects

Since the completion of the project, more buildings in Estonia have undergone serial refurbishment. International momentum for the project was and is high. However, this technology is still an innovative and not standardised way of refurbishment. Even 5 years after this first pilot building was refurbished, there is no scalability of this technology and there is still much to do.

Need for action

To alleviate the labour shortage resulting from an increase in renovation volumes, there is a need to increase productivity and, in the long term, cost-efficiency.
User behaviour and raising user's awareness around energy efficiency have to be taken into account to secure the long-term success of measures.
Buildings should be audited thoroughly before any heavy building equipment is brought to the site.

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