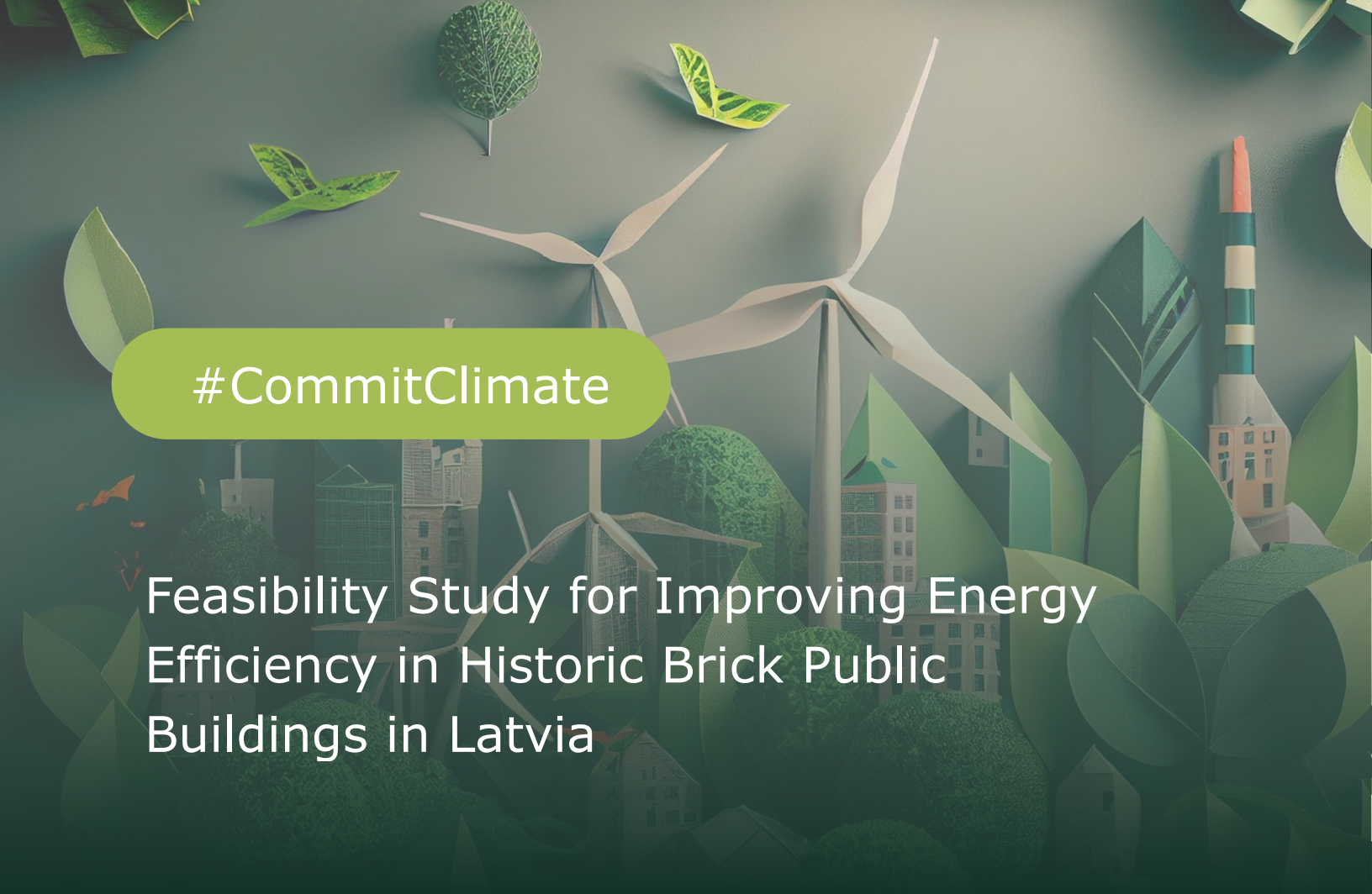

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Feasibility Study for Improving Energy Efficiency in Historic Brick Public Buildings in Latvia

Implementation site

CĒSIS, LATVIA

Target sector

HISTORIC BUILDINGS

Goal

Energy efficiency improvement while preserving cultural heritage

case study

Cēsis Municipality

Feasibility study object - building at Bērzaines Street 34, Cēsis

Historical part of Cēsis – old town

Cēsis County Integrated Sustainable Energy and Climate Plan until 2030

On September 22, 2022
Municipality of Cēsis county
Signed the renewed Covenant of mayors

Overview

Historic brick public buildings are an important part of Latvia's built heritage, particularly in municipalities with valuable pre-war architecture. At the same time, these buildings often have high heat consumption and limited possibilities for standard energy efficiency measures.

Unlike modern buildings, historic brick buildings require a careful balance between reducing energy demand and preserving architectural, cultural and material value. External insulation is usually restricted or not permitted because it can change the appearance of façades and damage heritage features. As a result, energy efficiency improvements must rely on solutions that are technically sound, low-impact and compatible with heritage protection requirements.

This feasibility study reviews possible measures for improving the energy performance of historic brick public buildings in Latvia, with a focus on solutions that could be relevant for Cēsis Municipality and similar historic urban environments.

Key Insights

The review of Latvian, EU and Northern European experience shows that significant energy-saving potential exists in historic buildings, but interventions must be selected carefully. The most suitable measures are usually those that improve thermal performance and indoor comfort without altering the external appearance of the building.

Internal insulation, secondary glazing, restoration of original windows, ventilation improvements, heating system upgrades and digital monitoring tools are among the most relevant options. However, each solution must be assessed individually, considering the building's condition, moisture behaviour, ventilation needs, heritage value and expected use.

A step-by-step approach is recommended. Simple low-impact measures, such as improving heating control, reducing air leakage, using thermal curtains or blinds, and restoring existing windows, should be considered before more complex structural interventions

Technical Solutions

Internal insulation

Internal insulation can improve the thermal performance of historic brick walls when external insulation is not allowed. Natural and vapour-open materials, such as mineral wool or wood fibre boards, may improve wall insulation by approximately 50–70% and reduce heating energy demand. However, internal insulation is one of the most technically sensitive measures in historic buildings. It can reduce indoor space, change the thermal behaviour of walls and increase the risk of moisture accumulation or mould if not properly designed. Before implementation, moisture modelling, building diagnostics and ventilation assessment are essential.

Secondary internal windows

Installing secondary glazing on the interior side of existing windows can significantly reduce heat loss while preserving the historic façade. This solution can improve window thermal performance from approximately 3.0 to 0.97 W/m²K and reduce window-related heat losses by up to 60–70%.

Secondary internal windows are particularly suitable where original window frames contribute to the heritage value of the building. The final cost depends on the selected design, materials and installation complexity.

Window restoration

Restoration of original wooden windows is generally preferred over full replacement. It helps maintain architectural authenticity and can improve energy performance, especially when combined with draught-proofing, repaired frames, improved glazing or secondary internal windows.

Window restoration can provide energy savings of around 10–30%. Although new windows may offer higher thermal performance, replacement can negatively affect the building’s appearance, microclimate and heritage value.

Ventilation modernisation

Improving ventilation is essential when reducing heat losses in historic buildings. Heat recovery ventilation systems can recover approximately 70–90% of heat from exhaust air, improve indoor air quality and reduce moisture-related risks.

Such systems may reduce energy use by around 20–40%, depending on the building and system design. However, installation requires space for ducts and equipment, which can be challenging in heritage buildings. Ventilation solutions must therefore be adapted to the building layout, airtightness and preservation requirements.

Technical Solutions

Heating system upgrades
Replacing outdated heating systems with more efficient solutions can improve overall energy performance. Options may include condensing boilers, heat pumps or other low-emission heating technologies, particularly where they can be combined with renewable energy sources. Heating system upgrades may improve efficiency by approximately 10–20%. Their effectiveness is higher when combined with improved controls, zoning, monitoring and gradual reduction of heat losses.

Digital twin and monitoring technologies
Digital twin solutions, IoT sensors and BIM-based models can support real-time monitoring and optimisation of indoor climate and energy consumption. These tools are especially useful in historic buildings because they allow better control without major physical interventions.
Digital monitoring can support predictive maintenance, identify overheating or moisture risks, optimise HVAC systems and help preserve the building's microclimate. This approach can also support long-term decision-making and more targeted investments.

Northern European Experience

Northern European projects, including RIBuild, demonstrate that energy efficiency improvements in historic buildings are possible when technical measures are carefully designed and supported by building-specific analysis.
Experience from the region shows that internal insulation can be effective, but only when moisture control and ventilation are properly addressed. External insulation is rarely acceptable for protected façādes, and window replacement is often discouraged due to its impact on heritage value.
Experts from Latvia and Nordic countries emphasise that preserving façades, original materials and the historical character of buildings should remain a priority. Energy efficiency measures should therefore be selected not only according to potential savings, but also according to their reversibility, compatibility with heritage values and long-term impact on the building.

Expected Results and

The implementation of suitable energy efficiency measures in historic brick public buildings can provide several benefits:
Energy-related benefits: reduced heat demand, improved energy performance and lower greenhouse gas emissions.
Economic benefits: lower operating costs and more predictable energy expenses.
Heritage benefits: preservation of original materials, façades and architectural character.
Indoor climate benefits: improved thermal comfort, better air quality and reduced moisture risks.
Administrative benefits: better planning, monitoring and maintenance of municipal building stock.
Social benefits: increased awareness of sustainable heritage renovation and demonstration of good practice for building owners and local communities.

Recommendations

To support energy efficiency improvements in historic brick public buildings, several actions are recommended:

- Develop national guidelines for energy renovation of cultural heritage and historic public buildings.
- Create dedicated financial instruments for municipalities and building owners dealing with heritage-related renovation constraints.
- Prioritise low-impact and reversible solutions, such as secondary internal glazing, window restoration, thermal curtains, improved heating control and monitoring.
- Require building-specific diagnostics before implementing structural measures such as internal insulation.
- Promote integrated renovation strategies that combine technical, regulatory, financial and educational measures.
- Strengthen cooperation between municipalities, heritage authorities, engineers, architects and building owners.
- Support training and knowledge exchange on moisture-safe renovation, ventilation and energy-efficient restoration.
- Include historic buildings more clearly in regional and municipal energy planning.
- Encourage regular monitoring of indoor climate, moisture conditions and energy use in public heritage buildings.

Conclusions

Improving energy efficiency in historic brick public buildings is possible, but it requires a careful and balanced approach. Standard renovation measures cannot always be applied because cultural heritage value, façade preservation and material integrity must be protected.

The most suitable solutions are those that combine energy savings with respect for the building's historic character. Internal insulation, secondary internal windows, window restoration, ventilation modernisation, heating system upgrades and digital monitoring can all contribute to improved performance when applied appropriately.

For municipalities such as Cēsis, historic public buildings can become important examples of how climate goals and heritage preservation can be addressed together. A gradual, evidence-based and building-specific approach can help reduce energy consumption, improve indoor comfort and preserve valuable architecture for future generations.

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