

Property name: Kiriku 2 / Kiriku 4, Tallinn
Property owner: State Real Estate Ltd
Consultants: Estonian Society of Heating and Ventilation Engineers

Total Concept method

Step 1. Creating the action package

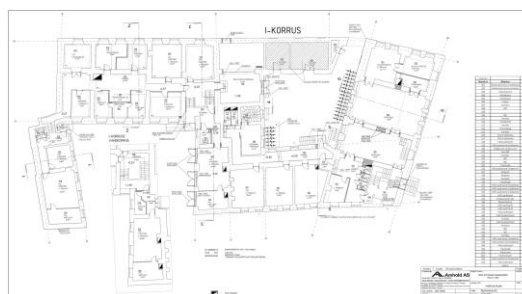
Building and its use

Year built: End of the 18th century
Area: 1 877 m² Heated area
Type of building: Office

The building has two parts with different address, which are physically together. The buildings are located in the old town of Tallinn and are under the protection of cultural heritage.

The building was last used in the second half of the 2010. The building was used as an office building and building is planned to be renovated.

The building was used as an office for state agencies. The building was mainly used from Monday to Friday 8: 00-18: 00.



Indoor climate

Indoor climate requirements set for the building are the same as commonly set for the offices: minimum airflow rates + 2.0 l/s per heated area.

The indoor climate was not monitored in the building, because the building was not in use during the auditing period. Also information about the previous indoor climate measurements was not available.

The status of the building and its technical systems before measures

Building envelope

The building has a limestone foundation, but there are also sections of stacked bricks. In the walls are a mainly two types of materials: brick and limestone. The walls are covered with lime plaster. Last plaster repairs and painting of facades were carried out in 1996. There are cracks in the walls caused by uneven sag of the foundation. The roof frame is wooden and covered with stone roofing tiles. Attic floor is covered with additional insulation (approx. 200 mm). The basement floors are made of concrete. The basement floor has no thermal insulation. The windows have wooden frames and are regularly maintained and updated. There are older double-glazed windows and newer triple-glazed windows.

Estimated thermal transmittance of building envelope:

External walls $U=1.7 \text{ W(m}^2\text{K)}$

Attic floor $U=0.4 \text{ W(m}^2\text{K)}$

Ground slab $U=2.7 \text{ W(m}^2\text{K)}$

Windows (old) $U=3.0 \text{ W(m}^2\text{K)}$

Windows (new) $U=1.8 \text{ W(m}^2\text{K)}$

Heating

Building has district heating with one sub-station. The existing distribution system is the two-pipe system with radiators. Radiators are partially equipped with thermostatic valves.

Ventilation

Building has natural ventilation system.

Cooling

There are no cooling system.

Lighting

Office premises have mainly type T8 fluorescent lamps. Switching of the lighting are controlled manually. Lightning system is technically out of date, part of the system is dismantled.

Equipment

At the moment, there is no energy consuming equipment in the building.

Control and monitoring system(s)

Heating sub-station is equipped with a local controller. Heating system temperature is adjusted according outdoor air temperature. Domestic hot water temperature is kept constant.

Energy and resource use before measures

Specific energy use before measures $283 \text{ kWh/m}^2\text{,Year}$

Whereas

Heat energy $48 \text{ kWh/m}^2\text{,Year}$

Electricity for building operation $235 \text{ kWh/m}^2\text{,Year}$

Electricity for tenants $\text{kWh/m}^2\text{,Year}$

Heating energy consumption (adjusted with degree days) per heated area was 215-235 kWh/a. Most of the heating energy was used for space heating. Energy need for heating domestic hot water was marginal.

Electricity use per heated area was 48 kWh/a and electricity was measured with one energy meter. Therefore electricity consumption of different building parts and different tenants is unknown.

Baseline for the energy performance improvements is set on the basis that the indoor climate requirements are met in the building (indoor temperature +21 °C and ventilation airflow rates + 2.0 l/s per heated area m²).

Identified energy saving measures

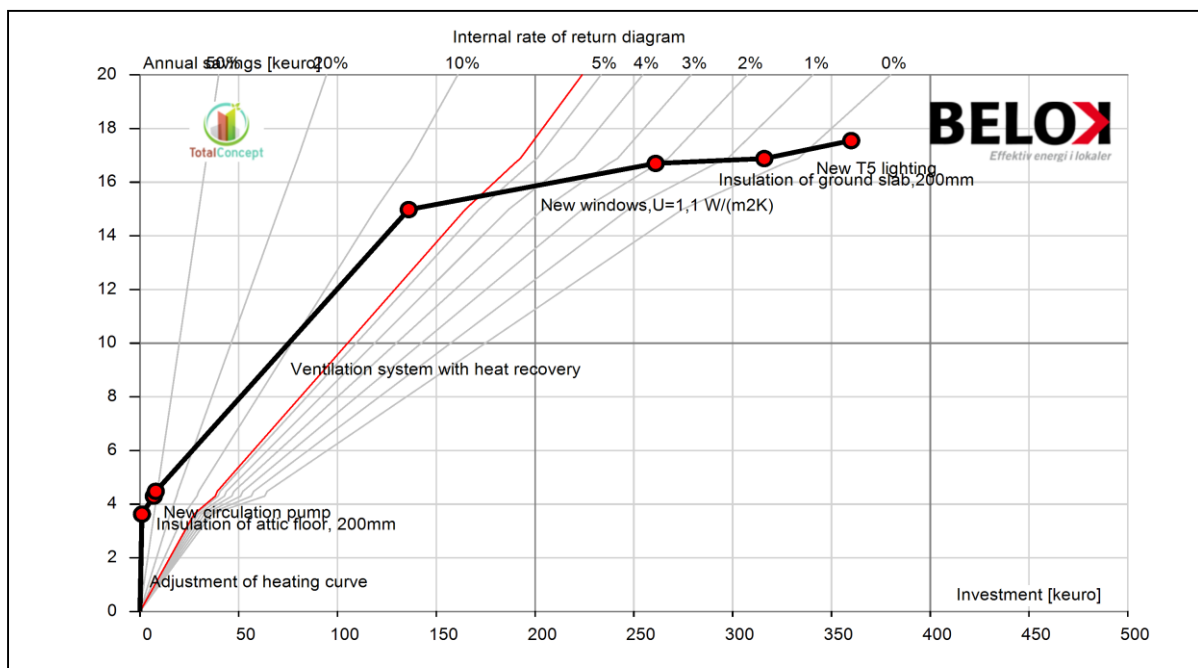
Seven energy saving measures were identified during the auditing. However, only four of them meets the property owner's profitability requirement 5.5% internal rate of return.

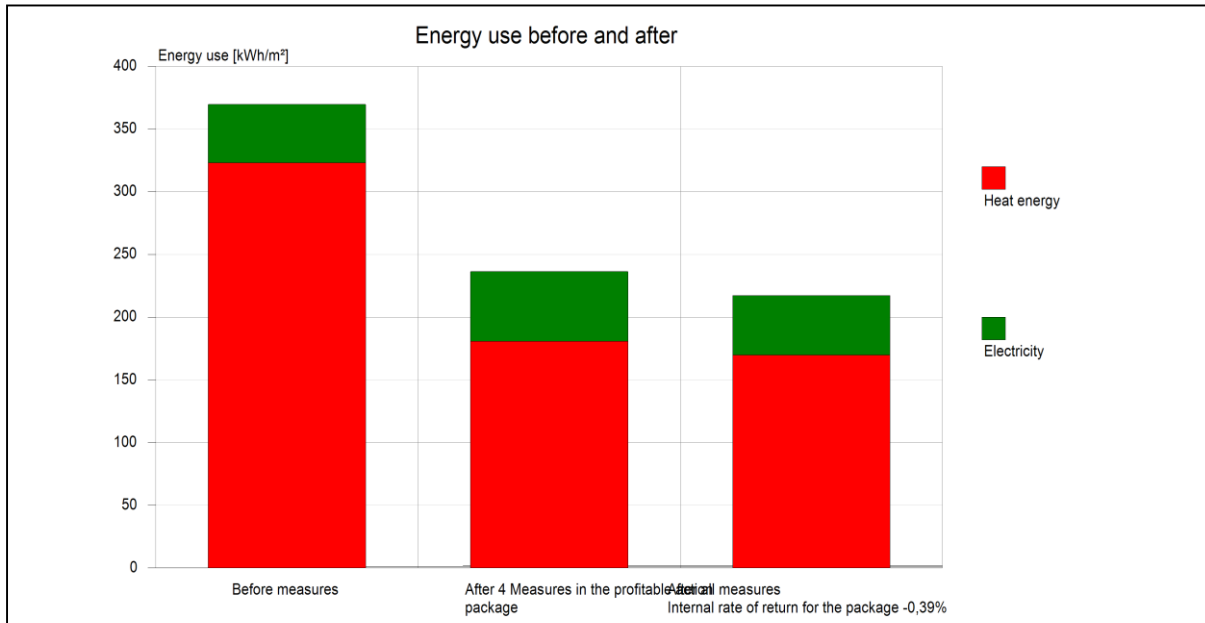
It is proposed to adjust the heating curve, install new circulation pump for the heating system, insulate attic floor and install new ventilation system with heat recovery. Those four measures as a package fulfills the profitability requirement 5.5% internal rate of return.

Additionally the replacement of old windows, insulation of ground slab and installation of new T5 lighting system is proposed as possible measures. Those measures did not meet the profitability requirement but contributed to reduction in energy demand and therefore reduced energy costs.

Summary of the measures in the action package

Measure	Investment cost keuro	Cost saving keuro/year	Energy saving MWh/year
1 Adjustment of heating curve	1	3	59
2 Insulation of attic floor, 200mm	6	0	11
3 New circulation pump	1	0	2
4 Ventilation system with heat recovery	128	10	178
5 New windows U=1,1 W/(m2K)	125	1	28
6 Insulation of ground slab,200mm	55	0	3
7 New T5 lighting	44	0	5
- Sum	360	17	286





Results

The property owner's profitability demand is 5.5%. The internal rate of return of the action package is about 8 %. The total energy saving potential is approximately 36%. District heating use can be reduced by about 270 MWh/year, but electricity use will be increased by 17 MWh/year.