Property name:	Norrtälje prison- Building 9
Property owner:	Specialfastigheter
Consultants:	CIT Energy Management AB

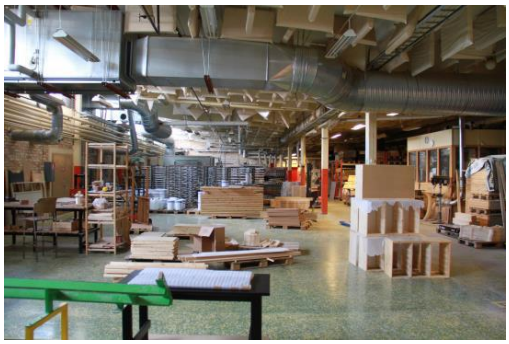
Total Concept method

Step 1. Creating the action package

Building and its use

Year built: 1958
Area: 8 030 m² heated area
Type of building: Prison

The Norrtälje prison is a high security institution for male prisoners. The building of interest - Building 9 - is with its 8 030 m2 floor area by far the largest building within the Norrtälje prison area and holds several activities. The building is divided in four almost equally large sections separated from each other due to security reasons. The building is owned by Specialfastigheter AB but used by Kriminalvården. The greater part of the building is for stock-keeping, carpentry and mechanical work were wood furniture and all sorts of sheet-metal work is carried out. The rest of the building is for office and educational use. The activity is from 07.30 to 16.30 Monday - Thursday and 07.30 - 13.00 on Fridays. All together there are about 100 persons in the building during activity time.



Indoor climate

Indoor climate requirements in the premises are dependent on the function of the rooms and activity. The levels are controlled in the rental agreement between Specialfastigheter and Kriminalvården. According to these indoor climate requirements the room temperatures must be kept in between 16 - 22 °C, depending on the room and activity.

According to the energy audit, thermal comfort in premises is considered to be poor, which is a consequence of a malfunctioning heating system. In a number of rooms the room temperature setpoints are as low as 12 °C. The thermal comfort will however be improved soon, regardless if Specialfastigheter choose to carry out Step 2 of the Total Concept or not. The indoor air quality is considered to be rather good, due to high infiltration rates and the airflow rate measurements carried out previously.

The status of the building and its technical systems before measures

Building envelope

The building envelope is poor in general with almost no insulation in the light concrete walls, old original single or double pane windows and a bottom slab without insulation. The concrete roof is however in good shape

with new additional insulation. The air infiltration is probably huge, not the least due to several large and leaky doors for trucks etc.

Heating
The building has district heating distributed to a substation in a neighbor building. The heating system with mainly radiators is really poor in general, incapable of keeping the thermal comfort at required levels. The radiator system is probably never balanced and has old thermostats. In addition the radiators are often covered by slabs of wood etc. which of course reduce their performance and usefulness.

Ventilation
Building 9 has several ventilation systems providing the building with comfort ventilation and process ventilation. The comfort ventilation is provided with three separate air treatment units with heat recovery. Parts of the comfort air are provided with displacement ventilation but the ducts are often covered by slabs of wood etc.

The process ventilation systems (local exhaust ventilation systems) take care of dust particles from carpentry/mechanical work and chemical emissions from paint coating.

Comfort cooling
Building 9 has no comfort cooling.

Lighting
The lighting systems in the large production zones consist of 250 light fittings with 2x58 W fluorescent tubes. Almost all lighting in Building 9 is controlled manually.

Equipment
Even if there is some standard office equipment such as computers, refrigerators, kitchenettes etc., the vast majority of the ?equipment? consists of machines. There is also a large compressed air system.

Control and monitoring system(s)
The ventilation and heating systems are connected to the central building management system, TAC Vista, installed in 2002.

Other systems
Domestic hot water is produced by district heating.

Energy and resource use before measures

Total specific energy use before measures (baseline)	128 kWh/m²,yr
Whereas,	
Heat energy (district heating)	60 kWh/m²,yr
Electricity for building operation	13 kWh/m²,yr
Electricity for tenants	56 kWh/m²,yr

Energy supplied to the Norrtäljeanstalten - Building 9 consists of electricity and district heating. There is no separate heat meter for Building 9. District heating use is measured with one meter for the whole property. Additionally, there is only one electricity meter in Building 9, which means that electricity for building operation and electricity for tenants is measured together. The energy use of Building 9 and different energy end users are therefore calculated with the energy simulation tool IDA ICE. Based on the calculations, the specific annual energy use for the building is today ca 121 kWh/m^2, including electricity for tenants.

According to the energy audit, it can be difficult to meet the indoor climate requirements set for the premises. For improving thermal comfort the room temperature set points need to be increased in some areas of the building. With increased room temperatures the annual heat energy use will increase from 53 kWh/m^2 to

60 kWh/m^2 (excluding domestic hot water). The new baseline for the total specific annual energy use for Building 9 will be 128 kWh/m2 including tenants. This is shown in the specification above.

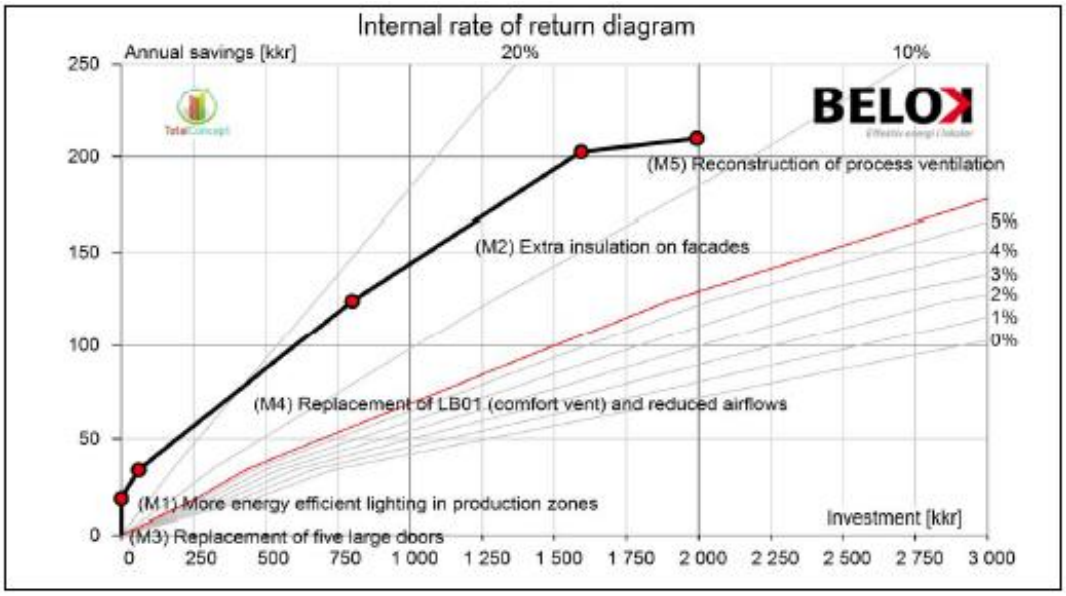
Identified energy saving measures

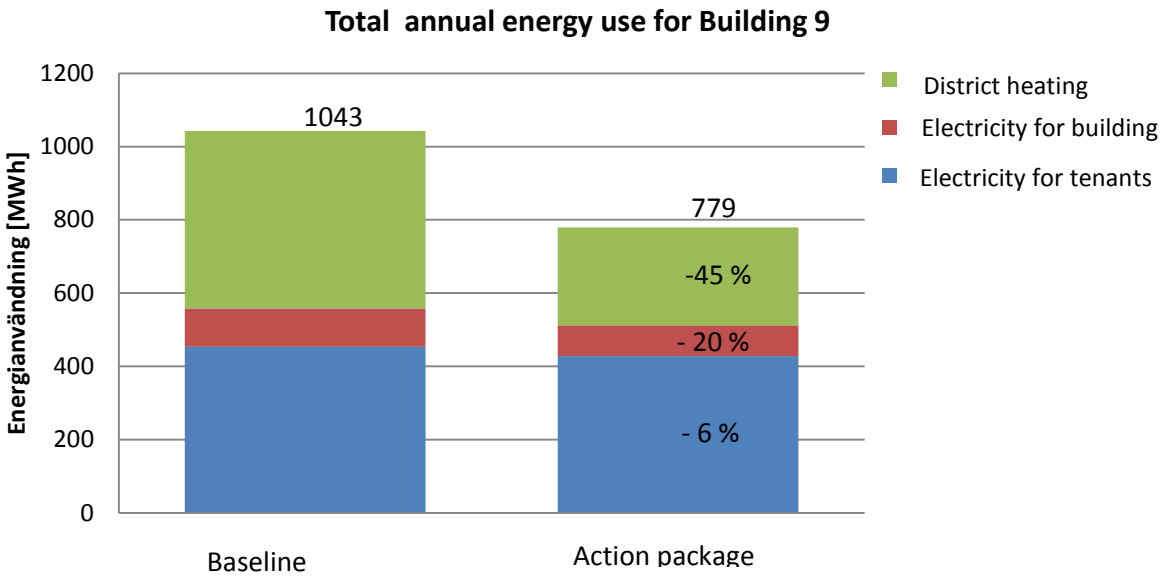
Five energy saving measures were identified during the auditing. All of them are included in the action package that meets the property owner's profitability requirements. Additionally two measures are proposed for improving indoor climate and for assuring that heat energy measurements can be carried out in the future.

It is proposed to: replace most of the existing HVAC-systems (two separate measures), replace most of the existing lighting system, replace five large doors and add extra insulation on the façade. Since the proposed measures will also be carried out as part of the property maintenance plan, therefore only part of the investment cost is included to the costs for energy efficiency improvement.

Summary of the action package

	Measure	Investment cost kSEK	Cost saving kSEK/yr	Total energy saving MWh/yr
1	M3. Replacement of five large doors	0	18	24
2	M1. More energy efficient lighting in production zones	60	14	12
3	M4. Replacement of LB01 (comfort vent) and reduced airflows	740	90	125
4	M2. Extra insulation on facades	792	78	104
5	M5. Reconstruction of process ventilation	400	7	7
-	Sum	1993	209	274





Results

The total energy saving is approximately 25 % compared to a reference level (baseline). District heating use can be reduced by 45% and electricity use for building operation by 20% and electricity for tenants by 6%. The total specific annual energy use of the property will be about 96 kWh/m² yr incl. tenants. Total annual costs savings will be about 203 kSEK/yr. Energy investment cost for the proposed action package is ca 1 993 kSEK.

Internal rate of return for the proposed action package is about 11 %. Property owners profitability demand is 5,7 % and the estimated relative energy price increase is about 2%.