Property name: Lyngby Port
Property owner: Nordea Ejendomme
Consultants: Rambøll Danmark

Total Concept method

Step 1. Creating the action package

Building and its use

Year built: 1992
Area: 20 630 m² of heated area
Type of building: Office building

Lyngby Port is an office building in portfolio of a Danish property company Nordea Ejendomme. The building is built in 1992 and divided into 3 building segments; A, B and C at Lyngby Hovedgade 94, 96 and 98 - each of them has main meter installed. Lyngby Port has 7 floors including basement. Segment A has 7 floors, B has 6 floors and C has 5 floors. In the basement an unheated parking area is located. From the center main building three "fingers" stretches out and contains most of the office area. Fingers do not have heated basement. Main "body" or "bow" of the building contains main part of technical rooms and restrooms.
The building consists of cell offices grouped in modules. The intensity of occupancy is around 25m2/pers. The office building Lyngby Port, with several tenants, is being prepared for a new tenant in larger parts of the building. It is expected that there will be a general change from cell offices to more open office areas, supporting a higher number of employees.

Indoor climate

Nordea Ejendomme has informed that the overall indoor climate is with acceptable air quality, lighting and noise reduction, typical for buildings from that time. During summer period temperature in the offices is often too high.

The simulations show that 6% of all rooms can experience high temperatures during summer. All the rooms are situated in the "Finger" part of the building.

It is concluded that the installed diffusers do not work as designed – supply temperatures under 19˚C causes draught and therefore limits the cooling capacity of the system, which would be increased with lower supply temperatures. The diffusers are mounted incorrectly in the suspended ceiling – the cold air falls down and causes drought among employees.

There has been no earlier assessment of the indoor climate. Indoor climate for the new renovation is specified as class B (operative temperature, draught, air quality) or better according to EN15251.

The status of the building and its technical systems before measures

Building envelope

The building envelope consists of flat roof isolated with roughly 300mm mineral wool all over. Balcony is isolated with 200mm mineral wool.

Most off outer walls are made as masonry with 45mm spacing. Outside is covered with bricks, inside with aggregated concrete and 190mm mineral wool as isolation between. Basement walls towards earth are made with 40 mm concrete and 100 polystyrene plate on the inside of the wall. Basement wall towards non heated area is built the same, but with mineral wool as isolating material instead.

Windows used are 2- and 3-layer thermo windows. The windows are simulated with only air and not argon in the cavity, as it is estimated that most of this gas has evaporated during the last 20 years, which gives a minor increase in the U-value. Most windows are mounted with inner sun screening.

Basement flooring is constructed in concrete. 200 mm expanded clay aggregate towards the dirt.

Heating

The main heating system consists of radiators in all heated rooms. Basement under the building (storage, bath, etc.) is treated as heated area.

For heating two boilers from DANSTOKER are installed. It is evaluated that efficiency of the boilers is 84%.

Heat distribution piping is done with a two-string supply system, going from basement to roof. Technical rooms are placed in the unheated parking basement, so part of the distribution is through basement. Mixing plants are placed in technical rooms in basement and in roof houses A and B.

EMO-repport states that domestic cold water use is 1800 m³ pr. year. It is assumed that 30 % of this corresponding to 540 m³ pr. year is domestic hot water.

Ventilation

The buildings ventilation system is divided into 6 VAV- systems with heat recovery (71-74%) and 6 exhaust systems with no heat recovery. The 6 exhaust systems; 1 for cooling technical room; 2 for kitchens; 1 for labs and printer rooms; 1 for fume cupboard. All systems are approximately 23 years old and in good condition. It is though evaluated that efficiency of fans and heat recovery has dropped by approximately 10%.

The air distribution works with a variable flow rate CTS-system. Constant air pressure in air ducts. Ducts are approximately same age and condition as ventilation system.

There is exhaust ventilation in parking basement.

Cooling

The cooling system consists of 2 compressor-/water cooling-systems with 6 cooling units with an average COP=2.5 and is in very poor condition. Chillers are used for distribution. There have been no changes since construction. Cooling central is placed in basement parking area. Mixing plants are placed in basement C and roof houses A and B. The building is cooled through the ventilation air.

Lighting

The lighting systems vary, depending on the location in the building and it is as follows:

- Staircases (energy saving light bulbs with PIR sensors)
- Corridors (energy saving light bulbs, no sensors)
- Canteen (halogen spotlights, no sensors)
- Offices:
  - Bank (compact fluorescent light and energy saving bulbs, no sensors)
  - Court (compact fluorescent light and energy saving bulbs, no sensors)
  - Other offices (compact fluorescent light; 216W/module)

Equipment

The equipment in the building is typical office equipment and corresponds to around 100W/pers. There is no server room or kitchen in the building.

Control and monitoring system(s)

Nordea Ejendomme informs that BMS though does not work correctly and needs an upgrade in connection with the renovation.
Because of a very limited temperature deadband for ventilation system and draught problems there is a high risk for simultaneous heating and cooling throughout the year.

Energy and resource use before measures

The calibrated model showed correspondence between measurements and simulation model. However the assumptions do not reflect future use, with a higher person load in section A and C of the building. This is based on 20% more people in the A section of the building. The B section is adapted with same load per square meter. The result of the higher person loads is that several rooms will have higher operative temperatures than existing fit-out. It is therefore necessary to lower ventilation inlet temperature from 19˚C to designed 17˚C. This change increases energy consumption in comparison to existing building.
The baseline model is therefore carried out with higher person load and minimum supply temperature 17˚C.

Specific energy use before measures	131 kWh/m²,Year
Whereas	
Heat energy	77 kWh/m²,Year
Electricity for building operation (cooling, ventilation, lighting in parking)	25 kWh/m²,Year
Electricity for tenants	29 kWh/m²,Year

Identified energy saving measures

The following measures were identified:

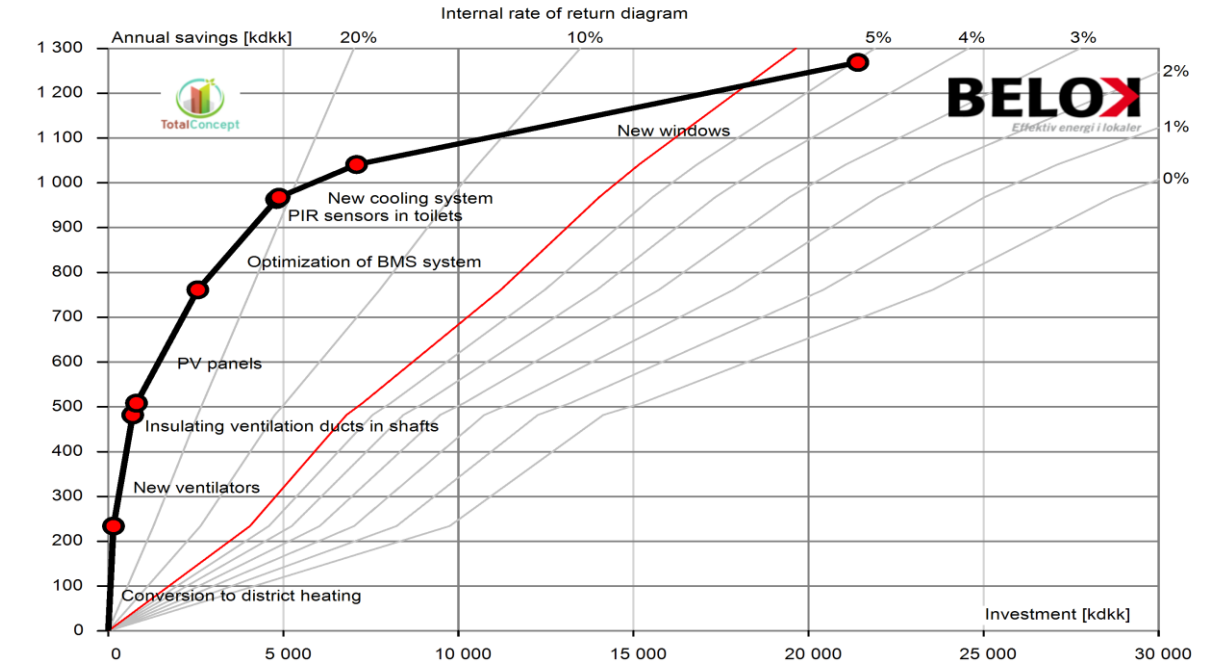
1. Conversion of natural gas boilers to district heating
2. Replacing existing cooling machine
3. Isolating ventilation ducts in the shafts
4. Replacing fans in ventilation units.
5. Optimization of BMS system, including heating, lighting, ventilation and solar shading.
6. Lighting sensors in toilets, corridors and technical rooms.
7. Photovoltaic
8. Replacing existing windows and solar shading

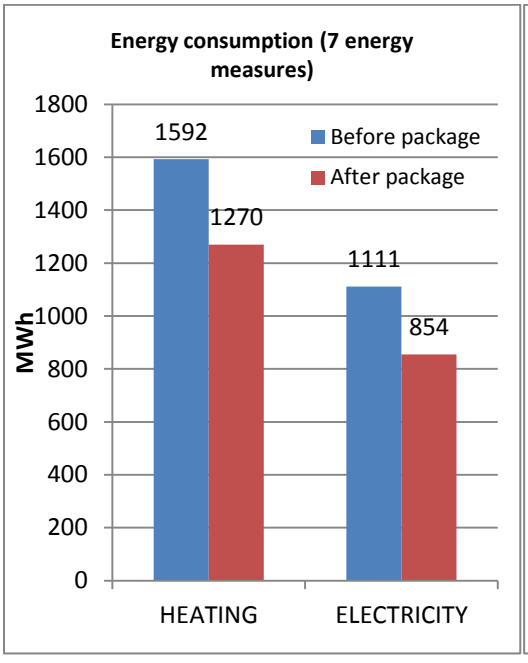
Following measures are not seen as potential energy saving measures

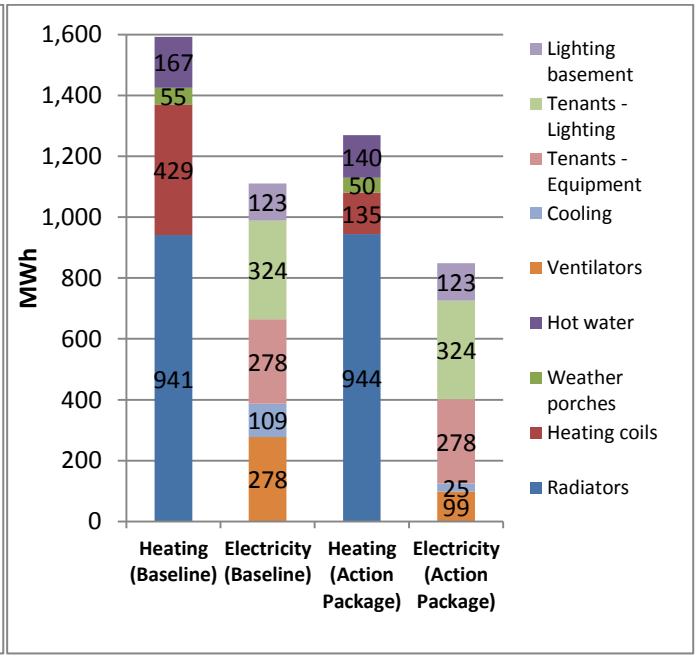
- Exchange of pumps as described in earlier energy certificate was performed last year, and therefore not a potential energy saving measure.
- Installed lighting effect is already rather low, and is not included as a potential energy saving measure.

Summary of the measures in the action package

There have been 8 energy measures analyzed and the action package including 7 measures has been created. As shown on the graph, 1 energy measure (new windows) is situated below 6% threshold for internal rate.







The energy saving for the package that fulfills the owner internal rate of return is 20% for heating and 23% for electricity. The graph also shows that reduction for the common electricity is around 50%. The electricity for tenant's energy consumption is a fixed value.