

SOLBRÅVEIEN OFFICE CENTER, ASKER

1. INTRODUCTION

PROJECT SUMMARY

Year of construction: 1980 and 1982

Past energy renovations: None

SPECIAL FEATURES

Building envelop

- *Interior insulation and a high insulated glass façade system with passive house windows*
- *Additional insulation of the roof*

Building Service System

- *Use of existing ducts and active supply air terminal devices*
- *Ventilation with heat recovery (85%) and low SFP*
- *Demand controlled ventilation and lighting system*
- *Air/water heat pump*

CONTRACTOR

Cooperation between GK Norge AS and Moderne Byggfornyelse AS

OWNER

Solbråveien Eiendom KS through Banco Management

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IEA SHC Task 47

Renovation of Non-Residential Buildings towards Sustainable Standards

2. CONTEXT AND BACKGROUND

BACKGROUND

Office building with tenants
BRA 10386 m²

Low tenant rate
High energy use
Ineffective area for the tenants
Outdated technical system
Need for a general renovation

OBJECTIVES OF THE RENOVATION

Overall goals for the project are:

- Higher Energy Label B
- Norwegian low energy class

Higher energy performance certification
More area efficiency
Lower operating cost
Better design of the offices

More attractive, higher tenant rate/higher rent

SUMMARY OF THE RENOVATION

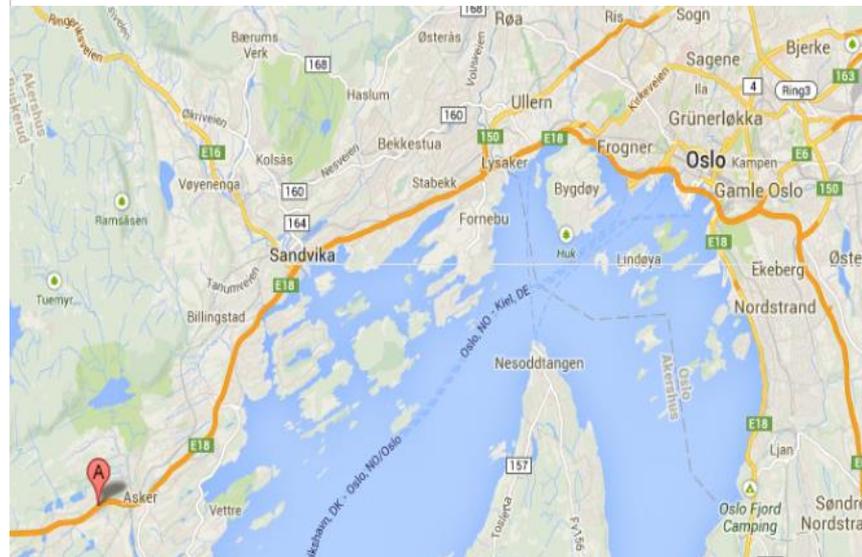
60% reduction of the energy use
Higher indoor air quality



Before



After



Location:

25 km outside
Oslo centre

Just by the
highway (E18)

1 km to the train
station

3. DECISION MAKING PROCESS

Building owner initiated the project together with GK Norge and Moderne Byggfornyelse.

The building owner wanted a retrofit "as good as possible."

The existing tenants moved out and it was necessary with an extensive upgrade to make the building attractive for potential new tenants.

The first upgrade was made on ventilation and the energy distribution system, only in one part of the building.

The decision of the envelope renovation was made afterwards. An integrated solar system in the façade was also evaluated, but abandoned due to cost.

Contract based on total enterprise after project development in interaction with the building owner and subcontractors in an already established cooperation from earlier projects with the same contractor.

The project was divided into two actions:

Initial plan – Energy class B, low energy class:

- *Air to air heat pump*
- *Ventilation with heat recovery (85%) and low SFP*
- *Use of existing ducts and active supply air*
- *Demand controlled ventilation and lighting system*
- *New windows (1.0 W/m²K) with internal shading*
- *Additional insulation on all roofs (0.1 W/m²K)*
- *Additional insulation on staircase rooms and gables (0.2 W/m²K)*

Revised plan:

- *Interior insulation and a high insulated glass façade system with passivhouse windows.*
- *Additional insulation in the roof*

Timeline for the decision making process



4. BUILDING ENVELOPE

Wall construction:

Materials . (Interior to exterior):

Prefabricated façade system: Schüco 50

Under window:

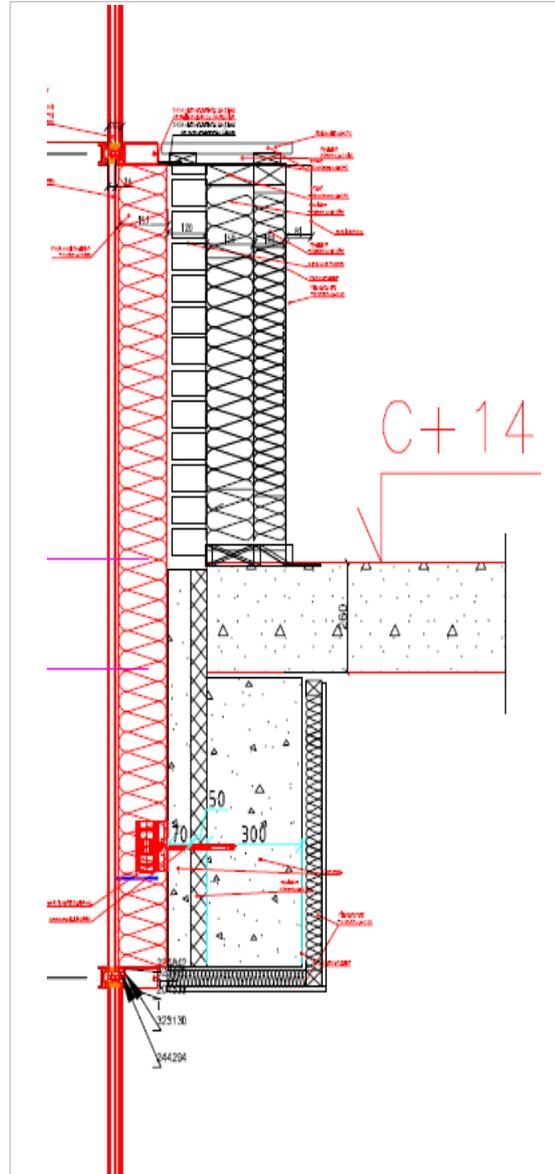
Gypsum board	13 mm
Vapour barrier	
Mineral wool (new)	100 mm
Mineral wool (existing)	150 mm
Masonry wall (existing)	250 mm
Rock wool insulation (new)	120 mm
Air space	20 mm
Glass facade	26 mm
Total	590 mm

Over window:

Gypsum board	13 mm
Mineral wool (new)	50 mm
Vapour barrier	
Concrete wall (existing)	300 mm
Insulation(existing)	50 mm
Concrete wall	70 mm
Rock wool insulation (new)	120 mm
Air space	20 mm
Glass facade	26 mm
Total	650 mm

Summary of U-values [W/m²K]

	Before	After
Roof/attic	0,20	0,13
Floor/slab	0,12	0,12
Walls	0,27	0,16
Windows	2,64	0,9



External insulation with 120 mm mineral wool, wind barrier, air space and glass facade.

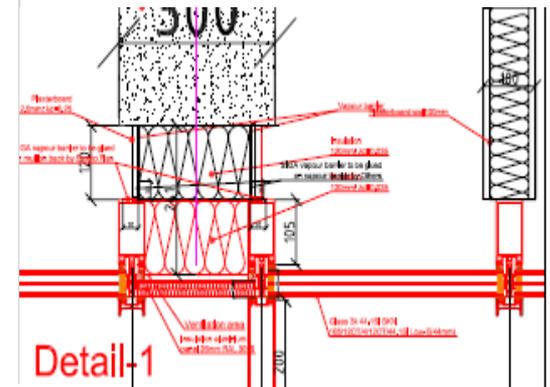
Interior insulation with 100 mm mineral wool, vapour barrier and 13 mm plasterboard.

Sun reflecting glass to the southeast.

Southeast facade: Glass type 8 mm SKN 165-15g-4-15g-44,1 Ultra Science
Rw+Ctr=39dB U-value 0,6

Other facades: Glass type 6mm SKN 165-15g-4-15g-44,1 RW+Ctr=36dB U-value=0,6

Insulation in cavity under the wooden roof. Thickness 200 mm.



5. BUILDING SERVICES SYSTEM

OVERALL DESIGN STRATEGY

LIGHTING SYSTEM

T8 changed to T5

HEATING SYSTEM

Existing electric heater replaced by a air/water heat pump and replaced old electric ovens to more effective demand controlled ones.

COOLING SYSTEM

Cooling tower and ice water machine replaced with heat pump/cooling machine.

VENTILATION

Constant airflow (CAV) replaced with demand controlled ventilation (VAV) with active supply air terminal devices.

HOT WATER PRODUCTION

The central heating replaced with local hot water heating.

RENEWABLE ENERGY SYSTEMS

- New air/water heat pump

Demand controlled ventilation diffuser



Ventilation

The existing shafts was used.

90-95 % of the ventilation ducts were cleaned.

Active air supply with integrated regulation using detectors and temperature sensors for room and duct temperature.

Variable opening enables constant inflow velocity.

It can also be connected to CO₂-sensors.

6. ENERGY PERFORMANCE

Energy performance (kWh/m²)

Total Calculated Delivered Energy*:

Before: 204 kWh/m²

After: 78 kWh/m²

Total Calculated Net Energy Demand*:

Before: 218 kWh/m²

After: 64 kWh/m²

Energy cost (NOK)

Before: 2,75 mill.NOK (335 k€)

After: 0,88 mill.NOK (107 k€)

Primary energy consumption:

Electric and preheated supply air with heat pump.

*Norwegian standard including standardized internal loads

Calculated energy

		Before	After
HEATING			
Net energy heating demand	[kWh _{therm} /m ² a]	91.0	20.3
Delivered energy use	[kWh _{fin} /m ² a]	92.9	33.2
COOLING			
Net energy cooling demand	[kWh _{therm} /m ² a]	25.2	7.0
Delivered energy use	[kWh _{fin} /m ² a]	10.1	7.0
VENTILATION			
Delivered energy use	[kWh _{fin} /m ² a]	33.1	8.6
LIGHTING			
Delivered energy use	[kWh _{fin} /m ² a]	25.6	15.7
TOTAL BUILDING USE			
Delivered energy use	[kWh _{fin} /m ² a]	171.2	58.7
APPLIANCES/PLUG LOADS			
Delivered energy use	[kWh _{fin} /m ² a]	35.2	18.8

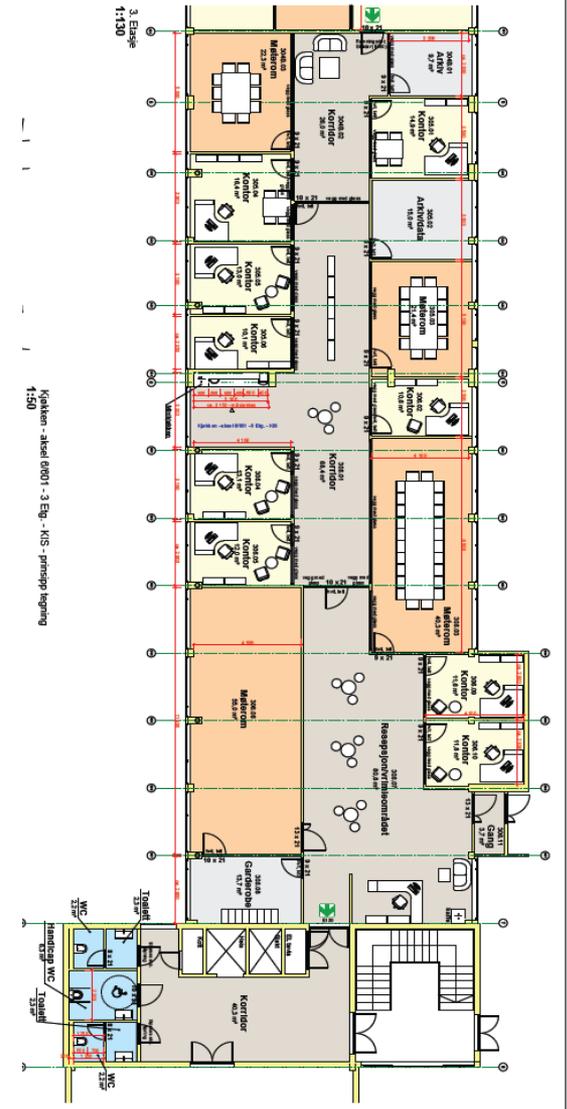
7. ENVIRONMENTAL PERFORMANCE

- Certification/Labels
 - Low energy class 1
 - Energy Building Performance Certification: Class B (Yellow in the Norwegian heating grade. 62% use of direct electricity)
- Indoor climate
 - Individual temperature regulation by CO₂ and indoor temperature
- Increasing quality of life
 - More steady and better indoor environment
 - Increased space in the cell offices due to removal of window installations. Total increase: 150 m² BRA
- Lighting quality
 - Demand controlled lighting

Before



After



8. MORE INFORMATION

RENOVATION COSTS

- Total cost 115 mill.NOK + tax
(14,4 mill EUR)
- Split between extra investment for energy savings
- Additional cost, upgrading to EBPC class B estimated to 8 mill NOK + tax
- Subsidized products for demo: No

FINANCING MODEL (EUR)

Enova	0,6 mill
Loan	11,2 mill
Equity	2,6 mill

The Enova grant is on the basis of the first action, with energy class B and low energy classification.

OTHER INTERESTING ASPECTS:

Summer 2013: 90% of the space is rented.

