Center 2 renovation

Arne Damsgaard Olsen/2015-10-26

ROCKWOOL®
FIRESAFE INSULATION

CREATE AND PROTECT®

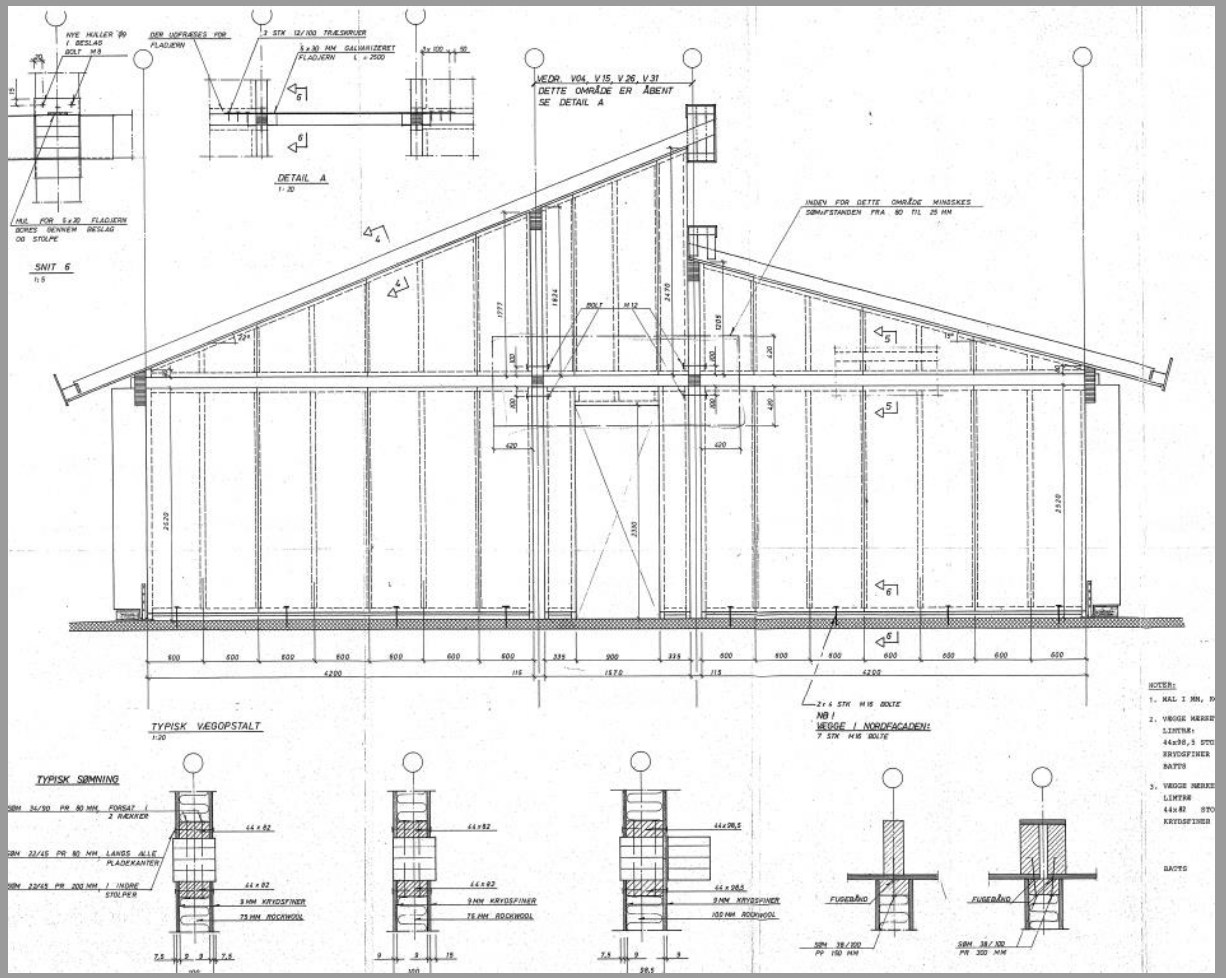
Agenda

1. Background and aim
2. The team
3. Data sheets and actions
4. Constructions
5. Indoor climate
6. Interior design and workplaces
7. Economy
8. Measured energy consumption

1. Background and aim

The office building was built in 1979. The work places were outdated and the energy performance and indoor climate were far below the current standard.

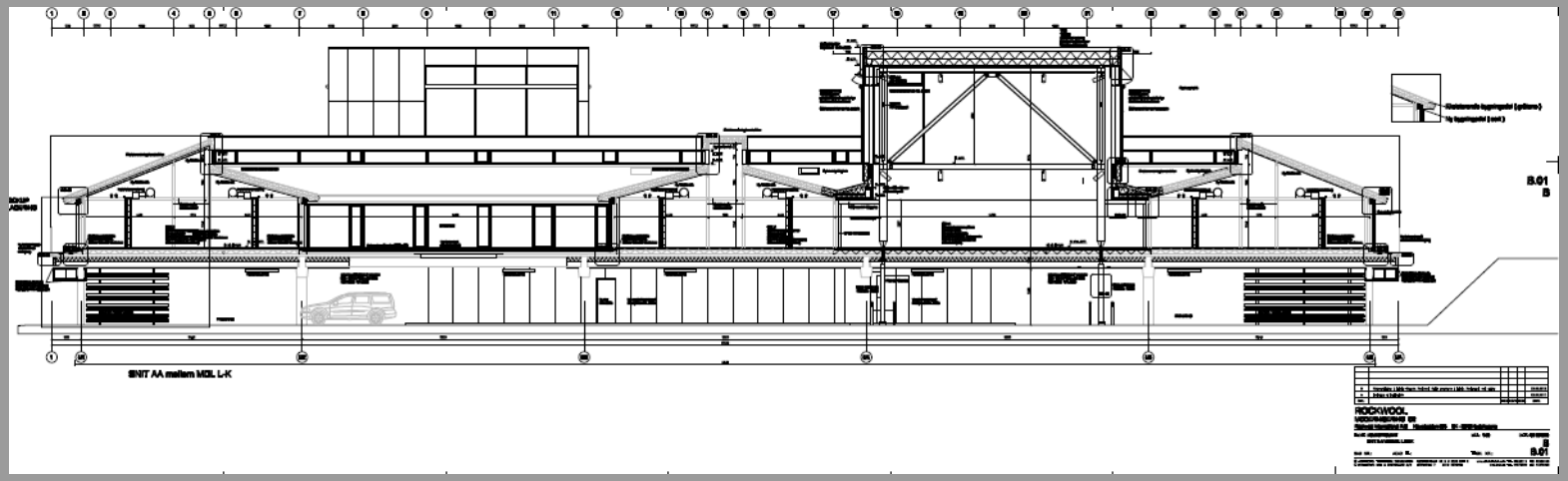
The existing construction



2. The team

Building owner: ROCKWOOL International A/S

Architect: Vandkunsten A/S
Engineer: MOE A/S
Contractor: Jakon A/S



3. Data sheets and actions

Renovated to low energy class 2015: 41 kWh/m²/year

Item	unit	Existing Centre 2	After renovation
Area	m²	3133	3626
Green gardens	no	4	2
Atriums	no	0	2
Total energy consumption	kWh/m²/year	264	38,5
Total saving	%		85
Workplaces	no	120	120

Building codes:
Danish energy requirements for new buildings

	Offices	**Offices**	**Offices**
	2010	2015	2020
Energy class	kWh/m² / year	kWh/m² /year	kWh/m² /year
Heating, cooling, hot water, electricity	**72**	**41**	**25**

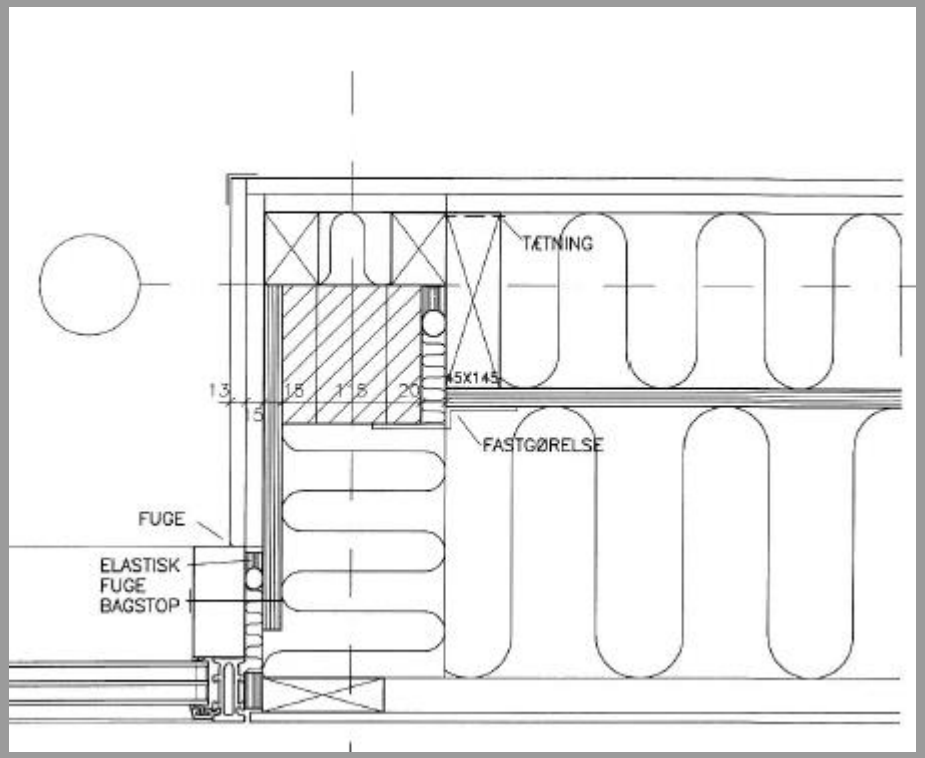
EEC 1990-2020 plan: **Reduction of CO2 emissions with 20 %**
EEC 1990-2030 plan: **Reduction of CO2 emissions with 40 %**

Actions:

- New facades with 395 mm ROCKWOOL-FlexSystem: (U-value: 0,08 W/m²K)
- New 3 layer windows (Outrup windows with high density ROCKWOOL frames U-value 0,75 W/m²K)
- Extra 180 mm Hardrock insulation and granulate in the parking deck (total 450-850 mm ROCKWOOL insulation; U-value: 0,06 W/m²K)
- LED electrical light
- Mechanical ventilation with heat recovery (84 %) and cooling
- Natural ventilation in the top of the building
- Heat pumps (2x75 kW) with 15 vertical 150 m deep wells
- 86 m² heat collector for hot water (production 2,5 kWh/m² year)
- 170 m² PV (production 19,5 kWh/m² year)
- The renovated building will be EEC-ECO-Life certificated.

4. Constructions

Facade: U-value: 0,08 W/m²K



Gypsum board
Fermacell board

145 mm ROCKWOOL
A-Flexi Batts

Plywood

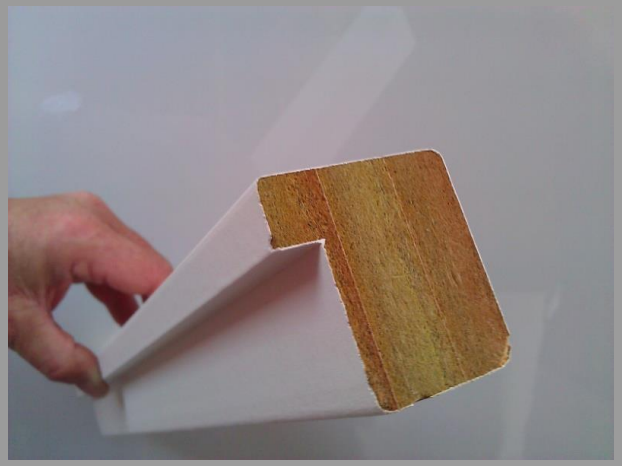
250 mm ROCKWOOL
FLEXSYSTEM batts

Rockpanel board

Outrup windows and doors

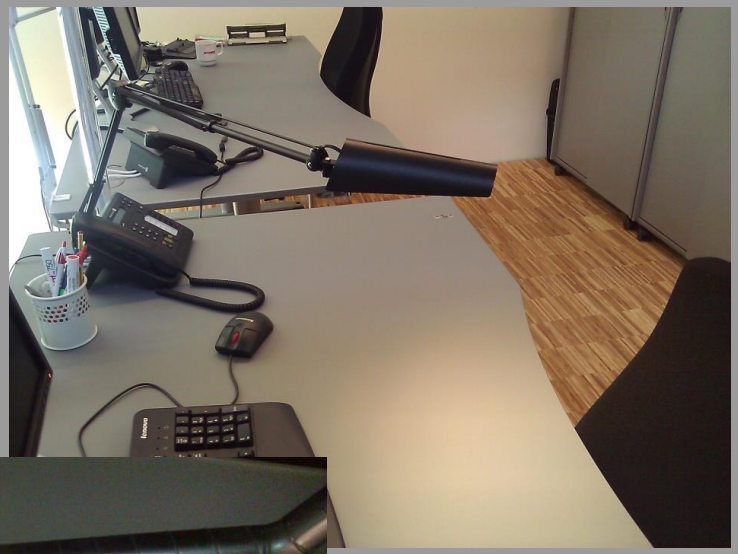
U-value: 0,75 W/m²K

Frames made of ROCKWOOL



Insulation parking deck and floor: U-value: 0,06 W/m²K

LED electrical light (and other low energy light):



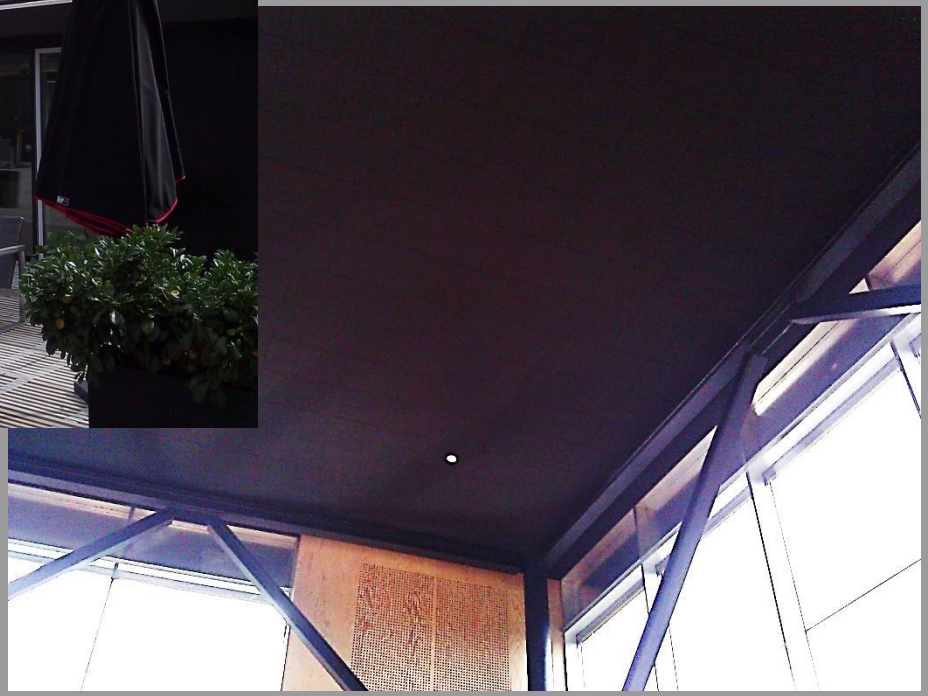
Heat pumps (2x75 kW) with 15 vertical 150 m deep wells

86 m² heat collector for hot water (production 2,5 kWh/m² year)
170 m² PV (production 19,5 kWh/m² year)

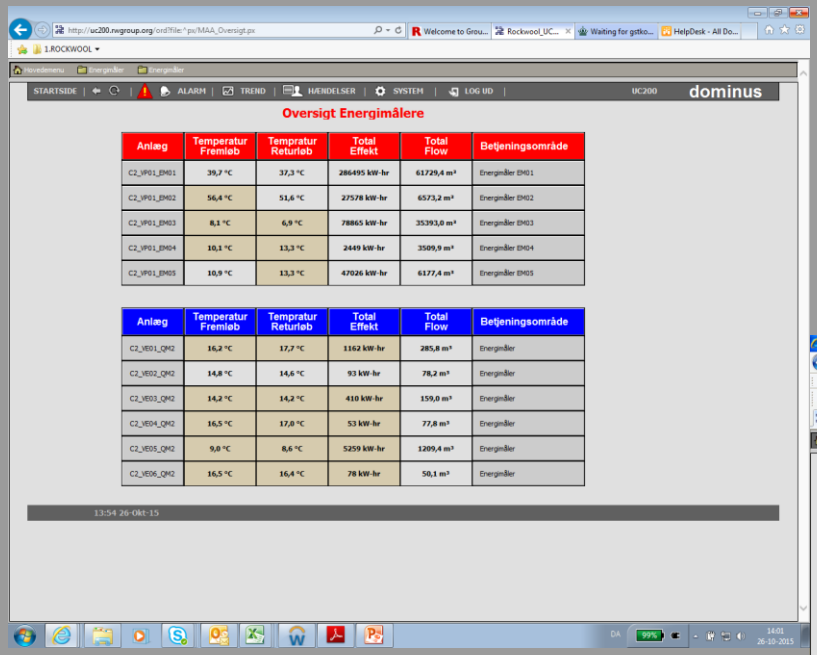
5. Indoor climate

Mechanical ventilation with heat recovery (84 %) and cooling
Indoor climate: Class A

Natural ventilation in the top of the building



CTS controlsystem



Anlæg	Temperatur Fremløb	Tempratur Returløb	Total Effekt	Total Flow	Betjeningsområde
C2_VP01_EM01	39,7 °C	37,3 °C	286495 kW-hr	61729,4 m³	Energimåler EM01
C2_VP01_EM02	56,4 °C	51,6 °C	27578 kW-hr	6573,2 m³	Energimåler EM02
C2_VP01_EM03	8,1 °C	6,9 °C	78865 kW-hr	35393,0 m³	Energimåler EM03
C2_VP01_EM04	10,1 °C	13,3 °C	2449 kW-hr	3509,9 m³	Energimåler EM04
C2_VP01_EM05	10,9 °C	13,3 °C	47026 kW-hr	6177,4 m³	Energimåler EM05

Anlæg	Temperatur Fremløb	Tempratur Returløb	Total Effekt	Total Flow	Betjeningsområde
C2_VE01_QM2	16,2 °C	17,7 °C	1162 kW-hr	285,8 m³	Energimåler
C2_VE02_QM2	14,8 °C	14,6 °C	93 kW-hr	78,2 m³	Energimåler
C2_VE03_QM2	14,2 °C	14,2 °C	410 kW-hr	159,0 m³	Energimåler
C2_VE04_QM2	16,5 °C	17,0 °C	53 kW-hr	77,8 m³	Energimåler
C2_VE05_QM2	9,0 °C	8,6 °C	5259 kW-hr	1209,4 m³	Energimåler
C2_VE06_QM2	16,5 °C	16,4 °C	78 kW-hr	50,1 m³	Energimåler

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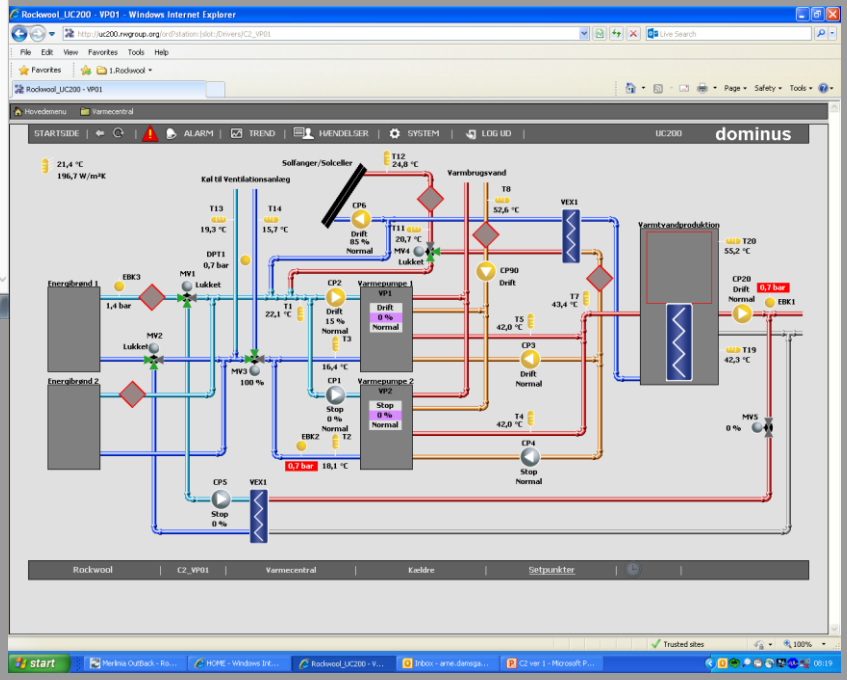


Rockfon ceilings

6. Interior design and workplaces

Layout

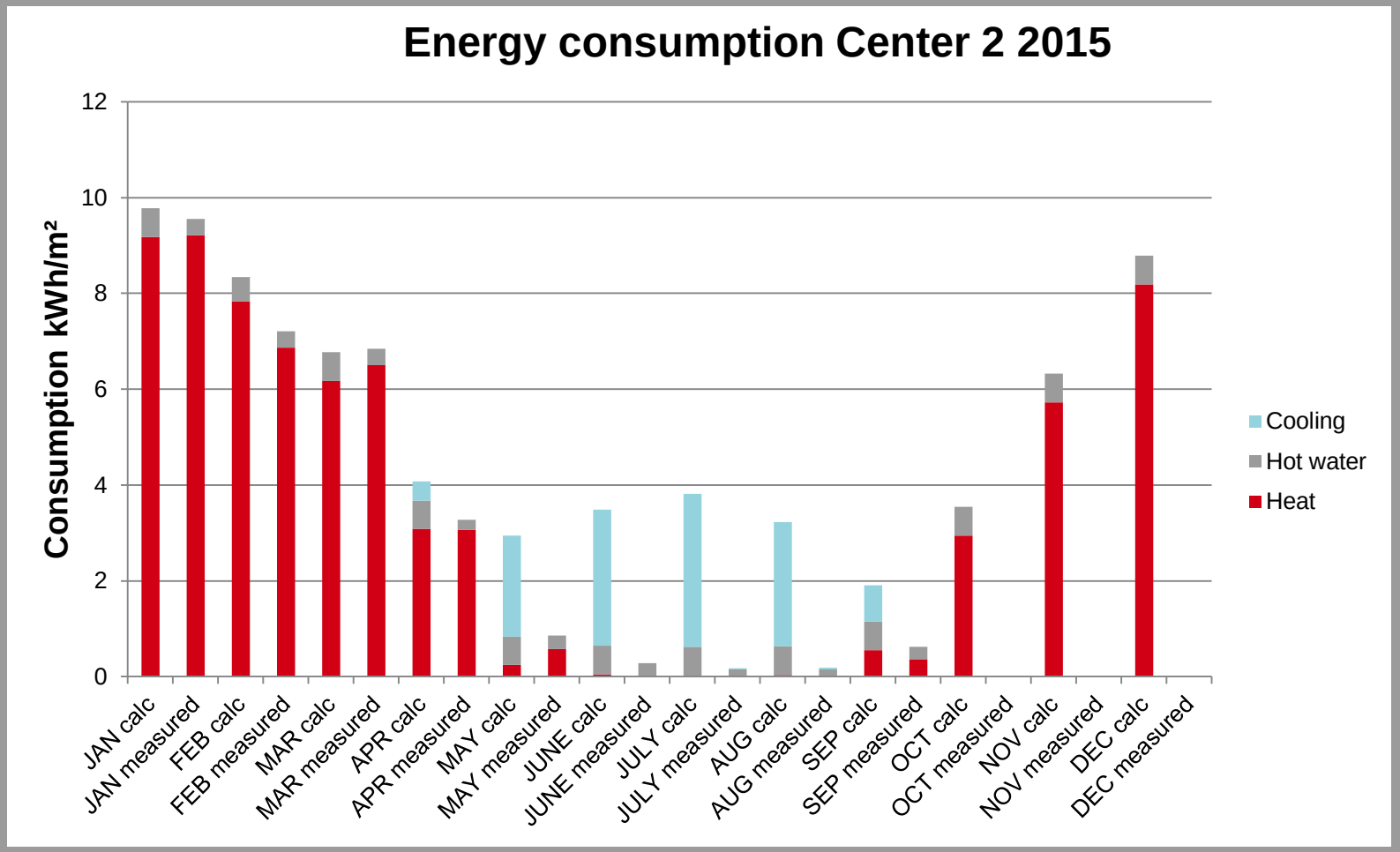
7. Economy

Building renovation costs including consultancy	kr./m²	EUR/m²
Total costs excluding furniture	16700	2241
Total costs for energy renovation only (including mold and fungi repair)	9700	1300
Building costs for a new building	**kr./m²**	**EUR/m²**
New building including parking cellar	25000	3350
Difference in costs new building and renovated building	8300	1100
Saving in renovation or building new	**30 mill. kr.**	**4 mill. EUR.**

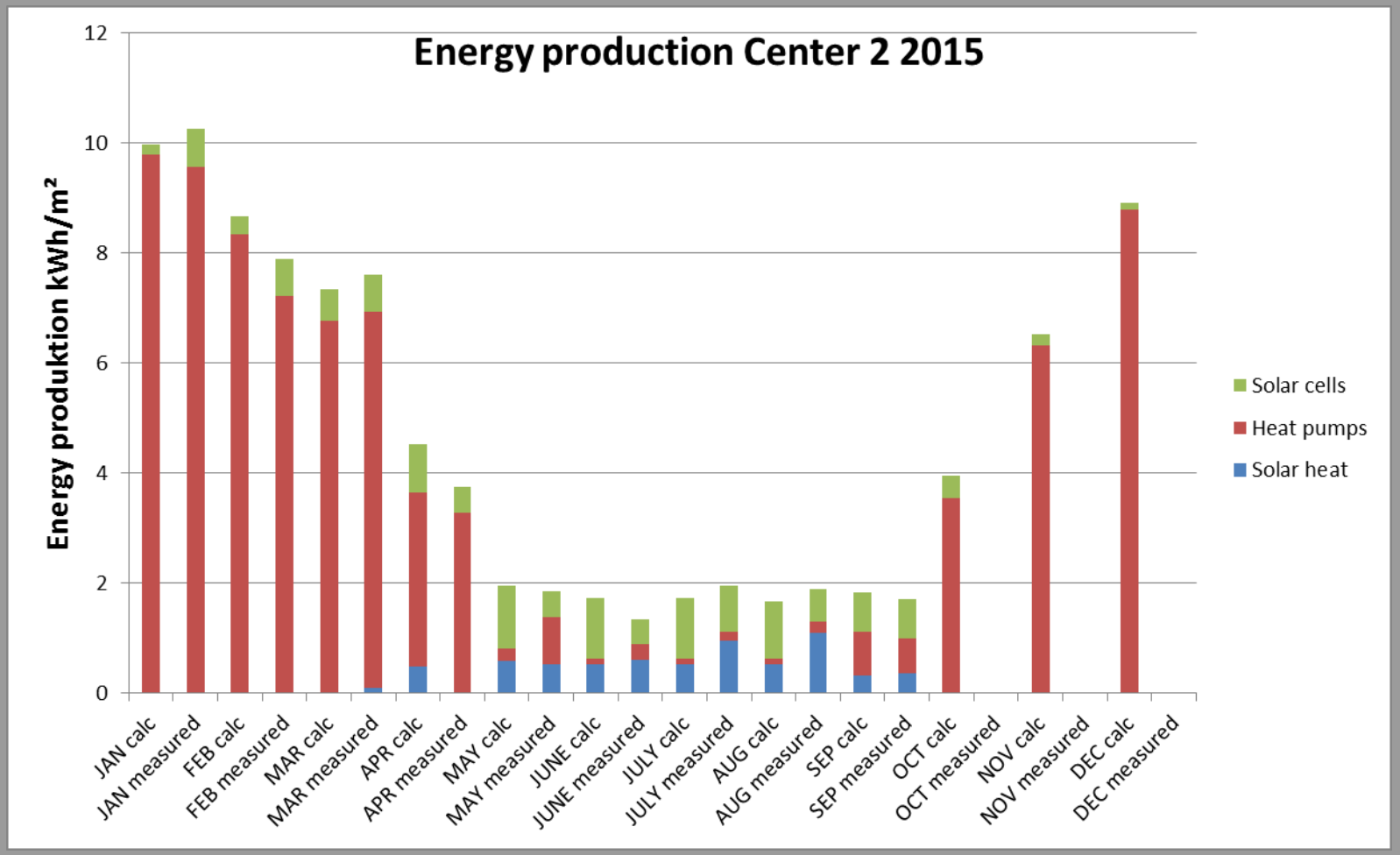
Costsavings and pay back

Cost savings (energy renovation costs only)	
Energy costs before (heating, cooling, light, hot water)	1,0 mill kr./year
Energy costs after	0,2 mill. kr./year
Payback	41 years

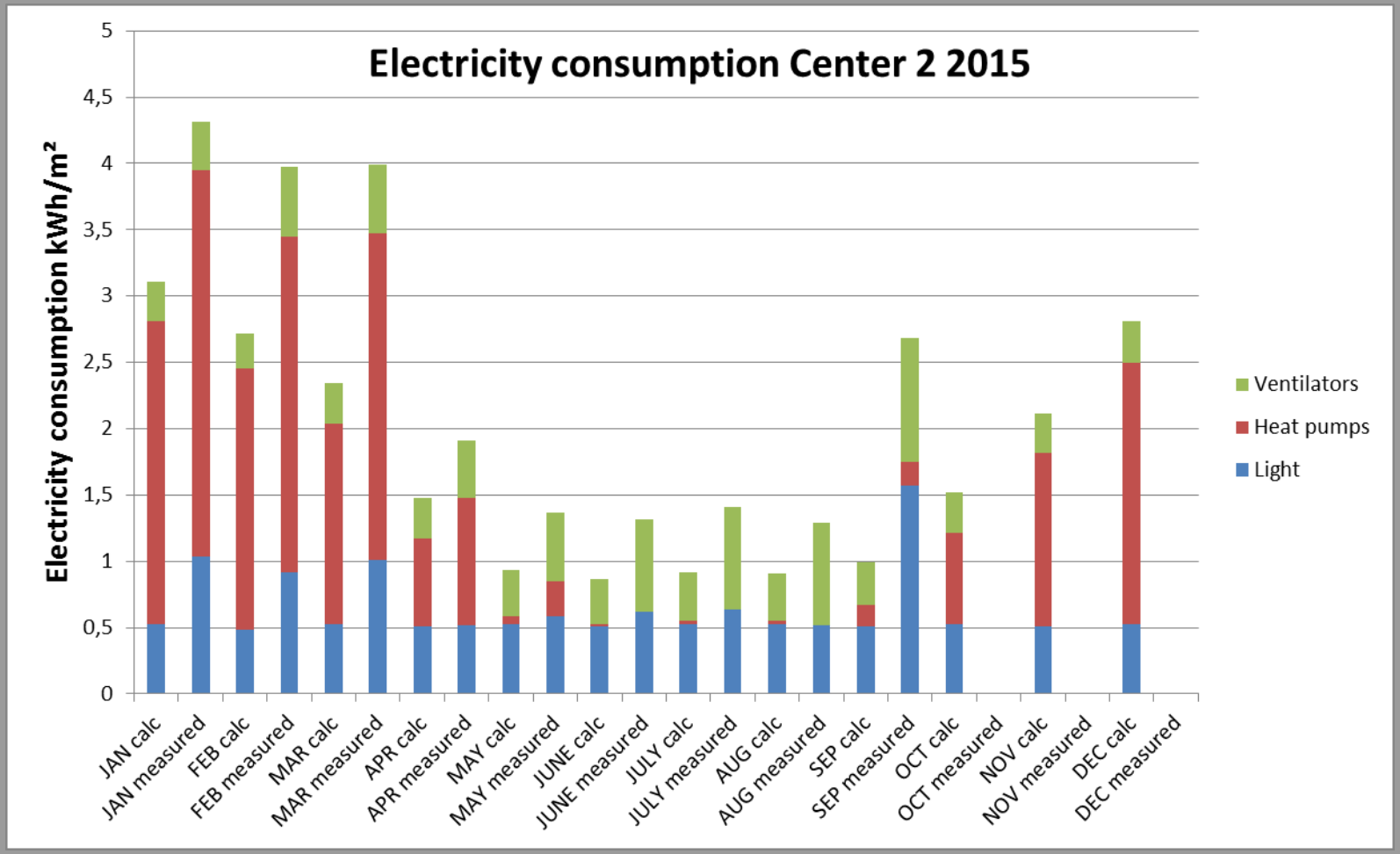
Measured energy consumption JAN-SEP 2015
Corrected to standard year climate



Energy production JAN-SEP 2015
Corrected to standard year climate



Electricity consumption JAN-SEP 2015
Corrected to standard year climate



Main conclusions and comments:

January-September 2015:

The energy consumption was 28 % lower, and the *energy production* was 3 % lower than calculated with BE10 (Danish building code software program).
The result is within the uncertainty for this kind of measurements.

Electricity consumption was 31 % higher than calculated with BE10.
The main reason for this is that the efficiency (the COP factor) of the heat pumps has been to low (factor 2,75 against the theoretical factor 3,43).
Actions to improve this are on going.