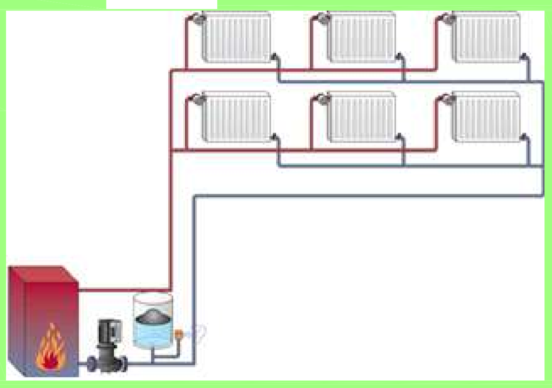
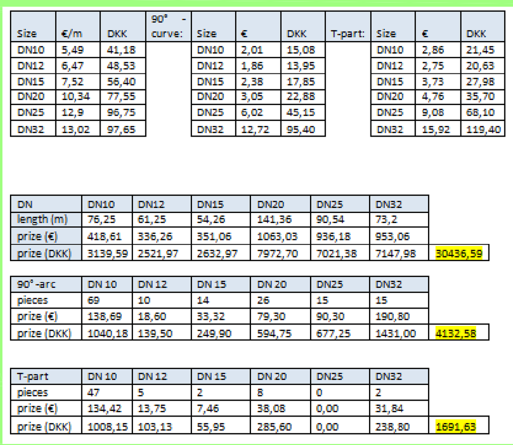
ENERGY DESING AND ANALISIS OF AN INDUSRIAL BUILDING IN HORSENS

RADIATORS

DESIGN



PIPES AND PRICES

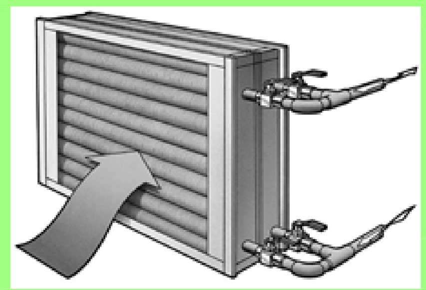


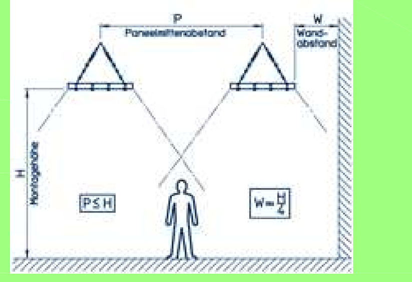
PUMP

The system consists of 3 circles with one pump each. We chose the Danish company Grundfos which produces high efficiency pumps which are worldwide in use.
Two Grundfos ALPHA2 15-40 130 supply the office area.

2x1795DKK

The storage area is supplied with a Grundfos ALPHA2 15-60 130.
1x2107DKK





5. ELECTRICITY REQUIREMENTS

After had taken in count at the light requirement and put a suitable system of lightening in each rooms, the total requirement in electricity use for lightening is value at 22700 kW per year in the office. So, 28,2 kWh/m2 per year. And after do the same in the storage the total requirement is value at 8900 kW per year. So,11,7 kWh/m2 per year. The total annual consumption is 31600kWh per year.

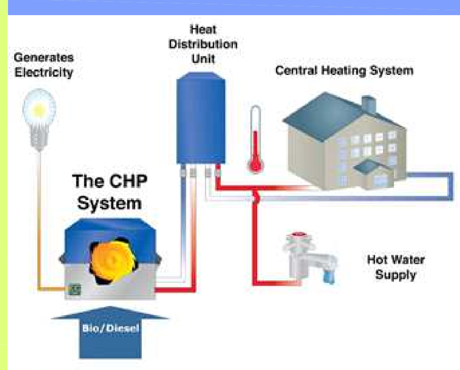
The office part has an additional electric consumption because of the electric staff like 35 computers for the employer, 12 printers, 11 screens, all of the tools for using in a canteen etc... The calculation for this consumption is done for the average time of the tools utilization. Example one computer is use around 8 hours by day at a power about P=144W only the fridge is used all time including the night with an average power of P=175W. Finally after add all of the electronic tools consumption the annual energetic demand for this is 94823kWh. So, 117,8kWh/m2 per year. The additional electricity in the storage part is negligible.

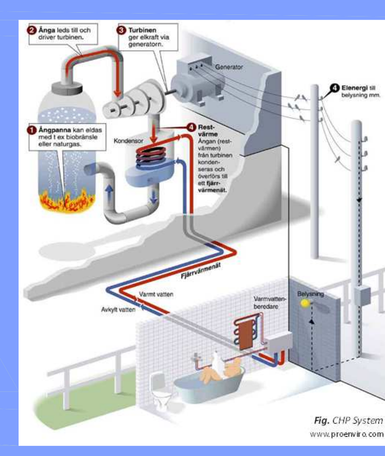
So the **global specific electric demand is about 126423 kWh per year** for all of the building. The picture on the right come from the BE10 program and represents the energetic requirement in the office part in kWh/m2. As it´s possible to see on it this demand can increase depending about the energetic system which will find.

Selected electricity requirements	
Lighting	28,2
Heating of rooms	0,0
Heating of DHW	0,0
Heat pump	0,0
Ventilators	0,0
Pumps	0,0
Cooling	0,0
Total el. consumption	146,0

6. ENERGY SOURCES

DISTRICT HEATING





FOSSIL BOILER

DOMESTIC HOT WATER PRODUCTION

First of all I decided to produce the domestic hot water independent of the heating boiler.
The reason for this decision is that in offices the consumption of domestic hot water is not very high.
This could cause hygienic problems with legionella. A way to avoid hygienic problems would be to have a long circle with a circulation pump to provide the hot water quickly and keeps the water flowing. The chosen solution includes a continuous hot water heater for the canteen and a continuous hot water heater with 30 liter storage for the showers and toilets. The heater – storage combination can be mounted outside of the office area in the storage wall and supply ground and first floor with short ways.
The chosen models are:

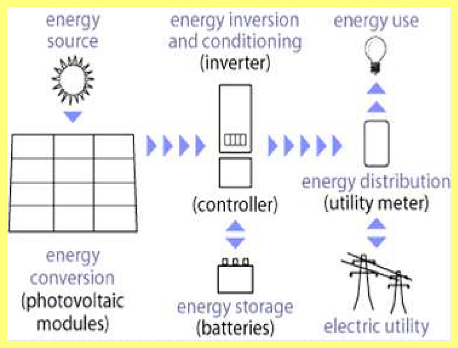
Vaillant miniVED H 3/1N	2,0l/min	3,5kW	95€/ 712,50DKK
Vaillant VEN/H 30/2	30 liter	2kW	453,50€/ 3401,25DKK

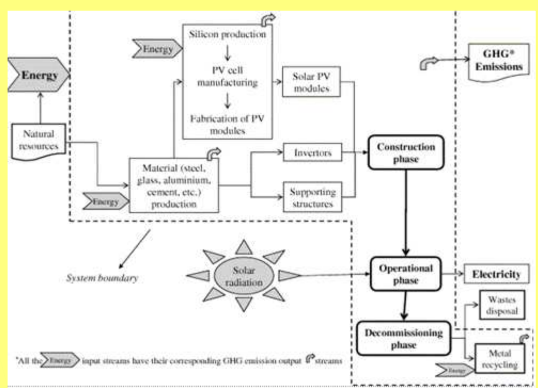
GAS CONDENSING BOILER

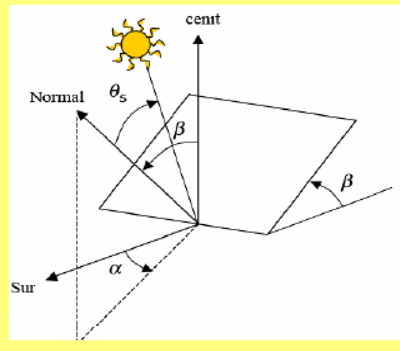
To provide the office area and storage with the necessary energy we could also use a gas condensing boiler. Condensing boilers have an increased efficiency in comparison with non-condensing boilers because they also extract the heat which is stored in the water which is gaseous after the burning process and condense it. For this process low system temperatures are necessary which we have with 55/45.
The head loss of the building is 38.993W. The chosen boiler would be by the manufacturer BUDERUS.
The chosen model would be the **Logamax plus GB162 45kW**.

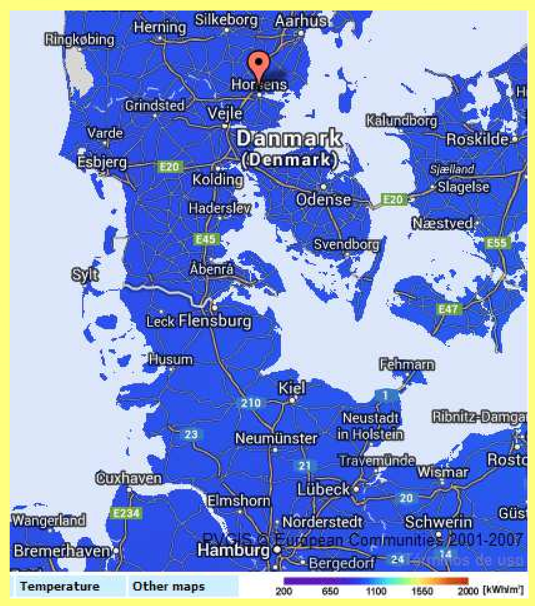
Boiler size	GB162-45
Power (kW)	9,6-44,9
Hot water temperatur (°C)	Up to 85
Efficiency with 40/30°C (%) Hs/Hi	Up to 99,5/ up to 110,5
Efficiency with 75/60°C (%) Hs/Hi	Up to 96,4/ up to 107
Height (mm)	695
Width (mm)	520
Depth (mm)	465+6
Electrical consumption max/ average (W)	76/ 53
Mass (kg)	45
Prize	4025€ // 30.187,50DKK

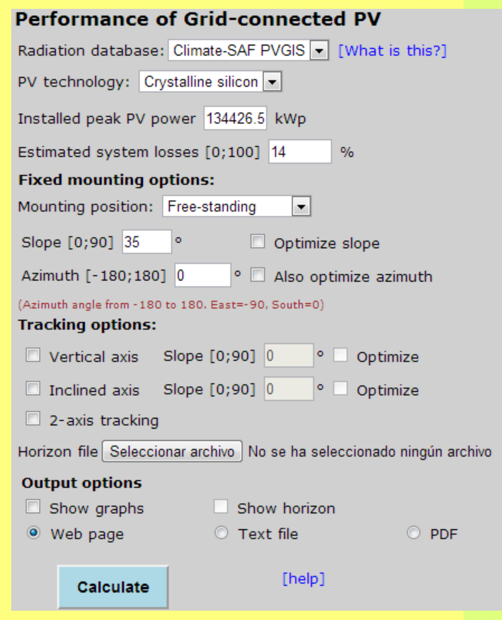
PHOTOVOLTAIC PANELS

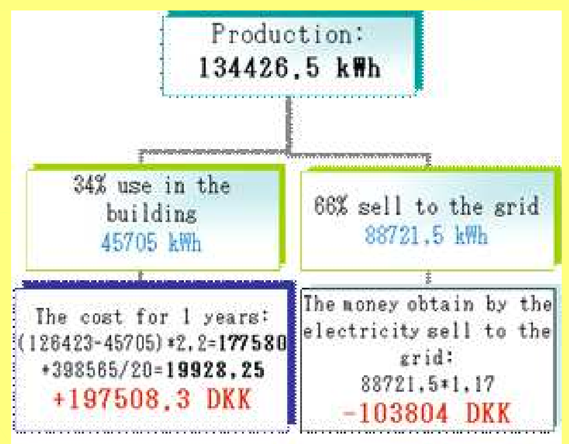




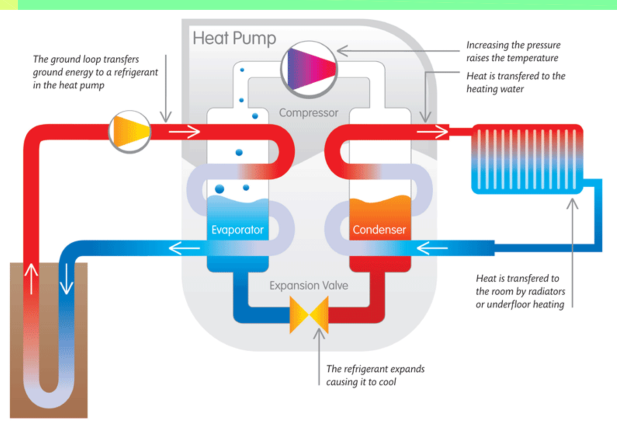




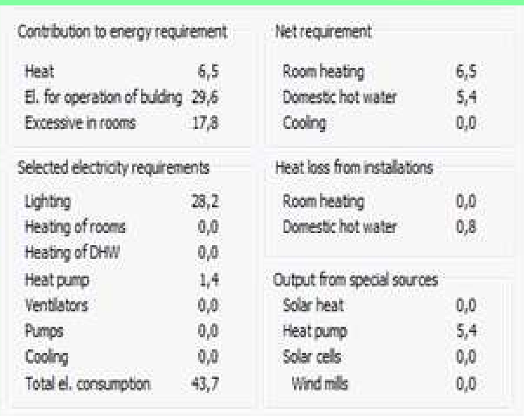




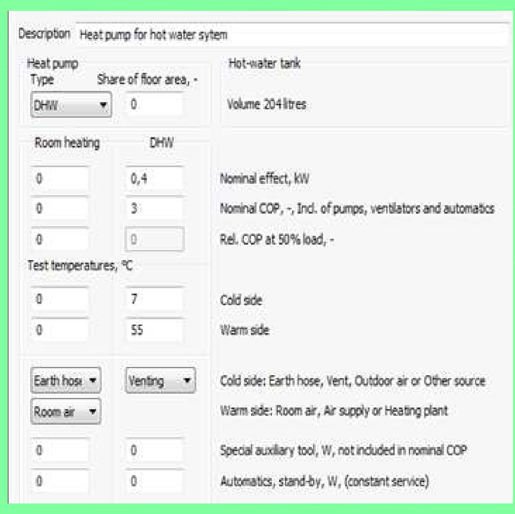
HEAT PUMP



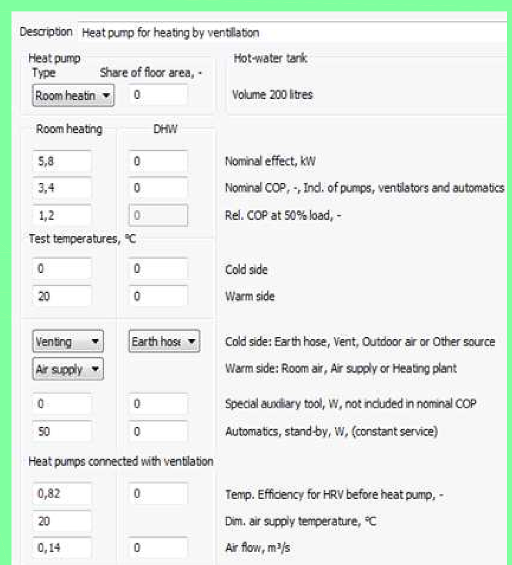
CALCULATION



HEAT PUMP USED FOR WATER FOR DOMESTIC USE AND HEATING

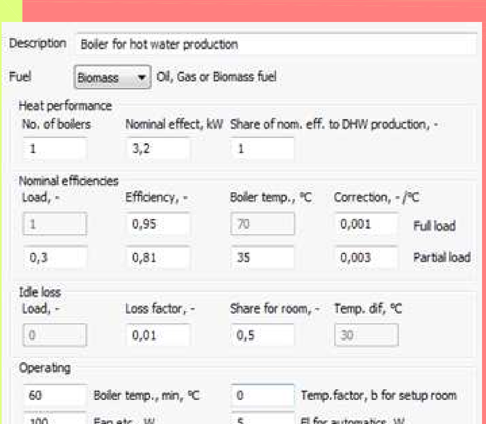


HEAT PUMP USED JUST FOR HEATING

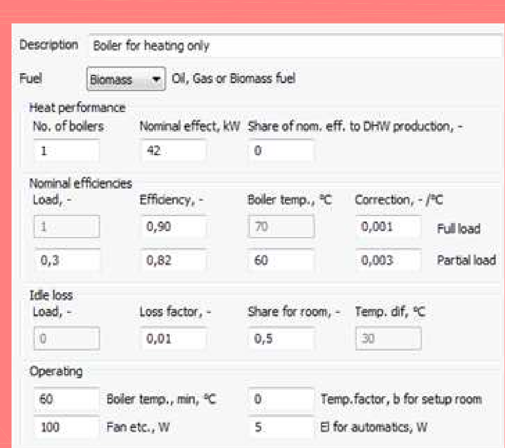


BIOMASS BOILER

CALCULATION



BIOMASS BOILERP USED JUST FOR HEATING



BIOMASS MATERIALS AND PRICES

Now we are going to see the prices of a Spanish company, Biomasol during season prices 2011/2012.

- Olive pit, heating 1º, bulk driven, silo more transport 0.15 c€/kg
- Olive pit, heating 1º paper bag of 15 kg 0.13 c€/kg
- Pine pellets 100% without bark, bulk driven, silo more transport 0.19 c€/kg
- Pine pellets 100% without bark, paper bag of 15 kg 0.17 c€/kg

Materials to improve the reception of the materials:

- Adaptation mouths to the impulsion of the tank to work silos 15 €/unit
- Metallic silos with storage bag and filling openings since 1 to 5 Tn variable cost

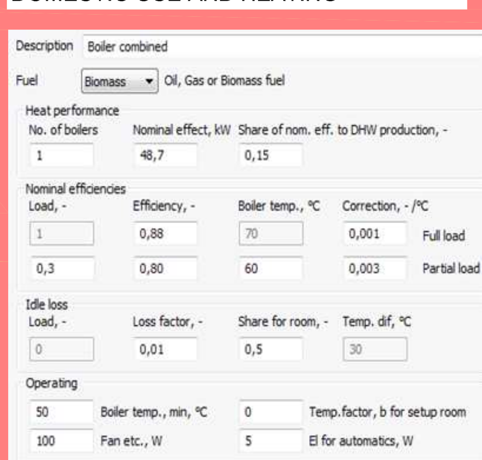
The fuel price list includes:
- Transport until 50 km of beginning, to 0.7 km just compute outward
- Pneumatics impulsion service to silo
- Weighbridge during downloading
- To transport of bag in pallet of 750 kg consult the prices (are variable)

This prices are going to be the same during the next 5 years and they are not include the IVA (18%)

HEAT POWER OF BIOMASS MATERIALS

	PCI		MOISTURE
Materials	(KJ/KG)	KWh/Kg)	b.h. (%)
Pellets	17.000 - 19.000	4,7 - 5,3	< 15
Chips	10.000 - 16.000	2,8 - 4,4	< 40
Olive nut	18.000 - 19.000	5,0 - 5,3	7-12
Nut shell	16.000 - 19.000	4,4 - 5,3	1-8
Wood	14.400 - 16.200	4,0 - 4,5	< 20
Briquettes	17.000 - 19.000	4,7 - 5,3	< 20

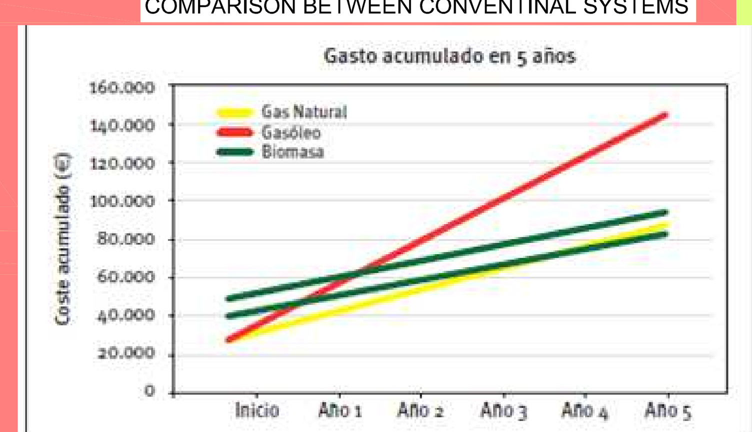
BIOMASS BOILER USED FOR WATER FOR DOMESTIC USE AND HEATING



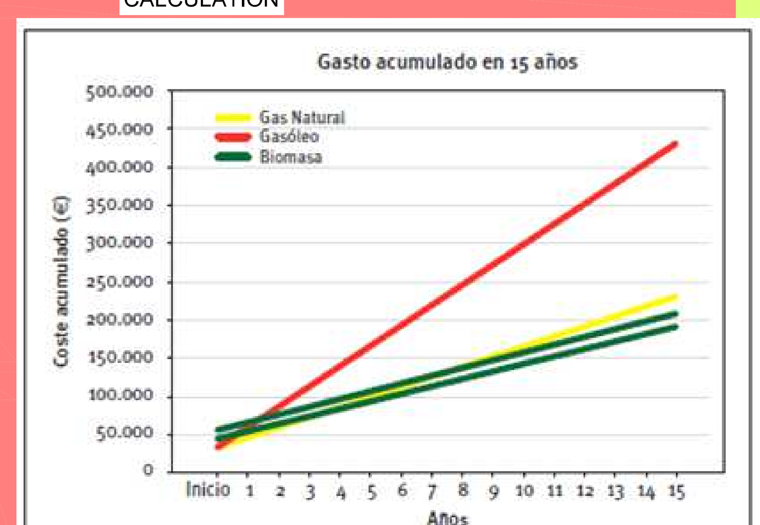
INSTALLATION PRICE

INVESTMENT OF BIOMASS BOILERS WITH DIFFERENCE POWER			
Price in €	50 kw	100 kw	325 kw
BIOMASS BOILERS	4.500	6.000	16.210
FUNCTIONAL AUTOMATION tansportador equipment fuel from storage silo hopper hast lung, bench for combustion system, combustion air supply sitema, automatic ignition and ash collection system automatic	1.800	2.250	8.550
CHIMENEY AND AUXILIAR PROBE	758	947	3.600
EXPANSION AND ASSEMBLY HYDRAULIC supply and installation of: networks of pipes, cold water rush, filling, emptying and expansions, expansion tank, pressure gauges, presostratos, valves, meters and other meters	696	870	3.305
CIRCULATION PUMPS FOR HEATING	353	441	1.676
ELECTRICAL INSTALATIONS	1.000	1.251	4.752
VENTILATIONS	394	492	1.871
FIRE SYSTEM	151	188	715
CONTROL AND REGULATION SYSTEM	722	903	3.431
INSOLATION AND LAGGING	260	325	1.235
TOTAL BUDGETS (without IVA)	10.634	13.667	45.345
TOTAL BUDGETS (with IVA)	12.335	15.854	52.600

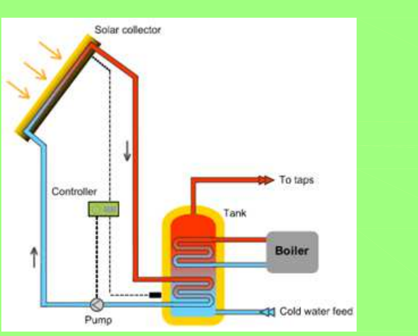
COMPARISON BETWEEN CONVENTINAL SYSTEMS



CALCULATION

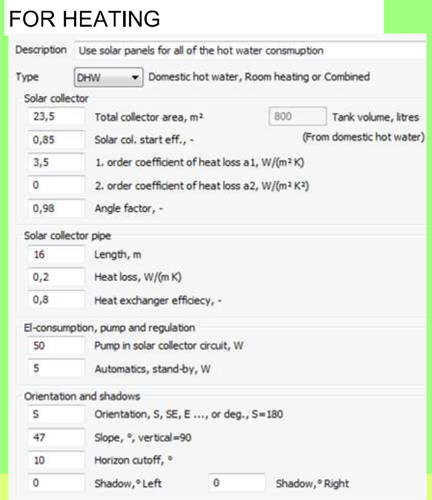


SOLAR COLLECTOR

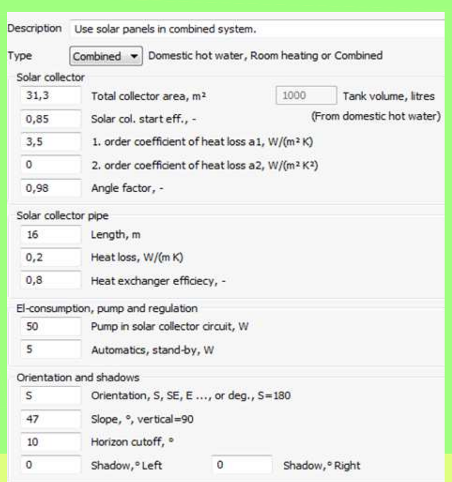


Net requirement	
Room heating	9,9
Domestic hot water	5,4
Cooling	0,0
Heat loss from installations	
Room heating	0,0
Domestic hot water	0,8

SOLAR COLLECTORS USED JUST FOR HEATING



SOLAR COLLECTORS USED FOR WATER FOR DOMESTIC USE AND HEATING



ELECTRICAL HEATING

There are different possibilities to use electric heating:
One would be to have a heater spiral in a water containing radiator. The water can store the thermal energy for some time. Possible as well is to have under floor heating by electricity.
Another possibility is to have heat storing plates. These plates are made of a material that can store thermal energy for a long time. This offers the possibility to heat up the material during night when the electricity prices are lower and give the heat to the room during the day. Depending on the heating demand a fan can blow room air through the heat emitting material.

Advantages:
- No storage room for fuels
- Low investment costs
- Low or even no maintenance costs

Disadvantages:
- High operation costs
- Not everywhere allowed
- Cool storage in the evening (especially problematic for under floor heating)
- The efficiency depends in the end on the way the electricity was produced (which is often not very efficient)

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For the reason that we wanted to choose an environmentally friendly and efficient system that offers a good indoor climate we don't choose a form of electrical heating. Main reasons are the high operation costs and that it is hard to get a good certification for a building with electric heating.
It was also not possible to find a system based on electrical heating which is suitable for the storage area.

SEASONAL STORAGE

Times New Roma|b0|i0|c0|p16;Another interesting solution for the building would be a seasonal storage system.
The German company isocal invented a system in collaboration with the company Viessmann which is not spread so far but has from my point of view a high potential in the future.
The system bases on the phase change of water to ice, a heat pump and a solar –air absorber.
Function:
During the heating phase the heat pump extracts energy from the water in the storage which is located outside of the building underground. By the time the ice starts to freeze (this process gives extra 332kJ/Kg). The extracted heat can then be used to heat the building. During the summer/ cooling phase the created ice can be used to cool the building. In the chosen case of ventilation a cooling coil could just be integrated in the air handling unit. In addition to that a solar collector and air collector can be used to heat up the storage again. The solar collector can also fulfill the demand of hot domestic water during the summer.

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