



**Johan Frey, manager
Dronninglund Fjernvarme**

**World (3.) largest solar powerplant
for district heating**



Dronninglund Fjernvarme

- ☀ Started 1959.
- ☀ 1,350 houses, population 3.300 people.
- ☀ Approximately 50 kilometer of pipes.
- ☀ Annual production of 40,000 MWh.
- ☀ Turnover approx. 4 mill. € . According to Danish law, you cannot make a profit from selling heat.
- ☀ Owned and operated by the customers.



Production plants

- Combined heat & power:
Four Gas Engines 3.6 MW power, 6.4 MW heat.
- An emergency gas boiler, 8 MW of heat.
- One bio-oil boiler with associated absorption heat pump, a total output of 6 MW.
- One bio-oil hot water boiler 10 MW.
- 37,573 m² solar panels, approx. 27 MW with associated seasonal heat storage of 62,000 m³ of water. Approximately 18,000 MWh annually



Why the solar powerplant?

In 2006 we had to find replacement for two oilboilers, so the customers instructed the Board that:

- ☀ The new powerplant should not result in increasing the price of heating.
- ☀ 50% phase-out of fossil fuels in the first phase.
- ☀ In the long run up to 100% phase-out of fossil fuels
(National goals: heat production fossil free in 2035, all energy fossil free in 2050)

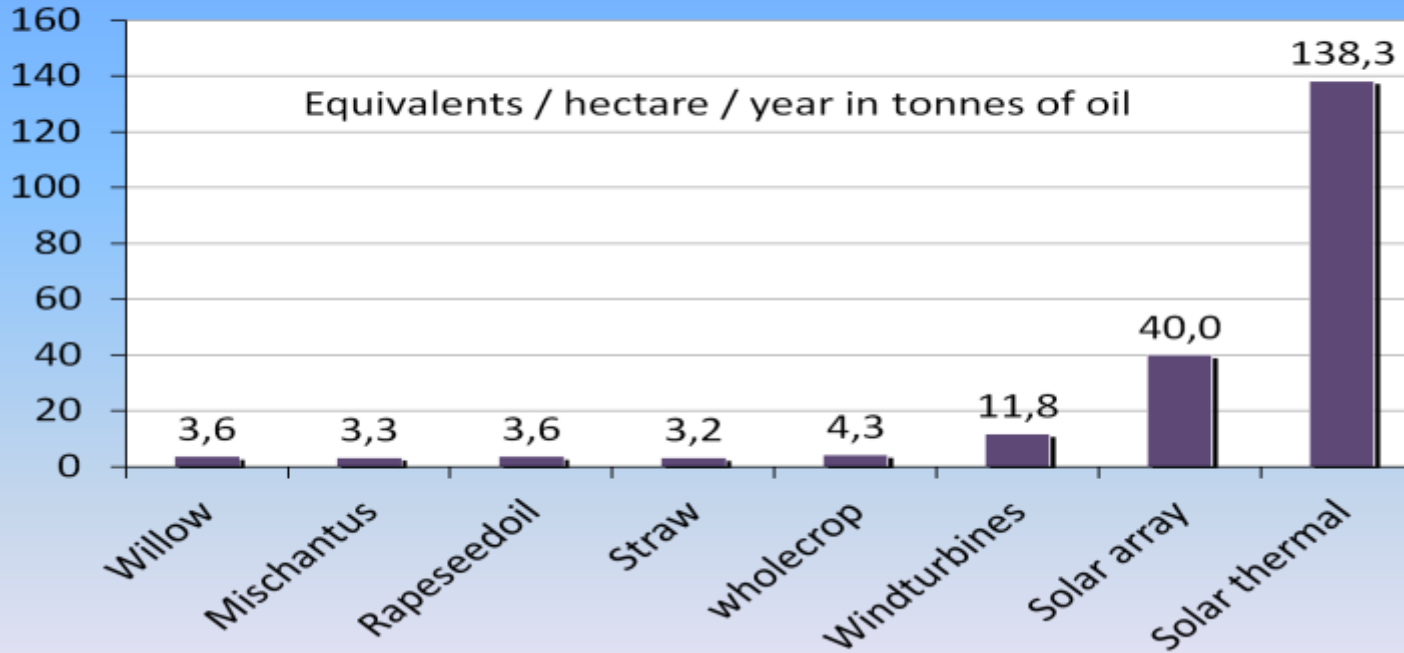


The incentives in year 2006 was:

- High taxes on natural gas.
App. same level as the gas price itself.
- No tax on solarenergy.
- Not allowed to use biomass at naturalgas fired plants.
- Saved CO₂ quotes could be sold.



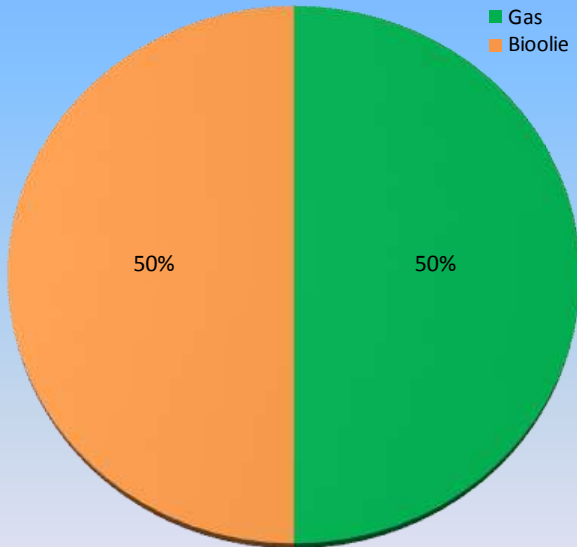
Why solar thermal?



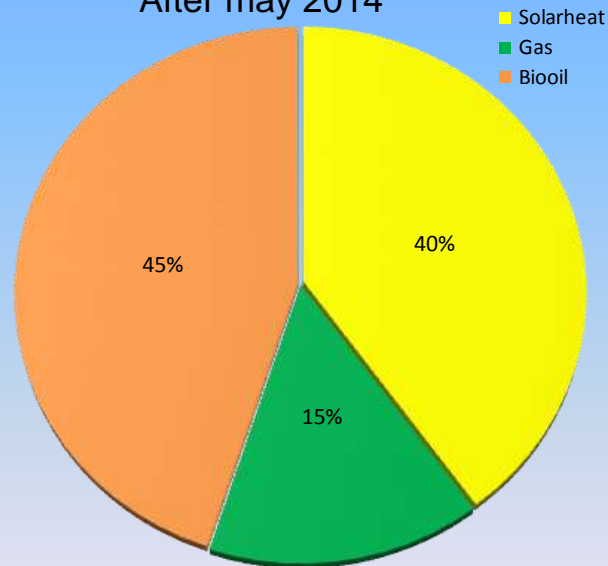


change of energy production

Before may 2014

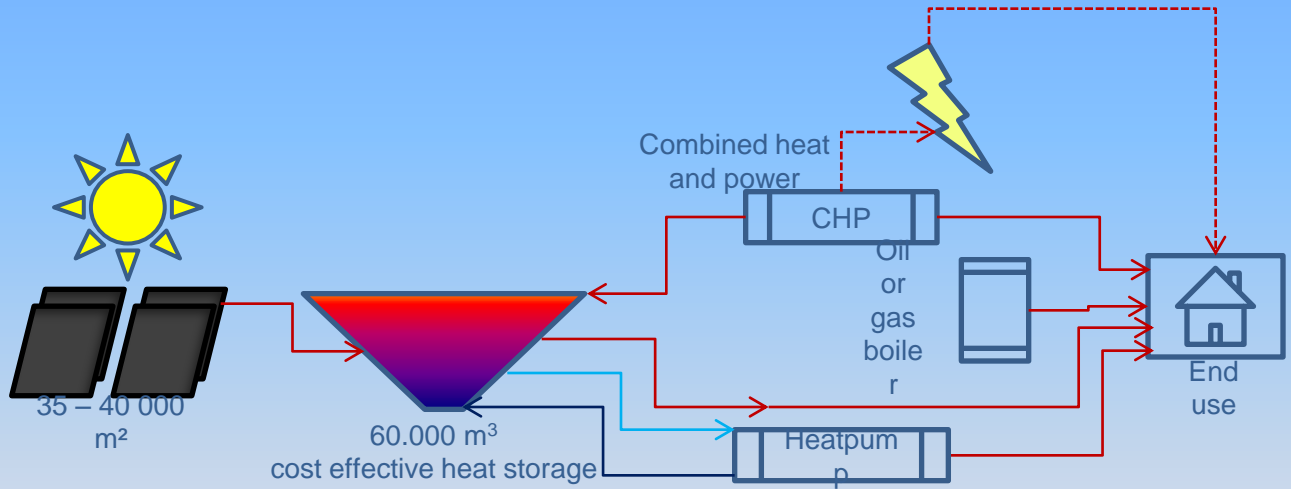


After may 2014



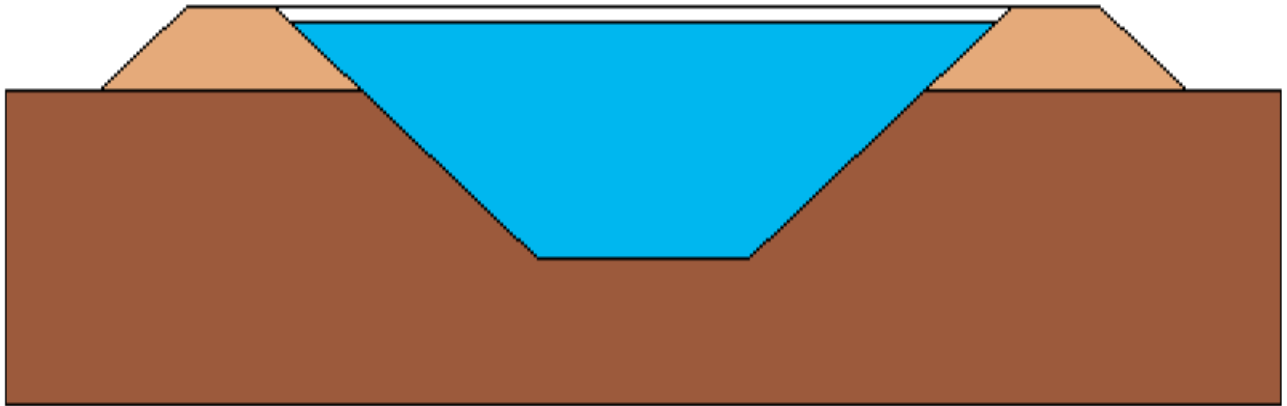


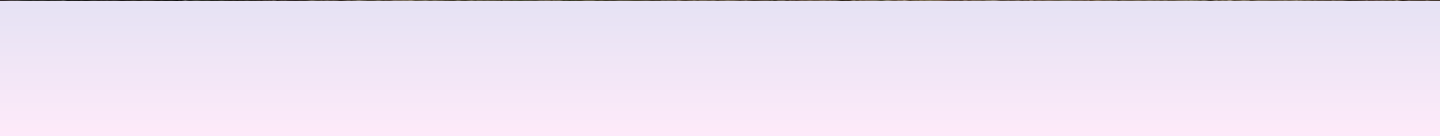
Using a large pitstorage and a heatpump we can allow 50 % of solar energy in our system.





Design of pit heat storage













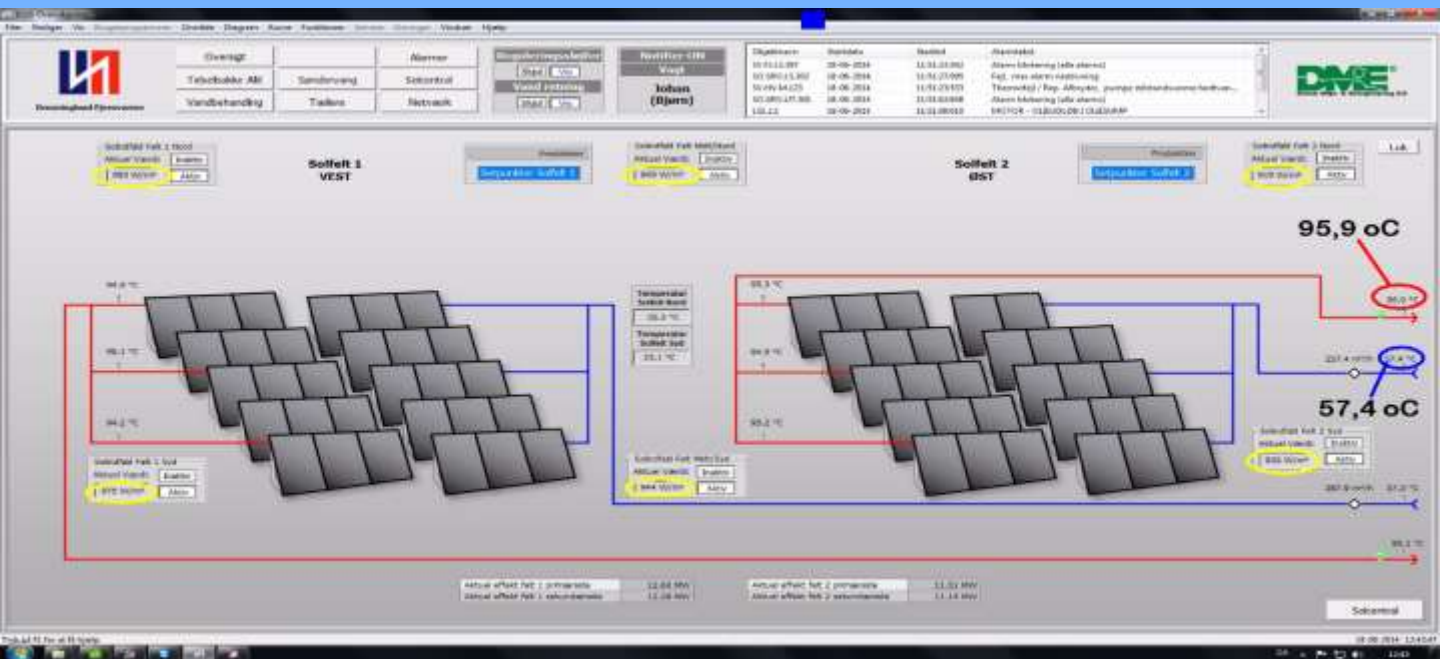






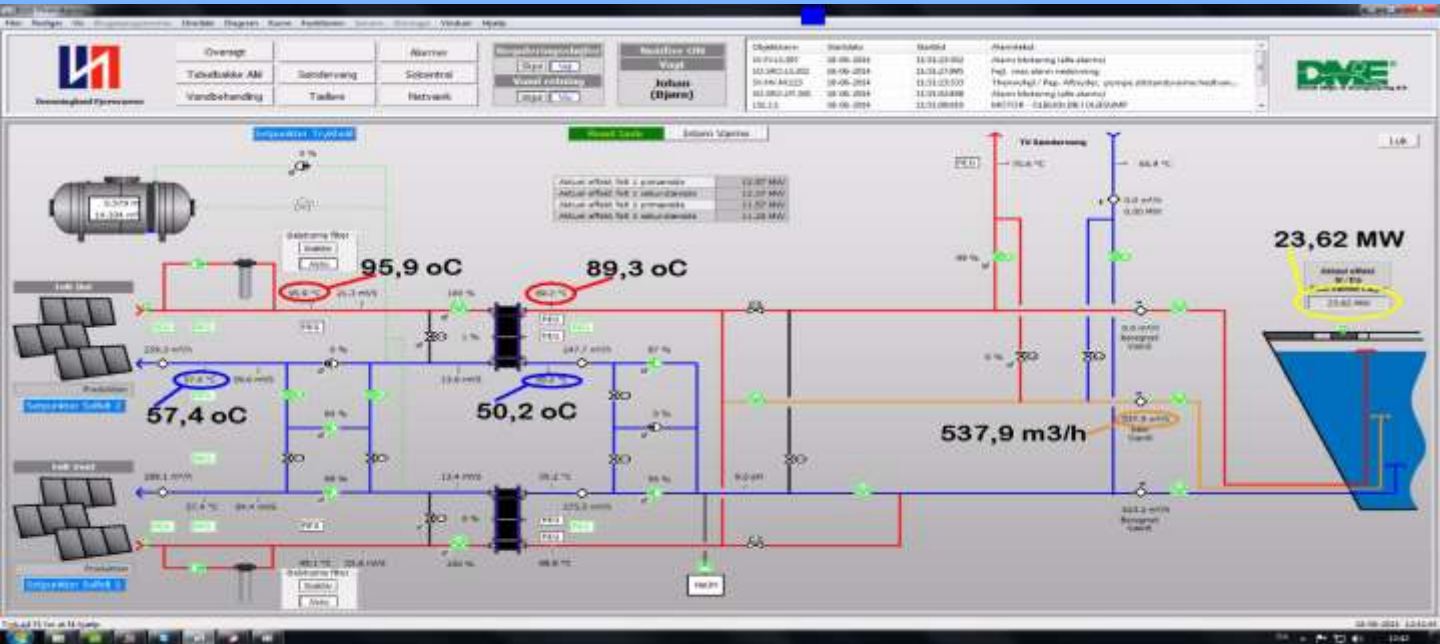


Screen dump, solarpanels

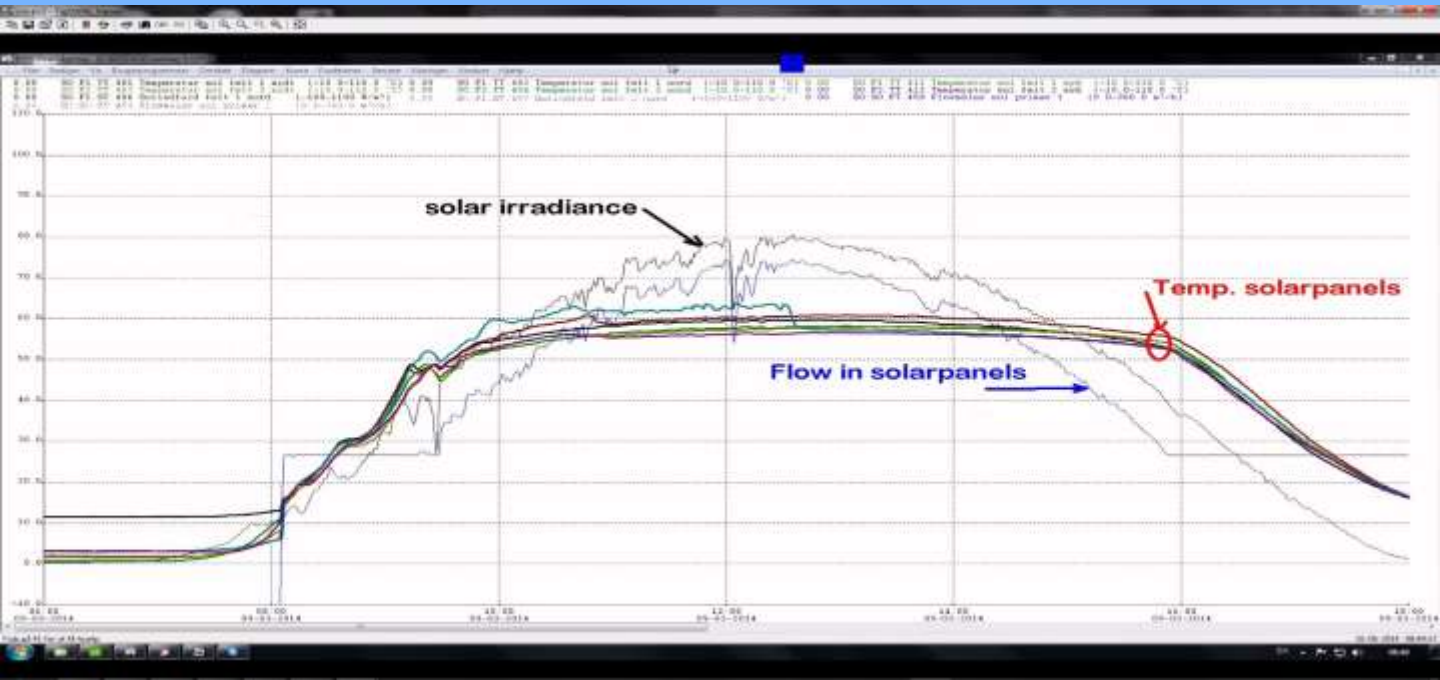




Scendump, heat exchanger

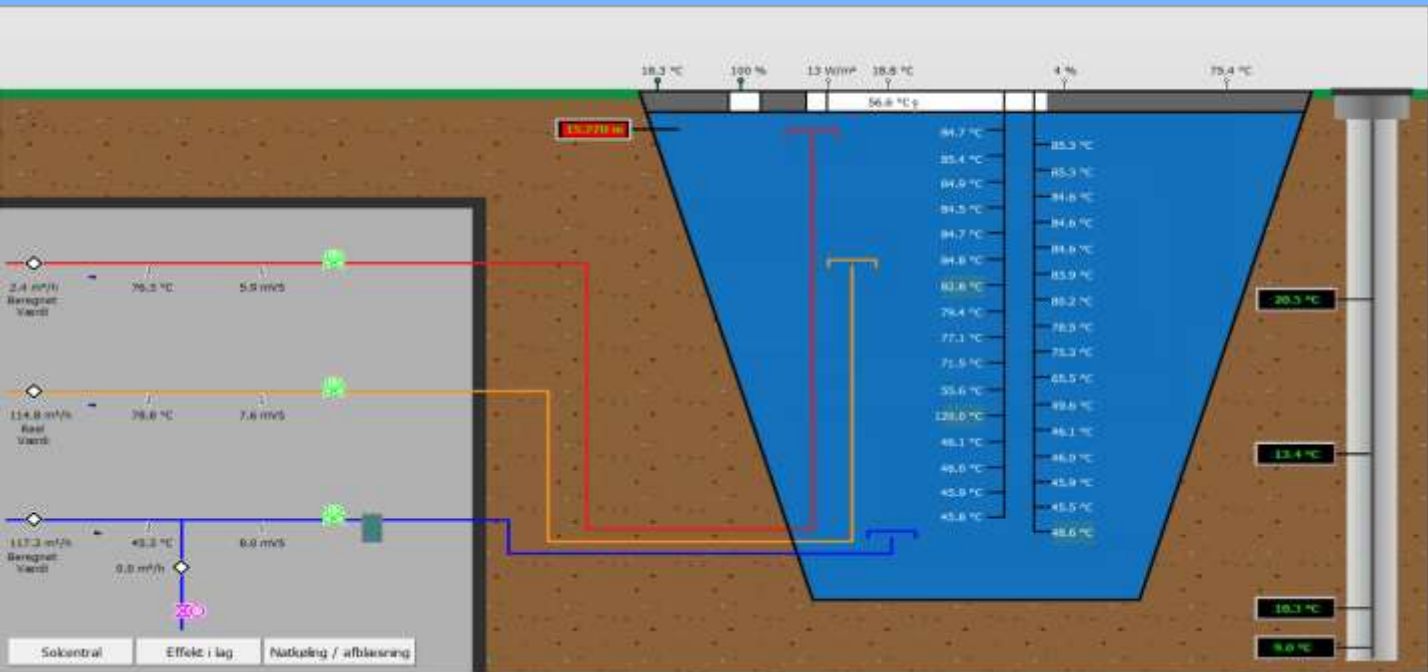


Regulation of the temperature from the panels





Pitstorage, 28-09-2015





Investment, Dronninglund

	Ammount in thousand Euro.
Heat storage, 62.000 m3 (38,7 Euro/m3)	2.400
Buildings	2.400
Solarpanels, 37.573 m2	6.100
District heating pipes	1.340
Booilerplant and heatpump	920
Building interest and contingencies	800
Total investment hadware	13.960
Consulting engineers	673
EUDP (subsidies from Danish Department of Energy)	-2.953
Nettoinvestment:	11.680



Budget 2014/2015 for a standard house in Dronninglund

	2013-2014	2014-2015 1. year with solarpanels	Price reduction for a standard house
Energy price/ MWh	75,83 €	66,44 €	171,84 €
Fixed costs/ m2	2,81 €	2,55 €	33,80 €
Energy saving tax	6,71 €	0,00 €	6,71 €
		Saved VAT	53,09 €
		Total savings:	265,44 €

A standard house in Denmark is considered to be 130 m2 and use 18,1 MWh pr. year



Experience with large solar installations

- ☀ Easy to operate,
runs unattended most of the time.
- ☀ Little maintenance:
Shaft seals, filters and area-inspection.
- ☀ Operating expenses:
Approximately 15 cent per. MWh solar heat.
- ☀ Power consumption:
App. 3 kWh electricity /MWh solar heat.



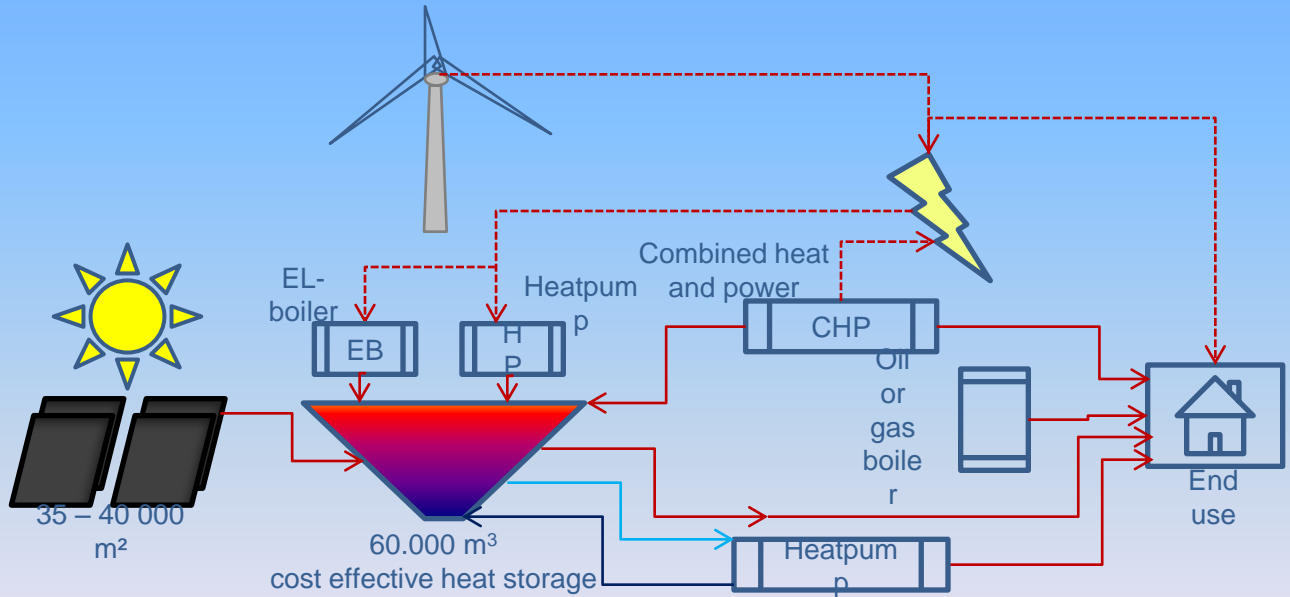


Benefits

- ☀️ Cleaner environment
- ☀️ Power supply is inexhaustible
- ☀️ Trouble-free operation
- ☀️ Low operating costs
- ☀️ Satisfied consumers
- ☀️ Replacing fossil fuels
- ☀️ You know the "fuel price" 30 years into the future.

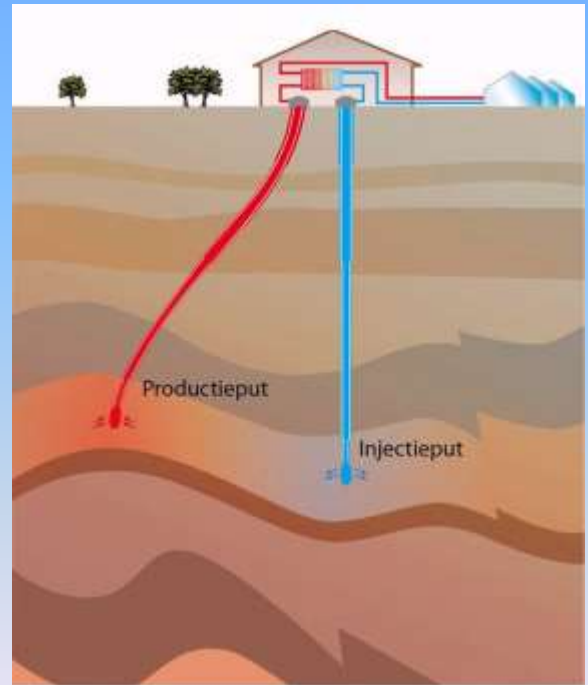
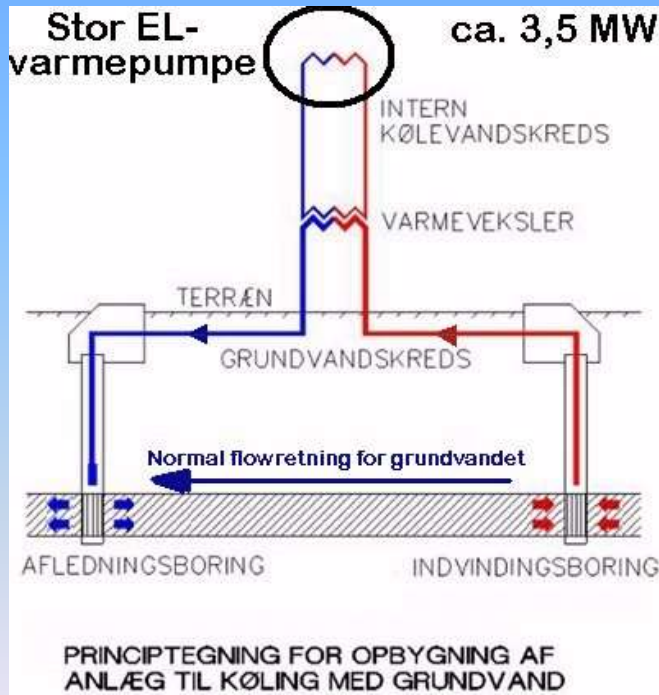


Future plans: Large pitstorage can integrate renewable electricity in heat production.





Large electrical heatpump, chilling groundwater





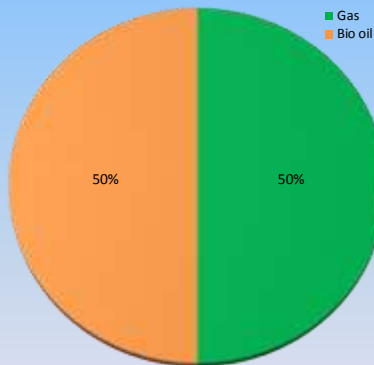
Large electrical heatpump



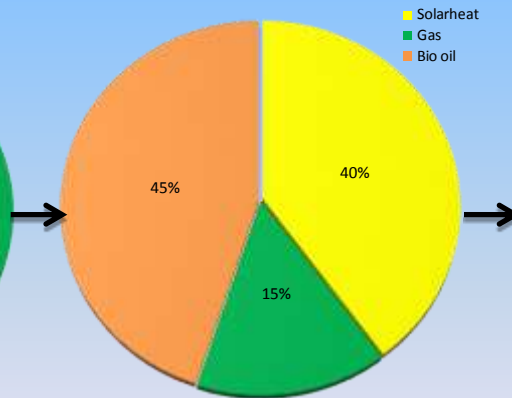


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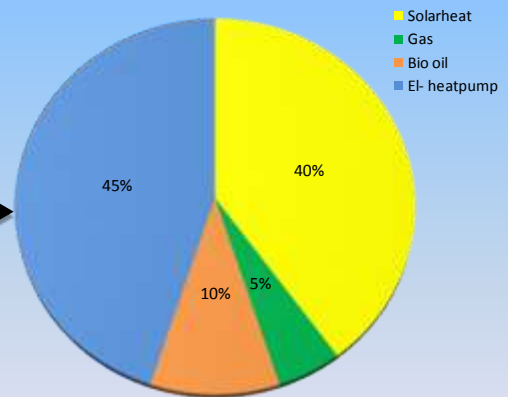
Before may 2014



After may 2014



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Thanks for your
attention