

Chapter:	Preliminary investigations
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### Introduction

Solar heat can technically be combined with all other fuels for district heating, but it is not always environmentally and economically feasible to do it. The production price from a solar heating plant will in Northern Europe be at least 3 € cents/kWh and in Southern Europe at least 2 € cents/kWh which have to be compared to heat production prices from other sources including possible changes in the total efficiency of the combined heat generation system.

### Combination with heat from waste incineration and industrial processes

Heat from waste incineration will normally be wasted if it is not utilised as district heating. Therefore the heat is approx. free. Also heat from industrial processes can be very cheap to utilize as district heating. If the total summer load is covered by heat from waste incineration and/or heat from industrial processes, there will be no increase but a loss in energy efficiency and there is environmentally no advantage for solar heat. Also the solar heat will normally not be able to compete on prices. Also environmentally there is no advantage for solar heat.

### Combination with geothermal heat

Geothermal heat comes from the earth, often from more than 500 m deep drilled holes.

Both solar heat and geothermal heat have high investment costs and low operational costs. Therefore investment in both technologies in the same heating system has to be carefully calculated.

### Combination with fossil fired CHP-plants

The high efficiency of fossil fired combined heat and power systems are based on the total cover of the summer load in the DH-network. In an established system the total efficiency of the CHP-system could only decrease if the heat production is substituted by solar thermal heat. Also the heat production price of CHP-plants is low and combination with solar heat will thus be difficult.

### Combination with biomass CHP

The biomass combined heat and power system normally covers the total summer load in a district heating system and once the plant is established the heat production price is low and combination with solar heat will

thus be difficult.

### Combination with biomass fired heating plants

Heating plants using wood chips or straw has a marginal heat production price of 2-3 € cent/kWh. But prices for biomass are up going and a future demand for biomass for transport and other purposes might mean a lack of biomass. Solar heating can cover the summer load and thus the biomass boiler can be turned off for a longer period.

To cover the summer load an accumulation tank is needed. The accumulation tank will in addition make it possible to run the biomass boiler with a fixed (and lower) load during the winter and function as back up if the biomass boiler has a brake down.

There are two technical aspects, which shall be taken into account when biomass and solar are combined.

The biomass boiler has a minimum load limit. That means, that the boiler has to be run on/off, if the solar fraction is too high but not high enough to turn the biomass boiler off for longer periods. Therefore the solar fraction has to be near 100% in the summer period.

If the biomass system is with flue gas condenser the biomass boiler and the solar collectors has to be in parallel to optimize the efficiency.

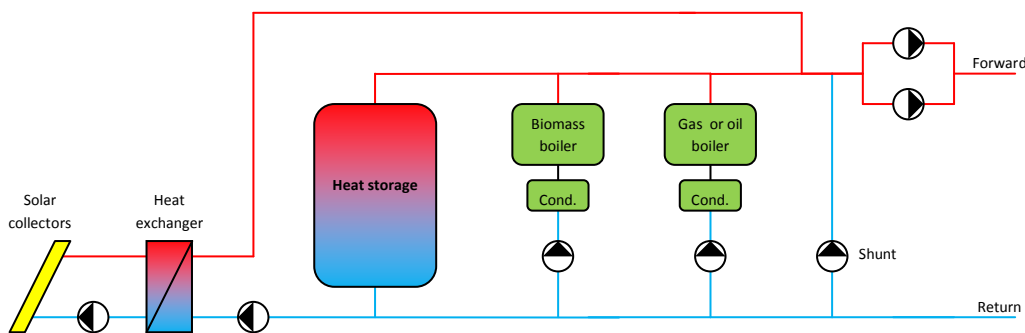


Fig. 2.1.2. Example of diagram for solar heat combined with biomass boiler. (Source: PlanEnergi)

### Combination with natural gas fired CHP

Natural gas fired combined heat and power plants use a more expensive fuel than biomass or coal fired CHP plants. In table 2.1.1 is seen the price of natural gas including tax when it is used for district heating (only).

Table 2.1.1. Price of natural gas produced district heat. All values are in €/MWh.

Country	Price for gas	Tax	Total
Austria [1]	35	11	46
Czech Republic [2]	33	12	45
Denmark [3]	30	28	58
Germany [4] & [5]	36	10	46
Italy [6]	37	24	61

Referring to table 2.1.1 it has to be mentioned, that district heating utilities in some countries e.g. Germany have different contracts with the natural gas suppliers (e.g. with long term conditions). This means that the price market is very heterogeneous and that prices which differ from the shown table, must be expected in “real life”.

Natural gas fired CHP plants are quickly to start and stop (especially for engines). If the percentage of wind power produced electricity goes up, regulation of other power producers (or end use) are necessary. Natural gas fired CHP plants are in Denmark used for that kind of regulation. That means stop for the engines in longer and longer periods when the amount of wind power is extended. Heat production in these periods is usually done with gas boilers, which is very expensive. Solar heat can be produced much cheaper. Therefore a lot of Danish SDH-systems are installed in combination with natural gas fired CHP-plants.

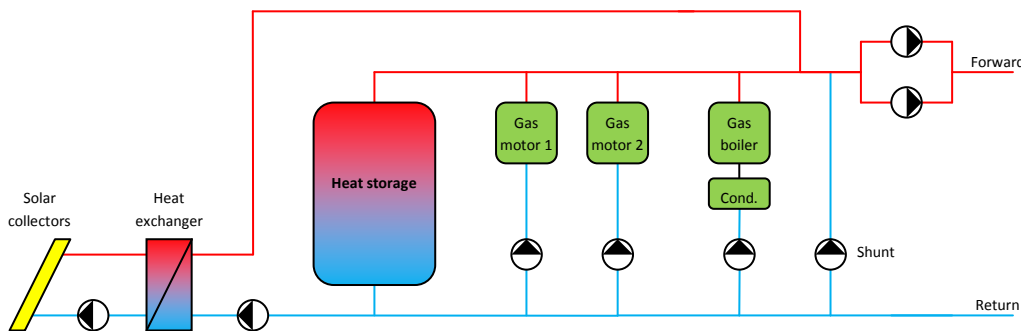


Fig. 2.1.3. Example of diagram for solar heat combined with natural gas fired CHP. (Source: PlanEnergi)

If wind produced electricity is a large part of the electricity production in the summer period similar possibilities for solar heat in district heating might occur in other countries.

### References

- [1] [www.e-control.at](http://www.e-control.at) for nationwide taxes; there are different extra taxes on gas in regions
- [2] Materials from the ADH CR 2011, currency rate 24,225 Kč/euro (official rate for date 8/3/2011)
- [3] Punktafgiftsvejledning 2011-1, F.4 Natur-og bygas, February 2011.
- [4] Bundesministerium für Wirtschaft und Technologi, "Energiedaten – ausgewählte Grafiken" p. 40, [www.bmwi.de/BMWi/Navigation/Energie/Statistik-und-Prognosen/Energiedaten/energiepreise-energiekosten.html](http://www.bmwi.de/BMWi/Navigation/Energie/Statistik-und-Prognosen/Energiedaten/energiepreise-energiekosten.html), January 2011.
- [5] Stadtwerke Bochum GmbH, [www.stadtwerke-bochum.de/index/privatkunden/energiepreise/steuern\\_erdgas.html;jsessionid=037B6542E6C518E20256D4057383BC91.pwc1](http://www.stadtwerke-bochum.de/index/privatkunden/energiepreise/steuern_erdgas.html;jsessionid=037B6542E6C518E20256D4057383BC91.pwc1), February 2011.
- [6] AIRU, Italian District Heating Association, 2011.

↓ *The SDH fact sheets addresses both technical and non-technical issues, and provide state-of-the-art industry guidelines to which utilities can refer when considering/realizing SDH plants. For further information on Solar District Heating and the SDHtake-off project please visit [www.solar-district-heating.eu](http://www.solar-district-heating.eu).* ↑