Chapter:	Preliminary investigations
Date:	April 2012
Size:	8 pages
Description:	Different possibilities for the combination of ownership and financing.
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Available languages:	English
Version id:	2.5-2
Download possible at:	www.solar-district-heating.eu

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Introduction

Normally for investments in district heating production the implementation costs are relativity low and the costs for fuel and running the plant calculated as net present value is higher. But for solar district heating the situation is, that nearly all costs are in the implementation phase. Thus the investor is paying the costs for heat for the next 20-30 years already in the implementation phase. Since heat production prices from alternative sources (gas, oil, biomass) are fluctuating and the technological development might bring new solutions on the market investors might be cautious when investing in solar district heating. On the other hand solar district heating offers stabile heat prices for a part of the heat production. This argument is often one of the reasons for establishment of solar district heating.

In the following different combinations of ownership and financing are explained.

We have chosen examples from different European countries where 1) **The district heating utility** owns the solar collector plant. This is a legally uncomplicated solution often used in Denmark for ground mounted solutions, 2) The solar collectors are **roof mounted and owned by the utility or private owned.** This solution is common in Germany, 3) The solar collectors are **financed and owned by a 3rd part.** A solution that has been used a.o. in Austria and 4) . The solar collectors are **co-operative owned**, where public authorities or utilities can be a partner also.

If someone else than the utility owns the solar collector plant a contract has to be made between the utility and the plant owner. A check list of important issues in such a contract can be found in the last part of this fact sheet.

Utility as owner

If the utility owns, finances and runs the solar district heating plant no contracts and feed in tariffs have to be made with 3rd parties. This is the simplest situation for the district heating utility and the normal way if they trust the technology and can find financing.

Financing of ground mounted solar collectors in Denmark is as a main rule with annuity loans, where the local municipality gives a 100% guarantee for the loan. The municipality can do this with nearly no risk because the consumers have a contract with the district heating utility, saying that they are obliged to be a customer and thus the income for the district heating utility is secured.

Private ownership

If the solar collectors are placed on a private roof or integrated in the roof, there is a risk for losing the investment if the owner of the building goes bankrupt. It is crucial that the party who made the investment for the collectors always keeps ownership of the collectors and is thus not affected by bankruptcy of the building's owner.

There are different solutions to handle this issue. In Sweden central plants with collectors on roofs are built by municipal companies and they own the buildings, the heating plant and the collectors. In the most recent decentralized plants, the collectors are owned by the building owner and then he is buying and selling heat according to a contract with the district heating net owner (in the same way as it is done for a grid-connected PV-plant).

In Germany some cases exist where the building is privately owned and the roof-mounted collectors are owned by the utility. However, according to German law everything that is fixed to the building and that is necessary for the function of the building passes into the ownership of the building owner after installation. This can be avoided by a private contract between the building owner and the utility. The owner of the building and the utility also have to sign a contract that defines the easement on the real estate as well as maintenance, liability for premises and deconstruction of the solar collectors. It is further recommended to install a sub-roof below the solar collectors and to define exactly the ownership interface. The legal base for such a contract has been elaborated in [1].

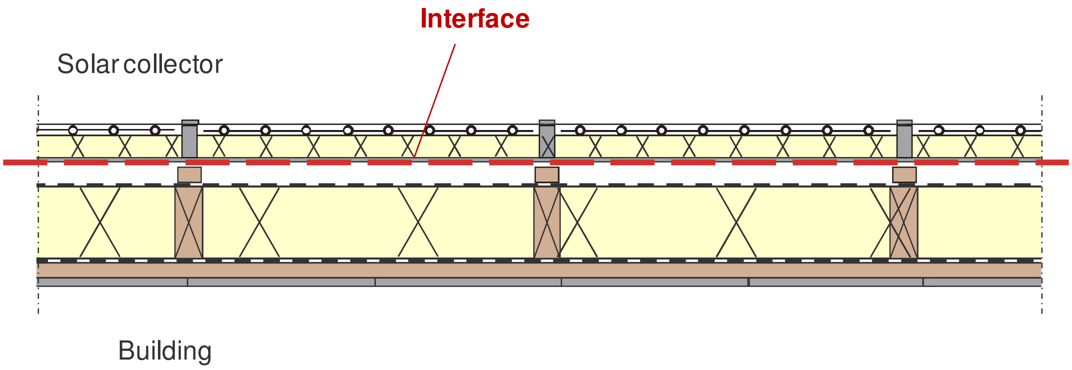

Fig. 2.5.1. Definition of ownership interface for roof mounted solar collectors. (Source: Solites)

There will also be risk for extra costs from leakages. Therefore the district heating utility might prefer private ownership and financing.

In this case a contract between the utility and the plant owner including feed in tariffs for delivering heat to the district heating network is needed. This contract might also include service obligations if the utility runs the solar plant.

The most important issues are mentioned in the check list in the last part of this fact sheet. A more detailed description can be found in [2].

Private ownership and 3rd part financing

The implementation of solar heating requires a major investment while the operation costs are very low. One prerequisite to make the investment is that the plant owner judges the risk in a favourable way. As most utilities and building owners lack experience from solar heating the risk is judged to be too large, even if the long term economic feasibility looks interesting. One way to overcome this problem is to create an Energy Service Company (ESCO) that makes the investment, operates the plant and sells the heat to a housing facility owner or to a district heating utility. The main driver behind the solar ESCO development is the local company S.O.L.I.D. The development has led to a number of realised solar heating plants in Austria, especially four large plants in the district heating system in Graz. Further description can be found in [3]. Use the check list in the last part of this guideline for contracts between utility and plant owner.

Solar collectors in co-operative ownership

A solar assisted district heating system was built in a new housing development of Neckarsulm (DE) in the late 1990s. The district heating system includes several solar collector fields and is operated by the Utility of Neckarsulm.

One of those solar collector fields was installed as roof of a carport with an aperture area of 454 m² (see Fig.2.5.2. At first the financing of the solar collectors (incl. piping, substructure, etc.) was done by the utility Neckarsulm. Afterwards the collector field was sold in units of 20 m² to private persons but is still operated by the utility Neckarsulm until today. The administration and the accounting are done by the Solar- und Energie-Initiative Heilbronn e.V.

Fig. 2.5.2. Solar collector field “carport” in Neckarsulm (DE). (Source: Solites)

The calculation of the costs is done according to the energy value of the heat meter once a year. The financing concept bases on an annual output of 300 kWh/(m^2·a) of the solar collector field. The dividend of the solar collector field consists of the demand charge which is fixed to 97.15 € per year and unit and the energy price that is linked to the gas price. From the dividend an administration fee and reserve is subtracted. Per unit the stakeholders get an annual dividend of about 130 to 180 €.

Types of loans

As mentioned in the beginning of this fact sheet the cost structure of renewable energy systems is totally different from the cost structure in an energy system with fossil fuels. Therefore it can be difficult to make a fair comparison of prices.

In the following production prices for renewable energy systems are calculated with two different loan types and under different conditions:

Serial loans, where write-off is linearly and annuity loans where the yearly costs of the loan are fixed (same amount every year).

If the loan is 1 million €, interest rate is 5%, period of payment 20 years and inflation is 2% the payment will develop as shown in fig. 2.5.1 below.

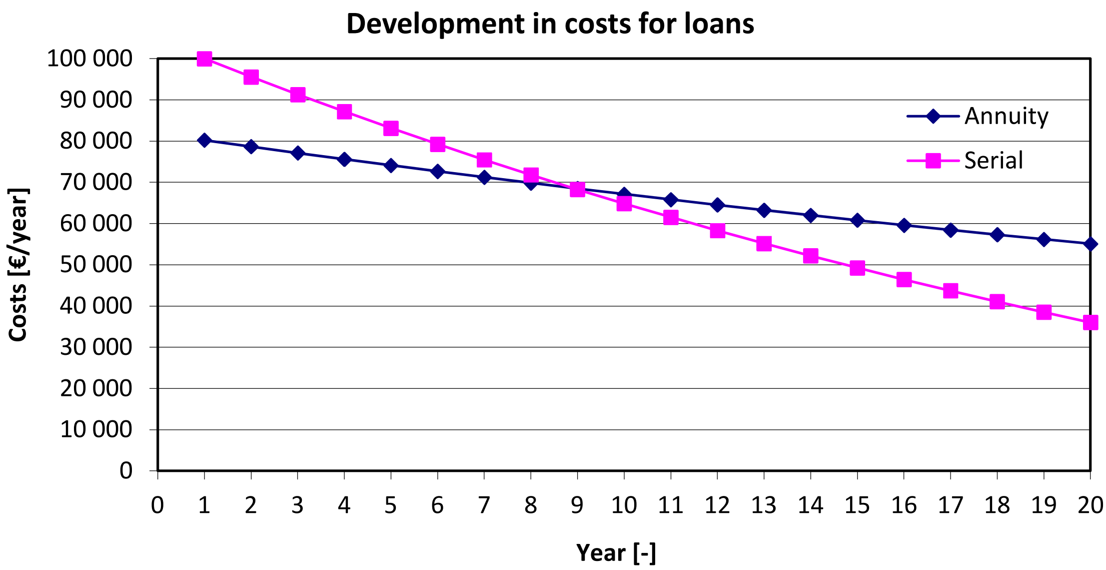

Fig. 2.5.3. Development in costs for annuity loans and serial loans, interest rate 5%, inflation 2%.

If all the costs are implementation costs the yearly costs in the example in figure 2.5.1 will in year 20 be 36% of the first year costs with a serial loan and 55% of the first year costs with an annuity loan. Thus it is not fair to compare first year costs only. Below is shown the differences for calculation under different assumptions.

Table 2.5.1. Yearly costs for loans, interest 5%, 20 years, inflation 2%.

Assumption	Cost in % of serial loan
Serial loan, 5%, 1st year	100
Serial loan, 4%, 1st year	90
Annuity loan, 5%, 1st year	80
Annuity loan, 4%, 1st year	74
Annuity loan, 6%, average	67
Annuity loan, 4%, average	61

Check list of important issues in a contact between utility and plant owner

1. Subject of the contract

Fixes the basics of the solar energy supply:

- Who is the plant owner, who is the utility
- General information on the system integration of the solar thermal plant
- Start of the energy supply, usually fixed within a certain period of time or with a latest starting date.

2. Duration of the contract

Fixes the beginning and the end of the energy supply, and additionally:

- Exit clauses and exit terms for contracting out of the agreement for both contractual parties. This can be a tricky paragraph, and it is important to negotiate conditions which assure long-term stability for selling the solar energy!

3. Installation of the solar plant, property line

- Who is responsible for the installation of the technical equipment?

- Describes in all detail where the limits of performance are drawn, in particular the utilities responsibilities are defined. Moreover, the energy delivery point (usually position and integration of heat exchanger) is specified.
- Certifications requested
- Who pays the electrical energy for pumps and other equipment?
- Who cares for the ongoing service and maintenance of the solar plant?
- Property structure of the areas which are going to be affected by the solar plant in some way (tech room, roof, space for piping, …)

4. Details on the energy supply and the operation of the plant

Fixes all details between the plant owner and the utility that are related to the solar energy supply service:

- For the plant owner, is there an obligation or a right to deliver the system’s energy output to the utility? Required forward temperature and max flow?
- For the utility, is there an obligation or a right to buy the solar energy? How about required return temperature?
- All the risks concerning damage of the solar plant and damages or consequential damages that are due to some improper operation of the plant are for the plant owners’ account.
- Date for earliest and / or latest begin of the energy delivery to the utility.

5. Solar energy price

This part specifies all questions related to the tariff model of the solar energy. It is completely arbitrary for both contract parties to agree upon a model which serves both sides’ interests.

- Same price for the whole year or difference between summertime and wintertime?
- Price reduction for lower temperatures than required?
- Solar energy indexed to consumer price index / some other energy / any other reasonable factor? What’s the effective date that serves as a basis for the indexing calculations?
- What happens if one of these factors changes drastically? New definition of this part of the contract?
- What happens if solar energy prices are related to other fossil fuel prices?

6. Measurement and charging of the solar energy

- How is the solar energy measured?
- Any prerequisite for the measuring facilities or the measurement system in general?

- How is the solar energy going to be metered and charged to the customer?
- Who calibrates the measurement equipment?
- Term of payment for the solar energy invoices

7. Other contract clauses

- How are withdrawals from the energy supply contract handled? States all circumstances under which one of the contract parties could exit the contract without legal consequences.

8. Legal venue

- Fixes the legal venue for any misconceptions between the contract parties
- Usually, there are appendices to the energy supply contract. Most commonly, the following appendices are included:
  - Hydraulic scheme of the energy delivery station with integration of the solar plant
  - Hydraulic scheme of the solar thermal plant.

References

[1] von Oppen, M.: Rechtliche Rahmenbedingungen für große Solarwärmeanlagen - Vorstellung einer Studie im Auftrag des BMU, OTTI 20. Symposium Thermische Solaranlagen, May 2010.

[2] IEE-project ST-ESCOs.

[3] Jan-Olof Dalenbäck: Success Factors in Solar District Heating, January 2011, www.solar-district-heating.eu

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.