Cost and Economics

Factsheet 5: Integration of solar energy in district heating

General Information

The development of very large solar thermal systems, especially in Denmark, has led to a decrease in the cost of solar heat with larger and larger solar thermal systems through optimisation of collectors, mounting and piping for large field installations. Production costs of less than 4 Cts/kWh of solar heat can be achieved for large-scale free-standing systems. However, the price of heat is highly dependent on various factors, with the lowest costs possible for very large ground-mounted systems. Feasibility studies have shown that solar heat production costs of around 6-7 Rp/kWh are also possible in Switzerland, even with collector areas starting at thousand square meters. Although there are no binding regulations for subsidizing large scale solar thermal systems, financial support can be expected in some cantons. Production costs of less than 5 cents per kWh are possible in Switzerland if subsidies are included.

Cost of Installations

Typical cost and scaling

There is a significant economy of scale in the implementation of solar thermal energy. This is supported by an analysis conducted by IRENA of all large-scale European plants in recent years. The results have been converted to Swiss conditions, taking into account higher labour costs, and are shown in Figure 1. The data show that the target cost for large installations can be reduced by a factor of four to 400 CHF/kW. This means that costs of just over 200 CHF/m² can be achieved under ideal conditions. Roof-integrated systems of less than 1000 m² have already been built in Switzerland at considerably higher costs.

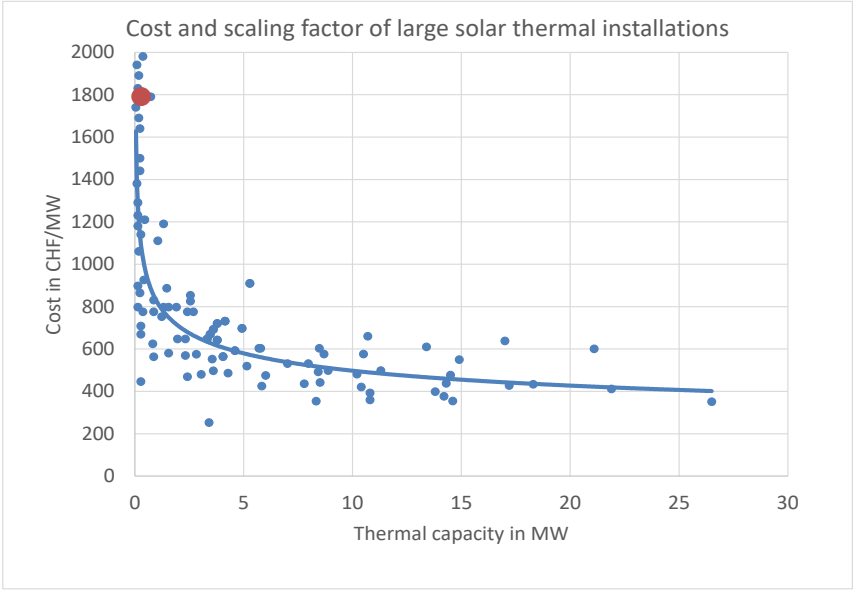

Figure 1: Cost of international large solar thermal installations adapted to Switzerland vs. their respective thermal capacity. The cost of a Swiss example WLS is given in red.

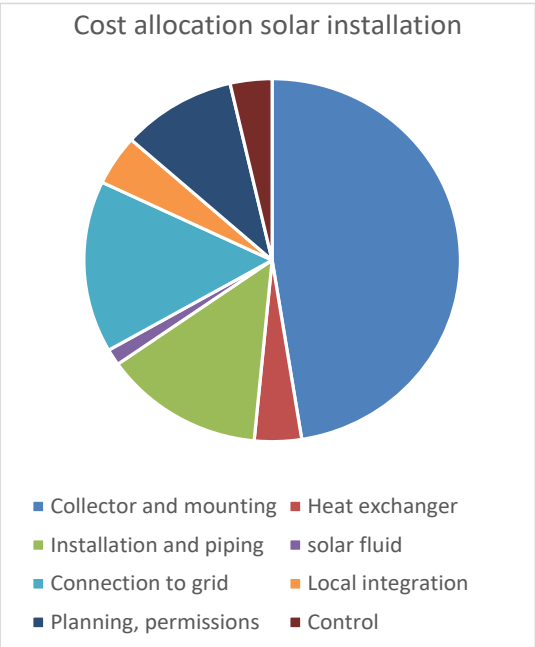

Figure 2: Cost distribution for the system of WLS with about 500 m² in Schüpfen CH. Source: WLS from BioSolFer report.

Cost assignment

In large-scale solar thermal systems in the range of thousand square meter in Switzerland, about half of the cost is typically spent on the collectors. The other half of the cost is divided between storage, integration, control, planning and installation. The figure 2 on the left shows the cost distribution for the system of WLS with about 500 m² in Schüpfen CH (source: BioSoFer report, see also figure on the left). There, no additional storage tank was required, but a longer connection pipe to the central station and an additional integration for a building at the location of the solar system had to be built. For larger systems the fraction of planning, control, installations and pure material cost for collectors, pipping and mounting gets dominant. Systems with a high solar fraction require relatively large storage tanks, and the share of the storage tank in the total cost increases with the targeted solar fraction.

Operating cost

Typical values for operating cost*

Financing cost	5-10%
Maintenance cost	0.27-0.5 %
Electricity/pumping cost	0.14-0.25 %
Land use	1-2 %

*annual cost as a fraction of total investment

Solar energy is free

Since the primary energy, i.e. the solar radiation, is free of charge in solar thermal systems, there are no energy costs and the operating costs are dominated by the capital costs. Only the operation of the circulation pumps requires some electrical energy. Based on international experience, the IEA SHC Task 52 gives a typical value for annual electricity costs of 0.14% of the investment costs. Maintenance costs should be less than half a percent of the investment costs, with a value of 0.27 % for large Danish installations. This shows that the financing costs for large solar thermal systems dominate the operating costs, which are strongly dependent on parameters such as the duration and the interest rate. Even with an optimistic interest rate of 3% and a payback period of 25 years, the financing cost is 5.5%. Shorter terms and higher interest rates result in significantly higher financing costs. Land costs (for lease or land purchase) are also not insignificant; according to the IEA SHC, they amount to 1-2% of the total investment costs per year.

Funding schemes

For large solar thermal plants, there are alternative funding schemes to the well-known bank loans, although some of them have not yet been used in Switzerland. They have their different advantages and disadvantages in terms of cost, liability and ownership.

Energy contracting

In this business model, the plant is financed by a third party, usually an Energy Service Company (ESCO) or specialized contracting companies (e.g. the operator of the district heating system). The plant is owned by this company, which then sells the energy to the heat consuming company. The heat price and the minimum purchase duration are contractually fixed. All aspects regarding financing as well as all operation & maintenance are handled by the contracting company. Some contracts include an option to purchase the plant after a pre-determined period.

Special Purpose Vehicles (SPV)

A special purpose vehicle is a company created solely for one specific purpose. In this case, the SPV is owned by either the user or by an ESCO and pays dividends to them. The SPV owns the solar plant and sells heat to the consuming company. This system reduces the risk for the owning company and provides more contractual flexibility.

Contracting companies:
- local Energy suppliers
- NewHeat, France
- Enertracting, Germany
- Solid, Austria

Third-party investors:
- kyotherm, in France
- TVP Investment

Subsidies and permissions in Switzerland

In Switzerland, financial support for solar thermal energy is part of the building program and is therefore regulated at the cantonal level. This also means that there are only binding rules for financial support for smaller systems integrated into buildings. A harmonised subsidy model defining minimum financial support according to the formula written below is adopted by most cantons. However, this rule often doesn't apply directly to very large grid-integrated systems and special rules usually have to be clarified individually with the relevant authority. The current subsidy situation for each individual canton can be found at www.kollektorliste.ch.

$$S > 1200 + 500/P$$

where P is the installed nominal power in [kW] and the resulting subsidy S in [CHF], from: HFM2015.

Legal situation for field installations

Technical installations in the agricultural zone may be approved if they are "locally bound and serve a higher interest". In the case of large solar thermal installations, both can be claimed, as they must be built close to large consumers such as heating networks and serve the supply of renewable energy. However, since this is a matter of weighing up interests and there are no precedents yet, there is no clarity in Switzerland on the permissibility of large solar thermal plants in the agricultural zone.

Relevant source & further information

- www.kollektorliste.ch
- Webpage *on solar district heating*
- IEA-SHC Task68: *Efficient Solar District Heating Systems*
- SolCAD: *Potentiel du solaire thermique dans les chauffages à distance en Suisse*
- BioSolFer: *Integration von Solarwärme in Biomasse Fernwärmenetze*

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