solarcombi+

D2.5: Summary of report on specification of component costs

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Identification of most promising markets and promotion of standardised system configurations for the market entry of small scale combined solar heating & cooling applications
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1 Introduction

In the framework of the SC+ project this report summarizes the main outcomes of the market analysis in terms of economic sustainability for the examined technology. This analysis was done on the basis of a three-step process:

- a discussion on the resulting statistical data occurred through a survey among the project's industrial partners,
- an economic comparison to the most competing technologies and
- an examination of the potential for future manufacturing cost reductions based on the learning curve methodology.

2 Component costs

The chiller, being the main component of the SC+ system, has a particular role in the cost analysis. Not only does it normally stand as the most expensive component in the cost breakdown, but it is also vital for the dimensioning and cost accounting of the remaining components.

Further cost parameters that have to be considered in the final turn-key solution include the individual needs of the end user, the profit margin of the retailer and the installation as well as the transportation costs. Because of the uncertainty concerning the aforementioned parameters as well as the specific component cost breakdown, a number of assumptions and estimations had to be made. The analysed chiller cost, conversely, was based on much more accurate information, as it was provided directly by the manufacturers.

Overall, the data that were obtained through the performed survey were characterized by strong variations and low uniformity. However, this uncertainty was more or less anticipated and attributed to the current position of the technology in the market development course, hence the **emerging market stage**.

The production of custom-made systems, rather than the establishment of an integrated production line to meet varying needs, as well as the risk involved and correlated to new technologies, which is considered for the

pricing of installation are **constraints** that do not permit a strict classification of the different cost-affecting parameters.

A rough analysis, though, classified the different cost parameters according to their share in the turn-key price. In specific, the chiller holds an average of **33%**, while the solar collectors **26%** and the cooling tower **9%**. The installation cost exhibits large variations, sometimes exceeding **15%** of the final price, due to the aforementioned reasons. This randomness is also illustrated in Figure 1, which represents the specific system price (in €/kW) – not including installation and transportation cost – in descending order. It is clearly observed that the final cost of the system is not weighted, although expected, by the cost of the chiller, rather by the rest of the components of the SC+ system.

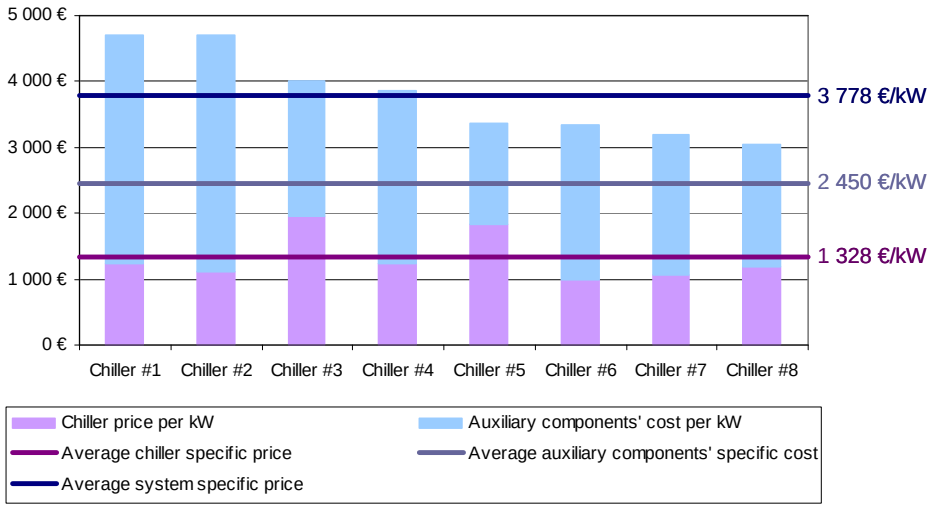

Figure 1: SC+ specific system price

Evidence that the examined technology has not yet fully overcome the first phase of market penetration is found through the observation of Figure 2, which represents the distribution of chillers' specific price in reference with their capacity.

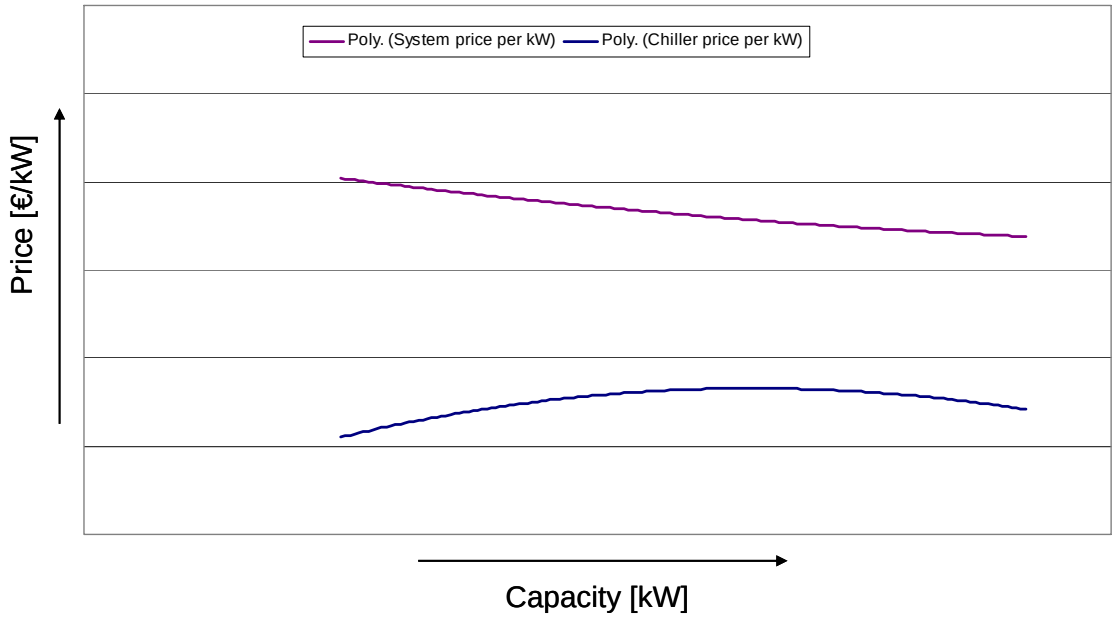

Figure 2: System and Chiller specific price

When analyzing the specific system and chiller prices (per $kW_{chiller}$), it would be expected that they either are at least constant or become more economical as the capacity increases. However, in Figure 2 the chiller price experiences a slight increase for intermediate capacities. This could be attributed to the different manufacturers, specifications and technical characteristics, but, nevertheless, it signifies large deviations in the existing SC+ market.

3 Economic analysis

The economic analysis performed later examined two different cases for the evaluation of the economic viability of a SC+ system. The first one concerned the prospect of replacing a conventional system with a SC+ system in existing buildings and the second one examined alternative investment plans in new buildings.

The choice of alternative investments was done according to the current competition, based on both new and efficient technologies as well as conventional and reliable systems. Certain assumptions concerning technical, economical and climatic parameters were made and adequately justified to reflect a sufficiently realistic situation.

In the case of existing buildings, the payback period for investing into a SC+ system to replace the existing technology was evaluated. The examined scenarios concerned both a single family house and an office building. The resulting payback period did not seem economical in any scenario examined - as it resulted to periods above 23 years, considering that the lifetime of the system rarely exceeds the 20 years' time.

However, another scenario implemented, hence the availability of subsidies, proved that the payback period can be reasonably reduced, not becoming, though, significantly competitive to the existing systems, what highlights the need for further market, cost related, adjustments for the SC+ systems.

The case of new buildings examines four alternative investments for the single family house and two for the office building. The results obtained by evaluating the net present values are represented in Figure 3.

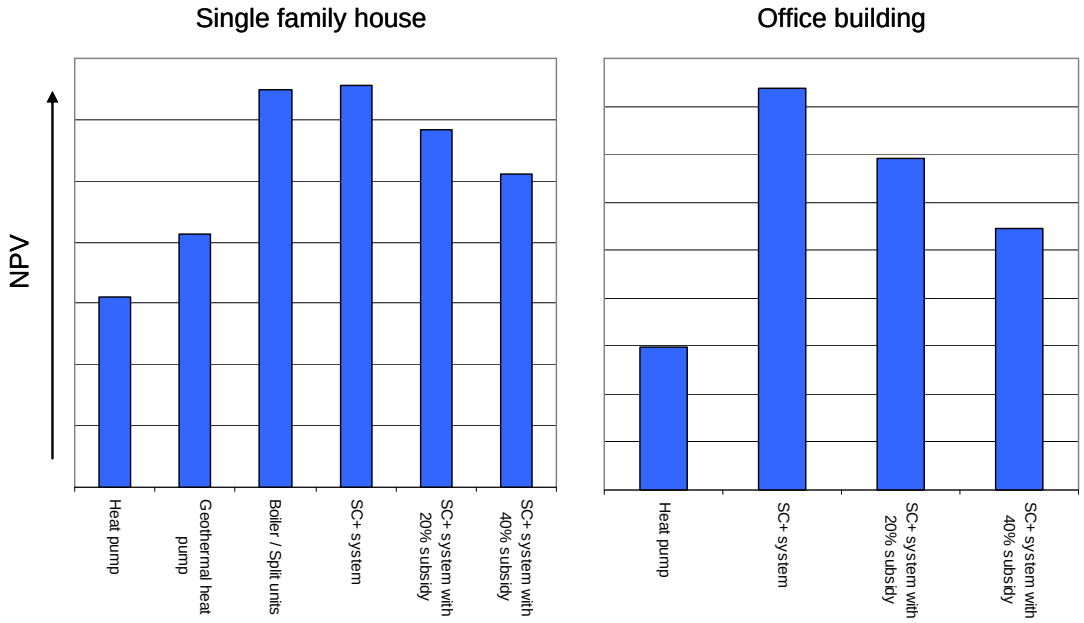

Figure 3: Net present values of alternative investments for the single in comparison

As observed in the graphs for the case of the single family house the SC+ system alone is fairly competitive to the conventional boiler and split units, in terms of NPV and when considering new investments. Above all, the availability of subsidies renders the SC+ system a reasonable choice. However, it still seems poor when compared to a heat pump or a geothermal heat pump - what is also observed in the case of the office building - and denotes that further reductions of the capital cost have to

take place, in order for the SC+ system to be robustly established in the relevant market.

4 Market potential

The potential for cost reductions can be investigated through numerous techniques, most of which refer to statistical analyses and observation of historic developments. The **learning curve methodology** belongs to such methods and is based on the theory of learning by doing. Hence, repetition of the same operation results in less time or effort expended on that operation.

In the case of the examined technology, this can be translated as the cumulative production of SC+ systems necessary to induce the desired manufacturing cost reductions. As the capital cost of the system or the final market price are directly related to the manufacturing cost, a significant reduction of the latter is able to provoke an intensive penetration as well as foundation to the relevant market.

According to empirical data, the cost of a technology is reduced exponentially as the cumulative production increases. What is interesting is to estimate an indicative level of cumulative production necessary to make the SC+ system's production competitive to the one of opposing technologies. Through the conducted analysis, it was concluded that even with optimistic assumptions (i.e. high learning rate), there has to be a considerable multiplication of the current number of installations (or systems already produced) for that to take place. For instance, the number of cumulative installed SC+ systems would have to become approximately 24 times larger than the current one, for the SC+ technology to adequately compete (in production cost) the heat pump.

The above presumption actually indicates that the examined SC+ system has to transit from its current position in the market development chain to the next level, hence the **mass production of standardized systems** that are feasible to fulfill varying users' requirements and create economies of scale.