Doing work by hand guarantees flexibility. Labour costs only make up 10 % of collector costs – the remaining 90 % come from the materials. Photo: Viessmann

Generating inexpensive solar heat

In the last few years the solar thermal industry has invested quite a lot in the optimisation of their manufacturing. Rising material and raw material costs have negated the effects of lower production costs, however. The sector is now calling for better research support in a new strategy paper.

At the beginning of May 2009 the heating system manufacturer Rotex Heating Systems GmbH from Heilbronn, southern Germany, started up a new production line for its Solaris collectors. Its aim was to reduce costs and increase its production capacity. Indeed, the company was not only able to reduce the amount of work required per collector, down from one hour to just 18 minutes, but was also able to make production more flexible. Minimal set-up times also make it possible to do small production runs, says the company. A new design of the collector housing has helped here and has considerably reduced the effort required in manufacturing. Instead of complicated screw and seam connections, the Rotex developers went for quick to manufacture but still robust crimping techniques. Time, and thus money, is also saved in the production process by having a frameless glass assembly process.

Many collector manufacturers have expanded, modernised and optimised their production lines as Rotex has done. But the solar thermal sector still has a problem; according to an analysis by the Institute of Thermodynamics and Heating Technology (ITW) in Stuttgart, Germany, the system costs for solar thermal systems have hardly dropped in the last few years. “Until now, the relatively high cost of solar thermal systems has not been a fundamental problem, as ecologically minded customers have had no other prac-

tical alternatives for heat generation from renewables available to them," says ITW researcher Harald Drück. But price pressures will rise due to technological developments and price reductions which have meanwhile occurred in biomass and photovoltaic systems, for example. While the photovoltaics industry has been able to strongly reduce the generation price of electricity in many countries through uninterrupted support from models based on the German Renewable Energy Act (EEG), the solar thermal sector has been struggling internationally with continuously changing and mostly worsening frameworks.

High cost of materials is causing problems for manufacturers

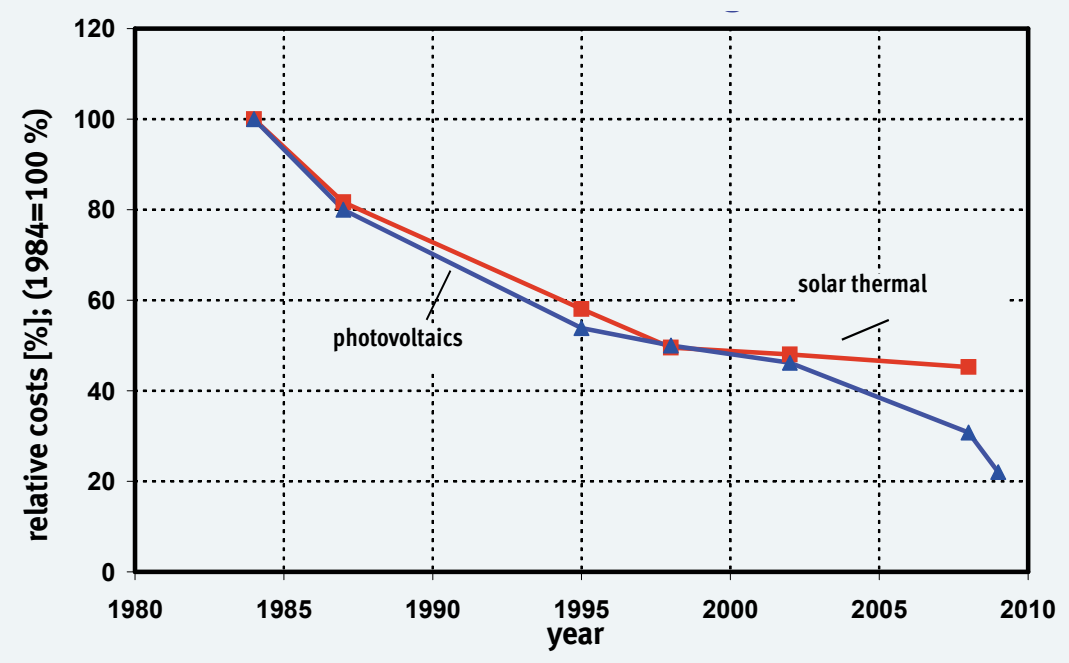
This is one reason why the economies of scale have not had an effect on prices in the sector, thinks Andreas Knoch, head of the systems manufacturer Wagner & Co Solartechnik GmbH of Cölbe, Germany: "The European solar thermal markets shrank twice in a row in 2009 and 2010. Combined systems, for example, which the sector has invested a lot of money in to get them optimised, are currently losing in market share on the solar thermal market. Additionally, there has been a considerable price increase in raw materials in the last few years." Alexander Eichwalder, head of sales at the world's largest collector manufacturer GREENoneTEC Solarindustrie GmbH of St. Veit, Austria, estimates that the cost of collectors as a sector average consists of 90 % materials costs and only 10 % labour costs. It is not only the opinion of Davorin Pavic, head of technology at the German absorber coating company Bluetec GmbH & Co. KG, that cost savings through higher production efficiency have been eaten up by the rising cost of materials.

The question remains of what manufacturers can do to compete successfully with conventional and other renewable energy sources. "The focus must be on the simplicity of the solar system. Most systems in Europe tend towards 'over-engineering'. In the future the end consumer will not be willing to spend € 4,000 or more to get an installed solar hot water system. The payback period for a solar system should not be more than five years even without support," says Eichwalder. Replacing high-cost metals with plastics will also have a positive effect on the system price. Knoch concurs with his Austrian colleague: "The successive switching of absorber materials from copper to aluminium can at least compensate for the rising price of metals." He sees a potential for material optimisation in all the system components. It will be a matter of achieving this without suffering in terms of quality and system efficiency.

How much can collector manufacturing be automated?

In his opinion all potential for cost reduction must be made use of: the use of new materials, the development of cheaper manufacturing processes, increasing the system efficiency and the development of

Cost developments in solar thermal/photovoltaics

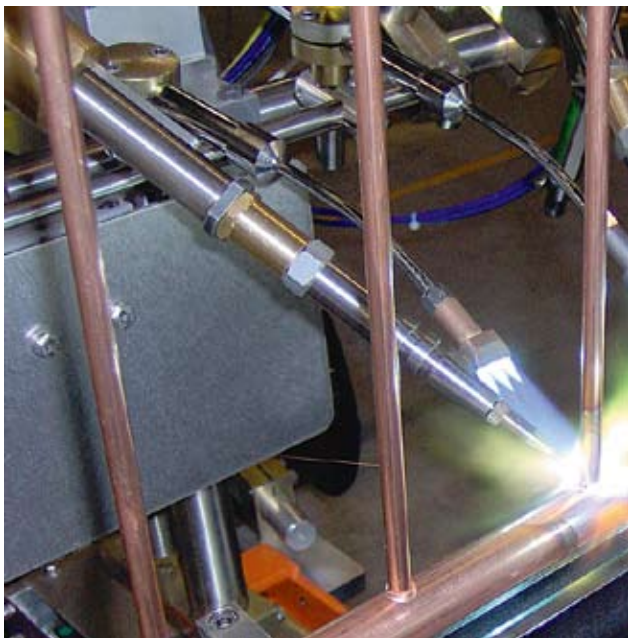


Relative costs per kW of installed thermal and photovoltaic power. The price curve for solar thermal systems has been stagnant for several years.

Graphic: ITW

simpler systems. Professor Wilfried Zörner from the Ingolstadt University of Applied Sciences in southern Germany sees things similarly: "It won't be a case of suddenly recognising and hoisting up a 'great' potential somewhere along the line. Rathermore, a continuous cost-oriented approach in all process areas will be required, from development and design to the manufacturing itself. Unfortunately, one has to note that innovation and engineering efforts in the last few years have mainly been directed at increasing performance, which has led to an increase in costs rather than a reduction in quite a few cases." Zörner has studied production processes in the collector industry in the last few years and has come to the following conclusion: "On the one hand, the costs mainly lie in the materials, which makes a fundamental shift to cheaper materials necessary here. On the other, the current manufacturing setup is hindering a comprehensive automation of the manufacturing process."

Although absorber manufacturing already mostly runs automatically in many solar factories, in collector manufacturing most of the assembly processes are ones which are hard to automate and automated processes would restrict the manufacturers' flexibility. Given the low share of assembly costs in the total costs of manufacturing a collector, there is the additional question of what potential is still available for reducing costs through further automation. The cost structures for solar collectors have not changed much in the last few years. If anything, the materials share has risen further due to increased precursor material prices and simultaneously improved production processes. Zörner counters here: "At first glance this logic is understandable. But taking a second look, and realising that optimising production means fundamentally changing the collector design and thus also the choice of materials, shows that it isn't. We have to understand design and production as a single optimisation subject." Then, optimising production will open up potential on the materials cost side through the changed designs.



The sector is working on lowering costs together

An example from Germany shows that efforts to reduce costs are being considered as a joint task for the sector: the German Solar Thermal Technology Platform DSTTP, a coming together of 100 solar thermal experts from industry and research, published its research strategy paper on low-temperature solar thermal in 2030 (Niedertemperatur-Solarthermie 2030) at the beginning of December 2010. In this, the experts call for a significant increase in research funding, for example, in order to be able to work on the identified development tasks. The paper describes these as follows: "The R&D tasks for standard collectors mainly lie in reducing costs by reducing or replacing expensive materials and by taking design steps and optimising production methods. A further R&D task lies in seeking ways to better master the stagnation temperature without reducing efficiency and integrating the collector optimally into the building shell, i.e. into the roof and the façade."

As a further measure the paper calls for the building of various solar collector types which are tailored to the specific requirements of individual areas of use, instead of manufacturing universal collectors which are suitable for many uses and temperature ranges. Optimised and new manufacturing technology and processes are also mentioned by the DSTTP as a building block for reducing the cost of systems. New manufacturing processes such as gluing would provide an opportunity to improve designs and optimise production methods for all structural connections to the housing, between the housing and the transparent cover and on the absorber. The solar thermal experts demand more state support for their tasks. "The state research budget for low-temperature solar thermal research should be increased from approx. € 8 million a year today to approx. € 50 million a year by 2020 at the latest," it says in their strategy paper. Systems cost will then be able to fall again more strongly in the **end.**

Joachim Berner

New production lines increase the productivity of the solar thermal industry. But will this be enough to reduce systems prices in the long term? Photo: Vermotec

Brazing, punching and clinching – machinery solutions at a glance

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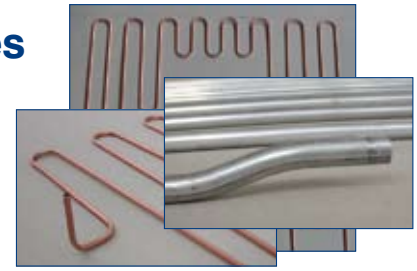

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Brazing aluminium pipes is one of the technical challenges with which machinery suppliers of the collector industry have to cope – flexible and cost-effective automation is the other. Photo: Dtec

Dagan presents new punching technology

Dagan Machine Engineering, Israel, has added a through-hole punching machine to its product portfolio. It is based on the company's punching model with a counter die and fits for the production of manifolds for the vacuum tube collector industry. "The new machinery model will enable manufacturers to pass the same pipe twice so that two holes opposite from each other can be punched with very accurate positioning," company founder Moshe Dagan explains. The machine will find its application in the vacuum tube collectors industry. Punching machines from Dagan achieve collar shapes by a patented technology which results in a cylindrical, rather than conical collar, best matching brazing requirements. According to manufacturer's information, the punching process is chipless, fast and does not require oil cleaning. The

counter head prevents collar cracking through harder copper material. Since 2006, Dagan has focused its business activities on punching, automatic brazing and automatic bending machines for solar absorber manufacturing.

Further information:
www.dagan-machine.com

Dtec systems fit for aluminium

Austrian automation specialist and machinery manufacturer Dtec GmbH has responded to the growing demand for aluminium as an absorber material. It has begun to offer tube processing systems, which can manufacture harps, as well as manifolds made of either aluminium or copper. Even the welding systems and bending machines by the machinery supplier can be used for both aluminium and copper products. Dtec's Managing Director Michael Dietl guarantees cycle times of 70 seconds for a standard pipe register. "The high bending quality at the different radii offers good opportunities to process the materials further. A transport system integrated into the table provides full protection against deformations of aluminium pipe registers," he says, listing additional advantages of the company's bending machines. All systems can be operated and programmed via touch screen.

Further information:
www.dtec.at

Internal punching specialists from Israel

Israeli company Ravid Solar Solutions has offered punching machines since 2002. So far, it has delivered around 30 machines to collector manufacturers all around the world. Its machines are all based on an internal punching process first implemented by Ravid Solar Solutions in a commercially available production machine. "Internal punching is cost-effective, clean and results in a good collar quality," Bezalel Ravid, founder and Managing Director of Ravid Solar Solutions names the advantages of the process. It works as follows: a small hole is punched first. The punch is then extracted further, bending out the circumference of the hole, to form a collar with the desired diameter. When punching is complete, the gripper, which is holding the tube, is placing it exactly at the next punching position.

Further information:
Ravid Solar Solutions: www.b-ravid.com

One machine, two process steps

German brazing specialist VerMoTec offers the entire service package for harp-type absorber manufacturing. Its portfolio includes machinery units for brazing copper and aluminium harps, which are flexible regarding the distance between pipe and manifold, and brazing paste. "The solutions for aluminium harp pipe registers base on long-term experiences with more than 500 brazing machines for aluminium parts in the automotive industry," Marcello de Cardenas, Managing Director of VerMoTec, points out. His professional carrier goes back to the Italian brazing company Saldomatic, which was purchased by VerMoTec in 2009.

Since then, the German company developed a special bending machine for harp pipes, which bends down the manifolds of the harp register in a way that the absorber sheet lies horizontal on the harp pipes. A special feature of this particular machine is its combination with a 16 or 20 bar air pressure difference test to ensure the harp does not leak. "We combine two process steps in one. No extra handling, no water dipping, no drying," de Cardenas summarises the advantages. Five units have been sold since the machine's launch on the market at the end of 2008.

Further information:
www.vermotec.de

SMEThermal 2011 at a glance

Motto: The solar industry meets equipment suppliers

Main topics: issues of cost reduction and production optimisation, i.e. automation, process optimisation, quality assurance in collector and storage tank production

Date: February 10th, 2011

Location: Beletage Conference Center, Heinrich-Böll-Stiftung, Berlin (Germany)

Participant statistics 2010: 150 specialists from 26 countries

Conference language: English

Organizers: Solarpraxis AG (Berlin) in cooperation with SUN & WIND ENERGY

Registration fee: € 595 (standard), € 545 (ESTIF members)

Link to the conference programme:
www.solarpraxis.de/en/conferenze/smethermal-2011/program

Clinching machine for Omega absorbers

Austrian machinery supplier RG Fertigungstechnik has developed a clinching machine for absorber production and delivered its first prototype in spring 2010 to Austrian solar thermal system specialist Estec. "We are satisfied with our new absorber production," Martin Wilhelmer, Estec's Sales Manager, confirms. "After testing the machine during a pilot phase, we are now officially in serial production."
The new so-called Omega absorber process consist of coated aluminium plates, harp-type copper pipes and omega-form aluminium sheets. In order to join plate and sheet, RF Fertigungstechnik has developed an entirely automated clinching machine.

The clinching machine is fed with the absorber plate, and the omega-form sheet that already encloses the harp-type pipe. The machine can do 96 buttons per cycle, which means about 8 minutes for one absorber of 2.5 m². If necessary, the number of buttons per pass can be increased to up to 196, the machinery manufacturer states.

Roland Grubelnig, Managing Director of RG Fertigungstechnik GmbH, confirms that the company has already received orders from other collector manufacturers to set up automated clinching machines tailored specifically to their requirements.

Further information:
http://www.rg-fertigungstechnik.at

Bärbel Epp, Joachim Berner