

# CONCENTRATED BRILLIANCE

From scientist to entrepreneur – thanks to measurement technology and research expertise

Dorothee Bürkle



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Measuring the geometry of parabolic trough collectors

For many years, the German Aerospace Center (DLR) has been conducting research and development on concentrating thermal solar power. DLR's experts are particularly active in Almería (southern Spain), where solar energy is increasingly being used for the generation of electricity. The knowledge and experience the DLR Institute of Technical Thermodynamics has gained here are in high demand among the planners, constructors and operators of solar thermal plants. Dr.-Ing. Eckhard Lüpfert and his colleagues Dr. Steffen Ulmer and Dr. Klaus Pottler have been the driving force behind the development of such plants at DLR over the past years. In September 2007, the three DLR researchers formed their own company, CSPS (Concentrating Solar Power Services). They provide consultancy services to investors and plant operators, and offer measurement technologies and other devices for plant optimisation. With notable success – the new company's order books are full. DLR Nachrichten spoke to Eckhard Lüpfert.

**How is electricity generated from the sun, and what is the advantage of concentrating thermal solar power plants?**

**Dr. Lüpfert:**

The best-known way of generating electricity from solar energy is photovoltaics. The electricity is generated directly from silicon cells. The disadvantage of this technology is that the production of silicon cells is quite expensive, as some of the materials are very difficult to obtain. Thermal solar powerplants are based on a different approach. It concentrates the rays of the sun to create heat, which is then used to generate power using conventional processes. This technology does not require any "exotic" materials for the components; all that's needed is glass, steel and concrete. The biggest advantage of solar-based power plants, of course, is their low impact on the environment. There are no carbon-dioxide emissions, and no non-sustainable resources are used up. However, the technological cost of constructing a solar-based power plant is higher than for a conventional power plant. It takes several years for a solar plant to become profitable – but once it does, it is very competitive.

**In 2007, you and your colleagues decided to take your expertise outside of the DLR umbrella. Why?**

**Dr. Lüpfert:**

While we were working at the Almería testing plant over the last few years, one of our tasks was to develop solar collectors in collaboration with industrial partners. The goal wasn't just research, it was to develop collectors that could actually be used to set up power plants. This industrial perspective focused our attention on the real-world considerations of solar-based power generation: How can it be made economical? What is the best way to focus the mirrors? How are the mirrors set up most efficiently? We were now dealing with quality standards, component specifications and industrial norms. The knowledge that we had gained at DLR was, we learned, in high demand in the industrial sector. This became most apparent in 2004/2005, when solar technology began to be used in commercial power plants. As DLR is a publicly funded research institution, however, its range of tasks does not include the fostering of industrial activity. As there is nevertheless growing interest in DLR expertise within the ener-



Dr. Eckhard Lüpfert

gy industry, we decided to form a spin-off company that could transfer R&D experiences onto the shop floor.

**What do you offer to your clients?**

**Dr. Lüpfert:**

On the one hand, we act as consultants and provide technical expertise. Not many people have followed the developments of this technology as closely as we have. In our 16 years of researching solar energy at DLR, we have put together a considerable knowledge base and network of contacts. On the other hand, we offer measurement technologies for evaluating the performance qualities of solar collectors. These are applicable from development and construction right through to operation.



Measuring the reflective geometries of parabolic mirrors

### What kind of measurement technologies are we talking about?

#### Dr. Lüpfert:

We analyse the solar collectors with a photometric system. This measures the collectors from different angles and evaluates the readings using our specialised software. At one of the power plants in southern Spain, our readings helped to optimise the more than 7,000 modules of parabolic trough collectors. This type of quality

management is vital for a plant to produce maximum output, as otherwise the plant's profitability may be jeopardised. Even if a plant's collectors are already aligned very accurately during construction, our technologies will typically increase the efficiency by another one to three percent. If a plant has badly aligned collectors, it may waste up to ten to 15 percent of its output. But we do more than just fixing collector alignment; we provide support for construction, we create yield forecasts, and we conduct employee training sessions. The demand for our services has been very encouraging, both in consultancy and in measurement.

remain the domain of DLR. Consultancy, client training and everything to do with construction sites – i.e. typical engineering tasks – are taken care of by CSPS. Of course, there are crossovers as well. Some of the service provision contracts we get for CSPS, for example, lead on to measurement contracts in other areas, and these are handled by DLR. Both sides are getting new projects and new know-how.

### How would it affect solar power plant constructors and operators if the services you have described were not available through your spin-off company?

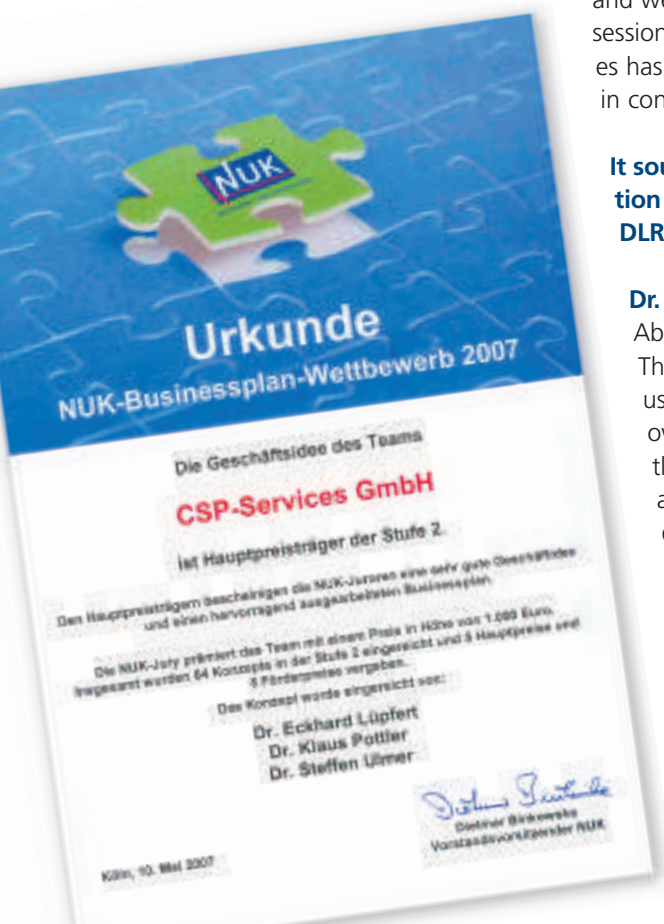
#### Dr. Lüpfert:

Well, I believe there would have been far fewer contracts, and the power plants that are currently being built would have missed out on some valuable input. It's interesting to see, actually, how positively our clients responded to the spin-off. They were happy that they didn't always have to interact with a major research institute, but that they could deal directly with a small, agile service provider – one that is

### It sounds like a win-win situation for your company and for DLR, wouldn't you say?

#### Dr. Lüpfert:

Absolutely, we all agree on that. The contacts we are making are useful to DLR as well as our own company. There is very little confusion about what's DLR and what's CSPS: Research, development and collaboration with strategic partners



The winners of the NUK Business Plan Award 2007

“In the construction of concentrating solar collectors, deviations of just a few millimetres can have a very detrimental effect on the energy yield.”

Quality assurance in solar collector assembly



firmly focused on getting results. We can respond very quickly, even when tasks or problems come up at very short notice.

#### What was it like for you as a scientist to become an entrepreneur?

##### Dr. Lüpfert:

It has been a really interesting experience. In the last few years at DLR, I had already ceased being a proper research scientist as such and had been focusing on project planning and implementation. Lots of communication and lots of project management. That contract-based approach to working is even stronger now. As entrepreneurs, we need to keep an eye on everything and be very versatile. We are also responsible for our own finances; we have

to be working profitably. At the moment, everything is running well and I feel like I'm in control. However, that can change in an instant! As an entrepreneur, you need to commit to your jobs, and you are obliged to deliver on your promises. Of course this can get quite stressful at times, and we are also working longer hours.

#### Where do you see your company heading over the next few years?

##### Dr. Lüpfert:

Since we formed the company, we've actually managed to make money. Our turnover is in the hundreds of thousands, and our order books are full. We started out with a tiny office in Cologne, and since July 2008 we've also been running an office in Almería – a large portion of our customers are from Spain. At the moment we employ eleven people, but their workload changes all the time and some of them are freelancers. We have just filled our first full-time position at the Almería office. It's all looking very promising right now, but it's difficult to predict our growth for the coming years. Basically we

will need to develop very organically. Our expertise cannot be mechanically replicated like an assembly-line product, even though some of our investors would love to see that. There is definitely a big demand for our services; the starting conditions for this kind of company are excellent. As long as we do justice to every contract and complete all the specific tasks to the best of our abilities, and as long as we manage to uphold our standards in the long term, we will be able to continue on the present path and expand our activities. Getting out of the DLR comfort zone will probably be our biggest challenge. But I fully trust our excellent foundations at DLR, and I'm sure we will continue to thrive together.

##### Author:

Dorothee Bürkle, DLR online editor.

Solar power plants with a collector surface area of between 200,000 and 500,000 m<sup>2</sup> are being planned and built in Spain, the US, Morocco, Algeria, Egypt, Iran, Israel, Mexico, Australia and other countries. In Spain alone, solar power plants are producing a total output of more than 400 megawatts, and more than a billion euros have been invested into construction. Further power plants with an output of several 100 megawatts are in planning.