SMARTER USE OF ENERGY

INDEPENDENT STORIES

SMA SOLAR TECHNOLOGY AG

CONTENT/EDITORIAL

TITLE
Nils Werner is a pioneer in renewable energy. Read more about his family´s life in a Smart Home starting on page 4.

How should we shape future energy supplies in the face of progressive climate change and the increasingly declining availability of fossil fuels? This is an issue being addressed by more and more people and companies all around the world. For many of them, the answer is simple: They want to take their energy supply into their own hands. PV systems provide them with the opportunity to become independent from rising electricity costs and to move away from the finite and climate-damaging conventional energy carriers.

As the technology progresses, solar power generation becomes increasingly economically viable, and the opportunities for using the technology become even more varied. In industrialized countries, people are upgrading their houses to smart homes. Through integrated storage devices, the electricity generated from the on-roof systems can be used during the nighttime as well. Industrial and commercial firms are installing PV systems on their buildings in order to reduce operating costs through use of cost-efficient solar electricity.

In newly industrialized countries with high levels of solar irradiation, large PV power plants are helping provide more and more people with rapid access to a sustainable and inexpensive electricity supply – and thus to prosperity and economic development. Industrial consumers who struggle with regular power outages or who even have no access to the utility grid at all are no longer dependent on expensive diesel fuel for a reliable and uninterrupted electricity supply. They supplement their diesel generator sets with photovoltaics in order to reduce costs and CO_2 emissions.

Innovative system technology for intelligent energy management is one of the prerequisites for increased independence in the use of energy. And with passion, we have devoted our efforts to this task for more than 30 years. With SMA technology, everyone can personalize the way they use their energy. On top of this, it also helps ensure that more and more renewable energy can be integrated into the utility grids – without lengthy planning and construction phases or overly expensive grid expansion projects.

The articles on the following pages will tell you more about how this takes shape in people's everyday lives. In these stories, people from different countries talk about their experiences, their visions and the targets they're pursuing with their energy projects. From the family in the Northern Hesse region of Germany that turned its dream of a smart home into reality, to the physicist in the U.S. who is researching the optimum use of large-scale storage systems, to the service manager who makes the impossible possible for the operator of a large PV power plant in Japan – they all have one thing in common – they are pioneers in the independent, decentralized and renewable energy supplies of tomorrow.

Home **SMART** Home

A COLD WIND IS BLOWING TODAY IN THE NORTHERN HESSE REGION OF GERMANY. BUT OUR INTERVIEW IN MANDY WERNER AND SIMON BUTTERWECK'S LIVING ROOM IS COZY AND WARM. TWO YEARS AGO, THEY BUILT THEIR DREAM HOUSE – AND SINCE THEN, THEY HAVE BEEN GENERATING A LARGE PORTION OF THEIR ENERGY THEMSELVES WITH THEIR OWN PV SYSTEM. AND AS IT IS A "SMART HOME," THEY CAN EVEN TAKE ADVANTAGE OF THE ELECTRICITY THEY HAVE GENERATED IF THE WEATHER IS BAD OR DURING THE EVENING, WHEN THE SUN ISN'T SHINING.

"OUR OWN ELECTRICITY IS MUCH CHEAPER THAN THE ELECTRICITY FROM THE UTILITY GRID, AND WE ARE LARGELY INDEPENDENT FROM THE CONTINUALLY INCREASING PRICE OF ELECTRICITY."

SIMON BUTTERWECK

— ***Mandy and Simon, why don't you get your electricity from the utility grid like most people?***

Mandy: This is something we were sure about for a long time: If we were going to build a house, we wanted to save energy and generate our own electricity.

Simon: And now we use our PV system to produce our own electricity. This is much cheaper than electricity from the utility grid, and we are largely independent from the continually increasing price of electricity. By the way, our solar electricity is not just for electrical equipment – we also use it to provide hot water and heat the home. The only time it is not enough is during the winter months, when we have to fire up our wood pellet stove as well.

— ***But you've no doubt invested quite a lot in the PV system ...***

Simon: Yes, but it has definitely been worthwhile. With the help of the Sunny Home Manager and the Sunny Island, we have turned our house into a smart home. As a result, we can maximize the amount of solar electricity we use ourselves.

€30

A MONTH – SINCE MANDY, SIMON AND NILS HAVE LIVED IN THEIR SMART HOME, THEIR ELECTRICITY BILLS HAVE BEEN SIGNIFICANTLY LOWER THAN BEFORE.

— ***So how does it work?***

Simon: It's actually very simple. I tell the Sunny Home Manager the time by which the clothes and the dishes need to be washed, and the system knows when the PV system is generating enough electricity for the washing machine and dishwasher.

Mandy: This even works with our old washing machine. We load it up in the morning before we head off for work, and once enough solar electricity is available the Sunny Home Manager starts the machine via the SMA radio-controlled socket. When we get back home in the evening, everything is clean.

— ***Did you need to make a lot of changes to your day-to-day lives after moving into the smart home?***

Mandy: No, not at all. But I do think we are now much more aware of how much energy we use. And this has even rubbed off onto our son, Nils (laughs). Just yesterday, he told me off: "Mom, do you really need to use the hairdryer again even though the sun is not shining? Do you know how much electricity that uses?" But because we are able to store the solar electricity that is not immediately used in the battery, this means that we can use it practically around the clock, regardless of the weather.

Simon: Nils is growing up with this level of awareness, which is great. But, of course, there are also some people who are critical about what we're doing. For example, lots of our friends and acquaintances have asked us whether our PV system is really worthwhile. After all, there are reports everywhere about how solar electricity is allegedly overpriced.

— ***So, have you been able to convince your critics that this is not the case?***

Mandy: So far, yes – always. Nobody has beaten Sunny Portal yet. This is an online portal to which the Sunny Home Manager sends data. Here, we can then for example see – with accuracy down to the second – which electrical devices are currently using how much electricity, how much of this electricity is coming from the PV system and how much electricity we are purchasing from the utility grid. Whenever we show this to the critics, they are always astonished at how much of the solar electricity we are actually able to consume ourselves.

Simon: We even managed to convince my brother. He now also has a smart home with a PV system and is currently testing the new Sunny Boy Smart Energy inverter with integrated storage for SMA. At the end of each month, we always compare who has been able to use a larger share of our self-generated electricity and who needed to purchase the least amount of electricity from the utility grid. This gets more exciting the more components we allow the Sunny Home Manager to control. We are currently on the lookout for a small electric car. We will be able to recharge it cheaply with our own solar electricity and thus use it as an additional storage system.

Mandy and Simon, many thanks for taking the time to talk to us.

SMA SMART HOME

With the SMA Smart Home system, owners of PV systems can cover a particularly high proportion of their demand with cost-efficient electricity from the roof. This makes them more independent from rising energy costs.

BATTERY STORAGE SYSTEM AND SUNNY ISLAND

In conjunction with battery storage systems, the Sunny Island battery inverter enables you to store any solar energy that is not immediately consumed so that it can be used later. This means the energy can be used when the sun is not shining.

SUNNY TRIPOWER

The photovoltaic inverter converts the direct current produced by the PV modules into alternating current. This is preferably used in the house or stored in the batteries, and only what is then left over is fed into the utility grid.

SUNNY HOME MANAGER

The control center of the SMA Smart Home automatically and easily ensures that power generation and consumption are perfectly matched. The Sunny Home Manager also knows when, where and how much energy to store in the batteries for later use.

LEAN ON SOLAR

UPHOLSTERED FURNITURE MANUFACTURER HIMOLLA IS DEEPLY ROOTED IN THE BAVARIAN TOWN OF TAUFKIRCHEN AN DER VILS. WITHIN THE SPACE OF A FEW DECADES, THE COMPANY HAS GROWN FROM A SMALL FAMILY BUSINESS TO ONE OF EUROPE'S LARGEST MANUFACTURERS OF UPHOLSTERED FURNITURE. MANAGEMENT AND EMPLOYEES BOTH REGULARLY DEMONSTRATE A WILLINGNESS TO EMBRACE INNOVATION AND ARE HAPPY TO TRY OUT NEW THINGS. LIKE THE COMPANY'S PV SYSTEM THAT PROVIDES THEM WITH THEIR OWN ELECTRICITY SUPPLY. "THIS SETS US APART FROM OTHER COMPANIES, AND IT IS SOMETHING THAT WE ARE ACTUALLY RATHER PROUD OF," SAID ENERGY MANAGER MARKUS FISCHER. "I WOULD BE VERY SURPRISED IF ANY OF OUR COMPETITORS HAD A SYSTEM AS BIG AS THIS. AND YET, COST-EFFECTIVE AND ECO-FRIENDLY PRODUCTION IS BECOMING INCREASINGLY IMPORTANT TO OUR CUSTOMERS."

FULL OF ANTICIPATION Installer Josef Ecker and Energy Manager Markus Fischer are eager to find out whether the PV system will generate the forecast annual yield – or even exceed it.

"The furniture market is extremely competitive, so every cent really matters," said Fischer, who knows what he is talking about. For twelve years, this state-certified woodwork technician has been an extremely enthusiastic employee at upholstered furniture manufacturer himolla Polstermöbel. In order to keep up with international competition, the company must keep a constant eye on operating costs. After all, there is always pressure from the competition. So, naturally, everybody at himolla is thinking of ways to reduce costs even further.

"THE FURNITURE MARKET IS EXTREMELY COMPETITIVE, SO EVERY CENT REALLY MATTERS."

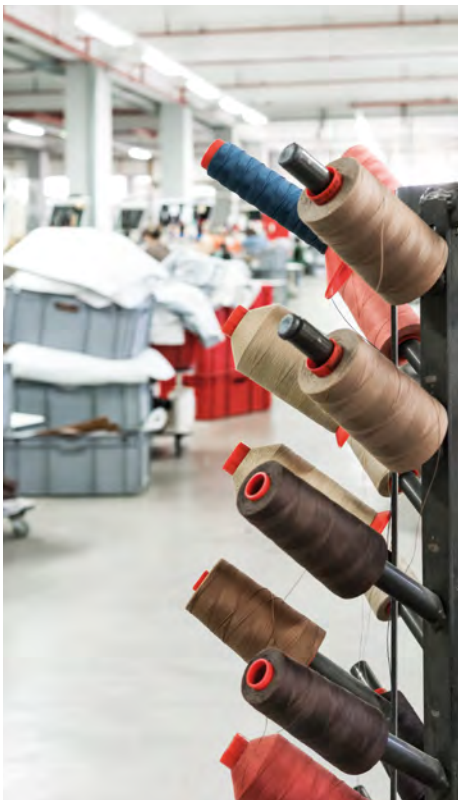
MARKUS FISCHER, HIMOLLA POLSTERMÖBEL

Fischer can't quite remember who originally came up with the idea of the PV system. "No doubt several people came up with it at the same time," pondered the 39-year old. "At the time though, it was not yet financially worthwhile to use the solar electricity ourselves. So our original plan was to lease out our roof space for a PV system." But then prices started falling so rapidly that Fischer and his colleagues soon realized that, if they were to build a PV system themselves and use the electricity for furniture production, they would need to spend far less on energy and would therefore be able to reduce operating costs. So Fischer got together with the head of production, the purchasing department and the factory's chief electrical engineer. During their intensive discussions, the plans for the PV system on the roof of the furniture factory became more and more concrete. Finally, they set out to identify an installation firm to turn this challenging project into reality and deliver a system with an output of 1 MW. After careful scrutiny of the various bids, Elektro Ecker from Landshut was awarded the contract to plan and construct the plant.

For Josef Ecker, company owner of Elektro Ecker, photovoltaics is more than just a career. "The idea of producing electricity and thereby becoming more independent has fascinated me for a long time." His passion started years ago with the construction of his own PV system – something the family man still likes to tinker with in any spare time he has. And now he has infected his whole family with his "solar fever." Both Ecker's parents and his wife work at his company. And for them in particular, the order from himolla was very special. "Before this we had never built such a large plant for self-consumption with such a high level of self-consumed electricity," recalled the electrical engineer.

"THE IDEA OF PRODUCING ELECTRICITY AND THEREBY BECOMING MORE INDEPENDENT HAS FASCINATED ME FOR A LONG TIME."

JOSEF ECKER, ELEKTRO ECKER



MADE IN BAVARIA Craftsmanship and employee skills are highly valued at himolla.

SUSTAINABLE The PV system is perfectly in tune with the environmentally friendly and resource-conserving nature of himolla production.

During implementation of the himolla plant, the grid operator's requirements regarding integration of photovoltaics into the factory's internal medium-voltage grid were a real challenge. Nonetheless, it only took six months before himolla was able to start operation of its own PV power plant. Since the beginning of December 2013, the 3 700 PV modules and 46 Sunny Tripower inverters from SMA have been supplying cheaper and cleaner electricity to the himolla production facilities.

Ecker has calculated that they are able to use over 90 % of the solar energy they produce. With an annual electricity bill of around €900 000, this equates to potential savings of around €150 000. "The plant produces the most electricity exactly when our production is running at full speed," said Markus Fischer, whose excitement is plain to see. "As a result, we need to purchase a lot less electricity and are largely freed from worries about how energy costs will continue to rise in the future." For himolla, this is a decisive advantage over their competitors.

"THE PV PLANT PRODUCES THE MOST ELECTRICITY EXACTLY WHEN OUR PRODUCTION IS RUNNING AT FULL SPEED."

MARKUS FISCHER

The company's approximately 1 100 employees manufacture 600 to 700 sets of upholstered furniture every day. Himolla promises its customers "Quality made in Bavaria." Craftsmanship and employee skills still play a very important role in this, as does the company's careful approach to its use of resources and treatment of the environment. So it wasn't for nothing that the manufacturer's entire product range has been awarded the Blue Angel eco-label. "Generating and using solar electricity fits perfectly with our corporate philosophy," explained Fischer. "Not only does this help us save money, but it is also good for the environment."

Both he and Ecker are now very excited to see whether the PV system will indeed meet the projected calculations for annual power generation – or whether it might even outperform them. "Well, it wouldn't be the first time that happened on a system I installed," smiled Ecker.

90 %

OF HIMOLLA'S SOLAR ELECTRICITY CAN BE USED DIRECTLY BY THE COMPANY – RESULTING IN ANNUAL SAVINGS OF €150 000.

SIMPLY COMPLEX

During his mechanical engineering degree course, electrical engineering was not one of Jörg Jahn's favorite subjects. Despite this, he took part in a wind power project in order to gain the necessary certificate in the subject. Ever since then, the engineer has had a passion for renewable energies – and he has become an expert in electrical engineering. At SMA, Jahn is working on ways to integrate more electricity from regenerative sources into the utility grids – essential if the global spread of renewables is to continue.

For more expert knowledge on
grid integration of renewable energies, please visit
en.SMA-Sunny.com/Netintegration

With sufficiently intelligent systems, even large quantities of renewable energy can be integrated into the utility grids.

— ***Jörg, why is it so important that photovoltaics be seamlessly integrated into the utility grids?***

All around the world, focus is shifting more and more to solar power as an infinite and inexpensive energy source. The share of large-scale PV power plants in overall power generation is growing rapidly. As a result, they are starting to have a major impact on supply grids. This means that, in the future, we will only be able to guarantee the stability of utility grids if we find ways to optimize how the electricity from these plants is integrated into the grids. And the share of renewable energies in global energy supplies will only continue to grow if we can succeed in our efforts.

— ***What makes grid integration so difficult for renewable energies?***

Well, first utility grids are all designed for conventional power generation, because, of course, this is what they were originally built for. The system is designed so that the synchronous generators, for example nuclear or coal power stations, automatically support the utility grid. This isn't necessarily the case with renewables. But by no means does this mean that we are going to have to invest vast sums into comprehensive grid upgrades before we can integrate electricity produced from renewable sources. In fact, highly flexible renewables are actually much better at delivering some of the grid services than conventional power plants, which are often comparatively slow to respond. But you have to tell them that they need to do it.

— ***And how do you do that?***

This is already happening now. With their intelligent system engineering, large PV power plants are already supporting the utility grid in many different ways, for example in terms of frequency and voltage stability. If we look at the overall system, the inverters and communication components of these plants offer tremendous further potential. The challenge for us is to integrate more and more functions while lowering costs at the same time. In order to do this work as efficiently as possible, we need to have the most accurate possible requirements in terms of connection conditions.

— ***So who defines the requirements for the grid connection?***

The directives are set out by committees made up not only of grid operators but also industry representatives. This is why this type of committee work is also an important part of my job – and not as dry as it may sound. Germany has already made a lot of progress in this field and is internationally seen as a good example. I think it's really exciting that, in this way, I am able to help shape the future of our energy supplies. After all, I am acting out of conviction.

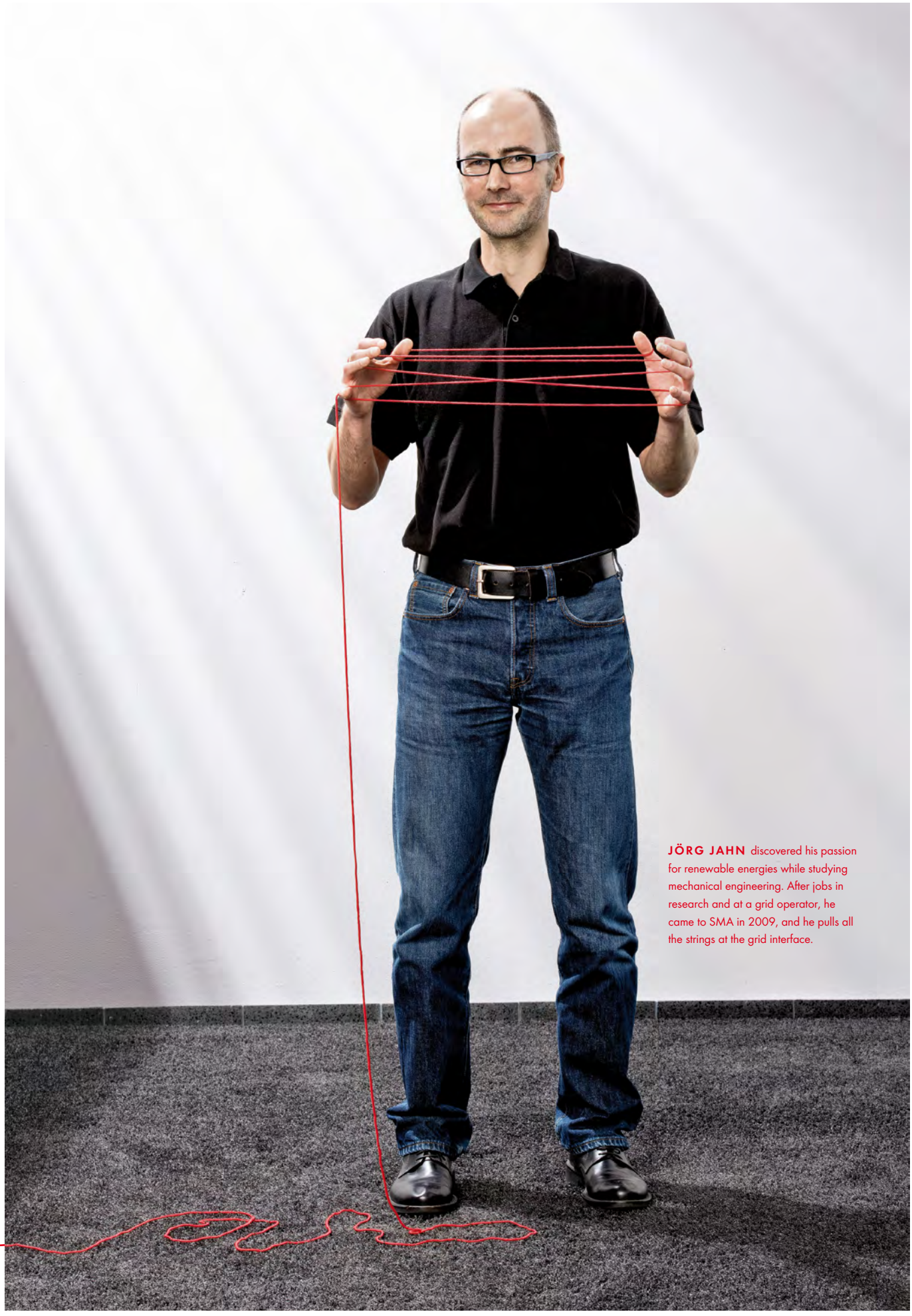
— ***But is it that straightforward to transfer German standards to other countries?***

This is something we are working on. But of course, we do not encounter the same conditions in every country. Particularly in newly industrialized countries where large-scale PV power plants are becoming increasingly competitive, the development of guidelines and directives is often still in its infancy. However, we have already seen a number of successes in these areas as well. For example, binding grid connection regulations were passed in South Africa at the end of 2012. And, by the way, some colleagues of mine helped work out these regulations. SMA took a very early and very active role in the German committees. As a result, we have witnessed many of the developments in the field of grid integration firsthand. We are now able to use this experience to bring the regulations and directives up to date much more quickly in new markets, and this in turn means that much faster rates of expansion can be achieved. There is no need to keep re-inventing the wheel. Luckily, the physics involved are the same wherever you go anyway.

— ***Are the results from the committee work also incorporated into the development work at SMA?***

Of course. For example, we learn where exactly the challenges are for grid operators and have the opportunity to think about ways in which inverters can help deliver even better solutions to these challenges. This also means that we can protect our customers' investments, as we offer them future-proof solutions that meet tomorrow's challenges today.

Jörg, many thanks for the interview.



JÖRG JAHN discovered his passion for renewable energies while studying mechanical engineering. After jobs in research and at a grid operator, he came to SMA in 2009, and he pulls all the strings at the grid interface.

MAKING THE GROUND SOLID FOR THE GRID

TUCSON, ARIZONA. THIS CITY IN THE AMERICAN SOUTHWEST IS SITUATED ON AN ELEVATED PLAIN SURROUNDED BY MOUNTAINS. THE LANDSCAPE IS DRY. NOTHING BUT CACTUS, SAND AND BRUSH. THE REGION ENJOYS 10 1/2 HOURS OF SUNSHINE A DAY ON AVERAGE. PERFECT FOR SOLAR ENERGY TO BE CONVERTED INTO ELECTRICITY BY A VERY SPECIAL PV POWER PLANT ON THE GROUNDS OF THE LOCAL UNIVERSITY. AT THIS SITE, SOLON AND ITS PARTNERS ARE EXPLORING THE POSSIBILITIES OPENED UP BY LARGE-SCALE STORAGE SYSTEMS – SO THAT WE CAN BECOME LESS DEPENDENT ON CONVENTIONAL POWER PLANTS AND PREVENT THE UNNECESSARY EXPENSE ASSOCIATED WITH EXPANDING THE UTILITY GRIDS.

Researching for more renewable energy

"If we don't integrate storage systems, we limit how far we can go with renewable energy sources to a small fraction of our total electrical needs," said Daniel Cormode, a physicist and head of R&D at Solon. "These systems enable us to use the electricity generated from wind and solar energy at any time and help stabilize the utility grids. This is why it's so important to explore their technical capabilities." To do this, his employer Solon, a leading PV cell and module manufacturer, which also builds complete large-scale PV power plants, has joined forces with SMA and the power company Tucson Electric Power (TEP). "With this in mind, we integrated a storage system into an existing PV system that we built three years ago for TEP on the grounds of the University of Arizona," explained Cormode.

Using solar electricity – even at night

The project provided SMA with a very special challenge. "For the system, we developed a battery inverter with an output of 500 kW – the most powerful that SMA had ever built so far," said Jan Rössler, who is in charge of the research project at SMA. "The system has been up and running in Tucson since October 2013, and it ensures that the solar electricity not needed by TEP customers is temporarily stored in the battery and made available later on. This enables people living in Tucson and the surrounding area to use more solar electricity – even at night. It also helps us support the utility grid." This is an important aspect as the share of renewable energies in power generation is continuing to rise in the U.S., just as it is in other countries. Large-scale PV and wind turbine systems play a key role in this. Given that the sun doesn't shine constantly and the wind isn't always blowing, they feed more or less power into the utility grid depending on weather conditions. "This leads to voltage fluctuations in the utility grid, which utility grids aren't designed to withstand," explained Rössler. "By storing surplus energy and releasing it again when it's needed, we're removing fluctuations from the utility grid. Solar electricity then has a much more uniform flow, which in turn eases the load on utility grids and reduces the need for their expansion."

"IF WE DON'T INTEGRATE STORAGE SYSTEMS WE LIMIT HOW FAR WE CAN GO WITH RENEWABLE ENERGY SOURCES TO A SMALL FRACTION OF OUR TOTAL ELECTRICAL NEEDS. THESE SYSTEMS ENABLE US TO USE THE ELECTRICITY GENERATED FROM WIND AND SOLAR ENERGY AT ANY TIME AND HELP STABILIZE THE UTILITY GRIDS. THIS IS WHY IT'S SO IMPORTANT TO EXPLORE THEIR TECHNICAL CAPABILITIES."

DANIEL CORMODE, SOLON

Big storage system – big impact

In Tucson, Cormode is further testing utility grid functions that PV systems have to offer to an ever increasing extent, such as regulating frequency. The grid frequency falls if more electrical power is taken from the utility grid than is fed into it, and rises if there is surplus power. Regulating the frequency of the solar electricity drawn from the storage

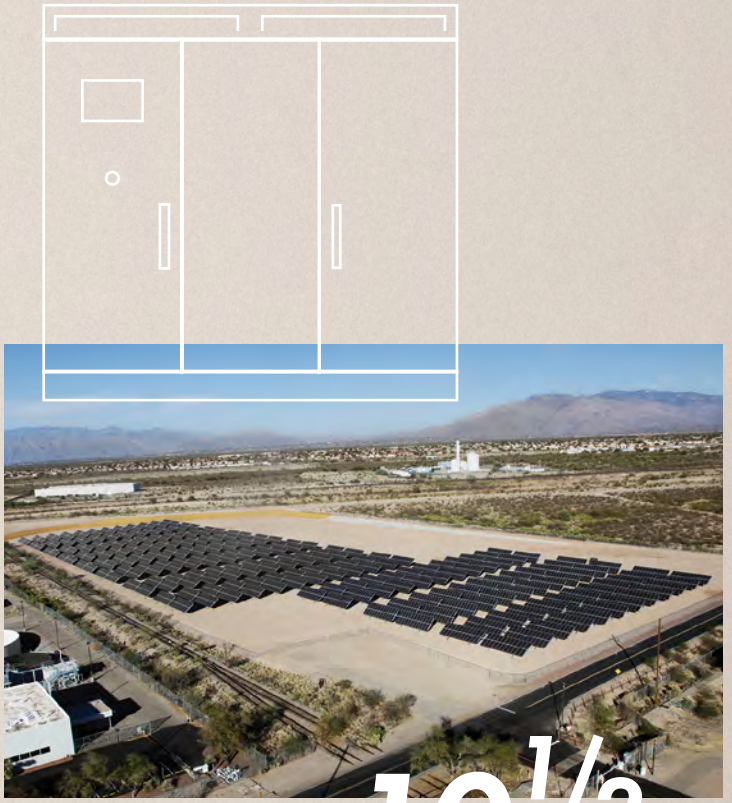
"BY STORING SURPLUS ENERGY RELEASING IT AGAIN WHEN IT'S NEEDED, WE'RE REMOVING FLUCTUATIONS FROM THE UTILITY GRID".

JAN RÖSSLER, SMA

system up or down as needed allows us to support the utility grid quickly and effectively. "This is roughly comparable to water pipes in a house. The more taps we turn on, the greater the pressure that's needed to ensure that water comes out of the taps at the same pressure throughout the house," explained Rössler. "If there is no increase in pressure, only a small trickle will come out of some of the taps."

Rendering conventional power plants redundant

Cormode is pleased with the results that his research has yielded so far. "We are currently working on further reducing the losses incurred when charging and discharging the storage system," reported the family man, who enjoys camping and hiking in the surrounding mountains with his three boys. Rössler is excited as well: "In Tucson, we are able to test the functionality of our inverter under completely normal, everyday operating conditions. This helps us considerably with further development of our storage technology." By 2018, the project will yield more important findings and will be instrumental in rendering conventional power plants redundant in the future.



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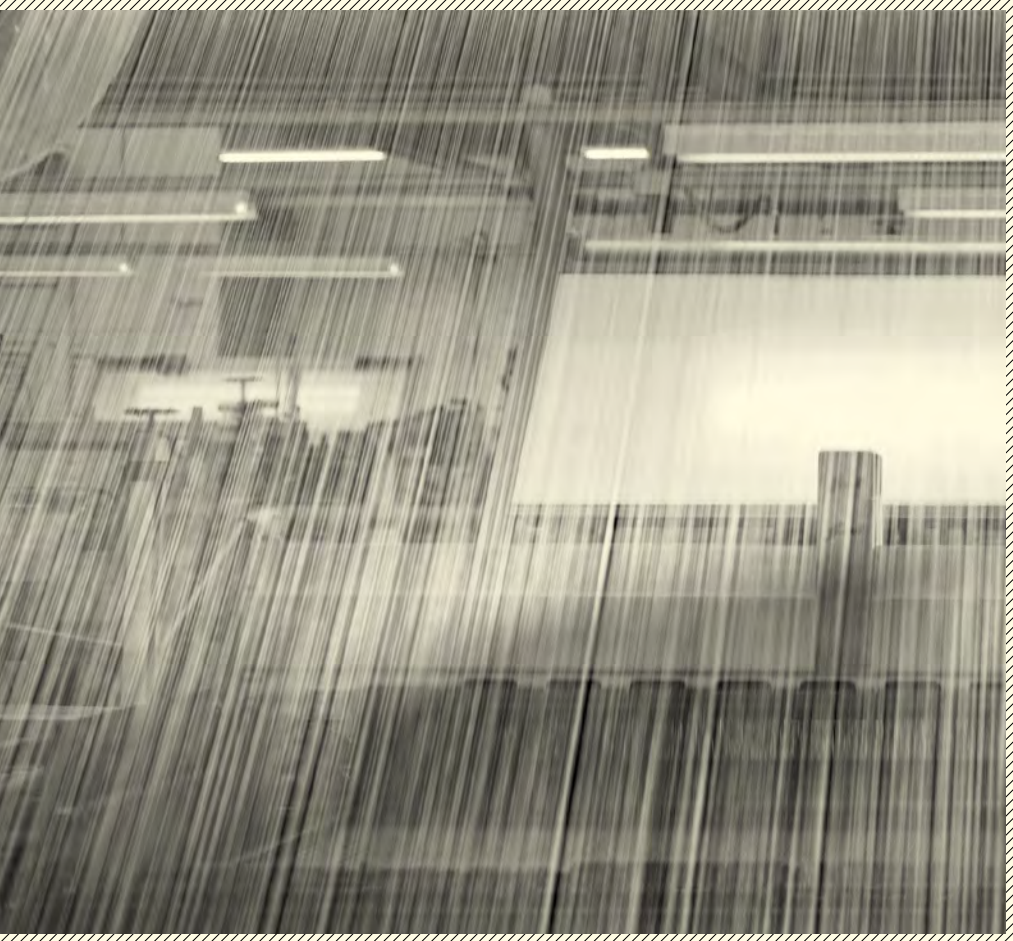
HOURS OF SUNSHINE EVERY DAY – THE REGION AROUND TUCSON IS AN IDEAL LOCATION FOR PV POWER PLANTS.

A video about the research project is available at en.SMA-Sunny.com/SMRT

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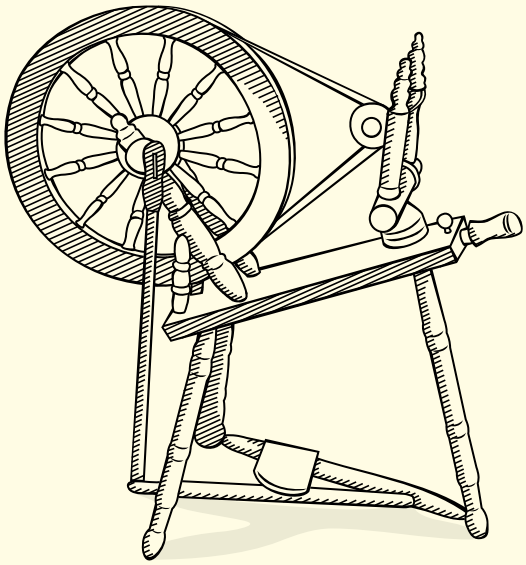


Not just spinning yards

THE SUN IS SHINING IN THE GLIMMERING HEAT. AT RAJA SHANMUGHAM'S COTTON MILL, OVER 20 000 SPINDLES ARE RUNNING AT FULL CAPACITY. IT IS IMMEDIATELY OBVIOUS THAT THIS IS USING ELECTRICITY – AND A LOT OF IT. HOWEVER, THE ENERGY SUPPLY IN THE SOUTH INDIAN CITY OF PALLADAM IS UNSTABLE. FOR MANY BUSINESS OWNERS, THIS IS THE PRIMARY MOTIVATION TO INVEST IN A DIESEL GENSET. BUT THE COST OF DIESEL FUEL CONTINUES TO CREEP HIGHER. TO CUT COSTS, SHANMUGHAM LOOKED FOR AN INDEPENDENT ELECTRICITY SUPPLY – AND FOUND PHOTOVOLTAICS.

"Over the past few decades, the region has undergone significant economic development, especially when it comes to cotton processing," explained Shanmugham, who comes from a family of entrepreneurs. His cotton mill is located in Palladam, a city in South India that is home to around 32 000 people. Here in the state of Tamil Nadu, there are approximately 1 600 cotton processing operations. "Cotton processing is extremely energy-intensive," said Shanmughan. "And with the growing market, energy is in increasingly short supply." Furthermore, in addition to there being a lot of competition, the electricity supply is unstable. In fact, it is not unusual to see the machines standing idle in these companies because the public utility infrastructure has collapsed again. Business owners who generate their own electricity, and thus protect themselves against power outages, are at a clear advantage. To do this, most businesses use a diesel genset. However, not only is using a diesel genset detrimental to people and the environment, but the fuel is also expensive – especially if it needs to be transported over long distances.

UNSTABLE GRID The PV inverters' AC collector shows what is currently happening in the utility grid.

SOLAR PLANT CONSTRUCTION – INDIAN STYLE Via a bamboo staircase, modules and inverters for the PV system are transported onto the roof of the factory.

JOINT PROJECT Together with the system integrator Chemtrols Solar from Mumbai, SMA is already planning additional PV diesel hybrid systems in India.

INTERFACE The SMA Fuel Save Controller integrates photovoltaics into the diesel power grid. This enables Alpine Knits to save 50 000 liters of fuel per year.

Independence from rising diesel costs and unstable utility grids

Shanmugham and his employees no longer wanted to be reliant on costly diesel fuel alone. "Electricity makes up around 15 % of the cost of our product," said the businessman. "The cheaper the electricity we use, the more competitively priced our products. We originally invested in wind power, but when there was a grid failure, we couldn't use wind energy because it was supplied to us via the utility grid. So we had to find another solution." While considering their options, Shanmugham and his employees were clear on the fact that the energy needed to be produced directly on-site. "So we decided on photovoltaics as it was the best solution for us."

So how does a PV diesel hybrid system work?
en.SMA-Sunny.com/PV-Diesel

"MORE AND MORE PEOPLE ALL OVER THE WORLD WILL COME TO REALIZE THAT PHOTOVOLTAICS IS THE BEST ALTERNATIVE TO EXPENSIVE DIESEL GENSETS FOR AN INDEPENDENT ELECTRICITY SUPPLY."

HEIKO STIEBER, SMA

Now, if there is a power outage, he can sit back and relax. If the utility grid collapses, the diesel system forms a utility grid that the PV system on the factory's roof feeds into and that reliably supplies the 20 400 spindles with solar power. Palladam has up to 300 days of sunshine per year and solar irradiation of between four and seven kilowatt hours per square meter, which form ideal conditions for the use of photovoltaics. This enables the company to save 50 000 liters of diesel fuel a year, which also translates into cash savings.

A little box with a big impact

An important step in the project was to integrate the new PV system into the existing diesel system. This is all made possible thanks to a small, inconspicuous metal box. The SMA Fuel Save Controller provides the interface between the diesel generator, PV system and loads. "It ensures that the exact amount of solar power needed is fed into the diesel grid," explained Heiko Stieber, who worked closely with local installers as the SMA project manager responsible for the Palladam system. "The Fuel Save Controller knows exactly which loads require electricity and how much. This enables diesel fuel consumption to be kept to a minimum. For me, this is one of the most exciting projects I've ever worked on."

It is the afternoon and the thermometer reads 33 degrees Celsius. The windows of the cotton mill are wide open. The workers are helping themselves to water from water dispensers set up in the workshops. But wind and water aren't the only things responsible for creating a better working atmosphere. Since the PV system was installed on the roof, the workshops don't heat up nearly as much as before. India is known as the country of origin for cotton, its tradition of spinning is long. From 1921 to 1947, India's unofficial flag even bore the symbol of a blue spinning wheel. It signified the pursuit of economic and political independence. Still today, the wheel in the center of the Indian flag looks a bit like a spinning wheel.

Leasing models already under discussion

"With ever increasing fuel prices and the progression of climate change, renewable energies like photovoltaics are becoming increasingly important for us," explained Shanmugham. "Here in India, the importance of photovoltaics will almost certainly grow and not only in the commercial arena. I could even see myself setting up a solar energy supply at home." He lives with his wife, son and parents in Tiruppur, which is about 20 kilometers away from Palladam. New business models, such as leasing PV systems, are already under discussion in India. This model means that users won't have to buy the system themselves. Instead, the leasing company provides the system to its customers for a monthly fee and they can use it freely," Shanmugham continued. "I think that models like this and solar energy itself will catch on quickly for private households in India too."

More sun – less expensive fuel

Not just in India but worldwide, diesel gensets are still being used primarily to supply remote areas with electricity or to supplement unstable grids. The initial investment costs are relatively low, so the decision to use a diesel genset is easy in most cases. However, operating these gensets can be extremely expensive especially in remote areas as you must constantly buy fuel that then has to be transported over long distances to its destination. This is in addition to the fact that the price of conventional energy sources like diesel fuel is constantly on the rise. By contrast, photovoltaics are becoming increasingly more cost-effective, and in sunny regions it is the cheapest form of power generation available today. "Solar power can be used as a replacement for expensive diesel fuel and is generated directly where it is needed in the event of a power outage. It can help businesses become independent and save a lot of money," said Stieber confidently. "More and more people all over the world will come to realize that photovoltaics is the best alternative to expensive diesel gensets for an independent electricity supply."

unlimited energy unlimited energy

HOW CAN WE SUCCEED IN PROVIDING THE GROWING WORLD POPULATION WITH ACCESS TO CLEAN AND AFFORDABLE ENERGY, THUS OFFERING A CHANCE OF ECONOMIC DEVELOPMENT?

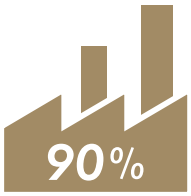
Raymond Carlsen, Chief Executive Officer of the international solar project developer Scatec Solar, has been a manager in the energy industry for more than 20 years and has traveled the world. "Access to energy is a prerequisite for prosperity. Almost everything we do in the modern world requires energy, especially the running of a company and the creation of jobs. This is a mammoth task," said Carlsen a native of Norway and hits right at the heart of the challenge – globally, 1.3 billion people still do not have access to energy – and thus have very little chance of improving their standard of living.

1.3 billion people worldwide still do not have access to energy

Take South Africa, for example: Although a lot has happened in recent years, one sixth of the population is still waiting for an electricity connection. Not to mention the country's numerous mines and industrial companies that are also dependent on a stable supply. South Africa produces almost 90% of its energy in coal-fired power plants. This is not only harmful to the climate but also creates considerable costs. The state-run electricity supplier, Eskom, estimates that an additional 60 million tons of coal are required each year to cover the country's growing energy demand to 2020, which would necessitate investing billions in domestic mines.

"However, people need affordable energy quickly, including in remote areas. This is the only way we can continue to develop," explained Joseph Mashao, Managing Director of SMA South Africa. He is convinced that this is not possible with conventional power plants: "Large coal-fired power plants not only make us dependent on expensive fuels for decades but are also extremely inflexible. Additionally, planning and construction take far too long. It takes many years before this type of power plant actually produces electricity. This is time we don't have."

A conviction that Carlsen shares from a global perspective: "The only way we will be able to provide energy in a reliable, sustainable and cost-effective way to an increasing global population is by utilizing renewable energy sources and thus make ourselves independent from conventional energy carriers as quickly as possible."



OF SOUTH AFRICA'S ENERGY IS STILL PRODUCED IN COAL-FIRED POWER PLANTS

A good thing for South Africa – clean electricity for 33000 households

The South African government has also recognized this and has set up an incentive program for renewable energies. As part of the program, PV plants with a total output of 8.4 GW are to be installed by 2030. This is equivalent to eight or nine large coal-fired power plants. A good thing for South Africa, thinks Mashao. He was born and grew up in the northern part of the country and now lives with his family in Johannesburg. "If we are to advance the development of renewable energies in South Africa we need politics to act as door opener," he said.

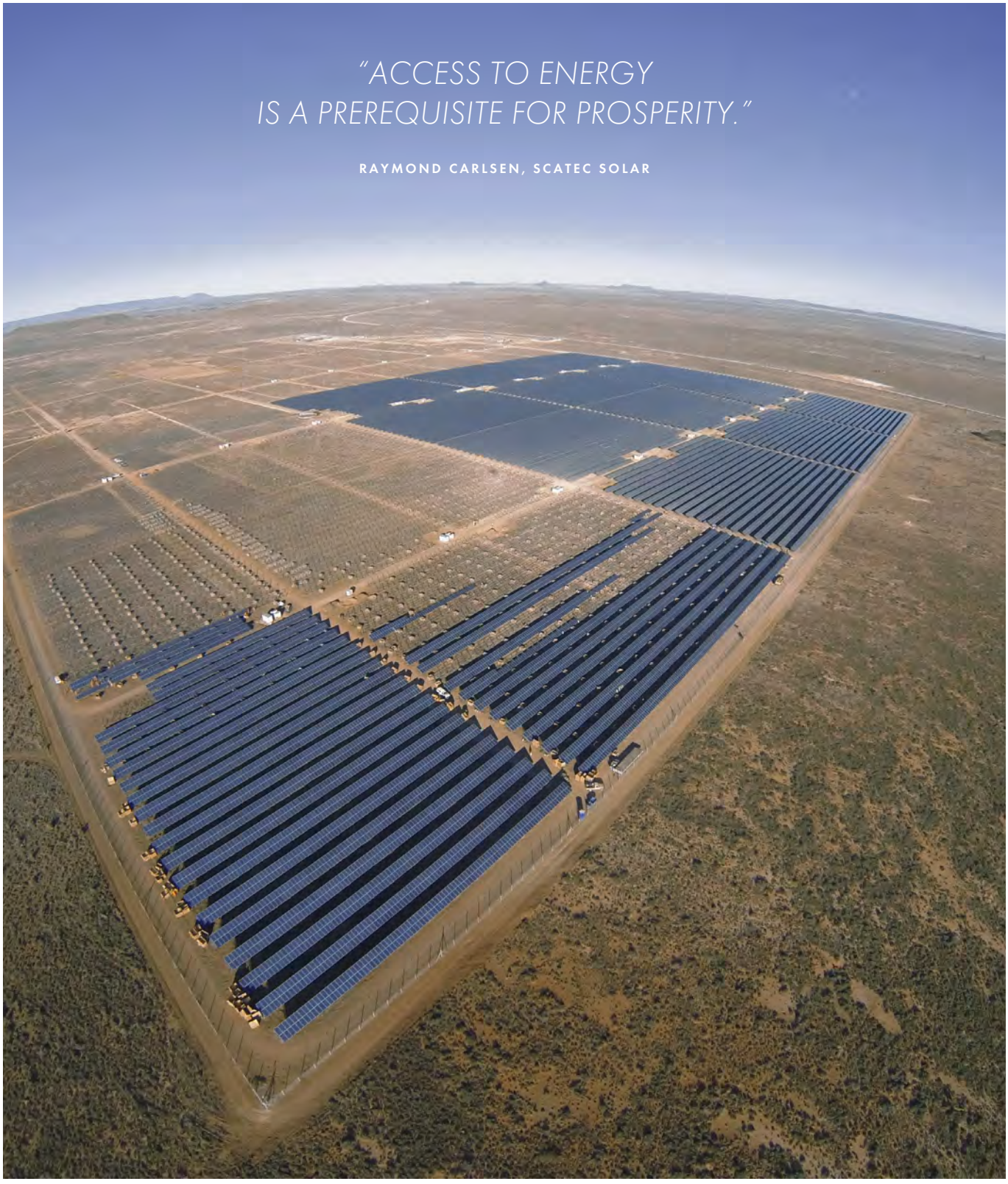
HOUSEHOLDS ARE SUPPLIED WITH INEXPENSIVE AND CLEAN ELECTRICITY BY THE KALKBULT PV POWER PLANT

Seizing this opportunity, Carlsen's company, Scatec Solar, along with SMA and other partners have built the Kalkbult photovoltaic power plant with an output of 75 MW on an area equivalent to 140 soccer pitches in northwestern South Africa in less than a year. Against all odds, including logistical, the plant was connected to the utility grid ahead of schedule. Since autumn 2013, it has been supplying about 33,000 South African households with cost-effective and clean solar electricity.

"I am very proud of what we have achieved with the Kalkbult project. We have built the largest photovoltaic power plant in the whole of Africa and it was the first to be grid-connected under the South African renewable program. That is an important contribution. Ultimately, the growing hunger for electricity in South Africa is far greater than the capacity for generation," said Carlsen with a smile. "Even more importantly, however, is the fact that the project has enabled us to show the South African people that a photovoltaic power plant of this size can be built and commissioned in less than a year – much quicker than any other reliable source of energy."

There is still a lot to be done – in South Africa and elsewhere

Moving forward following this first milestone, Scatec Solar and SMA are continuing their work on getting more and more South Africans access to energy and in turn fostering economic development. The photovoltaic power plants Dreunberg and Linde are scheduled to be connected to the utility grid in 2014. And many additional projects will follow until the government's expansion target for 2030 is reached," predicted Carlsen confidently. Mashao nodded and added: "I think that when our neighboring countries see the success we are having with renewable energies in South Africa, they will follow our example." So there is still a lot to do for Carlsen and Mashao.



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Kalkbult in South Africa is the largest PV power plant on the African continent.

On the Road to ... Commissioning
the Largest PV Power Plant in South Africa
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Quality

JOSEPH HELWEG, HEAD OF COUNTRY MANAGEMENT AT SMA SERVICE, IS AN OLD HAND WHEN IT COMES TO THE SERVICE BUSINESS. "CHINA, PAKISTAN, INDONESIA, A BIT OF TIME IN AFRICA, ALWAYS WITH THE WHOLE FAMILY IN TOW" – THESE ARE THE PLACES HE LISTS AS THE STATIONS OF HIS LIFE DURING THE LAST DECADES. EVEN TODAY, YOU WILL RARELY FIND HELWEG AT HIS OFFICE AT SMA'S HEADQUARTERS IN NIESTETAL. HE IS ALWAYS TRAVELING TO MAKE SURE THAT SMA'S CUSTOMERS ALL AROUND THE WORLD ARE GETTING EXACTLY THE LEVEL OF SERVICE THEY NEED, AND SO THAT THEY DO NOT NEED TO WORRY ABOUT THE YIELD OF THEIR PV SYSTEM. IN THE PROCESS, THE 53-YEAR OLD IS OFTEN NOT JUST THE COMPANY'S SERVICE EXPERT, BUT HE OFTEN ALSO ACTS AS AN INTERMEDIARY BETWEEN DIFFERENT CULTURES. AS WAS THE CASE ON HIS MOST RECENT PROJECT, A TAILOR-MADE MAINTENANCE CONTRACT FOR JAPAN'S BIGGEST PV POWER PLANT.

Of course, if you invest in photovoltaics, you want to be assured that your system will run profitably so that you can focus on your core business. This is why good service is so important to most PV system operators. "However, requirements and approaches can vary a great deal from one country to the next," said Helweg. In order for customers to be satisfied, he believes that it is very important to understand and accommodate their cultural background. "The ability to listen, always being open to new ideas, never falling into the trap of dated thinking patterns. If you bear all these things in mind, it is really quite straightforward," explained Helweg, talking about his own experiences.

Maintenance assignment for the biggest PV power plant in Japan

Helweg has just returned from Japan. Since the Fukushima disaster in March 2011, interest in solar energy has risen dramatically there. It offers the Japanese a way to free themselves from risky nuclear power but also from the costly imports of fossil fuels like coal and oil. The biggest PV power plant in the country was put into operation in November 2013 in the Kagoshima Province. Helweg negotiated a maintenance contract for the project with the managers of operator Kagoshima Mega Solar Power Corporation. No mean feat. "The Japanese are perfectionists, and they have really high quality demands," reported Helweg. "They have no interest whatsoever in ready-made solutions. In addition, it is very important to the Japanese that they understand all of the details. And if they have a question, they want an answer right away – it doesn't matter if we need to get

JOSEPH HELWEG has been making the impossible possible for clients throughout his 20 years in the international service business.

"IF WE CAN BUILD AND OPERATE A PV POWER PLANT UNDER THESE CONDITIONS, THEN WE CAN DO IT ANYWHERE."

JOSEPH HELWEG

something translated first or the people who are responsible in Germany are out of the office because of the time difference. It was good that I could always rely on the support of my colleagues from our offices in Tokyo."

13 MONTHS FOR CONSTRUCTION despite a volcanic eruption, torrential rain, flooding and lighting strikes. Even so, SMA Service Engineers demonstrated their first-class work during construction of the PV power plant in Kagoshima. For the next few years they'll be providing an individually tailored package of services to support the operator.

Working side-by-side with an active volcano

Helweg's negotiating partners had good reason to be so careful when selecting a service provider for the plant in Kagoshima. This is because the 70 MW power plant is not an everyday photovoltaic project. In fact, it is the first large-scale plant in Japan, so there are no specific empirical values for the technology, installation and maintenance to reference for this country. In addition, the plant is right by the sea, near to an active volcano and in a region

Connects

where typhoons are not a rare occurrence. "If we can build and operate a PV power plant under these conditions, then we can do it anywhere," explained Helweg with bright eyes as he talked about what it took. "The project developers wanted to show what could be done. And, of course, that's what we want to do at SMA as well. This is why we have not only supplied the inverters and the technology for monitoring plant functions but will naturally also support our customer during the maintenance of the PV power plant."

Flooding, lightning strikes and a maintenance contract

SMA Service Engineers successfully illustrated their ability to manage all these challenges. Despite a number of unforeseen events, the plant went into operation after a construction period of just 13 months, thanks to international support from SMA engineers from Korea, Thailand, India and Germany. In addition to a volcanic eruption, there was torrential rain with flooding and lightning strikes at the construction site. In each of these situations, the SMA Service team was promptly on-site to sort out the problems. "This was very important for our customer," remembered Helweg. This no doubt also helped to ensure that SMA was awarded the maintenance contract for the plant for the next few years. In collaboration with his colleagues from SMA headquarters, Helweg worked out an individual contract that perfectly met the specific needs of the plant operator. SMA Service Engineers will provide maintenance on the PV power plant in conjunction with employees from the Kyocera Group, which is part of the operator consortium.

"With our service team in Japan, we are always able to guarantee fast on-site support in the form of an engineer who speaks the same language and is able to discuss all of the technical issues on the same level as our customer's engineers," said Helweg. Now that he knows the plant in Kagoshima is in extremely safe hands, it is time for him to prepare for his next trip: This time, Saudi Arabia is on his calendar. This means new circumstances and requirements and therefore new challenges. Helweg is looking forward to it.

SMA Service Engineer Sammy Büder talks about the commissioning of the PV power plant in Kagoshima in the SMA blog: **en.SMA-Sunny.com/Japan**

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