energy magazine

A GILDEMEISTER energy solutions publication

Grid of the future

On the German North Sea Island of Pellworm energy storage systems are being tested in regional grids

Clean cars

Europe's biggest car maker supplies its fleet of electric vehicles to 100% from renewable energy at its own e-charging station

Intelligent power source

GILDEMEISTER energy efficiency GmbH develops a complete solution for optimising energy efficiency for their customers

GILDEMEISTER
energy solutions

Use of renewable energies to combat climate change

The rise in emissions caused by the use of fossil energy sources impacts the environment and has consequences for industry – it is high time to rethink.

For years now global growth has been behind the worldwide rise in energy consumption. Climate change and dwindling fossil fuel resources are the consequences of this trend. Nuclear power is also becoming less of an option, because the problems linked with the final disposal of atomic waste are simply insolvable. Plus the risks involved in this technology were once again brought home to everyone with the catastrophe of Fukushima in Japan. Ergo: seen in the long term the use of renewable energies is the only viable solution for energy transformation.

The world's energy consumption has virtually doubled in the last 30 years. A striking factor here is the extreme difference in growth rates in the individual industrial nations that was clearly brought to light in a statistical survey carried out by BP. While the USA recorded a rise of 40% there was in fact a slight decrease in energy consumption in Germany. The picture is entirely different in Asia. China, who long ago worked its way up into the champion's league of industrial nations, consumes sixty times more energy today than it did 30 years ago – around a fifth of current worldwide energy consumption.

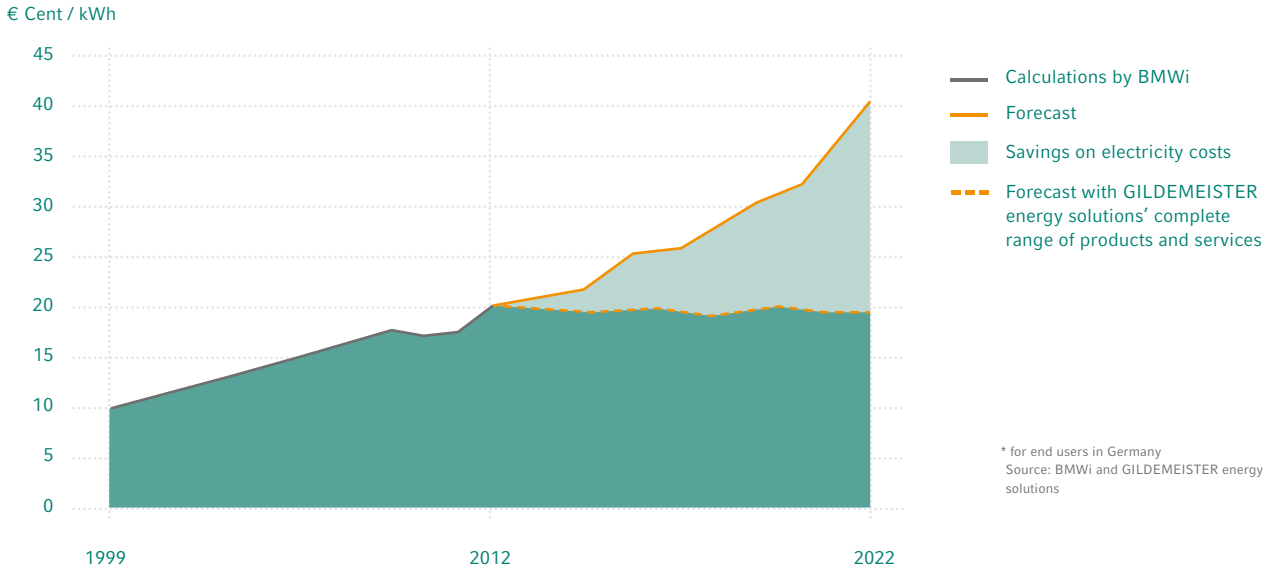
The steadily increasing demand for energy in the high-growth countries necessitates a high energy density in the

generation of electricity. Maximum yield at minimum costs. That is why such nations usually rely on fossil fuels such as coal or oil. The economic consequences – a shortage of resources and continuously rising energy costs – are as obvious as the even more serious long-term consequences for the environment. The International Economic Platform for Renewable Energies has calculated that 34 billion tons of carbon dioxide were emitted in the year 2011. A new world record, to which the three biggest producers of CO_2 – China, the USA and India – alone accounted for almost half of the emissions.

So we really need to rethink, whereby the ambitions of politicians and industry with regard to energy transformation is in fact promising in Germany. It has been decided to opt out of nuclear power and the development of renewable energies is making good headway. While 22% of energy in Germany was derived from renewable energies in the year 2011 according to Enerdata, the Federal Ministry for the Environment expects this value to go up to 40% by 2020. The German Renewable Energy Federation even holds 47% for possible.

The International Energy Agency (IEA) forecasts a 70% rise in the consumption of energy worldwide for 2035 compared to today, with this increase being driven by the combined effect of population growth and rising prosperity in the developing countries.

Energy costs 1999 – 2022*



With the price of electricity continuously on the rise it makes sense to produce and store energy locally.

Volkswagen's e-charging station is supplied to 100% from renewable energy sources, and is not without reason the first stop on the energy path.

Products

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References

Market

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GILDEMEISTER energy solutions

For over 140 years the name GILDEMEISTER has stood for innovation in the field of mechanical engineering. Any company operating in an energy-intensive industry must keep an eye on the price of electricity and how its energy is generated. That is why the Group has been active in the sector of renewable energies since the year 2006.

GILDEMEISTER energy solutions develops and implements complete solutions for an efficient renewable energy supply.

We develop a custom energy solution for your specific needs!

Please email us: **energysolutions@gildemeister.com** or call us: **+49 931 250 64 120.** We look forward to speaking with you soon!

Electricity generated from renewable sources is synonymous with independence, economic efficiency and environmental responsibility.

The expertise of Cellstrom GmbH and a+f GmbH are brought together under the umbrella of GILDEMEISTER energy solutions. The portfolio includes complete solutions for industrial customers and municipalities for all aspects related to energy efficiency and the generation, storage and utilisation of renewable energies. The innovative and intelligent energy concepts needed to supply green electricity night and day are now possible thanks to the solar tracking system SunCarrier, the small wind turbine WindCarrier and the vanadium redox flow solution for storing electricity. Every industrial enterprise can now produce a part of its own energy requirements itself – and can do so without any grid connection.

GILDEMEISTER, for example, operates two e-charging stations at its location in Bielefeld that run on renewable energy generated locally. These stations can charge up to six electric vehicles simultaneously in no time at all with their quick charging system. What is more, the machine manufacturer also produces a part of its machine tools without impacting the climate using its self-generated energy from wind and sun. This results in enormous electricity savings at its headquarters in Bielefeld through peak load levelling and increased utilisation of the energy it generates itself.

Energy efficiency

In addition to these innovative technologies, GILDEMEISTER energy solutions also offers extensive services that are implemented under the motto "Energy efficiency. Generate. Store. Utilise" from the company GILDEMEISTER energy efficiency GmbH that was founded specifically for this purpose. The first step here: an analysis of the actual consumption. This involves identifying the areas of the company that are major consumers causing a proportionally high part of the energy costs. Even in this early stage significant energy saving potential can be utilised through targeted and manageable investments. »

Responsible handling of the topic energy efficiency has a dramatic impact on the running costs of a company, allows independence from rising electricity prices, not to mention the positive effect on the environment.” *Dr. Frank Beermann*

COMPONENTS FOR THE ENERGY AND MACHINE TOOL INDUSTRY

→ SINCE 1996

components

Dr. Frank Beermann, Managing Director of GILDEMEISTER energy solutions, sees lighting as a good example here: “New light sources, motion detectors, larger windows and a new coat of paint for the production halls are often enough to reduce the electricity consumption in this segment sustainably.“ A company can reduce its energy costs by up to 25% simply by optimising the major consumers and the overall load profile.

With its complete energy concept GILDEMEISTER energy solutions creates flexible options for using electricity purposefully – always then when it is needed.

Following the sun: SunCarrier

In addition to these measures for saving energy, the energy concept of GILDEMEISTER energy solutions also encompasses the sustainable generation of clean electricity from renewable energy sources. Photovoltaic tracking systems play a predominant role here, because their energy yield is up to 40% higher than that of fixed systems thanks to their continuous orientation to the sun. These SunCarriers are offered in different sizes and capacities, so every customer can find the right solution to match its available space. Even the most compact system, the SunCarrier 22, can cover the electricity requirements of a four-person household.

Utilising wind energy: WindCarrier

The WindCarrier rounds off the portfolio for energy generation. With a height of 14.25 m it serves as a space-saving, productive and reliable instrument for generating electricity. A characteristic feature of this system is the Darrieus principle upon which the vertical design of the rotor is based. The benefit: The WindCarrier does not have to align itself to the direction of the wind to maximise its performance. A low-maintenance and low-noise motor spindle like those used in tool machines serves as the generator.

“The only difference is that the rotary movement is converted into electricity instead of the other way round,” explains Beermann. The WindCarrier switches on even with wind speeds of as low as 3.5 m/s. The WindCarrier is ideally suited for coastal regions and locations with strong winds, but it is also effective in regions with weaker winds where it can generate a positive image as both design and logo placement can be integrated.

GILDEMEISTER energy solutions business units

Solar tracking systems

→ SINCE 2006

suncarrier

Project planning and service of solar parks

→ SINCE 2006

Storage systems

→ SINCE 2010

cellcube

Small wind turbines

→ SINCE 2011

windcarrier

Storing Energy

Energy can be buffered in a CellCube storage system and kept ready for use for times when the sun is not shining and the wind not blowing, or even when too much electricity has been produced. Lars Möllenhoff, Managing Director of cellstrom GmbH, sees this feature as a great chance: "This is exactly where the benefit of intelligent storage solutions lies, solutions like our CellCube system!" These groundbreaking large-scale storage systems are based on the vanadium redox flow principle that allows a virtually endless number of charging and discharging cycles. The vanadium solution is neither explosive nor flammable.

With its complete energy concept GILDEMEISTER energy solutions creates flexible options for using electricity purposefully – always then when it is needed. So peak loads can be levelled and the risk of a power cut reduced.

Energy efficiency growing in importance

"With our backup solutions industrial firms can increase their production security significantly", says Beermann, to name just one example. "Thanks to our close links to machine tool manufacture we are well aware of the energy needs in the metal cutting industry," continues the Managing Director. "Responsible handling of this topic has a dramatic impact on the running costs of a company, allows independence from rising electricity prices, not to mention the positive effect on the environment."

With this in mind Beermann expects the importance of energy efficiency and de-centralised systems for utilising renewable energy sources to grow continuously – both in the metalworking sector and in many other energy-intensive branches of industry.

www.gildemeister.com/energysolutions

"Secure and efficient energy supply and mitigating climate change go hand-in-hand"

One-on-One with Dr. Frank Beermann, General Manager GILDEMEISTER energy solutions.

GILDEMEISTER has made solar tracking systems, small wind turbines and energy storage systems the mainstay of "GILDEMEISTER energy solutions". What is behind all of this?

The foundation of GILDEMEISTER energy solutions in the year 2006 was the start of our specialising in energy efficiency solutions and offering industrial customers complete solutions for all aspects of energy efficiency, the generation, storage and utilisation of renewable energies. In 2011 we changed the focus of GILDEMEISTER energy solutions away from planning solar park projects and more towards integral energy solutions.

What is the biggest attraction for companies in generating their electricity locally from renewable sources?

Electricity generated from renewable sources is synonymous with independence, economic efficiency and environmental responsibility. All industrial enterprises can produce part of their own energy requirements themselves with our products – and can do so without any grid connection. In Bielefeld and other locations we have realised an integral energy concept that stands as an example for the great potential offered by renewable energy. With an installed capacity of almost one Megawatt at the Bielefeld Energy Solutions Park, we do not just generate a considerable part of the energy we need on site. The aim of the Energy Solutions Park is also to use the electricity for a good purpose and to organise consumption appropriately.

What do you mean by organised utilisation?

Before we even started covering part of our energy requirements with renewable energy, we had to ask the question of energy management. Analysing consumption to find energy guzzlers, recording energy flows and incorporating the findings in an intelligent metering system all took us a lot of time at the outset. But without doubt we made very valuable findings. They enabled us, even at this early stage, to save a considerable sum – an impressive 300,000 Euros a year – by using energy efficiently and replacing excessive consumers in our Energy Solutions Park. In addition, we were in a position to plan the Energy Park optimally from an economic point of view. Our aim now is to pass on our experiences to our machine tool customers and, as part of a package including energy storage systems and green electricity plants, to help them use energy as efficiently as possible. With this offer we are unique on the market.

> "All industrial enterprises can produce part of their own energy requirements themselves with our products – and can do so without any grid connection."

Where do you start with energy management?

The main reason that energy potentials are often insufficiently used in companies is a lack of information. This then is our first step; we inspect existing as-built plans and undertake a plant inspection to determine the existing asset situation in the relevant areas, evaluate the findings and identify all the building supply systems that are the major energy consumers. Lighting systems in particular usually offer an energy saving potential of up to 80%.

In other words it is well worthwhile companies using their resources as efficiently as possible.

It most certainly is! Up to 50% of energy can be saved alone where compressed air systems are concerned. In addition to direct energy and financial savings, the expenditure for optimising energy efficiency is also profitable from a tax point of view.

What do you understand by energy efficiency?

Consumers and industry both suffer from rising electricity prices. So for us and our customers efficiency means organising production processes in such a way that they run with minimum energy consumption and in so doing reduce energy costs. This of course goes hand-in-hand with reducing the CO_2 emissions that play an increasingly important role in companies, because responsible handling of this topic has a positive impact on the running costs of a company, not to mention on the environment.

Reducing emissions means increased use of renewable energies – locally, in Germany, Europe and the world. How do you estimate the market here?

Secure and efficient energy supply and mitigating climate change go hand-in-hand. Energy efficiency and the speedy implementation of CO_2-saving technologies can help countries like Germany to reduce public expenditure, lower dependency on imported energy and diminish emissions. You can find renewable energy sources and potential for energy efficiency more or less everywhere. I believe there is enormous potential to be found in mature technologies such as wind power and photovoltaics, not least because decentralised solutions for local energy production give us the chance of operating independently from large-scale grids.

But wind energy in particular has a significant drawback: the output of wind electricity production varies greatly depending on the wind force. The same is true for solar electricity, although this is easier to calculate. What is the solution here?

In order to compensate such fluctuations, to increase grid stability and to limit the expansion of electric grids we need the right electricity storage solutions, solutions that will play a decisive role in the transformation of energy systems. One very promising energy storage option is the vanadium redox flow technology that we offer with our CellCube. Our energy storage systems are already making a valuable contribution in field studies aimed at levelling fluctuations in the electrical output of consumers and generators successfully, as well as ensuring autonomy from the grid with an electricity supply produced to 100% from renewable sources.

Reducing electricity consumption in industry

Compressed Air

Almost all branches use compressed air for a multitude of applications, rapid screwdrivers, chisels, pneumatic conveyor systems and the like. Energy is very often wasted here. This can be counteracted by the use of high-efficiency motors and inverters for changing frequencies and voltage amplitudes.

In addition, the overall efficiency of compressed-air systems can be improved as follows:

- Repairing leaks,
- Selecting the best compressor for the respective end application, avoiding over dimensioning,
- Improving the compacting effectiveness of compressors, e.g. by using multi-stage compressors,
- Using waste heat efficiently,
- Improving air treatment, e.g. drying or filtering
- Regular and thorough servicing and maintenance
- Improved air flow in pipe systems in order to prevent loss of pressure due to friction,
- Avoiding unnecessary usage

Up to **50%** of energy can be saved in this way.
In order to exploit this potential the entire system must be taken into consideration - not just the compressor.

Electric Motors

Electric motors are responsible for around 70% of electricity consumption in industry. Electricity consumption accounts for more than 90% of the total costs of an electric motor, the purchase price accounts for less than 10%.

Electric motors with a higher efficiency factor result in respectively higher savings – both on a macroeconomic as well as an operational level. Efficiency can sometimes also be improved quite simply by reconnecting the motor windings.

The German Electrical and Electronic Manufacturers' Association (ZVEI) has calculated that 5.5 billion kWh of electricity could be saved economically in German industry by the use of energy-saving motors. Besides, with the technology available today, it is possible to control motors with speed control electronically. This would improve process control as well as reducing wear and noise levels.

If only a third of electric motors used in German industry had speed control, 1.2 billion Euros could be saved.

Pump Systems

Pumps keep many industrial processes running. A lot of electricity could be saved by new technologies, sub-assemblies and components. This also applies to systems that need fewer motors and pumps. Choosing the right type of pump for the respective application and operating environment in particular can increase the efficiency of pumps.

What else can be improved in order to save electricity?

- Optimising the suction nozzles
- Dual pump operation
- Making rotor blades more efficient, e.g. by changing the pitch of the blades
- Selecting the right speed of the motor
- Technical saving potential here stands at **25%**, economic saving potential between 12 and 15%.

Lightning

Up to **80%** of energy consumption for lighting can be saved.

What can be improved?

- Using energy-saving bulbs (compact fluorescent lamps) instead of conventional bulbs: approx. 80% lower electricity consumption
- Using halogen metal halide lamps instead of mercury high-pressure lamps: around 50% higher light yield and better colour reproduction
- Replacing luminaires for fluorescent lamps that have a conventional ballast for ones with an electronic ballast: approx. 20% lower electricity consumption, higher service life of the lamp and better colour reproduction
- Using mirror louvre luminaires
- In halls: Replacing T12 fluorescent tubes with T8 or even better with T5 tubes
- Using automatic time switches and motion detectors in areas that are only used occasionally
- Using daylight-dependent controls in rooms with natural daylight: five to 40% lower electricity consumption.

Source: Broschüre Energieeffizienz Tipps für Industrie und Gewerbe, BMU

"Every kWh must be used efficiently and with the price of electricity continuously on the rise it also makes sense to produce and store energy locally."
Christian Kleinhans

Energy efficiency: the intelligent source of electricity

Increasing energy efficiency in industry as a means of promoting the transformation of our energy systems is becoming of ever greater importance. According to expert opinion 20 to 40% of energy consumption could be saved in Germany by 2020, which would double energy productivity in comparison to 1990. The efficiency analysis from GILDEMEISTER energy efficiency GmbH identifies potential and helps companies retain long-term competiveness on the international market.

Electricity consumption is on the rise. The International Energy Agency (IEA) forecasts a 70% higher consumption of energy worldwide for 2035 compared to today, with this rise being driven by the combined effect of population growth and rising prosperity in the developing countries. This goes hand-in-hand with a potential rise in CO_2 emissions because, standing at 41%, heat and electricity generation accounts for the lion's share of all emissions that adversely affect the climate. It is with this in mind that the expansion of renewable energies is being advanced as never before; according to the IEA renewable energies will account for 24% of the global electricity production by the year 2035. But there is still a long way to go, because further expansion plus the development and modernisation of the grid infrastructure to an intelligent network that this entails will take many years to achieve. However, measures for increasing energy efficiency can be implemented immediately and they bring economic benefits.

Saving and intelligent utilisation of energy is of particular interest in industry and commerce, because according to Germany's Federal Environment Agency the sectors industry and commerce, trade and services together consume 70% of the total electricity in Germany. Whereby the industrial sector is the biggest consumer of all, accounting for almost half (42%) of total electricity consumption.

Utilising electricity saving potential

So it is vital to utilise existing electricity saving potential, claims Christian Kleinhans, Managing Director of GILDEMEISTER energy efficiency GmbH in Würzburg, Germany. "Every kWh must be used efficiently and with the price of electricity continuously on the rise it also makes sense to produce and store energy locally."

The experts at GILDEMEISTER energy efficiency GmbH develop a complete solution for optimising energy efficiency for their customers. In addition to an extensive energy efficiency analysis and the development of a specific strategy for the sustainable reduction of energy costs, energy efficiency GmbH as part of the GILDEMEISTER division energy solutions also offers systems for the local generation and storage of renewable energies.

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The two steps in the energy efficiency analysis

STEP 1

- Description of the current situation of the company with regard to energy requirements
- Description of existing energy-related weak points
- Approach for energy efficiency measures
- Review of existing contracts (energy supply contracts)

STEP 2

- Proposal for specific energy saving measures
- Identification for measuring energy input and energy consumers
- Planning of the installation of energy meters
- Switch cabinets for meters and equipment
- Database and web servers, installation and connection of energy meters
- Creation of automatic reports possible
- Detailed evaluation of the actual state
- Priorities for efficient use of energy
- Economic assessment of the proposed energy saving measures
- Information concerning aid programmes

Kleinhans goes on to explain, "in contrast to classic energy consultation our customers not only receive an efficiency analysis they also reap the benefit of expert advice with regard to the feasibility of installing solar systems locally and the intelligent use of storage. We develop a strategy for our customers, put the energy saving effects into practice and if desired install the solar and storage systems – all from a single source."

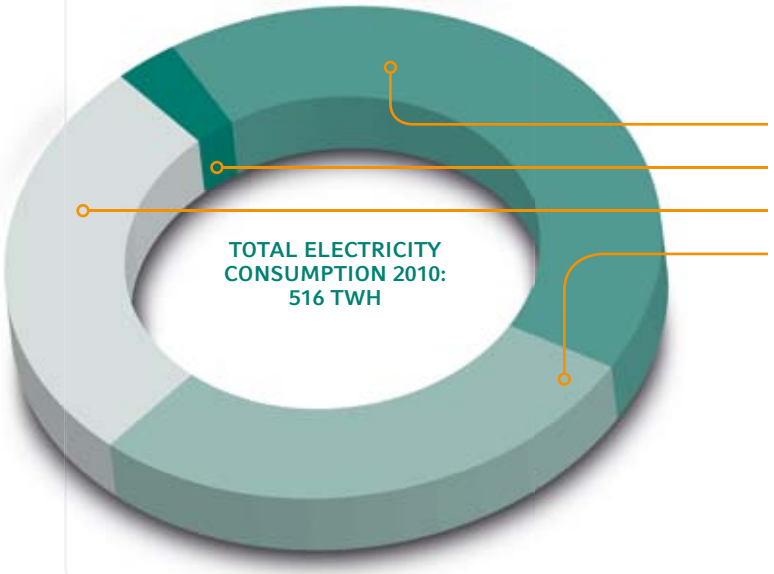
The energy management system offered by GILDEMEISTER energy efficiency GmbH allows detailed recording of a company's energy consumption, identification of energy saving potential and the implementation of the corresponding energy efficiency measures. In addition to direct energy and financial savings, the expenditure for optimising energy efficiency is also profitable from a tax point of view. These investments are the first step for customers on their road to achieving certification in compliance with DIN EN ISO 50001 or the European Eco-Management and Audit Scheme (EMAS) necessary for claiming the tax cap for energy and electricity taxation.

The analysis

In the first step of the energy efficiency analysis Christian Kleinhans' team inspects the existing as-built plans and then undertakes a plant inspection to determine the existing asset situation in the relevant areas and evaluates its findings. All the building supply systems that are the major energy consumers are documented within the scope of the basic initial consultation. The analysis is carried out based on the findings of the inspection of the actual situation and existing documentation.

GILDEMEISTER wants to pass on the experience gained by the energy management in Bielefeld and other plants to its customers together with green energy systems and energy storage devices. "With this offer, we are unique in the market," says Dr. Frank Beermann, Managing Director GILDEMEISTER energy solutions.

In Kleinhans' experience saving potential can be found especially in older existing buildings, whereby compressed air, pump and ventilation systems are the biggest power guzzlers. Generally lighting systems in particular offer an energy saving potential of at least 10%.



Electricity consumption by sector

- Industry, 42%, 219 TWh
- Transport, 3%, 17 TWh
- Households, 28%, 141 TWh
- Trade, Commerce, Service, 27%, 140 TWh

Source: Arbeitsgemeinschaft Energiebilanz: Auswertungstabellen zur Energiebilanz der Bundesrepublik Deutschland 1990 bis 2010, Stand 07/2010

The Federal Environment Agency also confirms that in the industrial and manufacturing sector around 80% of the total electricity is used for powering the drives of subassemblies such as compressed air systems, pumps and ventilators. According to a study carried out by the Wuppertal Institute for Climate, Environment and Energy around 71 billion kWh of electricity could be saved in the industry and commerce, trade and services sectors. The study indicates that the greatest electricity saving potential is to be found in the use of efficient pumps (21 billion kWh), electricity-saving process heating (16 billion kWh), energy-efficient lighting (13 billion kWh) and efficient food refrigerating systems (4 billion kWh).

According to the Federal Environment Agency the main reason that the vast cost-effective potentials are insufficiently used is a lack of information. And that is exactly what Christian Kleinhans and his colleagues Sebastian Braun and Maximilian Heindl intend to change.

If we have awoken your interest and you would like more detailed information please contact us at GILDEMEISTER energy efficiency GmbH, energysolutions@gildemeister.com, Telephone: +49 931 25 064 120.

Energy efficiency live: Example Bielefeld

GILDEMEISTER AG has set a good example by exploiting the expertise of GILDEMEISTER energy efficiency GmbH to increase energy efficiency at its headquarters and plant premises in Bielefeld. Over two years were spent searching for excessive consumers, compiling an extensive energy efficiency analysis and optimising electricity consumption based on the findings. Over 70 points for saving energy were identified in addition to the major power guzzlers of hall lighting, air-conditioning and compressed air systems. The implemented optimisation measures in combination with the use of renewable electricity generated in-house and the identification of energy-intensive systems have resulted in savings of € 300,000 a year for the group.

GILDEMEISTER AG has also installed solar and wind power systems with a total output of 1 MW on an area of 20,000 m² in its Energy Solutions Park in Bielefeld (see page 20). GILDEMEISTER uses the electricity produced in Bielefeld directly on site with which it covers around 15% of the plant's energy requirements.

A small wind turbine with high yield potential

Generate green energy locally – GILDEMEISTER energy solutions' space-saving WindCarrier operates efficiently and quietly.

Small wind turbines give companies the opportunity of covering a significant part of their electricity requirements with green energy or of feeding this into the grid in order to achieve additional earnings. With its WindCarrier, GILDEMEISTER energy solutions offers a wind turbine developed by Kessler that is small enough to be installed independently of any building height restrictions or with only simplified approval procedures. Thanks to its integrated spindle – a technology Kessler already uses successfully in machine tool construction – the WindCarrier starts to rotate at wind speeds of just 3.5 m/s.

The most noticeable feature of the WindCarrier – apart from is low height of only 14.25 m – is its most decisive one: in contrast to large horizontally arranged wind turbines its construction is based on the Darrieus principle. The special feature of the Darrieus rotor is its vertical rotation axis. Its rotor blades are formed like the wings of a plane. While the latter provide the necessary aerodynamic lift, the vertical design of the WindCarrier's rotors drive the turbine. The great advantage of this design is independence from the wind direction. The wind always hits the three aerofoils at the optimum angle. What is more, the WindCarrier – in contrast to wind turbines with a horizontal rotation axis – operates extremely quietly.

Another special innovative feature lies inside the turbine: the WindCarrier operates without a gearbox. The expertise of the parent company comes into play here as GILDEMEISTER energy solutions draws on the proven spindle technology from the machine tool manufacturer – the only difference being that the motor spindle acts as a dynamo. Its rotational motion is converted into electricity instead of the other way round. But the operator of a WindCarrier benefits from the same advantages: The spindle is wearfree so has a long service life, it requires very little maintenance, operates with low noise and guarantees an optimum energy yield. Even winds with speeds as low as 3.5 m/s result in continuous energy production. The WindCarrier reaches its full potential in coastal regions with consistently strong winds. Not until wind force 7 is reached does it switch off automatically for safety reasons.

The wind turbine can pay for itself in less than ten years – depending on the location.

However, the WindCarrier is not only a worthwhile investment with regard to securing supply and environmental questions. Even low wind speeds generate enough electricity to supply two four-person households with no problem at all. This yield can easily be doubled in windy regions. So investing in a WindCarrier is certainly an attractive option promising significant earnings due to savings in electricity costs or feeding into the mains grid. Depending on location and public funding the payback times are well under ten years. The version of the WindCarrier with a branding option can also generate additional value. The already attractive design can be customised in line with the corporate design of the customer.

The GILDEMEISTER Energy Project

Electricity generated from renewable sources is synonymous with independence, economic efficiency and environmental responsibility. GILDEMEISTER AG demonstrates just how this works in practice at its own plants in Pfronten, Seebach and its headquarters in Bielefeld.

In view of the continuously rising energy prices, energy as a cost factor is becoming an ever greater issue in industry. So companies are intensifying their efforts to find new ways of increasing energy efficiency, particularly where production is concerned, which accounts for up to 45% of total electricity costs. The first step in this direction is to identify saving potential and thus reduce consumption. However, in a second step energy can be generated locally, stored and used in a targeted manner. GILDEMEISTER AG demonstrates this at its own plants in Pfronten, Seebach and Bielefeld. An Energy Solution Park that has been up and running here since 2012 embodies the complete range of products and services from GILDEMEISTER energy solutions. The energy experts in Bielefeld have realised an integral energy concept that stands as an example for the great potential offered by renewable energy.

Energy efficiency

"Increasing energy efficiency began in Bielefeld with identifying areas that consumed an excessive amount of energy," says Dr Frank Beermann, Managing Director of GILDEMEISTER energy solutions, about how the project got underway at the headquarters of the GILDEMEISTER Group. The largest energy consumers were found to be the hall lighting and the building ventilation systems, each accounting for around 30% of consumption. "But at the same time these proved to be the areas with the greatest saving potential."We installed new HVAC systems, for example, which resulted in a 38% share of overall cost savings." Beermann then goes on to give some details about the optimised hall lighting: "Using new light sources,

In Bielefeld, GILDEMEISTER has reduced the carbon footprint by 520,000 kg of CO_2, the equivalent of the CO_2 emission of an Audi A4 2.0 TDI that travels a distance of over four million kilometres.

motion detectors, a glass front and saw-tooth roofs, a new coat of paint for the halls and last but not least employee training we managed to achieve a 24% share of overall savings here – and the costs for all this have an amortisation period of just five years." With these and other measures the overall electricity costs were reduced by an impressive 25% in this first step.

Energy Solutions Park

In addition to these measures for saving energy, the energy concept of GILDEMEISTER energy solutions also encompasses the sustainable generation of "green" electricity from renewable energy sources. In this respect the Energy Solutions Park at the Bielefeld plant unites all these measures both impressively and graphically. "With an installed capacity of 825 kWp – enough to cover to the electricity consumption of over 200 four-person households – we do not just generate a considerable part of the required energy. The aim in the Energy Park is to use the electricity to good purpose and to organise consumption appropriately," explains Beermann.

Around 95% of the electricity generated in the Energy Solutions Park originates directly from solar energy. For the most part the photovoltaic solutions are tracker systems. These tracker systems achieve a maximum energy yield by aligning their solar panels to the position of the sun and the angle of incidence." "This results in a plus of up to 40% in comparison to fixed systems", claims Beermann.

Utilising sun and wind

GILDEMEISTER energy solutions has continuously enhanced the technology of the tracking systems. Today's portfolio includes photovoltaic systems that rotate both horizontally and vertically. Thirteen SunCarrier 250 systems have been installed at the plant in Bielefeld, for example; »

Energy flow in the park

Generate

5 WindCarrier

1 SunCarrier 250

2 SunCarrier 22

3 SunCarrier Fixed

4 PV system on roof

Store

6 CellCube FB 10-100

7 CellCube FB 200-400

Utilise

8 e-filling station bike garage

9 Headquarters

11 IT building

12 Turning machine plant

10 Car park lighting

this model rotates on its vertical axis and together these systems generate the equivalent to the electricity requirement of 125 four-person households. The sturdy construction of this model requires only low maintenance, is simple to install and has an extremely long service life; advantages that derive from the group's many years of experience in machine tool production according to the managing director. In addition, 86 compact SunCarrier 22 models each with a horizontally rotating wing have also been installed whose capacity would be sufficient to supply a four-person household with electricity. Nine conventional (fixed-panel) systems round off the photovoltaic section of the solar park.

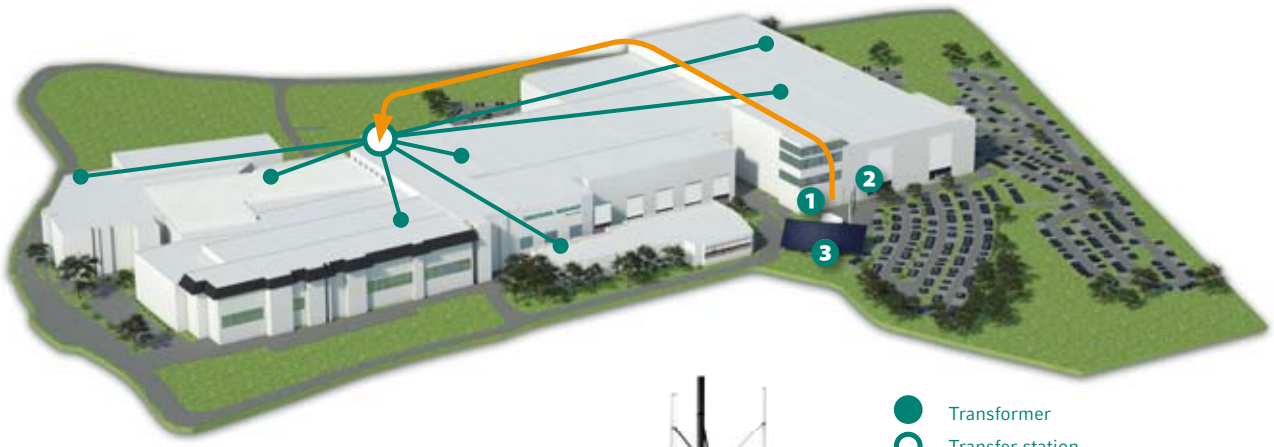
Efficient: In the Bielefeld Energy Solutions Park, energy can be generated locally and stored and used in a targeted manner.

GILDEMEISTER energy solutions also makes use of the wind as a supplier of energy. The WindCarrier that stands at a height of 14.25 m serves here as a space-saving, productive and reliable instrument for generating electricity. A characteristic feature of this system is the Darrieus principle upon which the vertical design of the rotor is based. This ensures that the wind always hits the turbine blades at the optimal angle making it independent of wind direction. A low-maintenance and low-noise motor spindle like those used in tool machines serves here as the "dynamo".

"The only difference is that the rotary movement is converted into electricity instead of the other way round," explains Beermann. The WindCarrier switches on even with wind speeds of as low as 3 m/s. The Energy Solutions Park in Bielefeld has four of these 10-kW wind turbines.

Storing energy

When the sun is not shining and the wind not blowing GILDEMEISTER can fall back on the energy stored in the CellCube. These groundbreaking large storage devices are based on the vanadium redox flow principle that allows a virtually endless number of charging and discharging cycles. The safety aspect has also been taken into consideration: the vanadium solution is neither explosive nor flammable. Other advantages of this intelligent storage system include individual matching of power and storage capacity plus its scalability. GILDEMEISTER energy solutions operates two small CellCube FB 10-100 storage devices and one large CellCube FB 200-400 in Bielefeld. »



Transformer
Transfer station
Main energy supply
Energy supply to transformers

1

CellCube FB 10-100

Capacity	10 kW
Storage capacity	100 kWh

2

WindCarrier

Installed capacity	10 kW
Energy generated per year	5.000 kWh

3

1 x SunCarrier 220

Installed capacity	34 kW
Energy generated per year	40.000 kWh

DECKEL MAHO Pfronten

38% reduction in electricity costs

The energy concept at the DECKEL MAHO plant in Pfronten takes into account the consumption of electricity as well as that of oil and water. The energy efficiency measures undertaken to date have resulted in significant savings in all these areas. The electricity costs alone have been reduced by 38%, from 14,000 kWh per machine produced to around 8,500 kWh, thanks to a more efficient lighting system, new compressed air and assembly unit management plus the use of SunCarrier and WindCarrier units for our own in-house generation of electricity. It is planned to save another 15% of energy costs by means of changing to LED technology, regular monitoring of the compressed air system and increasing the percentage of our own in-house generation of electricity from renewable energy sources.

The experts at GILDEMEISTER energy solutions have achieved a similar success with regard to oil costs and consumption. A 40% reduction in oil costs has been marked up thanks to an intelligent heating and cooling system, a concrete core temperature control and gradual changeover to natural gas - and all this despite a 41% rise in the price of a litre of oil over the past three years. Other energy-efficiency measures are in the pipeline that are expected to bring an additional 15% saving. Where water supply is concerned, consumption has been reduced by 46% to date at DECKEL MAHO Pfronten. This has been achieved through training employees in the economical handling of water, optimising seepage surfaces and new supply sources. In future the municipality of Pfronten will provide enough water to allow another 15% saving.

Integral offer for industry

A glance at the electricity management reveals clearly how the power balance of the GILDEMEISTER plant has been affected by the Energy Park. All the energy generated is supplied either directly to the plant or after buffering in the CellCube. The GILDEMEISTER Group building, for example, is completely energy self-sufficient and peak loads in the plant are levelled. The reduction of peaks means the risk of a power cut is much lower – and even if this does occur, CellCube acts as a backup for key departments such as IT and Administration. The lighting for the parking lot also comes from renewable energy and the Park supplies an e-charging station for electric cars.

With its multitude of applications GILDEMEISTER energy solutions demonstrates that the competences extend far beyond just electricity generation and storage. "With our backup solutions industrial firms can increase their production security significantly," says Beermann, to name just one example. Thanks to their close links to machine tool manufacture the people at GILDEMEISTER energy solutions are well aware of the energy needs in the metal cutting industry.

"Responsible handling of this topic has a dramatic impact on the running costs of a company, not to mention the positive effect on the environment," concludes Beermann. "In Bielefeld we have reduced our carbon footprint by 520,000 kg of CO_2, the equivalent of the CO_2 emission of an Audi A4 2.0 TDI that travels a distance of over four million kilometres. And you are more independent of rising electricity prices." With this in mind the managing director expects the importance of energy efficiency and de-centralised systems using renewable energy sources to grow continuously – both in the metal cutting sector and in many other energy-intensive branches of industry.

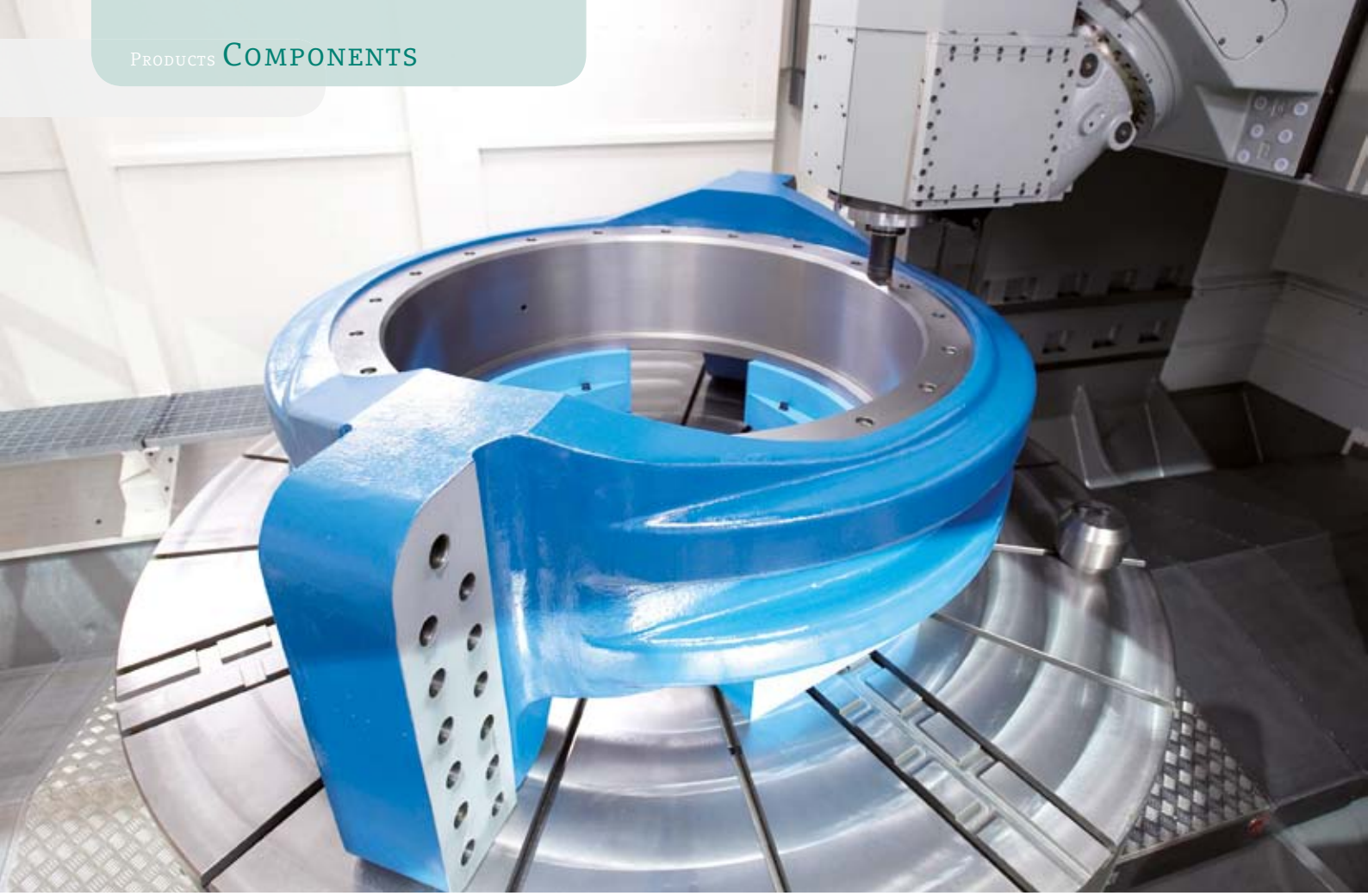
GILDEMEISTER AG's headquarters are operated with an autonomous power supply by renewable energy sources.

DECKEL MAHO Seebach

Independence from rising electricity costs

The motto at DECKEL MAHO Seebach is "generate, store and utilise your own energy locally!" The concept here is similar to that of the Energy Solutions Park in Bielefeld in that it is based on an actual state analysis, measures for saving energy, the use of different SunCarrier and a WindCarrier plus storage of electricity using a CellCube. In addition we were able to take energy-saving measures into consideration during the construction of the new technology centre that was part the plant expansion in Seebach.

The daily electricity consumption at the Seebach plant after its modernisation stands at 20,000 kWh. Thanks to local energy generation, 5% of its total requirements come from renewable energy - an amount that is sufficient to manufacture 500 MILLTAP 700 machines in the production hall. So the sustainable energy concept provides flexibility and independence from rising electricity prices, not to mention its environmental benefits.



Integral manufacturing expertise

The Components business division of GILDEMEISTER energy solutions is the ideal competence partner for many different branches of industry and as a supplier it promotes commitment in the energy sector.

Its Components business division ensures the reputation of GILDEMEISTER energy solutions as a convincing and versatile supplier for many different branches of industry. It is active not only in the precision machining of cast components in best jobshop manner, but to an ever greater extent as a competence partner for ready-to-mount welded components as well as subassemblies, cast parts and machines. Meanwhile, one of its key customer industries is the wind power sector where the Components business division of GILDEMEISTER energy solutions has gained a leading position as a manufacturer of bearing housings and mechanical components.

"For over 25 years now our Components business division has successfully developed, designed, projected and manufactured components for wind turbines, machine tools, industrial trucks and general mechanical engineering for its customers. Building close and lasting supply alliances has enabled us to find extensive solutions with which we meet the wide range of demands in the mechanical engineering sector. Excellent quality, adherence to delivery deadlines, top precision and perfect communication between customer and plant, thanks to our multi-lingual project engineers, are our outstanding characteristics," boasts Udo Mall, Director of Components at GILDEMEISTER energy solutions.

"As a result of our service, customers are able to save the time and cost of carrying out incoming goods inspections because we not only offer them complete quality documentation but also have our processes regularly inspected by the TÜV

(German Technical Inspection)." Mall takes the bearing housings produced at the location for wind power turbines, in which the company has gained a leading position on the market, as an example of its expertise. He stresses that: "The wind energy division was expanded in the past with investments in our machine park allowing us to strengthen our position as a supplier in this branch."

The range includes over 8,000 different production parts.

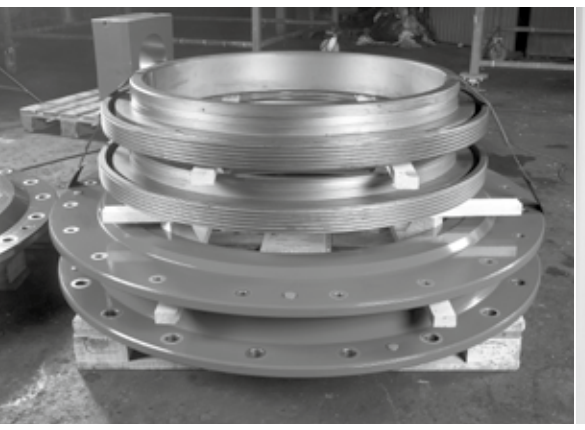
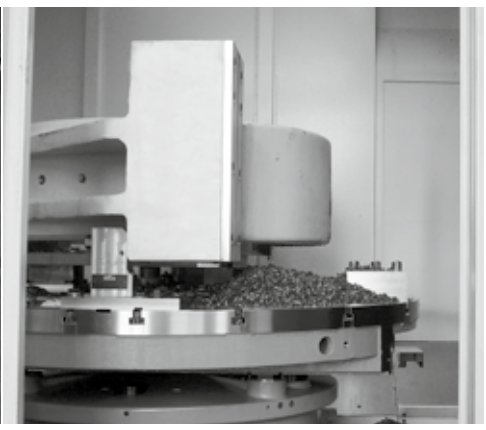
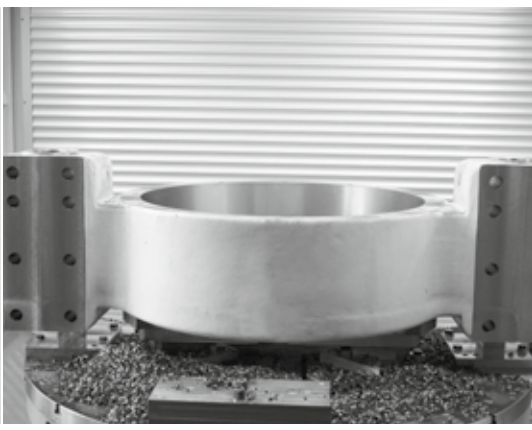
"Another of the company's key fields of activity is mechanical engineering," Mall goes on to explain. The company supports, among others, the GILDEMEISTER Group with the strategically oriented procurement of cast iron, steel and machine components, thus securing procurement advantages for the group. The Components business division supplies sophisticated and complex components made of grey cast iron and spheroidal graphite iron, whereby the best technical and economical solution is always found for every project.

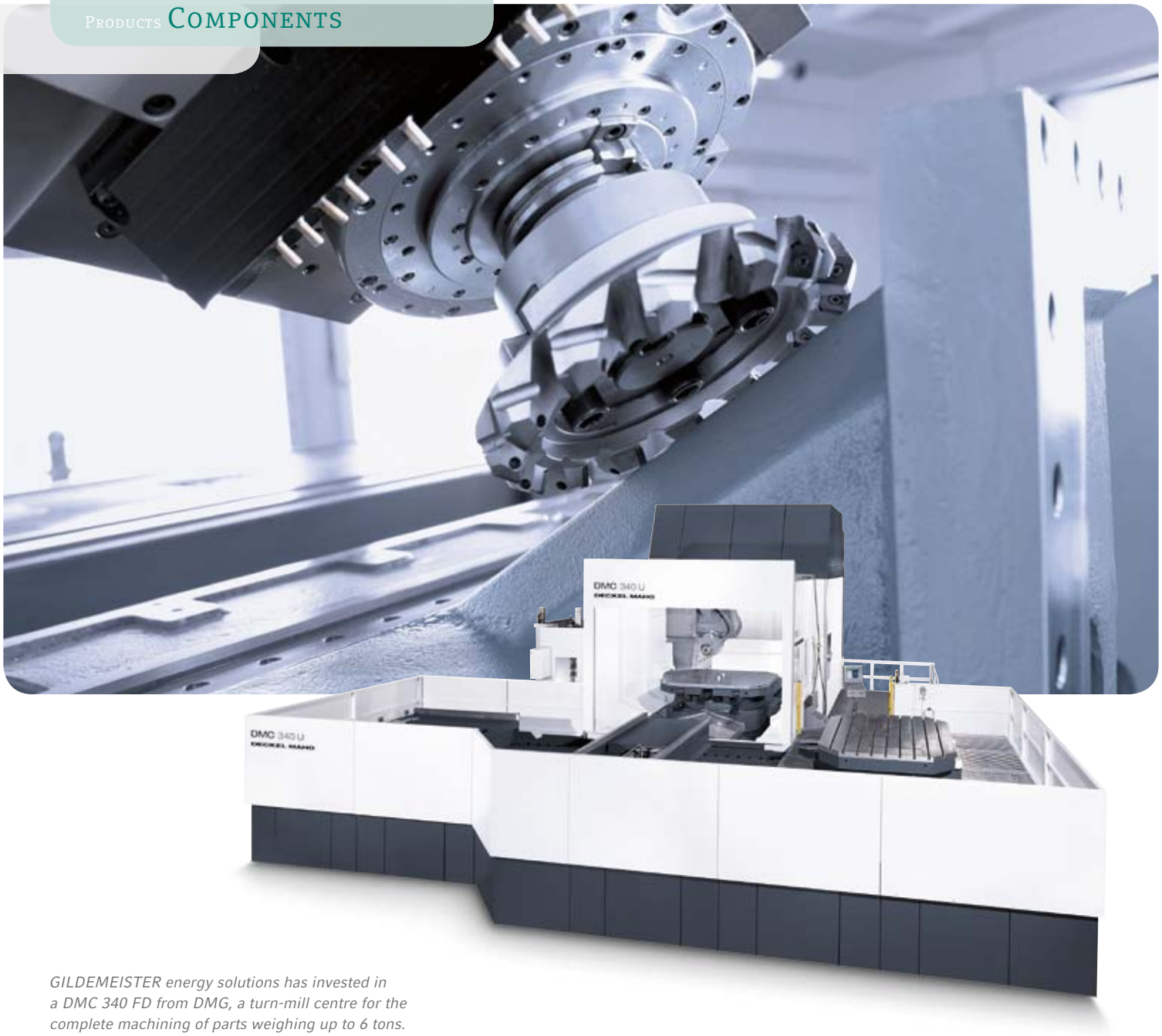
Sector mix: GILDEMEISTER energy solutions

- Construction machinery
- Industrial trucks
- Specialised mechanical engineering
- Machines for the plastics industry
- Machinery for the paper industry
- Gearbox manufacture
- Steel and metal construction
- Electrical switchboards
- Components for wind turbines
- Machine tools

Mall bundles the range of services together as follows: "We are a reliable partner for precision machine tools, ready-to-mount welded parts and finished cast iron components," and then goes on to give details: "Our range includes over 8,000 different production parts that we offer as subassemblies or pre-assembled unfinished machines. We take over the coordination of the entire production chain: from the construction site offices, to model builders, foundries, forges and welding specialists and on through to processing and assembly operations." Mall also explains that the success of a project is guaranteed by the individual project-related and integral support given by the company's competent engineers. "Another advantage of our company is provided by the central administration and availability of extensive logistics concepts." »

One of the key customer industries is the wind power sector where the Components business division of GILDEMEISTER energy solutions has gained a leading position as a manufacturer of bearing housings and mechanical components.



GILDEMEISTER energy solutions has invested in a DMC 340 FD from DMG, a turn-mill centre for the complete machining of parts weighing up to 6 tons.

Long-standing supplier of wind turbine manufacturers

Like the sun, wind is an inexhaustible source of energy that was discovered as a way of producing energy hundreds of years ago. Not only in Germany but all over Europe has the wind power industry grown rapidly as an environmentally-sound generator of electricity and its importance will continue to grow in the future. GILDEMEISTER energy solutions entered this future-oriented market at an early stage and has been supplying components to well-known manufacturers of wind turbines since the mid-nineties. Mall says: "We offer a wide range of products and services." The product portfolio extends beyond completely machined ready-to-mount welded parts to include cast iron components with spheroidal graphite and high-notch impact strength as well as forged drive shafts made of tempered steels. In addition, the company focuses on the high-quality manufacture of key components for the wind energy sector.

The wind power industry's importance will continue to grow in the future.

GILDEMEISTER energy solutions considers itself to be the competence partner for wind energy components - from design to the finished product.

Key components for wind energy

- Bearing housings
- Azimuth brake disks
- Clamps
- Bearing covers
- Gaskets
- Machine supports
- Rotor hubs
- Rotor locking disks

Leading manufacturer of bearing housings

Continuous quality assurance and documentation is indispensible for a leading manufacturer of bearing housings for the wind power sector. Regular inspections of all necessary permits are carried out by SLV (materials engineering and welding-related processes and technologies) and TÜV for all components, as are regular inspections of the materials and welding seams. The technology optimisation and process optimisation divisions at GILDEMEISTER energy solutions have gained in importance enormously due to the need for meeting the demanding customer and quality requirements of this emerging branch. Mall goes on confidently: "This ensures that we keep market leadership when it comes to quality, efficiency and increasing productivity. Continuous expansion of our production facilities will facilitate even better utilisation of our casting and machining capacities in future. Furthermore, planning has been in the pipeline in the last few years for an expansion of the machining centres that will enable larger, cubic components such as hubs and machine supports to be manufactured in a single machining process. As a result, throughput times will be reduced and quality enhanced."

Following the Sun

Up to 40% higher yields, because tracking systems from GILDEMEISTER energy solutions always align themselves to the current position of the sun.

The sun radiates over a trillion kilowatt-hours of energy a year, the equivalent of around 10,000 times the world's primary energy demand. The photovoltaic systems of the SunCarrier series from GILDEMEISTER energy solutions convert a significant part of this energy into usable electricity. Designed as tracking systems the intelligent SunCarriers continuously align themselves to the position of the sun and the angle of incidence via a horizontal or vertical pivot axis, so that an additional yield of up to 40% can be achieved in comparison to fixed photovoltaic systems.

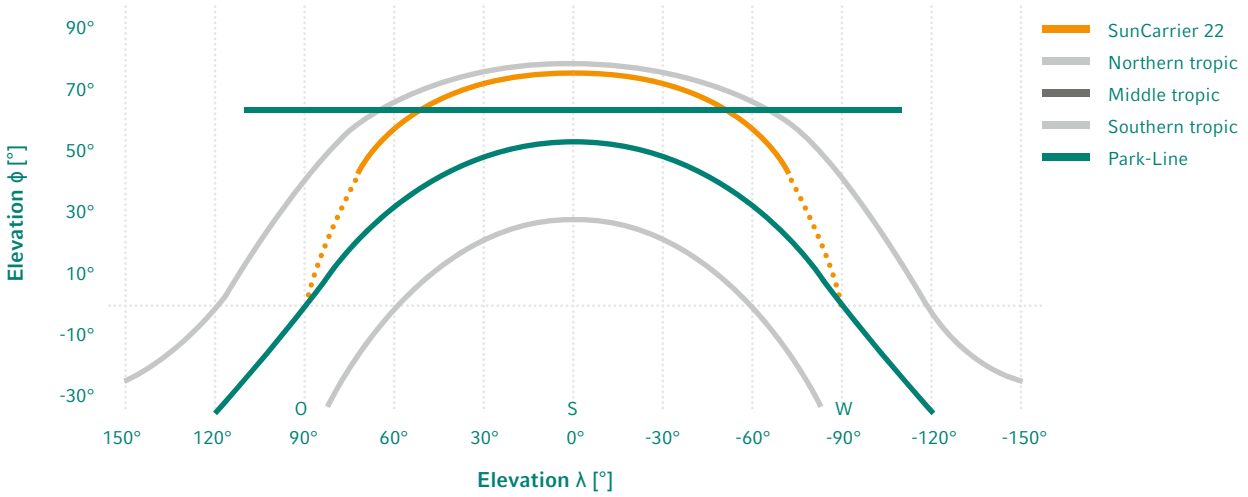
Solar electricity is still an attractive way of combating rising energy prices. Where the SunCarrier systems are concerned, GILDEMEISTER energy solutions focuses its offer on customers who wish to generate and utilize energy from renewable energy sources locally. Investing in such systems is certainly a profitable option, as the turnkey project solutions go hand-in-hand with maximum energy yields and short amortization times. Every project is planned and realised individually in line with the customer's requirements. The product portfolio ranges from powerful systems suitable for whole solar parks to compact standalone systems ideal for installation on unused industrial areas.

SunCarrier 22: More energy on less space

The latest member of the SunCarrier family is also the most compact version. With a module surface of just 22 m² the SunCarrier 22 generates enough electricity to cover the annual requirements of a four-person household. Tracking of the photovoltaic module is effected via a pivot axis with a pitch angle of between 10° and 20°. The SunCarrier 22 can be used in areas stretching from the equator to 55 degrees of latitude – in both the northern and southern hemispheres. It strengths come into play in particular in its tracking ability, that allows orientation to the daily course of the sun (see graphic). The SunCarrier 22's maximum output is enough to cover the electricity requirements of a four-person household. Another benefit that is of particular importance in countries that have a construction height restriction. the system has a height of maximum four meters and even this can be further reduced by lowering the pitch angle.

A maintenance-free electrohydraulic motor drives the wings of the SunCarrier 22 reliably and quietly. Depending on requirements and site conditions it has enough power to simultaneously rotate up to eleven wings coupled to a push- »

Tracking graph



The tracking system is much more environmentally friendly as the ground continues to receive rainwater and sunlight. Moreover, screws ensure the ground and soil is not damaged by concrete foundations found in other systems. As a result, energy is generated efficiently and environmentally friendly.

rod. The programmable logic controller can control 32 such SunCarrier groups – in total therefore up to 352 wings. The light-weight SunCarrier 22 also impresses through its sturdy design and simple installation. The use of conventional steel profiles in its construction and either a concrete or screw-in foundation for anchoring the system make this model an economical solution. The system can withstand wind speeds of up to 144 km/h and a snow load of up to 1 meter of fresh snow. In addition its modern design makes the SunCarrier a real eye-catcher, a potential that users can exploit even further by integrating branding elements.

More output thanks to larger module surfaces

Another system that, despite its comparatively small footprint, promises a high degree of efficiency is the SunCarrier 70. This model also has a height of four meters and can be anchored using either a screw-in foundation or a 6 x 6 m concrete foundation. The 84 m² module surface has an output of 14 kWp – sufficient to supply three four-person households.

GILDEMEISTER Energy Solutions enters very different output classes with its SunCarrier 260. With a module surface of almost 250 m² and a maximum output of 48 kWp this tracking system is designed for use in large solar parks. Equipped with an anti-derailment device the SunCarrier 260 can retain optimum alignment even when subjected to wind speeds of 128.9 km/h, because the wind forces are dissipated directly into the foundation via the enclosed case of the steel construction. In other words the large SunCarrier continues generating maximum electricity yield where other systems would have been forced out of action long ago by the wind.

With a module surface of almost 250 m² and a maximum output of 48 kWp the SunCarrier 260 is designed for use in large solar parks.

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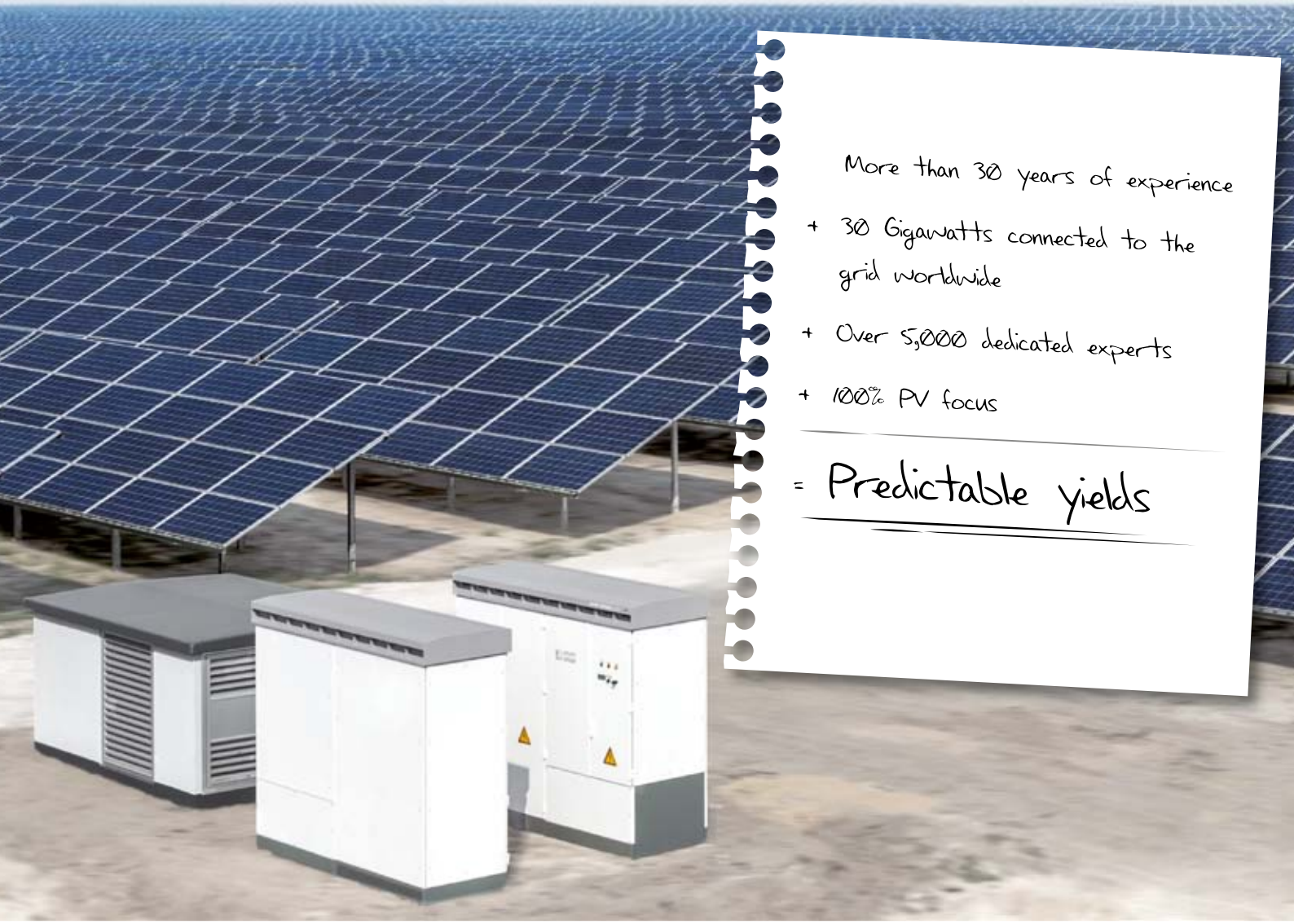


ENERGY THAT CHANGES

SMA

Mori Seiki: Green ambitions

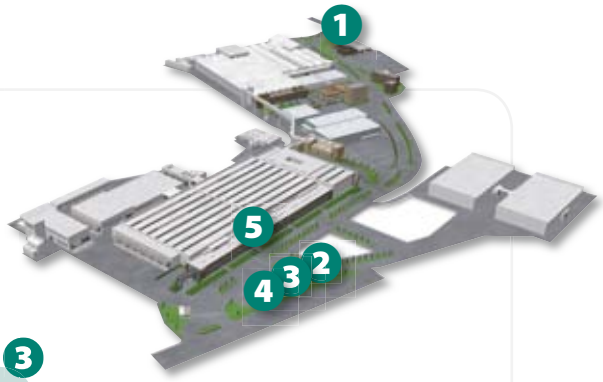
In 2012, Mori Seiki officially opened its Energy Solution Park at the company's Iga campus in Japan. The park is part of Mori Seiki's efforts to address environmental issues and secure the machine tool builder's energy supply in case of power blackouts.

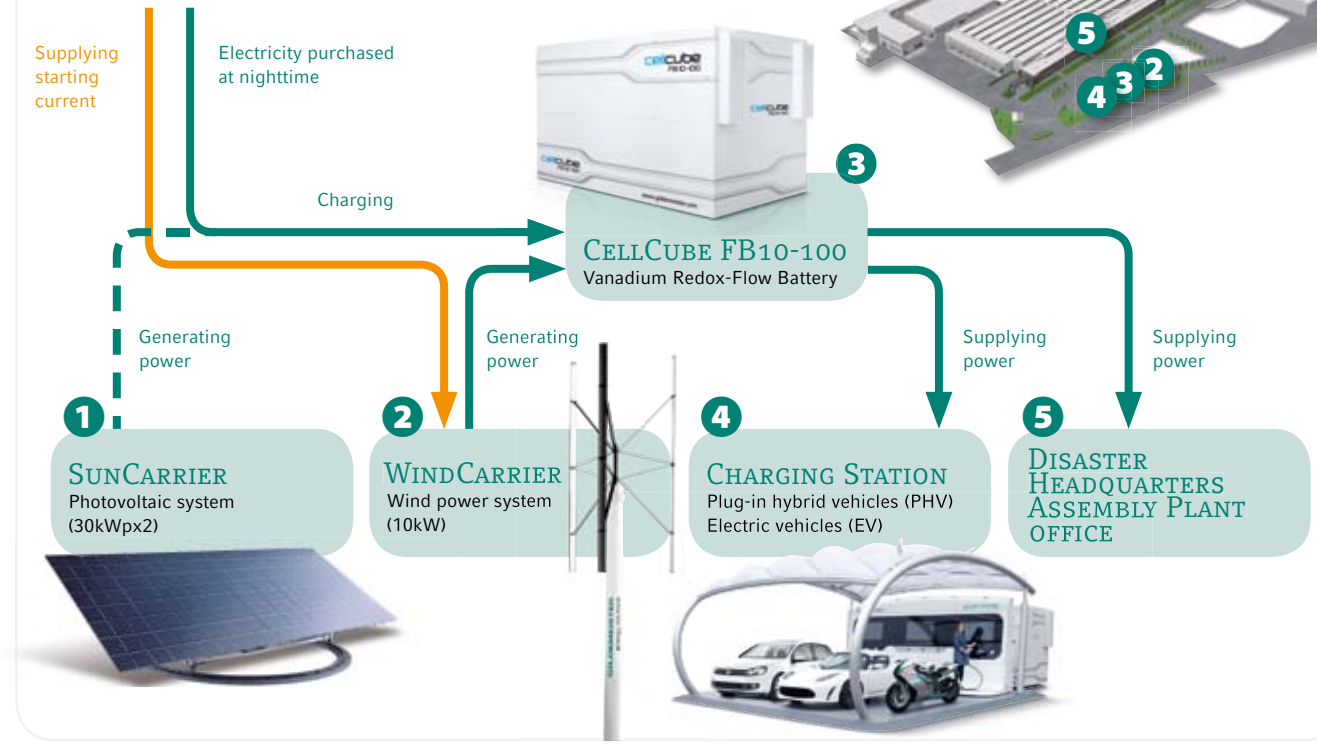
In the wake of the Fukushima nuclear disaster and the horrific Tohoku tsunami, Japan is about to begin an amazing transformation: In 2012, the Japanese government switches off most of its 50 nuclear reactors and plans to invest heavily in solar and wind power, as well as energy-efficient technology.

Japan certainly does not lack green energy ambition. Neither does machine tool company and GILDEMEISTER business partner Mori Seiki. In 2010, the company installed two PV-systems on its Iga Campus (Iga City, Mie, Japan), which were complemented by a wind power system, a Redox-Flow battery and an e-filling station for electric vehicles to make up

In 2010, Mori Seiki installed two PV-systems on its Iga Campus, which were complemented by a wind power system, a Redox-Flow battery and an e-filling station for electric vehicles to make up the Mori Seiki Energy Solution Park.

Mori Seiki Energy Solution Park





Renewable energy in Japan

Prior to the Fukushima nuclear disaster in March 2011, Japan relied on nuclear power for roughly 30% of its energy needs, with 60% coming from conventional sources such as coal, oil and natural gas.

Among the total electricity generated in fiscal year 2010, renewable energy accounted for approximately 10%. Hydroelectric power accounted for 9%, with other renewable solar, wind, biomass and geothermal energy contributing only 1% of the total power capacity of the nation.

Since the disaster, however, most of Japan's nuclear reactors have been taken offline, leaving power generated from the remaining sources to fill the gap. In May 2012, 90% of all power in Japan is derived from fossil fuels, but the government plans to increase the amount of power generated by renewable energy equipment to 10.5% in 2030.

the Mori Seiki Energy Solution Park. Moreover, the company has been engaging in various energy-saving activities and successfully reduced total electricity consumption of all three campuses by 20% in the first year after implementation.

"Every campus set up its own targets for reducing electricity consumption, repairing air leakages, eliminate processes or improve productivity rates of various machines and equipment," Shigeaki Ushio, Mori Seiki Renewable Energy, explains. "Moreover, the implementation of daylight saving time reduced electricity use and saved petrol consumption by avoiding rush hours. Moreover, all employees refrained from using too much air-conditioners and lights, while many air-con systems and light bulbs were replaced by energy-saving equipment. As a result, we received an honourable mention as an environmentally-friendly company from the Japan Machine Tool Builders' Association, JMTBA."

Energy Solution Park

As part of Mori Seiki's efforts to address environmental issues, the company officially opened the Mori Seiki Energy Solution Park in May 2012, where two SunCarrier 260 generate about 88,000 kWh/year. To achieve the highest possible energy yields, the SunCarrier adjusts itself to ensure an opti- »

mum angle to capture sunlight. A single-axis tracking system continuously aligns each of the 248 m² module surface areas to the current position of the sun via its vertical axis. Compared to fixed installations, an additional yield of up to 35% can thus be generated.

"The power generated is supplied to the club house, the facility for employees, and residual quantity of generated power is fed back into the grid," Ushio-San explains. "Currently, 31% of the power used by the club house is generated by the PV-system, equalling 44 kWh/day."

Wind Power

Additional to the power generated by the sun, a 14-m-tall WindCarrier from GILDEMEISTER energy solutions powers parts of the assembly plant. The turbine blades generate a rated power of 10 kW, whereby the blades' special shape forces the air on the curved upper surface to flow more quickly than the air below the blade. The resulting force gives the WindCarrier its driving force, similar to the wings of an aircraft. The system is independent from the direction of the wind and quietly starts generating power when the wind speed reaches 3 m/s.

But what if the wind doesn't blow or the sun doesn't shine? Or heavy winds overnight mean high power generation when the energy is in fact not needed? Well, then the energy is either stored or generated from a large battery installed at the Iga campus, a CellCube FB 10-100. The Vanadium Redox-Flow battery allows independent and flexible utilisation of the electricity generated by the Sun- and WindCarrier around the clock. The storage system is at the heart of the whole installation, storing the fluctuating supply of electricity based on photovoltaics and wind power until the time of consumption.

Mori Seiki will continue to promote a „green" environment at the Iga campus through various energy conservation efforts.

The battery can then supply the assembly plant, disaster headquarters and the e-filling station. "While we haven't experienced a power blackout since the battery was installed, the CellCube Redox-Flow battery makes sure the disaster headquarters can be supplied with power in the case of an emergency," Ushio-San says. "Additionally, the e-filling station, which currently charges two electric vehicles on the Iga campus, can also be supplied with renewable energy through the battery."

The future: E-vehicles

The station is capable of charging up to six electric vehicles at the same time. A video for promoting renewable energy is played on the central monitor of the station, and the amount of CO_2 to be reduced by every charge is displayed on the right and left monitors.

It takes about 6.5 hours for the Nissan Leaf and 1.2 hours for the Toyota Prius to be fully charged at the station, which is approximately 1.2 times faster than ordinary EV charging methods. According to Ushio-San, the number of electric vehicles in Japan is increasing, and the company offers its employees to use the e-filling station for commuting.

Mori Seiki will continue to promote a „green" environment at the Iga campus through various energy conservation efforts, including temperature control in the machining plant, tree-planting, and reduction in power consumption by shortening parts machining time. "We will continue to make efforts to reduce environmental load, while validating the potential for utilisation of those green energy sources," Ushio-San concludes.

www.moriseiki.com

Iga Campus

Here, at the Iga campus, Mori Seiki produces medium to large CNC machines and key components such as spindles, ball screws and machine housings. A new plant for the precision manufacturing of machine beds and travelling columns is also located at this site since April 2012.

Overview

E-FILLING STATION

- Body dimensions:
  5,350 × 2,000 × 2,600 mm (height)
- Weight: Approx. 1,500 kg
- Foundation dimensions: 6,606 × 6,930 mm
- Roof height: 3,523 mm

SUNCARRIER PV-SYSTEM

- Generating capacity: 30 kWp × 2 units
- Number of panels: 294 (installation area: 437 m^2)
- Equipment: Solar panels (made by Kyocera) and tracking system (SunCarrier 260 made by a+f)

CELLCUBE FB10-100

- Type: Vanadium Redox-Flow battery
- Storage capacity: 100 kWh
- Output: Nominal 10 kW
  with up to 15 kW maximum output
- Size (L×W×H): 4,500 × 2,200 × 2,400 mm
- Weight: 10 t

WINDCARRIER WIND POWER SYSTEM

- Type: Vertical axis wind power generator
- Specification: Rated output 10 kW
- Size: 4,700 mm (rotor diameter),
  14,250 mm (overall height)
- Weight: 2.5 t

A 14-m-tall WindCarrier from GILDEMEISTER energy solutions powers parts of the assembly plant. If the wind doesn't blow, the energy is either stored or generated from a CellCube FB 10-100.

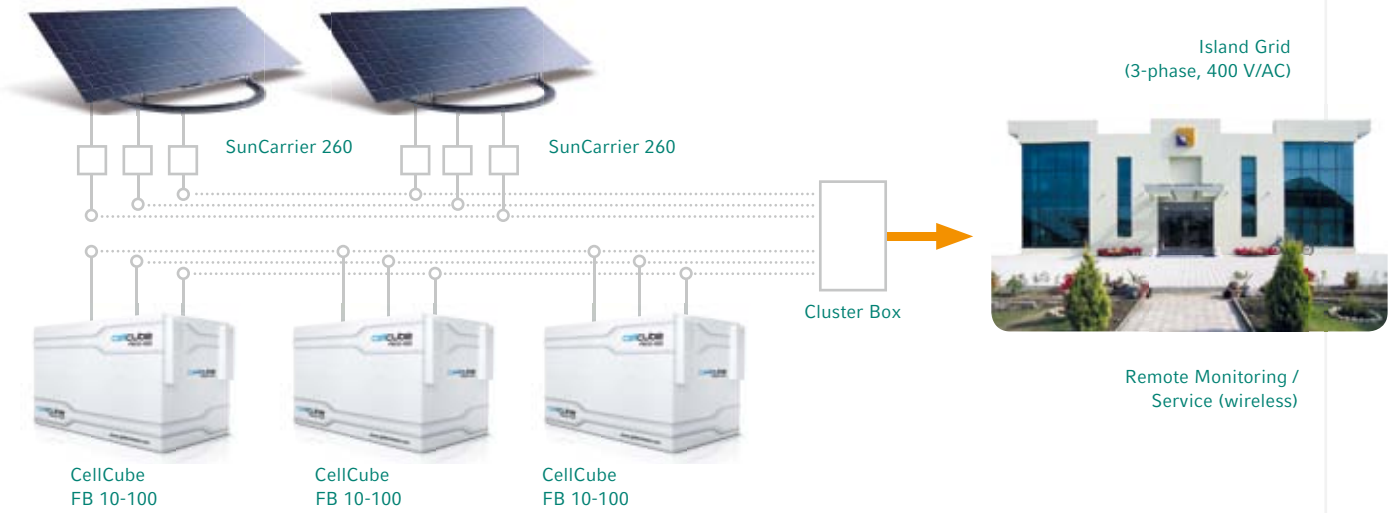
India's first commercial Net Zero Energy Building

The SunCarrier Omega Net Zero Energy Building Bhopal, located in the central part of India, is an example of how organisations can ensure energy supply by implementing off-grid green energy systems that leverage nature's abundance of solar energy.

In December 2011, over 300 million Indian citizens had no access to electricity. Of those who did have access to electricity, the supply was intermittent and unreliable because India's power generation capacity has not kept pace with growth. Demand outpaced supply by 10.2% in March 2012, and by 2016 this deficit is likely to be up to 25%, as government statistics show.

Diagram of connections

Office building completely supplied with 100% renewable energy



Turnkey system from GILDEMEISTER energy solutions

As a result, Blackout Tuesday in July 2012 left more than half a billion people without power; the makings of a disaster movie: Trains motionless on the tracks. Miners trapped underground. Subway lines paralysed. Traffic snarled in much of the national capital. Three of the country's interconnected northern power grids collapsed for several hours, as blackouts extended almost 2,000 miles, from India's eastern border with Myanmar to its western border with Pakistan.

For a country considered a rising economic power, Blackout Tuesday – which came only a day after another major power failure – was an embarrassing reminder of the intractable problems still plaguing India: Inadequate infrastructure and a crippling power shortage.

Lighting up all homes

Getting back in charge of critical power requirements sounds like an appealing idea – and so does SunCarrier Omega's corporate vision: To harness the available sunlight to light up all homes in India!

SunCarrier Omega Private Limited (SOPL) is an Omega RENK Bearings Pvt. Ltd. joint venture, and a member of the GILDEMEISTER energy solutions. SunCarrier Omega offers best-in-class products and turnkey system integration services for grid-tied and off-grid Solar PV systems for applications in residences government, telecommunications, and corporates.

Each SunCarrier 260 delivers 33.2 kWp via suitable inverters onto the main power line connected to the building's main switch. The batteries are connected to the main power line in parallel to each other and the SunCarrier. In order to ensure adequate power management of the system, a cluster box needs to be installed as the main connection point to handle the strong currents. Integration of a small WindCarrier wind turbine is also possible in the future. The complete turnkey systems from GILDEMEISTER energy solutions are also easy to maintain and wear-free.

The off-grid renewable energy system is capable of delivering a maximum load of 111.4 kW. The system is designed to cover the complete demand for energy, including the lighting of the offices and the outside sections, the air conditioning system and the water system. Excess energy charges the flow batteries. In case of an insufficient energy supply from renewable energy sources, supplemental energy provided by the CellCube FB 10–100 batteries satisfies the load.

»

Project Overview

The office of SunCarrier Omega Private Limited is one of India's first Net Zero Energy Buildings. The energy generated by a solar PV SunCarrier system feeds the lighting and air-conditioning load for the building, while also charging the large capacity CellCube Vanadium Redox-Flow battery and energy management system. The CellCube provides adequate power night and day when the solar power generation is inadequate. The facility does not draw any power from the grid, nor does it depend upon the traditional diesel generators for its electrical needs. SunCarrier Omega achieved LEED PLATINUM, a notable US-American sustainability certificate. SunCarrier Omega office sports many green features that directly contribute to the environment in terms of reduced energy consumption, impact on the local environment and usage of natural resources:

- 100% of the building's annual energy consumption is sourced through onsite renewable energy
- The project has achieved 43.83% energy cost reduction in proposed design
- Energy efficiency measures such as Hi albedo paint on roof, efficient lighting design, efficient HVAC design and VRV systems for saving more energy than the conventional systems
- Provision of battery charging stations for 14% of the total car parking capacity in an effort to promote use of alternative and low emitting vehicles
- Low flow dual-flush toilets, sensor based urinals and other low flow fixtures have been selected to install at site to reduce water consumption by over 40%
- 100% of wastewater is being treated onsite to tertiary standards
- More than 95% of the debris generated during construction has been has been recycled or reused
- The project has achieved a combined recyclable content value of 10.65% of total material by cost thereby reducing virgin material exploitation
- 5.95% of the total materials cost used on the project were from rapidly renewable sources
- 24% of the project's material and products by cost was extracted, harvested, recovered and manufactured within 800 km of project site
- 99.18% of the wood based materials & products used in the project are certified in accordance with FSC principles
- 81% of roof area is covered with a highly reflective material to reduce heat islands
- 77% of the occupants can control the air speed and temperature of the cassette units in their workspaces
- More than 81% of the regularly occupied areas have daylight

BENEFITS OF NET-ZERO ENERGY BUILDINGS

- Electricity whenever you need it
- Continuous electrical power supply; no unstable grid
- Easy to maintain and wear-free
- Protect your production line with a stable grid
- Less energy required because energy losses through conversion, transmission and distribution can be minimised
- Fewer peak-demand problems
- Easy to install

Watch our videos

About SunCarrier Omega

SunCarrier Omega Pvt. Ltd. offers turnkey renewable energy solutions incorporating one of the world's largest sun-tracking systems, the SunCarrier series, and large capacity vanadium redox flow energy storage and management system, the CellCube series, and small wind turbines, the WindCarrier. SunCarrier Omega is a joint venture member of GILDEMEISTER Energy Solutions, of the GILDEMEISTER Group of Germany.

Since about 35% of the total energy needs is consumed in buildings, investing in net-zero energy systems for buildings makes sense. A Net Zero Energy Building (NZEB) is highly energy-efficient and produces at least as much energy over the course of a year as it consumes.

SunCarrier Omega decided to invest in an off-grid NZEB as its corporate office to demonstrate that it's possible to have energy whenever you need it. And there is a desire in India to consume only green energy, Sushil Prakash, Managing Director of SunCarrier Omega Pvt Ltd, says.

"There is, indeed, a greater consciousness amongst consumers about the depleting fossil fuel resources, and the pollution caused by excessive use of fossil fuels. India has also seen a huge increase in the generation and consumption of clean energy – caused in equal measure by voluntary consumption, as well as through favourable government policies of renewable energy subsidies and mandatory renewable purchase obligation."

Energy production & storage

In Bhopal, two SunCarrier 260 produce all energy for the building, including lights and air conditioning. The excess energy is stored in three CellCube FB 10-100 units, thus ensuring 24/7 grid-independent clean energy. Moreover, renewable building technologies adopted at SunCarrier Omega include daylighting, insulation, occupancy monitoring, high-efficiency heating, ventilation and air conditioning (HVAC) equipment, natural ventilation, water harvesting and evaporative cooling. »

Left: In case of an insufficient energy supply from renewable energy sources, supplemental energy provided by the CellCube FB 10–100 batteries satisfies the load.

Right: The air-conditioning is fed with energy generated by the SunCarrier, and more than 81% of the regularly occupied areas have daylight.

While solar energy has been used for long as a source of electricity, the SunCarrier NZEB system is a rare example of using on-site solar energy to support all electrical loads. The ease of installation, commissioning and maintenance, as well as design life of 25 years of such projects make this a very attractive solution to ensure energy security, while protecting the environment at the same time.

The SunCarrier Omega Net-Zero Energy Building evolved as a multi-act play:

Deployment of a renewable energy generator in the form of Solar PV system

The SunCarrier SC 260 was chosen since it was one of the largest sun-tracking solar PV systems available worldwide, with a designed energy yield that was 35 to 40% higher than that of similarly rated static systems. Its large format, and its ability to track the sun, has made it a beacon for the eco-inquisitive and eco-conscious from all walks of life. It now acts as a great motivator for those desirous of adopting sustainable energy policies for their own residential or commercial operations.

Incorporate demand-side energy efficiencies

The SunCarrier Omega NZEB design incorporated daylighting for high utilisation of natural lighting, as well as LED lighting and occupancy monitoring sensors. The air conditioning system chosen was one with ozone-friendly refrigerant and carbon dioxide monitoring sensor system and low noise inverters. Water harvesting system, controlled water discharge toilets, and sewage treatment with zero discharge ensured efficient usage of water. The furniture chosen, too, was 95% recyclable.

> **100% of the SunCarrier Omega NZEB's annual energy consumption is sourced through onsite renewable energy.**

Integration of a large capacity energy storage system, the Cellcube FB 10-100

In addition to its ability to store up to 100 kWh of energy per unit, it also functions as an effective energy management system. Excess energy produced during the day by the SC 260 is stored in the Cellcube, which in turn supplies energy during the night hours, and during monsoon days when the sun does not shine.

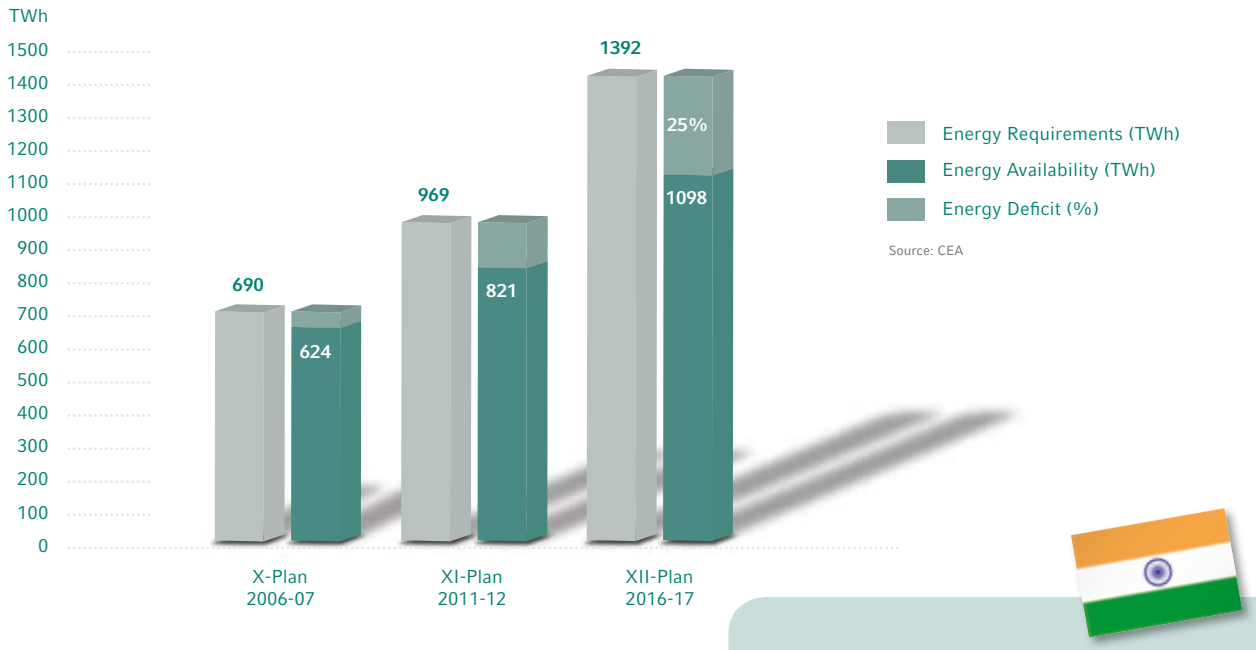
Based upon the sizing for the SunCarrier Omega energy plan, the system was configured with two units of SunCarrier SC 260, with an overall rating of 67 kWp, for a planned yield of over 130,000 kWh per annum. Three units of CellCube FB 10-100, each with a maximum power rating of 15 kW, and a storage capacity of 100 kWh, were configured. One SMA multi-cluster box completed the configuration.

Minimal maintenance

The described system has a design life of 25 years. The SunCarrier SC 260 requires minimal maintenance in terms of periodic cleaning the dust off the PV module surfaces. Since PV efficiencies are improving rapidly, periodic replacement to newer and more efficient modules is desirable, though not essential. The PLC controls and monitoring systems incorporated both in the SunCarrier SC 260 and the Cellcube FB 10-100 allow remote monitoring of critical performance parameters and take the rarely required preventive actions to ensure smooth functioning of the system. The systems are highly eco -friendly in that they are over 95% recyclable, emit no harmful gases or effluents, and there are no heavy metals to dispose of.

Solutions, as exemplified by the SunCarrier Omega Net-Zero Energy Building, are ideal energy solutions for energy security for corporates and residential complexes. India will certainly see similar projects in future since renewable energy trading has been introduced, and the Renewable Energy Certificate (REC) scheme democratises the access to renewable energy. SunCarrier Omega's utility-scale project under the REC scheme will be commissioned over the first half of 2013. There are various possible applications of the SunCarrier Omega Net-Zero Energy Building design principles. Among them are:

- Providing a environmentally responsible energy solution to the eco-conscious consumer
- Rural electrification – where grid energy is not available
- Providing energy security from escalating fuel prices, to industries with significant use of diesel generator sets, e.g. hospitals
- Providing non-polluting energy to industries with significant use of highly polluting diesel generator sets, e.g. telecom towers



There is an increasing energy deficit, both in terms of peak energy and total energy requirements. In 2016 the deficit will rise up to 25%.

Global Energy Solutions Park

SunCarrier Omega's picturesque campus today serves as a Global Energy Solutions Park. As general awareness about renewable energy solutions in India is fairly poor, the park has helped to inform a large community of students, industrialists, politicians, bureaucrats, engineers, architects and other citizens about the technologies installed. That Net Zero Site Energy NZEB is easy to implement, manage, and monitor, and has few external dependencies, has come as a revelation to many who considered setting up of 'green' captive power plants to be too complex to be undertaken.

"The time is now for us to channel our ingenuity to help preserve our abode and halt the deterioration of our environment," Mr Prakash comments. "Our belief is that the path to prosperity lies in corporate commitment to sustainability. Adopting and propagating environmentally responsible energy policy is the way forward. Now is the time to reclaim the world we truly deserve."

www.suncarrieromega.com

Energy consumption in India

In the past few years, India has experienced a fairly rapid growth in energy consumption, resulting in an increasing energy deficit, both in terms of peak energy and total energy requirements. Alone 35% of the total energy needs is consumed in buildings. 46% of all energy is consumed by industry. The electricity grid, the primary source of power in India, has not kept pace with the rising demand. This has led to an unstable electricity grid and, consequently, problems within the production flow.

It is not possible for India to achieve energy security by concentrating on non-renewable sources like coal and oil as the world does not have enough of such resources to meet demands which are continually increasing. India needs to look increasingly towards renewable energy for attaining energy security by 2050 and India's target of getting around 15.9% of total energy need from renewable sources by 2022 is too modest. India being endowed with year round solar radiation must exploit this source to the fullest extent as it is abundant and will remain as long as Earth is in existence irrespective of the cost involved today. Further, India needs to fully exploit the potential of other renewable energy sources like bio fuels, wind, hydro and even nuclear energy, as projections of energy requirements indicate an approximately three times increase from around 620 Mtoe in 2008 to 2043 Mtoe by 2031-32.

Full-service for solar parks: Maximum yields thanks to perfect service

Regular maintenance, repair and preventative measures are all part of the full service that guarantees the required long-term stability and security of invested capital, so that the desired profits can be achieved with the solar park over its entire service life.

For GILDEMEISTER energy solutions realising a large-scale turnkey project such as a solar park also entails providing competent support for customers, even after the key has been handed over. Operating a solar park profitably demands the kind of technical, organisational and commercial expertise that GILDEMEISTER energy solutions as well as its parent company GILDEMEISTER stand for.

In addition to the planning and construction of efficient solar parks GILDEMEISTER energy solutions also offers its customers individual customised service and maintenance packages that ensure the smooth operation of the park. The service portfolio ranges from monitoring to technical and commercial management. The photovoltaic experts from GILDEMEISTER energy solutions create a package that ensures the customer achieves the maximum yield from his solar park. In this respect the customer benefits not only from the high-degree of competence of the solar provider but also from the maximum availability of the trained service technicians.

Technical support comprises the largest part of the service offer from GILDEMEISTER energy solutions. This includes both spare part management as well as repair measures in the event of failures and damage. The service also includes inspections and maintenance of mechanical and electrical components of the system and thermography where state-of-the-art software and equipment are used. Thermography comprises both analyses and thermal imaging scans on site as well as fault diagnostics for technical components and fire hazard analysis. In addition the technical service it also concentrates on peripheral component installations. Safety systems, for example, not only serve to protect the solar park, they also have a positive impact on operating costs, because the expenditure for insurance policies can be reduced.

GILDEMEISTER energy solutions handles the management and optimisation of such insurance policies and other contractual issues within the framework of its commercial management. The specialists in charge also take care of accounting with the energy provider and ensure efficient operation of the photovoltaic power plant.

In the third part of its service offer – monitoring and control – GILDEMEISTER energy solutions provides a worldwide online installation monitoring service for the solar park. This offer includes alarm management, troubleshooting, performance analyses and monthly reporting. In addition this part of the service offer also includes complete management of yield, radiation and weather parameter data. This data is used as the basis for compiling target/actual comparisons and for calculating yield forecasts.

The advantages of the full-service are obvious: in order to secure the profitability of the solar park, GILDEMEISTER energy solutions ensures the greatest possible operational availability of the systems thereby maximising energy yields. »

GILDEMEISTER runs 123 industrial solar parks around the globe, including a network of subsidiaries and sales partners at 93 locations.

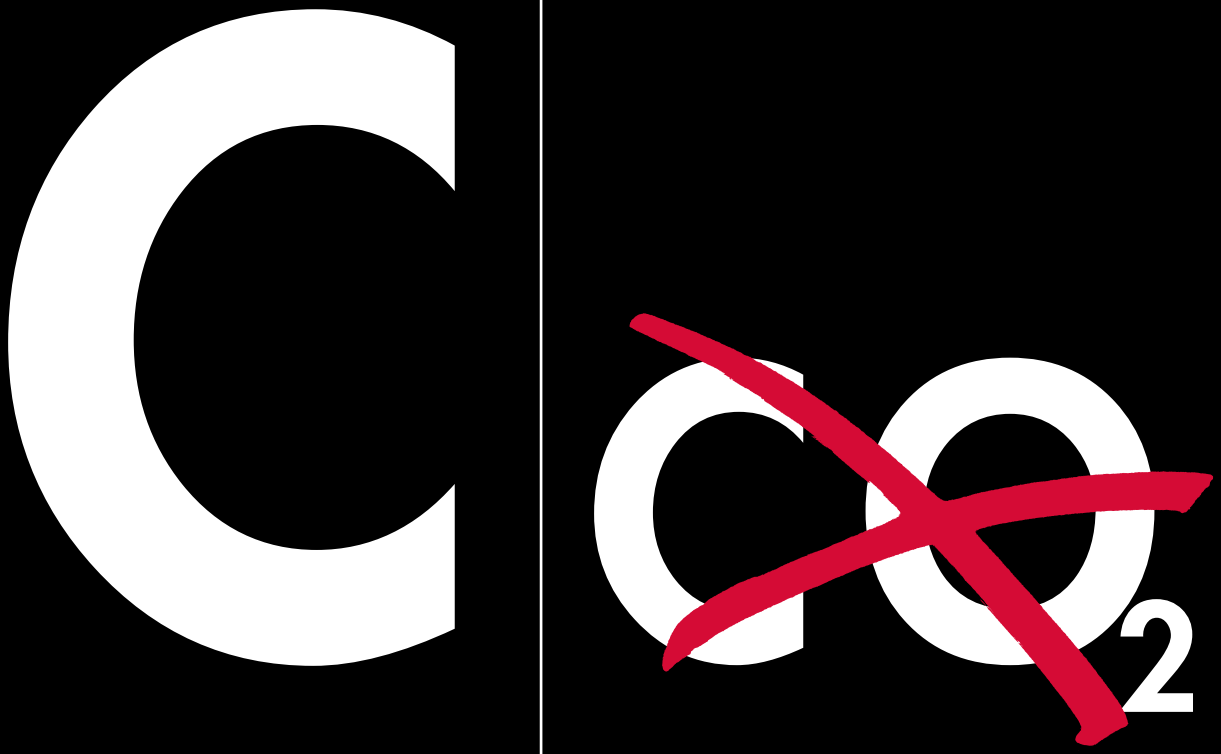
However, although photovoltaic systems are low-maintenance systems they are not maintenance free. By means of regular maintenance, repair and preventative measures, the full-service guarantees the required long-term stability and security of invested capital, so that the desired profits can be achieved with the solar park over its entire service life.

GILDEMEISTER energy solutions' comprehensive service package ensures a long-term profitable operation of solar systems.

Its results are clear proof of the success of GILDEMEISTER energy solutions with its full-service for solar parks. The company currently has more than 200 MW of output under O&M contract. This includes both SunCarrier parks as well as solar parks from third party investors. Here, too, the service team from GILDEMEISTER energy solutions is able to increase the output of the plants significantly. While the industry average for performance ratios (PR) ranks around 75% GILDEMEISTER energy solutions achieves PRs that lie between 80 and 84%.

In other words: competent service for all technical and commercial aspects involved in operating a solar park certainly pays off.

MORE CARBON



FOR LESS CARBON DIOXIDE

Carbon has unique properties. It enables the manufacture of solar cells, increases wind turbine performance and reduces weight in airplanes and cars. All of this leads to less CO_2 emission. More carbon for innovative, efficient, and sustained solutions for the environment and our future. This is what we stand for. More information at www.sglgroup.com.

Carbon is Future.

SGL Group – The Carbon Company.

Broad Base. Best Solutions.

SGL GROUP
THE CARBON COMPANY

E-mobility – for a clean way to travel

Benefits of the complete solution at a glance

- Complete system solution including specially adapted inverters, connection to many different sources of energy possible
- Turnkey energy storage system in weather-proof and tamper-proof housing
- Energy storage system with unlimited cycles (charging/discharging)
- CellCube has 100% deep discharge capability
- Nominal 10 kW power, peak power up to 15 kW (other options available)
- Up to 100 kWh peak capacity (other options available)
- Intelligent battery management for optimum operating performance
- Spontaneous response to load requirements
- Maximum efficiency in every operating mode
- Optional integration of power electronics from vehicles in CellCube

GILDEMEISTER energy solutions moves its focus to the topic of electric mobility with a complete e-charging station solution.

The maxim here: electric vehicles are only as clean as the electricity upon which they run. That is why the company has set its sights on the sustainable and efficient generation of electricity using SunCarrier and WindCarrier models combined with a CellCube for storing the electricity, so that electric vehicles can be charged round the clock. An intelligent Yana charging point ensures clean and user-friendly charging. An information screen clearly displays charging time, duration and power during charging as well as indicating the renewable source from which the electricity derives.

The vehicles can be charged via 'normal' alternating current 230 VAC/3.7 kW (charging time for a VW-UP about 6-8 hours), or via an AC-plug, 400 VAC and 43.6 kW (charging time for a VW-UP less than 30 min for travelling distances of 150 km, speed limit 130 km/h).

Clean and efficient: Electric vehicles can be charged with 10kW charging power – quick and environmentally-friendly.

Charging is effected via a 400-volt AC socket that has an output of almost twelve times the power of a normal household socket, thus ensuring fast charging times. So the e-charging station facilitates high availability of the electrically-powered cars and scooters. A VW Golf, for example, can be charged to 50% of power capacity within 60 minutes – enough for intercity journeys. Up to three Vetrix scooters can be charged to 46% in the same time. This, too, is sufficient for intercity travel. Whether for your own e-fleet, for renting electric vehicles or even as an ultra modern service for customers and visitors - the e-charging station offers a multitude of options for promoting electric mobility on the basis of renewable energies.

Clean electricity for clean cars

With the complete E-charging station solution from GILDEMEISTER energy solutions, Europe's biggest car manufacturer can charge up its electric vehicles – with zero emission for a clean and resource-saving future.

The Volkswagen group headquartered in Wolfsburg is one of the leading automobile manufacturers worldwide and in Europe the largest. Over one fifth of the cars in Western Europe have come from the Volkswagen Group. It sold a record 9.07 million vehicles in the year 2012, making this the car manufacturer's best sales year ever.

Volkswagen's e-charging station is supplied to 100% from renewable energy sources, and is not without reason the first stop on the energy path.

But a company like Volkswagen is not satisfied with simply making superior cars and laying back to enjoy economic success. For the Chairman of the Board of Management at Volkswagen AG, Prof. Dr. Winterkorn, it is clear that, "Responsible action must be taken if the economy is to function properly." For Volkswagen this includes giving priority to the question of sustainability, whereby environmental and climate protection play a key role here as well as social commitment and economic sustainability. And in this respect the group has set itself a very ambitious target: Volkswagen has set its sights on being the most economically efficient and ecological automobile manufacturer in the world by 2018.

The group has certainly set the yardstick here very high: The CO_2 emissions of Europe's new fleet of cars are to be reduced to 95g/km by 2020.

Sustainable production: Think Blue. Factory

The company is also working hard on the question of sustainability in production, explains Prof. Dr. Siegfried Fiebig, manager of the Wolfsburg plant. "By 2018 production processes are to be 25% more environmentally friendly in comparison to 2010". To be more specific, energy and water consumption, emissions and waste are to be reduced by 25% respectively within the framework of the "Think Blue. Factory" strategy.

In order to achieve long-term energy savings, Volkswagen is pointing the way with what it calls the "energy path" at its Wolfsburg plant. The Wolfsburg energy path includes many practical examples from all areas of energy efficiency. The blue and white signs that show exactly where energy can be saved are posted along a path that leads though the production halls. The practical examples shown relate to both the process and the product, stresses Fiebig. "The target of the press shop, for example, is to make the Wolfsburg press shop the most efficient in the group. The older presses have been retrofitted and equipped with more efficient drive technology. The energy requirements have been reduced drastically thanks to measures such as replacing mechanical systems with electrically powered ones, reducing dynamic masses and introducing an energy management system." »

In Wolfsburg Volkswagen manufactures clean cars which are charged with clean energy.

Prof. Dr. Siegfried Fiebig, manager of the Wolfsburg plant (left) and Andreas Michalzik, head of location planning, in front of the company's first e-charging station for renewable energies. The e-charging station is independent from the grid and consists of a SunCarrier, a WindCarrier and a CellCube redox flow battery.

In addition, innovative ideas and technologies, such as gravity conveyors in the assembly, kinetic energy storage systems for lifting units or the use of LED lighting systems in the production halls, have resulted in significant improvement in the specific energy requirements in assembly, which after only two years were reduced by 10% in 2012.

However, Volkswagen is not only reducing its energy requirements, it also intends to cover these to a greater extent with renewable energies from solar, water and wind power. Altogether, Volkswagen is investing around 600 million Euros in renewable energies with which it intends to reduce CO_2 emissions from the plants' energy supply by 40%. "Many people do not know this, but here in our Wolfsburg plant we operate one of the biggest solar power plants north of the Alps," explains Fiebig. "Parts of the production halls are equipped with solar cells that generate enough energy to supply 4500 households a year. In addition, we obtain electricity from a run-of-river power station in Switzerland and we intend to expand the percentage of renewable energy sources by 2018."

100% green "fuel" at the pump

Today, the Wolfsburg plant already supplies its e-charging station to 100% from renewable energy sources. The e-charging station was installed in front of the plant headquarters in Wolfsburg in the summer of 2011 by GILDEMEISTER energy solutions in just three weeks. Meanwhile, the CO_2 -free e-charging station has become a showcase venue and a highlight for visiting groups and is not without reason the first stop on the energy path: The station is completely independent from the electricity grid and consists of a solar system, a wind turbine and a vandium redox flow storage device .

Volkswagen is investing around 600 million Euros in renewable energies with which it intends to reduce CO_2 emissions from the plants' energy supply by 40%.

Volkswagen has now come full circle with the group's first ever charging station for renewable energies, because "clean cars produced in a clean factory can now be charged with clean energy," says Fiebig and stresses that a conventional e-charging station, that gets its electricity from the grid and which might therefore derive from coal or nuclear power stations, was out of the question. "We have created an opportunity here for people to experience first hand what such a complete cycle will look like in future; and the efficient energy generators and storage systems from GILDEMEISTER are perfect for powering our products."

The SunCarrier has a surface area of 250 m² and with 154 solar modules generates a maximum output of 35 kWp. Its polycrystalline photocells track the sun ensuring an opti-

mum angle of incidence and thereby achieving an up to 35% higher energy yield. The WindCarrier has a nominal output of 10 kW and generates energy even with wind forces of just 3m/s, it is 14 m high and operates on the Darrieus principle making it independent of the direction of the wind.

Up to 100 kWh of the ecologically sustainable energy generated is buffered in the CellCube FB 10-100. Surplus energy is fed into the plant grid. But the around 120 E-Golfs used in and around the plant normally use up all the electricity from the six pumps themselves.

"On weekends there are always three to five vehicles standing around here being charged," says Fiebig. "We can accommodate the needs of users with our AC fast charge connection, charging then takes around two to three hours. Besides we will soon be offering the plug-in Golf that has a combustion engine and electrical motor as a provisional solution."

Plug-in Hybrid: Clean duo

In so-called plug-in hybrid cars the charging energy comes from both the socket and from the combustion engine. The Golf VII hybrid plug-in version is an extremely economical vehicle. Although the plug-in hybrid system represents a major step towards promoting and expanding e-mobility, the experts nevertheless all agree that there is still a long way to go on the path to securing such future clean and resource-saving automotive technology. This is true for both the development of the vehicles and the way the electricity is generated. Seen from an ecological point of view, e-mobility really only makes sense if the electricity is generated from renewable sources – as is the case here at the Wolfsburg plant. "We demonstrate in Wolfsburg that the future is already here and that Volkswagen takes the question of clean e-mobility seriously," says Fiebig. "Whether or not this technology has a future depends of course greatly on the degree of acceptance," he adds, "but our employees and the people of Wolfsburg have all proved open for e-mobility and have shown great interest."

The plant manager is convinced that the e-charging station will more than meet the demands, because in the development of its "energy solutions" GILDEMEISTER has drawn on its expertise and experience in mechanical engineering and is a pioneer in questions of energy generation, storage and energy utilisation. "Our expectations have been met to the full," Fiebig goes on to emphasise.

www.volkswagen.de

ThinkBlue. Factory.

In order to achieve long-term energy savings and to reduce CO_2 emissions Volkswagen is pointing the way with what it calls the "energy path" at its Wolfsburg plant. The energy path includes many practical examples from all areas of energy efficiency. The blue and white signs that show exactly where energy can be saved are posted along a path that leads though the production halls. This keeps the energy path clearly in sight for all employees and motivates them to follow it.

The practical examples relate to both the process and the product. The conversion to modular traverse matrices (MQB), for example, reflects the idea behind the "Think Blue.Factory". This initiative will make a considerable contribution to achieving the aim of making production processes 25% more environmentally friendly by the year 2018.

Car Park of the Future

A unique mobility and energy concept in the multi-storey City Car Park in the oldest city in Germany is out to set new standards. An e-charging station, a photovoltaic system and a redox flow storage device are all part of the concept with which Trier Municipal Utilities is set to demonstrate what the autonomous car park of the future looks like.

The German Federal Government aims at having one million electric vehicles on Germany's roads by the year 2020, because these play a potentially significant role in meeting the EU CO_2 limit value. The EU Commission estimates that traffic emissions will have to be reduced from 54% to 67% by 2050 compared to 1990 in order to reduce carbon dioxide emissions by up to 95%.

An ambitious target

However, in order to achieve this we need sustainable mobility concepts and these are already in the pipeline under the auspices of the smartlab Innovationsgesellschaft, a subsidiary of the Municipal Utility Companies of Aachen, Duisburg and Osnabrück, within the framework of the "econnect Germany" research project. Eight industrial partners, four uni-

In their “Car Park of the Future”, the Trier Municipal Utilities (SWT) use clean energy generated by wind turbines and solar power plants to power the fleet of electric cars.

versities and seven municipal utility companies from all over Germany have come together in this research collaboration - from Sylt in the far north via Osnabruck to southern Allgäu, from Aachen and Trier in the far west to Duisburg and on to Leipzig in the east.

The total funding for the ambitious project amounts to 23 million Euros, whereby partners from research and development will be bundled together at the seven locations of the municipal utility companies involved in so-called “hubs”, each dedicated to a different selected topic. These range from intelligent traffic applications for e-mobility (Smart Traffic) to the integration of e-mobility into the intelligent grid of the future (Smart Grid).

In their “Car Park of the Future” the Trier Municipal Utilities (SWT) intend to use electricity generated by wind turbines and solar power stations as clean “fuel” for electric cars. Around 127,000 kWh a year are to be generated by a photovoltaic system installed on the roof that has a surface area of 990 m². This clean electricity can be buffered in a storage system depending on demand and solar radiation. The aim is to supply the charging poles of a local e-charging station with renewable electricity from the region, preferably directly from the roof.

Researchers are working on sustainable mobility concepts within the framework of the “econnect Germany” research project.

The Trier energy company is cooperating with the University of Applied Sciences Trier, the University of Trier and ABB Germany to work on a solution as to how the electricity can be used in the electric vehicles. »

Just-in-time energy

"The aim of the project is to make e-mobility fit for the future. Our focus here is on the Car Park of the Future, in which we wish to supply electric vehicles to 100% from renewable energies," explains Falko Willmes, project manager at SWT. "Our intention is to deliver just-in-time energy, in other words when electricity is needed at the charging pole, it should be produced renewably at the appropriate time. Either by one of our highly efficient communal heating/power plants, wind or solar power plants, that operate with an efficiency factor of over 90%."

"The CellCube impresses with its 100 kWh storage depth, which is similar to the performance of our planned pumped-storage power station. The storage density and response behaviour are similar, so we can test whether the software we are developing here can also control the pumped-storage power station."

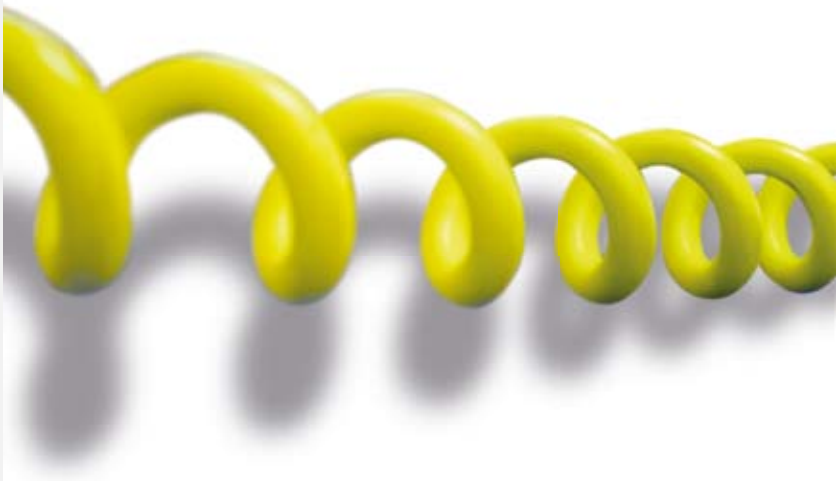
Project manager Falko Willmes

About Trier Municipal Utilities

Trier Municipal Utilities (Stadtwerke Trier, SWT) are the infrastructure providers for Trier and its environs. The company supplies the city of Trier reliably and competently in the sectors of electricity, gas, drinking water, heat, waste water treatment, local public transport, parks, swimming baths, sauna baths and telecommunication. SWT are active in the region as a supplier of gas and water and as a service provider in the field of engineering and materials procurement and delivery. Nationwide the municipal utilities sell the electricity and gas energy products from Römerstrom and Römergas.

With their co-operations SWT generate synergies in the different business sectors. Almost 1,500 jobs depend directly or indirectly on these business activities. But it is not only the economic activities, the extensive promotion of culture, sport and social facilities in the region enhance the quality of life in Trier and its environs. Step-by-step the municipal utilities are also extending their commitment to climate protection in the region of Trier. Activities here range from promoting e-mobility via the use of natural gas as a fuel and regional heat/power plants and on to include the generation of energy from renewable sources such as sun, wind and water. In this sector SWT invested around 80 million Euros between 2007 and 2012 and today contributes a total output of 100 MW to generation capacities. The aim of SWT is to cover the electricity requirements of the City of Trier to at least 50% with energy generated regionally by the year 2025. As a key milestone in implementing regional energy transformation SWT are currently planning a pumped-storage power plant in the association of municipality Schweich.

On the ground floor of the multi-storey car park customers and project participants can fill up their cars with environmentally sound green electricity – and thanks to the vanadium redox flow storage system from GILDEMEISTER energy solutions.



Under the project title "From wind turbine to electric car" the researchers are currently developing a virtual integrated energy system comprising generator plants, energy storage systems and consumers, in order to test and optimise the control system for future demands. "The aim of the project is to develop a management system that records all consumption and generation data online, data such as feed-in volumes of a photovoltaic system in connection with the consumption behaviour of a household customer, for example," says Andreas Kohl, member of the project team. "The data is then collected centrally, so we have an overview of consumption and generation. We work here among other things with weather forecasts, in order to deduce when and which solar or wind system is producing electricity or whether we have to trouble the storage system."

Green electricity even when the sun is not shining

A CellCube FB 10-100 serves as a storage device which is installed next to the first e-charging station in the City Car Park in the Zuckerbergstraße in Trier's city centre. On the ground floor of the multi-storey car park customers and project participants can fill up their cars with environmentally-sound green electricity - and thanks to the vanadium redox flow storage system from GILDEMEISTER energy solutions they can even do it when there is no sun and no wind.

"In our opinion, today's storage possibilities are not sufficient for the future," Willmes explains. "That is why we are planning a pumped-storage power plant on the river Mosel and are also looking for a solution that will enable us to use energy in the short and medium-term quickly and de-centrally, so we can stabilise and relieve local grids, for example. And that is where the CellCube from GILDEMEISTER energy solutions comes in – as exactly the product we need."

According to Willmes, the CellCube is the ideal solution for the project, because as the name "econnect" suggests, the aim of the project funded by the Federal Ministry of Economics and Technology is the integration of e-mobility by means of suitable information and communication technologies (ICT). Generators must be able to communicate with »

The SWT project team, Andreas Kohl (left) and Falko Willmes, in front of the C C-Zero e-car

the installations in the grids. "The storage device uses standard protocols for communication, and that makes the data connection really simple for us," says Kohl. "It took us less than a day to connect the battery to our control system."

The CellCube also scored points with the people in Trier thanks to its flexibility, long service life and ease of handling. "We can switch from charging to discharging mode quickly and can expand the system simply with additional CellCubes without having to change the control. Low-maintenance and a high level of efficiency were also among the features that convinced us."

The redox flow storage device also serves other research purposes for the project participants. Although optimisation of our own requirements under the motto "How self-sufficiently can we operate the car park?" plays a key role, topics such as the reloading of car batteries into the grid and to what extent storage systems can contribute to grid stability in future should also be researched.

Another crucial factor for our decision to take the CellCube on board was the performance of the battery. "The CellCube impresses with its 100 kWh storage depth, which is similar to the performance of our planned pumped-storage power station. The storage density and response behaviour are similar, so we can test whether the software we are developing here can also control the pumped-storage power station," Willmes goes on to explain.

Road capability

The CellCube has been standing in the City Car Park since September 2012 and was recently adorned with stickers describing the project for the citizens of the city and its environs. These are being involved in the project as test persons in order to assess user acceptance and mobility behaviour in field trials.

econnect Germany

Filling up via card: Andreas Kohl shows how it works.

The CellCube has been standing in the City Car Park since September 2012 and was recently adorned with stickers describing the project for the citizens of the city and its environs.

"We cooperate in our research group with technicians and IT specialists from the University of Applied Sciences Trier as well as psychologists from the University of Trier," explains Willmes. "Together we are trying to find out what functionalities this technology must have in order to meet the needs of the motorist of the future." Among other things the on-board computers in five C-Zero E-cars should test and optimise the SWT with the user interface developed specifically

> **The storage devices support research on how to charge car battery power back into the grid.**

by the University of Trier for this purpose, in order to test the road capability of the cars. The test persons can then use the touch screen to set how long and where they wish to "fill up" the car, in dependence on schedule and distance planning.

Because in the last instance it is the acceptance factor that will decide whether or not the government's forecast can be realised and whether in future the majority of cars on German roads will be clean cars running on clean energy.

www.swt.de
www.econnect-germany.de

Innovative energy storage for more autonomy

A basic requirement for securing production processes or other core areas of a company is an uninterrupted supply of energy. Large-scale storage systems like the CellCube provide just such security, both in combination with local electricity generation as well as parallel to grid operation. GILDEMEISTER energy solutions relies on vanadium redox flow technology for this storage solution. This technology ensures an extremely long lifetime, enables unlimited charging and discharging cycles, requires only very low maintenance and is safe to use.

Fluctuations in weather conditions or the number of daylight hours affect the production of renewable energy in as far as the amount of electricity generated does not necessarily correspond to actual needs. Small wind turbines, for example, continue providing electricity at night when considerably less is consumed, while electricity peaks cannot be covered if there is no wind – or in times of low solar radiation in the case of photovoltaic systems. Therefore, the CellCube from GILDEMEISTER energy solutions is the ideal solution for all companies wishing to keep their operations independent of such impacts. The large-scale storage system can cover basic loads as well as peak level electricity loads. Once installed the low-maintenance storage system operates reliably. The energy carriers used are to be thanked for the durability of the CellCube. These are dissolved vanadium salts that do

The CellCube ranks as a milestone in the history of renewable energy management.

not age and can be used an unlimited number of times. In contrast to conventional batteries this solution has no loss of reactive material and vanadium redox flow storage systems contain no problematic materials such a lead, cadmium or mercury.

The vanadium redox flow principle is based on the use of two tanks for the storage of the liquid energy carriers which are pumped through electrochemical cells housed in so-called stacks. The outstanding feature of this technology is the flexible scalability of the CellCube: the bigger the tank the higher the energy storage capacity and the more stacks the higher the power output. GILDEMEISTER energy solutions offers CellCubes with outputs from 10 to 30 kW and storage capacities of between 40 and 130 kWh. The largest energy storage system in the range, the CellCube FB 200-400, has an output of 200 kW and a storage capacity of 400 kWh. It is also possible to combine several CellCubes in order to achieve even higher performance. By combining the units into whole blocks, GILDEMEISTER energy solutions can offer CellCube solutions that achieve an output of up to 10 MW. The maximum capacity is sufficient for a back-up time of up to 10 hours.

Smart technology, intelligent sensors and extensive control functions ensure secure and reliable operation of the CellCube. A monitoring system and simple maintenance boost user comfort as does the flow battery controller via which

Highlights CellCube FB 10-100

- Integrated system solution including specially adapted inverters allowing connection to many different sources of energy
- Turnkey energy storage system in weather-proof and tamper-proof housing
- Energy storage system with unlimited cycles (charging/discharging)
- CellCube has 100% deep discharge capability
- Nominal 10 kW power output, peak power output up to 15 kW, up to 100 kWh storage capacity
- Intelligent battery management for optimum operating performance
- Spontaneous response to load requirements
- Maximum efficiency in every operating mode

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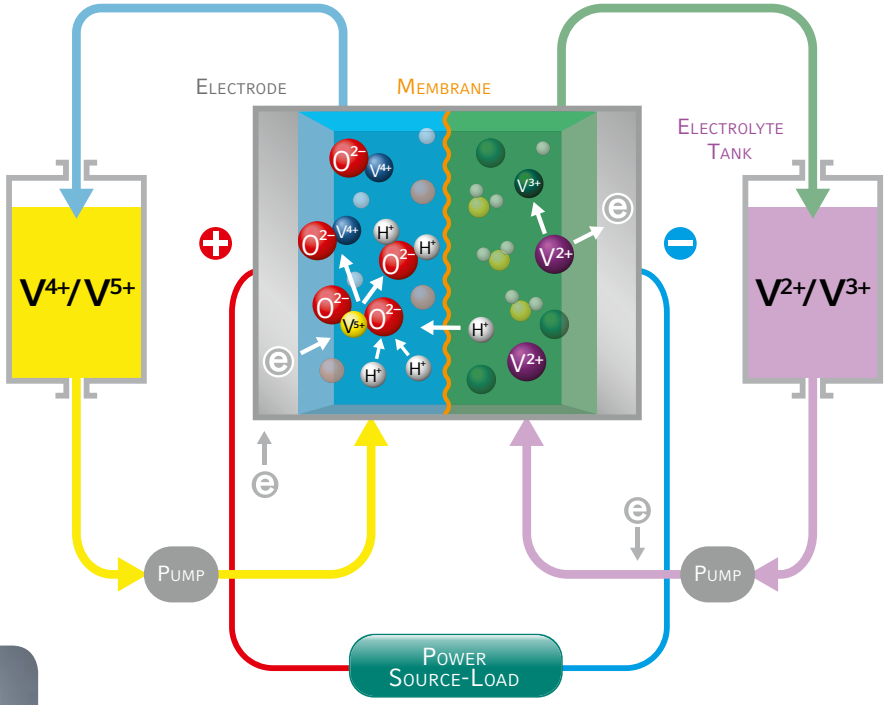

The liquid energy carriers are stored in two tanks and pumped through the electrochemical cells. The energy carriers are either charged or discharged depending on the applied voltage. Charge controllers and inverters serve as the interface to the energy source or to the consumer.

Vanadium Redox Flow Technology

The active material in redox flow batteries are salts dissolved in liquid electrolytes. The electrolyte is stored in tanks and when required pumped into a core reaction stack for charging and discharging cycles. Typically the solubility of the salts in the electrolytes is not very high, so energy densities similar to those of lead acid batteries are achieved. The core charging unit is typically a membrane with catalysts and functions in a similar way to a hydrogen fuel cell or an electrolyser. The size of the tank determines the energy storage capacity of the battery; the charging/discharging unit determines the power output of the battery.

In redox flow technology energy is stored in electrolyte solutions – vanadium solutions being the most common of these. The vanadium electrolytes are present in different oxidation states (V^{2+}/V^{3+} and V^{5+}/V^{4+}), so at the membrane they either deliver or take up electrons, i.e. are charged or discharged.

This process takes place in stacks consisting of cells connected in series. These stacks influence the power output of the battery: the more stacks, the higher the power output. In contrast the storage capacity depends on the volume of vanadium solution stored in the external tanks. This means that the power output and storage capacity of batteries with redox flow technology are scalable independently from each other. In addition, redox flow batteries have an extremely long service life, because no components are subjected to any structural changes during charging and discharging. Further, in contrast to other systems, only one liquid is used instead of two. This ensures that there is no cross-contamination.

The electrolyte in vanadium batteries can be completely regenerated by means of an external recycling process, so it can be re-used without any loss of vanadium.

all storage data can be accessed at all times online. Where safety is concerned, a double-walled tank protects the battery from external impacts. Plus, the vanadium solution is neither explosive nor flammable. Customised service packages and service contracts round off the range of products and services offered by GILDEMEISTER energy solutions.

Smart technology, intelligent sensors and extensive control functions ensure secure and reliable operation of the Cell-Cube.

The CellCube ranks as a milestone in the history of renewable energy management – not least thanks to its wide range of applications. It is not only the ideal storage option for locally generated electricity: as an off-grid solution the CellCube supplies systems and buildings with no grid connection, in solar parks it levels energy output and where e-mobility is concerned it stores enough energy at solar charging stations to supply electric vehicles round the clock.

Areas of application for the CellCube FB 200-400

GRID SUPPORT
For stabilising low and medium-voltage networks; as an energy buffer; for peak load shaving (levelling of load and generation peaks)

BACKUP
Use as an inline-UPS with frequency and amplitude decoupling; system security

WIND AND SOLAR PARKS
As a buffer for energy output shaving and balancing fluctuations; enhanced contract certainty thanks to energy reserves for times of lower output

REPOWERING
Investment hedging: CellCube ensures uninterrupted feeding even after amortisation of the wind or solar park

Harvesting and storing light

More and more dairy farmers in the Netherlands are investing in solar, wind, biogas etc. But there is one drawback here: the electricity generated from such sustainable energies cannot be stored efficiently. However, this problem has now been solved by a CellCube FB 10-100 – a vanadium redox flow-based battery – from GILDEMEISTER energy solutions that has been installed on the farm of Jan Borgman and Erna Roeterdink in Vierakker in the Netherlands.

Cow number 658 has just pushed her way into one of the high-tech boxes and is now munching away at her feeding trough. At the same time the arm of the milking robot moves down and washes her udder with rotating brushes. Red laser beams then feel the teats.They guide the teat cups that are then attached and start their work with unbelievable precision. However, the milk is not only pumped but also analysed simultaneously.

The milking robot first made its appearance on the farm of Jan Borgman an Erna Roeterdink in Vierakker in 2009 and in the meantime it saves around half the milking time required previously. The cows move about freely and simply trot over to the milking robot when they feel they need to be milked.

Jan and Erna operate their family farm with two milking robots and around 100 dairy cows. They have a milk yield of 890,000 litres. However, in contrast to traditional milking systems, the milking robots need electricity virtually all day long. And this energy comes from the sun and is stored in a CellCube FB 10-100 vanadium redox flow battery which has the size of a small sea container. Their farm is a modern enterprise and has very little in common with our idyllic images of farm life.

"Farming and energy generation go well together," says Jan, because farmers have the space necessary for solar and wind power plants and the raw materials that are needed, for example, to operate biogas plants.

Storing solar energy

The photovoltaic systems installed on the roof of the farm's barn has a surface area of 360 m² and generates 50 KWh of electricity. They call themselves "photon farmers" because they convert light particles collected by the solar cells into electricity. This solar energy is buffered in the CellCube. This stores the electricity that can then be supplied when the dairy farmer needs it.

Jan and Erna have been photon farmers since 2010. The dairy farm 't Spieker, that has been owned by the Borgmann family since 1750, is the first farm in the Netherlands to become self-sufficient by generating its own electricity. "We wanted to go that extra mile," says Jan. "By upgrading our farm with renewable energy sources we hope to make it more economically attractive and viable. This is still something of a rarity in the Netherlands."

"But there is more to it than that. We want to encourage other farmers to invest time and effort in expanding their operations in the same way. Generally farmers who focus exclusively on dairy farming opt for a rather lonely existence. We are proud of our operations here and are keen to show others how modern farming techniques work. We are also glad of any opportunity to boost the image of agriculture and dairy farming." »

"By upgrading our farm with renewable energy sources we hope to make it more economically attractive and viable. This is still something of a rarity in the Netherlands." Jan Borgman, photon farmer in Vierakker, NL.

The PV-system installed on the roof of the farm's barn has a surface area of 360 m² and generates 50 KWh of electricity. The farmer calls himself "photon farmer" because he converts light particles collected by the solar cells into electricity.

CellCube FB 10-100

The CellCube FB 10-100 allows customers to use electricity generated from alternative energy sources independently and flexibly round the clock. The storage device from GILDEMEISTER energy solutions is a turnkey system. In order to meet the different demands of customers and different circumstances, the batteries are available in different versions with varying outputs and storage capacities. So the CellCube can be configured and combined flexibly as required. Nominal outputs from 10 kW up to the MW-class and storage capacities from 40 kWh up to several MWh can be offered.

POSSIBLE APPLICATIONS:

- For storing electricity from solar, wind power or biogas plants
- As an electrical backup system to ensure sensitive systems continue operating in the event of a power cut
- As an isolated solution where there is no power grid
- For transferring loads in the network over time (peak shaving)
- As a solar charging station for electric vehicles
- In parallel operation with the grid in the case of instable networks

Groundbreaking project

Photon farmer 't Spieker in Vierakker is a joint project developed by Courage, InnovatieNetwerk (which was set up by the Dutch Ministry of Agriculture, Nature and food quality LNV), Alliander, Trinergie and the province of Gelderland. Courage develops and realises groundbreaking innovations intended to strengthen dairy farming in the Netherlands.

"The project is intended to serve as a reference project to show how dairy farming can take on a new position on the energy market," explains Jeroen de Veth, project leader at the energy agency Trinergie. "It also indicates that the Dutch dairy industry is open to experimentation, to new technologies and to taking responsibility for a sustainable society."

As the project team started to look around on the market for a suitable vanadium redox flow storage medium at the end of 2008, the solution from GILDEMEISTER energy solutions proved to be the only viable large-scale storage system available at the time. The storage device was delivered and installed in the summer of 2010.

The CellCube FB 10-100 has specially designed inverters that enable connection to different energy sources. Its storage capacity of up to 100 kWh and its nominal output of 10 kW mean that on sunny days energy for eight hours can be stored on the farm.

Autonomous electricity supply

So the photon farmer can take control of his own electricity supply. Firstly, he can use the electricity for his own operation and feed any surplus electricity into the power grid at a time that suits him and when the price is right.

This is a far better solution with regard to sustainability and waste of energy than only supplying the grid, says Jeroen. That is why electricity storage is the core element of the photon farmer model.

"Currently small consumers are invoiced at the end of the year in the Netherlands, for the actual net amount of energy taken from the grid," he explains. "Here on the farm around

62,000 kWh are needed, of which 42,000 kWh are generated from solar energy. So the farmer only pays for the remaining 20,000 kWh he took from the power grid."

The situation in Germany, for example, is different says Jeroen. The EEG (Renewable Energy Sources Act) also rewards a high level of personal consumption. On the other hand systems with energy storage systems are more suitable for the future "Smart Grid".

Energy for the future

The project has proved quite impressively that the solar energy that has been generated can be stored for later use. So it really is quite literally "energy for the future," a sustainable innovation. "We can balance energy consumption very well and can ensure an uninterrupted energy supply, a fact that is important for hospitals, for example," he explains. "Together with GILDEMEISTER we have designed a software and control system that guarantees optimum battery operation and that is very stable."

The jointly developed software can monitor energy production and the status of the storage device continuously: the measured temperature, the load percentage of the battery, the exchange of energy with the public power grid can all be read off exactly. Peaks in demand, for example when the milking robots start up, can be seen immediately.

Jeroen points to a monitor on the wall that has an impressive display of lines and circles. "That," he says, "is the heart of the photon farmer." And it is true – the monitor shows a small red heart beating, indicating that CellCube is alive and working. The intelligent control system diverts the solar power to the place where it can be of most benefit. It can either be delivered directly to the dairy farm, to the storage device or to the national power grid. "Let's say sunny weather is forecast for tomorrow, then the system will respond by ensuring that the storage device is discharged to the best economic effect before then."

Photon Farmer

A farm's crops usually include corn, grass and milk. But on the dairy farm 't Spieker in Vierakker in the Netherlands (near the town of Zutphen) photons are now being "harvested" by a solar system installed on the roof of the barn.

Buildings on dairy farms often have large roof areas which, if they are facing south, are ideally suited for the installation of solar cells. The drawback of this kind of renewable energy is that the yield is dependent on the weather. A CellCube FB 10-100 vanadium redox flow storage device from GILDEMEISTER energy solutions can be used to catch and store the surplus capacity so that the energy can be used later, either for the milking robot or other electrically powered devices or for feeding it into the grid at an opportune time.

www.fotonenboer.nl

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Efficient: Thanks to the modern feeding robot, 70% of the original diesel costs can now be saved.

The farmers in Vierakker are always on the lookout for new opportunities. Two new solar boilers, for example, have been installed on the roof. The farm also makes use of the warm water generated during the milk cooling process. Another clever innovation is the use of an LED lighting system in the cow shed, because trials have shown that good lighting can really improve cow milk, especially in winter. Sixteen hours of light and eight hours of darkness are ideal for a cow. In addition the farmer has saved 70% of his costs for diesel since a state-of-the-art feeding robot has been in operation that now no longer needs to be powered by his generators.

Wind in the mix

"We are currently evaluating a possible investment in a WindCarrier for additional energy generation," says Jeroen. "The CellCube has been running smoothly now for two and a half years and we are very satisfied with its performance, but it by no means operates at full capacity in winter, because the photovoltaic system itself does not even operate at its full capacity then. If we take wind power on board, we will be able to generate more renewable energy even in winter and then really work independently from the grid. That is the aim."

The Netherlands plan to increase the percentage of renewable energies from currently 4% to 14%.

"It is very important that everybody in the agricultural sector keeps a close eye on the new alternative energy sources," says Erna. "These are opportunities to boost your income." Today this involves subsidies, but this may not be the case in the future.

The project participants' vision for the future: filling up with charged electrolytes at the photon farmer. The charged vanadium solution in the storage device can be pumped, so it can also be used for mobile systems, in commercial vehicles, for example, or even in cars. But it will be a little while before we reach that stage.

www.fotonenboer.nl

A step in the right direction

Renewal energy is one of the many political topics in the Netherlands. The working program "Clean and Efficient" plays an important role here. Its goals include reducing the emission of greenhouse gases by 30% by the year 2020 compared with the figures from 1990. The percentage of renewable energies is to be increased from currently just 4% to 14%. Already in force is the so-called SED regulation, a program for promoting renewable energies. Subsidies are made available in the sectors of solar energy, on-shore wind energy, biomass, bio-production and power-heat coupling. Wind energy is to be expanded.

The solar market has remained steady in the last few years, but has only developed slowly. Nevertheless, photovoltaic systems are at the top of the wish list for Dutch dairy farmers. Around 16% of this want to invest in renewable energies. Currently the major part of electricity generated from renewable energies comes from biomass, as energy production from the combustion of organic materials such as plants, dung and green waste.

Being a flat and windy country, the Netherlands also set their sights on the utilisation of wind energy. Thanks to the goals set in the year 1990, there was a boom in this sector from 1992 onwards. Over 600 wind power stations were built at that time. But a lot remains to be done in the sector of renewable energies if the targeted 30% is to be achieved.

More off-shore wind parks are among the plans in this respect. However, this means that investments must be made in the laying of power supply lines and energy storage systems.

Source: www.sonnenertrag.eu

The state-of-the-art feeding robot is fed with renewable energy from the CellCube storage system.

The German North Sea Island of Pellworn serves as a model region for intelligent grids and the local storage of electricity generated from renewable sources.

Energy world of tomorrow

Scientists are currently carrying out research into the use of efficient storage systems on the North Sea Island of Pellworm as part of a project entitled "Smart Region Pellworm". New ways of ensuring a stable and cost-effective electricity supply are to be identified so that Smart Grids do not remain just a vision of the future.

You can see hundreds of sheep and lambs grazing on the lush green meadows and dykes on the Island of Pellworm that lies in the fascinating expanse of the North Sea. However, these animals are not just a cute attraction, they also make a significant contribution to coastal protection with their endless tramping down of the grass and act as environmentally-friendly and untiring lawn mowers.

But these living lawn mowers are not the only environmentally-friendly thing on the small 37.44 km² island of Pellworm in Schleswig-Holstein, the same applies to the electricity supply for the 1100 people living there. 22.5 million kWh are produced on Pellworm every year from renewable energy sources. About three-times the amount needed to supply the island itself. What is left is transmitted to the mainland behind the dyke, in part even as far as Hamburg, explains Dieter Haack, head of the technical grid service of the Schleswig-Holstein Netz AG, a company-daughter of E.ON AG.

"The island has over 100 feed-in systems deriving from renewable energy sources, primarily photovoltaic systems. So the energy is produced without the usual losses if it is consumed locally on-the-spot," says Haack. "Currently two thirds of the energy produced on Pellworm is transmitted over long distances to the mainland. Not only is this inefficient, it also puts an additional burden on the grid infrastructure as well. We as a technical grid service wish to ensure a reliable power supply and this could be better achieved through a high level of self-consumption." »

Benefits of CellCube

- Turnkey energy storage system in weather-proof and tamper-proof housing
- Energy storage system with unlimited cycles (charging/discharging)
- CellCube has 100% deep discharge capability
- Intelligent storage management for optimum
- operating performance
- Spontaneous response to load requirements
- Maximum efficiency in every operating mode
- Flexibility in output and capacity: outputs available from 10 kW up to megawatt class and capacities from 40 kWh to several MWh

Intelligent on-the-spot electricity supply

This is the reason the flagship project "Smart Region Pellworm" was launched in the year 2012. The aim of the project is to bring together electricity generation and consumption using smart energy technology. The idea is to decrease dependency on electricity transmitted on a large-scale right across Germany and Europe and to reduce the expense of expanding the grid for electricity from renewable energies that this entails.

The large amount of electricity generated on the island thanks to the strong winds and high solar radiation could in future be held ready for local use in powerful large-scale storage systems and individual storage heaters in the houses. This buffered electricity could then be used to supply the island in times of low wind and relatively little solar radiation and make it independent of electricity from the mainland.

The project is being carried out by a broad-based innovation alliance from industry and science and supported by the Federal Ministry for Environment, Nature Conservation and Nuclear Safety.

The aim of the Government here is to give new impulses to the research being undertaken with regard to energy storage systems in Germany. Because in the words of the Federal Ministry of Education and Research improved access to energy storage systems that are reliable, efficient and economical to operate is of significant strategic importance for the future energy supply in Germany.

> **Energy storage systems are of significant strategic importance for Germany's future energy supply.**

The project "Smart Region Pellwom" will determine the contribution that these energy storage systems comprising centralised and decentralised elements can make to the supply system. According to project member Matthias Glüsing from Schleswig-Holstein Netz AG, completely new avenues are being researched: "The concept of a large-scale storage facility that combines two state-of-the-art technologies – vanadium redox flow and lithum-ion storage systems – is indeed innovative."

Left: As early as 1983 one of the biggest European solar parks of its time was built on the island and later in 1989 expanded to the largest hybrid power plant in Europe.

Below: The CellCube 200-1600 stores 1.6 MWh with an output of 200 kW and undergoes endurance testing on the island.

The two storage technologies, the CellCube storage system provided by GILDEMEISTER energy solutions and those from Saft Batterien GmbH, the German distributor of the Saft Group, are very different where output is concerned. "We will create synergies by combining the two," says Glüsing.

Hybrid storage system

The lithium-ion battery has an output of 1 MW and a 560 kWh storage capacity, while the CellCube FB 200-1600 from GILDEMESITER energy solutions stores 1.6 MWh with an output of 200 kW. The two different technologies will undergo endurance testing with regard to duration of effect and service life as well as charging and discharging under extreme conditions.

The large amounts of electricity generated on the island under favourable weather conditions can in future be stored locally in the storage systems and the storage heating systems in the individual houses. "For the first time we will be able to test energy storage systems in regional grids and gain valuable experience in such operation for our research," says Glüsing. "It is our aim as energy providers

Smart Region Pellworm

The German North Sea Island of Pellworn will become as a model region for intelligent power grids and the local storage of electricity generated from renewable sources. The flagship project "Smart Region Pellworm" was launched in the year 2012 on the completion of an extensive analysis of all the technical energy facilities on the island. The aim of the project is to bring together the generation and consumption of electricity locally in order to decrease dependency on electricity transmitted on a large-scale right across Germany and Europe and to reduce the expense of expanding the grid for electricity from renewable energies that this entails.

Serving as system platform Schleswig-Holstein Netz AG is promoting the transformation of the energy system in Schleswig-Holstein. To achieve this the regional grid operator together with its parent company E.ON AG is installing new systems and expanding existing ones in the Smart Region Pellworm, with the aim of gaining vital knowledge concerning the interaction of different grid and system components.

The aim of using different coordinated storage options – like the two central large-scale systems – is to develop particularly cost-effective solutions. The grid operator sees great practical importance in the gaining such knowledge. Other members of the project include the Westcoast University of Applied Sciences (FHW), the company Saft, the Frauenhofer Application Centre for Systems Technology, Gustav Klein GmbH & Co. KG and RWTH Aachen.

»

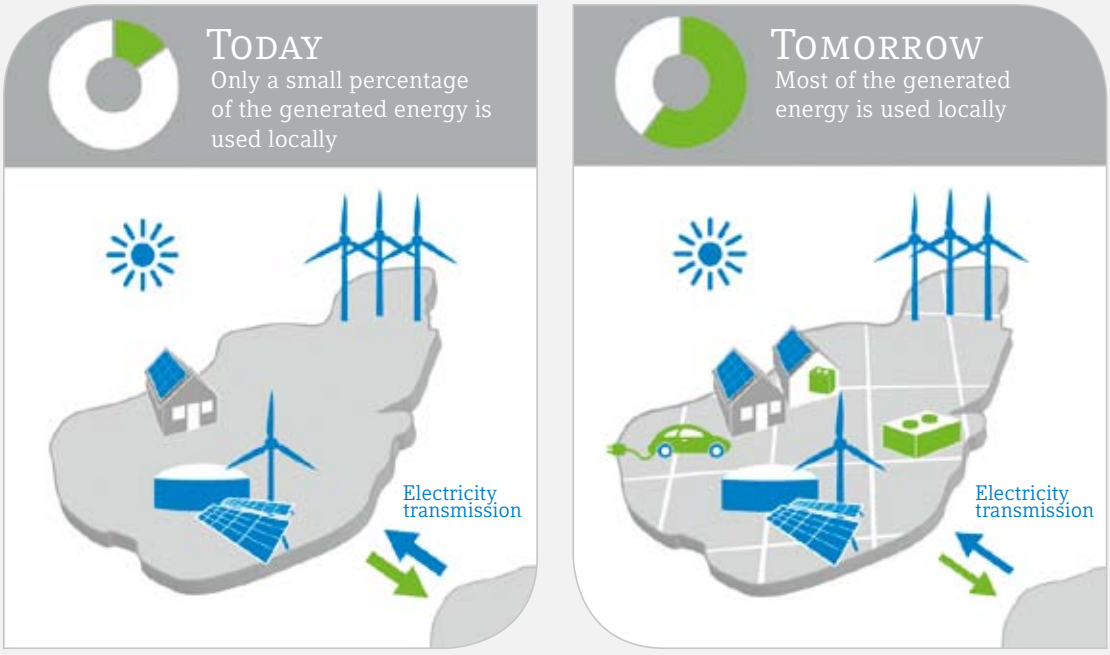
and grid operators to increase supply reliability and reduce peak loads in the grid. In addition it will be possible to defer the expensive expansion of the power grid that would be necessary in view of the rising demand for electricity."

The linking of decentralised power plants with innovative storage technology and intelligent grid management systems makes Pellworm a model region for realising the energy world of the future.

But it was not by chance that the island was chosen for the flagship project. The findings of a feasibility study undertaken by the Westcoast University of Applied Sciences (FHW) in cooperation with E.ON and the Fraunhofer Application Centre for Systems Technology proved that the island is an ideal location for the installation of a Smart Grid, due to its infrastructure and the willingness of its inhabitants to accept innovation.

For the first time, energy storage systems will be tested in regional grids on the North Sea Island of Pellworm.

Energy supply today and tomorrow



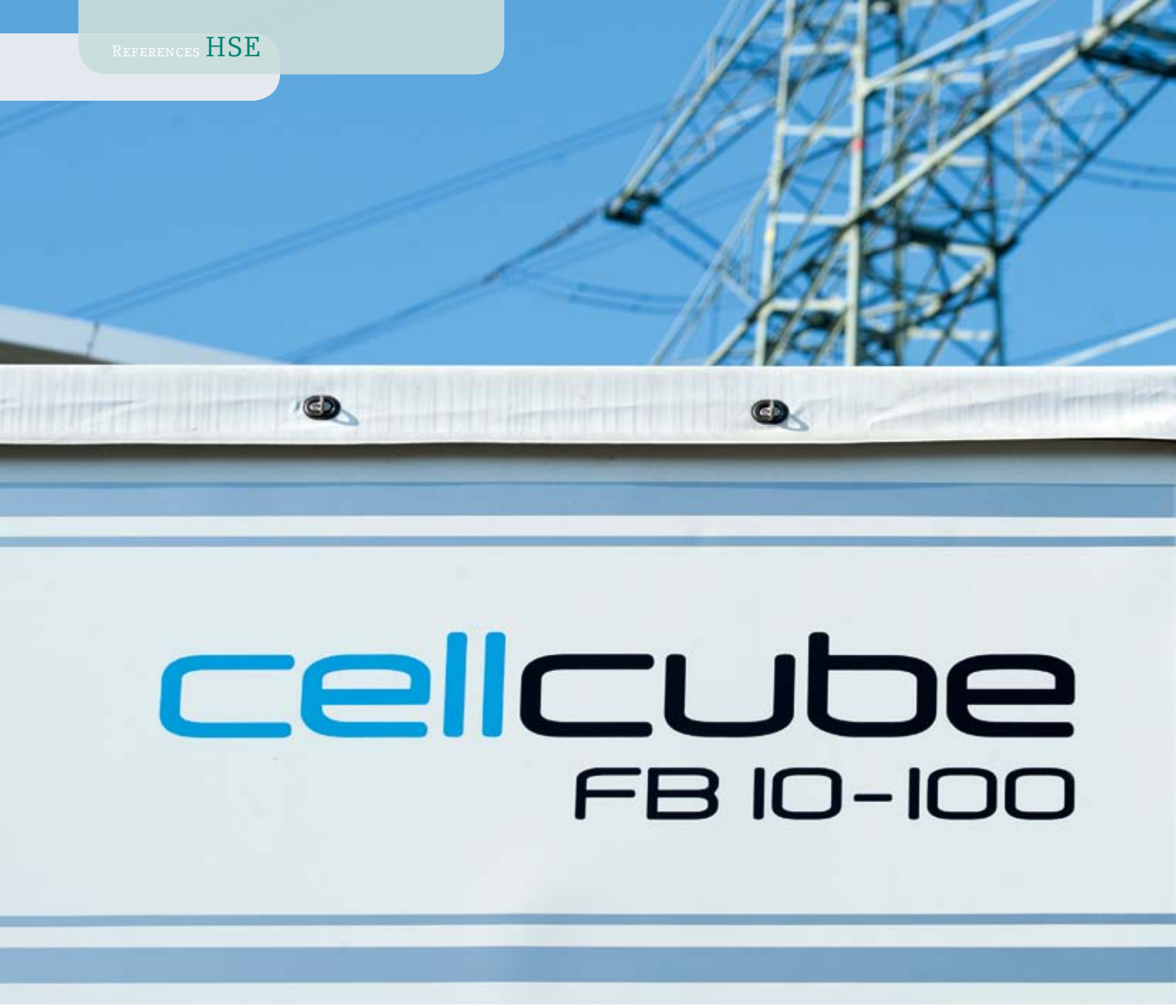
100% of the island's required energy is generated from renewable sources and is distributed and managed through smart grids.

As early as 1983 one of the biggest European solar parks of its time was built on the island and later in 1989 expanded to the largest hybrid power plant in Europe. The island is also one of the sunniest regions in the whole of Germany with a substantial annual yield of solar energy amounting to 1,000 kWh per square metre. So the whole island generates around 2.2 million kWh of solar energy every year, the equivalent of a saving of 22,000 litres of oil for heating. In addition Pellworm produces 4.2 million kWh from biomass a year and twelve wind turbines also make a valuable contribution to the CO2-free production of energy.

However, the willingness of the inhabitants to accept innovation is also of particular importance, stresses Haack. "90% of the people on the island are open for renewable energies and the expansion of the power grid. From the very outset we involved the inhabitants in the project with information evenings and discussion rounds. The people on Pellworm want there their home to become a green island and wish to play their part in spreading the idea of intelligent grids and the local storage of electricity generated from renewable sources throughout the world."

www.smartregion-pellworm.de

Dieter Haack, head of the technical grid service at Schleswig-Holstein Netz AG, wants to ensure reliable power supply on the island. To achieve this electricity generation and consumption are to be combined locally.



Intelligent electricity

How well can the supply and demand of electricity be balanced? The answer to this question was prepared by the HEAG Südhessische Energie AG (HSE) during the test phase of the EU research project "Web2Energy". Two CellCube FB 10-100 vanadium redox flow storage devices from GILDEMEISTER energy solutions were used here as storage systems in the Smart Grid.

At its headquarters in Darmstadt the HEAG Südhessische Energie AG (HSE) operates an innovative pilot project for a Smart Grid. Wind, water, the sun, geothermal heat and bio-energy are available to us as virtually endless sources of energy. So it is no wonder that the share of renewable energies in total electricity consumption in Germany is to be increased to at least 35% by the year 2020, and an impressive 80% is the target for 2050.

> **"Smart Grids require the networking of the connected parties, which means that a modern information and communication infrastructure must be developed in the distribution network of the HSE AG."**
>
> *Andreas Doß, internal project manager "Web2Energy," HSE*

That sounds good. But the problem is that today's grids are not designed for these eager targets, explains Andreas Doß, internal project leader for "Web2Energy" at HSE. "The Renewable Energies Act has resulted in an increasing number of systems entering the grid whose feed-in behaviour fluctuates," he says. "But customers use the electricity simply when they need it, which in Germany leads to a continuous variation in consumption. On the other hand wind and solar energy is fed into the grid only when the systems are generating electricity, they cannot be controlled like a conventional power station. That is why we have to coordinate the electricity intelligently and offer consumers incentives to use the electricity at times when it is being generated regionally from renewable sources."

Bi-directional electricity

"Formerly, electricity only had to be transmitted in one direction, namely from the transmission networks via distribution networks to the consumer," he explains. "Today, the networks must handle the transmission of electricity in both directions. Wind and solar energy is also fed into the grid at the distribution network level by consumers, in contrast to conventional electricity which for the most part is fed in on the level of the transmission network."

As a result, we need so-called "Smart Grids," intelligent electricity networks that can balance the fluctuating supply of renewable energies and electricity consumption. "The aim is to achieve this balance primarily on the distribution network level and to operate the networks in such a way that they can manage the volatile feed-in and maintain secure and reliable operation of the grid," explains Doß. »

The scale of the practical trials of the Smart Grid is unique worldwide and thus the basis for subsequent wide-spread introduction at the distribution level.

The "Web2Energy" project is one of six EU research projects responsible for finding solutions for the future of electricity supply, whereby the key target is testing and expanding international standards for communication and data management in Smart Grids. Under the leadership of HSE, European companies and institutes are working under realistic conditions on a universal communication standard with which the electricity generators, consumers and electricity storage systems will in future be able to communicate with each other and bring electricity supply in line with electricity consumption. The long-term aim is the development of a worldwide standard for regional distribution networks.

Standardised communication

"A Smart Grid requires the networking of the connected parties, which means that means that a modern information and communication infrastructure must be developed in the distribution network of the HSE AG," explains Doß. "In future all participants of the Smart Grid should speak a standardised language – from the wall socket at home, to the industrial lines through to the control centre of the transmission network. This makes the engineering of such large systems far easier and reduces the risk of failures."

HSE provided the infrastructure for the test phase of the Smart Grid, such as the grid area and transformer station, and 200 households in southern Hessen plus regional generators were connected to the Smart Grid in August 2011. Before the start of the test phase, the participating households, which are located in six new housing developments around Darmstadt, received smart meters that carry out time-dependent recording of their electricity consumption, which can be read remotely.

Two CellCube energy storage systems are crucial with regard to successfully balancing the fluctuations of the electrical output of consumers and generators.

To ensure secure grid operation, HSE uses innovative storage technologies. In addition to ten small lithium ion batteries, HSE operates two CellCube FB 10-100 vanadium redox flow storage devices from GILDEMEISTER energy solutions. Each CellCube supplies an output of 10 kW and provides 100 kWh

of storage capacity. Both CellCubes can be charged by the grid and by solar, wind or hydro power. Thanks to its flow technology the CellCube can achieve full storage capacity even after an unlimited number of deep discharges.

In addition, another member of the consortium, EUS, has developed a Virtual Power Plant (VPP), that constitutes the project's core module and processes all information (weather data, feed-in from wind power plants, PV plants, biomass and battery systems plus energy consumption).

Virtual power plant

With just a few clicks of the mouse Doß calls up the VPP on his computer, which shows current consumption plus electricity generation and storage. "All the information is collected at the central point, so we always know the exact status of our grid and with the aid of forecasts can predict the generation for the next few days. On the other side we have the consumers and can tell our customers when it would be best for them to use electricity because, for example, the sun is shining and a lot of solar power is being fed into the grid."

On the distribution level a lot of small generators are also feeding electricity into the grid. These are monitored and coordinated in such a way that the output of the generators can be planned and adjusted to meet demand or rather market requirements. This allows a balancing of predictable fluctuations in the generation of electricity by wind and photovoltaic plants through their aggregation with controllable generators and loads. The controllable loads in this model include among others heat pumps, heating systems as well as a swimming pool whose water temperature can be regulated.

Web2Energy

11 EUROPEAN COMPANIES ARE COOPERATING FOR THE SMART GRID OF THE FUTURE

The member states of the European Union are promoting the expansion of renewable energies in order to reduce dependency on fossil energy sources and to protect the climate. But today's grids are not designed for this: The feeding into the grid of electricity generated from renewable wind and solar energies fluctuates greatly depending on the weather conditions and the amount generated. The supply and consumption of electricity are often different. In future, an intelligent electricity network (Smart Grid) will have to balance fluctuating supply and electricity consumption by means or modern information and communication technology.

The "Web2Energy" project is one of six EU research projects responsible for finding solutions for the future of electricity supply, whereby the key target is testing and expanding international standards for communication and data management in Smart Grids. Under the leadership of HSE European companies and institutes are working under realistic conditions on a universal communication standard with which the electricity generators, consumers and electricity storage systems will in future be able to communicate with each other and balance electricity supply and electricity consumption. The long-term aim is the development of a worldwide standard for regional distribution networks.

www.web2energy.com

HSE provided the infrastructure for the test phase of the Smart Grid, such as the grid area and transformer station,and 200 households in southern Hessen plus regional generators were connected to the Smart Grid in August 2011.

Energy storage systems ensure stability

The two installed CellCubes play a decisive role in stabilising the Smart Grids, because they provide reserves that can be used in times of failures or low feed-in from renewable energies. Storage systems can balance generation and consumption. The classic method here is to use pumped storage power plants. But the geographic location of such plants is limited and investment costs very high, explains Bernhard Fenn, project leader and authorised officer at HSE AG. "100 new dams the size of the biggest German pumped storage facility Goldisthal in Thuringia, that has a storage capacity of 8,000 mWh, would be necessary to balance the fluctuation of 30% of the renewable energies in the Federal Republic of Germany. It is an illusion to think that these could be approved and constructed."

So what we need is another way of storing electricity. Large centralised compressed-air or hydrogen storage systems are options worth considering, but as the fluctuations in renewable plants and customers arise de-centralised it seems reasonable to look into the solution of de-centrally installed storage systems. With regard to efficiency, availability, long-term performance and positive experience the battery is well suited as a method of storage. Batteries can be used for example in medium-sized systems in MV/LV transformer stations (100 kWh range), or as large-scale storage systems in substations (MWh range).

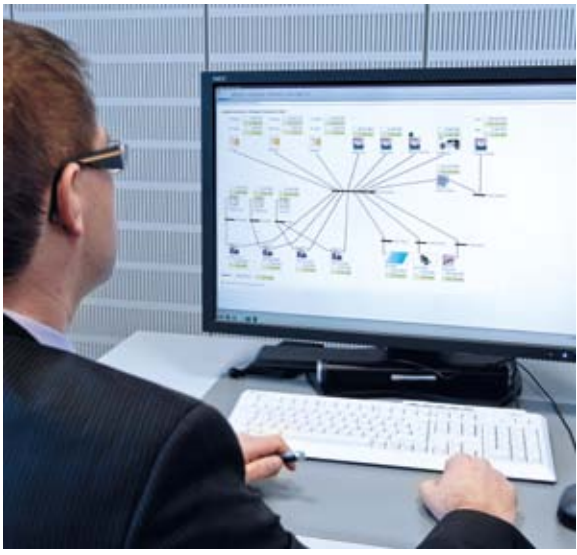
The batteries can then level the fluctuations in consumption and electricity generation from renewable energy sources and thus avoid the use of expensive peak-load electricity. The need to install a bigger supply cable or a more powerful transformer can be avoided, because the batteries are able to compensate overloads and so bridge bottlenecks.

"The results show that the two CellCube electricity storage systems play a decisive role in levelling fluctuations in the electrical output of consumers and generators successfully," says Doß, who is more than satisfied with the performance of the GILDEMEISTER energy solutions storage media. "The batteries are in continuous operation, but still work reliably without any failures. Potentially the storage systems can help to stabilise the future Smart Grid electricity networks. The storage devices can also stabilise electricity prices and thus reduce the risks for all market participants."

www.hse.ag
www.web2energy.com

Left: The HSE biogas plant in Semd in Hessen is an integral part of the strategy for fundamentally changing the current system of energy supply towards sustainability, decentralisation and self-sufficiency.

Right: The Virtual Power Plant (VPP) constitutes the core module of the project and processes all information (weather data, feed-in from wind power plants, PV plants, biomass and battery systems plus energy consumption).



SmartPvCharge

E-mobility through the self consumption of solar energy

Electric charging pillar for the public sector

The **P-CHARGE Wallbox Duo** is custom-designed for underground parking lots and for parking garages.

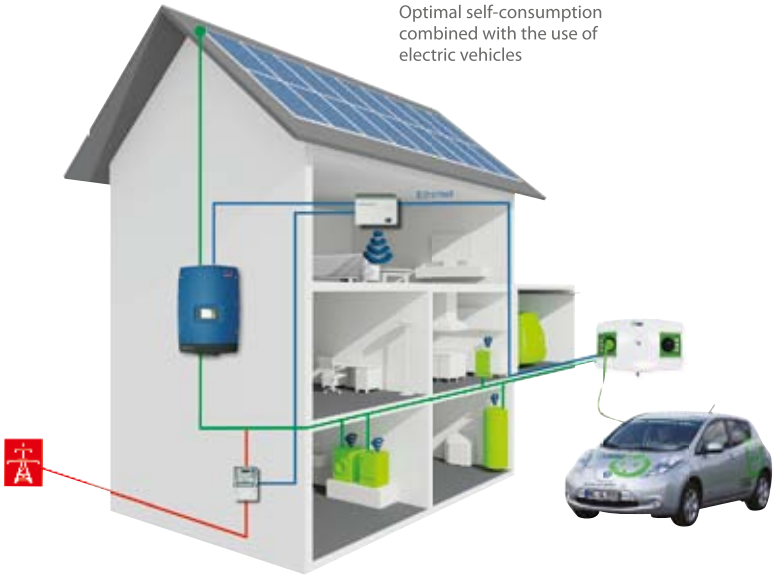
NEW!

Electric charging pillar for private usage

The **P-CHARGE Wallbox Mono** enables the safe and quick charging of electric vehicles on private premises and can be individually customized to the vehicles onsite.

SmartPvCharge

Optimal self-consumption combined with the use of electric vehicles

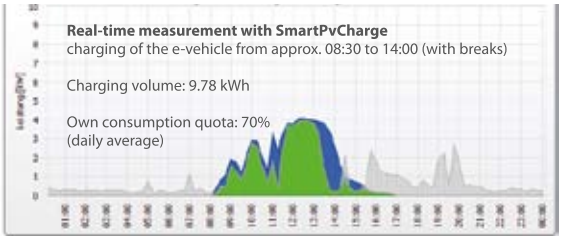


The ecological solution for managing mobility!

Renewable energies, relief of networks, network storage capacity or SmartGrids - these are the demands being made on the development of our "energy systems of the future!"

The ever increasing cost difference between "self-produced" energy and power drawn from the grid is leading to a growing economic demand for self consumption of the energy produced from private photovoltaic plants. Low feed-in tariffs for solar energy saved to the grid further intensify this need. A high percentage of own consumption is therefore the key to optimal economic efficiency and is, at the same time, the first step towards the liberally cited "time post German Renewable Energy Act".

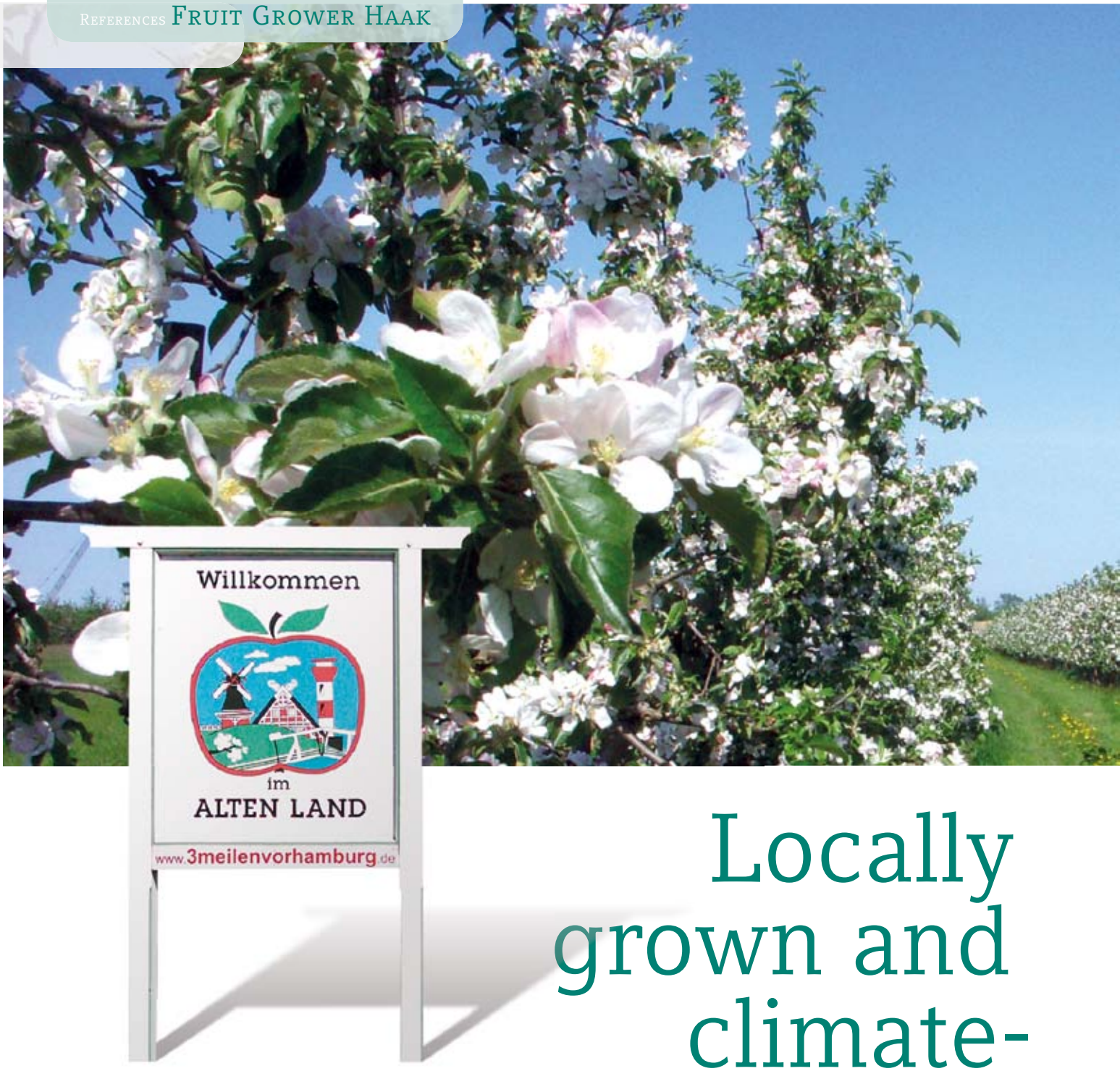
An electric car powered by the SmartPvCharge system can facilitate a consumption percentage of over 80% over the long term due to high storage capacity and the time-oriented flexibility of the charging process. At the same time, a flexible approach to charging levels can facilitate the achievement of "CO2-neutral" mobility: Fill up - but only from the sun!



Green=Self-consumption, Blue=Feed to grid, Grey=Drawn from grid

SCHLETTER

Further information at www.schletter.eu • Subject to changes including technical modifications



Locally grown and climate-friendly apples

Fruit grower Haak harbours the vision of one day operating his farm to 100% with his own energy. This is what led him to invest in a photovoltaic system and a CellCube energy storage system.

The use of fossil energy and the emission of greenhouse gases from cultivation to storage, transport and marketing and on through to the end consumer define the environmental relevance of products. You hear it said time and again that an apple from Lake Constance or from the "Altes Land" region in the north of Germany leaves a greater track of CO_2 in its wake from tree to consumption than one that comes from New Zealand.

This is however, not true for fruit grower Haak with his farm in the wonderful Altes Land region near Hamburg. He has decided to generate as much of the energy he needs for cultivation through to the sale of his apples from renewable

sources using a photovoltaic system and also to buffer this electricity in an energy storage system so it can be used on overcast days or at night.

"We had really only intended to set up a PV system, but then we heard about energy storage and after looking into the options we decided to purchase a CellCube FB 10-100 which GILDEMEISTER energy solutions had offered us at a good price," explains Claus Haak, who together with his wife and son Henrik run the farm in the fifth generation. So in the traditional agricultural region of Altes Land the Haak family has taken on a pioneering role in resource-saving energy generation and harbour the vision – one that will hopefully soon come true – of running the farm to 100% on the energy they produce themselves completely independently of the public electricity grid.

High electricity requirements

There are several reasons for wanting this, explains Haak. Firstly, unlike most fruit growers, Haak stores all the fruit he harvests from 27 hectares himself and that pushes up electricity consumption, his farm in fact consumes around 125,000 to 150,000 kWh a year and that is a lot of electricity. Such storage entails keeping 1,250 tons of "hibernating" apples in cold storage. Because apples are living things that absorb oxygen, which of course, ripens them. That is fine for the early varieties that are delivered directly for sale to customers between August and October after harvesting. But this is the exception to the rule, because not all varieties of apples can be sold immediately.

> **Neat and clean: The Haak family harbour the vision to operate their farm with renewable energy.**

Once the early varieties are harvested, the farmers in Altes Land go out again and pick different kinds, such as the German favourites Elstar and Jonagold. Some of these are stored for up to nine months so lovers of fruit in Germany can enjoy home-grown apples all year round.

The Haak family has temperature-controlled storage facilities on their farm where the apples are kept in so-called "Ultra-Low-Oxygen storage". This is an age-old method of storage which allows fruit to be kept for a long period without the need of chemicals. The farmer uses a special system to increase the natural nitrogen content of the air thus forcing »

the oxygen out of the room. The lower the oxygen level, the stronger and faster the nitrogen slows down the metabolism of the fruit. The fruit grower goes on to explain: "This results in the apple breathing more slowly which in turn delays its ripening process. Apples can be stored relatively long in this way."

All very well, but these systems need a lot of electricity. And not only them. The automatic sorting system that Haak also uses to sort other farmers' apples is another electricity guzzler. And electricity is expensive. Although the electrical power is controlled via a peak load limiter, in order to keep peak load values low.

"We do try to manage with that," says Haak, "But we need a lot more electricity in autumn during harvest time." This is when the apples are put into storage and have to be cooled very quickly – and a million kilograms of apples take quite lot of cooling! The limiter then ensures that the cooling units are switched off before the set peak load value is exceeded. Cycles of five to six minutes are not good for the cooling system in the long term.

Generating and storing your own electricity

"I would love to cut off the connection to the grid and be completely autonomous where electricity is concerned, and perhaps we will even manage to do it," says Haak. "We want to produce our electricity ourselves. That is why we have installed a 100 kW photovoltaic system on the roof, a big advantage for us in summer and autumn because we can get a lot more electricity than we do now."

A CellCube energy storage system has also been installed on the farm so that the self-generated electricity is also available at night and any surplus electricity produced on particularly

Above: The CellCube storage system brings farmer Haak a step closer to realising his dream of independence from the public electricity grid.

Right: The fruit grower Claus Haak (on the right), who together with his wife and son Henrik (on the left) run the farm in the fifth generation, is a pioneer in resource-saving energy generation.

Energy efficient frost protection

The sensitive young apple blossoms are "sprinkled" to protect them from frost. Sprinkler frost protection is the best way of protecting blossoms from frost. It is virtually emission free and very effective. When water freezes it generates enough energy in the form of heat to wrap around the tender blossoms like a blanket and keep them warm.

The blossoms must be sprinkled permanently in a freeze night. This requires a vast amount of surface water – 40 m³ per hectare and hour. 93 watt-hours of energy per kilogram are released as a result of the water freezing. You can heat one kilogram of water to a temperature of 80°C with this amount of heat. You would have to burn 3,000 litres of heating oil to produce the same amount of heat that is produced in a freeze night by frost protection sprinkling.

The automatic sorting system needs electricity all year round – electricity that Haak now generates locally with a PV system on his roof.

sunny days can be collected and buffered. "I want to offer a good product, apples that have a small CO_2 footprint. People say that apples stored over a long period of time produce a lot of CO_2 so it is better to buy apples from abroad! That cannot be true. And it isn't; even German apples that have been kept in cold storage for eight months use up less energy than it takes to transport apples from abroad conveying them half way around the world on ships or lorries. With our solar and storage solution we are trying to convince people to buy domestically grown fruit and to do it all year round."

"This is a modern agricultural region where we do not shut ourselves off from new ideas," says Haak. "The investment will pay off in about ten years. What we also need is an energy mix of both sun and wind, because in our region in particular it is always windy."The innovative fruit grower has already put out feelers in the local council in this direction and would like nothing better than to order four of the Wind-Carriers also offered by GILDEMEISTER energy solutions. "I think the wind turbines are representative and futuristic and after all we have a lot wind here. I would love to utilise it."

This would bring the fruit grower Haak a step nearer to his vision of energy independence – and Germany could enjoy locally grown apples stored in a climate friendly way with a good conscience.

Citizens store energy

"Using intermediary storage systems we can shave peak loads and store surplus electricity from wind and solar plants."

"Bürger speichern Energie eG" – is the name of a new energy cooperative in Germany in which normal citizens are taking energy transformation into their own hands and becoming co-owners of energy storage systems installed nationwide. Not only are they paid a dividend and offered a long-term electricity price that is competitive and transparent, they are also guaranteed green electricity from Germany.

People are losing trust in our politicians to advance the energy transformation to an adequate degree. That is why many normal citizens are taking the fate of energy transformation into their own hands. Meanwhile there are around 600 energy cooperatives with over 80,000 citizens as members.

A number of companies, service providers and energy suppliers have now got together and founded the cooperative "Bürger speichern Energie eG" headquartered in Erfurt, with the aim of setting up a network of storage systems across Germany using many regionally installed CellCube redox flow batteries from GILDEMEISTER energy solutions – a nationwide network offering people transparency.

"Anyone can become an associate and therefore a co-owner of the cooperative by investing in a €100 share – he/she can then claim 'my electricity comes from the storage system,'" explains Ekkehard Jung, member of the board of Bürger speichern Energie eG.

Like every cooperative, "Bürger speichern Energie eG" consists of at least three persons. The company belongs to all members and has a democratic structure. Everyone has a vote at the annual general meeting. The members themselves decide how many people the cooperative will admit. The actual amount members usually invest in shares is between 500 and 3000 Euros. And: membership pays off. Projected dividends are around 5% a year.

Don't just sit back and rely on the EEG

Although the chance of making a nice profit is often what motivates people, it's not the only thing, says Jung. "Firstly people want to support renewable energies and regional value creation, and secondly we are striving to achieve long-term relief of the grid by taking an active path and not just sitting back and relying on the EEG." The EEG (German Renewable Energies Act) funding is continuously on the decline. The feed-in tariff for electricity from ground-mounted photovoltaic systems, for example, was reduced on 1 April 2012 from 17.94 to 13.5 cent/kWh bringing it in line with the drastically reduced costs of such plants. The intention here is to cut "existing over-funding".

So for Jung and his colleagues it was clear that there was no way round the question of regional storage technologies which would provide independence from the EEG on the one hand and allow active participation in the operating reserve market on the other, because enough electricity must be generated in the entire grid to ensure availability at exactly the moment it is consumed. But individual consumption fluctuates greatly, as does the generation of electricity from renewable energies.

"Using intermediary storage systems we can shave peak loads, store surplus electricity from wind and solar plants and then sell it at a reasonable price later," explains Jung. This makes

a positive contribution towards the financing of the project, as does the government's new funding for solar electricity storage systems that allow financing via the kfW, Germany's Investment and Development Company.

Several such batteries have already been ordered from GILDEMEISTER energy solutions, the first of these is to be installed in summer 2013.

"We needed a battery that can be charged and discharged in a relatively short time and most especially one that has deep-charge capability," says Jung. "We do not want to lose surplus electricity, as is the case today, because grid operators are afraid the possible 52 Hz in the network will be exceeded. We then came up with the idea of looking for a partner with whom we could cooperate in order to press the project forward.

"GILDEMEISTER energy solutions turned out to be just the competent partner we wanted; a company that does not sit tinkering in a garage, but is one of the heavy weights on the market," explains Jung. "Apart from that we wanted as many components as possible to be produced primarily in Germany and the EU. "

High discharge depth

Deep charge capacity is of vital importance, especially for batteries to be used in the solar sector: it can have a considerable impact on the service life. Very good lead acid batteries allow a discharge depth of up to 80%. But the service life is considerably reduced if this happens often. Redox flow batteries, on the other hand, are virtually 100% deep charge capable without their service lives suffering.

The technology used in the CellCubes allows an almost unlimited number of charging and discharging cycles, so you can count on a service life of around 20 years. In addition the batteries can be cascaded to achieve an even higher performance.

"We are setting up a virtual large-scale storage system in Germany," Jung goes on. "The batteries will be distributed all over Germany and managed in such a way that they store peaks supplied from solar plants at midday when the sun is at its highest, and then it feeds back the stored energy at night or in the mornings. This makes the already existing virtual storage power plants even more efficient."

"We are working hard on achieving our aim," claims Jung. "We are endeavouring to leave a better world behind us than the one we found – and after intensive preparation, installation of the first storage system is soon to get underway."

www.buerger-speichern-energie.de

Bürger Speichern Energie eG plans to install CellCube batteries similar to the one you can see here all over Germany.

SIEMENS

www.siemens.com/siestorage

SIESTORAGE

The modular electrical energy storage and power flow control system

The modular energy storage system ensures a stable and reliable power supply and enables the integration of renewable energy sources into the grid. Power fluctuation is compensated, thereby improving system stability. SIESTORAGE can be used for a wide range of applications in utilities, industries, cities and infrastructures. Thanks to its grid stabilizing power electronics module that fits to a variety of battery systems, it provides a high level of availability and reliability.

Additional benefits:

- Good response time
- Black start capability
- Voltage stabilization through reactive power compensation and active power regulation

Applications:

- Integration of renewable power sources
- Peak load management (supply and output)
- Integration of fast charging station for e-vehicles
- Balancing power
- Frequency regulation
- Offset-diesel generation

Modular system:
Various configurations and storage sizes possible

Answers for infrastructure and cities.