

## Global climate protection: Potential for new markets



Efficient UPS energy storage systems 12–21



Liflex NG – Lifetime redefined 26–33



Charging stations of up to 1000 V 38–39

Editorial



Dear Readers!

As we make progress in the tasks of reducing CO<sub>2</sub> output and enhancing climate protection, we'll be developing new markets: for sustainable energy production, smart power distribution and transport that doesn't come at the cost of any generation that produces CO<sub>2</sub>. These goals will call for increased inventiveness from our development departments – whilst holding out a diversity of market opportunities.

One of the crucial components of our energy transition is to achieve electrically powered transportation. Especially utilising sustainable power. In the future, too, our vehicles will store reserves of energy adequate to cover the unpredictability of wind power and solar power. In this issue, we'll be introducing the various applications that take in wall box and the rapid charging stations – all part of the new system of BELATRON modular T2 charging stations.

And in the meantime we've succeeded in developing a new generation of lithium batteries for the field of drive/charging systems. In this issue, you can discover why our lifex NG energy systems are going to set a new benchmark for service life, efficiency and sustainability.

We'll also show you how hybrid "USB" (= UPS – Uninterruptible Power Supply) energy storage systems, including the ENERTRONIC modular storage concept, prevent blackouts and also reduce power supply costs.

In this edition, we'll be going on to look at the new products being made at our facility in Bocholt – which are utilised in our neighbouring country, the Netherlands – where the energy transition has really got going.

So please settle down for an enjoyable read! I look forward to receiving your feedback. .

Best wishes – Dietmar Papenfort

telephone: +49 2871 93 264  
e-mail: d.papenfort@benning.de

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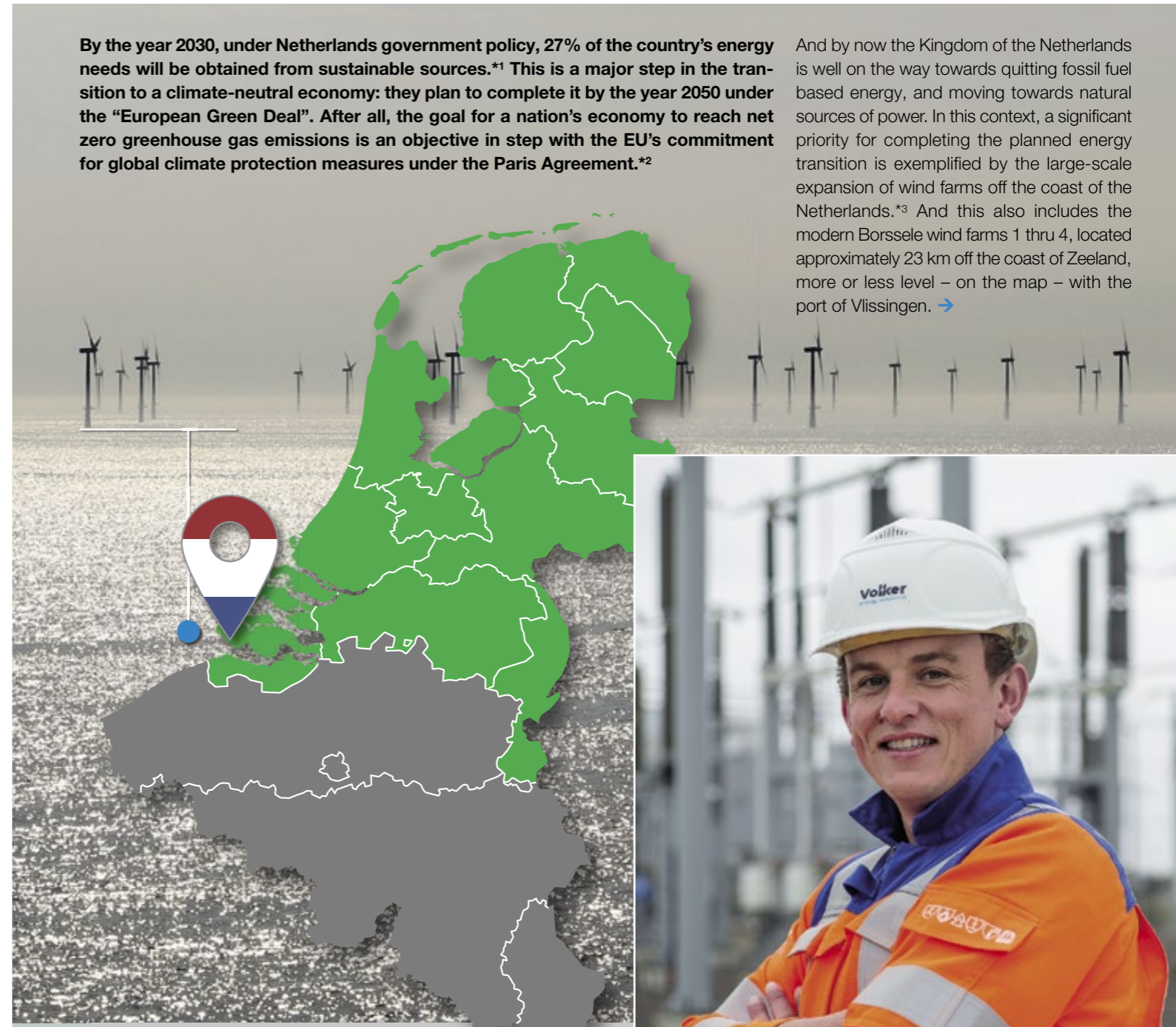
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Volker Energy Solutions protects a high-voltage substation thanks to BENNING's modular power supplies

In the Netherlands, the energy transition is really up & running – with a large proportion coming from offshore wind farms.

**By the year 2030, under Netherlands government policy, 27% of the country's energy needs will be obtained from sustainable sources.\*1 This is a major step in the transition to a climate-neutral economy: they plan to complete it by the year 2050 under the "European Green Deal". After all, the goal for a nation's economy to reach net zero greenhouse gas emissions is an objective in step with the EU's commitment for global climate protection measures under the Paris Agreement.\*2**

And by now the Kingdom of the Netherlands is well on the way towards quitting fossil fuel based energy, and moving towards natural sources of power. In this context, a significant priority for completing the planned energy transition is exemplified by the large-scale expansion of wind farms off the coast of the Netherlands.\*3 And this also includes the modern Borssele wind farms 1 thru 4, located approximately 23 km off the coast of Zeeland, more or less level – on the map – with the port of Vlissingen. →



\*1: <https://www.rijksoverheid.nl/onderwerpen/duurzame-energie/windenergie-op-zee>

\*2: [https://ec.europa.eu/clima/policies/strategies/2050\\_en](https://ec.europa.eu/clima/policies/strategies/2050_en)

\*3: <https://edison.media/energie/niederlande-baut-windkraft-auf-see-massiv-aus/25201304/>



A view of the Borssele high-voltage substation in the process of inspection. The substation is protected from grid disruptions or failures thanks to two ENERTRONIC modular SE UPS systems (each one comprising 60 kW) together with two BENNING rectifier systems (220 VDC / 200 A) (see background).



Mr Dorré explains the function of the equipment that Mr Schoon is pointing at in the switch yard of the TenneT 380 kV / 220 kV Borssele Landstation.

**“We collaborate with various providers, on our projects. And we normally shop for components by means of outsource posts on an online platform. For many years, we have enjoyed our collaboration with BENNING. They always come up with practical solutions whereby the conception process is backed up with the necessary drawings and documents. Because Volker Energy Solutions will be setting up further projects of the same type over the next few years, we are anticipating that the two companies will continue to collaborate, going forward.”**



Rolf Dorré,  
Project Manager,  
Projects at Volker Energy Solutions

**Protecting the processes that are critical to operation**

But this is not to be achieved solely by constructing wind farm systems. A critical point is the feeding of the DC power generated at sea into the grid infrastructure on the land side. If any disruptions or failures arise at these points of connection, then the process of transferring power from sea could fail altogether, under certain circumstances.

Again, the entire power transport grid can suffer unwelcome repercussions. These considerations give rise to the need to provide specifically defined, critical nodal points – in this instance, high-voltage substations – for protection against grid disruptions or power failures.

Accompanied by Mr Bram Slaager, the MD of BENNING Benelux, POWER news was able to pay a visit to the high-voltage substa-

tion near the Borssele site, which is operated by the firm of TenneT. This plant is owned by TenneT and was planned & constructed by the Rotterdam company of Volker Energy Solutions, and commissioned in 2019.

The company, which has come to be identified as the specialist in this field, had successfully passed the outsourcing selection phase in 2018/2019. We were able to have a chat on site with Mr Dorré about the project. →



Photo: © Volker Energy Solutions

Volker Energy Solutions  
Zalmstraat 7a  
3016 DS, Rotterdam  
NL  
www.volker-es.nl

**Volker Energy Solutions is a leading supplier in the field of infrastructure/energy management.\*4** The company specialises in planning, constructing and managing sophisticated medium voltage and high voltage plant.

**In conjunction with their customers – who include grid operators and energy producers – they develop solutions to meet the challenges of the energy transition.**

\*4: <https://www.volker-es.nl/nl/over-volker-es/bedrijfsprofiel>



Rectifier system  
(220 VDC / 200 A)  
equipped with three  
TEBECHOP 13500 SE type modules

ENERTRONIC modular SE,  
20 kW module

## Objective: Maximised plant availability

The systems for automation of substations, for their safety and for their management are the particularly critical consumers of any high-voltage substation. Without these key elements, it would be impossible to assure the operation of the high-voltage switching circuitry. In conjunction with the need for these systems to receive the optimum protection from power failures and grid disruptions, Volker Energy Solutions opted for BENNING's high-availability, modular standby power supplies.

It goes without saying that the specialists will have insisted on having redundancy built into

the backup systems, since – as already discussed, above – any failure in critical applications could result in serious consequences. And the advantages of BENNING's modular system technology were already familiar (from the project phase) to Volker Energy Solutions.

These advantages include, for example:

- Maximum availability and reliability
- Impressive MTTR (hot-swap)
- Straightforward and cost-effective to service
- Minimised operating costs

Further plus points were available, since it was possible to reduce the floorspace requirement, thanks to the modest footprint of BENNING's modular systems. In future, too,

it will be a convenient, straightforward procedure to complete updates or expansions, when it comes to the need to scale up the output. This adds up to a sustained, reliable investment roadmap for the operators of the high-voltage substation.

## Custom solution

The standby power supplies which BENNING adapts to clients' specific, individual needs are tailored for 2n redundancy. In essence, they consist of two ENERTRONIC modular SE UPS systems each with 60 kW output and two rectifier systems (220 VDC / 200 A). These are based on three TEBECHOP 13500 modules.



Photo: © TenneT

TenneT TSO B.V.  
Utrechtseweg 310  
Arnhem  
NL

**TenneT is one of the leading ÜNBs (=transmission system operators) for electrical power in Europe, with business activities in the Netherlands and in Germany.\*5** The company upholds a posted mission of maintaining reliable, round-the-clock power supply to approximately 42 million end consumers in its catchment areas – from its own high-voltage and extra high-voltage grid.

\*5: <https://www.tennet.eu/de/#&panel1-1>

In the event of a power failure, the UPS systems will uphold the operation of the safety systems whilst the rectifier systems will cover the supply of power to the high-voltage switching plant. In conjunction with the lead cell banks which are connected and locked into the function circuit, a four-hour covering period is guaranteed.

Borssele windfarms 1 and 2 have been reliably supplying power to the Netherlands energy grid – via the landside station at Borssele – since the beginning of April 2020. A total output of 752 MW is being produced by a total of 94 wind turbines. This amount of energy is enough to supply 1 million households with electrical power.\*6

\*6: <https://orsted.nl/onze-windparken/borssele-1-and-2>

\*7: <https://edison.media/energie/niederlande-baut-windkraft-auf-see-massiv-aus/25201304/>

\*8: [https://de.wikipedia.org/wiki/Grüner\\_Wasserstoff](https://de.wikipedia.org/wiki/Grüner_Wasserstoff)

A further 77 wind turbines are planned for Borssele farms 3 and 4.

In the future, a portion of the generated power will be used in electrolyser systems to produce green hydrogen.\*7 This constitutes a readily storable secondary energy source alongside electrical power.\*8

## Moving closer to the energy transition

In the final analysis, it's the teamwork between BENNING's power supplies and UPS systems in conjunction with the high-voltage substation constructed by Volker Energy Solutions (and operated by TenneT) that ensures that the landside grid infrastructure can

securely depend on receiving uninterrupted feed of the sustainable electrical power produced at sea. This is how the participating companies are making such a crucial contribution to the energy transition, supporting the Netherlands in the country's policy of achieving a fully climate-neutral economy. □

author/contact: Bram Slaaiger  
telephone: +31 30 63 46 010  
e-mail: [slaager@benning.nl](mailto:slaager@benning.nl)



Scan the QR code for further information

## TRUE RMS Earth resistance clamp meter from BENNING CM E1

### Application Report



**BENNING, a manufacturer from Bocholt, has dubbed its first TRUE RMS Earth resistance clamp meter the “CM E1”.**

In contrast with similar products on the market, the CM E1 is relatively affordable, at an RRP of €1199.80 plus VAT. Nevertheless, it provides some useful additional functions. Such as leakage current measurements with an impressive resolution of 0.001 mA and current measurements (produced in much the same way as with the traditional current measurement clamp meters) for which you can use it to detect currents of up to 35 A.



Testing a lightning conductor system using the BENNING CM E1: grip the earth conductor with the clamp, take the reading and you're done.

The BENNING CM E1 is supplied in a robust transport case. The base price includes all of the following: shoulder strap, reference resistance loop, battery, operating instructions and a test certificate from the manufacturer.

**In what respects is an earth resistance clamp meter any more advantageous than the conventional earth measurement apparatus?**

The task of carrying out earth measurements in electrical plants and industrial installations is not necessarily the electrical engineer's favourite task. There is so much that depends on the condition of the plant and other external factors. And, usually in line with established measurement principles, you will have to set “ancillary earths” at specific intervals relative to each other. This may represent a problem if the surfaces available in the vicinity of the object to be measured are sealed or if they are in poor condition when it comes to tapping in the required earth rods.

In many cases, as the alternative, engineers will resort to “2-conductor reading”. This is sometimes broadly referred to as “city measurement”. But this does require a pre-existing, accessible earth connection with a

known earth resistance. An adequately long electrical connection to the measurement instrument has to be set up, and an offset has to be applied in order to allow for the corresponding electrical resistance. If there is no accessible earthing connection, or not one which is reliable, then it will not even be possible to produce any reading at all.

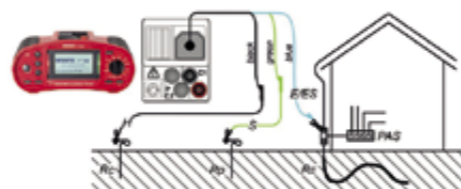
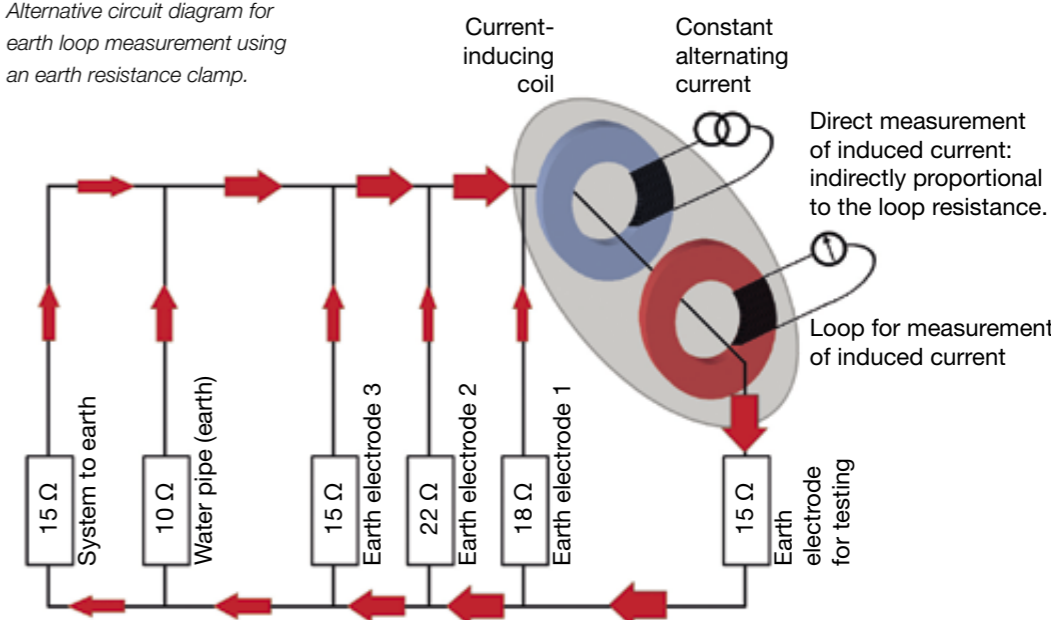


Diagram of conventional earth measurement system using auxiliary earths.

There is often a considerable amount of work and time required when earth measurements are carried out using conventional methods!

Alternative circuit diagram for earth loop measurement using an earth resistance clamp.



**The BENNING CM E1 provides a much more straightforward earth measurement method. And one which is much quicker.**

Using this measurement method, you don't have to separate the earth conductor to be measured and you don't have to use auxiliary probes in the form of earthing rods, let alone the laborious procedure of running a cable to the measurement instrument.

Due to the way in which earth loop measurement operates, the construction of the measurement instrument itself is relatively complex. Consequently, the physical design, with particular reference to the measurement head used by the BENNING CM E1, is significantly more robust than what you find with conventional current measurement clamp meters. This is because the clamp head contains two coils instead of just one. Via a magnetic alternating field, the active coil induces a defined voltage in the conductor and this results in a current which is a function of resistance. The main measurement coil then detects the cur-

rent flow, and on that basis the precise earth loop resistance is calculated and is shown as a reading on the display.

This approach achieves measurement results which are just as accurate as those which are arrived at on the basis of previous measurement processes. The whole procedure is achieved with no other ancillary equipment required and no other constraints. The only requirement is that there should be at least two earth connections: which is why this measurement method is also called “earth loop measurement”. →



BENNING CM E1 measurement head with two separate measurement coils and a substantial clamp spacing of 38 mm.



(left side) Integrated measurement value memory and data logger for up to 116 readings.



Routine checking of measurement accuracy using the reference resistance loop (included as standard).



Measuring the total leakage current in a sub-distribution system.



On the other hand, there is no theoretical upper limit, of the quantity of existing earth connections in place. In other words, the question of whether there are a further two, five or more than ten parallel earth connections is immaterial. Conversely, the measurement result obtained will be even more accurate if it is possible, and in practice it usually is possible, to have recourse to more than just one individual measurement loop.

In the rare cases where there is only one single earth connection, a straightforward solution is to make a direct connection to an existing earth electrode (to the junction box in the building, for example). Alternatively, we can set just one single auxiliary earth electrode ("earth rod") – and this approach also sets up the required auxiliary measurement loop.

And it's a simple enough task to determine whether or not a multiple-earth system is in place: if the earth resistance clamp display indicates ".OL" instead of any numerical figure, then the measurement value will be in excess of 1500 ohms. What this tells us is that either there is only one single earth electrode working, or that the earth connection we are looking at is defective. This will be the logical conclusion if the measurement value given is conspicuously high and if it differs significantly from acceptable values.

Earth loop resistance measurement makes it considerably more straightforward to carry out troubleshooting for defective earth electrodes. In this instance, specifically, we can rule out the possibility of receiving the misleading impression of an intact earth system due to the presence of parallel earth connections. Any

earth electrode which is defective or which exceeds the limit values will be recognised as "defective".

**It's almost impossible to get incorrect readings with the BENNING CM E1.**

This is achieved firstly because of the employed measurement principle, but secondly, because the measurement clamp automatically self-calibrates every time it is switched on. Additionally, the CM E1 will recognise any incorrectly completed surface contact made with the measurement clamp. A warning message is also issued if there are any external disruptive signals which could affect the reading. And the operator can always consult the reference resistance loop to check up on the correct function and level of measurement accuracy.

For the measurement of leakage currents and load currents, a total of 6 measurement ranges – from 0.300 mA to 35.00 A is avail-

able, and the most appropriate measurement range is selected automatically. Here, resolution will range from 0.001 mA to 10 mA; and this level of resolution is unlikely to be exceeded even by specialised current clamps. The task of working in relatively inaccessible, difficult environments, is made easier by the fact of the hold function and a programmable threshold for an acoustic alarm for earth loop resistance.

**Conclusion:**

BENNING's new TRUE RMS CM E1 earth resistance clamp meter makes earth measurements a straightforward and rapid task. Readings can be taken with no risk to the test engineer and to the plant in place, because the earth electrodes to be tested do not need to be separated. Consequently electrical safety and plant operation remain assured at all times.

In city areas in particular, the problems that often used to occur when setting the required

auxiliary earth electrodes are now a thing of the past. Now, you don't have to lug around a range of earthing rods, rolls of cable, connecting lines and tools for hammering rods in, so just this compact measurement clamp will be adequate in earth systems which are predominantly multiple-grounded.

And where your systems are topographically extended, such as in solar power sites for example, you can dispense with the task of repeatedly re-siting individual auxiliary earths. That speeds up the whole exercise of taking earth readings. Workload and the time required are greatly reduced when the BENNING CM E1 is utilised, and for that reason the cost of investment should be paid off relatively quickly for most professional operators.

In most cases it should not be necessary, thanks to the BENNING CM E1's high resolution and accuracy, to go to the expense of using a separate earth leakage current clamp. And in many cases there will be no

need to use a separate AC current measurement clamp, since the CM E1's load current measurement function extends to cover the measurement of AC load currents up to 35 A. The fact of routine application of the TRUE RMS measurement procedure enables precise measurement of the value of currents – even those which are not sinusoidal.

It's a welcome benefit that this earth resistance clamp meter is user-friendly, almost intuitive. You don't have to keep looking things up in the operating instructions. With this instrument, there are no complicated menu chains to cope with and no functions that can only be activated with outlandish key combinations. Users do not have to pay extra for a manufacturer's test certificate; this is already included in the base price and is supplied together with the product. □

contact: Tobias Enck  
telephone: +49 2871 93 447  
e-mail: t.enck@benning.de

You can find further information about the BENNING CM E1 by visiting [www.benning.de](http://www.benning.de)

BENNING Elektrotechnik und Elektronik GmbH & Co. KG  
Münsterstraße 135 – 137  
D-46397 Bocholt  
Tel.: +49 (0) 2871 / 93-111  
Fax: +49 (0) 2871 / 93-429  
Email: [duspol@benning.de](mailto:duspol@benning.de)

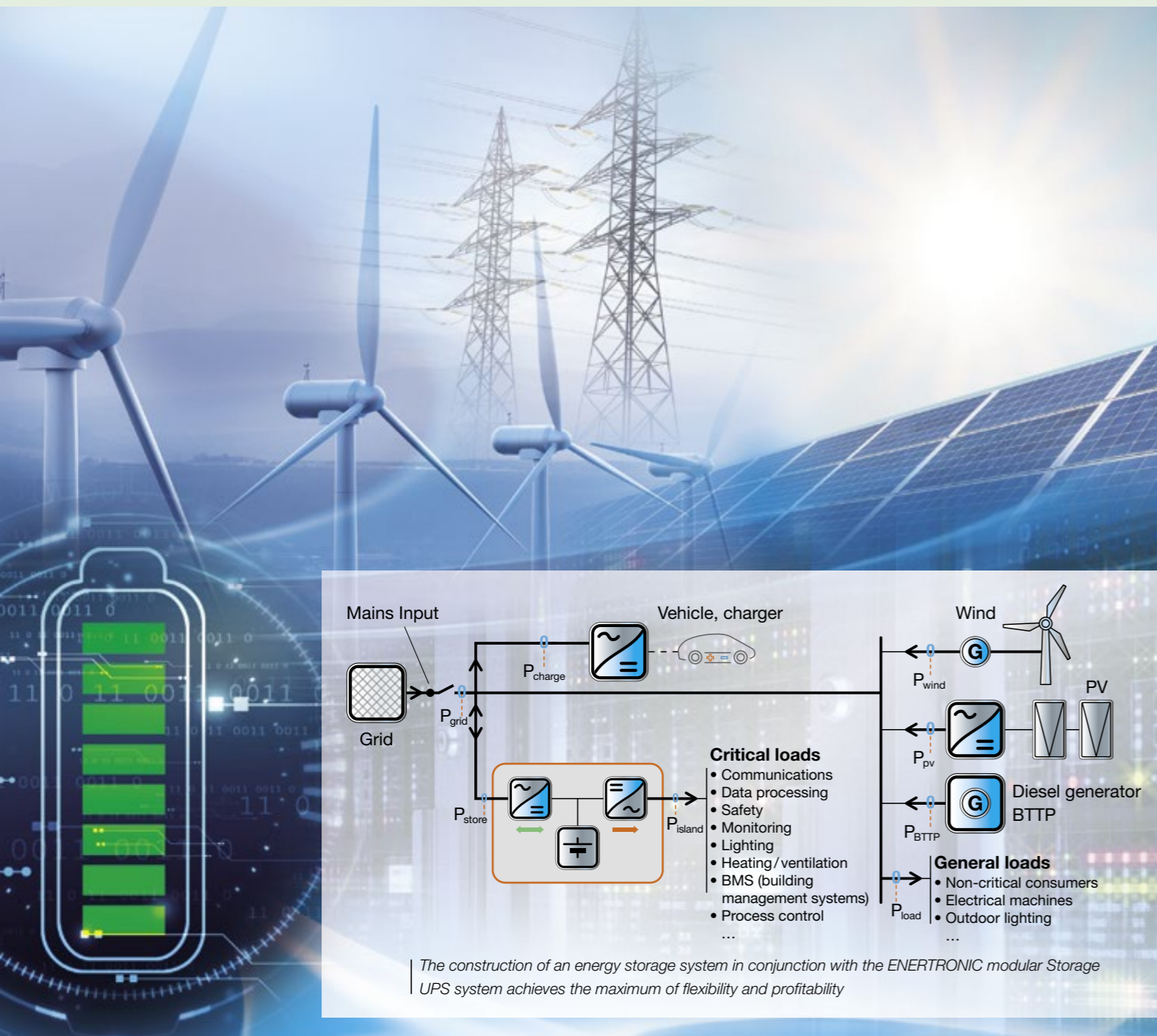
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[www.tech-journalist.de](http://www.tech-journalist.de)



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Are smart UPS combined with storage systems the best approach in financial terms as we approach the transfer to alternative energy sources?

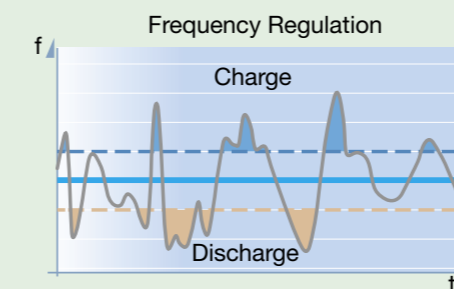
Hybrid UPS storage systems offer cost-effectiveness and a prompt return on investment, combined with security for critical loads.



For many years now, UPS systems with battery backup have been used successfully in various market sectors – but particularly including industry, telecommunications and IT – for the protection of critical supplies. In parallel, we have experienced the emergence of the widest range of network-controlled energy storage systems, whose development has been prompted by the use of regenera-

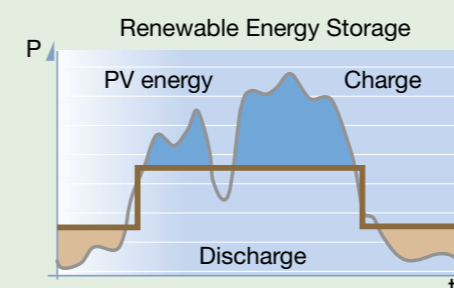
tive energy sources such as solar power. In this article, POWER News (PN) examines the increasing relevance of combining these systems as we approach the change to renewable energy sources.

Then we will go on to examine two projects exhibiting the financial and technological benefits available for a range of companies and of business areas.



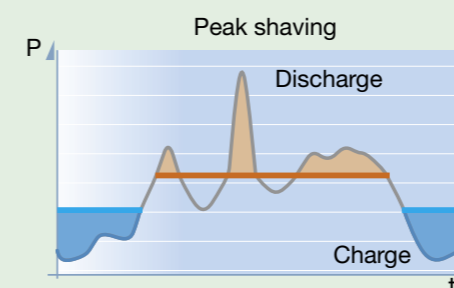
#### Network services

- Primary power control
- Reactive power control
- Voltage stability



#### Renewable energy sources

- Storage during low-load conditions
- Bridging of troughs
- Avoiding mains usage costs
- Micro grids



#### Industrial applications

- Peak shaving
- Load levelling
- Micro grids
- UPS operation

Functions of energy storage systems in the fields of grid services, renewable energy sources and applications in industry

In December 2020, the EU member states agreed to reduce greenhouse gas emissions from within the EU by no less than 55 % – by contrast with the previously planned figure of 40 % – relative to the 1990 figure.\*1 For this purpose, the EU Commission plans to present a range of legislative proposals, in 2021 for the adaptation of the EU climate and energy regulations currently in place.

In this context, the European Green Deal (abbreviation: EGD) stands as a core project with a comprehensive growth strategy for a climate-neutral economy, thrifty with resources, by 2050. This would make the EU the World's leading industrial region in terms of climate neutrality.

The achievement of this ambitious climate protection goal will be dependent firstly on the continuous transition from fossil fuel driven power generation towards regenerative energy sources and, secondly, on a significant optimisation of power draw and consumption on the part of Trade and Industry.

#### Making use of the potential offered by storage technology

The required progress in the establishment and expansion of regenerative energy production will give rise to fluctuations, whose magnitude cannot be predicted, in terms of energy feed. Energy stores provide a greatly needed degree of flexibility in terms of the smoothing out of loads, in combination with efficient load management, and these stores have a significant contribution to make to the definable smoothing-out of the load curve within the grid. They mean that the extremes are rounded off, and that goes for load peaks and surplus energy spikes.

#### Sustainably reducing the cost of operation

Hybrid UPS storage systems are now available. They are essential hardware in financial terms, as companies approach the transfer to alternative energy sources. →

\*1: <https://www.bmu.de/en/topics/climate-adaptation/climate-protection/eu-climate-policy>

# Smart UPS combined storage systems

**“Active peak load management in conjunction with UPS functionality ensures technical and financial stability.”**

Ronald Metzgi,  
Head of Office East, Germany  
BENNING

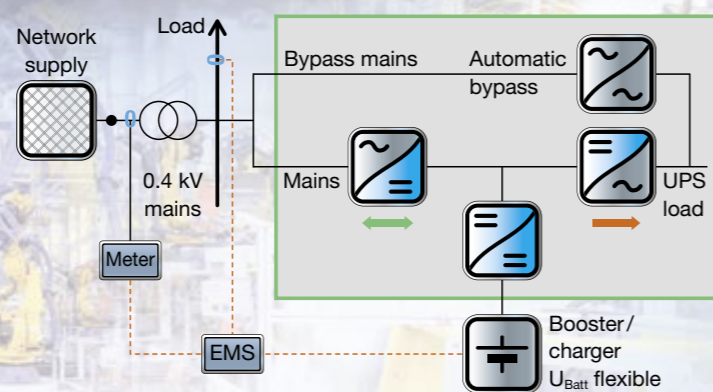


**“Optimising the cost-effectiveness of a biogas power station by means of smart use of ecologically produced power combined with smart networking of all systems involved.”**

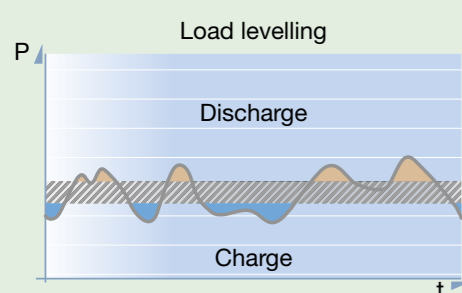
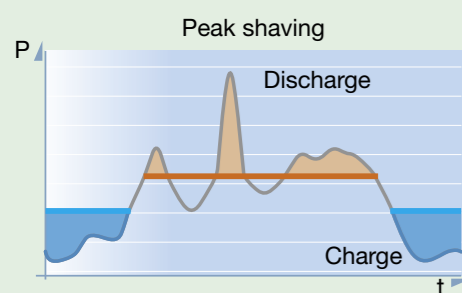
Claus Kirmaier,  
Head of Office South, Germany  
BENNING



## System: UPS ENERTRONIC modular Storage (island mode operation)



The UPS protects the critical loads from mains disruptions. At the same time, in conjunction with the “on-board” EMS, the system takes on load management tasks and thus contributes significantly to faster return of the investment compared to systems without a storage function.



These are multifunctional systems which can be incorporated, with appropriate communications interfaces, into EMS's (Energy Management Systems) that are already available.

This is a field where self-managed UPS storage systems with “island operation capability” offer significant advantages. At all times – irrespective of ongoing load management functions, such as peak shaving, load levelling or the optimisation of power draw – they assure continued operation for the connected critical supplies in the event of any disruption to the grid.

Smart load management for these hybrid systems offers the simultaneous combination of enhanced reliability and efficiency of power supply with a sustained reduction in operating costs. This technology is ideal for use in

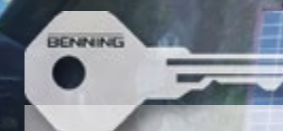
all applications where the supply of power from storage systems can be partially or fully deferred in chronological terms.

### Rapid break-even on investment costs – thanks to a combined approach

In BENNING's new ENERTRONIC modular Storage range, it offers individually customised energy storage systems with true UPS function and “on-board” EMS. This smart system is designed for:

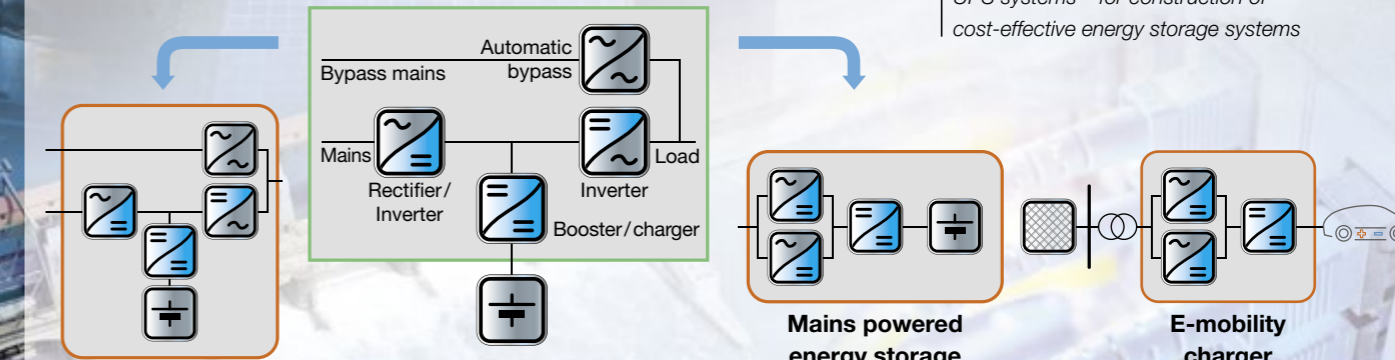
- Industrial applications
- Storage of regeneratively produced power
- Micro grids

UPS functionality protects critical supplies from any disruptions on the grid. At the same time, the system – in conjunction with “on-board”



## Hardware for multiple applications

### Hardware based on industrial UPS modules



BENNING supplies modular architecture – based on tried & tested industry grade UPS systems – for construction of cost-effective energy storage systems

ENERTRONIC modular Storage covers load management functions such as load levelling and peak shaving

EMS – covers load management functions, thus making a significant contribution to a quicker break-even time on investment (by comparison with systems lacking any storage functionality).

### Single-source turnkey products

On the basis of tried & tested industrial UPS systems, BENNING offers a modular architecture for the construction of cost-effective energy storage systems both for network-controlled and for self-managed plant.

They cover an output range of up to one megawatt per supply point. Moreover, it is possible to install larger systems, with further supply points, within the same common grid. This decentralised scaling enables optimised,

cost-effective integration into an existing infrastructure. And it is also possible to upgrade or to retrofit existing energy storage systems with modular UPS tech to produce smart power supply systems with island operation capability.

Where BENNING supplies a turnkey solution, it regards its role not merely as the manufacturer of hardware but as a system integrator characterised by partnership. Consequently, the projects described below illustrate not only the technical & financial aspects but also the consultation, planning & development services that will be entailed in successfully meeting the range of customers' specific needs.

With all of this in mind, **PN** was able to meet up with Mr Ronald Metzgi (Head of Office

East, BENNING) and Mr Claus Kirmaier (Head of Office South, BENNING).

■ Mr Metzgi has completed the planning & implementation of a li-on battery storage system (320 kVA/300 kWh) with UPS capability for an industry customer, specifically: a global automotive supplier with several sites in Germany. → ref. Page 16 ff.

■ for Biogas Gröber Ruf GmbH & Co. KG, a producer of regenerative power in Fuchstal, southern Germany, Mr Kirmaier was responsible for completing a turnkey UPS storage solution (160 kVA/462 kWh) → ref. Page 19 ff.



## Smart UPS combined storage systems

“Active peak load management in conjunction with UPS functionality ensures technical and financial stability.”

**PN:** Mr Metzsig, before we specifically talk about your project, could you tell us something about the general market situation concerning storage systems with UPS capability?

**Metzsig:** Given the challenges which companies face in connection with the energy transition, there is currently very keen interest in UPS storage systems. Our customers are aware of the advantages of a hybrid system which enhances safety for sensitive consumers and which – in parallel – provides buffer storage of one's own generated power, so that it can be made available on a flexible basis. And the considerations with regard to reducing energy costs – for example by reducing peak loads – are also significant when it comes to the rapid charging of electric vehicles.

We are currently finding that many companies are taking the crisis as the ideal time to set themselves up to meet the future. In most cases, this will include establishing an environmentally-friendly power supply system, typically one which is based on a storage system with UPS capability.

**PN:** Where you refer to considerations: what was the leading motivation, with specific reference to this automotive supplier?

**Metzsig:** The answers to that question are to be found in a project entitled “Energy storage systems for managing peak loads (peak

shaving) to adhere to the 7000-hour rule”. By definition, the operating hours count, which can be described as the quotient derived from annual energy consumption (> 10 GWh) and the highest load peak which occurs in the integral of 15 minutes, is greater than 7000 hours. Compliance with that rule is the prerequisite for achieving an individual network charge corresponding to “Strom NEV” – the electricity grid charges regulations (refer §19, paragraph 2) – in other words a considerable reduction in network charges for energy-intensive industries – to a maximum of 20 % of the standard rate. Depending on the corresponding processes, production may give rise to load peaks extending to a quotient < 7000 hours. Bearing in mind that the reimbursement of the network charge relates to the whole year. In other words, the duties of the UPS storage system include its having to cap the function of these peak loads: “peak shaving”.

**PN:** But load management in itself is nothing new. Is it of crucial financial significance to large-scale consumers?

**Metzsig:** That is correct, in principle. As a rule, however, efforts are made to compensate for the encountered load peaks by temporarily switching supplies off, or by delaying their switch-on. Consequently, this mode of load management has tremendous repercussions on production processes. That being the case, it increasingly gave rise to problems for

our customers. Consequently, an attractive solution appeared to be to invest in an energy storage system. Given the relatively high costs of investment for storage systems, it is becoming increasingly necessary to resort to “multi-use applications” in order to operate storage systems economically. In addition to conventional peak shaving, this includes buffer storage of regenerative power or a standby capability.

**PN:** How was the customer's attention drawn to the solution developed by BENNING?

**Metzsig:** BENNING's ENERTRONIC modular Storage system with UPS capability gives it a unique benefit which ensures its market profile. And we already had business connections with the parent company. This is a context where BENNING is well-regarded as a versatile turnkey provider specialising in complex, high-availability power supply systems. But the current project was the first one to have been installed at that site, in Saxony.

**PN:** How was the project approached, and exactly what did the customer receive?

**Metzsig:** At the end of 2018, the initial outline concepts were discussed, followed by a budget quotation in the first quarter of 2019. By the end of 2019, we received the order, once everything had been analysed and the technical details had been sorted out. It was in the summer of 2020 that we completed the pro-

ject work, production, supply, commissioning and trial run. Our service department has a 320 kVA ENERTRONIC modular Storage system installed on site with the customer, and equipped with eight 40-kVA modules (expandable to ten modules), a supply connection panel compliant with VDE AR-N 4105, a DC connection and communications panel, together with 10 battery cabinets whose energy capacity comes to a total of 300 kWh. The ENERTRONIC modular Storage system is based on hardware tried & tested on the industrial UPS marketplace. It offers excellent linear peak shaving over the entire load range, and comes with the UPS functionality required in order to protect critical supplies.

**PN:** In retrospect, what were the particular challenges, and what were the requirements imposed by the customer that meant it was you that won the order?

**Metzsig:** The energy storage system needed to be integrated into the company's existing infrastructure with – of course – the lowest possible overheads. Consequently, technical criteria dictated just one solution: the Company's own transformer station, for the installation and integration of the system. The grid structure in place meant that it was ideal to apply connection directly to the low-voltage supply, especially as this is a functionality that comes with the ENERTRONIC modular Storage product. Installation in the switchgear room was not really an option for

the customer. The available separate room needed a very compact layout, since the system had to be designed with flexible scalability, to cover the eventuality of any possible adaptations to power capacity. From the outset, thanks to the modular architecture and the advantageously small footprint characterising the ENERTRONIC modular Storage system, we were able to offer ideal solutions, which were very cost-effective. And we imagine that our range of “soft skills” – starting with active customer consultation, passing through the design and interface planning stages and culminating in turnkey handover (conducted by our service department) – all helped to win the day.

**PN:** Commissioning took place quite a while back. Has there been any feedback from the customer concerning the system's ongoing operation? →

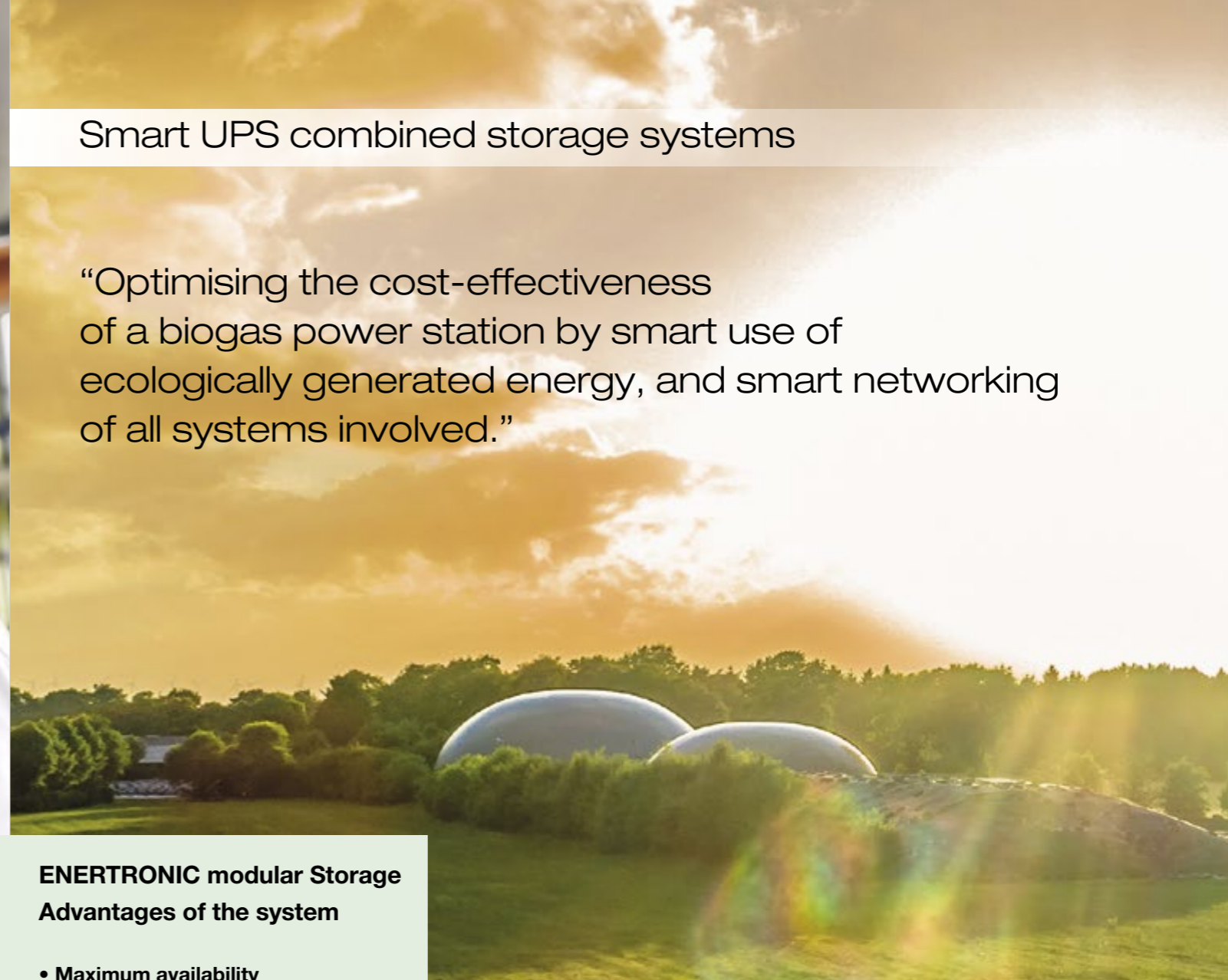


Example of a flexible scalable ENERTRONIC modular Storage system with 5 modules



## Smart UPS combined storage systems

“Optimising the cost-effectiveness of a biogas power station by smart use of ecologically generated energy, and smart networking of all systems involved.”



**Metzig:** For the customer's parent group, this plant represents something of a pilot project. Now, we have received enquiries for similar storage systems with UPS capability for further locations. I believe that this proves that active peak load management is regarded as being highly valuable in financial terms, especially in conjunction with the UPS functionality as supplied by BENNING.

Our customer is aware that in the near future it will have to face up to further challenges associated with the energy transition, such as the capability to incorporate sustainable energy sources, electrical mobility and enhanced energy efficiency in parallel with the assurance of uninterrupted power supplies for its processes critical to operation at all of its sites. In Saxony, at any rate, it has already set up the optimum conditions for that investment.

**PN:** We are very glad to hear that, of course. Finally, could you venture to share with us a look into the future? How do you think the market for such systems is going to develop in the future?

**Metzig:** It goes without saying that this is dependent on a wide range of factors. However, we can foresee that our UPS capability storage systems – fulfilling UPS classification criterion VFI-SS-111 – will be carving out a whole new market segment for themselves. They are markedly more cost-effective than other known applications. And we can imagine, given the major cost/benefit advantages, that in a great number of fields of industry, the marketplace for conventional energy storage systems is going to merge with the UPS systems marketplace.

**PN:** Many thanks, Mr Metzig, for the interesting insight you've shared with us with regard to this leading-edge project. □

contact: Ronald Metzig  
telephone: +49 172 2859286  
e-mail: r.metzig@benning.de



Scan the QR code for further information

### Benefits of storage systems with UPS capability

- Flexibility
- Economy of operation can be achieved via:
  - Peak shaving
  - Load levelling
  - Optimisation of power draw (“7000-hour rule”)
  - Day-to-night energy transfer
  - Energy reserve can be defined flexibly
  - Storage during low-load phases
  - Additional output during high-load phases
  - Suitable for lead and lithium batteries
  - Own consumption optimised
  - Safe UPS operation (VFI-SS-111)
  - Power factor correction

### ENERTRONIC modular Storage Advantages of the system

- Maximum availability
- Minimised operating costs
- Variable component concept can be achieved by:
  - Storage and UPS function
  - De-centralised, parallel architecture
  - Hot plug system with modular expansion facility
  - Flexible battery configuration (secondary battery, group battery, individual battery)
  - Can be used in conjunction with regenerative energy systems such as solar power, hydro or wind systems
  - Option of connection to low-voltage grid as per VDE AR-N4105
  - High efficiency
  - Rapid return on investment

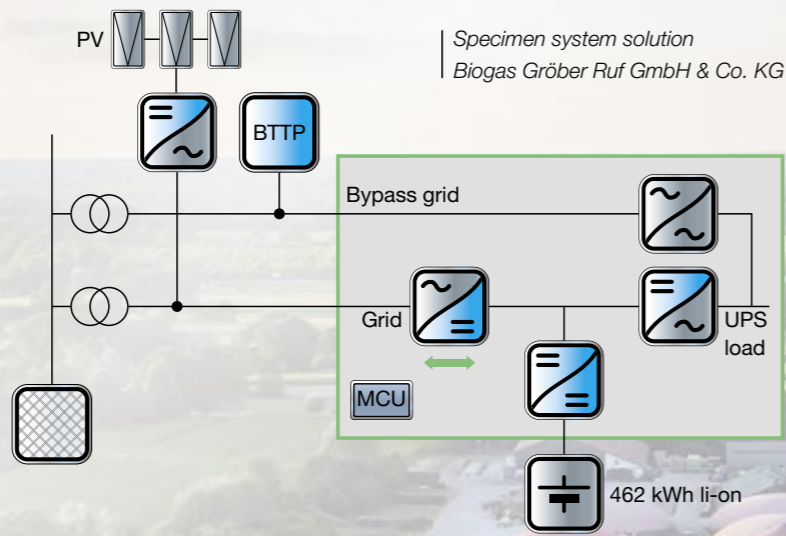
**PN:** Mr Kirmaier, would you kindly tell us about your customer and their field of business, in brief?

**Kirmaier:** Biogas Gröber Ruf GmbH & Co. KG – as the name implies – is a company which generates energy on a climate-neutral basis. Using the gas generated from biomass, the customer drives BTTP (Block type thermal power station) gas motors which generate electricity and heat with a high degree of efficiency. In close partnership with local farmers, the customer – which is based in Fuchstal, Bavaria – obtains the required biomass from cultivation in the region. In addition, the customer makes use of the roof areas of its operational buildings to generate photovoltaic energy. We have come to appreciate how future-oriented and innovative this customer is. We immediately noticed that this Company's fundamental policy is to give priority to the sparing and intelligent use of ecologically generated power. The Company's affiliations include its capacity as a partner of the Fuchstal Energy Future

project, which is funded by the Federal German Ministry for the Environment and Natural Conservation. Photovoltaic systems, a hydro power station, a municipal wind farm and Biogas Gröber Ruf's biogas system have all been combined, within this project, to form an innovative energy grid that spreads across a number of communities. The goal of logically applying renewable energy sources then gave rise to the customer's further considerations with a view to optimisation. We were able to provide the customer with tremendous support. Previously, in phases where there was no solar radiation – in other words on rainy days or at night – the plant's own electrical power needs in terms of operating the system were covered on a round-the-clock basis by the biogas BTTP. The power draw entailed in that context, representing approximately 9% of the generated power, was consequently no longer available to be fed into the power supply grid. By virtue of investing in an energy storage system which provides for buffer storage of the surplus solar power generated in →

# Smart UPS combined storage systems

- Energy accumulator + UPS
- Modular system
- Connection direct to 400 V AC
- No transformer needed
- Inverter output 160 kW
- Flexible expansion capability
- Modular-design
- li-on energy accumulator
- Projected useful battery life: 10 years
- Reserve capacity for UPS consumers
- Reserve capacity for particular operating cases



the daytime – and not required to cover the plant’s own needs – it was possible to achieve a significant increase in the proportion of own-generated solar power that could be used in-plant. That meant that only a residual quantity – approximately 2% of the more ecologically valuable biomass power (also available at night) – could be drawn upon to cover the plant’s own requirements.

It was possible to increase the proportion of own consumption of generated solar power to the commendable figure of 80%. And there is a further benefit from a commercial viewpoint, because under EEG (German-language abbreviation for Sustainable Energy Regulations) the biomass power feed earns higher payment than solar power does.

**PN:** In other words, a greater proportion of the more financially profitable biomass electricity can be fed in: an undeniably attractive layout. Mr Kirmaier, you cover southern Germany. Prior to this project, did you already have an ongoing business relationship with Gröber Ruf GmbH & Co. KG?

**Kirmaier:** For us, this customer was a “new acquisition”. On the other hand, our initial contact with them came about via a company which is networked with ourselves. For a considerable time, Mr Ruf had been searching in vain for a system partner who could be entrusted – in the capacity of a fully responsible turnkey partner – with the operation of an energy storage system consisting of a combination of the components of a current trans-

former, a battery system and incorporation in the energy management system. Their company then received a crucial hint – from a company which is in partnership with ourselves (in the field of battery technology) – thus putting them in touch with BENNING.

**PN:** Accordingly, we could say – possibly with a little exaggeration – that you won the order because BENNING is the only supplier who was prepared to accept such a complicated challenge?

**Kirmaier:** In fact it was the customer who later told us (in the course of a project meeting) about the long and futile search they had previously undertaken, to find a suitable provider. And they emphasised how particularly concerned they had been (on top of all the technical and financial aspects) by the fact of the need to have competent consultation at the outset when it came to the eventual order being issued.

Perhaps I could best characterise the situation’s complexity as follows: The infrastructure already in place with the customer consisted of several biogas generators, a solar power system and various feed inverters. The plant’s consumption and energy feed was controlled by an EMS – energy management system – already in place with the customer. In addition to the hardware, in other words, there was the communications link for our UPS and storage systems together with the BMS – Battery Management System – feeding into the customer’s data flows.

**PN:** You mentioned technical aspects, just now. Why did the customer want a combination of battery systems and UPS plant? Would an energy storage system not have been adequate?

**Kirmaier:** Amongst other functions covered by the UPS system, it also provides for an increase in the operational reliability of the plant, because the sophisticated automation system consisting of sensors, evaluation computers, actuators, feed pumps and managed stirring drives could not tolerate any grid fluctuations / failures.

Any fault would have given rise to considerable complications in the operation of the plant. And a worst-case occurrence would have given rise to safety-critical situations, because plant parameters such as gas pressure or volumetric levels would then have been unavailable. In order to avoid such a scenario, a portion of the energy which is available from the batteries is not released to cover our own needs, but is kept in reserve to guarantee continued supply for the sensitive plant technology. In the event of any grid failure, the ENERTRONIC modular Storage system – which operates simultaneously as a storage system and as a UPS – will cut in and support the reliable continuation of operation by virtue of its energy reserve. In addition to the basic function which covers the storage and release of the climate-neutral production of electrical power, then, the system – without any significant additional costs – provides absolutely interruption-free, continued power supply to sensitive supplies should



Smart networking of a pre-existing type S7 EMS with the new components.

Photo: © BENNING / Claus Kirmaier



The MCU (monitoring & control unit), with its diversity of supported protocols and interfaces, makes it possible to connect the system to EMSs of the widest range of software manufacturers. The system controller (MCU 3000) integrated into the power supply system cabinet door comes with a 10.4 inch touch display.

any grid failures arise. This comes in conjunction with an extended service life, since it filters out any of the grid impurities such as harmonics or transient voltages that would otherwise reduce the service life of the plant components – most of which are expensive.

**PN:** So, looking once again at ENERTRONIC modular Storage: Could you kindly provide us with a brief description of which system components were installed and commissioned by BENNING Service in the autumn of 2020, please?

**Kirmaier:** The outcome of the early-2020 planning & analysis phase was the requirement, on the hardware side, for a system consisting of ENERTRONIC modular Storage with 160 kVA output (4 modules, each providing 40 kVA), a BMS and a li-on energy accumulator of modular layout, with an energy capacity of 462 kWh (2 x 7 x 33 kWh). It was not viable – for financial reasons – to consider a solution with conventional lead batteries, although the ENERTRONIC modular Storage solution is also suitable for such an applica-

tion. It was possible to make connection directly at the low-voltage level (400 V AC / VDE AR-N4105). This approach meant that there was no need for the plant to invest in its own transformer.

The system’s design is based upon maximum availability, with redundancy. The advantages of modular architecture – such as quick & straightforward servicing, flexible scaling and modest space requirements – were as convincing as the benefits of high system energy efficiency, added safety and a quicker breakeven time.

**PN:** Just there, you emphasised on the hardware side. Why was that?

**Kirmaier:** That’s right: an important module of the project was the smart networking of the already existing EMS (type S7) with its new components and specifically with the BMS. The corresponding integration was carried out by our engineers hand-in-hand with the customer’s EMS specialists. The Monitoring and Control Unit (MCU) – developed by ourselves and used in many areas of industry

and telecommunications – provides for the widest range of manufacturers to be connected up to the EMS with a wide range of supported protocols and interfaces.

**PN:** Mr Kirmaier, many thanks for speaking to us today. It was most interesting for us to learn how a biogas power station can be operated with such great efficiency – by virtue of investing in an energy accumulator system with UPS capability – can be operated not only with greater safety but also using the various payment models under EEG (sustainable energy regulations) – looking at things from the commercial viewpoint – and with such impressive efficiency as to ensure a rapid ROI (return on investment). □

contact: Claus Kirmaier  
telephone: +49 8332 936363  
e-mail: c.kirmaier@benning.de



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## Investing in the future

Noteworthy achievement for  
Bocholt site: high-shelf store extended  
to 3,500 m<sup>2</sup> floorspace



BENNING factory 2, on the right in the picture the extended high-shelf store



Upon commissioning of the second phase of its building, in 2020, capacity in the expanded logistics centre now total 7,400 pallet spaces in the “APL” (= automated pallet store), 16,000 container spaces in the “AKL” (= automated small-parts store) and 1,750 special-pallet spaces in the narrow-aisle store. This is an example of the effective combination of goods inwards/outwards, consolidation and commissioning.

And this is an investment which will continue to enable Production to maintain the reliable supply of raw materials and assemblies for the company's subsidiaries, totalling more than 25 worldwide. This development comes as the natural progression of the Company's continuous expansion of distribution activities to cover global consumer markets.

For more than a decade, now, it has been a strategic factor in the Company's development to optimise its logistics processes. A crucial prerequisite for the ROI or Return on Investment for the project to extend the central store – and it came to a 7-figure sum – will be growth in the volume of turnover, making this expansion a noteworthy achievement for the Company's continued development of the Bocholt site.

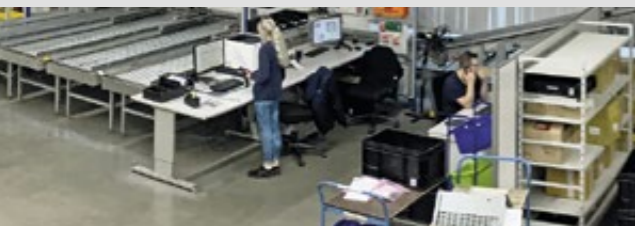
According to Mr Wilms (Production Manager with BENNING), the main milestones in expansion were the optimisation of throughput times for logistics, the enhancement of process efficiency and the in-sourcing of storage facilities – which, up until then, had been rented – together with a fundamental expansion in storage space. At the same time, it was essential to cut down the costs for storage and logistics without sacrificing customer proximity and service orientation in distribution.

To judge by the figures characterising the development in Company facilities and storage space over the last two decades, the new construction will provide adequate space – thanks to doubling the size of the automated pallet store – to cover the next 10 to 15 years. And the new storage complex has been designed with future-proofing in mind, with potential for further compaction of storage space, whilst leaving a reserve for further expansion: the possibility of a further phase of building has been planned in. →



**“Expansion and restructuring have succeeded in optimising our processes, combined with a marked reduction in response times and transport routes. All of this benefits our customers and ourselves as a company.”**

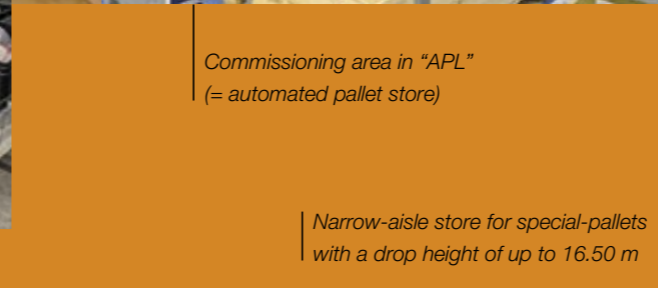
Thomas Wilms, BENNING's Production Manager



Pallets and small-parts commissioning containers: consolidation area



Automated container feed and commissioning area in "AKL" (= automated small-parts store)



Commissioning area in "APL" (= automated pallet store)

Narrow-aisle store for special-pallets with a drop height of up to 16.50 m



### Massive increase in commissioning output

During the planning & analysis phase (which began in May 2019) the project team defined the requirements entailed in achieving the core goals, and encountered various bottleneck issues in the process. The central store was expanded with business ongoing, such that the external stores were replaced and integrated within a phase coming to no more than 4 weeks or so in the wake of the commissioning stage (during the first quarter of 2020). Subsidiary transport operations and the ongoing in-store and out-store processes are a thing of the past – having in-sourced the out-

lying storage facilities. Thanks to consolidation and compaction, the number of employees required has been reduced with a high level of automation. This has resolved the bottleneck effects that were suffered in terms of maintaining supply to commissioning areas.

### Production throughput times have been cut down

In conjunction with computer-aided processes such as the "put to light system", the applied management system has achieved a significant reduction in error rates combined with an increase in peak performance. By this

means, it has been possible to achieve a marked increase in throughput in these areas, together with effects benefiting production times as a whole. In parallel, the "round robin" procedure has maximised store availability, which means that Production is able to continue to provide supply for the subsidiary companies even when individual aisles are down.

### Improvement in CO<sub>2</sub> footprint

And there are also environmental plus points in addition to the commercial benefits. Firstly, the fact of discontinuing the transport routes which had previously had to be covered by

the fleet of HGVs and forklifts means that CO<sub>2</sub> output has been reduced, and secondly it has been possible to reduce power draw thanks to excellent thermal insulation and small-sized design. One more small contribution towards reducing Europe's energy consumption. □

author/contact: Thomas Wilms  
telephone: +49 2871 93 223  
e-mail: t.wilms@benning.de



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### Biodiversity

Once the store expansion project had been completed, 15 fruit trees were planted on the open area (5,600 m<sup>2</sup>) in front, and a flowering meadow was created in order to contribute to diversity enhancement and climate protection.



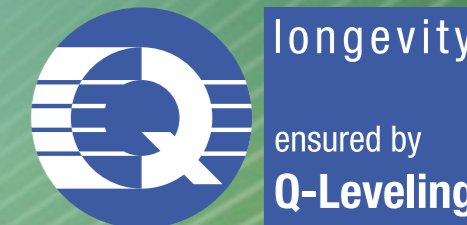
## The profitability of your investment is determined by service life

A clear profile of requirements, combined with knowledge of what is technically possible at the time, will help vehicle operators to assess the major differences between lithium ion energy systems presently available.



Peter Hoepfner,  
Traction Distribution Manager,  
BENNING

For many years now, lithium ion batteries have already been put to good use in many applications. This applies as much to motive power as it does to the interim storage of power produced regeneratively from solar cells. Experience gained in recent years teaches us that the financial success of any investment will hinge essentially on service life and the amount of energy that can be gained in one charge/discharge cycle; system availability is not the only criterion. Consequently, we need to categorise and investigate with a critical eye, looking firstly for cost effectiveness – and the service life of the various system options – whenever we are considering investing in lithium powered systems for in-house movements of goods. So, what are the specific requirements and precisely what are the distinctions to be drawn? And what – in detail – are the corresponding repercussions?



**liflex classic**, robust, reliable battery,  
24 V to 48 V, 120 Ah to 480 Ah.

**liflex NG**  
innovative, future-proof, modular,  
quick-charging capability, fulfils DIN EN 1175,  
24 V to 120 V, 140 Ah to 700 Ah.  
**longevity ensured by Q-Leveling**

In this article, we look into these topics, and we've consulted a specialist in this field, Mr Peter Hoepfner, the traction distribution manager of BENNING to help us appreciate the distinctions to be drawn – and the all-important details.

### Aspirations and Objectives

Firstly, let's review the current market situation and take a good close look at the aspirations and objectives of our customers, the operators of the corresponding powered systems. We're talking about: ROI, adaptability and

guidelines for operation. At the end of the day, that must be how manufacturers compare the requirements to be fulfilled, depending on their clients' systems, which is how people arrive at a soundly-based investment decision.

### Cost-effectiveness, flexibility, connectivity

As you would inherently expect when it comes to a corporate investment, one of the top priorities is going to be a rapid ROI (Return on Investment).

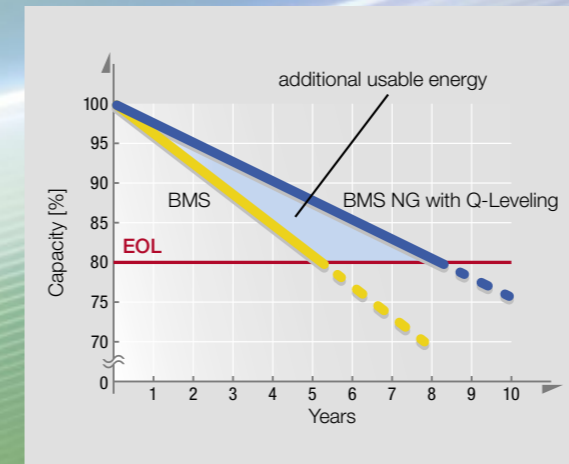
In that light, low operating costs, manageable maintenance and servicing intervals to-

gether with fault-free (and interruption-free) operation will be high on the list. It's equally important to offer versatility with regard to the connectivity of systems, such as when it comes to integration into a company's own energy management systems, together with the simplest and most straightforward access to the essential battery and charging-system parameters.

### Second life, CO<sub>2</sub> Footprint, Recycling

Last but not least, ecological criteria have now come to be included in decision-making

criteria: the CO<sub>2</sub> footprint, sustainable recycling or a second-life option. It goes without saying that the type of plant duty, together with the associated range of investment cycles, must give rise to diversity in the weighting of objectives, although the same basic requirements still apply. The process of defining the requirements essential to the achievement of the operator's plans will call for a differentiated study of the employed lithium ion battery, the energy system (charger/battery combination) and the company's assessment of the system supplier/manufacture. →



Here, we've compared the service life of a lithium ion battery (LFP 8S1P) equipped with a BMS or with a BMS plus Q-leveling. Our comparison illustrates the repercussion – on the whole system – of one cell's loss of power. The loss is markedly reduced if the Q-leveling process is employed.

As the number of cycles increases, each cell will suffer an individual capacity loss determined by ageing. This individual process is further accentuated within a battery system. This gives rise to differences in capacity between cells, increasing over a period of time and greatly reducing any battery system's anticipated service life. Q-leveling takes a completely innovative approach to slowing down this system-induced ageing process suffered by lithium batteries. This is a patented process which can be licensed and used by all battery manufacturers.

**With Q-Leveling, the system's assessment doesn't rely exclusively on knowledge of the cells' voltage curves.**

Q-Leveling's innovative measurement & control algorithms continuously collect the details of each individual cell's SoC (state of charge) and SoH (state of health) so as to detect individual charge levels and ageing-induced changes in capacity. Because charging currents are managed precisely throughout the charge/discharge phases, you can avoid (or largely compensate) differences in charging levels between cells. This is achieved by way of an additional secondary power circuit which can dynamically treat each cell with an individual charge/discharge current.

**Advantages of Q-leveling:**

- The working capacity of the battery as a whole is no longer affected by the weakest cell in a series circuit. This means that more usable energy is available throughout a battery's entire life-cycle.
- The ageing mechanisms suffered by a battery due to series connection will be compensated or even virtually avoided altogether.
- The battery system service life we can anticipate subject to having Q-leveling is almost comparable to an individual cell's life expectancy.

**ROI and profitability**

Let's start with profitability. This has a direct correlation with service life in the case of the lithium ion battery, or you could refer more specifically to a correlation with the number of operating cycles. In the field of in-house logistics, we refer to "end of life" only after the nominal battery capacity has gone down to 80%. Once that's the case, it doesn't mean the battery is no longer usable.

There are great differences between available charging cycle figures, if we compare some of the currently available lithium battery systems, and this will vary according to the employed BMS (Battery Management System). These differences become all the more pronounced if we compare batteries equipped with a BMS plus conventional balancing against a BMS which already uses the new Q-leveling process.

**Longer service life**

The service life of this latest generation of lithium power systems, enhanced with

Q-leveling, is significantly longer. It basically means that you get a longer overall life-cycle and – consequently – a longer useful daily service time.

Accordingly, in a plant which works on a multi-shift basis, considerable time can be saved since less time needs to be spent on interim battery charging.

**Up to 30% higher efficiency**

Let's look at the energy system, which is the combination of lithium ion battery power and our charging technology.

These need to be ideally matched to each other, and this applies both to hardware and to software. Consequently, any faults which lead to floor conveyor failures will have a direct repercussion on the profitability of the whole production process.

Modular-design chargers offer the advantage – in this context – that they can still be operated at reduced power even if one module fails. Accordingly, the floor conveyors can still be charged. Furthermore, the modular de-

sign enables an extension or a reduction together with straightforward, rapid replacement of the module while work continues in the plant, so that – here, too – the repair/shut-down times are greatly reduced.

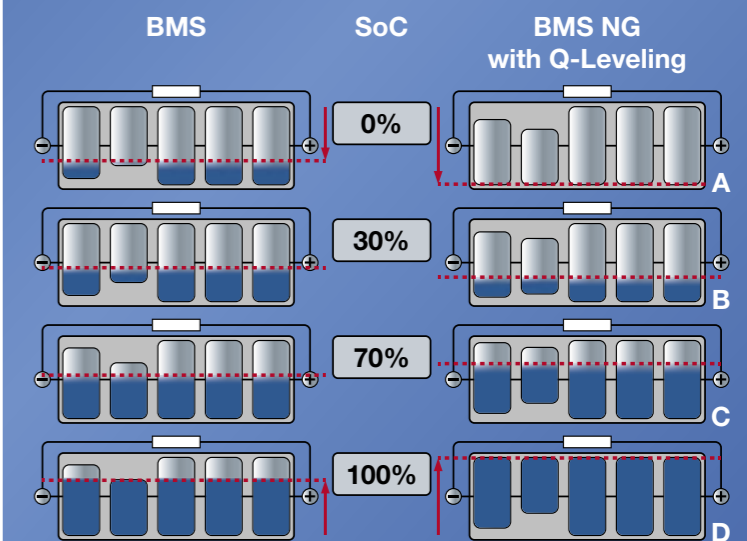
Operating costs represent a major proportion of the overall costs.

Because the costs of energy are significantly represented, here, our systems' energy efficiency must be an important criterion. For example, the efficiency achieved with BENNING's BELATRON chargers comes to approximately 96 %.

By now, nobody questions whether conventional lead-based technology or modern lithium ion tech will give the greater energy efficiency.

In the final analysis, the electrochemical conversion of the electrical power in a lead battery offers an efficiency level of no more than approximately 70% (see graphic at top of Page 30).

The relatively higher losses are due to the chemical process in the lead battery. →



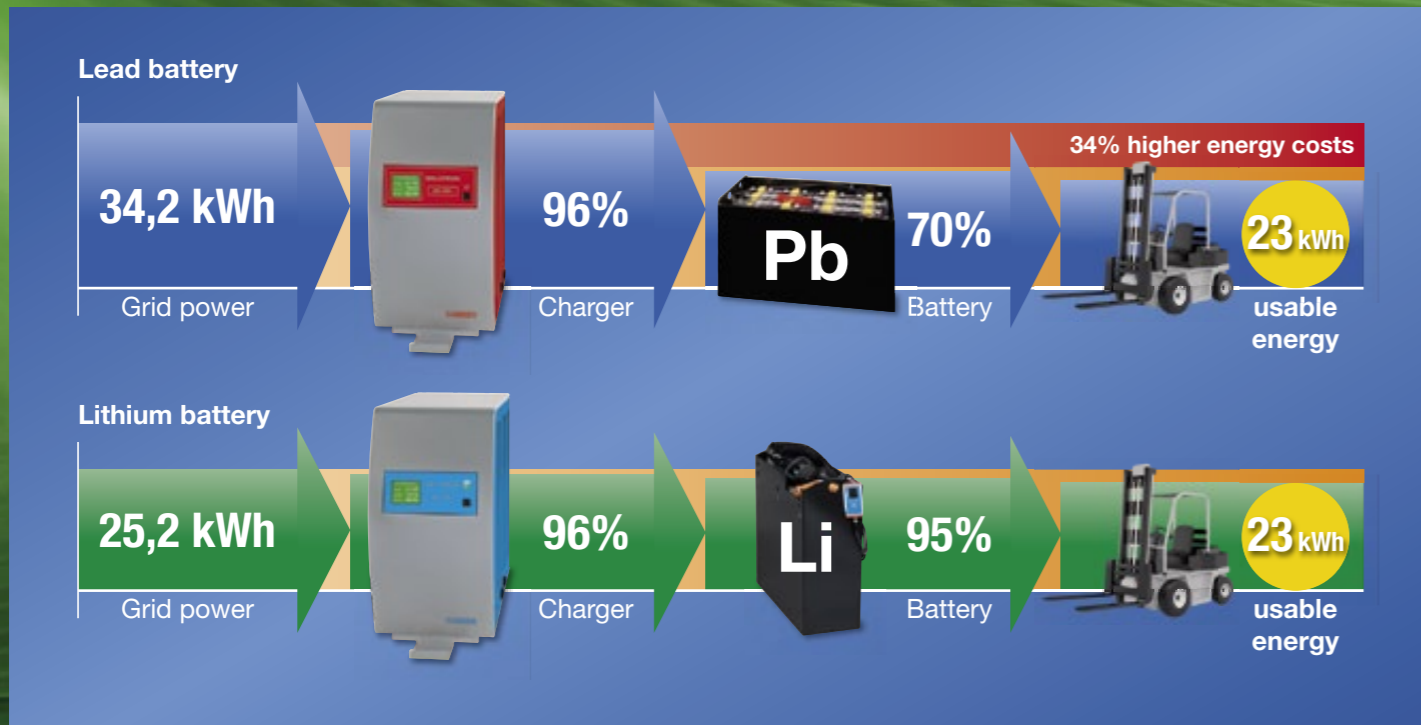
Here is a comparison of the charge/discharge processes of a lithium ion battery equipped with a conventional BMS or with a BMS comprising Q-leveling.

**For further information about Q-leveling:**

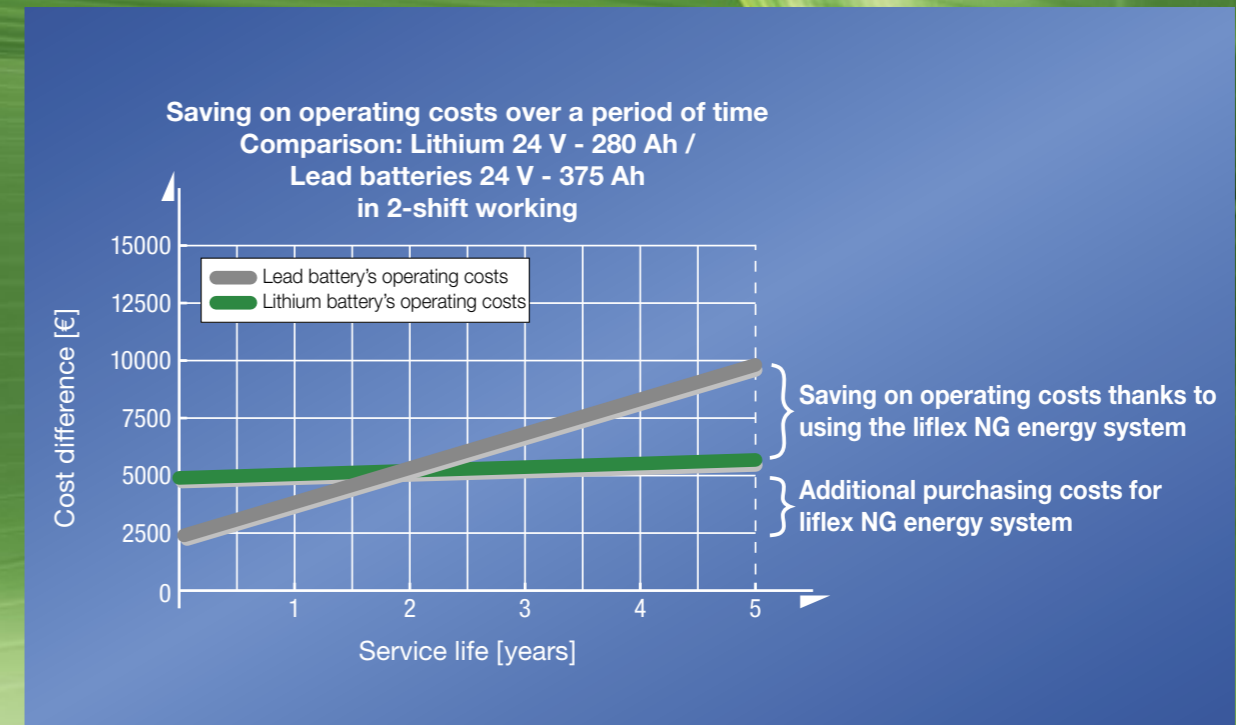
BENNING CMS Technology GmbH, Freiburg  
 contact: Frederik Fuchs  
 telephone: +49 7665 52372 11  
 e-mail: fuchs@cms-technology.de



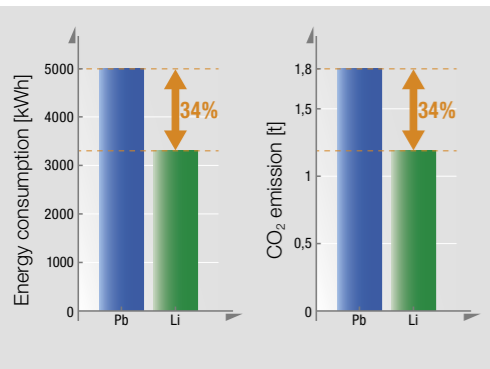
BELATRON Li+ series chargers  
 24 V to 120 V, various options available,  
 e.g. protection type IP54 and higher,  
 or various communications interfaces



Comparison of usable energy with lead batteries and lithium batteries



The extra costs from investing in a liflex NG energy system are compensated by the savings on operating costs – even after just two years



Annual energy consumption and CO<sub>2</sub> emissions from charging of drive batteries: lead battery (Pb)/lithium ion battery (Li)

The use of a lithium ion power system does more than to just save up to 34% of the energy costs entailed in operating a floor conveyor. More than that: the CO<sub>2</sub> emissions when charging lithium ion drive batteries are reduced by the same factor (refer graphic on left).

Even after no more than around two years, the additional costs for investing in a lithium ion energy system are covered by the saving in operating costs. This is illustrated – by the graphic on page 31 – on the basis of comparing the 24 V, 7.2 kWh (280 Ah) liflex NG energy system with a 24 V – 375 Ah lead battery. Approximately 34% reduction in power draw, approximately 75% less spent on servicing and approximately 60% less spent on battery maintenance – a massive contribution to a successful investment.

### Increase your plant's loading capacity

Interruptions to the floor conveyor's operation will cause reduced efficiency. Consequently

it pays to keep charging periods as short as possible, or to program them completely outside of normal operating periods. For example, if you can carry out interim charges in the respective breaks (1x15 minutes and 1x30 minutes) in the context of 2-shift working, then you don't need a replacement battery.

The graphic on the right, for example, shows the capacity curve of a liflex NG 24 V/7.2 kWh (280 Ah) energy system in 2-shift working with interim charges.

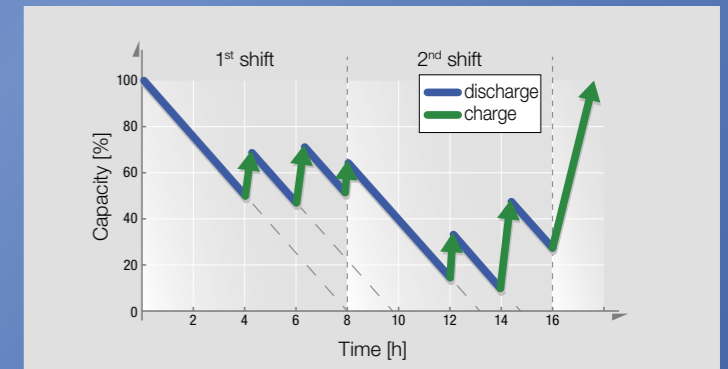
For that purpose, though, not only the chargers but also the lithium ion storage systems must be designed for rapid charging at high current levels.

Liflex NG energy systems fulfil this requirement: they have quick-charging capability and can therefore be used effectively for interim charging. Charging takes place at a constant current level.

### Versatility when it comes to investing or replacing equipment later on

Remember: sustained soundness of investment presupposes the maximum possible compatibility. What this means with regard to chargers is that, amongst other considerations, you need to be able to charge conventional lead batteries in the first place and then – after transition – to charge the up-to-date generations of lithium ion batteries. The ideal option is for systems to be correspondingly converted using firmware updates.

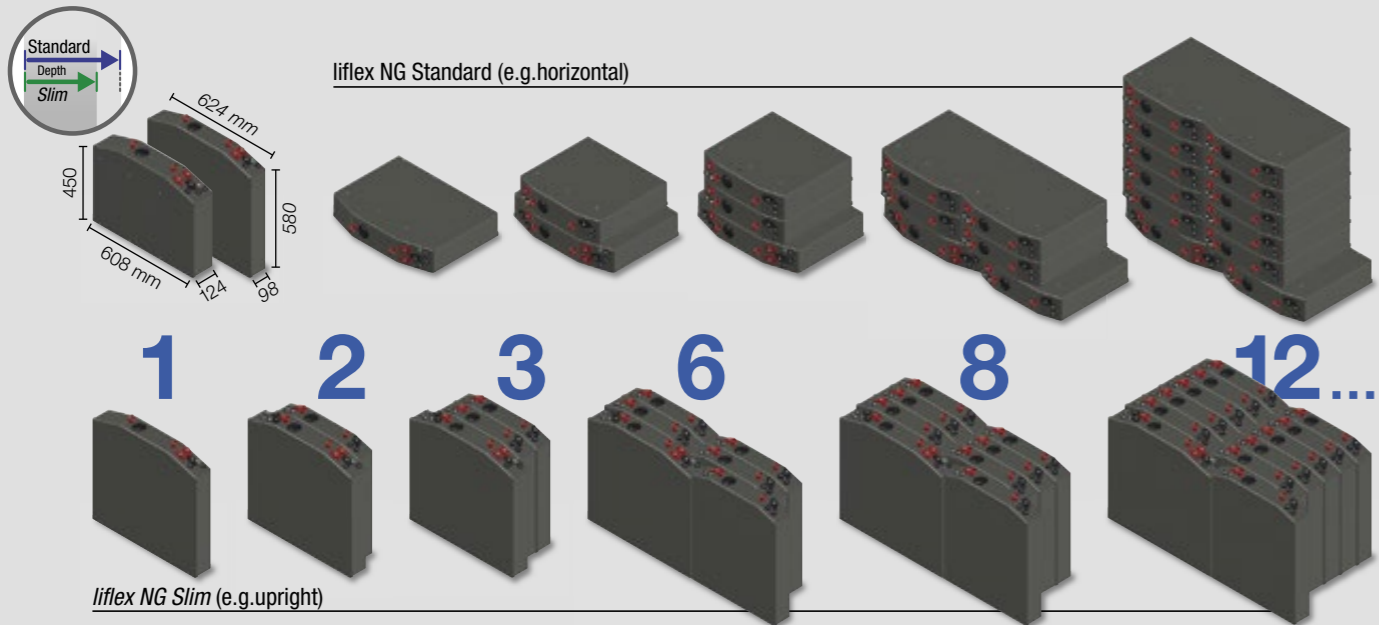
When selecting a lithium battery system manufacturer, take note of the extent to which the manufacturer continuously redevelops not only hardware but also software. This is going to require a high level of priority, particularly if a fleet of vehicles is to be managed and/or if one's energy systems are connected with an in-house EMS (energy management system). →



Capacity curve of a liflex NG energy system in 2-shift working with interim charges



**Examples of liflex NG module configurations:  
Standard or slim, horizontal or upright**



**360° services**

**Consultation**



**Choice of contracts**

**Diversity of products**

**Straightforward rental/tryout**

Rental models for industrial assets – totally matched to a company’s particular operating procedures – are now a fixed component of any company’s financial planning. They provide the operator with some certainty in their planning, they enable the use of the most modern products and they offer versatility and the maximum availability, all for a fixed monthly price.

BENNING’s rental model for energy packages is designed not only for vehicle and battery dealers but also for companies which operate floor conveyors. It gives you the opportunity to satisfy yourself as to the advantages of lithium ion tech in practical operation but without incurring any risk.

It means that there are no high initial investment costs or unpredictable expenditures on servicing, maintenance or replacements. Rental instalments remain stable. The outcome is a fleet of floor conveyors which remains available at all times. Upon expiry of the contract term, the complete energy package can be acquired.

**All-round flexibility**

Let’s assume that a company wants to start with a trial basis: equipping a few of the floor conveyors about to be purchased (or already in place) with lithium ion batteries.

The existing vehicle fleet will be upgraded step-by-step over a period of time.

From the operator’s viewpoint, it would then make financial sense for all of the employed energy systems to be covered by a single source for repairs, servicing and rentals.

However, this can be tricky, given the diversity of various vehicle types. In many cases, after all, the available battery systems can only be obtained in a small number of standard sizes.

Ideally, a given battery manufacturer should offer flexibility, so that the lithium ion batteries – and also the battery trays – can be configured individually for the various vehicle types.

With that in mind, in our latest liflex NG battery generation, we’ve developed a modular concept.

This series can be obtained in two types of module: standard and slim. Both module types have the same capacity. A different arrangement of cells is employed for the various casing sizes.

Systems/modules can be operated either in the upright position or horizontal. This achieves greater flexibility, depending on the installation location (refer graphic above)

In parallel, specifically sized battery trays are available.

**Servicing and preventive maintenance will guarantee a long service life**

Present generations of lithium energy systems are largely maintenance-free. At the same time, each system should be serviced at regular intervals in order to ensure a long service life.

This can be achieved by the operator’s trained personnel or by the manufacturer’s service engineers.

BENNING offers an extended guarantee under its service contract for preventive servicing and life extension.

**Sustainability: thinking and acting**

Ecological thinking means considering more than just the energy efficiency of our systems. Responsible action also means looking into what happens to lithium ion batteries after their EOL.

Ideally, batteries can be sent back to the manufacturer for recycling and/or second-life concepts.

**Conclusion:**

It may ultimately be concluded that the service life of lithium ion energy systems actually represents a considerable proportion of an investment’s cost effectiveness.

Here, there are significant differences between the service life achieved by currently available lithium ion energy systems. To some extent, they are achieved by various manufacturers’ embracing BMS: with conventional approaches to balancing.

Recently developed approaches are available (Q-leveling), and these can enhance a system by 30 to 40% until EOL. A checklist of requirements for any lithium

system should consider the following points: Service life, energy efficiency, rapid-charge and interim charge capability, modularity, compatibility and the connection options offered by systems.

Additional protection can be gained if we use a checklist of requirements awarding appropriately high priority to these criteria, followed by the requirement for a long guarantee period together with a service contract; and these considerations on their own are already an indication for the quality of any battery system. All of the above should be included in the list of requirements upheld by responsible companies, together with an ecologically sustainable recycling or second-life solution – offered by the battery manufacturers – for each lithium ion battery system. □

contact: Peter Hoepfner  
telephone: +49 2871 93 233  
e-mail: p.hoepfner@benning.de



Scan the QR code for further information

*The rental model (graphic on left) offers comprehensive, complete service for your entire energy package*



*The maximum of flexibility – systems can be operated in the upright position or horizontal*



## Livestream acceptances by customers

Can video conferencing adequately take the place of physical presence sessions for simulations and tests?

**Customers mostly consider that it's essential to have on-site works acceptance tests, depending on the complexity of the power supply system.**

**These tests make it possible to confirm adherence to the contractually established specifications and requirements as applicable to the power supply system. They also make it possible to ensure that the system – under the defined conditions – is going to operate as expected.**

*The session leader and the test engineer communicate online with the client's project team. The test centre is equipped with a 5 GHz Highspeed WLAN, which provides for connection between the video cameras, a smart phone, PCs and headsets. In parallel with the readings taken and the tests made, there will be expert discussion concerning the system's functionality and performance.*

Once this test has been successfully completed, then the system can be delivered as planned, installed on site and commissioned. The extent of the acceptance framework will be determined by the client's requirements, and it will include not only function checks and simulations but also the verification of documents, manuals, diagrams and drawings.

BENNING conduct these tests in conjunction with the respective project team from its international clients, including the test centres at its Bocholt site. Since the onset of the pandemic – which has given rise to restrictions on travel and contact – BENNING has offered attendance by video conferencing as the alternative to acceptance sessions requiring →



Mathias Schmaenk,

BENNING Bocholt

**“Hardly anything has changed in terms of the tests and simulations to be carried out, apart from the fact that the client is not physically present.”**



One or several static cameras – depending on the size of the power supply system – will convey an impression of the general test structure. The details of the system can be assessed in live consultation with the client, using a mobile camera unit.

During the videoconferencing session, the client can request specific readings and tests, and these can be correspondingly carried out in the test centre.



Measurement values are live streamed, and the client receives the result in real-time.



physical presence. In order to meet this challenge, the technical prerequisites were set up in all of the test centres, and the entailed processes were slightly adapted and agreed with the clients, with adequate time in hand.

The lead time prior to an acceptance session is approximately two to four weeks. The client can take this period as the opportunity to carry out a preliminary check of the technical documentation – such as circuit diagrams, dimensional drawings, parts lists and test reports – as already provided by BENNING. The client can then present BENNING with

questions, or specify certain simulations. Accordingly, the acceptance session as such will take place by online video conferencing. Hardly anything will have changed in terms of the tests and simulations to be carried out, apart from the fact that the client is not physically present.

The utilisation of several mobile and static video cameras will cover the complete test setup, together with any detailed views required by the client, such as the connections and terminals area, the cabling method or contact prevention/safety.

The same is applicable with regard to all messages and alarms arising in the course of the simulation, dynamic characteristics such as short-circuit, overloads, load steps and transferring over to bypass mode in respect of AC supplies.

In order to clarify expert technical content, furthermore, test settings and adjustments can be streamed live and in real time, or documents can be shared on the monitor for further discussion.

Following successful completion of all tests, a corresponding acceptance test report is emailed to all participants.

### Conclusion

Customer acceptances can be carried out professionally and efficiently even in pandemic times, with their attendant restrictions on travel and contact.

It goes without saying that acceptance by video cannot fully replace an acceptance session with physical presence, and such an objective would mean that the content of information to be shared would exceed the framework of a regular acceptance procedure. Nevertheless, it does provide the client

with the option of detailed and live examination of the main function and product characteristics before delivery. Consequently, the client can be confident that when the equipment is on-site, the client will be able to commission precisely the robust and efficient power supply system that he requires, complete with all of the benefits which prompted him to opt in favour of collaboration with BENNING in the first place.

The extent to which the marketplace is ready to tolerate online acceptances over an extended period is something that remains to be

seen in the future. We can be sure that minor, small-scale acceptance sessions are adequately covered by video-based acceptance sessions as an environmentally acceptable alternative, and one which saves on CO<sub>2</sub>. ■

author/contact: Mathias Schmaenk  
 telephone: +49 2871 93 316  
 e-mail: m.schmaenk@benning.de



Scan the QR code for further information



## Charging stations of up to 1000 V for all current EV models

**BELATRON's modular T2 range offers charging outputs of 30 – 480 kW DC and 22 kW AC.**

*"Irrespective of whether our customers intend to install one single individual charging station or a quick-charge fleet of equipment, we have all the products & services needed for their e-mobility solution."*

*Peter Hoepfner, Traction Distribution Manager*



Scan the QR code for further information

**All new cars registered in the EU need to be zero emission by 2035 in order to reach the targets negotiated under European climate regulations. A reliable charging infrastructure needs to be in place by that time, to cover long-distance journeys. Consequently the EU has issued a Regulation to the effect that charging stations must be installed along major European motorways: at regular intervals of a maximum of 60 km.\*1**

Infrastructure solutions based on rapid charging during a journey will not be enough to enable EV travel to be straightforwardly and conveniently integrated into everyday life in the future. Shopping breaks, fitness centre visits or just working hours are all windows for EV owners to charge up their vehicles, especially if they don't have a wall box of their own at home.

### A solution for each point of use

With the BELATRON modular T2 charging systems, BENNING has covered the entire

bandwidth of e-mobility applications, starting from:

- Wall-boxes of 30 / 60 kW DC (with an option of 22 kW AC), ideal for use at home or in company car parks.
- Using 180 kW DC charging stands (with an option of 22 kW AC), typically for use in car parks provided for customers of hotels and restaurants, or in shopping centre car parks.
- Up to and including split systems: 480 kW DC (with an option of 22 kW AC) e.g. for quick charging at motorway services/rest areas.

Smart charging systems combine the maximum of safety and energy efficiency with a

flexible component concept. They are quick to install and straightforward to maintain, during their service life.

### Versatile configuration; high efficiency

The flexible component concept in this design series provides for a wide range of options. Depending on preference, you can select a range of different installation variants, output characteristics and charging connectors, such as CCS2, CHAdeMO and the option of AC type 2. Furthermore, these charging stations support Universal Open Charge Point Protocol 1.6 enabling them to communicate across the whole range of vehicle manufacturers, together with charging & management systems.

All of the systems are based on the same 30 kW output module. This module is designed for

a voltage range of up to 1000 V and ensures a constant charge rate. It operates with high efficiency, giving up to 96 % efficiency.

### High availability through redundancy

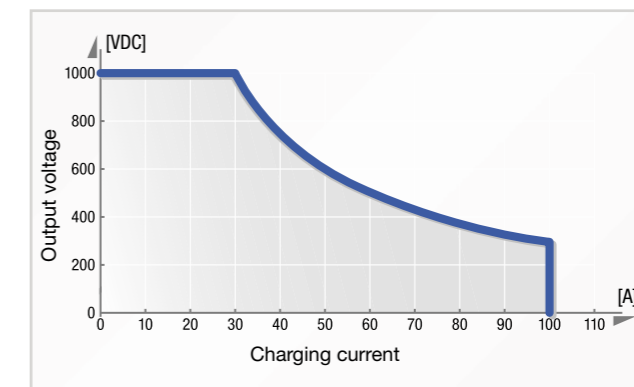
As a rule, BELATRON modular T2 charging systems are configured with output upwards of 60 kW in a modular design with redundant characteristics. Consequently, even if one output section fails, they can still be operated (albeit at a reduced charging power) by relying on the remaining 30 kW output module until such time as the unit can be repaired.

### User-friendly, safe operation

The charging stations' controls are user-friendly – with a 7-inch touch screen panel. The logical layout of the controls, catering to the user's

needs, gives a clear, precise, easy-to-understand display of all of the required charging parameters and settings. Charging procedures can be initiated with parameter-controlled RFID cards (e.g. employee cards or customer cards). □

author/contact: Peter Hoepfner  
telephone: +49 2871 93 233  
e-mail: p.hoepfner@benning.de



The 30-kilowatt output module offers excellent service, with a constant charge output.



Various configuration options are available with the 30 kW BELATRON modular T2 range. The range of choice includes wall boxes, charging stand systems and mobile charging units, ideal for versatile deployment in workplaces or in vehicle depots.

The 60 kW BELATRON modular T2 is a modular design featuring redundancy benefits, and with the option of configuration either for wall mounting or as a stand-based system.

The operation of the 180 kW BELATRON modular T2 can be set to any desired output of between 60 kW and 180 kW on a scale in 30-kilowatt steps. Output can be adapted later on (pay as you grow).

If the available installation space for charging systems is tight, then the BELATRON modular T2 Split system (480 kW) series is an available choice. It consists of three slim split charging stands and a central power cabinet.

\*1 Source: European Commission Press release dated 14-07-2021, [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_21\\_3541](https://ec.europa.eu/commission/presscorner/detail/en/ip_21_3541)

## BENNING

Elektrotechnik und Elektronik  
GmbH & Co. KG

Factory I  
Münsterstr. 135-137

Factory II  
Robert-Bosch-Str. 20

46397 BOCHOLT  
GERMANY

Tel.: +49 2871 93 0  
Fax: +49 2871 93 297

E-Mail: [info@benning.de](mailto:info@benning.de)

[www.benning.de](http://www.benning.de)



Fairs, events and exhibitions  
**2022**

### MODEX

28/03 – 31/03 in Atlanta/USA

### Intersolar Europe

11/05 – 13/05 in Munich/Germany

### LogiMAT

31/05 – 02/06 in Stuttgart/Germany

### iVT Expo

29/06 – 30/06 in Cologne/Germany

### ENERGETAB

13/09 – 15/09 in Bielsko-Biala/Poland

### InnoTrans

20/09 – 23/09 in Berlin/Germany

### belektro

08/11 – 10/11 in Berlin/Germany

### GET Nord

17/11 – 19/11 in Hamburg/Germany

*All details provided without liability*

