MISSION: POWER FOR THE FUTURE

FULL POWER FOR THE ENERGY TRANSITION

Topics in this Issue

WAGO

MISSION: POWER FOR THE FUTURE

FULL POWER FOR THE ENERGY TRANSITION

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THE STABILITY OF THE GRID IS UNDER PRESSURE

WHAT WE CAN CONTRIBUTE TO THE SUCCESS OF THE ENERGY TRANSITION.

Dear Reader,

The past few months have been "energized" in the most literal sense of the word. As expected, pending political decisions related to the Building Energy Act caused heated discussions nationwide in the run-up to the summer holidays. Basically, everyone agrees that a switch to renewable energies for heating and hot water is essential if we want to protect the climate. But how do we proceed in practice?

While some still hope that everything will somehow pass them by, we discuss specifically what needs to be done and how it can be sensibly implemented – with a focus on nuances and specific forms. This is the only way for us to seize the opportunity to take countermeasures promptly. This is because the legislative changes ultimately affect everyone – anyone who has any contact with environmentally friendly heating systems, in whatever form, or wants to be climate neutral in mobility. These changes impact producers and retailers alike, they are relevant for energy suppliers, they extend to the skilled trades sector and will ultimately touch every household.

"As long as we are blind in our actions, we don't know which direction we should go."

Where exactly are the decisive points of influence for the energy industry? What needs to be done to ensure that living rooms are warm in the coming winter and that e-vehicles are not just reliable when the sun shines?

The central task is keeping the networks stable. But what happens in the medium-voltage network when increased numbers of heat pumps are commissioned? How can local networks remain efficient? Do new cables need to be laid, or can future tasks be solved digitally? How are peak loads covered? And how do you run accurate calculations with the increasing number of flexible consumers?

The load profiles that we develop now must be sustainable later. This requires monitoring the bottlenecks – at the substation level. From the measured data recorded there, we can draw crucial conclusions that can then be individually tailored to very different conditions.

WAGO develops solutions for challenges and problems like these. Our key to any new development lies in our contacts with practitioners and experts. Together, we can find the right answers by regularly exchanging information to the urgent issues of our time.

Heiko Tautor
Head of Industry & Key Account Management for Utilities at WAGO

PLANTING A COMMON FLAG FOR THE ENERGY INDUSTRY OF TOMORROW!

In the face of increasing decentralization and fluctuating power generation, the individual participants in an energy system must be intelligently linked.

Energy generation, distribution, storage and consumption – the energy transition requires interaction between all actors. This is why WAGO has been a reliable partner in the energy industry for many years – with municipal utilities, system operators, system integrators, station builders and industrial customers alike.

Technically and technologically, WAGO is represented in many areas of the energy market by its automation technology, interface electronics and interconnection technology. In addition, our Smart Grid symposium promotes a collegial exchange of ideas – exploiting practical experience for practical applications. Furthermore, our WAGO Solution Provider Program unites project-specific clients and implementation experts.

This is how we can enable the energy transition together!

www.wago.com/smart-grid

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WAGO ENERGY TECH TALK

Expert discussions, the exchange of expert knowledge among practitioners – WAGO facilitates more than just this at the Smart Grid Symposium. Information, suggestions and background information on current topics related to the energy transition are also available every day: the WAGO Energy Tech Talk is available online and covers a wide range of topics.

The host is Heiko Tautor, Head of International Key Account at WAGO. Together with client partners, colleagues and experts, he explores the technical and technological challenges and approaches to their solutions.

LISTEN NOW OR TAKE A LOOK!

E-Mobility: Managing Charging Infrastructure
A conversation with Markus Große Gorgemann, Operational Manager for Load Management, Energy Manager, Münster
"Anxiety about travel distances in charging management can also be minimized given the growth in charging infrastructure."

Connection Technology for the Energy Sector
A conversation with Matthias Giese, WAGO Industry Management Device Connection Technologies
"Communication using secure, convenient connection technology is quite often underrated in power engineering."

Cybersecurity in the Energy Grid
A conversation with Steffen Nicolai, safety researcher, Fraunhofer Institute for Applied Systems Technology, Ilmenau, and Head of the Learning Lab for Cyber Security for Energy and Water Supply
"With all the technology, human actors remain the primary gateway for cyber attacks."

Smart Building – Smart Energy
A conversation with Daniel Wehmeier, Head of Building Technologies Industrial Management at WAGO
"Complexity in buildings is increasing so rapidly that it can only be solved by efficient engineering."

Heiko Tautor and Lukas Dökel discuss energy and load management in the industrial sector in our studio.

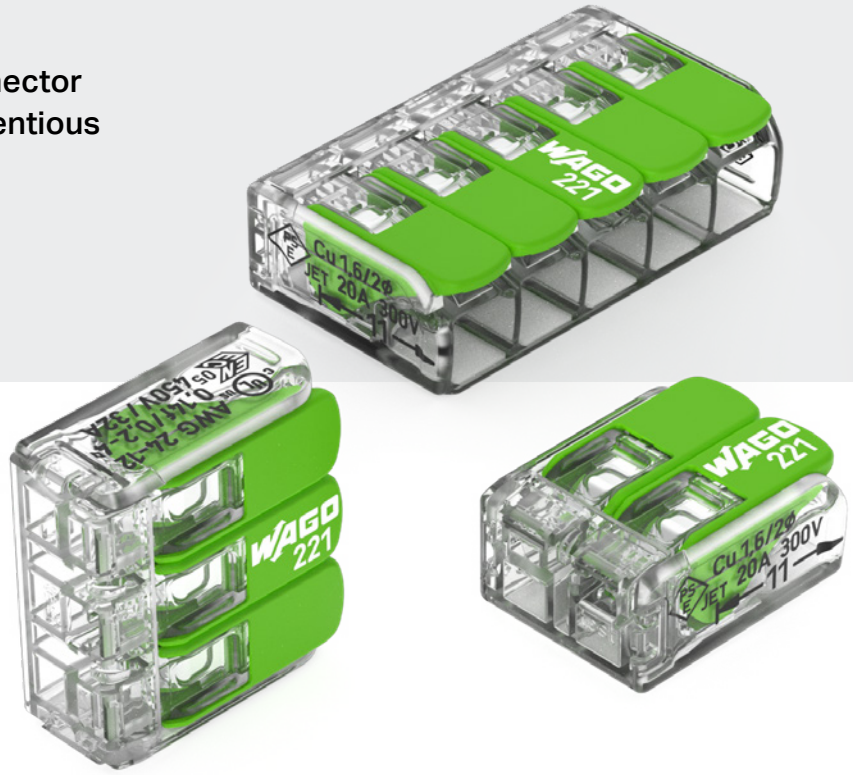
Digitalization of Substations
A conversation with Marco Genehr, planner and project designer at Ingenieurbüro Pfeffer, Rödermark; Smart Grid Lab
"We need intelligent substations to avoid overloading the low-voltage networks on the path to the energy transition."

Energy and Load Management in Industry
A conversation with Lukas Dökel, Head of Industry and Key Account Management Digital Plant at WAGO
"Climate neutrality in industrial companies? Proprietary systems are slowing down the energy transition."

Power Plant Controllers: Network Congestion Management
A conversation with Jens-Peter Schmidt, CEO JPs Project GmbH
"The Medium Voltage Directive has standardized everything a little bit – however, significant differences still remain."

SUSTAINABILITY BEGINS ON A SMALL SCALE

WAGO Green Range Splicing Connector with Levers signals a more conscientious use of resources.



Nothing is too small to contribute positively to our environment; after all, sustainability need not be obvious. Instead, it can be a small product frequently found in large numbers in buildings and devices: splicing connectors. We began here with these small connectors, and took things a step further: the WAGO Green Range Splicing Connector with Levers is a splicing connector manufactured partly from recycled plastics and bio-based waste material. We are sending a clear sign of our commitment to greater sustainability and more conscientious use of resources.

But what lies behind it? The lever for the WAGO Green Range Splicing Connector with Levers is made of polybutylene terephthalate – PBT for short. The PBT used is produced from at least 27 % post-consumer recycled materials. This is the recycled waste that our own consumption generates. In the case of the Green Range, we use PET bottles.

Up to 77% of the housing's mass-balanced weight is produced from biological waste, which is processed into high-quality polycarbonate (PC) using clever technical processes, reducing the use of fossil resources. The 77% of the plastic in the housing is not only bio-based, but is also bio-circular. Such materials are biological and are removed from existing waste streams and recycled. Specifically, tall oil, used grease, and residues from producing cooking oils are collected from industrial and residential sources and reused. Up to 87% CO_2 is saved by using the biocircular raw materials.

Safety and quality are particularly important for electrical components. The splicing connector with the green levers has the same high quality as its orange sibling. Both have the same technical properties and certifications. Copper and spring steel are also identical for both connectors.

A Connector for Projects with Sustainability Requirements

We have developed the Green Range for applications in which greater sustainability is required. These can include stricter regulations enacted by legislators, more sustainable products, and also special customer requests. By developing this connector, we can now offer a way to meet these requirements. However, it is not intended to replace the familiar splicing connector with levers from the 221 Series. We see the WAGO Green Range Splicing Connector with Levers as an option for anyone who wants to produce or construct more sustainably – whether they are electrical installers, building technicians or device manufacturers. And we do not exempt ourselves from this: as a manufacturing company, we require resources and energy to produce and operate our products. This presents us with great challenges for the future. Which makes it all the more important for us to contribute to overcoming these challenges.

We have strategically anchored environmental and social sustainability in our corporate structure and developed a sustainability program. Every entrepreneurial decision is evaluated in conjunction with the sustainability program, and the entire supply chain is considered. For us, every step in the right direction on the path to more sustainable action is important: none is too small or insignificant!

Additional information about WAGO Green Range Splicing Connector with Levers can be found here:

TRADE SHOWS AND EVENTS 2023

BDEW KONGRESS 2023

"WE SECURE ENERGY!"

June 13th to 15th, Berlin

Moderated by the BDEW area managers Benjamin Düvel and Gunnar Wreder, the three-day BDEW congress focused on, among other things, "system stability through the use of storage devices." As Vice-President of the Business Unit *SOLUTIONS* At WAGO, Ulrich Hempen also made interesting contributions. Other speakers included: Dr. Jens Kranacher, Head of Asset Control, DEW 21; Professor Dr. Hochen Kreusel, Global Head of Market Innovation at Hitachi; Boris Langerbein, Chief Innovation Officer, Intilion; and Dr. Martin Schleufen, Head of System Development at Amprion.

Hitachi Energy and WAGO partnered for this topic.

INDUSTRIAL TRANSFORMATION – MAKING THE DIFFERENCE:

THE PATH TOWARD SUSTAINABLE CONTACTS

Hanover Messe: Industrial Technology Trade Show

April 17th to 21st, 2023

At this year's Hanover Messe for Industry, around 4,000 companies from mechanical engineering, the electrical and digital industries and the energy sector presented technologies and solutions for a networked and climate-neutral industrial future.

WAGO was there with an upgrade: a Sustainability Path to try out and discover! Visitors to WAGO's booth could interactively learn about sustainability at six stations. WAGO, in cooperation with the Protective Association for the German Forest [Schutzgemeinschaft Deutscher Wald e.V.], planted a tree for each person who "walked" the path.

"Roboy" proved to be a highlight with visitors. WAGO components are installed in this research project at the Technical University of Munich. People remotely control this avatar via virtual reality (VR) and artificial intelligence (AI). At the Hanover Messe, he hugged visitors when welcoming them to the WAGO booth. A donation was made for each hug to Fruchtalarm gGmbH, a project that makes life a bit more colorful for children diagnosed with cancer.

The E-world trade show in Essen, from May 23rd to the 25th, is Europe's largest energy trade fair, similar in scope to the Smarter E in Munich, Europe's largest platform for the energy industry, which occurred from June 19th to the 21st. There were exhibitions and events at each of the trade shows, including opportunities to talk with WAGO experts, exchange ideas about current and individual challenges, and propose possible solutions.

E-world energy & water

THE smarter EUROPE

THE FOCUS OF ATTENTION:

HOW DO MUNICIPAL UTILITIES REMAIN EFFICIENT?

Handelsblatt Jahrestagung Stadtwerke 2023, Berlin

25. April, 15th and 26th, 2023

Handelsblatt Jahrestagung Stadtwerke 2023

In times of crisis, municipal utilities must remain effective, as they are important players in climate protection and the energy transition. The event's goal was to outline feasible paths into the future, seek freedom from dependencies as quickly as possible, and make the investments necessary for crisis response.
For municipal utilities, this means being very close to their customers in the near term. How this can succeed and how the municipal utility landscape will change was discussed at the 2023 Handelsblatt annual meeting for municipal utilities.

The challenges related to decarbonization were also discussed within the framework of various approaches to the topics. Dr. Heiner Lang, CEO of WAGO; Felix Banaszak, Member of the German Bundestag, Economic and Budgetary Committee – Alliance 90/The Greens; Dr. Kerstin Busch, CEO of the Berlin municipal utilities; and Thomas Kästner, CEO of municipal utilities in Schweinfurt spoke about the responsibilities that accrue to regional suppliers in industrial centers.

HAJ: HIT THE GROUND RUNNING IN A FULLY CHARGED E-VEHICLE

EXPANSION OF CHARGING INFRASTRUCTURE AT HANOVER AIRPORT BOOSTS E-MOBILITY.

The capital of Lower Saxony, Hanover, is making the switch to e-mobility easy. It occupies a leading position among major German cities in expanding public charging infrastructure.

A strategy paper, adopted by the city in 2018, provided the impetus. Together with the local energy service provider, enercity AG, the city of Hanover has been implementing ambitious plans for climate-friendly mobility. The first goal was reached in 2022; however, the expansion continues. And not just in the inner city area.

Since the beginning of the year, enercity has been building publicly accessible charging infrastructure at Hanover Airport. "HAJ" is the airport code for the eighth largest airport in Germany. Around four million passengers passed through the airport this past year. Business travelers are among the many who start their journey here. "And aside from those taking brief vacations, business passengers are our core target in the first expansion step," says Constantin Reese, Head of Technology for Electric Mobility at enercity. The reason? The usage profile is clearly outlined: these customer groups are usually traveling for a short period of time. They often park close to the terminal for an average of only one to two days.

The tremendous growth of electromobility has been a catalyst for cross-asset load management solutions in the energy transition. WAGO products help ensure flexible balancing of generation, storage and consumption of renewable energy with reliable supplies.

This time is then available for the charging process. “This makes planning easier,” explains Reese when discussing the total power required for charging. “At the airport, this can be designed as a lower than usual rate, based on the predictable, longer parking times, compared with other publicly accessible charging stations.”

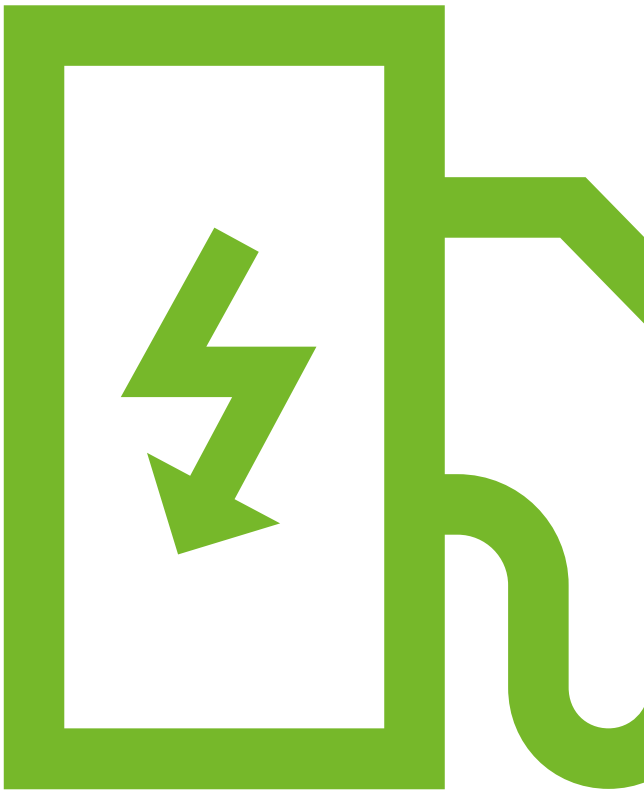
The first construction phase at Hanover Airport included 16 AC charging stations with two charging points each. In order to sensibly distribute the available capacities among the individual charging points, enercity relies on dynamic load management from WAGO. A WAGO Compact Controller 100 (CC 100) is the core and incorporates dynamic load management as a Docker® container. A Linux®-based controller, the CC 100 supports diverse programming languages – just like the rest of the WAGO PFC family – making it ideal for applications like a gradually growing charging park.

In addition to the controller, WAGO provided additional hardware and support for the charging park at Hanover Airport – a project that has proven quite unique even for the electrical engineering professionals at WAGO. “enercity had previously worked with a proprietary charging management system,” reports Nils Roth, Senior Area Sales Manager for Industry at WAGO. The energy supplier has extensive experience in building charging infrastructure in Lower Saxony and brought much of its expertise to the project. The WAGO system, whose open communication is suitable for versatile connection options, not only satisfies the most current technical requirements, it also offers future-proof expansion options. For the flagship project at the airport, they pulled out all the stops to plan a custom solution – a win-win for both companies.

The version of the WAGO Load Management application installed at the airport is branded as an enercity exclusive.

Although provided with the enercity look and logo, proven WAGO components provide the functionality. These were commissioned with WAGO support over a few weeks. However, that which sounds easy must be well prepared. “The first commissioning of a charging park takes some time, depending on its size,” Roth says in describing the process. “When integrating a charging station, we check for proper communication. If something doesn’t match the manufacturer’s data, we need to clarify it. As soon as everything is operational, we can run through the charging cycle live with an e-vehicle. At this point, errors that occur during the charging process can still be resolved in a relaxed manner.” As soon as a first charging point is successfully integrated, the rest can usually also be integrated via copy and paste.

Special security aspects must be taken into account, especially in critical infrastructure, such as those at an airport. “In addition, reliability of the supply must be ensured and the network must remain stable. Load management that runs smoothly and complies with all aspects of cybersecurity is extremely important here – also with a view toward further expansion.” A total of 72 charging points are planned at the Hanover Airport. Of these, 64 AC charging points will be distributed across two parking garages close to the terminals. There will also be eight fast charging points outside with charging capacities up to 200 and 400 kW. The energy required for several hundred kilometers of travel can be charged up within a quarter of an hour. “Anyone can use this: when dropping off or picking up passengers, for personal, business or taxi use.” It all has to function, and do so smoothly and seamlessly. Park in a free space, plug in the car, fly away, come back and drive with a charged vehicle – perhaps into the Hanover city center, the capital of e-mobility.



TRANSPARENT SUBSTATIONS

For the precise expansion of its grid, the Buchs electric and water utility company (EW Buchs) records the currents at its transformer stations' individual outlets. It uses the IEC 60870-5-104 telecontrol protocol of the PFC200 Controller, which it parameterized specifically for this task via the Grid Gateway solution.

Due to the constantly increasing proportion of renewable energies, the demands placed on the low-voltage networks are likewise growing. These are no longer just responsible for receiving and distributing the current from the medium-voltage level, they also must handle the feedback of electricity from decentralized generation. Innovations in network control systems, as well as modern regulation and control technology, are intended to solve these additional challenges to minimize the time- and capital-intensive expansion of the physical infrastructure. In an ideal case, it may even be avoided. However, this requires reliable and dependable data in order to precisely determine the network load.

"IT'S EASIER TO ENTER PARAMETERS THAN TO WRITE CODE."

Donat Vetsch, EW Buchs

Expanding a network is expensive and time-consuming – and can often be avoided by digitizing the transformer stations.

Parameterization has many advantages. It generally eliminates the need for time-consuming on-site use.

The electrical utility and waterworks in the town of Buchs (EW Buchs) is also aware of this. "So far, we've only measured the medium-voltage and transformer output at the low-voltage level," says Donat Vetsch. Because this is not enough data to allow reliable grid planning, the energy service provider now also records data from the outlets in its transformer stations. This allows them to precisely determine the current flow in their network, down to the individual distribution box.

Parameterization Is Easier Than Programming

To keep the acquisition costs for this data low, EW Buchs has automated as much of the process as possible. The telecontrol protocol in the PFC200 Controller plays an important and decisive role in this. This system meets the requirements of IEC 60870-5-104 and quickly and reliably transfers the transformer stations' current, voltage and power values to the control system via fiber optic cable or radio modem. There they are visualized on a monitor and, besides aiding grid monitoring, provide a basis for decisions about optimizing or further expanding the grid.

Donat Vetsch was initially supposed to write the corresponding program himself; however, the Grid Gateway solution came on the market precisely at this point. "Although we have programming experience, this approach is much easier," says the technician for system and network operation at EW Buchs. He adds, "It is significantly easier to enter parameters into a system than to write a complex code." He also considers this approach to be future-proof since there will be no problem handing the system over at a later date to employees who lack programming knowledge.

Real-Time Transformer Monitoring

EW Buchs would like to continuously record the low-voltage measured values in additional transformer stations automatically. In a further expansion step, the PFC200 Controller will record and monitor transformer temperature values. EW Buchs would also like use the controller to transmit various binary signals, such as error messages from ventilation or UPS systems, to the control system.

THE WAGO ENERGY WORKSHOP

PRACTICAL AND SOLUTION-ORIENTED COMMUNICATION PLATFORM FOR NETWORK OPERATORS

Only a fraction of a second and the city's streets lie in darkness. The last lightning bolt has struck home, and interrupted the entire electrical supply. But this time it's more than just an disruption: this time threatens to leave thousands of customers without electricity over a longer period. "In this situation, colleagues from the neighboring municipal utility came to our aid." Christian Schubert describes the two teams, whom he had only met a few days earlier in the WAGO Energy Workshop. "In an emergency situation, they united and solved the problem together. Unconventional, but decisively faster."

One of the goals of the WAGO Energy Workshop is to help people help themselves. "Our original motivation was to offer colleagues in municipal utilities a communication opportunity, in which they get to know each other, train together and exchange ideas, so that, in the best case, they can facilitate solutions through collegial advice." The cited example provides the best proof for how well this works in real life.

"We have already completed the proof-of-concept phase," says Schubert, who recalls the first two years of the energy workshop. WAGO's Business Development Manager in Energy had set the topic of "continuing education for practitioners" in motion, before Corona brought everything to a standstill from one day to the next: no more trade shows, no more training, limited sales, no in person exchanges. "Fortunately, we had already gotten far enough with the development of the Energy Workshop that we could quickly set it up as an online communication tool." Despite the Corona virus, the energy market continued to develop at an undiminished speed. Redispatch 2.0 raised many questions. New products and updated components were brought to market, and existing functions were expanded. "It became particularly clear during this phase that those who work 24/7 to maintain a functioning network need continuing education, and also informational exchanges with other practitioners as equals."

With its collegial approach, the WAGO Energy Workshop has become a key format in the industry. All appointments now take place in person. The concept developed for this has been successful: small groups "with fewer than 20 participants when possible", who come from three to a maximum of five public utilities. A WAGO expert moderates the day's event. The topics are hands-on and are sourced from actual topics in the daily workload. "We maintain close contact with our participants to ensure that the program is as tailored as possible."
Current information from the energy sector, for example, related to the Buildings Energy Act (GEG), applications in critical infrastructure, security requirements in IT security manage-

Practitioners meet here: Christian Schubert (r.) with the participants of one of the past Energy Workshop events

ment, and explanations about audits and the certification processes, are also discussed. This includes Redispatch 2.0, which has been integrated into the energy industry as a fixed thematic module. "We actively promote information exchanges about connecting renewable energy systems to the distribution network. A collegial and professionally supervised exchange of information is particularly valuable here. People exchange ideas about problems, learning first-hand what others have done and what they need to pay attention to. We at WAGO also draw conclusions from this for our product development: What solutions are people seeking from us?" Specific questions can be answered directly and specifically in the Energy Workshops. An outside expert is always available as a speaker. "Colleagues from the WAGO business unit *SOLUTIONS*. Energy Management Made Easy! also share their expertise", comments Schubert. "They discuss, for example, regulatory processes or technical requirements during development."

The one-day event has always prepared a specific highlight. This can be the venue for the conference: "Last time, we were guests at the Vinci Digital Smithy in Frankfurt." They are also concerned with the digital transformation in a way that is similar to municipal utilities. "A lot is currently focused on optimizing one's own work processes," reports Schubert, "and on developing standards that can't just be read from the regulatory guidelines." At the end of the process, the discussions move on to issues like how to ensure a functional charging infrastructure or the

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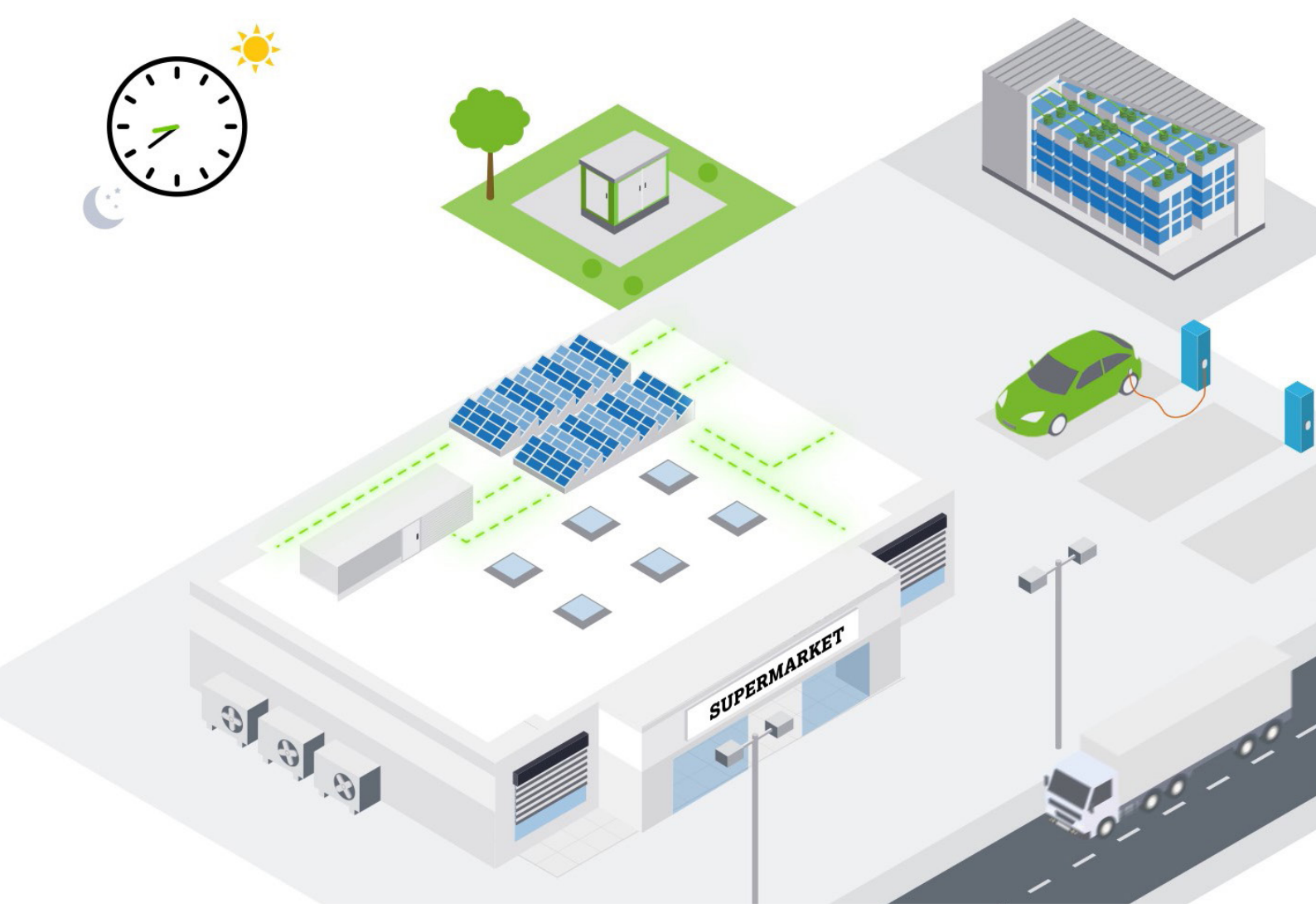
The Energy Workshop also provides opportunities to tackle challenging topics.

heating of swimming pools. This still leaves the topics that have recently been imposed by the political climate. "Even though the specific uncertainty has passed, increased attention has remained focused on the risks and the issues that need to be addressed."
Based on the many positive experiences with the Energy Workshop, the format will be expanded in the future. All WAGO sales offices – except for Baden-Württemberg and Hessen, where the Workshop was initiated – will be integrated into the project. There is still a lot to do because the requirements and regulations differ between federal states.

At the same time, the format needs to be expanded. "We are no longer focusing solely on municipal utilities. We also want to provide more intensive support for electrical professionals – that is, electrical engineers, station designers, integrators, energy managers, and last but not least, the skilled trades." In Christian Schubert's experience, a lot of practical work is worthy of explanation. "We receive specific questions daily from companies involved in implementation, who don't know what to do, who have never done certain things, and who need guidance." In addition, experience shows that skilled tradespeople often lack the time to calmly think through challenging new topics. Exchanging ideas among professional colleagues, as is possible at the WAGO Energy Workshop 1:1, can offer specific assistance.

"Regardless of our format for the Energy Workshop, we want to remain close to the clients. We will disseminate our knowledge where it is needed and where it can be used every day." As a manager, he knows what he is talking about. He is also a practitioner with more than ten years of experience in the energy industry. He understands that those at the bottom are subject to the most daily pressure. "You can expect WAGO to look outside of the box. With our Energy Workshop, we are trying to engage in information exchanges away from the computer."



THE FASTER PATH TO THE CHARGING PARK

The Grid Booster accelerates processes for more e-mobility.

The continuing growth of e-mobility is a decisive factor in slowing CO_2 emissions. The basic prerequisite for this is an existing charging infrastructure that covers as much territory as possible. Electrical charging should then be as natural as filling up with petrol or diesel. Generous incentive programs have been established at the EU, federal and state levels to achieve this premise. By the end of 2025, charging points up to 22 kWh will be funded, as will fast charging points with a charging capacity above 22 kWh. These subsidies apply to the construction of new charging parks and the expansion and upgrading of existing ones.

The distribution network operators should be the first point of contact for anyone who wants to construct publicly accessible charging infrastructure. The former will check the connected load and compare the values. What is the present regular consumption? And how much power is required for the charging infrastructure? An inquiry is then issued as to whether the upstream network can provide the required power.

In general, however, the mains connection must be increased. This often requires replacing the cables and the actual junction box. Depending on the circumstances, an existing customer transfer station may need to be expanded or updated. This is work that must be considered as a significant cost factor – long before the first person who wants to charge their EV can even use the new charging station. However, this waiting period associated with the development should not slow down the future operator's interest in innovation.

The path to your own charging station can be shortened. By using the Grid Booster, your capability of charging in a dimension X, even with a smaller grid connection point, can be achieved faster. A battery storage system helps to sustainably expand existing capacities. Either by drawing – in the best case, renewable – electricity directly from the grid and storing it in the battery system, or by integrating a PV system into the energy concept to use up to 100% renewable energy for charging the e-vehicles in a very targeted way. The Grid Booster is dynamic equipment that can simultaneously supply and discharge current. On a sunny day, the PV system fills the storage while an e-vehicle is charging on the other side.

In addition, a network connection point can be upgraded and configured to be "intelligent." Dynamic load management is established through appropriate technical support. This means that it includes the battery storage in its continuous measurements while taking the fluctuating charging capacity into account, and ensures that the fuses are not overloaded at any time. This state of charge (SOC) is one of the most important parameters of dynamic load management.

The WAGO Application Load Management optionally visualizes the function of the Grid Booster through graphs. If the dynamic load management is relevant for the network operator, the visualization can be expanded toward the customer's transfer station (CTS). If a grid connection from the medium voltage is required, the load management solutions must comply with the grid operator's technical connection requirements (TCR). As a rule, operators can then access the data from the CTS via a telecontrol gateway.

In the future, battery storage systems will offer interesting options in energy services. When the storage system is charged, but the energy is not being used at the moment, it can assist in compensating for dynamic fluctuations in the grid as these increase. In this case, the balancing energy provider could use the storage as a Grid Booster for the upstream distribution network.
In industrial environments, battery storage systems help minimize peak loads, so-called "peak shaving." When unpredictable load peaks occur, they are directly reflected in increased electricity costs because they increase network charges. Dynamic load management reacts quickly enough to prevent the resulting expensive peak loads in the customer network. Saved energy would be supplied in time to cushion spikes in consumption.
Wherever there is a temporarily high energy demand, battery storage systems can provide the necessary buffers. For example, batteries at charging stations can help with the constantly increasing number of electrically powered buses and trucks, particularly since the federal government is currently promoting their use with an 80% subsidy. In the future, a comparatively high charging capacity will have to be maintained within predetermined periods. Future charging hubs on the 110 kV network, for example, on highways, will also need to be supplied with sufficient energy.

WAGO represents a single-source provider that offers planning and implementation of the automation and control cabinets required for all of these applications – while also accounting for grid operator requirements.

Grid Booster for the Energy Transition

In the summer of 2022, WAGO and Intilion introduced the "Grid Booster," a jointly developed concept. The intelligent load management works by incorporating battery storage systems to prevent bottlenecks in the network caused by e-vehicle charging. The Grid Booster closes a gap between demand and presently available charging capacity. Excess energy is buffered in battery storage units and discharged to e-vehicles at charging stations or for internal consumption as needed. The WAGO Energy Management controls the energy flows and prevents network overloading through optimal use of the total available energy.

A COMPLETE SOLUTION FOR DIGITAL SUBSTATIONS

WAGO APPLICATION GRID GATEWAY

WAGO Application Grid Gateway offers transparency in the network. This solution, which consists of hardware and software components, supports the digitalization of substations. As a cornerstone of the energy transition, it improves network management and operation – last but not least, it can reduce costs, as grid expansions may no longer be needed. In addition, digitalization of the local substations is the only way to achieve the efficiency gains required by the regulations.

It is here, at the transfer points from the medium to the low voltage, that crucial parameters arise, which should be recorded continuously by exact measurements. However, this is particularly challenging in low-voltage applications. The deeper you go into the measurements, the more demanding they become. The reason for this is the amount of measurement data that must be recorded and evaluated in the shortest possible time – in addition, the degree of accuracy required makes the task into a high-performance art.

The WAGO Application Grid Gateway and Power Quality measuring device from a-eberle GmbH & Co. KG function together to offer all the possibilities needed for high-quality network management, in which analysis and reporting are the focus. The a-eberle measuring device measures the voltage at intervals of 10 milliseconds, at deviations with an accuracy of 0.1%. All measurements are synchronized for data collection and provided with a time stamp.

These components can monitor and register specific reference qualities or quality agreements between the energy supplier and the customer and provide them for evaluation or storage. A report regarding current carrying capacity can be generated on the basis of this data. Proof of voltage quality is provided per EN DIN 50160:2022.

The network information is transmitted directly to the control center per IEC 60870-5-104. The WAGO I/O System in the station records the measured values – from voltage and current to active and reactive power. In conjunction with the Power Quality measurement unit, the I/O system evaluates the long-term voltage and identifies faults.
It contains ground fault and short

circuit indicators. Switch positions are monitored. Faulty tripping of circuit breakers or power switches is recognized. In addition, it is possible to subsequently check, in a systematic way, as to whether the system reacted correctly to a problem. The low-voltage data from the Power Quality meter is stored in a central database, where it is available for targeted remote control.

WAGO Application Grid Gateway is commissioned via simple parameterization. The software is based on broad market knowledge, including customer projects from the past ten years. Transparent data acquisition is possible for up to two substations, each with 15 low-voltage outputs.

The measurement technology required to make the low-voltage network transparent at the substation's transformer output can be easily retrofitted to existing outputs. In the case of new construction, a suitable system or partial solution is compiled according to individual requirements.

WAGO components light up the Headwaters Center in Winter Park, Colorado.

SMALL – YET POWERFUL!

USING WAGO COMPONENTS TO ACHIEVE A FUNCTIONING MICROGRID

Application Example: Headwaters Center, Colorado, USA

Anyone who hears the term microgrid for the first time probably simply thinks about a small grid – an energy grid, self-contained, but significantly smaller than usual. And possibly in a system far away from the main power grid, far enough that an efficient and continuous power supply can't be guaranteed there.

However, for system planners and developers in the energy industry, defining a microgrid is far more complex and raises additional questions: Why is a microgrid needed at a specific location? What types of energy – sun, wind – are collected there? How is this energy stored? How is it controlled and managed? Innovative engineers develop microgrids, based on numerous details, that ensure stability, reliability, flexibility and efficiency at a wide variety of locations. Companies like Ageto Energy can solve these challenges, and they also offer the added value expected from microgrid solutions.

When it comes to renewable energies, Ageto Energy always comes back to one word, "simple." Working toward their corporate goal – to accelerate the global adoption of renewable energy – they simplify the integration and control of off-grid, microgrid power systems. Ageto En-

ergy thereby reduces complexity and integrates energy supply systems to enable future growth with low carbon emissions. This is achieved by coordinating the individual components of a microgrid and integrating them into consolidated systems. It all comes down to the Ageto ARC microgrid controller. It allows users to monitor and manage energy resources, ensuring that every consumer receives the power that they need.

The ARC microgrid controller is described as "the brain of your microgrid system, which seamlessly integrates, optimizes and manages various energy resources." This intuitive, user-friendly interface provides system operators with complete transparency concerning their system, energy resources, performance and status data. In order to offer customers reliable product performance, especially for off-grid systems, Ageto Energy had to ensure that the individual components in the ARC controller system also satisfied their requirements. "Our controller has been designed to work continuously for years without downtime. Therefore, we were looking for components that were just as dependable," says Ageto COO Mike Murray, "We were searching for products that were reliable and met our requirements, without being too complicated themselves."

To meet these requirements, Ageto Energy sought parts that would keep the design of its ARC controller as simple as possible. While the company was initially looking for rail-mount terminal blocks, Murray and his team soon found a company that provided both the connectivity they needed and produced the programmable logic controllers (PLCs) that the ARC controller required for communication. WAGO, known for its CAGE CLAMP® spring pressure clamping technology and a comprehensive portfolio of automation solutions, provided Ageto Energy with the desired flexibility and performance.

The WAGO solution proposed a bridge between an existing battery storage system that uses a CAN (Controller Area Network) communication protocol. However, the Ageto control system requires a Modbus TCP/IP input. WAGO provided a simple, scalable PLC that included

"WE SEARCHED FOR RELIABLE COMPONENTS FOR A RELIABLE PRODUCT."

Mike Murray, Ageto CEO

a CAN Master module and Modbus TCP port for communication with the ARC control panel. This architecture allowed Ageto to monitor the battery requirements (in terms of voltage, charge and temperature), and also program a small routine to actually control the battery storage system. This system functions as a control interface between Ageto and the on-site storage system.

According to Jim Ratcliffe, Regional Sales Manager at WAGO, "the Ageto system is based on a model that enables energy resource independence and at the same time offers customers multiple integration options for using several local resources." WAGO understood exactly what was needed and supplied Ageto Energy with a series of suitable test products. "Ageto was looking for a CAN solution that could communicate with its own control platform when remotely installed in an existing battery storage system," explains Ratcliffe.

After evaluating the tests, Murray knew that WAGO was the company Ageto Energy wanted to work with. "Support in both sales and technology confirmed my trust in WAGO," he says. To adapt its ARC microgrid controller, Ageto Energy uses WAGO rail-mount terminal blocks, a CAN-based PLC, and the 221 Series Splicing Connectors. They also use these products in their battery management system to monitor temperature and obtain data about the storage system.

The ARC microgrid controller from Ageto Energy can be found at locations like the Headwaters Center in

Ageto also controls the system in the Headwaters Center using a clearly organized user interface like this one.

WAGO Sales and Technology USA developed a highly tailored solution for the project in the Headwaters Center.

Winter Park, Colorado, USA. Colorado's first off-grid event venue hosts weddings, concerts, and educational events. The majority of the energy used in this Civil War-era facility comes from the sun. This energy is stored on-site in batteries and provided directly to the Headwaters Center as the power supply.

The ARC microgrid controller from Ageto operates under the most demanding conditions and offers Headwaters and other customers the assurance that they can obtain reliable and stable energy from an independent source. The unique interface, power monitoring and real-time control of the leading microgrid solutions, as Ageto Energy expresses it, remains, above all, one word: "simple."

CORNERSTONE OF THE ENERGY TRANSITION

AUTOMATION FOR MODULAR GENERATION OF HYDROGEN

Hydrogen will play an important role as an energy storage system in the sustainable energy landscape of the future. The collaboration between WAGO and FEST demonstrates how production can already succeed with the help of modular concepts and the interplay of sophisticated automation technology.

Electric vehicles, heat or hot water generation: wind and sun now drive more electrons through electrical conductors – without detours, directly from the generator to the consumer. Indeed, it seems that the future of energy supply can't manage without molecules. Energy must be stored. Some consumers are also thirsty for more energy in the tank than, for example, batteries currently offer. As the central ingredient in the energy cocktail of the future, the smallest molecule floats right through that drink: hydrogen. Produced with excess electricity generated from renewable sources, it forms both a potent energy storage system, and also an alternative energy supply for aviation, long-distance, heavy-duty and marine traffic.

However, as convincing as the concepts appear on paper, there are still questions about the origin of green hydrogen. One solution lies right outside your door: electrolyzers display all of their benefits near wind farms or solar parks. Instead of throttling wind turbines or removing solar cells from the grid in the event of an oversupply, the green current that is not being drawn off can be used to split water into oxygen and hydrogen. FEST, headquartered in Goslar, offers these systems. The company, which belongs to the SCHMIDT KRANZ GROUP, designs, develops, builds and installs individual hydrogen-electrolysis plants and supply systems for Power-to-X applications. These systems are not continuously monitored on site due to their size – a concept that only works if the engineering, system technology and automation work together perfectly.

Standardized Containers

"We work using largely standardized containers with a nominal output of two megawatts or more. This allows us to react flexibly to individual user situations," says Christian Perplies. He is the Senior Sales and Business Development Manager for Hydrogen Technology at FEST and has managed renewable energy systems for many years.

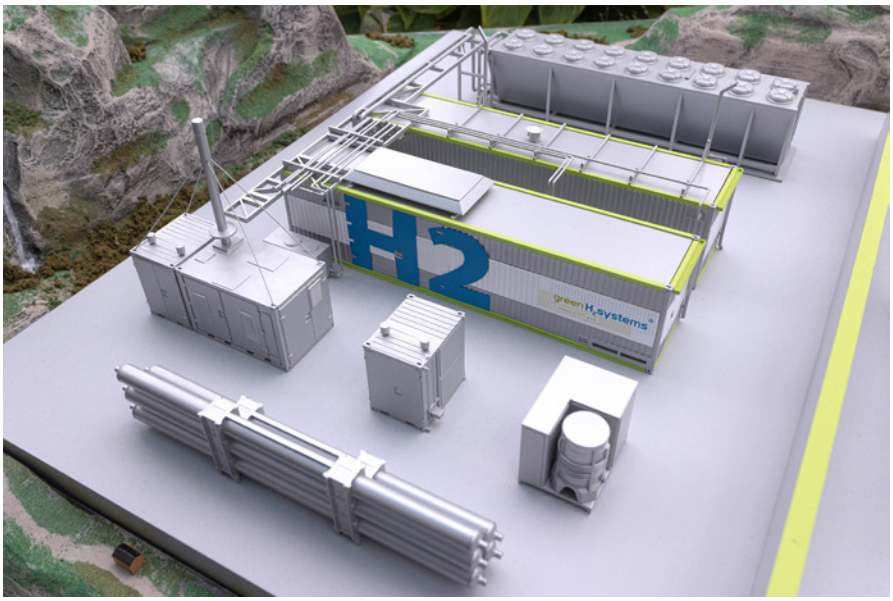
The preliminary work for Perplies lies in business development, i.e., designing the projects and systems with customers. He analyzes the demand side and ensures that the correct mix of customers is available for the hydrogen in consumption scenarios. These can include hydrogen-electric vehicle fleets, reverse-current systems, or smaller consumers of basic chemicals. Appreciative buyers of green hydrogen, and thus long-term partners, can also be found in the metal processing and semiconductor industries.

On the other hand, the energy generation process must be consistent. After all, about 55 kilowatt hours of system power are required to produce one kilogram of hydrogen. It is advantageous in this case if renewable energy is available from different sources. "Optimally, the oversupplies overlap, that is, there are different, inexpensive power sources, which are not available for the electricity market, but can be fed into the electrolysis system," explains Perplies. For profitable operation, utilizing at least 50% of the electrolyzer is crucial to achieve an optimal mixture of utilization and electricity costs. Therefore, battery storage systems are also included in the planning as an additional element for smoothing an energy profile. The system can also use waste heat. "Therefore, we don't limit ourselves but also propose using battery storage systems or heat applications in the planning phase to absorb peaks," he says.

Once these questions have been resolved, Perplies and his team deal with the design of the system itself. Operator tasks, installation areas, safety and logistics requirements, and approval procedures must be clarified and completed before the water can be continuously divided into its constituent parts. "If everything external is satisfied, we simply need to set up our modular systems and put them into operation via plug-and-play," he says, adding, "our aspiration is for our systems to function autonomously." This places high demands on the system, the automation technology used, and its suppliers.

Automation Supports Easy Commissioning

"There would be no acceptance for our systems without reliable, safe, autonomous, easy-to-maintain 'off-the-shelf' systems. Therefore, we're happy to have a partner



The containerized electrolysis system enables a standardized and modular design for system sizes with nominal loads up to 30 MW.

When selecting the right components, WAGO and FEST maintain close and personal communication.

like WAGO, who meets these automation challenges and goes farther: the thorough preparation from assembly to commissioning helps us get extremely close to the plug-and-play ideal," says Perplies.

Perplies also lists specific quality criteria: In addition to the materials and methods used in metal construction, the components – the PEM electrolysis stack, the high-pressure pumps, sensors and the system control and communication technology – must be intrinsically fail-safe. "For each component, we use well-known, established and 'mature' systems that have proven that they work in the past. Ideally, they have already been subjected to a certain evolution to

The WAGO Power Supply Pro 2 is reliable, with overvoltage protection per category OVC II, and ensures safe operation even during overvoltage peaks.

reach the performance level we need." For Perplies, quality is also reflected in the level of support. "My colleagues in electrical design have excellent communication with WAGO regarding the selection of components and securing the supply of these components."

Insight into the System via Remote I/O

Another argument in favor: WAGO supports their approach of using preconfigured components. This saves time during pre-assembly, which is reflected in reduced expenses, more cost-effective systems and higher reliability. Nils Roth, Senior Area Sales Manager for Industry at WAGO, is familiar with this request from many customers. "Our support for rapid commissioning on-site using our remote I/O modules is quite tangible. But our connection technology, our network components and the modular WAGO automation components that are approved for hazardous areas, are also especially suited for this project," he continues. Using the standard IO-Link, the data is routed seamlessly from the sensor and actuator levels to the control level and on to the cloud. Users constantly receive the relevant system monitoring data via dashboards. "This allows us to monitor current flows, pressures and temperatures at certain critical points, and to show that the components are running smoothly, or to report problems as soon as they arise," adds Roth.

"This is exactly what we base our approach on as an integrator: we provide systems that allow the valuable PEM stack to run, to the greatest extent possible at its optimal system parameters, yet within strict limits," says Perplies. He adds, "placing the WAGO components directly in the field is also worth gold because the control cabinet dimensions save space and the entire system appears visually to be very tidy, even though it is a complex system."

The automatic parameterization during commissioning and the self-monitoring functions are also advantageous. "When the system automatically checks whether the expected sensor is connected to the respective port, the time savings are significant," says Perplies with satisfaction.

Ultimately, these comprehensive concepts will help advance the energy transition in Germany and Europe. There is enormous potential here: from component suppliers to system designers to electrical producers and consumers of green hydrogen. "These concepts are like those from a sci-fi story that work together to build a more sustainable economy," says Roth.

Frank Jablonski, freelance journalist mylk+honey, Wurzburg

DETAILED VIEW OF THE DISTRICT HEATING NETWORK

IBC Energie Wasser Chur, a utility company located in Chur, Switzerland, relies on the versatile capabilities of the WAGO PFC200 Controller to optimize its district heating network. The WAGO controller not only transfers data from IBC Chur's heat generators and control devices to the control system, it also simultaneously enters the data into the billing system.

IBC Energie Wasserchur supplies its district heating network from various energy sources in and around Chur. These include a combined heat and power plant, several small wood-fired power plants and a waste incineration plant, whose waste heat warms apartments, offices and shops in Chur.

Although the district heating network consists of diverse energy sources, the managers at IBC Chur had previously had little insight into this. "Previously, we only had the central heating system linked to the control system; we were missing the data from the district heating network," explains Reto Werro. However, according to Werro, the person responsible for the telecontrol systems, it is exactly these values that are required to intervene when regulation is needed and thus optimize the district heating network. The energy supplier set up its own project to provide the necessary transparency.

Working Project Following a Workshop

In defining the project parameters, Reto Werro and his colleagues focused on two points. The first was to read out data and errors directly in the customer's transfer stations and display them on the control system; the second was to provide direct access via the controllers so that they could intervene in new projects as they are added to the district heating network. Controller programming capability was important here for addressing the specific requirements of the different individual heat transfer points.

The PFC200 Controller from WAGO came out on top when evaluating suitable controllers. It not only supports diverse protocols, such as FTP or Modbus RTU/TCP, it can also be individually commissioned. It can be precisely customized to the respective requirements with a parameterizable solution, like the WAGO Grid Gateway application, or by using CODESYS-based application software.
The foundation for the specific programming work was laid at a three-day workshop with WAGO. Werro learned about the controller and its possible uses based on various examples. "We built on this and then developed the program further. We already had a project by the end of the workshop." Two or three phone calls were still required after to solve problems as they came up since he is not a controller expert, but everything was quickly resolved in these discussions.

"THE INTEGRATED WEBSERVER IS WORTH ITS WEIGHT IN GOLD."

Reto Werro, Manager for Telecontrol Systems IBC Chur

Controller Supplies Data to the Control and Billing Systems

In retrospect, Werro considers segmenting the recorded data to be the greatest challenge in this project. While the heat meter data needs to flow into the control and billing systems for optimizing the district heating network, the controller data should only accrue in the control system. This doesn't sound complicated at first; however, it turns out to be tricky in practice – after all, this data comes from one controller, which is why it has to be separated.

However, the stakeholders were also able to solve this challenge, creating the conditions necessary for regulatory intervention in the network. Werro explains why this is necessary, "If the return temperature is too high somewhere, we just close the corresponding valve. In addition, we can trigger forced loads on certain boilers at night and shift the peak load so that the network does not collapse early in the morning when all the boilers are charging." In this case, charging the boiler is a command issued on the secondary side by the customer.

Web Browser Eliminates Expensive Display

Before joining IBC Chur, Reto Werro worked in power plant automation, which is why he is familiar with various control solutions. With the PFC200 Controller, he noticed various possibilities that he had never seen before. In addition to ease of use – "Once you have worked it in, it's relatively easy, and you can implement something quickly." – it is the integrated web server that impressed him. "This is worth its weight in gold," he says, immediately providing the explanation. "We don't need an option for clients to operate or install an expensive display. With the WAGO controller, we now log in via the web browser and simply control our systems that way."
The IBC Chur also uses the telecontrol capability per EN 60870 to optimize and control its district heating network. They also rely on the integrated modem to remotely monitor a provisional transformer or water stations quickly and easily.

The district heating ducts at the headquarters of IBC Chur

THE SIGNS ARE POINTING AT ELECTRICITY

KNOWLEDGE GAINED FROM THE "GREEN CAR POLICY" OPTIMIZES THE WAGO APPLICATION LOAD MANAGEMENT.

"In 2021, we made a fundamental decision at the company," states Dietrich Schlichter, recalling an unequivocal step. Since the introduction of the "Green Car Policy," the fleet manager has been monitoring the conversion of the WAGO company vehicle fleet toward e-mobility. "The project has not yet been completed," he describes the status, "but it emphasizes the priority that sustainability has at WAGO."

Prior to September 2021, the vehicle fleet owned by the energy component manufacturer from East Westphalia mirrored the company car fleet of a perfectly ordinary German company. At that time, the fleet consisted of 230 vehicles – predominantly compact commercial vehicles with diesel engines. Like all new cars, they contributed to substantial CO_2 emissions. In 2021, this was still nearly 80%. WAGO's decision to switch to e-mobility was, and remains, a clear commitment to climate protection. And every new e-vehicle that joins the fleet is a further step towards reducing emissions and moving the focus to environmentally friendly driving.

Today, around two years later, the WAGO company car fleet has grown to 270 vehicles at the three German locations. More than half – currently 145 vehicles – are e-vehicles or plug-in hybrids from a wide variety of classes, sizes and manufacturers. Another 50 fossil fuel burners will be replaced by e-vehicles this year. "The speed of the fleet conversion is determined by the long delivery times for e-vehicles," explains Schlichter, "and also by the remaining lease periods for the diesel-powered vehicles."

WAGO made a relatively early decision in favor of e-mobility. Currently, the national average of electric vehicles in company fleets has yet to top one-third. At WAGO, it's more than 72%. Extensive investments, not only in vehicles but also in infrastructure, created the conditions for this.
As with the design of any other charging park, the conditions on site and the individual expectations regarding the scope of services played a decisive role in the implementation. "The quality of the planning is the most important prerequisite," says Philipp Baumann, Product Manager in the Business Unit *SOLUTIONS* at WAGO, as he describes the first step. Operators must clearly define their requirements, and facility managers must provide their input at this early stage. "There's no single solution that can do everything."

"SUSTAINABILITY HAS PRIORITY AT WAGO."

The WAGO Application Load Management is consciously open-source and offers a wide variety of interoperable interfaces. Columns from around 30 different manufacturers can be linked here.

Instead, WAGO develops details into the standard. This means that, "our specific tasks only arise from the customer-specific requirements for the respective charging park – from adaptation, through connection, up to programming."

The second step: Where does the energy come from? The WAGO campus has a generously designed PV system. The excess of the generated energy flows into the batteries of the e-fleet, among other locations. It is obvious that ensuring grid stability plays a special role, especially in conjunction with industrial production. "The charging infrastructure must run correctly and be well protected. This means that the charging capacity of the infrastructure is dynamically determined, continuously adjusted, and optimized as a function of the total load at the location. This dynamic load management, which works to shave the peak loads, enables integrated energy management." If you want to charge electric vehicles intelligently and sustainably, there is no escaping contin-

Florian Deerberg, Technical Services; Philipp Baumann, Product Manager in the Business Unit *SOLUTIONS* at WAGO; Dietrich Schlichter, Fleet Manager (from left to right)

uous power adjustment and the integration and use of all available capacities. If you want to keep a grip on electricity costs, you must absolutely avoid peak load times – which incur the highest rates. In the future, software could be used to link charging times to the market prices for electricity directly.

"Every measure requires maximum transparency for facility management. They need to see what is happening at all times – for example, via remote access to the parameterization interface." In practical operation, many key values are important for troubleshooting. "This topic is the focus of the cloud app," says Baumann. Errors can already be detected by simply comparing the target and actual currents.
A project run by the WAGO apprentices, to enable communication with the charging infrastructure, was launched at the beginning of 2022. Florian Deerberg, who was training as a mechatronics technician at the time, was involved in developing the communication structure. "The goal was setting up a central, expandable communication structure that would enable access to a theoretically unlimited number of charging stations." The individual application requirements stipulated functional expansions in the system, which "we provided as part of add-ons." Florian Deerberg has now completed his training and, as a team member in Technical Services, continues to develop special functional expansions for the WAGO Application Load Management, for example, to enable facility managers to easily access an overview of the respective system. Ideas extend all the way up to charging prioritization – for vehicles assigned to Sales or Management, for example.

"WAGO Application Load Management is consciously open-source for wallboxes from different manufacturers and is interoperable with its wide variety of interfaces. At present, we can link columns from about 30 different manufacturers into one park, says Philipp Baumann, describing the booth. Charging stations from different manufacturers are also integrated into the WAGO charging park. The 46 charging points charge at 11 and 22 kW – with more in the planning stage – and also include a Hypercharger. "Basically, we can then also charge with direct current," Baumann describes as an aspect relevant for the future.

The construction of the company's own charging park presented many exemplary challenges for the WAGO team. Therefore, we know from our own experience where customer-relevant problems could lurk during the construction of a charging park. "Our primary concern is

the simple setup and fast, uncomplicated commissioning of the WAGO Application Load Management. Therefore, all measures are always accompanied by the necessary support – from additional programming, if necessary, up to commissioning.

At WAGO, the latter also worked well for the users of the company cars. “We have overcome the ‘German anxiety’ of running out of battery charge while on the way to the customer,” confirms Dietrich Schlichter with a wink. Reliable charging management can contribute to this. WAGO will set course for additional expansions of its infrastructure in the coming months.

In the WAGO fleet, more than 72% of the cars are now e-vehicles.

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