

Issue 1 2023



OMICRON Magazine



EMPOWERING WOMEN IN
ELECTRICAL ENGINEERING



DEAR READERS,

Although the new year has already begun, I'd still like to take this opportunity to wish you success in it, and if you ever feel insecure, I hope the quote on the right inspires you.

As you open this issue of the OMICRON Magazine, you may have already noticed our cover story: "OMICRON Energizing Women" is an initiative to promote female electrical engineers in the Middle East and Africa. After its fourth edition, it's clear – what began as a great idea became a huge success. Read the full origin story in the interview with Nadia and Ahmed starting on page 6.

When an exciting genesis story began, we were partners in the "INZELL" project. It's a research project about grid support and system services, supported by an industrial cell with islanding capabilities and renewable energy. The details have been summarized on page 26.

Learn about the importance of an insulating handle and a safety plug for high-voltage tests. Starting on page 18, we've taken a closer look at the new functionality of our ground spikes as part of the CPC 100 and COMPANO 100 grounding test sets.

Partial discharges (PD) are a common indicator of insulation degradation in electrical equipment, including generators and motors. You can read about the MONGEMO system's role in the interview with our Sales Partner from Malaysia, Mohamed Helmy Halim, starting on page 12.

Finally, we have summarized all the news about the German IT security law for you. Read about all three methods for detecting targeted attacks in the second part of our article, starting on page 22.

You can also learn more about the new PTM 5.00 update, which comes with new features for security, cyber security, and an SFRA measurement validation service.

If you have any feedback about this issue, please let me know – I look forward to hearing from you.

Enjoy reading!

Lia Thum

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OMICRON electronics GmbH, Adobe Stock (p. 1), iStock.com (p. 4, 6–14, 31),

MHH Condition Monitoring Sdn. Bhd. (p. 4, 15, 16), Firmengruppe Max Bögl (p. 4, 26–29), MKI (p. 30)

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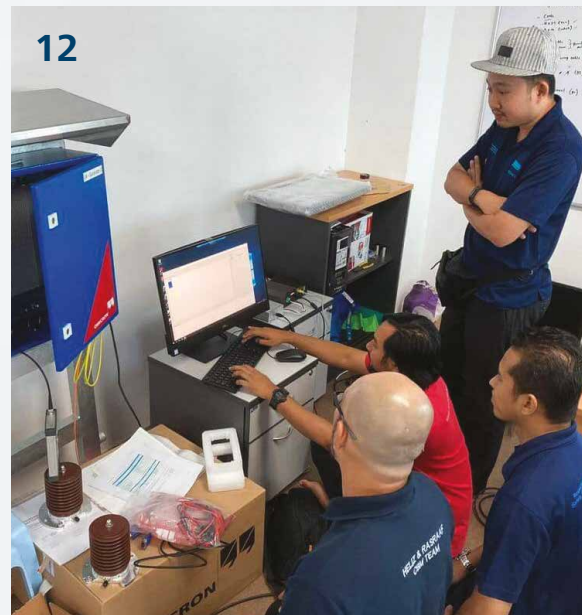
*«You belong, you
can do it, and you
can be the change
you want to see,
**and when it gets
hard, keep going.»***

Eman Hammad

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EMPOWERING WOMEN IN ELECTRICAL ENGINEERING

The success of the OEW initiative



Female Empowerment is about having an opportunity to develop, understanding an individual's challenges, and working together – it needs both women and men. 'OMICRON Energizing Women' (OEW) is an initiative that empowers female electrical engineers in the Middle East and Africa. After the fourth edition, it's clear – what began as a great idea became a huge success.

Sharing experiences, discussing challenges, and learning about different possibilities for women in engineering – that's the premise behind OEW. The first event took place in 2019. "We had a tough time finding participants, and only one woman attended. However, my coach Ahmed and I believed in the idea and decided not to cancel the event. It turned out to be the right decision", Nadia Bouslama,

Regional Marketing Communications Manager, at OMICRON Bahrain, explains. Since then, three more events have taken place, and the idea has become a success story. As of today, nearly 200 women have participated in OEW events. "The first two events were women-only to ensure a safe environment. We knew that certain topics could only be discussed if men were not present. I believe that was one of the main reasons that many women participated in the second event. We had people connecting from hospitals and airports to listen to our exchange, which was very impressive", Nadia describes. Nadia also invited men to the third event, including Ahmed – who participated in the meeting. "Men need to know about the struggles women have when it comes to opportunities. Their help is needed to solve these problems, as men are often in charge." ▶



*«Men need to know about the struggles women have when it comes to opportunities. **Their help is needed to solve these problems, as men are often in charge.**»*

Nadia Bouslama,
Regional Marketing Communications
Manager, OMICRON

«Thank you,
the event was
inspirational
for me.»

Intissar Hattabi, Algeria
OEW participant

«It's eye-opening for
a recent graduate trainee like me
to focus more on acquiring experience
and skills, than simply being focused on
finances. **It motivates me to develop
power engineering even further.**»

Abdulwahab Edun, Nigeria
OEW participant

FOUR YEARS OF OEW

- › Registration: 874 people
- › Attendance: 190 people (on site)
- › Speakers: 9 speakers,
6 female and 3 male

*"I'm an electrical engineer
from Kenya who is very passionate about
providing productive electrical solutions that use renewable
energy technologies for disadvantaged communities in East Africa.
These solutions enable their communities to develop sustainably. We face
challenges as women in the engineering field, and OEW allows us to share our
experiences and learn how others have handled them to succeed. I believe men
have an important role too, because they know how to get things done. By supporting
female electrical engineers, they foster inclusive participation and promote a
diversity of talent in their departments. My advice for other female electrical
engineers: See any challenges you face as stepping stones towards your
personal and career development and never stop learning."*

Mercy Chelangat K, Business and
Fund Development Director, IEEE Smart Village
OEW speaker



Supporting daily life is helpful

The event's fourth edition in 2022 included an additional workshop, where three female engineers talked about their challenges while three other women moderated. "We talked about how we can empower other female electrical engineers in our daily lives.

Sometimes a little support, like picking up the kids, goes a long way", Nadia explains. "We had productive discussions during the workshop, and the results have been shared with everyone."

Change takes time

Ahmed El-Hamaky, Regional Manager, at OMICRON Bahrain, was one of the male participants at the event. "To be honest, I didn't feel welcome at the beginning, but I knew we had to find a way to make electrical engineering more appealing to women. When I graduated over 20 years ago, there was only one woman in my graduating class. I feel fortunate that Nadia joined our team four years ago because she has experience empowering women in the Middle East. The idea for an event came up through the stories we shared with each other", Ahmed remembers.

«It's a good platform for learning that the challenges I face as a female engineer are universal.»

Evelyn Mutula, Kenya
OEW participant

"There's a significant gender imbalance in our industry, and as part of this industry, it's up to us to discuss and address the issues behind it. OEW provides a good platform for having these types of discussions. Inequality has always been present in the engineering field, as is evident in the number of females compared with males in our workforce. The role of male engineers is substantial when it comes to empowering female engineers. I have 14 years of experience, and during this time, male engineers always taught me what real-world engineering was. They supported me when I struggled to work on-site, shared their honest opinions to help me make better decisions, and promoted and encouraged me. But companies need to change too. Flexible working hours should be offered within practical limits that reflect the nature of the job. Concrete actions should be taken to recruit more female engineers. Companies should participate in STEM activities, so we can reach more young people to explain that girls can also become engineers. Women need to own their decisions, own their careers, and stop letting their gender or whatever perceptions others might have of them prevent them from reaching their goals."

Yasemin Baygar, Principal Protection Engineer,
Siemens Energy UK
OEW speaker



Offering an internship

Nadia knows about societal restrictions and how important it is to take control of your own life. "When I was 12 years old, I remember waiting for one of my brothers to fix something when my mother asked me why I was waiting. She said, you have two hands and a brain, so why not do it yourself? That made me think differently, and it changed me. Working on ideas for empowering female electrical engineers and having those ideas supported by my coach was a great opportunity." Taking action is just as important as talking about challenges and success stories, and that's why OMICRON Bahrain decided to offer a one-year paid internship. "Now we're happy to have a female engineer. She started in January, and she's the first female electrical engineer in Bahrain and a

member of a formerly men-only team. Our focus is not simply giving her administrative tasks but involves bringing her on-site and giving her a chance to learn hands-on", Ahmed explains.

New plans have already begun

"We're already working on the fifth edition of OEW. We've gotten in touch with customers, people from conferences, and LinkedIn to search for influential speakers. Organizing an event like this requires a lot of preparation. It's necessary to hear from inspiring women who know how to share their stories. Some of them have faced enormous challenges, but hearing their stories empowers other women. I hope those stories spread and are repeated in families and schools so more young women will become electrical engineers in the future", Nadia concludes. ■



*«The idea for an event came up **through the stories we shared with each other.**»*

Ahmed El-Hamaky,
Regional Manager, OMICRON

"I'm a passionate and ambitious electrical engineer working in the exciting cybersecurity field. I want to positively impact the world around me and be a force of change for the better in everything I do. There's always room for improvement, which is why I encourage different levels of leadership to revisit policies and working conditions to ensure we remove some barriers that obstruct equal and fair opportunities. I believe that I can represent, inspire, and mentor in OEM and similar venues. I hope to communicate and demonstrate examples of how inclusion and diversity in our field can positively impact the technical and personal aspects of working life. Always remember that you belong, you can do it, and you can be the change you want to see, and when it gets hard, keep going."

Eman Hammad, Assistant Professor,
Texas A&M University
OEW speaker



SPRING MARKS THE ARRIVAL OF NEW FUNCTIONS AND IMPROVEMENTS

Discover PTM 5.00 now

As the first spring flowers bloom, our Primary Test Manager™ (PTM) software will also arrive with new standards. The 5.00 update includes a whole host of practical new functions and improvements, such as Rapid Fault Sense (RFS) for the CPC 100, two-factor authentication (2FA) for PTM DataSync web users, and measurement value validation for SFRA measurements in the form of a web service. Download the PTM 5.00 update now to enjoy all the latest developments.

Cybersecurity



Two-Factor Authentication for DataSync

Web Users: Cybersecurity regulations requiring 2FA for software services that exchange data via the internet are becoming increasingly common. With PTM 5.00, we meet this demand and provide a two-factor authentication option for PTM DataSync users as an alternative to certificate-based authentication for client/server data synchronization. Administrators can quickly and easily add users and configure 2FA via the identity management system (IMS) in the DataSync Manager (DSM).

Safety



- › **Rapid Fault Sense:** The new RFS function monitors CPC 100 outputs. If an unexpected output change occurs, the CPC 100 will immediately stop the output. This rapid shut-down is intended to minimize the risk of unforeseen and unwanted situations occurring during test execution.

With PTM 5.00, RFS is enabled in the following applications:

- › 2-kV output
 - › quick test
 - › sequencer
 - › voltage transformer ratio
 - › voltage withstand test
 - › any CP TD application
- › **Timeout:** This new safety function allows a timeout to be set as standard, shutting down automatically after it passes. The benefits are evident: If a test exceeds the standard time, it already indicates a fault. A situation may also arise where the test engineer cannot stop the test procedure. The shutdown triggered by the timeout prevents the voltage from being applied where it's unwanted for an extended period of time.

Artificial Intelligence



SFRA Measurement Validation Web Service:

PTM 5.00 uses modern algorithms to test and assess the validity and quality of measurements for the SFRA. In simple terms, it works like this: PTM sends the measurement results to our web service, which analyzes the results and processes the data. Then it sends the classification results back to PTM. The algorithms report the validity and quality of the measurement results to the user and indicate any weaknesses in the measurement process. The aim is to bolster trust in the measurement results and promptly repeat the measurement once the cause of the fault has been eliminated.

There are four different quality tests available for validation:

- › Detection of noise in the nominal and harmonic frequency
- › Detection of background noise
- › Pattern recognition
- › Remanence state of the transformer

And that's not all:



- › **Polarity Check:** PTM 5.00 supports polarity measurements on current and voltage transformers in combination with CPOL.
- › **New equipment type—shunt reactor:** The shunt reactor has been added to the list of available equipment.
- › **VAM support tool:** The new version of the vibro-acoustic measurement (VAM) now includes a support tool. With this tool, users can upload their VAM data to an OMICRON server with the click of a button and request assistance from our technical support team. By uploading the measurement data in the MR Reinhausen customer portal, you can request an assessment of the respective on-load tap changer (OLTC) from MR. ■

KNOWING AHEAD OF TIME

Trending the insulation condition of generators to avoid failures and downtime with MONGEMO

Partial discharge (PD) activity is a well-accepted indicator of insulation deterioration in electrical assets, including generators and motors. More specifically, steadily increasing PD activity indicates a developing defect in the asset's insulation that could lead to eventual failure and costly outages. Therefore, the continuous trending of PD activity allows asset owners to assess insulation condition throughout the equipment's service life and make timely decisions that ensure reliable performance.



MONGEMO is our permanently installed, continuous on-line partial discharge (PD) monitoring system for single and multiple generators and electrical motors. The scalable and easy-to-use system is widely used by generation utilities and industrial plants worldwide to trend PD activity in stator windings and detect developing insulation defects before they result in damaging failures and costly unplanned outages.

We recently had the opportunity to speak with Mohamed Helmy Halim. He's the manager of MHH Condition Monitoring Sdn. Bhd., our dedicated Sales and Engineering Partner for rotating machine monitoring in Malaysia's oil and gas industry. He describes why one of his

customers – a major Malaysia-based oil and gas company – invested in the scalable MONGEMO system for the continuous online trending of PD activity in multiple gas turbine generators at two of their refineries. He also explains how continuous PD monitoring helps his customer ensure their generators' performance reliability, avoid unforeseen failures and outages, and optimize maintenance and asset planning.

Please tell us more about your company, MHH Condition Monitoring.

Mohamed Helmy Halim:

MHH Condition Monitoring is a consultant and solution provider based in Malaysia for rotating machine testing and monitoring. We are

dedicated to using our knowledge, expertise, and experience to help our customers maintain their assets. Our corporate strategy integrates different technologies to solve problems and extend the lifecycle of assets. We target customers with assets critical to their production, primarily in the oil and gas industry.

What is your company's relationship with OMICRON?

We've already been using various OMICRON solutions for several years for diagnostic testing on rotating machines at our customer sites, including the CPC 100 multi-functional testing device and the MPD PD measurement and analysis system. In 2020, we were appointed by OMICRON to be a dedicated Sales

The oil & gas refinery in Malaysia produces natural gas as a byproduct used to fuel gas turbine generators that produce power for critical plant processes.



and Engineering Partner for rotating machine monitoring in the oil and gas industry in Malaysia.

How did you find out about the MONGEMO continuous PD monitoring system for rotating machines?

We first became aware of the MONGEMO system in 2019 when we attended an OMICRON PD workshop in Malaysia. Coincidentally, at the same time, I had a request from a customer in the oil and gas industry for a PD monitoring and trending system for nine of their gas turbine generators at one of their refineries in Malaysia. We asked the OMICRON colleagues at the workshop for more information about the MONGEMO system to determine if it would meet our customer's needs.

After our initial discussions and system evaluation, we were convinced that MONGEMO was the right solution for our customer.

Please describe the types of generators your customer uses, and why they decided to add a continuous PD monitoring system.

Our customer uses 13.5 MVA generators, also known as alternators, driven by gas turbines to produce power for various processes at their oil and gas refineries, which separate crude oil into its various components. One of the byproducts is natural gas, which is used to fuel gas turbines. The high demand for energy at these refineries necessitates that their generators operate with a high level of reliability and efficiency and minimum operational downtime.

Our customer's generators are already designed for high performance and reliability. The performance of the materials used for electrical insulation has increased over the years, but the insulation dimensions have decreased. Even though it can withstand the operating voltages it is exposed to, various conditions, such as load, temperature, humidity, and wear-and-tear in harsh industrial environments, eventually cause defects and aging in the insulation. This results in a generator life expectancy of only about 10 to 15 years. Increasing PD activity levels indicate these developing insulation defects that can eventually lead to premature failure.

Therefore, our customer wants to ensure the reliability of their fleet of generators and always be aware of ▶

An example of the gas turbine generators used to produce power at an oil & gas refinery in Malaysia.

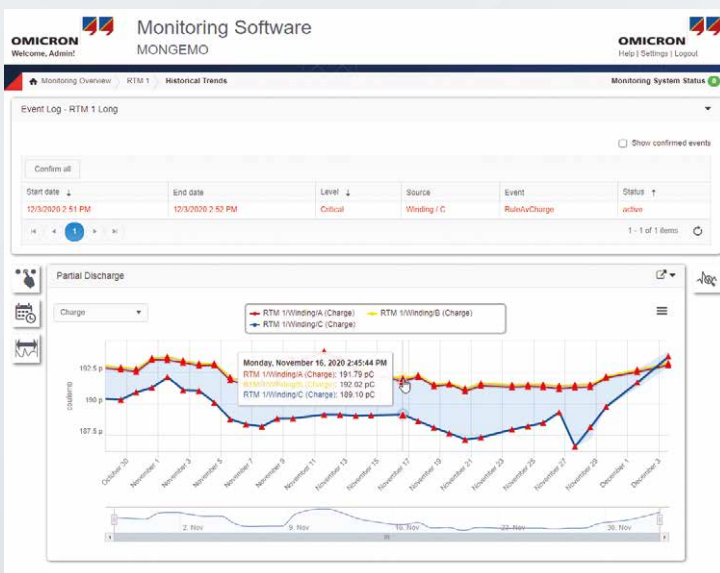


any potential problems and impending failures. Their goal is to increase their generators' life expectancy and reliability and decrease the rate of unforeseen failures and outages. That is why they decided to invest in a continuous PD monitoring system that they could integrate into their overall condition monitoring system. This enabled them to trend the insulation condition throughout their generators' remaining service life to plan maintenance and eventual replacement ahead of time.

What specifically led you and your customer to select the MONGEMO system?

We were and continue to be very impressed with the MONGEMO continuous PD monitoring system. There are various reasons why we decided it was the right solution for our customer.

Specifically, the MONGEMO system is robust enough for harsh industrial environments. It's easy to install and is scalable for monitoring an expanding



The MONGEMO system trends PD activity when generators are online. Increasing levels of PD activity often indicate developing insulation defects, which triggers warnings and alarms indicated in the event log and notifies operators via email.



«The MONGEMO system enables our customer to ensure the reliability of their generators, extend their service life and avoid unforeseen outages.»

Mohamed Helmy Halim,
Manager, MHH Condition Monitoring Sdn. Bhd.

fleet of generators. In addition, it can be easily integrated into existing monitoring and SCADA systems. The system allows users to configure settings and view data from a remote location using the system's convenient web interface. Users can set thresholds of tolerable PD levels and receive automatic warnings and alarms when these thresholds have been exceeded so that they can investigate the situation in a timely manner.

Convenient software features, such as 3PAR and cluster separation, help users easily separate PD signals from external noise to identify the exact phase indicating a problem. In addition, the pattern classification software feature gives users an indication of the defect type, so they can quickly figure out what's going on and decide the next steps.

Overall, we found the MONGEMO solution to be a very high-end PD monitoring and trending system that ensures users can make informed decisions

based on the condition of their rotating machines. The system continuously collects and processes the measured data using expert software features, producing understandable results for users.

Based on these strengths, it was easy to convince our customer that the MONGEMO system was their best choice compared to other monitoring systems. Our customer appreciated how MONGEMO could meet their continuous PD monitoring system specifications. It provided them with the information they could base their decisions on for maintenance and eventual replacement without needing a PD expert to review and interpret the collected data.

Please describe the installation process at the customer's site.

We installed and commissioned the MONGEMO system ourselves, initially on nine generators located at one of the customer's refineries. Since we already have a lot of experience with PD

and monitoring in general, all we needed were system specifics for installation and commissioning, which we received from the OMICRON team in a training session. They also offered us support via video conference when needed.

We previously installed PD couplers while the generators were out of operation for planned maintenance. The MONGEMO four-channel data acquisition unit was installed near each of the generators and is housed in an IP65-compliant protective enclosure to protect it from moisture and typical harsh conditions onsite. The computer used for storage and post-processing of the PD data was installed nearby for easy access to each location. The MONGEMO system was also easily integrated into the customer's condition monitoring system to assess their generators' overall performance and safety. Continuous PD trending by the MONGEMO system is a key component in the customer's condition monitoring system. ▶

Since the first installations, our customer was so pleased with the results that they asked us to install and commission the MONGEMO system on four additional generators located at another one of their oil and gas refineries. MONGEMO is monitoring and trending PD activity on a total of 13 generators used for producing power at two of the customer's refinery sites.

What has your customer's experience with the MONGEMO system been like?

Our customer has been completely satisfied with the MONGEMO system since it always lets them know the insulation condition of their fleet of generators. This enables them to identify a problem in its earliest stages of development with sufficient information about the growth rate and severity of detected defects. With this information, they can plan for maintenance, repair outages, and eventual replacement ahead of time. Most importantly, they have been able to ensure the reliability and availability of their generators, extend their service life and avoid unforeseen outages, which has always been their goal. ■



Mohamed Helmy Halim and members of the MHH Condition Monitoring team evaluate the MONGEMO system prior to installation at an oil & gas refinery in Malaysia.

The MONGEMO system's PD data acquisition device is housed in a protected, IP65-rated enclosure to keep it dry and dust-free in harsh environments. More information about MONGEMO is available at



omicronenergy.com/mongemo

LISTEN TO THE PODCAST

Interested in this topic?



Be sure to listen to our Energy Talks Podcast Series Episode Number 49 about the permanent monitoring and trending of partial discharge activity in rotating electrical machines and power cables. Scan the QR-Code or visit:

omicronenergy.com/permanent-pd



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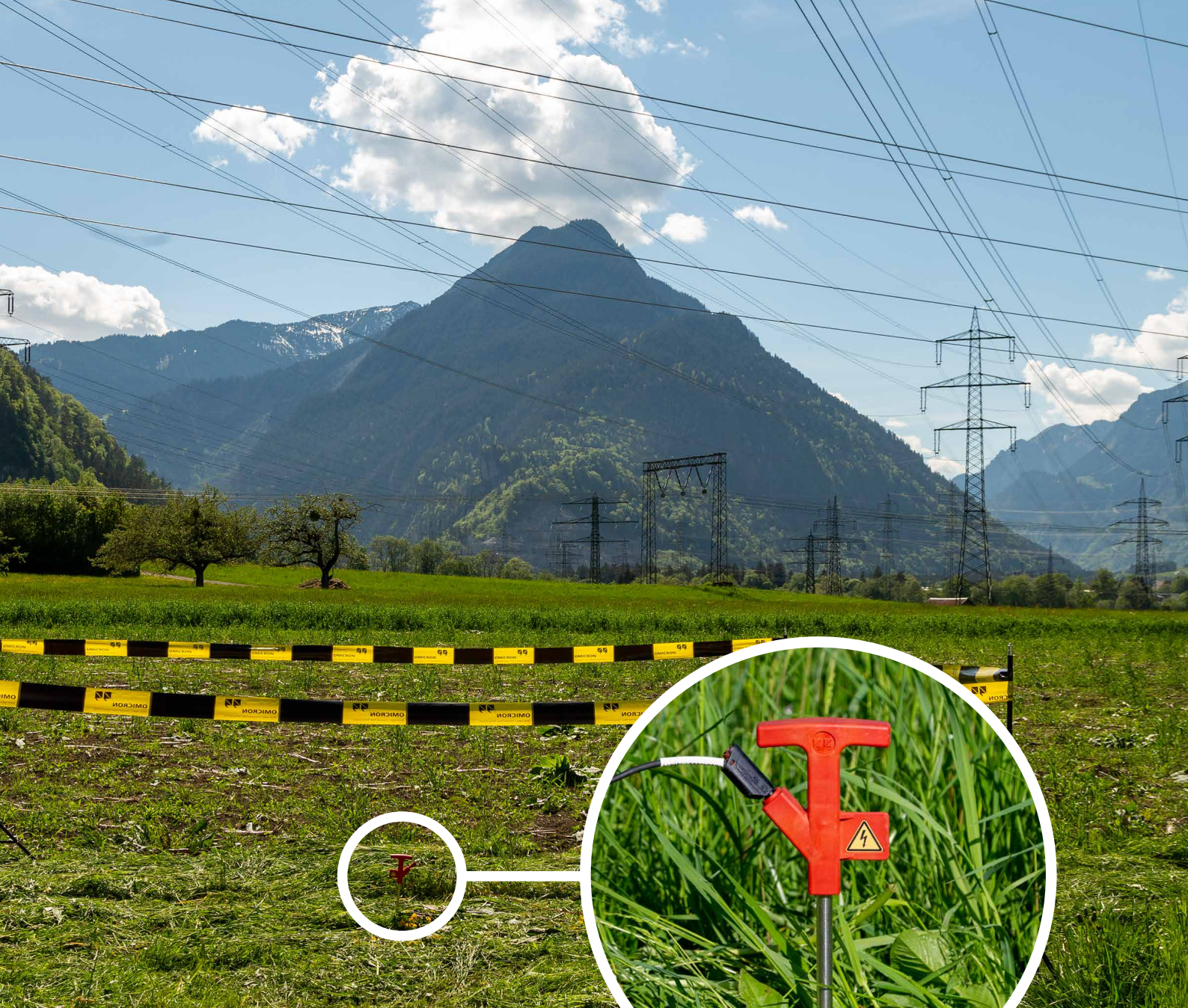
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INCREASED MEASUREMENT SAFETY WITH THE NEW GROUND SPIKE

Gain insight into one of our safety processes and the resulting product improvement



We recently redesigned our existing ground spike with an isolating handle and safety plug. This minimizes the risk of an electric shock when the spike is accidentally touched while a test is running.

Grounding system measurements require a test current injection at a sufficient distance from the substation under test. Our measurement sets can generate high voltages, which are necessary for some testing situations. This can be potentially dangerous if the ground spike is touched while a measurement is still running. Therefore, our user manuals and safety instructions draw attention to these potentially dangerous situations and describe measures for preventing accidents, such as cordoning off the dangerous area with warning tape and observing the injection site.

We spoke to Paul Kerr, Safety Expert at OMICRON, and Josef Harl, Development Engineer at OMICRON, about this safety improvement.

Paul, why is safety such an important topic for OMICRON?

Paul: Our products are used in environments where hazardous voltages and currents can occur. Our goal in these environments is to minimize the impact of dangerous scenarios so that everyone can safely carry out their work and go home at the end of the day.

How do you identify dangerous scenarios?

Paul: We need to understand how our products are used and the chain of events that can lead to a dangerous occurrence. This is done through regular internal audits where we discuss, analyze, and determine potential ▶

«Our goal is to minimize the impact of dangerous scenarios so that everyone can safely carry out their work.»



Paul Kerr,
Safety Expert, OMICRON
Background: Protection application engineer now
focused on product safety and quality

product improvements for safety and quality. An example is our Product Safety Risk Assessment process based on the common Failure Mode & Effects Analysis (FMEA) tool.

The feedback about our products we get from users has also led to key improvements. External factors play an important role when looking at the entire chain of events in a dangerous situation. So, user feedback helps us better understand the problem, which in turn supports us in defining appropriate actions to prevent it from occurring.

How did you come up with the idea of a new ground spike?

Paul: The ground spike is used to qualify the grounding condition inside and outside the substation. One critical point is that the ground spike can be

unsupervised during an injection cycle. This is because the ground spike is inserted some distance from the operator controlling the test, which means the ground spike is accessible to other people who may not understand the electric shock risk.

We improved the design to minimize this risk. The ground spike handle now has an isolated cover, reducing access to the conducting parts. The isolated cover is red and has a hazard icon to indicate danger. By doing this, we have lowered the risk of electric shock to people who may come across it when tests are being performed.

In addition, we took the opportunity to make the design more convenient for users by adding a banana plug instead of a crocodile clamp for the connection.

Josef, a grounding rod looks simple. What was the biggest technical challenge in developing the new ground spike?

Josef: The most difficult challenge was the impact strength of the material required. Depending on soil conditions, a hammer may be necessary to drive in the spike. This must work reliably, even at very low temperatures.

We needed plastic approved worldwide for this environment that offered sufficient insulation and could handle the practical stress mechanically. Finding a satisfactory material that fulfilled all three requirements was difficult.

Were there also other challenges?

Josef: One other challenge was the technical implementation in which a metal construction is encased in a plastic injection molding process in one



operation, thereby ensuring that the insulation is guaranteed.

How were the new ground spikes tested?

Josef: The most complex thing was finding a test method that enabled good repeatability, which was important for comparing the plastics. We developed a test setup with our production partners that made this possible. A defined hammer is guided on a brass rail and hits the test specimen from different heights. This ensures a high-quality level for our new ground spikes, increasing our customer's safety at work.

Thank you very much for your time. It was fascinating to learn about the ideas behind this project. ■

«The most complex thing was finding a test method that enabled good repeatability to ensure high quality for improved ground spikes.»



Josef Harl,
Development Engineer, OMICRON
Background: Mechanical engineering

The ground spikes are a part of the test sets for grounding measurements with CPC 100 and COMPANO 100.



1½ YEARS OF THE IT SECURITY ACT 2.0

Challenges for energy suppliers



Selektiertes Objekt enthält eine Formel

Auf diesem Monitor wird gerade ein Bild geltefnet.



In May 2021, the German Bundesrat passed the German IT Security Act 2.0 (IT-Sicherheitsgesetz 2.0, IT-SiG 2.0). Critical infrastructure operators are legally required to introduce intrusion detection systems (IDS) by May 1, 2023. For energy suppliers, this means: All plants with a generating capacity of over 104 MW, or 36 MW primary control power, as well as all black start plants are covered by this regulation.

More than a year after the law was enforced, on September 26, 2021, the German Federal Office for Information Security (BSI) published guidelines on the subject. These guidelines are general as they cover many sectors (power, water, telecommunications, etc.) with differing requirements in some cases and do not prioritize any manufacturer or specific technology.

The Problem with IDSs

Section 8a(1a) of the law states: "...appropriate organizational and technical precautions must be taken, which from May 1, 2023, also includes the use of intrusion detection systems..." A definition is not provided for IDSs in the context of this law. In addition, the guidelines only provide general recommendations. Are any existing virus scanners or log management systems

sufficient? Security experts and top consultants say: "Unfortunately not." Operators will have no choice but to establish a network-based intrusion detection system in order to minimize the risk of outages caused by cyberattacks and detect targeted attacks as quickly as possible.

Operators can choose three different approaches:

- › signature-based,
- › learning-based (anomaly detection), and
- › specification-based approaches, known as allow list or whitelisting approaches.

Signature-Based Approach

A signature-based approach assumes that there are currently enough signatures for all components in the OT networks of KRITIS operators. This method is error-prone, as false positives frequently occur. The system may warn of attacks that are intended operations, not actual attacks.

Learning-Based Approach

This approach involves solving the above problem by "observing" the system requiring protection for a sufficient period (several weeks). After the learning phase, the manufacturer of this ▶

«Operators will have no choice but to establish a network-based intrusion detection system in order to minimize the risk of outages caused by cyberattacks and detect targeted attacks as quickly as possible.»



Thomas Friedel, Sales Manager Cybersecurity, OMICRON

solution works with the operator to evaluate the resulting communication and decide whether or not the alarms have occurred as part of a routine operation. In the first case, the alarm is “acknowledged” and will be disregarded. The benefit of this approach is that it functions independently of signatures. Still, there is a risk that it may assess the activities of malicious software that was already in the OT network before the normal learning phase started. The lengthy learning process is time, resource, and cost-intensive.

Specification-Based Approach

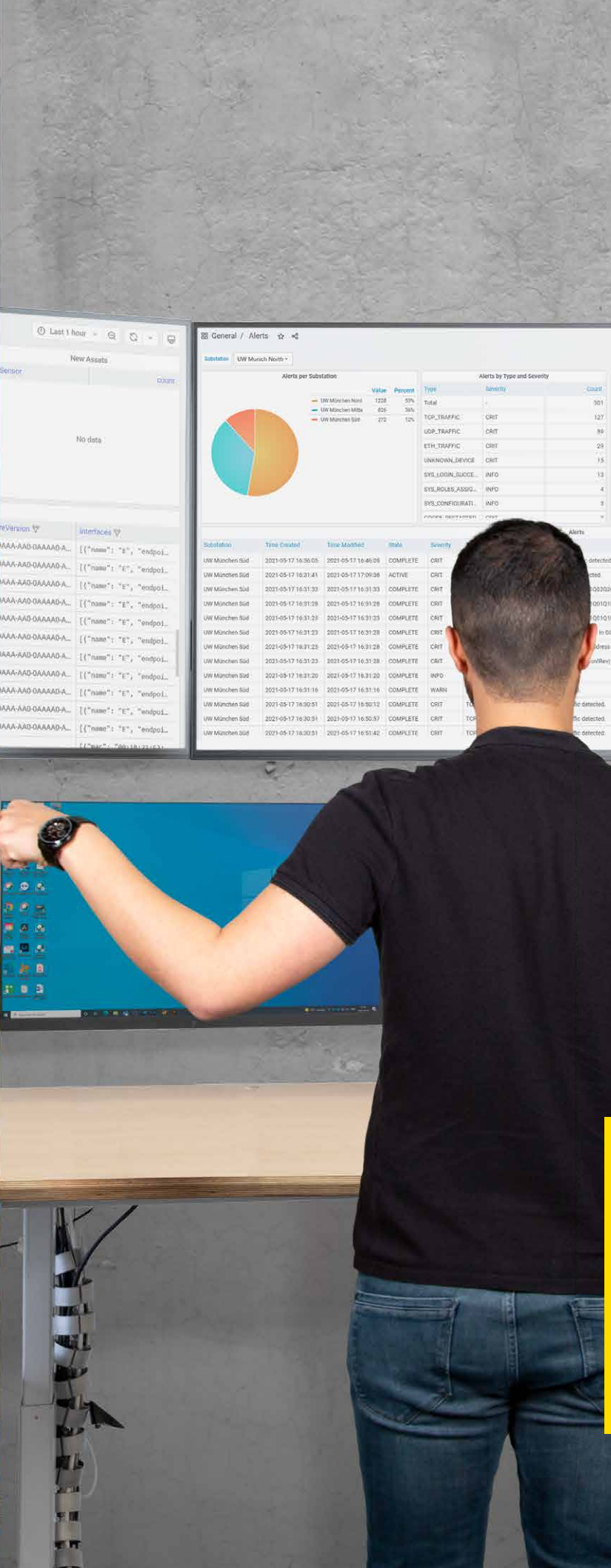
There are usually adequately documented specifications for systems (IEC 61850 SCL files, signal lists, IP address lists). These specifications describe the system and its communication comprehensively. The information about the system is transmitted to the IDS, making it immediately operational. It analyzes all data traffic immediately and assesses whether this communication is allowed in the system model, enabling the efficient and prompt detection of potential attacks and functional defects. There is no need for a time-consuming learning phase or ensuring that signatures are up to date.

When these approaches are compared directly, the allow list-based solutions are preferable for OT networks in the energy sector because minimal implementation effort is required. An in-depth understanding of familiar processes (protection testing, maintenance work, etc.) makes the day-to-day operation much easier for IT and OT employees and helps conserve personnel resources.

IT Cybersecurity ≠ OT Cybersecurity

However, all three intrusion detection options have one thing in common at a network level: They have to be integrated into operators’ process networks in a passive and nonreactive manner. This reveals a key difference between these security systems and the cyber security systems in classic (office) IT. In OT control networks, it’s essential that switch commands





for protection relays are not delayed. For example, it's common for packages with suspected malicious code (e.g., email attachments) not to be delivered in office IT. This approach would be completely unacceptable in protection and process control technology.

This and the use of incomparable protocols in OT networks make it difficult to adapt IDS solutions developed for office networks (IT). We strongly recommend using IDS solutions developed explicitly for OT networks and not implementing IT solutions in an OT network.

OT and IT—Working Together to Achieve Success

Some of the problems that occur when establishing IDSs arise because the decision has been left to the IT department, which will often turn to systems from the office IT world because they're familiar with them. However, these systems are then used in OT networks, and those responsible for them are forced to use systems that haven't been tailored to their specific needs. This often leads to frustration, and we strongly suggest that the OT and IT departments work closely together from an early stage when selecting an IDS solution for control networks to ensure the optimal product is chosen—ideally well in advance of May 1, 2023. 🟡

More on the topic

How important is it to choose the right IDS, especially in light of the IT Security Act 2.0? Read part 1 of our article in the OMICRON Magazine (issue 02/2021) to find out:



omicronenergy.com/it-security-act



Part 1:
Introduction to
the project INZELL

INZELL RESEARCH PROJECT

Max Bögl operates in the fields of mobility, renewable energy, housing, building construction, and infrastructure. With more than 6,500 highly qualified employees at 40 locations worldwide and an annual turnover of over 2 billion euros, they're one of the largest companies in the German construction industry.

 [max-boegl.de](https://www.max-boegl.de)

The INZELL (INDustrieZELLE—industrial cell) research project examines the grid support¹ and system services² provided by an industrial cell³ with island grid capability and renewable energy. It was launched in 2020, under the leadership of Prof. Brückl OTH and Josef Bayer, Max Bögl, and runs until the end of 2023. The industrial cell, in this case, is the “Max Bögl Group” industrial plant in Sengenthal, Germany.

Max Bögl Energy Cell technical data

Size:

- › Medium-voltage power grid spanning 30 kilometers
- › 25 transformer stations

Consumers:

- › Peak load: 6.3 MW (total peak load for Germany: 65–70 GW on a normal day)
- › Power consumption per year: 25.5 GWh (equivalent to the average energy demand of a town with approx. 30,000 residents)

Generators:

- › Generation peak: 10.5 MW
- › Annual generation: 29 GWh

- › Wind turbines: 9.6 MW
- › Rooftop photovoltaic systems: 2.5 MW
- › 1,7-MWp floating PV park
- › CHP steam engine: 0.4 MW
- › Battery storage facility: 2.5 MW/2.25 MWh

Planned:

- › 14-MW open-space PV system
- › 2 wind energy plants: 5–7 MW



 forschungsprojekt-industriezelle.de
(available only in German)

Project background

Industrial plants' increasingly cost-sensitive manufacturing processes require a highly reliable power supply. At the same time, however, the sup-

pression of large-scale power plants is creating vulnerabilities when it comes to system security, particularly in the following areas:

- › the reactive power in the transmission network, where—despite an increase in provision—increasing deficits in the availability of reactive power have been predicted⁴,
- › the instantaneous reserve, which is no longer inherent in many generation and procurement plants, and
- › grid restoration, which until now, has been planned using large-scale power plants.

Many industrial plants already have their own generation facilities in order to be less dependent on electricity procurement costs. Independent security and a high-quality supply will also become increasingly important, as extended power outages and voltage dips in the public power grid can cause production downtime and damage, resulting in high costs.

As part of the research project, investigations are being carried out that ▶

¹ **Grid support:** The grid is supported by the energy generation plant.

² **System services:** Services that power grid operators provide in order to ensure the functionality and quality of the power supply. These are services that power grid operators provide in addition to the transmission and distribution of electricity, such as:

- › maintenance of power frequency stability
- › maintenance of voltage stability
- › power supply restoration
- › operational management/grid bottleneck management.

³ **Industrial cell:** An energy cell within an industrial plant. In this case, the Max Bögl Group functions as an autonomous island grid with its entire supply chain using internal renewable energy generation plants (i. e., if the external power supply is disrupted or fails in the event of an incident).

⁴ **Source:** www.iren2.de/en/goals



Commissioning the battery storage facility

examine unresolved issues and aspects of research relating to the optimal interaction of different energy generation plants, storage facilities, and load management systems. During this project, the Max Bögl industrial cell can function as an island grid if any power supply interruptions occur. The aim is also to contribute to efforts for ensuring the stability⁵ of the public power grid in a more cost-effective manner. Following this approach, industrial plants will become increasingly significant to the successful and cost-effective implementation of the energy transition.

The project is focused on developing automated plant deployment and a grid manager (industrial computer with various grid management programs). The combined use of a

grid manager and automated plant deployment planning will open up new possibilities for the provision of system services and, thus, the provision of grid support through the Max Bögl industrial cell. In addition, multiple field tests will be carried out on the island grid operation to test for a scenario in which the external power supply fails.

How did OMICRON get involved in the project?

OMICRON Engineering Services (OES) tested protection devices in Max Bögl's network on several occasions before the project was launched. With OES, OMICRON offers its customers a global service process that supports them with the planning, commissioning, and maintenance of secondary technology installations.

OES also performs network calculations and calculates protection settings. Therefore, it made sense for OES to verify the protection settings resulting from the research project again—to have a second opinion. Within the scope of Max Bögl's order, OES will also parameterize the protection devices and, where necessary, make adjustments to the device hardware or replace the protection devices. Lastly, OES will be on site during the field tests to assist if any problems arise.

Current project status

Measurements are being carried out to record the reactions of different elements in the network—e.g., solar inverters—and correctly integrate them into the simulations. For example, how quickly does an inverter react to newly issued specifications

⁵ **Definition of stability and supporting stability:** This is about taking advantage of the opportunities offered by the various inverters in the site grid (PV, wind power, battery) in such a way that they help the

grid operator to ensure/maintain stability. For example, during a short-circuit fault in the grid, the inverters can make reactive power available to support the supply voltage.



PROJECT PARTNERS

Research and project management

- › Regensburg University of Applied Sciences (OTH Regensburg)
- › Technical University of Munich (TUM)
- › Clausthal University of Technology (TUC)

Industry partners

- › Max Bögl Wind AG
- › Intilion GmbH

Associated partners

- › Bayernwerk Netz GmbH
- › Bredenoord BV
- › Siemens Gamesa Renewable Energy GmbH & Co. KG.
- › OMICRON Engineering Services

for reactive and active power? Latency periods in the various communication networks are also recorded so they can be properly incorporated into the island grid's power regulations. Thus, the simulation models are almost complete.

Once the simulation models are ready, the next step is to evaluate the current plant protection concept and adapt it where necessary. Likewise, the planned control concept for the island grid operation will be assessed in various scenarios before it can be applied in field tests.

The concept is currently being evaluated using a test setup for the island grid with various components from the future network to determine whether it's feasible and whether the underlying assumptions regarding the control behavior of the different components are correct.

Various preparations are currently underway for the field tests on the actual site grid

- › expansion of the battery storage facility to include the necessary grid-forming functionality for the island grid operation
- › installation of measurement equipment in the site grid for the field tests
- › development of a plant deployment plan and a load forecast tool for parallel grid operation
- › installation of the grid manager (industrial PC) and connection to

the communication networks in the Max Bögl site grid.

In part 2 of the series of articles on the INZELL project (available in issue 2/2023 of the OMICRON Magazine), you will find more detailed information about the project, the tasks being carried out by those involved, and the unexpected challenges that couldn't be foreseen when the project first launched. ■

More on the topic

Read how an alternative network reconstruction using a high-speed network was tested in a prepared island network of the German transmission system operator 50Hertz and what lessons were learned:

 omicronenergy.com/ramp-up-network





ON SITE: OMICRON IN THE U.S.

Michael Gallo from MKI gives us his insight into the power sector

MKI has been a manufacturing representative since 1955. MKI continues to reinvest their success in their ability to serve their customers and manufacturers. They're focused on developing a team with experience, technical know-how, and industry relationships. MKI's core values of working hard, using unquestionable ethics, having fun, and respecting people are paramount to their company culture.

How is the American energy grid structured?

Michael Gallo: Generally speaking, high-voltage transmission lines carry power across the country. These branch down into distribution networks to supply homes and small businesses. California has the 2nd highest energy consumption in the country, behind Texas. It is one of the US's top producers of oil, hydroelectricity, and solar power. Natural gas power plants make up almost half of California's power generation.

What resources are being used to generate power?

The largest source of energy for power generation is fossil fuels. There is also Natural Gas, Coal, and Nuclear power generation. There is a growing desire for renewable energy sources, which include wind, hydro, and solar power. A senate bill was passed in 2018 here in California, which increases the renewable energy requirement for electric utilities from 50% in 2026 to 100% in 2045.

What are the current hot topics for the energy supply market?

Microgrids, energy resiliency and cybersecurity.

What kind of challenges are your customers facing?

The supply chain is the most significant challenge. Equipment such as transformers, breakers, PTs, etc., are being held up and delaying projects. Sometimes small components or devices that are part of the larger assembly slow things down. Shipping has also been a challenge because products are held up from smaller components which delay the majority of inventory from being shipped. Finally, some component lead times may change after the estimated shipping date and orders have been provided. This is due to many factors, but adds to the overall frustration.

When looking towards the future, where do you see the biggest challenges in the power sector and in general?

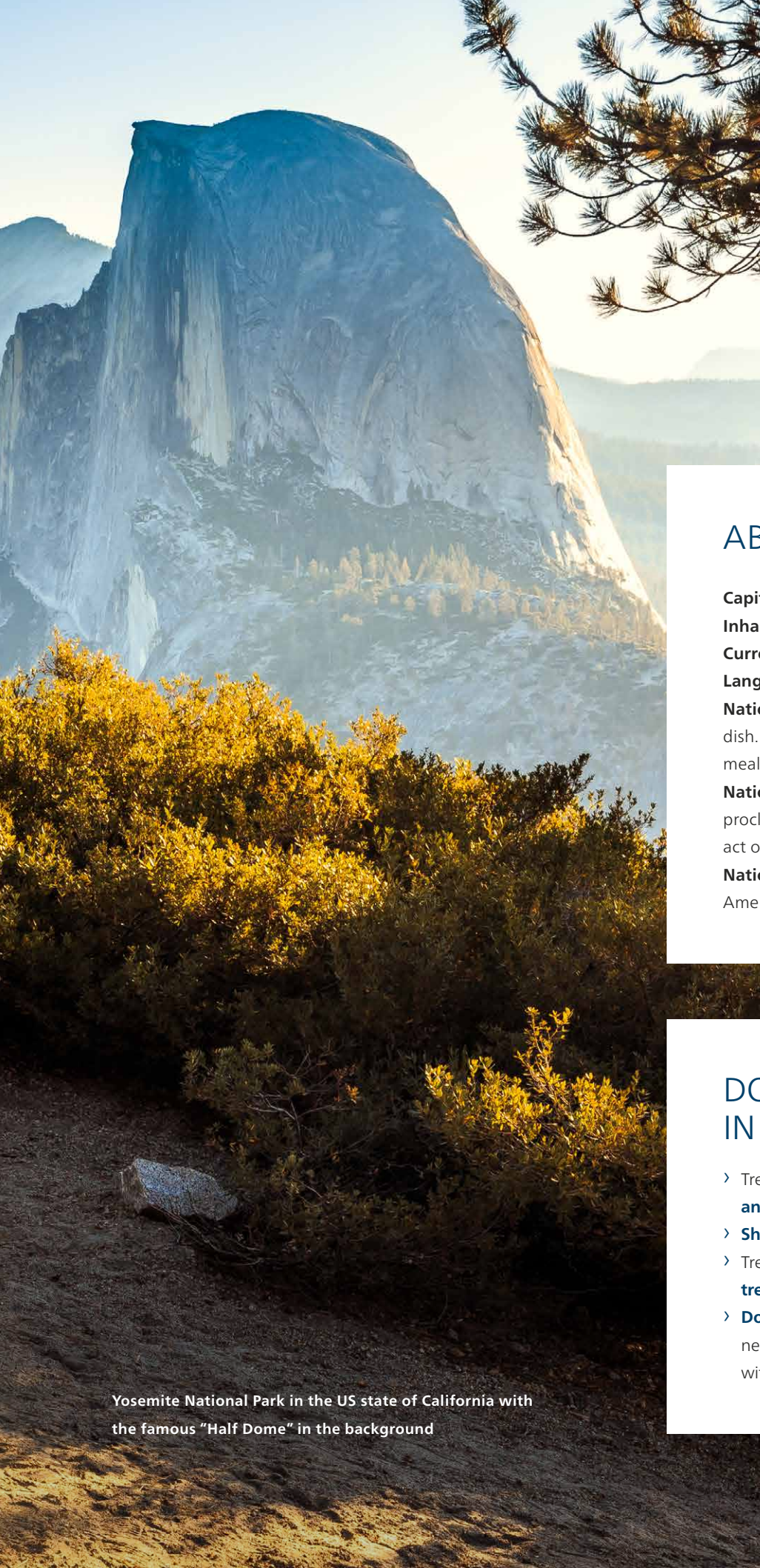
The supply chain and freight really need to stabilize to allow for better estimations and scheduling.

Thank you for the interview. ■



Michael Gallo,
Professional Engineer,
MKI

 mkireps.com



ABOUT THE U.S.

Capital: Washington, DC

Inhabitants: 331 million

Currency: US Dollar

Language: English

National Dish: There is no single national dish. However, one of the most popular meals is the Hamburger.

National Drink: Bourbon whiskey was proclaimed the U.S. National Spirit by an act of Congress in 1964.

National Sport: Baseball and American Football

DOS AND DON'TS IN THE U.S.

- › Treat your family and friends **with love and respect.**
- › **Show integrity and pride** in your work.
- › Treat others **as you would like to be treated.**
- › **Do not treat strangers poorly,** you never know what someone is dealing with in their personal life.

Yosemite National Park in the US state of California with the famous "Half Dome" in the background

WHAT'S GOING ON

We are continuing to share our knowledge. We are going to reach out to you physically or digitally with our events, trade shows, conferences, webinars and training courses. Keep yourself up to date by checking out our events and training courses.

Scan QR-Code to get fast access to all links:



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WE ARE LOOKING FORWARD TO SEEING YOU.