



The Remote Access Router from SIGMATEK ensures that IO modules can be controlled securely even in remote areas.

GRID STABILIZATION WITH METAL-HYDRIDE STORAGE

Hydrogen is considered the key to energy transition. But what has been a vision so far is now reality at GRZ-Technologies. Located near Lake Murten, the EPFL spin-off develops and builds modular systems that use control technology from Sigmatek to store renewable energy safely and make it available on demand at any time.

In the industrial area of Avenches GRZ, an EPFL (École Polytechnique Fédérale de Lausanne) spin-off is working on the energy storage of tomorrow. At first glance, it looks almost inconspicuous: a container loaded with metal tubes, electronics and sensors. But inside is renewable energy, safely stored in metal hydride stacks and ready to be converted back into electricity as soon as it is needed. These metal hydrides have an influence on the storage capacity of hydrogen. Therefore, a large part of GRZ's research is focused on them. The spin-off has already examined many alloys in its materials laboratory to gain an even deeper understanding of their thermodynamic processes.

'Hydrogen is safe, sustainable and flexible in use,

Shortcut

Task: Storage systems and DASH systems should function reliably and communicate with each other in a coordinated manner.

Solution: SIGMATEK supplies central control components for the DASH systems: CPUs, digital I/O modules, interface cards, and communication interfaces.

Benefits: The implemented Remote Access Router enables secure, fast remote access to machines worldwide, with integrated VPN technology, without IT effort and with simple plug-and-play installation; security is also guaranteed.



Bernd Maus at the control cabinet. He emphasizes: 'The excellent, direct support was an important factor in our decision to work with SIGMATEK.'

explains Bernd Maus and adds: 'Our metal hydride storage systems absorb the hydrogen reversibly and can release it again at any time.' The Head of Electrical Engineering remains silent about how this works. After all, that is the expertise for the sustainable energy storage of tomorrow. He only reveals this much: 'The material in the metal hydride storage units breaks down into a finer structure when activated and is therefore able to absorb large quantities of hydrogen.'

Suitability for use in hydrogen storage

The challenge: Each operation scenario has different, specific requirements in terms of temperature, pressure or cycle duration, to name just a few. This multitude of influencing factors is the reason why many alloys have now been tested for their suitability for use in hydrogen storage.

One of the product ranges developed in this context is the DASH-M series. This is a modular storage system that can be scaled for operations, ranging from private households to large industrial consumers.

GRZ goes even one step further with the DASH-C series. It integrates storage, control, cooling and peripherals in

one container and is therefore able to safely store 675 kilograms of hydrogen. To illustrate this energy density, it is equivalent to the storage capacity of 67 tanker trucks, such as those used by manufacturers like Linde to transport their gas.

From granulate to high-pressure compressor

Depending on the use case, hydrogen must be released quickly or in a controlled manner, for example for reconversion into electricity at times when there is no sunlight. In the DASH-Power systems from GRZ, this task is performed by a combination of fuel cells, batteries, inverters and controller. The stored energy can thus be fed back into the grid in a precise manner or made available for stand-alone applications. This option is particularly important in winter months when PV yields are low.

'Our storage systems are purely passive,' says Bernd Maus. Heating is therefore required for desorption, i.e. releasing hydrogen. This approach makes the systems safe, reliable and scalable. Another major point that should not be underestimated: compared to battery



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Depending on the application, the hydrogen must be released quickly or in a controlled manner, for example for reconversion into electricity during periods without solar radiation. In GRZ's DASH Power systems, this task is performed by a combination of fuel cells, batteries, inverters, and control.



solutions, the spin-off's process does not require any rare earths.

But that is not the only reason users choose this solution. In industry in particular, many customers appreciate the possibility of storing hydrogen produced in-house and using it later when required. This reduces dependence on external deliveries by trailer and saves costs.

However, safety remains a key issue too. 'Hydrogen is not more dangerous than other energy sources, as long as you understand and observe the basics,' assures Bernd Maus. For example, GRZ works with permanently sealed connections, to avoid hazardous areas as far as possible.

The right control technology in use

GRZ relies on control technology from SIGMATEK to ensure that all components communicate reliably with each other. In addition to the flexibility of the control components and their compact design, the short delivery times also spoke in favor of the solutions from the automation expert from Salzburg. Bernd Maus comments: 'We have a limited amount of space in the container – and SIGMATEK was a perfect fit.' CPU modules, interface cards, digital I/Os and communication interfaces for fuel cells, batteries and sensors are used. The modular S-DIAS automation system impresses with its high packing density, real-time capability and end-to-end bus communication. The extremely compact design of the modules enables integration even in very confined spaces – ideal for container solutions such as GRZ. The used Remote Access Router (RAR) enables secure, fast remote access to machines – worldwide, with integrated VPN technology and no IT effort as well

as simple plug-and-play installation.

Where performance meets precision

At GRZ, the control system not only connects all hardware components with each other but also controls the energy flow precisely. This is crucial, as any error or delay would pose a risk to the energy efficiency and safety of the system.

In the DASH-Power systems, the SIGMATEK controller communicates with around 170 to 180 I/O points, regulates temperatures, monitors pressures, controls valves and processes feedback from the fuel cells and battery systems. Although no real-time cycles are required for this, the cycle times are between 100 and 500 milliseconds and GRZ is happy to accept this extra performance.

However, that was not the only reason for choosing SIGMATEK. 'The excellent direct support was another argument in our favor,' says Bernd Maus. He was particularly pleased during the development and integration phase because the support was quick, competent and solution orientated. He hasn't experienced this from all the providers he has dealt with so far. 'If there was a problem, all it took was a phone call and we often received a solution on the same day,' Bernd Maus particularly praises.

For him, this is an aspect that should not be underestimated: 'We used to work with Linux-based industrial processes and Java. But that was not a permanent solution for us.' Although the introduction of the SIGMATEK tool LASAL was unfamiliar to him as a technician with a different control background, the training at SIGMATEK Switzerland quickly helped him

to understand the systematics of LASAL.

The engineering tool is based on object-orientated programming (OOP) and supports a clear, modular project structure. Thanks to the consistent OOP approach, functions such as temperature control or valve control can be mapped as classes and reused. This saves development time, increases maintainability and reduces sources of error. LASAL also enables seamless integration of visualization, diagnostics and simulation. Its graphically orientated program design in LASAL supports intuitive engineering. The combination of IEC 61131-compliant languages, graphical object modelling and diagnostic functions ensures a high level of efficiency – both in development and during operation.

This approach is particularly helpful in the further development of existing systems. The solutions can thus grow and be expanded modularly – be it for more memory, more output power or other requirements. He even sees potential for future applications, such as thermal compressors for generating high-pressure hydrogen.

One container – many possibilities

DASH systems are used in a wide range of applications, from large industrial consumers and buildings with PV systems to remote (distant) locations without a power grid. One example is a stainless-steel pipe manufacturer. It uses the solution for peak load capping.

But the real driver behind all of this remains GRZ's vision. 'Hydrogen can help make the energy transition a reality,' says Bernd Maus, adding: 'The challenge is no longer the technology, but the will to implement it.'

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User



GRZ Technologies was founded in 2017 as a spin-off from the Swiss Federal Institute of Technology in Lausanne (EPFL). The company's technology is the result of decades of research and development in the field of hydrogen since the 1990s. One of GRZ Technologies' core competencies is the development and application of metal hydrides. GRZ uses these materials to manufacture hydrogen-based energy storage systems, hydrogen storage tanks, and thermal hydrogen compressors.

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