



DASH Power

State-of-the-Art Renewable Energy Storage





We are at the very heart of the ongoing energy transition – in which we are progressing towards a net-zero and fully renewable energy system. For this transition, hydrogen plays a key role as a clean renewable energy carrier.

What are DASH Power Systems?

DASH Power are containerized and fully integrated systems combining GRZ's proprietary solid-state hydrogen storage, automotive-grade fuel cell systems from Hyundai Motor Company, and auxiliary components such as thermal management and batteries. It is a complete Plug & Play energy storage solution, ready to be deployed.

The DASH Power are charged with hydrogen from any source and deliver on-demand electrical power for your application. Whether it is for efficient and affordable power generation, enhanced grid management, system services, or other applications, our technology will enable you to store large quantities of electrical energy in a safe, dense and effective manner, wherever you need it.

How does it work?

In combination with a hydrogen source, for example, an electrolyzer, the modules allow realizing a hydrogen cycle by storing energy and releasing it at a later time. The process works in three steps. First, green hydrogen (H_2) is produced by splitting water (H_2O) with renewable electricity. Oxygen (O_2) is a byproduct of this process and may be used in some cases. The hydrogen is then stored for later usage in the DASH Power at low pressure – directly from the hydrogen source. Finally, when there is power demand, the stored hydrogen is consumed by the fuel cell system and converted into on-demand electrical power. The only exhaust gas is steam. Therefore, the process does not cause any greenhouse gas emissions or other forms of environmental pollution. It is a completely green, long-term, and high-capacity energy storage.



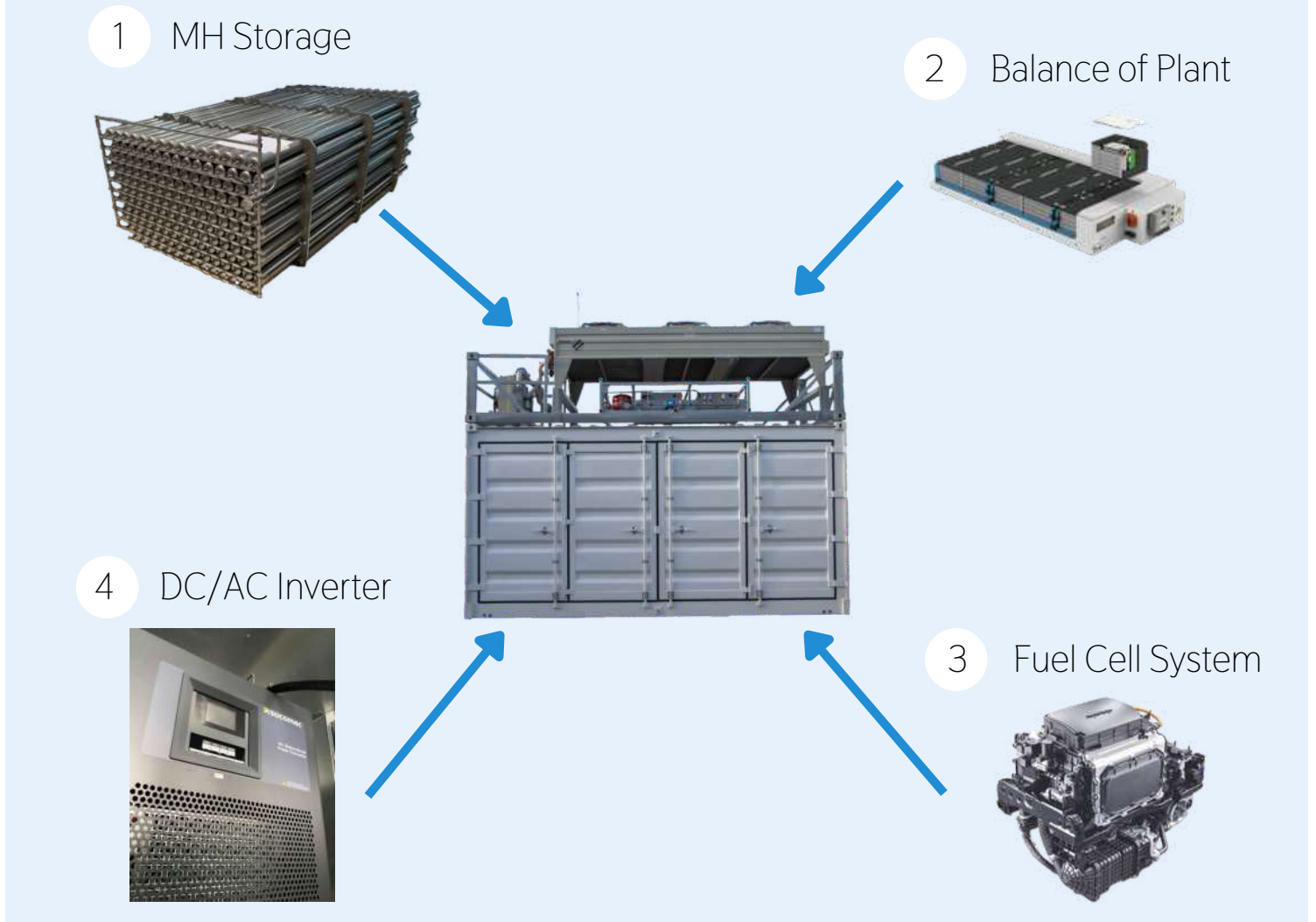
How is it Built ?

DASH Power are built using four main parts:

1. Metal hydrides storage modules
2. Balance of plant with thermal control, batteries, and safety management
3. Fuel cell systems
4. DC/AC inverters

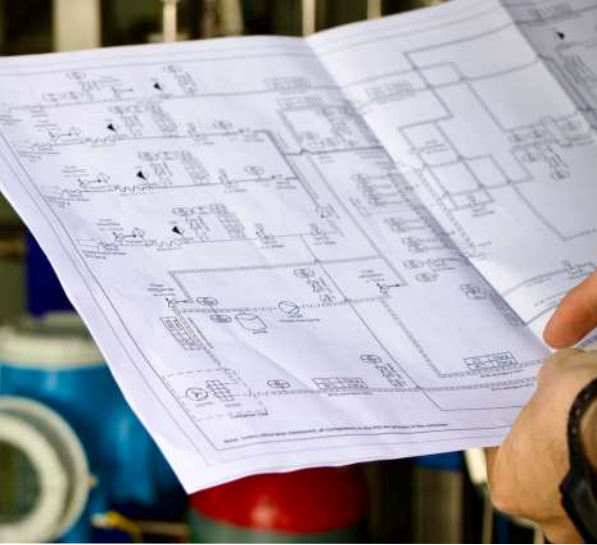
Altogether, they form a complete Plug & Play system which is ready for deployment. Our software connects all the components and enables automatic and remote operation of the modules.

DASH Power System



By creating a containerized modular design, we offer five different versions of the DASH Power Systems, fulfilling the requirements of a vast variety of projects.

Being modular also enables us to combine several modules to create bigger solutions. For instance, combining three modules makes it possible to deliver 1 MW of continuous electrical power, all while ensuring an excellent level of redundancy.



Energy Storage Applications

Together with a hydrogen source, for example an electrolyzer or green hydrogen delivered to site, GRZ's DASH Power unlocks the opportunities enabled by the hydrogen cycle for your energy application.

Typical applications are:

- Renewable energy storage
- Efficient and affordable power generation
- Fast electrical vehicle (EV) recharging
- Peak shaving and grid stabilisation
- Frequency regulation services
- Local grid strengthening
- Remote isolated sites
- Telecom sites
- Outdoor events such as concerts or sports events
- Film shooting events
- Construction sites
- On-shore power at ports
- Airports
- Factories
- Back-up at data centers, hospitals, cold storages, resorts, high-rises...

... or any other applications where clean power is needed on demand. Our technology will enable you to store large quantities of electrical energy wherever you need it.

DASH Power: Key Features & Benefits



Electric energy storage in the MWh range

Our standard configurations store up to 4.5 MWh of usable electrical energy on the very small footprint of a 20-ft ISO container and deliver up to 500 kW of power.



Longevity and cycle stability

The technology based on metal hydrides is extremely cycle resistant and enables a service life of 20 years or longer, as the storage technology is based on a fully reversible process. The entire capacity specified can be used without limitations. In addition, GRZ uses the most advanced, mass-produced fuel cell technology provided its strategic partner Hyundai Motor Company.



Safety without compromises - by design

Our integrated safety system in connection with our proven and patented solid-state hydrogen storage technology leads to excellent safety properties allowing for the installation in almost any environment.



Zero emission - environmentally friendly energy storage

As compared to batteries, the environmental footprint is greatly reduced thanks to the lower amount of grey energy linked with production, high system recycling percentage and long lifetime of our systems. The DASH modules are truly zero-emission – the only side products are pure water (H₂O) and heat. No NO_x, CO₂, or other fumes are emitted during operation.



Fully remote controllable

Using IP interface, DASH can be remotely controlled and operated – to ensure that electricity is generated whenever needed and in the amount needed.



Low noise level

Can be placed anywhere as it generates very limited noise.



Low pressure levels, no compressor required

The system works at a low pressure (under 45 bar(g)) and there is no need for a hydrogen compressor. This leads to significantly lower OPEX and prevents additional consequent costs, e.g., for noise insulation or unplanned outages. It also gives the possibility to refill the storage using a tube trailer – without the need for a compressor locally.



Proven PEM technology

The PEM fuel cells comes straight from our partner Hyundai Motor Company and are designed to meet the requirements of the automotive world – where it has realized many years of robust and safe operation.



Instant start-up and reactivity

For grid services or back-up power, the DASH Power system can be immediately available and secure a stable power needed at critical installations such as data centers or hospitals.



Easy to operate and maintain - by design

Using the IP interface, the modules can be operated as individual modules or can be combined with other modules to deliver several MW of electricity when needed. The DASH Power is very easy to operate. It can be done remote or in connection with standard SCADA systems.



Swiss made quality product

Our DASH Power are developed by our engineers and manufactured in Switzerland.

Hydrogen Energy Storage Compared to Battery Energy Storage System (BESS)

Compared to energy storage with Li-ion batteries, the DASH Power has the following substantial advantages:

- The standard metals we are using are 100% recyclable. Our system generates no waste during operation. The only side products from the process are pure water and heat
- Higher energy density 330 Wh/kg compared to 100-250 Wh/kg for lithium-ion batteries
- Four times more compact
- No self-discharge
- Three times longer lifetime
- No excess mining needed for the DASH Power, while lithium, nickel and cobalt used in batteries needs to be excavated, transported and extracted from minerals. 1 MWh of Li-ion battery requires 8 tons of lithium, 80 tons of nickel and 40 tons of cobalt!
- Much lower environmental footprint over the complete system lifetime
- The metal hydrides can last for decades without any losses (virtually no limit on the cycles, vs. 80% after 500-1000 cycles with Li-ion batteries)
- DASH Power can release 100% of the stored energy (0-100%) where BESS only release 60% (20-80%) of the capacity to ensure a reasonable lifetime. Thus, you need double the capacity of BESS to compare with DASH Power



Hydrogen Energy Storage Compared to Compressed High Pressure Storage

Compared to energy storage with compression and high-pressure storage, DASH Power has the following advantages:



- Extremely safe as hydrogen is stored below 45 bar(g) and the storage is inherently safe
- Same footprint as hydrogen stored at 1000 bar(g)
- Less demanding for obtaining permits due to higher safety
- No need for expensive and complicated hydrogen compression
- No OPEX for the operation of the compressor
- Less requirement for recertification of storage due to lower pressure
- Up to twice the lifetime of the high-pressure storage systems

5 standard Versions available

DASH 175-900

- ⚡ 175 kW electrical peak power
- 75 kW continuous power
- 🔋 45 kg_{H2} (900 kWh_e)
- 📦 Weight 12.5 tons
- 🕒 Provides power for 12 hours

DASH 260-1800

- ⚡ 260 kW electrical peak power
- 160 kW continuous power
- 🔋 90 kg_{H2} (1.8 MWh_e)
- 📦 Weight 16.8 tons
- 🕒 Provides power for 11 hours

DASH 400-2700

- ⚡ 400 kW electrical peak power
- 240 kW continuous power
- 🔋 135 kg_{H2} (2.7 MWh_e)
- 📦 Weight 21.0 tons
- 🕒 Provides power for 11 hours

DASH 500-3500

- ⚡ 500 kW electrical peak power
- 320 kW continuous power
- 🔋 180 kg_{H2} (3.5 MWh_e)
- 📦 Weight 25.3 tons
- 🕒 Provides power for 11 hours

DASH 500-4500

- ⚡ 500 kW electrical peak power
- 320 kW continuous power
- 🔋 225 kg_{H2} (4.5 MWh_e)
- 📦 Weight 29.3 tons
- 🕒 Provides power for 14 hours

Common Technical Specifications

DASH Storage	Unit	Specifications
Electrical interface output	V AC	3-phase 400 V 50/60 Hz
Communication interface	TCP/IP	OPC UA and hardwired
Ambient temperature	°C	-5 to +38
Noise	dB(A)	< 59 at 10 meters distance
Recommended hydrogen supply purity	%	> 99.995 (4.5)
Hydrogen supply pressure	bar(g)	30 - 45
Fuel cell efficiency (max.)	%	62
Max. efficiency (incl. waste heat)	%	84
Dynamic operation	%	10 - 90 in 1s during operation
Start-up time from cold	sec	60-120
Footprint	m ²	14.8 (20ft-ISO Container)
Expected service life	years	> 20

Options

The systems can be expanded with the following options:

- Integrated Air Compressor: in case compressed air is not available on-site, an air compressor can be included to ensure a fully autonomous operation
- Fire and Smoke Detector: as per the requirement of your own safety concept
- Waste Heat Recovery System (up to $8 \text{ kWh}_{\text{TH}}/\text{kg}_{\text{H}_2}$)
- Lightning Protection for Container

To ensure long time flawless operation of the system, we do offer technical support, on-site preventive maintenance, as well as a supply parts warranty to secure quick availability of spare parts at a fixed price. Long-term agreements are available to ensure bankability of hydrogen projects.

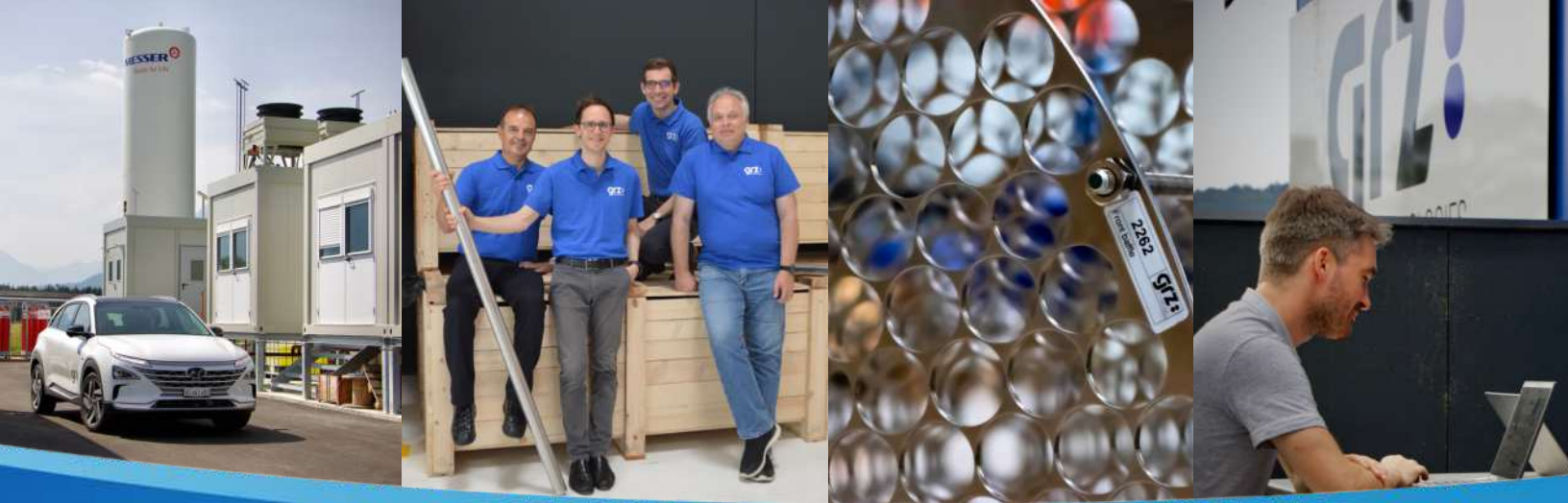


Compliance

The DASH Power Systems are CE certified according to the following directives:

- ATEX-Directive 2014/34/EU
- Machinery Directive 2006/42/EC
- Pressure Equipment Directive 2014/68/EU
- Low Voltage Directive 2014/35/EU





GRZ Technologies

GRZ Technologies was founded in 2017 as a spin-off from the Swiss Federal Institute of Technology in Lausanne. The company's pioneering technology is the result of several decades of research and development in the field of hydrogen, dating back to the early 1990s. GRZ's core competence is metal hydrides, which are used to manufacture different dense and safe hydrogen solutions, such as hydrogen storage systems, hydrogen-based power-to-power systems, and thermal hydrogen compressors. The latest development is our methanation solution UPSOM – which enables the conversion of raw biogas to nearly 100% synthetic methane, thus almost doubling the output of ordinary biogas.

Our team includes specialists from all relevant areas such as materials science, mechanical and thermal engineering, software design and project management. We operate our own materials laboratory and are continuously advancing our technology. Thanks to new, innovative approaches, combined with many years of experience, we are setting new standards in the field of hydrogen technology.

The vision of GRZ Technologies is to enable a world fuelled by renewable energy – day and night, summer and winter. In order to achieve this, we must replace fossil-based energy systems with safe, cost-efficient, and sustainable energy solutions where hydrogen is an important energy carrier in the equation. The introduction of a new, environmentally friendly energy system is a global challenge. Cooperation across countries and continents is crucial. GRZ therefore works together with organizations across the globe to battle these global challenges together. Our partners include Hyundai Motor Company, the Fischer group, AMPO, Sabanci, Susten, Auto AG, Gaznat and Messer Gas, among others.

Heute werden wir Strom
auf Wasserstoffbasis speichern.

Hier wird
erneuerbarer
Strom auf
Wasserstoffbasis
gespeichert.

ewb

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