



# DASH M-SERIES

SOLID-STATE HYDROGEN  
STORAGE MODULES

COMPACT

MODULAR

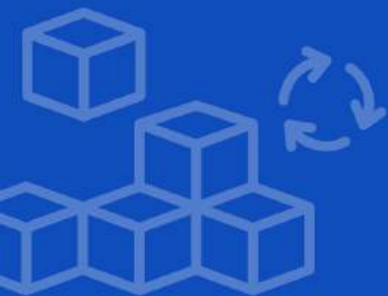
VERSATILE

POWERING THE FUTURE  
OF HYDROGEN STORAGE



# APPLICATION #1

The DASH M-Series offers a safe, compact, and scalable solution for hydrogen storage. Built for long-term reliability with minimal maintenance, it provides cost-effective energy storage for residential, industrial, and large-scale applications.



## UNLOCK THE POWER OF SOLID-STATE HYDROGEN

The ‘M’ in our DASH M-Series stands for modular, providing a variety of storage solutions that can always be scaled up for increased capacity.

### APPLICATION #1: RESIDENTIAL ENERGY STORAGE

The DASH M-Series is a compact, zero-emission storage solution that easily integrates with renewable energy systems for long-term, reliable residential use.

FEATURE	BATTERY SOLUTIONS	DASH M-SERIES H <sub>2</sub> STORAGE
Lifespan	5-10 Years	20+ Years
Storage Density	100 kWh <sub>e</sub> /m <sup>3</sup>	600 kWh <sub>e</sub> /m <sup>3</sup>
Safety Concerns	Fire Hazard	Extremely Safe (Low Pressure, Solid-State)
Environmental Impact	High Grey Energy, Challenging to Recycle	Low Grey Energy, Fully Recyclable





# CASE STUDY: HYVIVA

## HYVIVA'S RESIDENTIAL HYDROGEN STORAGE

Hyviva, a US-based company dedicated to sustainable energy, designed the "VivaGrid," a modular energy storage system for residential use. Typically installed indoors, this system stores excess solar energy for later use, offering a clean energy solution with extended storage capacity compared to traditional batteries.

### KEY DETAILS



CLIENT	HyViva
LOCATION	Washington, USA
PROJECT TYPE	Residential Hydrogen Storage
PRODUCT USED	DASH M1

### VIVAGRID TOWER SYSTEM

The VivaGrid consists of individual "drawers" that contain a specific technology, such as a controller system, fuel cell, electrolyzer, and GRZ's DASH M1.



### CHALLENGE

Hyviva needed a compact, scalable, and safe storage solution for homeowners committed to eco-friendly living. The goal was to provide an energy storage system that integrates seamlessly into home spaces while supporting a zero-emission lifestyle.

### SOLUTION

GRZ's DASH M1 Hydrogen Storage Module was the perfect fit. Compact and modular, the DASH M1 enables efficient hydrogen storage, where hydrogen serves as the main storage medium, complemented by a control battery. This setup allows easy expansion to meet growing energy demands over time.

### BENEFITS

With GRZ's DASH M1 at the heart of the VivaGrid, homeowners can store solar energy for use when solar generation is unavailable. The system reduces reliance on conventional batteries and thus aligns with Hyviva's climate-friendly solutions. Furthermore, its modular design allows for easy expansion, offering flexibility to meet growing energy demands over time.

## APPLICATION #2

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### APPLICATION #2: DASH M-SERIES AS REPLACEMENT OF HYDROGEN CYLINDER BUNDLES

In many industrial applications, hydrogen in moderate quantities (1-50 kg of hydrogen per day) is necessary. Typical applications include:

#### METAL PROCESSING AND HEAT TREATMENT

Hydrogen as a reducing agent during annealing, brazing, or sintering processes.

#### THIN-FILM DEPOSITION AND CHEMICAL VAPOR DEPOSITION (CVD) PROCESSES

Hydrogen for semiconductor manufacturing.

#### FUEL CELL STACK TESTING AND PROTOTYPING

Supports rapid, intermittent hydrogen consumption for testing stack efficiency, durability, and performance.

#### HYDROGENATION REACTIONS IN ORGANIC CHEMISTRY AND CATALYSIS LABS

Adds hydrogen atoms to unsaturated compounds, an essential process for synthesizing pharmaceuticals and agrochemicals, where stability and functionality are enhanced.

Traditionally, hydrogen is delivered in high-pressure gas cylinders at 200 or 300 bar, which can be costly and requires stringent safety measures.

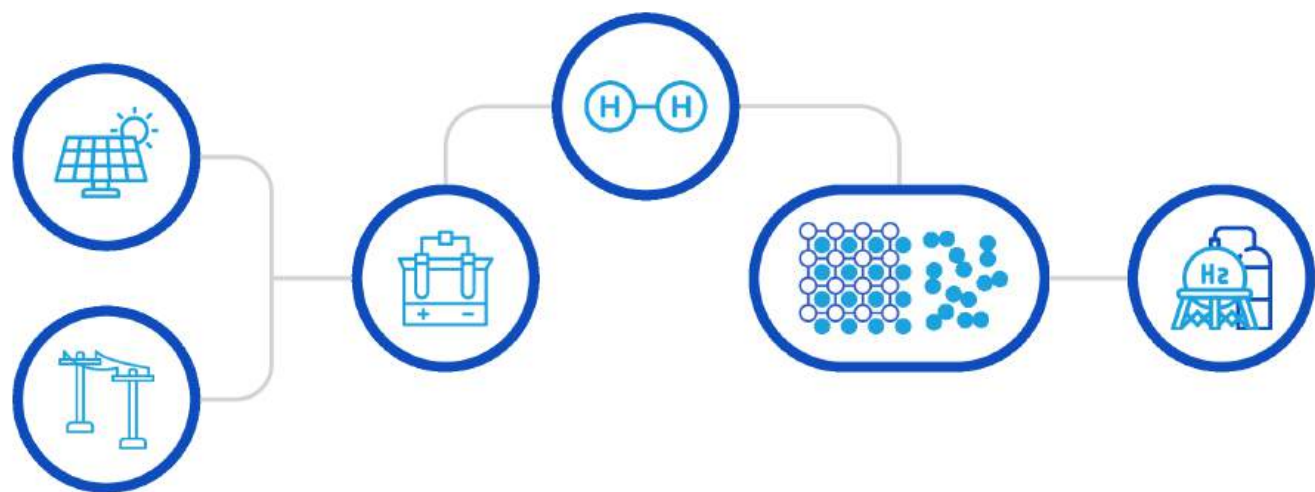
The DASH M-Series, when paired with a small-scale local electrolyzer, effectively replaces high-pressure cylinders, reducing handling time and improving safety while cutting levelized hydrogen costs by up to 70%.

This solution allows our customers to take a proactive approach to sustainability by generating and utilizing hydrogen locally.

By minimizing reliance on road transport for hydrogen delivery, we drive innovation and efficiency, helping to shape a more sustainable future.



# APPLICATION #2



A small-scale electrolyzer (e.g., 5 kW) is connected to the grid or to a local renewable production plant (e.g., a photovoltaic plant). The hydrogen produced is safely stored in the DASH M-Series module and delivered to the application on demand.

PARAMETER	BASIC SOLUTION: COMPRESSED H <sub>2</sub> CYLINDER BUNDLES (12 X 50L AT 300 BAR)	GRZ SOLUTION: DASH COMBINED WITH A SMALL-SCALE LOCAL ELECTROLYZER
Pressure	300 bar	< 45 bar
Hydrogen Storage Form	Gaseous	Solid-State
Explosivity	High	None
Safety Concept Required	ATEX, Ventilation and Sensors Required	None
Capacity	10.8 kg H <sub>2</sub> <sup>1</sup>	10 kg H <sub>2</sub> <sup>2</sup>
Footprint	1 m <sup>2</sup>	1 m <sup>2</sup>
Levelized Costs of Hydrogen Storage <sup>3</sup>	130€/kg H <sub>2</sub>	40€/kg H <sub>2</sub>

<sup>1</sup> Considering the DASH M10 unit; higher capacities are possible, even keeping the same footprint

<sup>2</sup> A capacity of 0.90 kg H<sub>2</sub> per cylinder (50L) is considered

<sup>3</sup> Considering a period of 10 years, cost of capital 4%/y, consumption of 2 kg H<sub>2</sub>/d for 250 d/y, cost of hydrogen (4.5) cylinder bundle at 300 bar 1570€ per unit, electricity cost 0.20€/kWh.

# CASE STUDY: EASYENERGY

## EASYENERGY'S APPROACH TO PRECISE STEEL ANNEALING

Easy Energy Companies & Consulting, a Swiss engineering and consulting firm, collaborated with GRZ to deliver a pioneering hydrogen storage solution for a prominent steel processing manufacturer. The solution—GRZ's DASH M20 solid-state hydrogen storage module—provides a dependable on-site hydrogen supply critical to the steel annealing process essential in sink manufacturing.



### KEY DETAILS



CLIENT	Easy Energy Companies & Consulting SA
LOCATION	Switzerland
PROJECT TYPE	Industrial H <sub>2</sub> Storage for Steel Processing
PRODUCT USED	DASH M20

### CHALLENGE

This project required a safe, efficient storage solution with adaptable thermal management to seamlessly integrate with the client's steel processing line. Precise hydrogen flow control was necessary for performance, reliability, and safety.

### SOLUTION

GRZ's DASH M20 module met the company's stringent operational standards, offering low-pressure, compact hydrogen storage with customizable performance and thermal management. The DASH M20's built-in TMS ensures a steady hydrogen supply in an ATEX-rated environment with minimal maintenance.

### BENEFITS

By implementing the DASH M20, EasyEnergy was able to provide a solid-state, low-pressure solution optimized for industrial demands. Its compact, modular design and integrated thermal management reduce reliance on external sources while delivering the precise control essential to steel annealing.



# APPLICATION #3

## APPLICATION #3: SOLID-STATE HYDROGEN STORAGE FOR LARGE-SCALE APPLICATIONS

Hydrogen is a vital technical gas. While its use in industry spans over a century, it is gaining traction as we transition to greener industrial processes. Large-scale hydrogen storage is essential for several applications, including:

AMMONIA SYNTHESIS

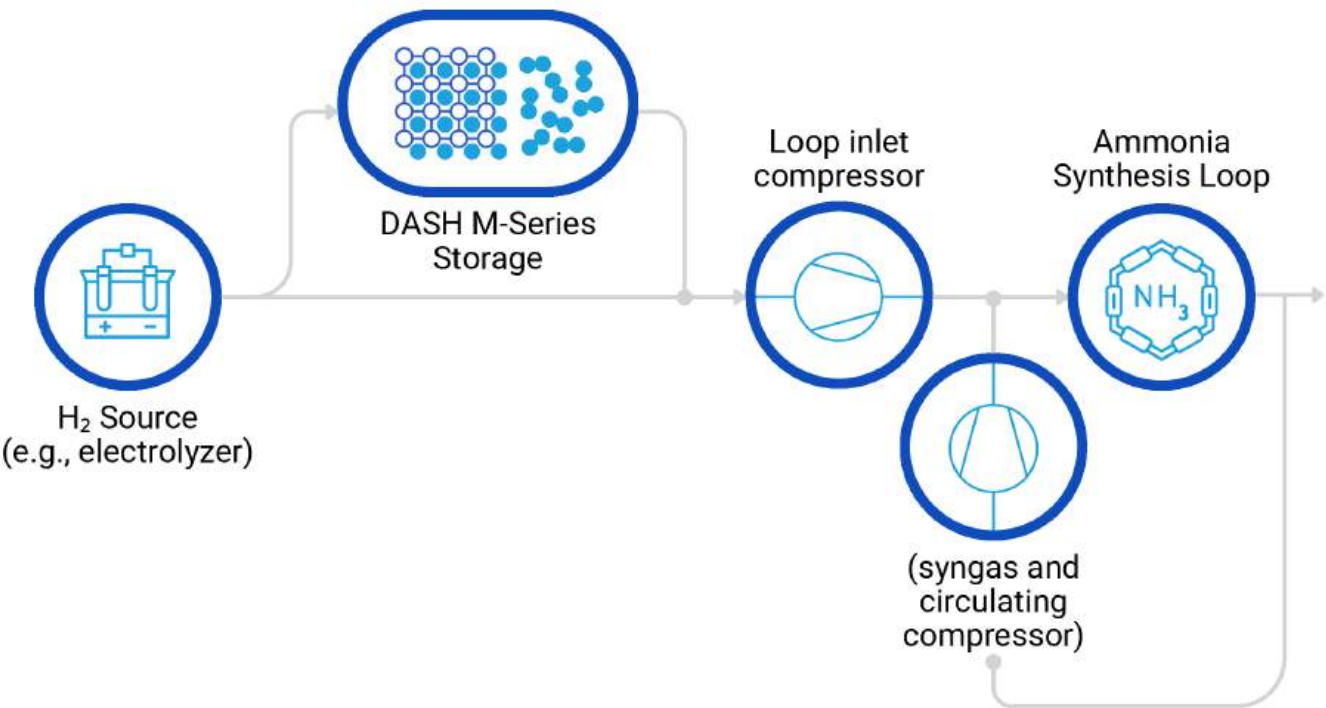
Hydrogen is a key precursor, and buffer storage is crucial for operational flexibility, especially when the hydrogen is sourced from fluctuating renewable energy.

POWER GENERATION

Hydrogen fuels MW-scale turbines, with buffer storage balancing the hydrogen production and consumption profiles.

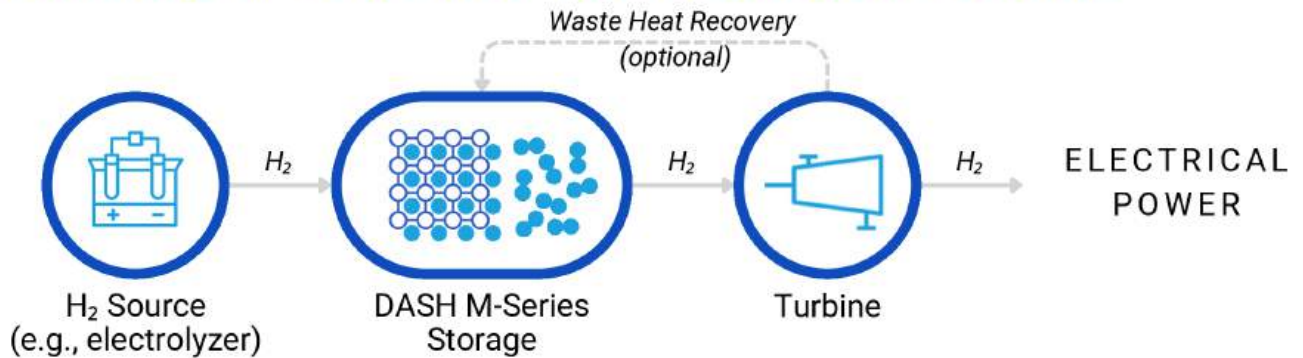
In these scenarios, hydrogen is stored directly from the electrolyzer without extra compression or liquefaction steps, making the DASH M-Series a streamlined, cost-effective solution. Upon demand, the hydrogen can be desorbed and supplied to the end user. Depending on specific requirements for pressure and flow rates, additional thermal integration processes enable waste heat recovery from turbines, which further optimizes overall energy efficiency.

### EXAMPLE APPLICATION FOR AMMONIA PLANT



## APPLICATION #3

### EXAMPLE APPLICATION FOR HYDROGEN TURBINE

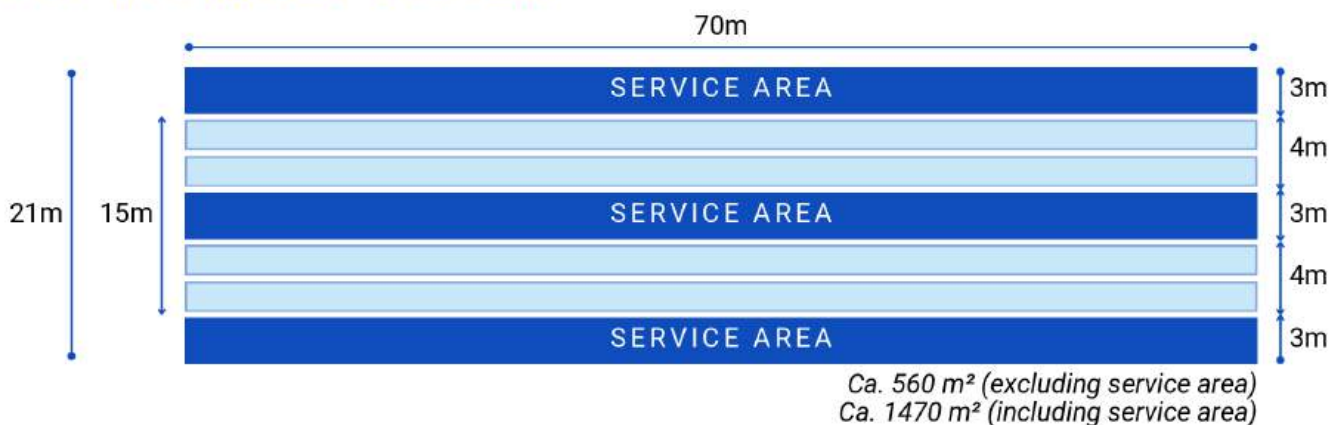


Typical  $H_2$  production pattern: 8-20 hours per day

Typical power generation pattern: 3-8 hours per day

With top-tier safety standards, a minimal footprint, and cost-efficient storage, the DASH M is a robust choice for industrial-scale hydrogen needs. For example, a 50-ton storage capacity requires only 560 m<sup>2</sup>, simplifying site preparation and safety requirements:

### 50T HYDROGEN SYSTEM



PARAMETER	BASIC SOLUTION: COMPRESSED $H_2$ (200 BAR)	GRZ SOLUTION: DASH M-SERIES
Pressure	200 bar	< 45 bar
Hydrogen Storage Form	Gaseous	Solid-State
Explosivity	High	None
Capacity	50 tons $H_2$	50 tons $H_2$
Levelized Costs of Hydrogen Storage <sup>1</sup>	0.48€/kg $H_2$	0.24€/kg $H_2$

<sup>1</sup> Considering a lifetime of 20 years, cost of capital 4%/y, costs of hydrogen compression of 0.55€/kg  $H_2$ , operation 365 days per year.



## KEY FEATURES

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DASH hydrogen storage modules are patented, solid-state systems designed to provide a safe, efficient, and sustainable solution for hydrogen storage. Utilizing advanced metal hydride technology, these modules excel in various applications, offering a range of benefits:



### HIGH STORAGE DENSITY

Each DASH M module stores up to 30 kg of hydrogen per cubic meter at system level, optimizing space and maximizing storage capacity in compact environments.



### MODULAR DESIGN

The system's modular nature easily adapts to growing demands, ensuring users can expand capacity as needed.



### NO COMPRESSION REQUIRED

DASH M eliminates the need for costly hydrogen compressors, simplifying installation and reducing infrastructure requirements.



### LOW LEVELIZED COST OF STORAGE (LCOS)

With no need for costly compression or liquefaction, DASH M offers an attractive levelized cost of storage, ensuring both efficiency and affordability over its lifecycle.



### LONG SERVICE LIFE

Built for durability, DASH M modules provide over 20 years of reliable service with no performance degradation.



### LOW OPERATIONAL EXPENDITURE (OPEX)

With fewer moving parts and no need for compression, DASH M significantly reduces maintenance costs and extends system lifespan.



### LOW EMISSIONS

DASH M operates emission-free, making it a sustainable choice for hydrogen storage.



### SUPERIOR SAFETY STANDARDS

DASH M's solid-state, low-pressure design ensures safe hydrogen storage, even in sensitive environments such as residential buildings or industrial sites.

# DASH M-SERIES COLLECTION

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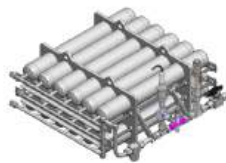
The DASH M-Series offers a comprehensive range of solid-state hydrogen storage modules, engineered to address diverse energy storage requirements across residential, small-scale, and large-scale industrial applications. Each module upholds the highest standards in safety and high-density storage, offering a secure, scalable, and cost-effective hydrogen solution.

## DASH M1, M3, M10

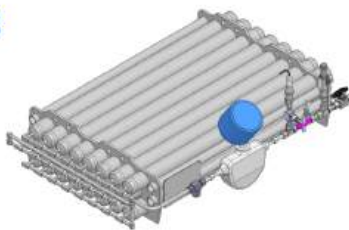
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Optimized for compact hydrogen storage needs, the DASH M1, M3, and M10 modules are designed for use in residential, laboratory, and industrial settings. These models deliver scalable, high-density hydrogen storage that balances efficiency and reliability.

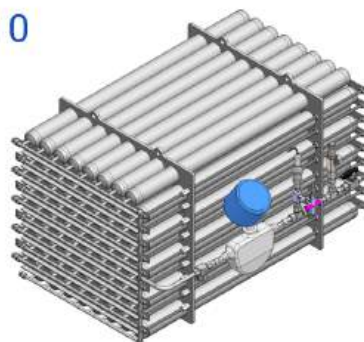
DASH M1



DASH M3



DASH M10

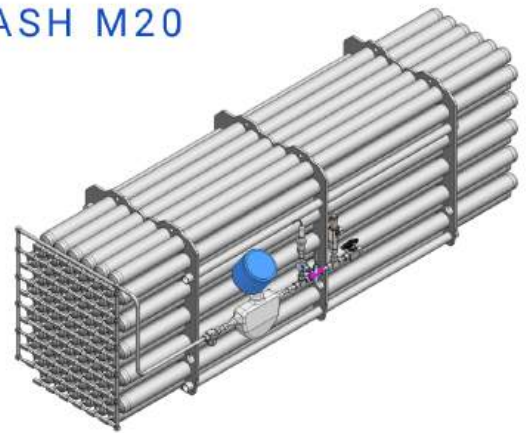


## DASH M20, M45

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Built for larger industrial and energy-intensive applications, the DASH M20 and M45 modules offer substantial storage capacity to support high-demand environments. Engineered for durability, these models are ideal for industrial processes, renewable energy integration, and large-scale backup power systems.

DASH M20

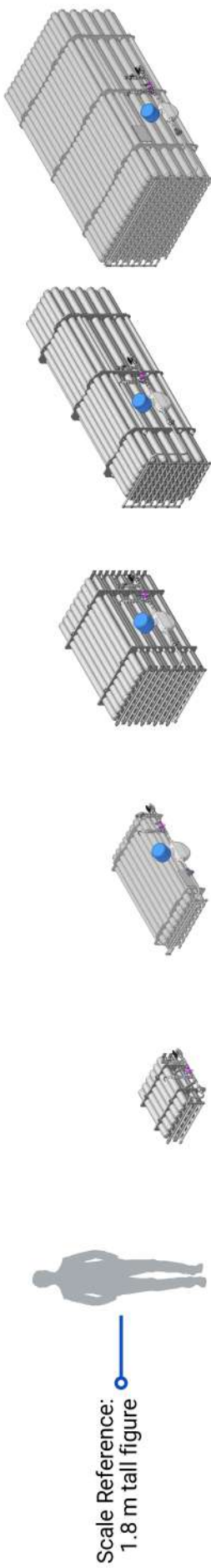


DASH M45





# TECHNICAL SPECIFICATIONS



DASH M-SERIES	UNIT	M1	M3	M10	M20	M45
Hydrogen Storage Capacity	kg H <sub>2</sub>	1	3	10	20	45
Weight	kg	111	315	1035	1910	4180
Dimensions (L x W x H)	m	0.55 x 0.44 x 0.22	1.05 x 0.65 x 0.22	1.07 x 0.65 x 0.70	2.00 x 0.60 x 0.70	2.00 x 1.10 x 0.70
ATEX Zones		None				
Recommended Hydrogen Supply Purity	%	99.995				
Hydrogen Charging Pressure	bar(g)	30 to 45 <sup>1</sup>				
Hydrogen Discharging Pressure	bar(g)	1 to 45 <sup>1</sup>				
Expected Service Life	years	> 20				

<sup>1</sup> Depending on Thermal Management System (TMS)

## OPTIONAL ADD-ONS

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The DASH M-Series offers a range of optional features designed to optimize performance across diverse environments and applications:



### PRESSURE TRANSMITTER

Monitors real-time hydrogen pressure for optimal operation and safety.



### IN-STREAM HYDROGEN TEMPERATURE SENSOR

Measures hydrogen temperature.



### BI-DIRECTIONAL MASS FLOW METER

Tracks hydrogen inflow/outflow.



### ACTIVE THERMAL MANAGEMENT SYSTEM (TMS)

Maintains ideal temperature for superior performance in hot or cold climates.

## TECHNICAL SERVICES

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Our comprehensive support offerings are designed to keep your DASH M-Series system running reliably and efficiently:



### ON-SITE ASSISTANCE

Expert assistance during setup for optimal system functionality.



### TECHNICAL SUPPORT

Available remotely or on-site for troubleshooting and preventative maintenance.



### WARRANTY EXTENSION

Extend warranty coverage annually when paired with our technical support.



# COMPLIANCE

Every DASH M-Series module is based on the strict quality requirements of GRZ with certifications that meet international safety and performance standards:



**CE  
CERTIFICATION**

Compliance with European safety, health, and environmental standards.



**ATEX DIRECTIVE  
2014/34/EU**

Certified for safe use in potentially explosive environments.



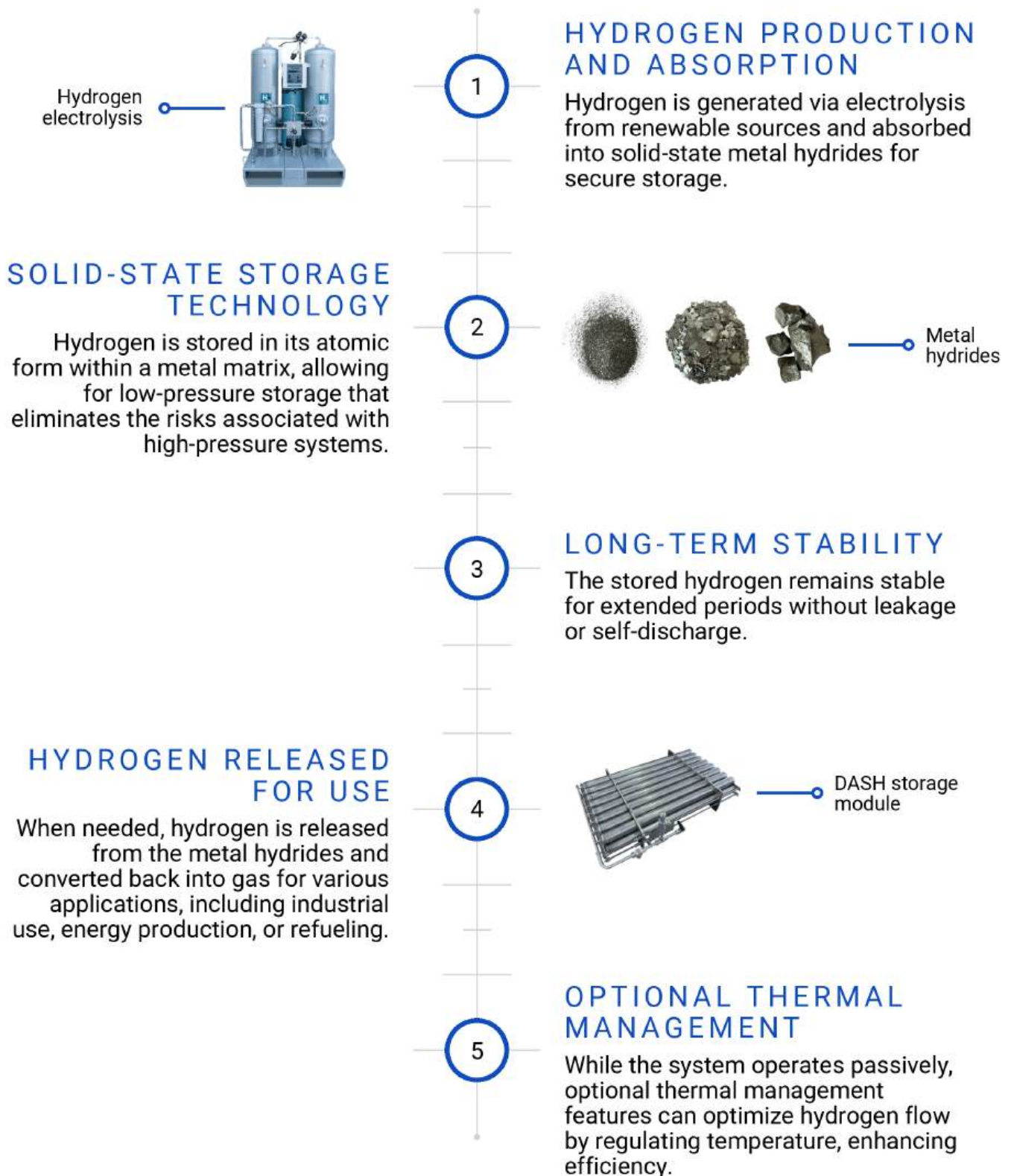
**PRESSURE EQUIPMENT  
DIRECTIVE 2014/68/EU**

Guarantees safe design and manufacturing of pressure equipment.



# OPERATIONAL OVERVIEW

DASH hydrogen storage modules safely and efficiently store hydrogen using advanced metal hydride technology. This proprietary method absorbs hydrogen in solid form, providing long-term stability and security.





## ABOUT GRZ TECHNOLOGIES

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At GRZ Technologies, we stand at the forefront of hydrogen storage innovation, dedicated to reshaping the future of clean energy through our patented metal hydride technology. With decades of research and development, we deliver safe, efficient, and high-density hydrogen storage solutions for diverse applications, from residential use to large-scale applications.

## PARTNERSHIPS

Our partnerships with industry leaders like Hyundai, AMPO, Sabanci, and the fischer group propel us forward, enabling advancements in backup power and renewable energy integration—all while prioritizing reliability and cost-efficiency.

A WORLD  
FUELED BY  
RENEWABLE  
ENERGY –  
DAY AND NIGHT,  
SUMMER AND  
WINTER.

Fueled by a passion for a sustainable energy future, GRZ Technologies is not just innovating; we are revolutionizing the storage and utilization of hydrogen, setting new benchmarks for excellence in the industry.

# CONTACT US TODAY AND BE PART OF THE CLEAN ENERGY REVOLUTION



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