



HOPEWIND

Stock Code: SSE-603063

Hydrogen Production Power Supply Product Manual

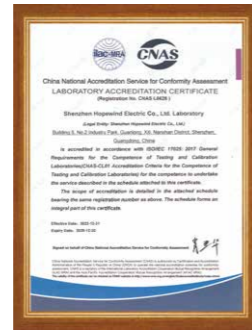
Shenzhen Hopewind Electric Co., Ltd. (Stock Code: 603063) focuses on the R&D, production, sales and service of renewable energy and electric drive products, with main products of wind power generation products, photovoltaic (PV) generation products, energy storage products, power quality products, and electric drive products, etc. Furthermore, Hopewind owns independent development and testing platforms of integrated high-power power electric equipment and monitoring system. Through innovation in technology and service, Hopewind continuously creates value for customers, and has become one of the most competitive enterprises in the renewable energy field nationwide.

In the field of electrolytic hydrogen production power supply, the IGBT rectification power supply scheme launched by Hopewind covers electrolyzer below 1500V, and the DC output current is as high as 20000A, which can meet requirements of electrolytic hydrogen production in multiple scenarios.

[Honors]



National Science and Technology Progress Award



Laboratory Qualification Approved by CNAS



National High-Tech Enterprise

[System Certifications]



ISO 9001:2015



ISO 14001:2015



ISO 45001:2018

Headquarter · Shenzhen

4 R&D and manufacturing bases: Shenzhen, Suzhou, Xi'an, Heyuan

30+ global service bases: Deployed worldwide to provide comprehensive services for global customers



Overview

Hopewind HHP series electrolytic hydrogen production power supply products ("Hopewind hydrogen production power supply" for short) adopt a fully-controlled IGBT topology scheme and a modular redundant design, thus featuring high efficiency, high reliability, high power factor and low harmonics. Inheriting and drawing on the company's successful application of and experience in new energy power generation and large drive, Hopewind Hydrogen production power supply is characterized by optimized design, reliability and stability, easy maintenance and high adaptability.

Naming Rules

HHP - 6600 - 740 - A / I / N

Product name:
Hopewind Hydrogen Production Power Supply

Rated output current:
6600A

Rated output voltage:
740Vdc

Cooling method:
A: Air cooling, L: Liquid cooling

Place:
I: Indoor, O: Outdoor container

Altitude:
N: Normal, P: Plateau, U: Ultra Plateau



Typical Power Supply Cabinet

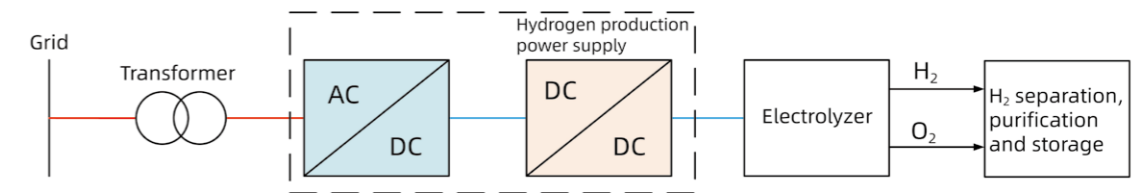


■ Grid-Connected Solutions

In the grid-connected hydrogen production scenario, the power comes from the power grid, wind power generation, PV power generation, etc. In this scenario, the power supply for hydrogen production acts as Grid-related power electronic equipment, which should have good grid-involved characteristics and good power quality. Hopewind IGBT hydrogen production power supply has these characteristics.

Grid Power-Based Hydrogen Production

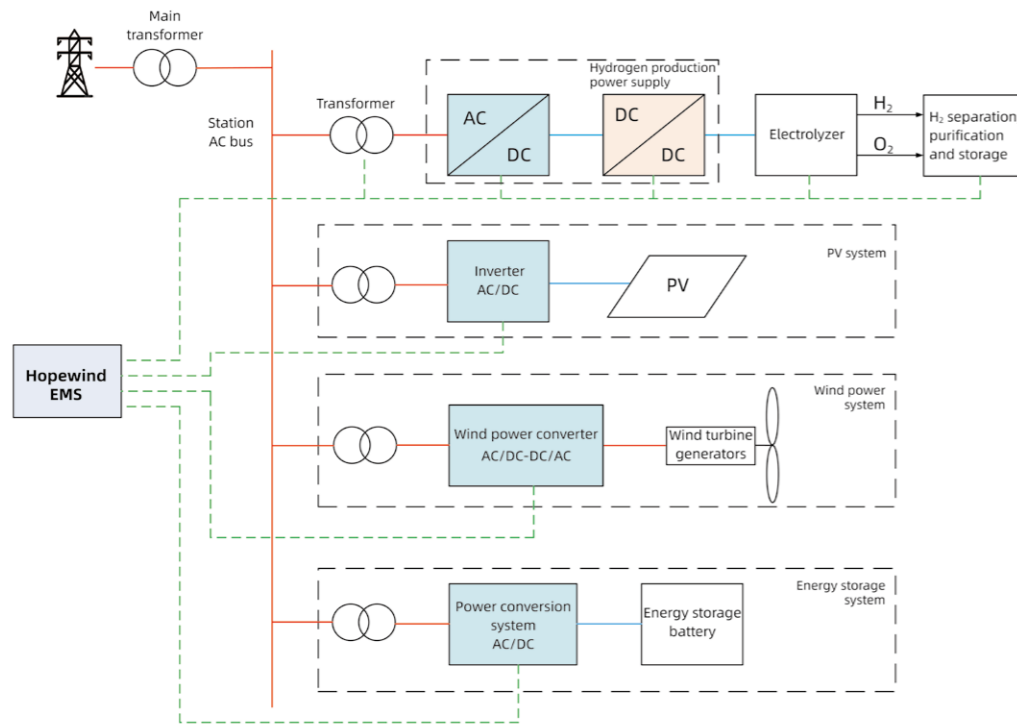
The power supply for hydrogen production from the grid. After voltage reduction by the transformer, the power is rectified by the IGBT hydrogen production power supply, rectify the AC power to stable DC power for the electrolyzer. The hydrogen power supply can be primary topology (AC/DC) or two-stage topology (AC/DC+DC/DC) according to the project situation.



■ Grid-Connected Solutions

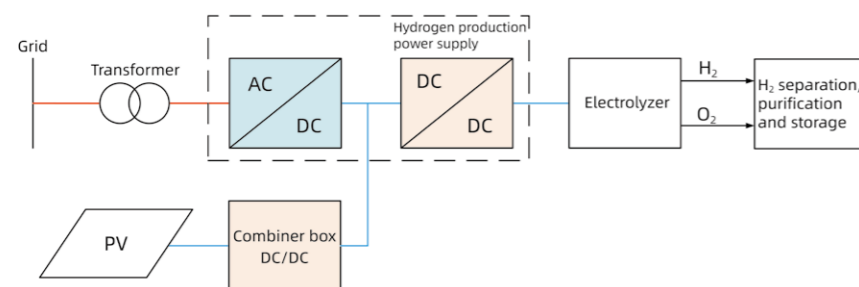
Centralized Wind Power/PV Power/Stored Power-Based Hydrogen Production

There are two operating modes. The first type: the centralized renewable energy station gives priority to supplying power to the grid as instructed, and supplies surplus power for hydrogen production. This can promote the consumption of wind and PV power. The second type: the wind and PV power can only be used to produce hydrogen, offset renewable energy volatility by configuring stored energy, maximizing the efficiency of green power-based hydrogen production. In this hydrogen production system, there are multiple types and a large number of devices. Hopewind Renewable Energy-Based Hydrogen Production Smart Management System (EMS) is a system for coordinated control of renewable energy power supply, PV power, energy storage, and hydrogen production equipment. It can ensure grid adaptability of renewable energy stations as well as wind/PV power consumption, hydrogen production with surplus power, safe hydrogen production, etc.



PV + Grid Power-Based Hydrogen Production

This system supports two power sources, namely, PV and grid power, which can be used separately or in a hybrid mode. Grid power can act as a standby source for PV power, which can be supplemented to the AC/DC part of the hydrogen production power supply when power of the PV system is insufficient, so as to maintain the output power of the hydrogen production power supply at the target value. The AC/DC part of the hydrogen production power supply features two-way regulation. When power of the PV system is greater than the operating power of the electrolyzer, the surplus power can be inverted to the power grid through the AC/DC part, hence improving the overall utilization rate of PV power.



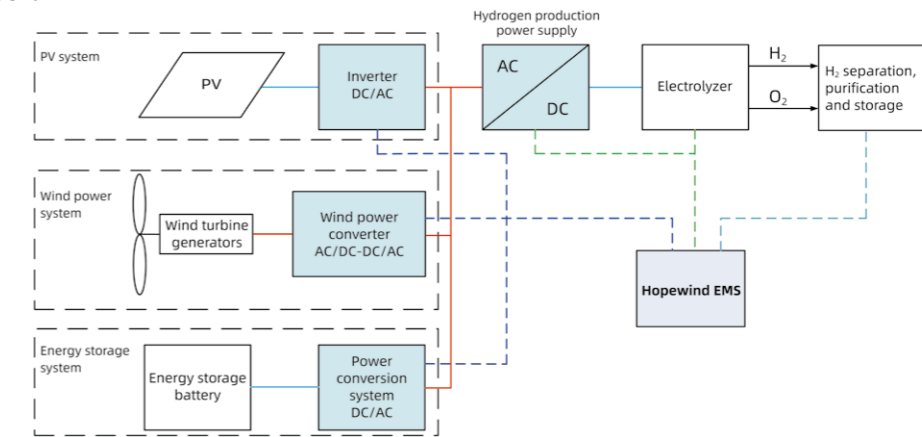
■ Off-Grid Solutions

In the off-grid hydrogen production scenario, the power comes from wind power generation/PV power generation/energy storage system, etc. In this scenario, due to a lack of large grid support and big volatility in the microgrid, the hydrogen production power supply is required to operate at a wider range of voltage and frequency fluctuations. Hopewind EMS coordinated control of renewable energy, energy storage and hydrogen production, enables efficient system response, coordinated output of active and reactive power, fast regulation of the energy storage system, and suppression of volatility in new energy power generation, ensures safe and efficient hydrogen production.

Off-grid systems can be classified into AC coupling system, and DC coupling system.

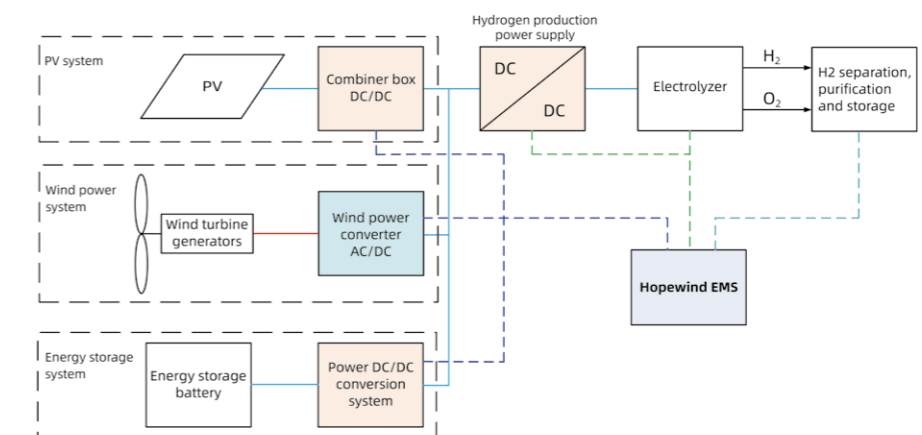
AC Coupling Off-Grid Hydrogen Production

In the AC coupling off-grid hydrogen production scenario, the power comes from PV/wind power, with the power supply sharing an AC bus with wind power, PV power and storage energy. This system features MPPT tracking that can track the maximum PV power generation in real-time to improve the efficiency of PV power generation. By configuring the energy storage system, it can suppress volatility in wind/PV power generation, thus stabilizing the output power of hydrogen production power supply and ensuring the efficiency of hydrogen production. AC coupling is a full-fledged off-grid hydrogen production solution.



DC Coupling Off-Grid Hydrogen Production

The DC coupling off-grid system, usually for distributed hydrogen production, is one of the typical applications for green power-based hydrogen production. PV power (via combiner box) and wind power are connected to the DC bus for powering the DC/DC hydrogen production power supply, and the energy storage system is used for volatility suppression. The DC coupling system has a higher theoretical efficiency because it eliminates AC conversion.



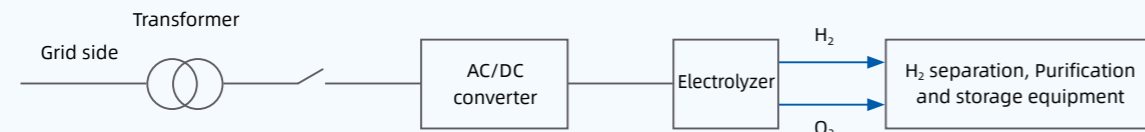
>> AC/DC Primary Topology IGBT Power Supply

Performance & Features

- Suitable for 600~1500V electrolyzer
- Regulation with a wide power range of 10~110% and fast response
- High power factor of above 0.99 ($\geq 30\%P_n$) and reactive power support as needed
- Good grid-involved characteristics, with grid harmonic current THDi $\leq 3\%$, and SCR ≤ 1.5
- High efficiency ($\geq 98.5\%$)
- Good parallel characteristics and easy system expansion
- Supporting air cooling/liquid cooling and easy maintenance



Product Working Principle



Technical Parameters

Product		AC/DC Primary Topology Series
DC Parameters	Output Voltage Range	600V~1500V
	Output Current Range	0A~20000A
	DC Voltage Ripple	$\leq 1\%$
	DC Stabilized Current Precision	$\pm 1\%$ (steady state)
	DC Stabilized Voltage Precision	$\pm 1\%$ (steady state)
	Load Response Time	$< 0.1s$ (0%~100% load, running state)
	Output Control Mode	Current control (default), Voltage control, Power control
AC Parameters	Input AC Voltage Range	380V~900V
	Rated Operating Frequency	50Hz / 60Hz
	Rated Power Factor	> 0.99 (over $30\%P_n$)
	Adjustable Power Factor Range	-0.95Lead~0.95Lag
	Allowable Grid Frequency Deviation	$\pm 10\%$
	Allowable Grid Voltage Deviation	$\pm 10\%$
	Total Harmonic Distortion Rate of Grid-connected Current	$< 3\%$ (over $30\%P_n$)
Access Method	3-phase 3-wire+PE	
System	Wiring In / Out Mode	In: top / bottom, Out: top / bottom
	Efficiency	$\geq 98.5\%$
Environmental Requirements	Cooling Method	Temperature-controlled air cooling / Liquid cooling
	Working Temperature Range	$-40^{\circ}C \sim +55^{\circ}C$
	Electromagnetic Environment Category	Class A
	Relative Humidity	0%~95% (no condensation)
	Enclosure Protection Rating	IP23 / IP54
Highest Altitude of Installation Site	4000m	
External Communication	External Communication Interface	RS485, Ethernet and 4mA~20mA digital analog, etc.
	External Communication Protocol	Modbus RTU, Modbus TCP
Display	HMI	Touch screen (optional)

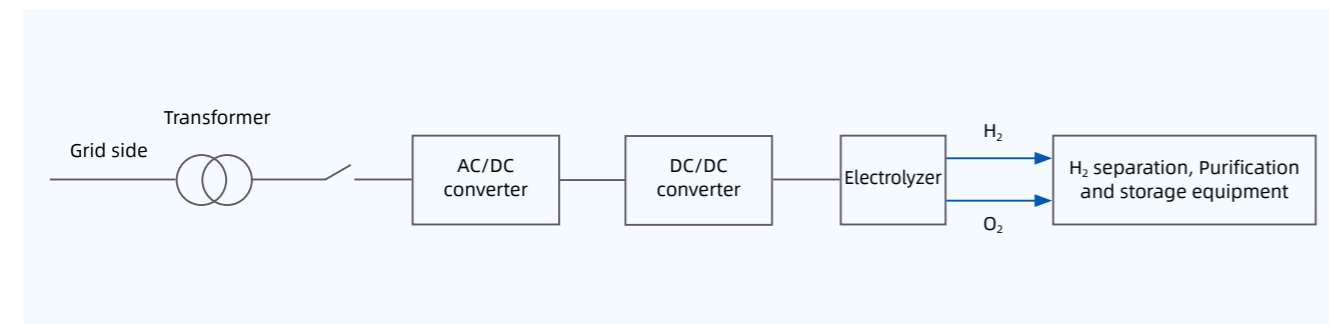
>> AC/DC+DC/DC Two-Stage Topology IGBT Power Supply

Performance & Features

- Suitable for 0~1500V electrolyzer
- Regulation with a wide power range of 10~110% and fast response
- High power factor of above 0.99 ($\geq 30\%P_N$) and reactive power support as needed
- Good grid-involved characteristics, with grid harmonic current THDi $\leq 3\%$, and SCR ≤ 1.5
- High efficiency ($\geq 97\%$)
- Good parallel characteristics and easy system expansion
- Supporting air cooling/liquid cooling and easy maintenance



Product Working Principle



Technical Parameters

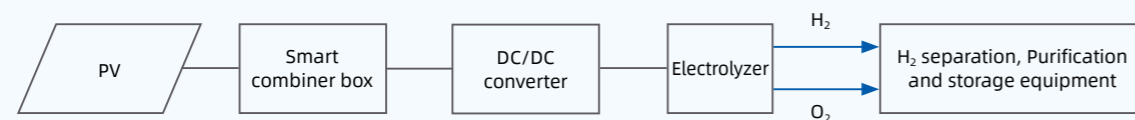
Product		AC/DC+DC/DC Two-stage Topology Series
DC Parameters	Output Voltage Range	0V~1500V
	Output Current Range	0A~20000A
	DC Voltage Ripple	$\leq 1\%$
	DC Stabilized Current Precision	$\pm 1\%$ (steady state)
	DC Stabilized Voltage Precision	$\pm 1\%$ (steady state)
	Load Response Time	<0.1s (0%~100% load, running state)
	Output Control Mode	Current control (default), Voltage control, Power control
AC Parameters	Input AC Voltage Range	100V~1140V
	Rated Operating Frequency	50Hz / 60Hz
	Rated Power Factor	>0.99 (over 30% P_N)
	Adjustable Power Factor Range	-0.95Lead~0.95Lag
	Allowable Grid Frequency Deviation	$\pm 10\%$
	Allowable Grid Voltage Deviation	$\pm 10\%$
	Total HarmonicDistortion Rate of Grid- connected Current	<3% (over 30% P_N)
	Access Method	3-phase 3-wire+PE
System	Wiring in / Out mode	In: top / bottom, Out: top / bottom
	Efficiency	$\geq 97\%$
Environmental Requirements	Cooling Method	Temperature-controlled air cooling / Liquid cooling
	Working Temperature Range	-40°C~+55°C
	Electromagnetic Environment Category	Class A
	Relative Humidity	0%~95% (no condensation)
	Enclosure Protection Rating	IP23 / IP54
	Highest Altitude of Installation Site	4000m
External Communication	External Communication Interface	RS485, Ethernet and 4mA~20mA digital analog, etc.
	External Communication Protocol	Modbus RTU, Modbus TCP
Display	HMI	Touch screen (optional)

Performance & Features

- Suitable for direct PV DC power for hydrogen production
- Fast power response adapted to rapid power volatility in PV power generation
- High efficiency ($\geq 98.5\%$)
- Good parallel characteristics and easy system expansion
- Air cooling and ease of maintenance



Product Working Principle



Technical Parameters

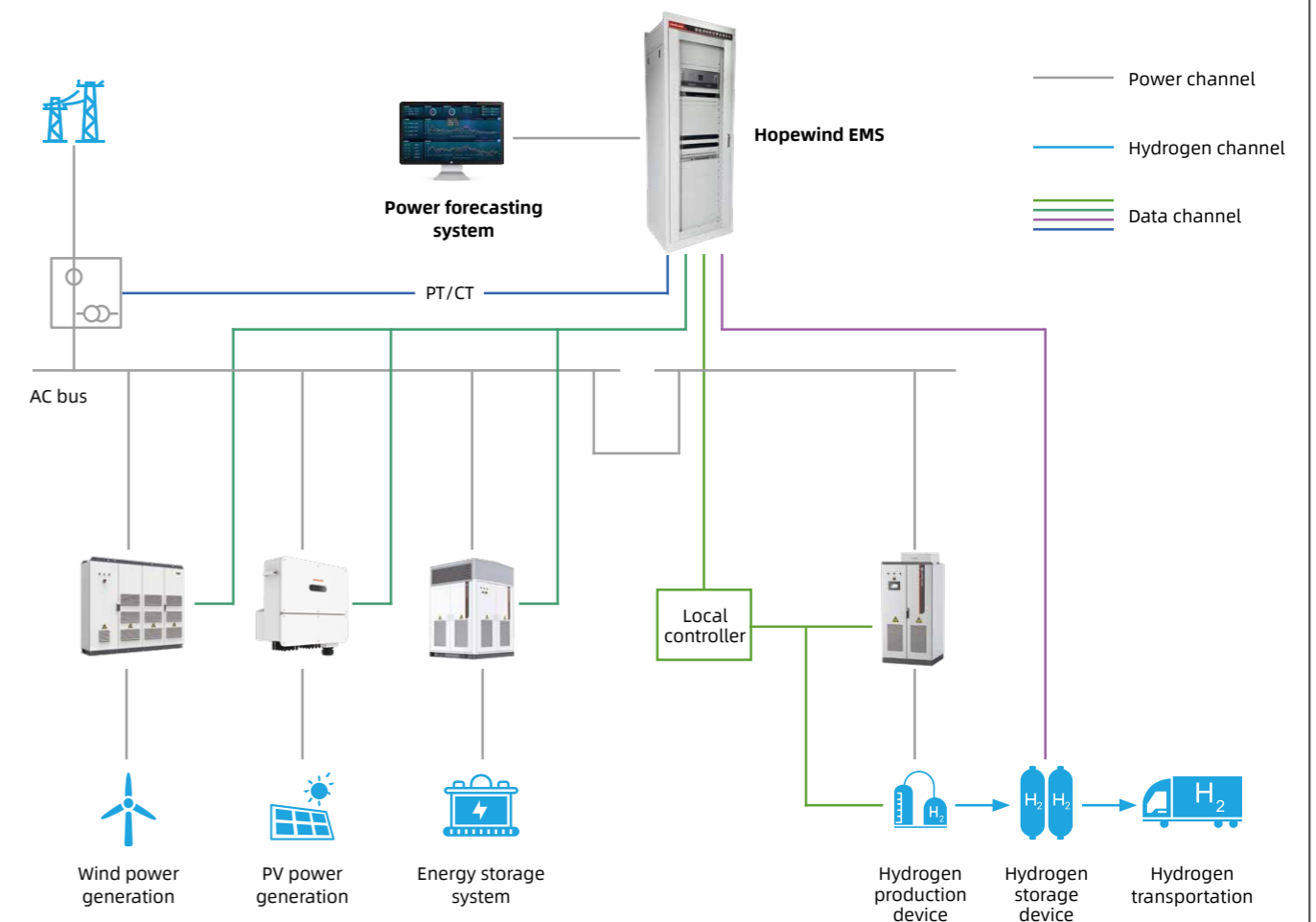
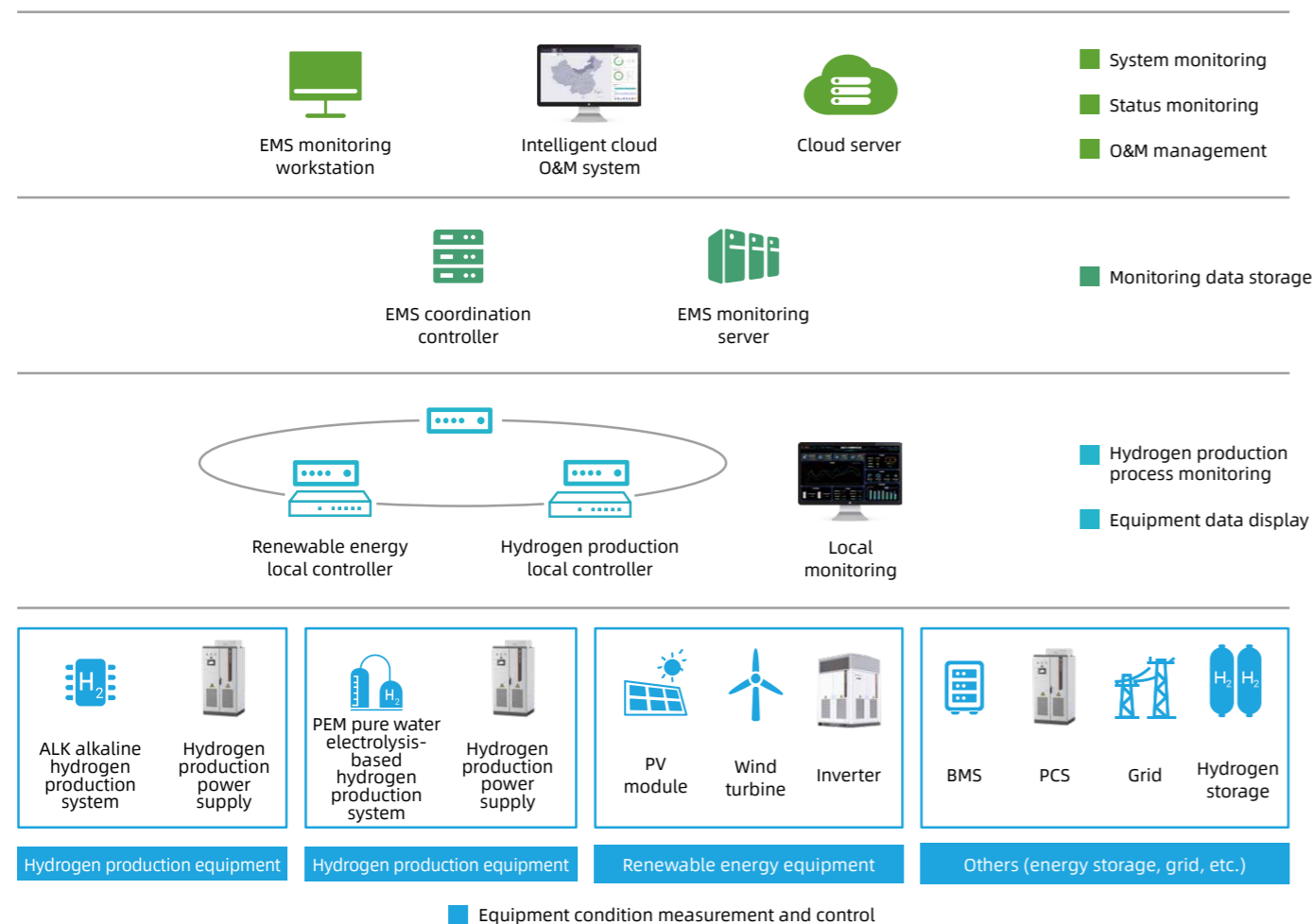
Product		DC/DC Conversion
Output Parameters	Output Voltage Range	0V~750V
	Output Current Range	0A~7260A
	DC Voltage Ripple	$\leq 1\%$
	DC Stabilized Current Precision	$\pm 1\%$ (steady state)
	DC Stabilized Voltage Precision	$\pm 1\%$ (steady state)
	Load Response Time	<0.1s (0%~100% load, running state)
Input Parameters	Output Control Mode	Current control (default), Voltage control, Power control
	Input Voltage Range	0V~780V
System	Voltage Fluctuation Range	$\pm 10\%$
	Wiring in / Out mode	In: side, Out: bottom
	Efficiency	$\geq 98.5\%$
Environmental Requirements	Cooling Method	Air cooling
	Working Temperature Range	-40°C~+55°C
	Electromagnetic Environment Category	Class A
	Relative Humidity	0%~95% (no condensation)
	Enclosure Protection Rating	IP23
	Highest Altitude of Installation Site	4000m
External Communication	External Communication Interface	RS485, Ethernet and 4mA~20mA digital analog, etc.
	External Communication Protocol	Modbus RTU, Modbus TCP
Display	HMI	Touch screen (optional)

Renewable Energy-Based Hydrogen Production Panoramic Monitoring Solution

- Supporting local and cloud-based deployment monitoring
- Massive data acquisition, storage, statistics, computing and analysis enabled by the monitoring server
- High compatibility: Supporting Windows, Linux and domestically developed operating systems with high security and reliability
- User-friendly interface: Dynamic component display under multiple standards
- Ease of deployment, flexible and convenient configuration, and intuitive monitoring interface
- Supporting operation across platforms such as servers, industrial control screens and PCs

Hopewind EMS

- As the control center of green power-based hydrogen production, EMS can coordinate multiple devices for safe and stable operation
- EMS can generate the optimal power curve of hydrogen production based on wind/PV power generation forecasts and energy storage system status and make proper corrections according to system inputs
- Working with energy storage, EMS can make full use of new energy power generation for maximum hydrogen production efficiency and be adapted to off-grid and grid-connected scenarios
- EMS supports coordinated control among multiple electrolyzers mainly under the "capacity assessment + shift control" strategy, thus shortening the start-up time and averaging the production cycle for electrolyzers
- The station layer-EMS control layer-controlled equipment layer networking architecture can enable layered control for higher control efficiency and reliability
- EMS supports grid-connected and off-grid scenarios, fully adapting to renewable energy-based hydrogen production



Performance & Features

- Stable operation: High-performance chips, real-time operating systems, and highly stable hardware and software
- High efficiency and reliability: Modular design featuring customization, power distribution optimization, high control accuracy and supporting fault locating, recording and history inquiry
- Active-standby configuration: Supporting configuration of both active and standby controllers for automatic switchover, greatly improving system stability
- Multi-scenario application: Applicable to grid-connected/off-grid energy management scenarios covering hydrogen production, power grid, wind power, PV power, and energy storage
- Strategy customization: Supporting both conventional control modes and customized development



System Specifications

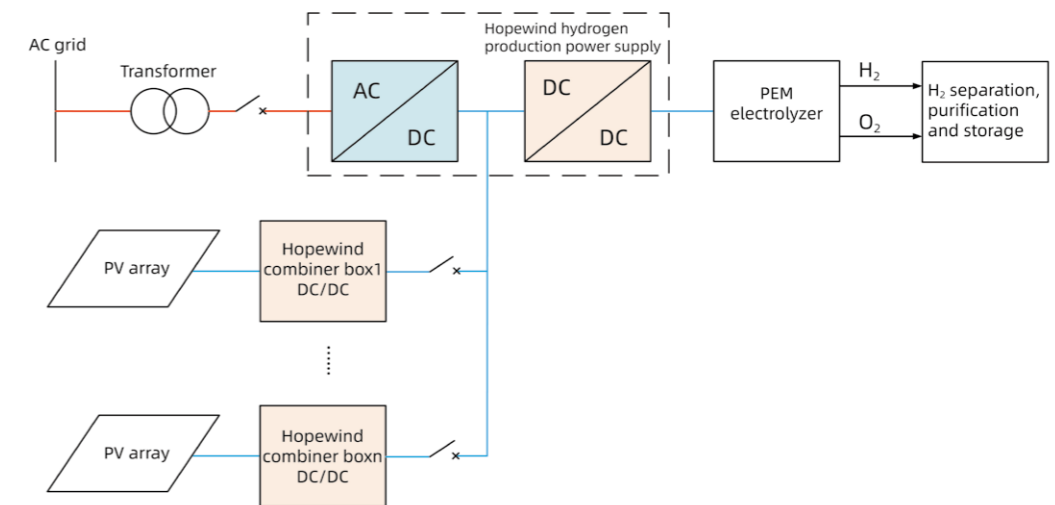
Panel Cabinet Input Power	220Vac / 50Hz
Control Unit Input Power	24Vdc, Max.4A
Device Communication Interface	RJ45, RS485, DO, AO
Operating System	Linux, Windows
Monitoring Display	Workstation
Working Temperature	-40°C~+65°C
Storage Temperature	<90°C
Relative Humidity	20%~90%
Dimensions (H*W*D)	2260*800*600 / 2260*800*800 (mm)

Application in Shaanxi

Hopewind hydrogen production power supply HHP-4500-200 was applied by a chemical manufacturer in Shaanxi. This project is a power supply system with two channels of power, namely, AC power grid and PV power. The hydrogen production power supply has different operating modes:

(1) Grid power-based mode; (2) Off-grid PV power-based mode; (3) PV + grid power-based mode.

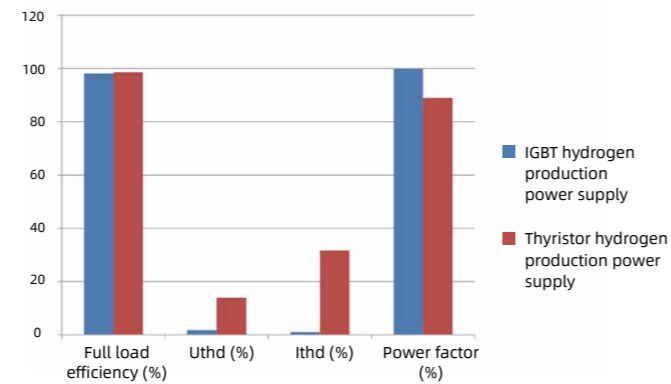
This project requires complex system functions. Hopewind's IGBT hydrogen production power supply solution can well adapt to the volatility in renewable energy power generation. The system has the MPPT function that can track the maximum power of the PV system in real-time, apart from working well under different working modes. It is a significant breakthrough in operating modes of renewable energy-based hydrogen production.



▶ Application in Yunnan

Hopewind hydrogen production power supply HHP-16000-170 matched with a Low-Voltage and High-Current (170V/16000A) hydrogen production electrolyzer was applied by a PV module manufacturer in Yunnan.

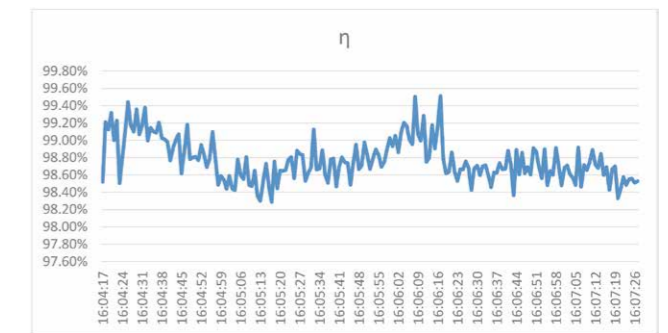
The product parameters are designed as per the altitude of 3000 meters, and the equipment operates stably. The lthd, Uthd and power factor of the IGBT hydrogen production power supply significantly outperform those of the thyristor hydrogen production power supply, as demonstrated by lower system harmonic loss and better grid adaptability.



Test comparison between thyristor hydrogen production power supply scheme and that of the IGBT

▶ Application in Gansu

Hopewind hydrogen production power supply HHP-12900-546 matched with two sets of ALK electrolyzer was applied in a hydrogen production demonstration base in Gansu. Hopewind IGBT hydrogen power supply power density is high, small footprint, strong environmental adaptability, a one-off operation in low temperature conditions, to help the customer first hydrogen production project smoothly!



Efficiency test curve



150 GW⁺

SHIPMENTS WORLDWIDE



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If the product size and parameters have changed, the latest actual product shall prevail.