

A large, stylized graphic of a water molecule (H<sub>2</sub>O) in light blue, composed of two large circles for hydrogen and one smaller circle for oxygen. The entire graphic is filled with a pattern of smaller, semi-transparent water molecules. The text "Hydrogen Energy Equipment Solution Provider" is overlaid on the central part of the graphic.

# Hydrogen Energy Equipment Solution Provider



***A Leading Provider***  
*of Complete Hydrogen Energy  
Equipment Solutions Worldwide*

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Founded in 1989, SANY Group's vision to build a first-class enterprise, to foster first-class employees, and to make first-class contributions to society has never wavered, building up this established brand of "SANY" in the industry. In 2021, SANY entered the Forbes TOP 500 Club, ranking 468th on the list. Based on the principal business in the equipment manufacturing, SANY Group strives for the "international, digital and intelligent and low-carbon" transformation to comprehensively reach out to the new energy equipment sector.

SANY Hydrogen Energy is wholly owned by SANY International (HK0631). As a publicly listed subsidiary of SANY Group, we are committed to being a global leading hydrogen solutions provider. We are mainly engaged in the R&D, manufacturing and sales of hydrogen production equipment and components, including pressurized alkaline water electrolyzers, modular alkaline water electrolyzers, PEM electrolyzers and BOP systems. Our product portfolio includes 200-2000 Nm<sup>3</sup>/h pressurized alkaline water electrolyzers, 500-3000 Nm<sup>3</sup>/h modular alkaline water electrolyzers, 50-200 Nm<sup>3</sup>/h PEM electrolyzers, 200-6000 Nm<sup>3</sup>/h separation and purification systems, 500-2000 kg integrated hydrogen producing and refueling stations, and solutions for above products. We have an automatic production line for 2GW electrolyzers and separation and purification systems, and put a 24MW electrolyzer testing a multi-in-one platform into operation, providing global customers with large-scale green hydrogen package solutions.

## 2021

- In December, Strategic planning SANY Group established a hydrogen energy equipment company



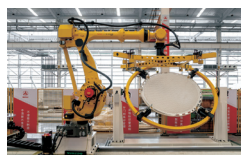
## 2022

- In August, SANY Hydrogen Energy was registered and established
- In September, 500 Nm<sup>3</sup>/h electrolyzers rolled off the production line
- In December, 1,000 Nm<sup>3</sup>/h electrolyzers rolled off the production line



## 2023

- In March, a 1.5GW hydrogen energy equipment production line was put into operation
- In April, we won the bid for the world's largest integrated green hydrogen synthesis ammonia project
- In May, 2000 Nm<sup>3</sup>/h electrolyzers rolled off the production line
- In December, the world's largest separate 3000 Nm<sup>3</sup>/h electrolyzers rolled off the production line

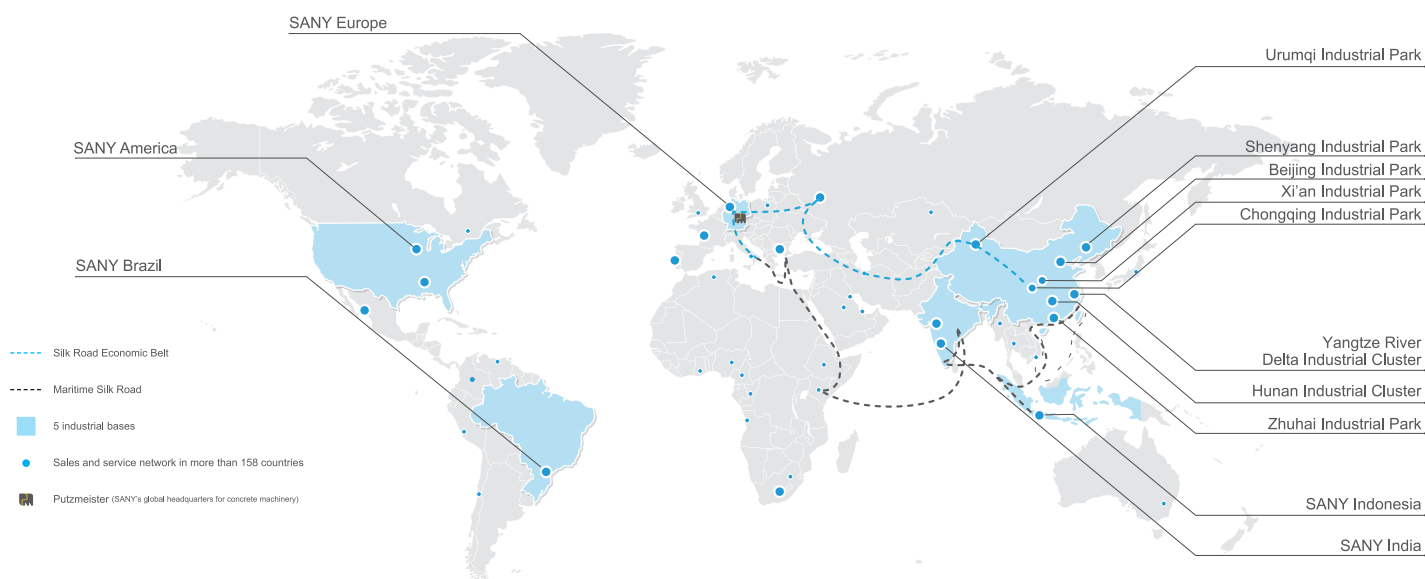


## 2024

- In February, we built the largest integrated hydrogen producing and refueling station in China
- In April, we entered into a cooperation agreement with an Australian customer on hydrogen producing and refueling equipment
- In July, 200 Nm<sup>3</sup>/h PEM electrolyzers rolled off the production line



# GLOBALIZATION



**60,000**

60,000 employees worldwide

**10,000+**

Including more than 10,000 R&D employees

**75%+**

Over 75% of the sales revenue have been generated from the countries and regions along the 'Belt and Road'

**50+**

No.1 brand in more than 50 countries

**15**

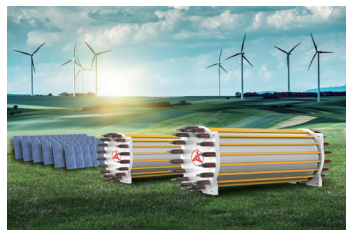
15 overseas manufacturing plants

**158**

Export to 158 countries and regions

**39%**

Annual compound growth rate of exports reached 39% in the past 6 years



## Safe, stable, economical, intelligent product system

- With the most complete product matrix in the industry, we can provide pressurized/modular alkaline water electrolyzers and PEM products that meet the needs for various applications;
- Thanks to the reliability verification, safety monitoring and interlocking control on the equipment, our products are guaranteed to be safe and reliable;
- We take a lead in core specifications such as power consumption and adjustment range in the industry;
- The intelligent hydrogen production management system powered by green electricity ensures our products more adaptable to the fluctuations of wind and solar energy for the efficient and stable operation of green hydrogen projects.

01



## Simulation-based, testing-oriented, innovative, reliable R&D system

- The largest 24MW electrolyzer testing platform in China sets up the core R&D capabilities for both hardware and software;
- Simulation technology for structural/flow/electrochemical/multi-physical fields reliably support the testing and iteration of our products;
- We reinforce the self-development and self-testing of components to ensure safe, reliable and stable operation of products.

02



## Digital intelligence, flexible, efficient, improved manufacturing system

- We have digital, improved and intelligent management of the production and operation process, relying on the digital intelligent manufacturing system of SANY Group;
- We ensure the standardized production and quality control capabilities of products from R&D to manufacturing and delivery, relying on the standard manufacturing process system of SANY Group; We have the automatic intelligent manufacturing equipment to realize the automation across the entire process;
- We have the flexible manufacturing system that is highly adaptable to various solutions for timely delivery.

03

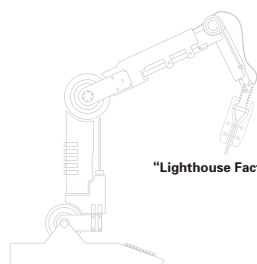


## Fast, professional, comprehensive, all-round service system

- We have the premium standard service system of SANY Group in the industry to provide customers with integrated solutions before, during and after sales;
- We have a comprehensive after-sales service network covering more than 900 service stations in 189 countries worldwide for a fast response to customer needs

04

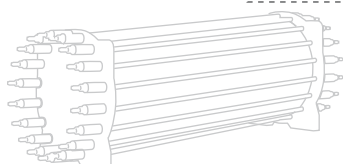
## Intelligent Manufacturing Factory



"Lighthouse Factory" for Intelligent Manufacturing



2 GW Electrolyzer Production Line



## Advantages

### ● Low energy consumption

Higher current density and lower electrolysis energy consumption in a more efficient process of electrolysis with high activity electrodes and low resistance membranes.

### ● High adability

Wide range and fast speed of power adjustment for a higher accommodation proportion of renewable energy and better adaptability to hydrogen production applications from wind and solar energy.

### ● High reliability

Selected electrodes passing the 5,000 hours stress test for an annual attenuation rate of less than 1%;

Simulation for improved structure and uniformity of flow/temperature fields of electrolyzers to tackle the risk of local overheating;

New sealing waterline design of the bipolar plate to address the leakage risk caused by local creep and thinning of gaskets;

High-precision assembly process of the electrolyzers for better consistency, namely less differences among various equipment in the hydrogen production cluster, and more precise control over the cluster.

## 5000 HOURS

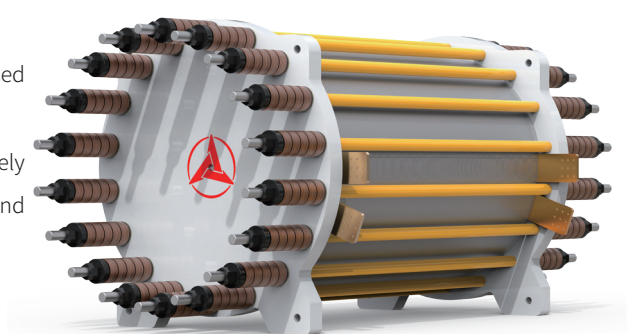
Accelerated stress test

## 4.2kWh/Nm<sup>3</sup>

DC power consumption

## 20% ~ 120%

Working load range



## Technical specifications >>>

NAME	E-200	E-500	E-1000	E-1200	E-1500	E-2000
Hydrogen production capacity (Nm <sup>3</sup> /h)	200	500	1000	1200	1500	2000
DC power consumption (kWh/Nm <sup>3</sup> )	4.2-4.4	4.2-4.4	4.2-4.4	4.2-4.4	4.2-4.4	4.2-4.4
Current density (A/m <sup>2</sup> )	≥4000	≥4000	≥4000	≥4000	≥4000	≥4000
Maximum operating pressure (MPa)	3.2	3.2	1.8	1.8	1.8	1.8
Operating temperature (°C)	90±5	90±5	85±5	85±5	85±5	85±5
Crude hydrogen purity	≥99.8%	≥99.8%	≥99.8%	≥99.8%	≥99.8%	≥99.8%
Hydrogen purity after purification	≥99.999%	≥99.999%	≥99.999%	≥99.999%	≥99.999%	≥99.999%
Dew point of hydrogen after purification (°C)	-70	-70	-70	-70	-70	-70
Working load range	20-120%	20-120%	20-120%	20-120%	30-120%	30-120%
Cold start time (min)	≤20	≤20	≤20	≤20	≤30	≤30
Hot start time (min)	≤3	≤3	≤3	≤3	≤5	≤5
Average annual attenuation rate	≤1%	≤1%	≤1%	≤1%	≤1%	≤1%

(Cold start: the period from starting at the environment temperature to when the hydrogen and oxygen purity is qualified;  
hot start: the period from starting at 50±5°C to when the hydrogen and oxygen purity is qualified.)

## Advantages

### ● High efficiency and energy saving

Zero-pole distance structure and high activity electrodes for electrolyzers to run under high current density and low energy consumption;

Stray current tackled in the main pipe for the ultra-high current efficiency and better capacity of electrolyzers.

### ● Safe and reliable

Wide range of power adjustment, and full-load hydrogen purity  $\geq 99.9\%$ , oxygen purity  $\geq 99\%$ , under safe operation conditions;

Fast warm start with qualified gas purity in the whole process, and real-time start and stop at any time for better adaptability to hydrogen production applications from wind and solar energy.

### ● Easy to operate and maintain

Module-based design and assembly for exceptionally easy maintenance, downtime  $< 36$  hours, electrolyzer replacement period  $< 1$  hours, and annual run-time: over 8000 hours.

## < 1 HOURS

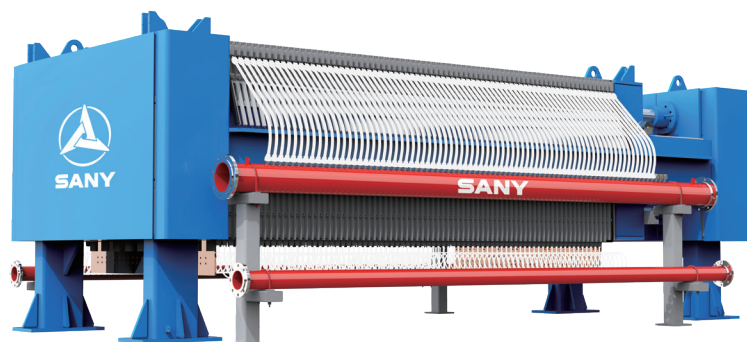
Replacement time per electrolytic chamber

## 4.3kWh/Nm<sup>3</sup>

DC power consumption

## 5% ~ 120%

Working load range



## Technical specifications >>>

NAME	S-1000	S-2000	S-3000
Hydrogen production capacity (Nm <sup>3</sup> /h)	1000	2000	3000
DC power consumption (kWh/Nm <sup>3</sup> )	4.3-4.4	4.3-4.4	4.3-4.4
Current density (A/m <sup>2</sup> )	$\geq 10000$	$\geq 10000$	$\geq 10000$
Maximum operating pressure (MPa)	0.5	0.5	0.5
Operating temperature (°C)	85 $\pm$ 5	85 $\pm$ 5	85 $\pm$ 5
Crude hydrogen purity	$\geq 99.9\%$	$\geq 99.9\%$	$\geq 99.9\%$
Crude oxygen purity	$\geq 99.2\%$	$\geq 99.2\%$	$\geq 99.2\%$
Hydrogen purity after purification	$\geq 99.999\%$	$\geq 99.999\%$	$\geq 99.999\%$
Dew point of hydrogen after purification (°C)	-70	-70	-70
Working load range	5-120%	5-120%	5-120%
Cold start time (min)	$\leq 5$	$\leq 5$	$\leq 5$
Hot start time (min)	$\leq 10s$	$\leq 10s$	$\leq 10s$
Annual working hours (h)	$\geq 8000$	$\geq 8000$	$\geq 8000$
Average annual attenuation rate	$\leq 1\%$	$\leq 1\%$	$\leq 1\%$

(Cold start: the period from starting at the environment temperature to when the hydrogen and oxygen purity is qualified;  
hot start: the period from starting at 50 $\pm$ 5°C to when the hydrogen and oxygen purity is qualified.)

## Advantages

### ● High energy density

Proton membrane materials with high ion conductivity and unique design of electrolyzers with high energy density for the industry-leading rated current density, and smaller volume and footprint of electrolyzers.

### ● Quick response to fluctuations

Electrolyzers are able to withstand a pressure difference of more than 3.5MPa, produce hydrogen purity  $\geq 99.9\%$ , oxygen purity  $\geq 99\%$ , under low load conditions, ensuring the safety of electrolyzers and systems under rapid fluctuations and changes of load conditions;

Electrolyzers with a smaller mass and better isolation of gas offers a shorter period of cold and hot starts to meet the customer's demand for applications with a need for fast start and stop at any time for better adaptability to hydrogen production applications from wind and solar energy.

### ● Easy to operate and maintain

Only pure water needed for the operation process where long-term unattended operation is possible with no chemical treatment involved.

## 2.5A/m<sup>2</sup>

Current density

## 4.3kWh/Nm<sup>3</sup>

DC power consumption

## 5% ~ 120%

Working load range



## Technical specifications >>>

NAME	P-200
Hydrogen production capacity (Nm <sup>3</sup> /h)	200
DC power consumption (kWh/Nm <sup>3</sup> )	$\leq 4.3$
Current density (A/m <sup>2</sup> )	$\geq 25000$
Maximum operating pressure (MPa)	3.0
Operating temperature (°C)	70 $\pm$ 5
Working load range	5-120%
Cold start time (min)	$\leq 5$
Hot start time (s)	10
Average annual attenuation rate	$\leq 1\%$

(Cold start: the period from starting at the environment temperature to when the hydrogen and oxygen purity is qualified;  
hot start: the period from starting at 50 $\pm$ 5°C to when the hydrogen and oxygen purity is qualified.)

## Advantages

### ● Highly adaptable

The electrolyzer supports separate circulation of alkali and control of operating parameters under independent power supply, which can meet the operation scheduling and power allocation of multiple equipment in applications of hydrogen production from wind and solar power.

### ● Highly safe

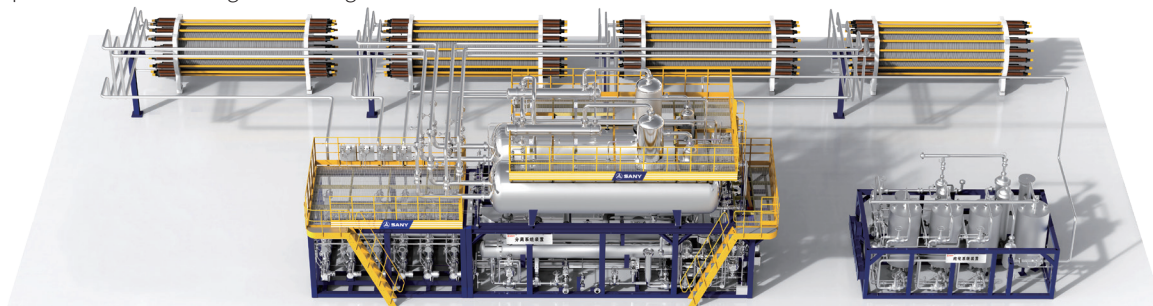
The purity of the gas is monitored at the outlet of the electrolyzer to understand the operating status of every electrolyzer and improve the operating safety of the multi-in-one system.

The five-level safety protection system provides real-time monitoring of operating parameters of all the indicators and factors, and timely warning and interlock shutdown for abnormal conditions to guarantee safe and credible operation.

### ● High economic

The circulation of hot alkali realizes the recyclable utilization of waste heat in electrolysis, and hot standby and quick start-up of the electrolyzer for better efficiency in the comprehensive utilization of energy;

The gas preheating process of the purification system realizes the recyclable utilization of heat from deoxygenated and reproduced gas with a decrease in the consumption of electric heating and cooling water.



## Technical specifications >>>

NAME	4*1000	4*1200
Hydrogen production capacity (Nm <sup>3</sup> /h)	4000	4800
DC power consumption (kWh/Nm <sup>3</sup> )	4.2-4.4	4.2-4.4
Maximum operating pressure (MPa)	1.8	1.8
Operating temperature (°C)	85±5	85±5
Crude hydrogen purity	≥99.8%	≥99.8%
Hydrogen purity after purification	≥99.999%	≥99.999%
Dew point of hydrogen after purification (°C)	-70	-70
Working load range	15-120%	15-120%
Cold start time (min)	≤20	≤20
Hot start time (min)	≤3	≤3

(Cold start: the period from starting at the environment temperature to when the hydrogen and oxygen purity is qualified;  
hot start: the period from starting at 50±5°C to when the hydrogen and oxygen purity is qualified.)

## Advantages

### ● Module-based

Skid-mounted module-based standard container design for a compact structure of electrolyzers that are convenient to deliver and install.

### ● High efficiency

Core materials such as high-performance electrodes and membranes and a new design of the flow field for operation under low energy consumption.

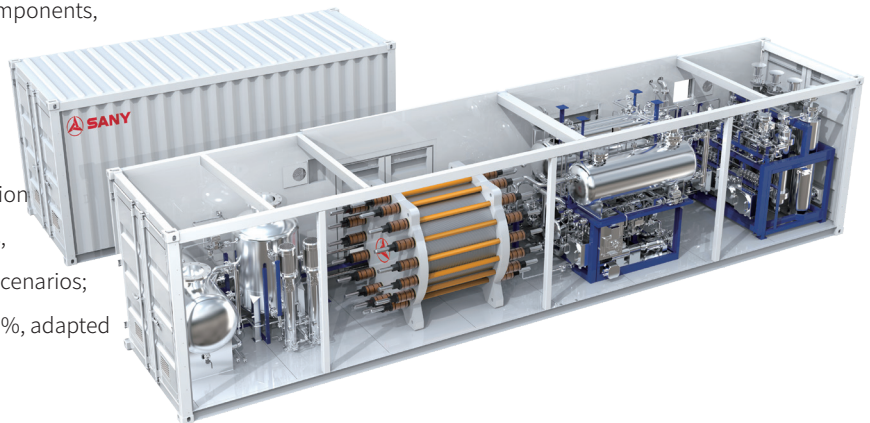
### ● High reliability

Long-term stability testing of core components, verification of the equipment under extreme operating conditions, and full-process monitoring and early warning of key parameters and indicators;

All the skid-mounted equipment, pressure-bearing components, and electrical components verified by CE certification to meet the requirements for exports.

### ● High flexibility

Flexible application scenarios, suitable for hydrogenation integrated stations, small and medium-sized refineries, natural gas hydrogen blending and other application scenarios; Flexible operation, allowing operation range of 20~120%, adapted to different hydrogen production conditions.



## Technical specifications >>>

NAME	V-200	V-500	V-1000
Hydrogen production capacity (Nm <sup>3</sup> /h)	200	500	1000
DC power consumption (kWh/Nm <sup>3</sup> )	4.2-4.4	4.2-4.4	4.2-4.4
Maximum operating pressure (MPa)	3.2	3.2	1.8
Operating temperature (°C)	90±5	90±5	85±5
Crude hydrogen purity	≥99.8%	≥99.8%	≥99.8%
Hydrogen purity after purification	≥99.999%	≥99.999%	≥99.999%
Dew point of hydrogen after purification (°C)	-70	-70	-70
Working load range	20-120%	20-120%	20-120%
Cold start time (min)	≤20	≤20	≤20
Hot start time (min)	≤5	≤3	≤3

(Cold start: the period from starting at the environment temperature to when the hydrogen and oxygen purity is qualified;  
hot start: the period from starting at 50±5°C to when the hydrogen and oxygen purity is qualified.)

Advantages

● Ultra-safe

Safety measures for the full-scale and full-element control of the system, and monitoring of changes in operating parameters such as thermal, pressure, liquid level of the separator, gas purity and others for timely response to abnormal conditions.

● Excellent energy-saving efficiency

Dynamic dual PID regulation of alkali thermal and dynamic dual PID regulation control methods are introduced to reduce the energy consumption index of auxiliary power equipment by 10%.

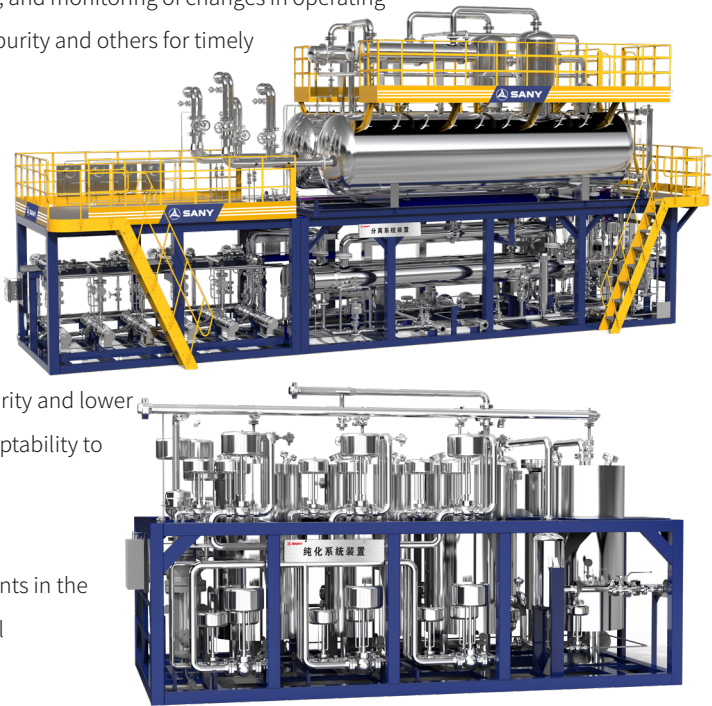
● Exceptional flexibility

Optimal algorithm utilized for the dynamic balance among alkali flow, thermal and pressure under power fluctuation conditions, better gas purity and lower energy consumption of the whole system under low load, for better adaptability to system load fluctuations.

● Ultra-intelligent

Automatic control provided for various equipment, valves and instruments in the skid with multi-level intelligent control, DCS monitoring and PLC control management in the central control room;

Automatic sampling and analysis, automatic water replenishment, intelligent drainage, and intelligent nitrogen replacement.



Technical specifications >>>

NAME	B-500	B-1000	B-1500	B-2000	B-4000	B-6000
Hydrogen processing capacity (Nm <sup>3</sup> /h)	500	1000/1200	1500	2000	4000	6000
Maximum operating pressure (MPa)	3.2	1.8	1.8	1.8	1.8	1.8
Hydrogen purity after purification	≥99.999%	≥99.999%	≥99.999%	≥99.999%	≥99.999%	≥99.999%
Dew point of hydrogen after purification (°C)	-70	-70	-70	-70	-70	-70
Working load range	15-120%	15-120%	15-120%	15-120%	15-120%	15-120%
Purification method	I	I II	I II	I II	I II III	II III
Control method	Fully automatic PLC	Fully automatic PLC	Fully automatic PLC	Fully automatic PLC	Fully automatic DCS	Fully automatic DCS

(Method of purification: I . Built-in heating, II . External heating, tee-type, III. External heating, cross-type.)



No.	Name	Scale	Remark
1	Air separation unit (Including air compression station, oxygen liquefaction unit)	2000Nm <sup>3</sup> /h Nitrogen	
2	Electrolysis hydrogen producing unit	4600Nm <sup>3</sup> /h Hydrogen	36 sets of 1000 Nm <sup>3</sup> /h alkaline electrolyzers, and 50 sets of 200 Nm <sup>3</sup> /h PEM electrolyzers
3	Synthesis ammonia unit	30*10 <sup>4</sup> t/a	
4	Solid hydrogen storage unit	6000Nm <sup>3</sup> /h Hydrogen	

- 

**2000<sub>kg</sub>**  
INTEGRATED HYDROGEN PRODUCING  
AND REFUELING STATION DEMONSTRATION PROJECT



## **SANY HYDROGEN ENERGY CO., LTD.**

Intelligent Connected Heavy Truck Industrial Park, Changsha County, Changsha City, Hunan Province, China  
Tel 0731-84031888 Sales Hotline 18373208373

[www.sanyglobal.com](http://www.sanyglobal.com)