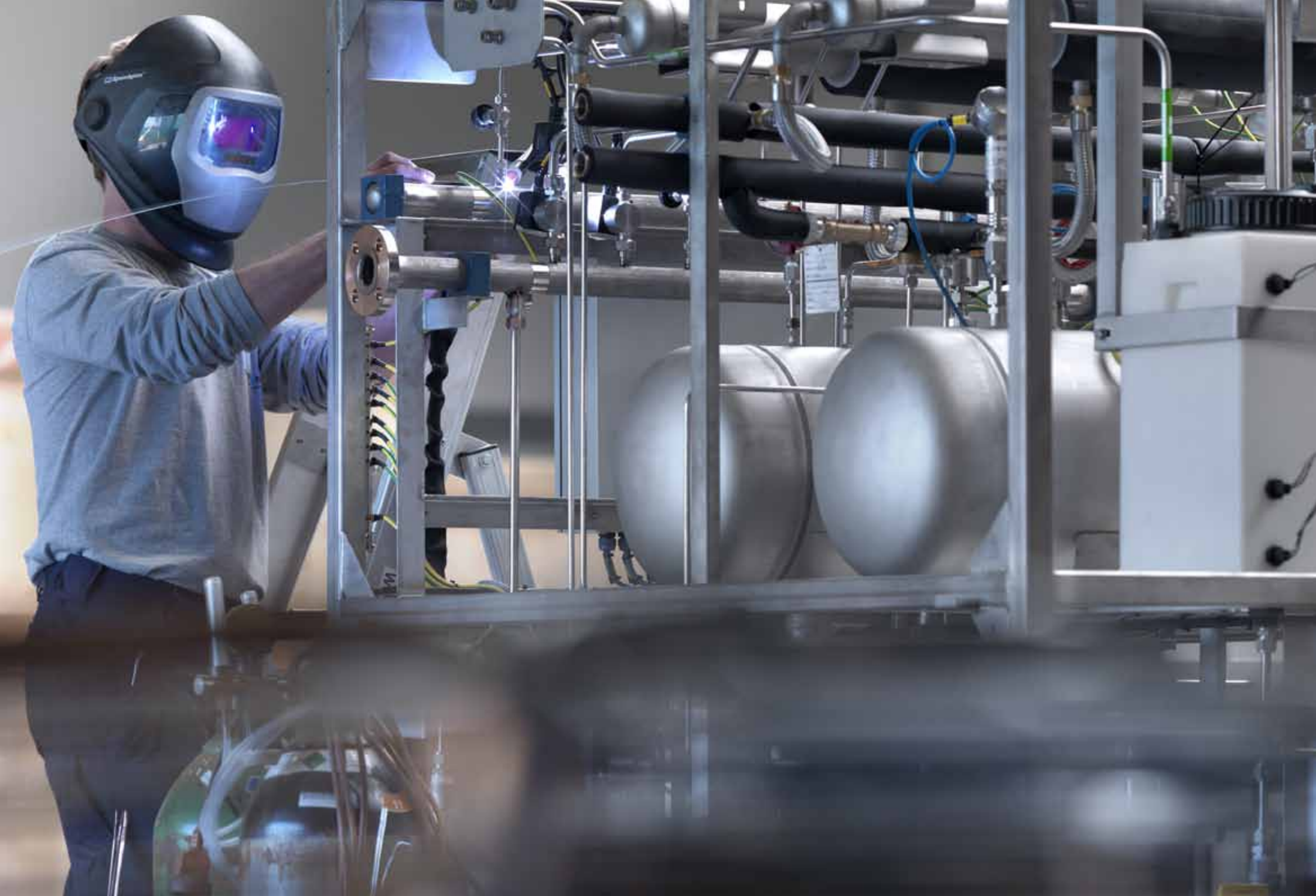


The background image shows two men in a factory or industrial setting. They are wearing grey zip-up hoodies with a small logo on the chest and safety glasses. They are looking down at a large, complex industrial machine in the foreground, which appears to be a hydrogen generator. The machine has multiple horizontal rollers and a mesh-like structure. The man on the left is pointing at the machine, while the man on the right is holding a piece of paper. The background is slightly blurred, showing industrial equipment and a high ceiling.

HYDROGENICS

Advanced Hydrogen Solutions

HYSTAT® HYDROGEN GENERATORS



A detailed view of a complex industrial water electrolyser assembly. The system is constructed from stainless steel and features a prominent blue electric motor, various pipes, valves, and a pressure gauge. The background is a blurred industrial setting.

HYDROG(E)NICS

Advanced Hydrogen Solutions

HYDROGEN ON-SITE

THE POWER OF EXPERTISE

Hydrogenics has a long term tradition building high performance water electrolyzers. Since its inception in 1948 (under the name Electrolyser Corporation), Hydrogenics has delivered more than a 1.100 units to a variety of customers worldwide.

The combination of experience and a constant drive to improve, has made Hydrogenics' HySTAT® the winning choice for a wide range of industrial applications, hydrogen fueling stations, renewable energy storage and conversion systems.

Today, HySTAT® water electrolyzers are designed and built in Hydrogenics manufacturing facility in Belgium. A dedicated staff of 60 skilled personnel bring a common ideal to work every day: To design and manufacture the world's best on-site hydrogen generator.

HySTAT® 10 or 15

ELEMENTARY

The HySTAT® hydrogen generator uses water and electricity to produce high quality hydrogen on demand. The basic HySTAT® 15, displayed here, was first introduced to our customers more than a decade ago. Since then the HySTAT® has been subject to a continuous improvement process, increasing performance, capacity, quality and durability. By taking our customer's feedback seriously, the result today is a product with no compromises at a reasonable cost.

A basic HySTAT® 15 unit consists of a hydrogen generating unit, a power rack, a control panel, remote monitoring and interconnection cables. With safety as a key priority every HySTAT® features:

- A hydrogen in atmosphere detector
- 'Hydrogen in oxygen' measurement
- A UPS (uninterruptible power supply)

The HySTAT® production capacity is continuously monitored and rapidly adjusted to meet any actual user requirements. Together with the best conversion efficiency in the industry, this makes the HySTAT® a flexible and economical source of hydrogen. HySTAT's are intended to be installed in dedicated premises and can be equipped with a variety of options. The maximum working pressures can be selected to be 10 barg or 25 barg.



Standard power rack
and control panel



Options

- Gas tight 'ATEX' protective enclosure
- Hydrogen Purification System (HPS)
- Closed loop cooling system
- On line gas quality measurement
- Reverse osmosis water purification system
- ...

Optional:

- 'ATEX' enclosure
- Closed loop cooling system





Technical specifications

MODEL	HySTAT®-10-10	HySTAT®-15-10	HySTAT®-10-25
Operating Pressure	10 barg		25 barg
Max. Nominal Hydrogen Flow	10 Nm³/h	15 Nm³/h	10 Nm³/h
Hydrogen Flow range	40 - 100% (25 -100% as an option)		
Hydrogen Purity (before HPS)	99,9%; H2O saturated, O2 < 1,000 ppm		
Hydrogen Purity (after HPS)	99,998% (99,999% as an option); O2 < 2ppm; N2 < 12ppm; Atm. Dew point: -60°C or -76°F (-75°C or -103°F as an option)		
Nr. of cell stacks	1		
Estimated AC power consumption (all included)	4,9 kWh/Nm³ at full load		
Voltage	3 x 400 VAC ± 3% (3 x 480 or 575 VAC ± 3% as an option)		
Frequency	50 Hz ± 3% (60 Hz ± 3% as an option)		
Installed power	100 KVA	120 KVA	100 KVA
Max. cooling water t° (electrolyte)	40°C	40°C	30°C
Design flow cooling water (electrolyte)	2 m³/h		
Max. cooling water t° (gas cooling)	15°C		
Design flow cooling water (gas cooling)	0,15 m³/h		
Demineralized water consumption	< 1 liter/Nm³ H2		
Electrolyte	H2O + 30% wt. KOH		
Approx. Electrolyte Quantity	300 L		
Installation Area	Indoor, in dedicated building		
Ambient Temperature Range	+5°C to +40°C		
Dimensions Process Part (LxWxH)**	1,7m x 1,85m x 2,6m		
Dimensions Power Rack (LxWxH)	0,9m x 0,9m x 2,3m		
Dimensions Control Panel (LxWxH)	1,0m x 0,5m x 2,1m		
Approx. empty Weight Process Part	1.350 kg	1.500 kg	1.400 kg
Weight Power Rack	750 kg		
Weight Control Panel	400 kg		

(*) HPS = hydrogen purification system

(**) including 'ATEX' enclosure

HySTAT[®] type V

COMPATIBLE AND VERSATILE

In 2001, Hydrogenics introduced its first containerized HySTAT[®]. This concept integrated the HySTAT[®] hydrogen generator with peripheral equipment such as cooling systems, a feed water purification system and a hydrogen purification

system. The result is a fully automatic unit with minimal implementation requirements for our customer. In 2011, the fifth generation of the containerized HySTAT[®] is a 'one fit all' 20 ft high cube container, designed to be installed in-

doors and outdoors. Capacities of 10, 15, 30, 45 or 60 Nm³/h can be configured. Upgrading the capacity beyond initial purchase is always possible. Installing a water electrolyser has never been this easy.



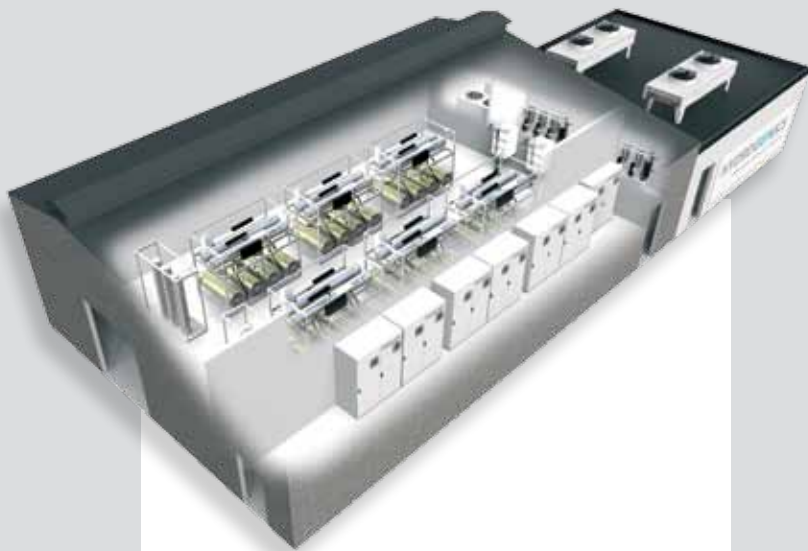
Technical specifications

MODEL	HySTAT®-10-10	HySTAT®-15-10	HySTAT®-30-10	HySTAT®-45-10	HySTAT®-60-10
Operating Pressure	10 barg				
Nominal hydrogen Flow	10 Nm³/h	15 Nm³/h	30 Nm³/h	45 Nm³/h	60 Nm³/h
Nr. of cell stacks	1	1	2	3	4
Hydrogen flow range	40 - 100% (25 -100% as an option)				
Hydrogen Purity (before HPS)*	99,9%; H2O saturated, O2 < 1,000 ppm				
Hydrogen Purity (after HPS)	99,998% (99,999% as an option); O2 < 2ppm; N2 < 12ppm; Atm. Dew point: -60°C or -76°F (-75°C or -103°F as an option)				
Estimated AC power consumption (all included)	5,4 kWh/Nm³ at full capacity		5,2 kWh/Nm³ at full capacity		
Voltage	3 x 400 VAC ± 3% (3 x 480 or 575 VAC ± 3% as an option)				
Frequency	50 Hz ± 3 % / 60 Hz ± 3 % (option)				
Installed power	100 + 35KVA	120 + 35KVA	240 + 35KVA	120 + 240 + 35KVA	2 x 240 + 35KVA
Max. cooling water temperature (electrolyte)	Closed loop cooling circuit installed				
Design flow cooling water (electrolyte)					
Max. cooling water temperature (gas cooling)	Chiller gas colling circuit installed				
Design flow cooling water (gas cooling)					
Demineralized water consumption	Feed water purification system installed				
Tap water consumption	1,5 - 2 liters/Nm3 H2				
Electrolyte	H2O + 30% wt. KOH				
Electrolyte Quantity	220 L	240 L	360 L	480 L	610 L
Installation area	Outdoor, general purpose area (optional indoor)				
Ambient Temperature Range	-20°C to +40°C (-40°C or +50°C as an option)				
Dimensions (L X W X H)	6,10m x 2,44m x 2,90m (+1,60m with dry cooler)				
Empty weight	Approx. 16 Tons				



HySTAT[®] engineered solutions

TAILORED TO WHAT YOU WANT, SCALED TO WHAT YOU NEED.



A 2MW installation: 2 lines of 3 HySTAT[®] 60 with a total production of 360 Nm³/h of high quality hydrogen. Each line has on large purification system, one closed loop cooling system, one feed water treatment system and is operated by one control panel to offer redundancy.

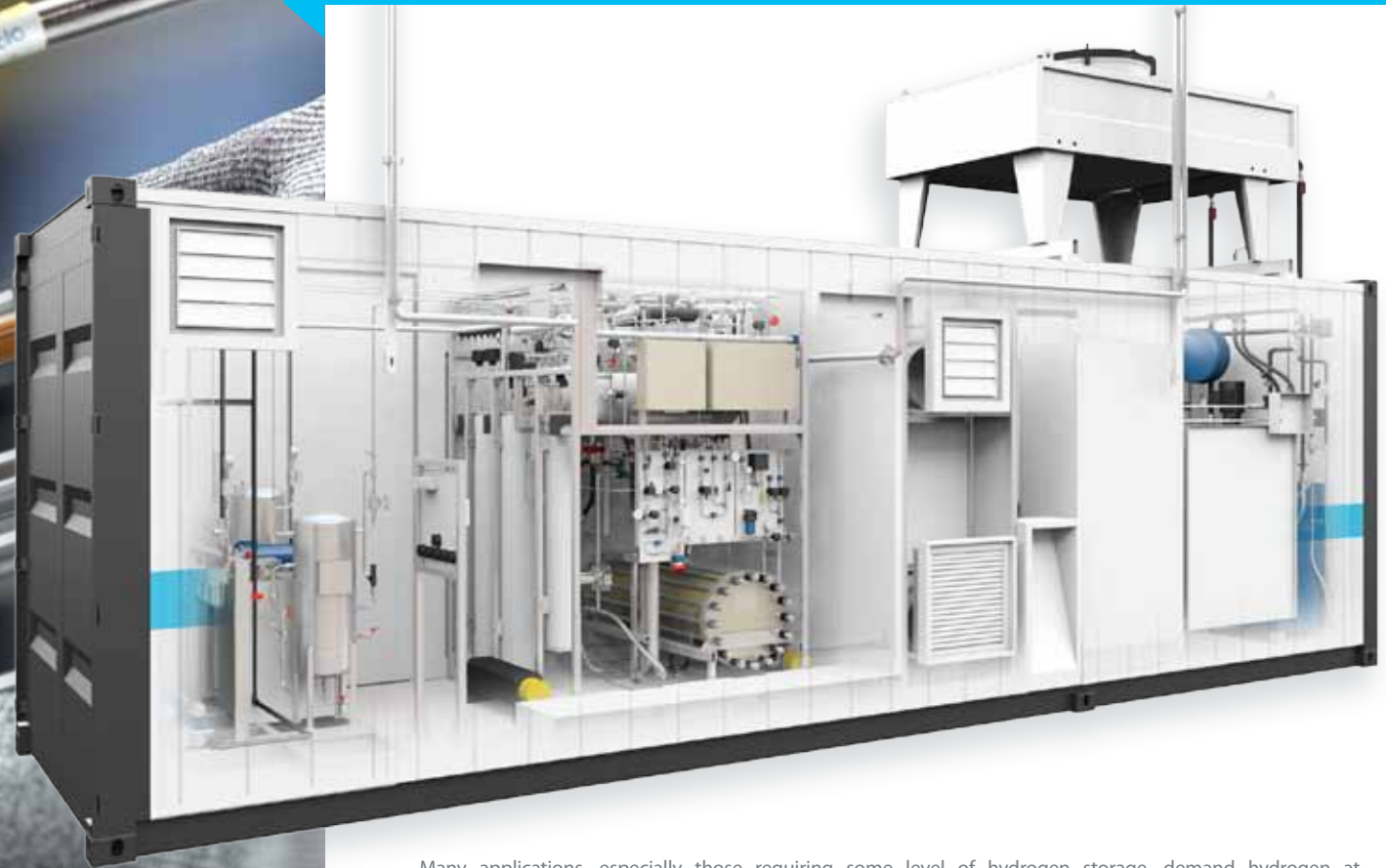
Specific requirements need specific solutions. So much is possible using the basic HySTAT[®] concept as a starting point. Higher production capacities are achieved by installing HySTAT[®] generators in parallel. Higher pressure is obtained by adding a compressor. Extreme ambient temperature requirements are handled with different ventilation and air conditioning configurations. Local standards drive specific adaptations ... with our world wide installation expertise we ensure full code compliance and hassle-free commissioning.

HySTAT[®] 10 Nm³/h with 150 bar compressor at the Shuaibah power plant in Saudi-Arabia.





HySTAT® 10 with compressor



Many applications, especially those requiring some level of hydrogen storage, demand hydrogen at higher pressures. In the tradition of supplying pre-integrated equipment in containers, Hydrogenics has developed an outdoor housing, featuring a HySTAT™ and a compressor as a fully integrated package. Flow rates can be selected between 10, 15 or 30 Nm³/h . Output pressure is typically 200 bar, but can be adapted higher to suit customer preferences.

IMET[®] cell stack

At the 'heart' of the HySTAT[®] water electrolyser is our patented IMET[®] (Inorganic Membrane Electrolysis Technology) cell stack.

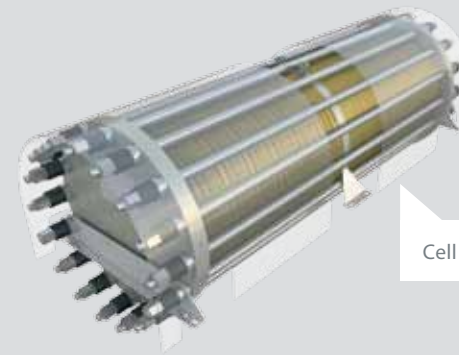
In this cell stack, water (mixed with 30% KOH) is broken down into its basic elements, hydrogen and oxygen, by means of a DC current. The cell stack consists of a series of interconnected, circular electrolysis cells, each containing two electrodes located on either side of an advanced patented inorganic ion-exchange membrane, which is manufactured in-house. The purpose of the membrane is 2-fold: to allow ion transfer with the minimum of resistance and to prevent recombination of the produced hydrogen and oxygen.

The IMET[®] cell stack combines an outstanding conversion efficiency with a long service life, of more than 50.000 hours.

HySTAT[®] quality

Only the highest quality manufacturing standards result in a top quality product. Manufacturing of the HySTAT[®] is done in several stages, each of which ends in a quality monitor or "gate". No HySTAT[®] moves to its next stage without sign-off from our quality personnel and an assigned Project Manager. Every HySTAT[®] that leaves the factory is tested for more than 24 hours at its full operating rate. Testing can be attended by the customer.

Hydogenics complies with ISO 9001 and 14001, OHSAS 18001 and all applicable world engineering codes and standard including CE, ATEX, Rostechnadzor, PED and ASME / UL compliances.



Cell stack





After installation of the HySTAT[®], our service team will come on-site for a final check and full commissioning of the plant. Many years of consolidated experience also makes our service team your best partner for longer term maintenance contracts.

Global servicing



WIND = A NEVER ENDING SOURCE OF CLEAN FUEL

Wind generated electricity is widely considered as the viable pathway to reduce CO2 emissions from electricity production. Every year wind generated electricity accounts for a larger share of the portfolio of applied generation technologies. However such an input of energy imposes

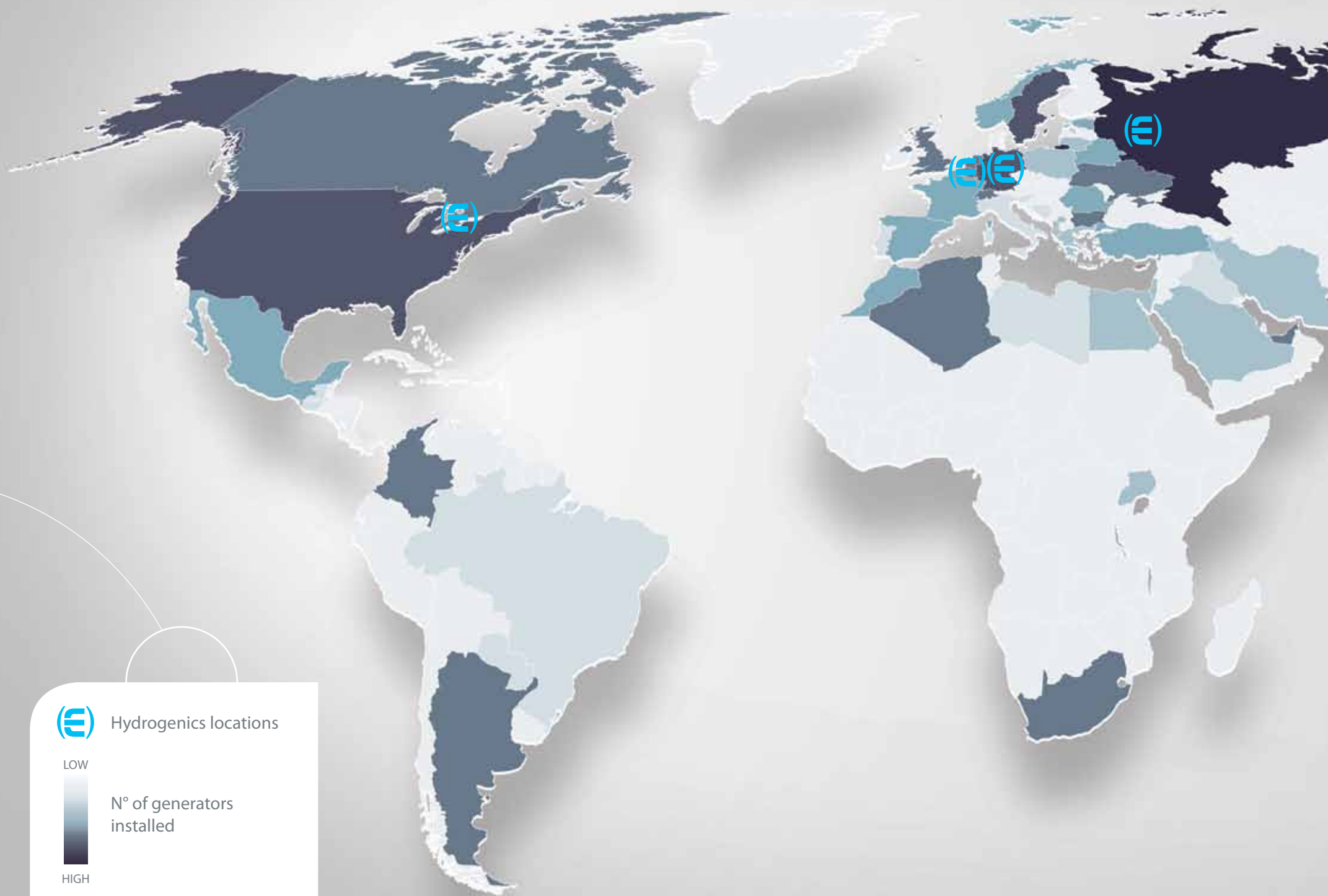
extra measures on the grid to maintain stability. In times of excess energy (demand lower than supply) hydrogen can be produced and stored. The energy thus stored can be used at any given time later. The electricity generated by one large wind turbine is sufficient to power a fleet of

4,000 hydrogen fueled cars.

Hydrogenics can offer you the adapted solution for fueling stations or MW installations.







Delivered success



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