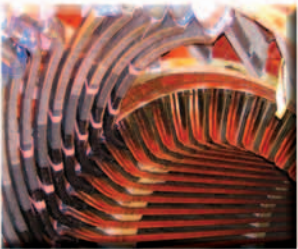


Profit Generators

HOGEN[®]

On-Site Hydrogen Generation
Systems with StableFlow™
Hydrogen Control System



Profit Generators

In today's challenging business environment, power plant operators must strive for the most efficient operations across multiple aspects of performance:

- Fuel Expense
- Safety and Security
- Emissions Reduction
- Generation Capacity
- Hydrogen Availability
- Personnel Productivity

Many power plants today are not running optimized. They operate out of OEM specifications for hydrogen purity, pressure and dewpoint, costing hundreds of thousands of dollars every year in excess fuel costs, lost generation revenue, emissions credits, and decreased winding life.

Proton Energy Systems has introduced two advanced technology systems — HOGEN® Hydrogen Generation System (HGS) and StableFlow™ Hydrogen Control System (HCS). Together, these systems ensure automatic and continuous measurement and feedback control of hydrogen purity and pressure for optimized generator performance.



HOGEN H Series

HOGEN S Series

HOGEN® On-Site Hydrogen Generation System

HOGEN HGS is a Proton Exchange Membrane (PEM) water electrolysis system that uses electricity to separate water into hydrogen and oxygen. The hydrogen is produced at 200 psi pressure without a compressor and at a purity of 99.9995% continuously and without operator intervention. The compact HOGEN hydrogen generator can be placed on the generator deck or any other indoor non-classified plant area. Due to its unique design, the HOGEN hydrogen generator contains virtually no hydrogen, even when generating hydrogen at up to 228 scf/hour — enough hydrogen to cool power plants as large as 1500MW.

HOGEN HGS provides reliable, safe, low cost hydrogen for generator blanketing.

HOGEN Hydrogen Generation System increases safety and security by eliminating:

- Hydrogen Storage
- Cylinder Handling
- Routine Hydrogen Delivery

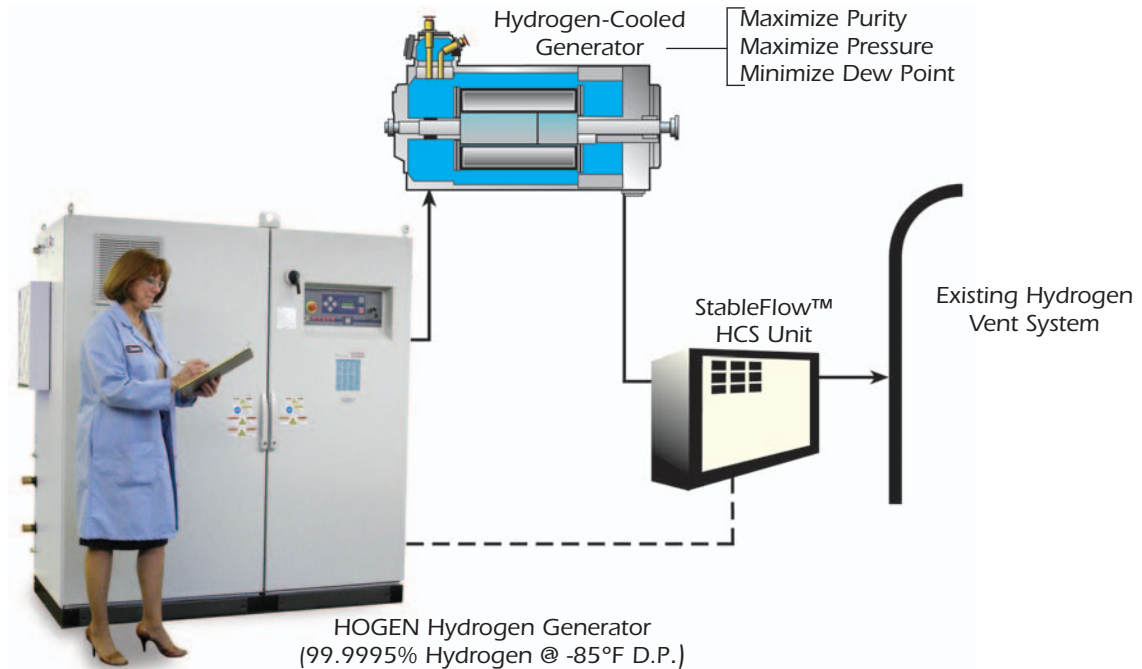


StableFlow™ Hydrogen Control System

StableFlow HCS continuously monitors hydrogen pressure, purity and dewpoint in the generator casing on a real-time basis, controlling impure hydrogen venting and calling for pure hydrogen injection as required. StableFlow's automated control replaces manual periodic hydrogen refill and its resulting variability from OEM specifications for hydrogen purity, pressure and dewpoint. Compliance with OEM specifications optimizes electric production efficiency and equipment life.

By maintaining OEM specifications for hydrogen pressure, purity, and dewpoint, StableFlow HCS:

- Reduces Windage Loss
- Optimizes Electric Generating Capacity
- Reduces Air Emissions
- Extends Equipment Life



Bottom-Line Benefit

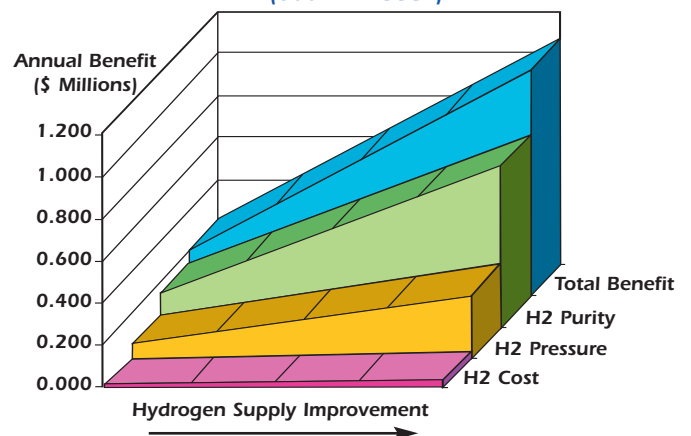
HOGEN Hydrogen Generation with StableFlow Hydrogen Control System can save most plants up to \$1000/year per megawatt of capacity.

Together these systems:

- Increase Power Generating Capacity
- Minimize Windage Loss
- Ensure Longer Generator Component Life
- Reduce Handling Costs

Let our application engineers configure a hydrogen generation system to meet your specific needs.

StableFlow™ Annual Economic Benefit (600 MW CCGT)



Technical Specifications

	HOGEN® S Series Generators		HOGEN® H Series Generators		
	S 20	S 40	H 2m	H 4m	H 6m
HYDROGEN PRODUCTION					
Net Production Rate					
Nm ³ /hr @ 0° C, 1 bar	0.53 Nm ³ /hr	1.05 Nm ³ /hr	2 Nm ³ /h	4 Nm ³ /hr	6 Nm ³ /h
SCF/hr @ 70° F, 1 atm	20 SCF/hr	40 SCF/hr	76 SCF/hr	152 SCF/hr	228 SCF/hr
SLPM @ 70° F, 1 atm	9.4 SLPM	18.8 SLPM	35.8 SLPM	71.7 SLPM	107.6 SLPM
kg per 24 hours	1.14 kg/24hr	2.27 kg/24hr	4.31 kg/24hr	8.63 kg/24hr	12.94 kg/24hr
Delivery Pressure	13.8 barg 200 PSIG		15 barg 218 PSIG		
Purity	99.9995%				
DI WATER REQUIREMENT					
Consumption Rate	0.47 L/hr 0.13 gal/hr	0.94 L/hr 0.25 gal/hr	1.83 L/hr 0.50 gal/hr	3.66 L/hr 0.96 gal/hr	5.50 L/hr 1.42 gal/hr
Pressure	1.5 to 4 barg 21.8 to 58.0 PSIG				
SYSTEM FEATURES					
Dimensions (L x D x H)	97 cm x 79 cm x 106 cm 31" x 38" x 42"		180 cm x 81 cm x 198 cm 71" x 32" x 78"		
Weight	215 kg 475 lbs		700 kg 1500 lbs	747 kg 1600 lbs	794 kg 1700 lbs
Electrical Specification	205 to 240 VAC, single phase, 50 or 60 Hz		380 to 480 VAC, 3 phase, 50 or 60 Hz		
Cooling	Air-Cooled		Liquid-Cooled		
Standard Features	Fully automated, push button start/stop. E-stop. On-board H ₂ detection. Automatic fault detection and system depressurization.				
Standard Siting Location	Indoor, level ± 1°, 0 to 90% RH non-condensing, Non-hazardous/non-classified environment.				
Ventilation	Proper ventilation must be provided from a non-hazardous area.				
SAFETY AND REGULATORY CONFORMITY					
	cTUVus (UL and CSA equivalent), CE (PED, ATEX, LVD, Mach. Dir., EMC)				
OPTIONS					
Proton offers a wide range of options to tailor your HOGEN hydrogen generation system to your specific operational requirements. Please contact your local Proton Energy representative to discuss current options available to best fit your needs.					

Specifications subject to change. For full technical specifications contact Proton Energy Systems.

Proton Energy System's HOGEN Hydrogen Generators are in place worldwide at power plants from 35 MW to 3600 MW in capacity. Please contact us for a current reference list.