



HYDROGENICS

SHIFT POWER | ENERGIZE YOUR WORLD

POWER-TO-GAS SOLUTION

The essential link to a cleaner, greener energy future.

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POWER-TO-GAS BRIDGES THE POWER GRID AND NATURAL GAS SYSTEM TO UNLOCK NEW OPTIONS FOR ENERGY CONVERSION AND STORAGE

Renewable sources of generation, such as wind power, provide a viable pathway to reducing our carbon footprint while increasing our energy supply security.

Since these resources are intermittent, other generating sources such as gas-fired generating plants must be dispatched by the independent grid operator to balance the aggregate supply with the load consumed throughout the day. However, at certain times during the day or seasons during the year when demand is lower, there may be a surplus of renewable electricity. Once the penetration of renewables reaches a critical mass given the constraints of the transmission grid, the need for large-scale energy storage emerges.

Power-to-Gas is a hybrid solution which converts surplus renewable generation to hydrogen using electrolysis and then injects the hydrogen into the existing natural gas infrastructure. The natural gas pipeline and underground facilities provides TWh of storage capacity which can then be discharged where and when it is needed most. It enhances the flexibility of the power system while providing a new source of renewable gas.



ADVANTAGES OF POWER-TO-GAS

Power-to-Gas is a highly effective way of integrating renewables. It can provide a rapid, dynamic response to the independent grid operator's signals to adjust to the variations in renewable generation output. A Power-to-Gas facility can provide ancillary services such as load following and can be deployed at locations on the power grid where there is congestion. Other large-scale energy storage technologies such as pumped hydro or compressed air energy storage are limited to specific reservoir or cavern sites. Traditional energy storage technologies such as batteries capture, store and discharge electricity at a single location, but Power-to-Gas represents an entirely new energy storage paradigm. It is a scalable technology which provides virtually unparalleled energy storage capacity.

The heart of the Power-to-Gas solution is the electrolyzer. It converts surplus energy to hydrogen by electrolysis—the splitting of water (H_2O) molecules into its constituent elements of hydrogen (H_2) and oxygen (O_2) using electricity. The hydrogen and oxygen are evolved as gases from the electrolyzer without any carbon emissions. The hydrogen is then compressed, metered and injected into the existing natural gas system. Alternatively, the hydrogen can supply a hydrogen fueling station for Fuel Cell Electric Vehicles (FCEVs). The purity of the hydrogen produced by an electrolyzer is very high and well suited to this application. Another option is to produce substitute natural gas through a methanation process. For example, hydrogen can be used to enhance the energy content and utility of existing biogas plants by converting the carbon dioxide content (typically 35–40%) to biomethane.

One of the unique characteristics of the Power-to-Gas solution is that it leverages the inherent advantages of the natural gas system. It provides the means to both store and transport energy. By storing hydrogen or substitute natural gas in the existing natural gas pipeline network and its associated underground storage facilities, the stored energy is not restricted to the site of generation. In effect the natural gas system serves as a 'Power by Pipes' alternative to the transmission grid to alleviate network congestion and transport energy. Separating the storage and discharge of energy results in a higher overall integrated energy system efficiency.

Another attribute of the natural gas system is seasonal storage. In many areas around the world, there is a seasonal pattern to the wind generation profile. Unfortunately, periods of high wind output may come during the shoulder periods of lower electricity demand. Power-to-Gas provides not only TWh of storage, but seasonal storage capability as well. This effectively enables the renewable gas produced from surplus renewable generation as part of the fuel stream of existing gas-fired generators at the most suitable time. It is the best of both worlds—a dispatchable generator with renewable gas.



WE'RE READY

Power-to-Gas is an innovative energy conversion and storage solution using electrolysis. It integrates renewable sources of generation, converts surplus electricity to produce hydrogen or renewable gas, and leverages the attributes of existing natural gas infrastructure including the transport of energy and seasonal storage. Hydrogen is the common denominator to a cleaner energy future. It provides a link to capitalize on the vast renewable potential of alternative generation sources using the unparalleled energy storage capacity and the flexibility of the natural gas system.

Hydrogenics is the world's leading supplier of hydrogen fuel cell power systems and electrolyzers for on-site hydrogen generation with over 1,900 sites worldwide. The combination of experience and a constant drive to improve has made Hydrogenics' HySTAT® water electrolyzers the winning choice for a wide range of industrial applications, hydrogen fueling stations and renewable energy storage and conversion systems.

Hydrogenics is pioneering Power-to-Gas development working with leading utilities worldwide in demonstration projects today and setting the stage for commercial-scale projects. The company is also advancing the next generation PEM Electrolyzers to meet the future demands of Power-to-Gas system developers.

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Hydrogenics GmbH
Am Wiesenbusch 2, Halle 5
45966 Gladbeck, Germany
Phone: +49.2043.944.133
Fax: +49.2043.944.146
energystoragesales@hydrogenics.com

Hydrogenics Europe N.V.
Nijverheidsstraat 48 c
2260 Oevel, Belgium
Phone: +32(0)14 462 110
Fax: +32(0)14 462 111
hydrogensales@hydrogenics.com

Hydrogenics Corporation
220 Admiral Boulevard
Mississauga, Ontario
Canada L5T 2N6
Phone: 905.361.3660
Fax: 905.361.3626
energystoragesales@hydrogenics.com

www.hydrogenics.com

We're ready.

