HydroGen
Electrolyzer

Stiesdal®
Hydrogen

Low-cost green hydrogen has arrived

Let deep decarbonization begin

Time is not on our side in the fight against climate change. The timelines between the necessary decarbonization and the mitigation measures currently being implemented do not level up. Fortunately, a global shift in energy infrastructure is finally underway, and the deployment of key clean technologies will need to speed up dramatically to meet the volume requirements: This is particularly relevant for green hydrogen.

At Stiesdal Hydrogen, we have taken up the challenge to accelerate the development of affordable green hydrogen. Our integrated electrolyzer unit, the HydroGen Electrolyzer, represents an innovative step forward capable of delivering on both cost and volume. Technologically based on classic alkaline electrolysis, the HydroGen Electrolyzer offers unprecedented low cost and fast ramp-up of supplies.

A necessary leap in evolution

By reviewing every detail in classical alkaline electrolysis and re-examining legacy engineering solutions in the light of the urgency of the green transition, one central question has guided our re-engineering efforts: What is the cheapest way to achieve this?

This simple question has led to a selection of innovative solutions that jointly represent a leap in the evolution of hydrogen electrolyzers.

The HydroGen Electrolyzer represents a lean, integrated product design of previously unattainable simplicity. The design is capable of maximizing the economy of scale through industrial manufacturing and is suitable for all relevant large-scale applications, including the supply of hydrogen for ammonia and methanol production and methanization.

The outcome of Stiesdal's innovative approach is that low-cost green hydrogen has now arrived.

"Delivering on both cost and volume"

Revolutionary compact: *The 3 MW HydroGen Electrolyzer integrated into a pressure vessel, resulting in an ultra-compact unit footprint. Depicted here at Stiesdal Hydrogen's test site in Give, Denmark.*

Abundant green hydrogen: *The low capex of the HydroGen Electrolyzer enables the production of green hydrogen at prices that facilitate the abundant supply of PtX fuel to such hard-to-abate sectors as shipping.*

Novel electrode stack design: *The electrode stack system of the HydroGen Electrolyzer is of a novel design that integrates cooling and reduces losses. The low-cost stack arrangement is designed for industrial-scale mass production.*

Competitive green hydrogen

Green hydrogen implies hydrogen produced by electrolysis that uses electricity from renewables. Green hydrogen is the steppingstone to achieving full decarbonization in sectors where the supply of renewable electricity falls short. Access to abundant green hydrogen will enable clean fuel production for aircraft, ships, trucks, and heavy industry. Green hydrogen is also a roadway to green plastics, green steel, and green fertilizers. Key to the viability of such green fuel supply is the price of conversion of energy from electrons to molecules, from electricity to hydrogen.

Rethinking alkaline electrolysis from scratch, the HydroGen Electrolyzer offers a simpler and more integrated configuration than traditional alkaline electrolyzers. The integrated approach lends itself perfectly to industrialized manufacturing using existing supply chains of key suppliers, thereby facilitating both low cost and fast ramp-up.

The HydroGen Electrolyzer can be adapted to a range of usages, ranging from offshore production of hydrogen based on seawater to becoming an integral part of next-generation ammonia and methanol facilities.

Why alkaline?

Alkaline technology uses electrodes made with conventional metals and does not require the noble metal catalysts other electrolysis technologies depend on. It operates at low temperature, ensuring long system lifetime.

HydroGen technology in brief

The HydroGen Electrolyzer is based on conventional alkaline electrolysis.

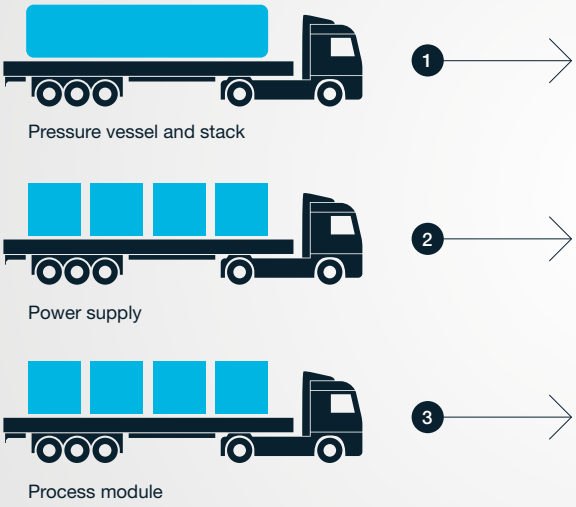
The electrode stack system is of a novel design that integrates cooling and reduces losses.

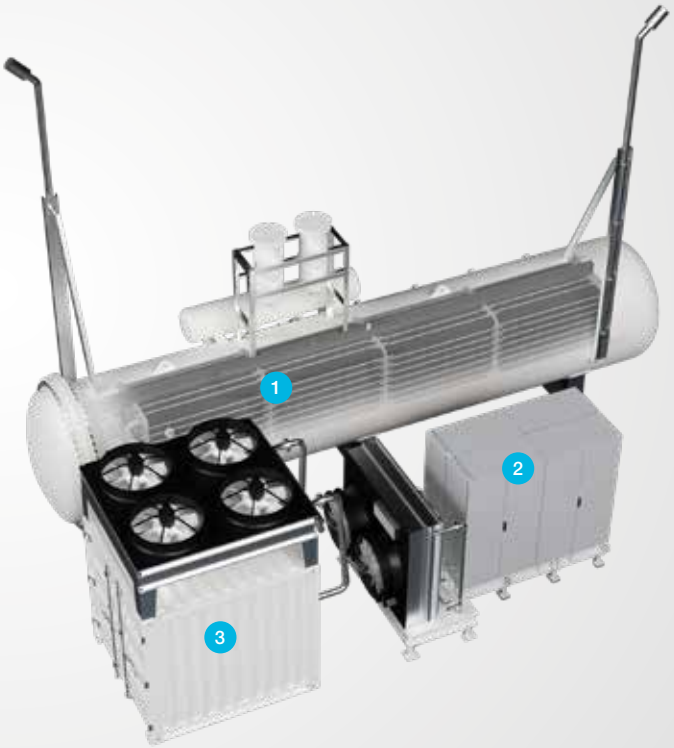
The electrode stack is located in a pressurized tank, allowing hydrogen production directly at pressure.

The HydroGen Electrolyzer can be supplied with optional cooling system for the stack. Alternatively, centralized cooling system can utilize the excess heat from the hydrogen production for process- or district heating.

Read more at
www.stiesdal.com

Innovative design focused on supply chain scalability





HydroGen's modular design arrangement: *The main components of the HydroGen Electrolyzer - pressure vessel, electrode stack, power supply and process module - are based on components available in large supply by suppliers with a global footprint. This strategy of adapting the product to suppliers rather than the other way around benefits from supplier know-how and ensures low component cost.*

Direct solar PV application

The HydroGen Electrolyzer is designed for direct connection to renewable energy sources as solar PV and wind turbines. This eliminates the need for solar PV inverters as well as almost all of the HydroGen Electrolyzer power supply system, thereby enabling very competitive hydrogen production from solar PV.

Hydrogen's moment is finally here

Hydrogen is the fundamental step required to turn renewable electricity into liquid fuels. There is no other way. Therefore, the demand for green hydrogen will dramatically increase over the coming decades, and electrolyzer suppliers will experience unprecedented demand for large volumes at affordable cost.

These simple observations are not new, and over the last few decades, the world has experienced no less than two major hydrogen "demand booms," both of which gradually fizzled out. Not so any more, however. Designed for industrialization and offering a game-changing cost level, the HydroGen Electrolyzer will deliver on the demands for volume as well as cost.

- Innovative, integrated application of proven alkaline technology
- Low-cost production based on factory manufacturing by existing supply chain
- From the outset designed for megawatt scale
- Small footprint and high adaptability to specific project requirements

3

MW. Rating of first commercially available unit

5

M^2 per MW.
Footprint area of 10+ MW HydroGen Electrolyzer

The Stiesdal approach

At Stiesdal, we define ourselves by our ability to innovate with impact.

The Stiesdal Company was founded with the purpose of developing and commercializing technologies that have major impact on mitigating climate change. This purpose is fundamentally rooted in a conviction that more needs to be done, and that real impact can be achieved through innovation.

The creation of jobs is an additional and highly important purpose of the Company. Our aim is to positively impact and benefit local communities and to think job creation into our activities.

We pursue innovative solutions that are suitable for industrialization in the belief that cost reduction is the strongest single driver of clean technology implementation.

Our approach is therefore the same across all our technologies. To achieve true impact, we always strive for game-changing levels of cost reduction. We continuously challenge ourselves, questioning what it takes for every aspect of every technology to become the cheapest without sacrificing on safety or performance.

We know from experience that volume and scale are the ultimate cost-cutting factors, which is why we optimize all our solutions for standardization and modularization to achieve streamlined industrial processes and mass production.

No new technology leaves our design offices, laboratories or workshops without a clear strategy for industrialization. If an innovative technology promises to make meaningful impact on the decarbonization of society, it must be ready-to-scale from the very beginning. This is the path that gives innovation true impact. And this is what lies in our DNA.

“Innovation with impact. It is in our DNA”

Stiesdal Offshore

Target: Unlimited low-cost offshore wind energy made globally available.

Means: The modular Tetra foundation concept, the world's first industrialized floating wind foundation.

Stiesdal Storage

Target: Firm power and energy security from renewables.

Means: The GridScale thermal energy storage system with 10 hours to 10 days capacity.

Stiesdal Hydrogen

Target: Application of renewable electricity across all sectors.

Means: The HydroGen electrolyzer unit for low-cost green hydrogen production.

Stiesdal SkyClean

Target: Affordable carbon capture and sequestration.

Means: The SkyClean system combining green fuel production and carbon capture and sequestration.

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