

## European Solar and Energy Storage Solutions

# What is the wind temperature of a hydrogen-cooled generator



## Overview

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Between 60 and 450 MW hydrogen cooling is employed. For the highest power generators, up to 1800 MW, hydrogen and water cooling is used; the rotor is hydrogen-cooled, while the stator windings are made of hollow copper tubes cooled by water circulating through them.

A hydrogen-cooled turbo generator is a with as a . Hydrogen-cooled turbo generators are designed to provide a low- atmosphere and cooling for single-shaft and .

Based on the air-cooled turbo generator, gaseous first went into service as the in a hydrogen-cooled turbo generator in October 1937, at the Co. in . .

The absence of in the atmosphere within significantly reduces damage to the winding insulation from ; these can be problematic as the generators typically operate at , often 20 kV. Seal oil system .

The use of gaseous hydrogen as a coolant is based on its properties, namely low , high , and the highest (at 0.168 W/(m·K)) of all gases; it is 7 to 10 times better at cooling than air. Another advantage of hydrogen is its easy.

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Many power generators over 150 MW in capacity utilize hydrogen as a cooling method to transfer heat from the power generating winding enclosure to the heat exchanges known as H2 coolers. Hydrogen cooled power generators are

more efficient and have less mass of materials of construction than their air-cooled cousins.

(2111°C) adiabatic flame temperature of hydrogen raises the temperature of the working fuel and improves the combustion efficiency. In addition, because hydrogen does not have carbon molecules, the result is lower CO and CO<sup>2</sup> emissions. The Fundamentals of Hydrogen in Electric Power Generation / 5 Hydrogen burns clean only when.

Hydrogen is readily available and has a thermal conductivity that is higher than air, making it a very good cooling medium. Hydrogen has also a much lower viscosity than air. This significantly decreases the windage losses and ensures the efficiency of the generator.

Hydrogen has attractive characteristics as a fluid to bathe the windings of the generator, and to remove heat from the windings and deliver that heat to the cooling water. Hydrogen is nearly the perfect cooling gas, except for its one massive flaw. What percentage of electric power generators use hydrogen cooling?

According to John Speranza, vice president, hydrogen product sales, Proton Energy Systems, almost 70 percent of all electric power generators over 60 MW worldwide use hydrogen cooling. There are two ways to fill the generator's hydrogen demand: have it delivered in cylinders or make it on site.

Does hydrogen help in cooling a generator?

Hydrogen is an effective way to cool a generator, allowing power plant operators to get more megawatts out of a smaller generator (Power Engineering). According to John Speranza, vice president, hydrogen product sales, Proton Energy Systems, almost 70 percent of all electric power generators over 60 MW worldwide use hydrogen cooling.

How does hydrogen cooling affect generator output?

Since hydrogen cooling replaced air cooling as the industry standard, the physical size of our generators has decreased and the generator output has increased due to the increased cooling potential of the hydrogen gas. The density of hydrogen is only 7% of the density of normal air, which reduces torque losses due to windage.

Why is hydrogen better than air for a generator?

Despite its reputation, hydrogen gas has qualities that make it a superior heat transfer media and internal atmosphere for a generator. Hydrogen is much less dense than air. Cooling fans can move up to fourteen (14) times as much hydrogen as air using the same amount of power.

What type of cooling is used in a generator?

For generators up to 60 MW, air cooling can be used. Between 60 and 450 MW hydrogen cooling is employed. For the highest power generators, up to 1800 MW, hydrogen and water cooling is used; the rotor is hydrogen-cooled, while the stator windings are made of hollow copper tubes cooled by water circulating through them.

What happens if you put water in a hydrogen generator?

Presence of water in hydrogen has to be avoided, as it causes deterioration of hydrogen's cooling properties, corrosion of the generator parts, and arcing in the high voltage windings, and reduces the lifetime of the generator.

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### Online Gas Analysis of Hydrogen-Cooled Electric Power ...

other challenges such as windage losses caused by wind resistance and friction on the spinning generator shaft. Helium used to be considered for cooling, but due to its low Maintenance of ...

### Air Cooled Generator vs Liquid Cooled: What's the ...

Liquid Cooled Generator Advantages. Power requirements that exceed 20-24kW require a liquid cooled generator. Liquid-cooled power capacity starts at 15kW for Diesel and 22kW for natural gas or propane. Air-cooled ...



### Why Use Hydrogen to Cool a Generator? , Power ...

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### (PDF) Generator On-Line Partial Discharge Monitoring ...

The latter is much more important than it was for

hydrogen-cooled machines. The variations of the flow rate of cooling air with the wind direction angles and aspect ratios of condenser cell

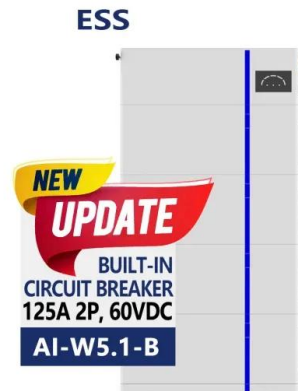


## Maintaining Hydrogen Purity in Turbine Power Generators

These factors have led to the use of hydrogen as an effective cooling mechanism for large turbine power generators. In simple terms, using hydrogen as a cooling gas helps to reduce frictional ...

## Hydrogen for Generator Cooling - The Pressure, Purity and ...

Hydrogen has attractive characteristics as a fluid to bathe the windings of the generator, and to remove heat from the windings and deliver that heat to the cooling water. Hydrogen is nearly ...



## A comprehensive scheme for cooling of large generators using hydrogen ...

The faster heat dissipation of generators in power plants calls for hydrogen cooling, and water is used as coolant to cool down the hot hydrogen which comes out from the ...

## How a Gas Turbine Generator Works , GE Vernova

wind turbines; hydro turbines; simple cycle gas turbines; but insulation and temperature control drive a generator's capacity to freely flow electrons through copper. Hydrogen-cooled generators require fewer materials, so units can

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## Hydrogen for Generator Cooling - the Pressure, ...

Hydrogen for Generator Cooling - The Pressure, Purity and Dewpoint Difference Presenter: David E. Wolff Proton Energy Systems [email protected]  
Topic: Safety, Reliability, Heat Rate and Generation Capacity can ...

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