

Test Report: Hydrogen Gas / Frauscher

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The wave of the future

Hydrogen gas as storage medium for electrical energy could be the solution to many problems. Austrian companies have proven the feasibility of this concept with a closed regenerative energy circuit and an electric boat!

Stefan Frauscher opens the engine cover on the afterdeck of his Riviera 600. Instead of the customary 8- or 6-cylinder engines as they known from other Frauscher boats, just two unimposing black boxes and a small electric motor can be seen. One box contains the storage bottle for the hydrogen gas, the other holds the fuel cell providing the power for the drive - the system is a miniature power station. This boat is Frauscher's contribution to the realization of an emission-free closed energy circuit. A pioneering project: solar energy, water and electric drive are interconnected.

Solar power, hydrogen, performance

It works this way. Using sunlight, the electric energy is generated in the process of which liquid water is split into hydrogen gas and oxygen gas. This process is known as electrolysis. Subsequently, when converting the hydrogen gas to water within a fuel cell, electrical energy is generated which then drives an electric motor. Klaus, the inventor of this closed circuit prefers to call the fuel cell an "energy cell".

There is no combustion, contrary to what the name suggests. The hydrogen gas reacts in an electro-chemical process with the oxygen in the air. In this process, electrons being electrical energy are freed. Thus, heat and water are generated at the same - nothing else. At least, that is

the principle. For the experts however, hydrogen gas was considered to be a difficult matter as an energy carrier. Its production from liquid water via electrolysis appeared to be far too expensive, as it does not exist in pure form. In addition, the gas must be chilled to minus 259 degrees in order to be stored as a liquid! This also requires an enormous amount of energy. Would it not be easier to directly store energy gained from sunlight and to use it to drive an electric motor in a boat? A pretty obvious question. And that's how it was (and is) done. However, powerful and also very light batteries as energy storage have been a great challenge for several generations of engineers. Frauscher, too, builds boats with batteries - predecessor models, one could say. What is clear is that the hydrogen helps in bypassing the storage problems for the electrical energy.

A working system

Photovoltaic systems are installed on the roofs of the boathouse of Frauscher Werft, generating electricity. With this, the gaseous hydrogen is produced from water and compressed. For the storage and transportation of the hydrogen, the Austrian Bitter Co., supported by Dynatec in Canada, developed the prototype of a container which is intended to become the standard container in our part of the world. The core of the cartridge is bottle manufactured from epoxy resin and carbon-fibres, insulated by protective covering made of aluminium. A pressure reducer reduces the outlet pressure from 350 to 10 bar.

The cartridge can be handled like a propane bottle as used by campers. Thanks to a clever mechanism, the cartridge and its holder can be placed in and removed from the boat. 26 litres of hydrogen, compressed to 350 bar, will provide up to five hours of running at reasonable speeds, before the cartridge must be exchanged - a simple task that can be done in just a few minutes. The running time obtained is a considerable improvement compared to the "old" electro system with heavy lead batteries. "We don't take anything from nature," says Fronius, "the sun is our inexhaustible energy supplier and the water is just borrowed from the earth."

Quietly into the future

Regions such as the lakes in South Germany or the Austrian Traunsee where the Frauscher shipyard is situated, are closed to boats with combustion engines in July and August. That's why the shipyard has manufactured electric boats for decades. With the new hydrogen system boat, the Sunday jaunt on the lake won't even have an impact on your electricity bill. Whatever is going on in the little power station in the engine room, the skipper won't even notice it. The boat moves almost silently across the calm lake. Just a low hissing sound and the lapping of the cooling water can be heard up front.

Live The Experience.

There is neither an exhaust system nor any exhaust gases. The Frauscher Riviera 600 is driven by an electric motor with 4.3 kW power which translates to a top speed of six knots. A 26-litre hydrogen cartridge provides 22 kWh, translated by the fuel cell (with 50% efficiency) to 11 kWh driving power. 25 m² solar cells provide sufficient electricity to generate hydrogen gas for 50 cartridge loads, enabling 250 hours of boat operation annually. At this time, the lifespan of a fuel cell is an estimated 5,000 hours. Its application in leisure activities translates this to a lifespan of between 15 and 20 years.