

An Update on Hydrogen as a Fuel

I have written about the coming fuel being hydrogen being a fuel sources as FUSION rather than Uranium where FISSION is utilized with the enormous and dangerous waste product that takes many centuries to dissipate.

This recent article on using hydrogen as a fuel has interesting possibilities. (Taken from the internet)

“.....Hydrogen Stations – fuel stations for hydrogen mobility

Standardised hydrogen filling stations for a range of mobility applications including compression, storage, and dispensing capabilities

GENO Hydrogen Refuelling Stations



Our GENO hydrogen refuelling stations (H) are suitable for both 350 and 700 bar hydrogen profiles, they deliver a back-to-back filling kg of hydrogen per day, ensuring unma

You can easily scale Haskel's hydrogen refuelling systems to meet your growing refuelling demands thanks to their standardised, modular design. The GENO system range includes hydrogen compression systems, alongside standard storage and dispensing options. Read more about the GENO Compression System range [here](#).

Key features of GENO Hydrogen Refuelling Stations

- Standard containerised solutions of 20ft or 40ft Hi-Cube
- Integrated compressed air system for pneumatic valve actuation
- Compression capability of over 3000kg per day
- Outlet pressure capability of up to 950 bar



GENO Hydrogen Refuelling Stations for Large Fleets

supports both 350 and 700 bar applications

- Installation, maintenance and service support packages provide peace of mind across the life of the GENO system.

[Speak to a Hydrogen Expert](#)

The Technology at the Heart of Haskel's Hydrogen Solutions

At the heart of all the GENO systems is Haskel's market leading, hydraulically operated H-Drive compression technology.

The [H-Drive booster](#) can compress hydrogen up to 1050 bar. This makes it the perfect choice for high pressure hydrogen compression and hydrogen storage. The advanced design of the H-Drive booster delivers supreme efficiency and reliability. Our experts made sure that it can operate under a range of challenging conditions.



Haskel H-Drive compressor uses a piston instead of a diaphragm to reduce the volume of hydrogen. This is because diaphragm compressors have complicated start/stop procedures and higher CAPEX requirements. What is more, a diaphragm ruptures or failure may lead to an oil leak.

[Get in touch for more information on Haskel Hydrogen Stations](#)

- Suitable for 350 bar and 700 bar vehicle filling applications
- Suitable for filling tube trailers or manifolded cylinder packs (MCPs) via direct compression
- Flexible inlet supply pressure ranging between 20 and 500 bar
- Capacity for consecutive back-to-back filling
- Fully compliant with J2601
- Fast and T40 capable dispensing, dual pressure dispensing capability



Nano and Nano Pro - Small Scale Hydrogen Fuel Stations



Materials handling - Fuel cell industrial trucks, like forklifts or towing trucks, are especially suitable for indoor operation, because they produce no local pollutant emissions and only low noise emissions. Fuel cell vehicles have advantages over battery operated industrial trucks in terms of refuelling. Instead of having to replace the battery, the trucks can be refuelled within two to three minutes. They take up less space and are cheaper to maintain and repair.



Trains - Rail vehicles that use hydrogen as an energy store and energy source can offer an additional alternative where electrification is not possible. Fuel cell-powered rail vehicles combine the advantage of pollutant-free operation with the advantage of low infrastructure costs, comparable with those for diesel or electric operation.

Areospace - In civil aviation, hydrogen powered fuel cells are regarded as potential energy providers for aircraft and have been used in space travel for some time. Fuel cell modules can supply electricity to the aircraft electrical system as emergency generator sets or as an auxiliary power unit. More advanced concepts include starting of the main engine and the nose wheel drive for airfield movements by commercial aircraft.



Shipping vessels – Hydrogen fuel cells are currently being tested as energy providers for the on-board power supply. The use of hydrogen powered fuel cells for ship propulsion, by contrast, is still at an early design or trial phase, with applications in smaller passenger ships, ferries and bulk material vessels.

Trucks - There is an increasing momentum behind the development and commercial use of fuel cell and hydrogen trucks in the heavy-duty vehicle segment. Compared to a battery electric solution, hydrogen fuel cell technology offers longer range, greater power, more payload capability, and faster refuelling. Fuel cell electric vehicles are best positioned to cover long-haul use cases and for weight sensitive use cases. This is because heavy batteries would reduce the potential



payload of trucks to a larger extent than would fuel cells and hydrogen tanks.



Buses - Buses in the public transport network are the most thoroughly tested area of application for hydrogen and fuel cells. Since the early 1990s, several hundred buses have been and are being operated with hydrogen worldwide – mainly in North America, Europe and increasingly also in Asia.

Modern fuel cell buses draw their energy from fuel cell stacks, carrying approximately 30 to 50kg of compressed hydrogen on board, stored in pressure tanks at 350 bar. Fuel cell buses

now have a range of 300 to 450 km offering almost the same flexibility as diesel buses in day-to-day operation.



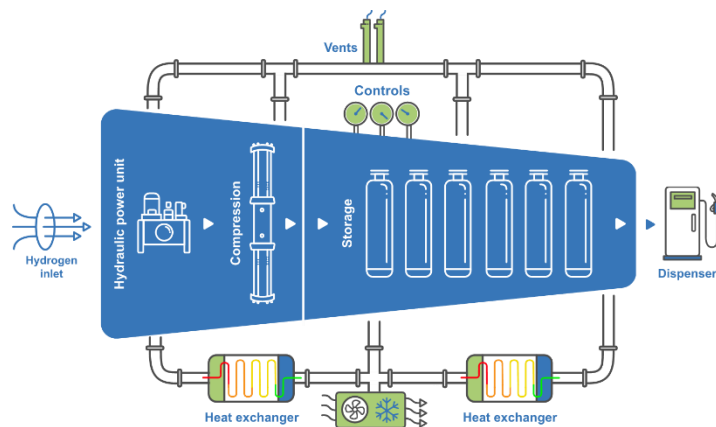
Light Vehicles - Along with battery electric vehicles, hydrogen powered fuel cell passenger cars are the only zero emission alternative drive option for motorized private transport. The fuel cell stacks in the latest fuel cell models have an output of 100 kW or more.

Compared with battery electric cars they have a greater range, of around 400 to 500 kilometers today. They also have a lower vehicle weight and much shorter refueling times of three to five minutes. They usually

carry 4 to 7 kg of hydrogen on board, stored in pressure tanks at 700 bar.

How does a hydrogen station work?

Hydrogen fuel cell vehicles can be refuelled quickly and efficiently at a hydrogen refuelling station. This results in an effortless refuelling experience that is comparable to traditional refuelling methods such as petrol or diesel.



Haskel standardized refuelling stations are configured for optimum performance based on the hydrogen inlet pressure. They accept hydrogen from a range of sources, including via Cylinders, tube trailer or generated on-site.

The hydrogen is compressed in various stages, using Haskel's proven compression technology, to increase the pressure and reduce the volume of the hydrogen. This enables a more efficient flow of gas when dispensing.

A heat exchanger removes the excess heat from the gas that was generated during the compression process. The process is powered, monitored, and controlled via the HPU, PLC and the electronic control panel in the non-hazardous zone.

The hydrogen is cooled to sub-zero temperatures to optimise the fuelling experience and vent lines are situated throughout the system ensure the hydrogen can be removed safely during operation. Specially designed hydrogen compliant valves and fittings are used to control the highly pressurized gas throughout the whole process.

The dispensing process regulates the flow of the gas to enable the hydrogen to be dispensed through a nozzle directly into the vehicle at a controlled pressure and rate.

[Get in touch for more information.](#)



Applications for hydrogen stations

Hydrogen fuel is considered a good candidate to contribute to the decarbonisation of the mobility sector if it is produced via renewable energy sources. The main advantages of fuel cell electric vehicles are the zero emission of CO₂ and pollutants, and the higher efficiency of fuel cells compared with internal combustion engines.

Hydrogen is used by the vehicle directly as an energy source, both in internal

combustion engines and in fuel cells, where the fuel cell uses the chemical energy of hydrogen to cleanly and efficiently produce electricity.

Haskel hydrogen stations are used to fuel a range of hydrogen fuelled vehicles.

Our innovative standard range of complete hydrogen fuelling stations includes Nano, Nano Pro and Geno for large and small fleets.

Haskel hydrogen stations are modular in design, offering cost effective and reliable refuelling options at 350 and 700 bar. They can be scaled to meet project requirements as usage grows. As leading experts in high-pressure gas compression and transfer, we are ideally positioned to support hydrogen refuelling requirements globally.....”

Interesting article is it not?

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