H2Drive®. Unlimited and zero emission power for forklifts and tow tractors

H2Drive® - Lifting the future ...

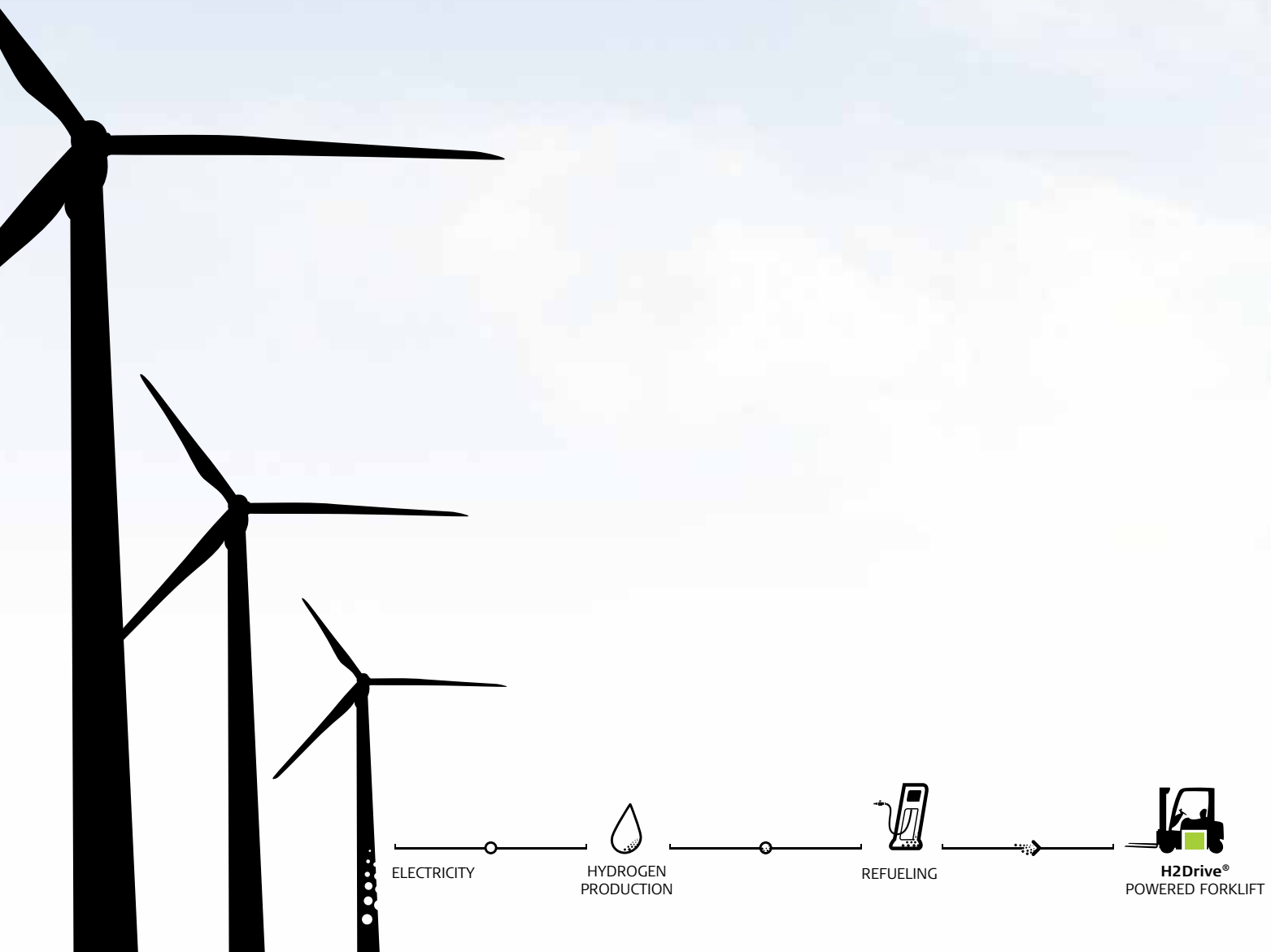
Inter Airport edition

H2 LOGIC PRESENTS

H2Drive®. Unlimited and zero emission power forklifts and tow tractors

H2Drive® fuel cell systems are developed specifically for material handling vehicles such as forklifts and airport tow tractors. The **H2Drive®** can replace batteries and provide a profitable and environmental friendly alternative to the internal combustion engine.

H2Drive® combines hydrogen and oxygen (from atmospheric air) to produce electricity. In principle, a fuel cell system operates like a battery but unlike a battery, a fuel cell system does not run out of power or require recharging. It will produce electricity as long as hydrogen is supplied. The only emissions from the fuel cell system is pure water and heat, thus no C02 or particle emissions!



H2Drive® - much more than just a power supply!

It does not look like much, but it can do a lot for your business. Batteries in electric forklifts, tow tractors and other material handling vehicles can be replaced with a **H2Drive®** fuel cell system. **H2Drive®** fits perfectly into the space occupied by the batteries, making it a simple and cost-effective solution for customers to adopt.

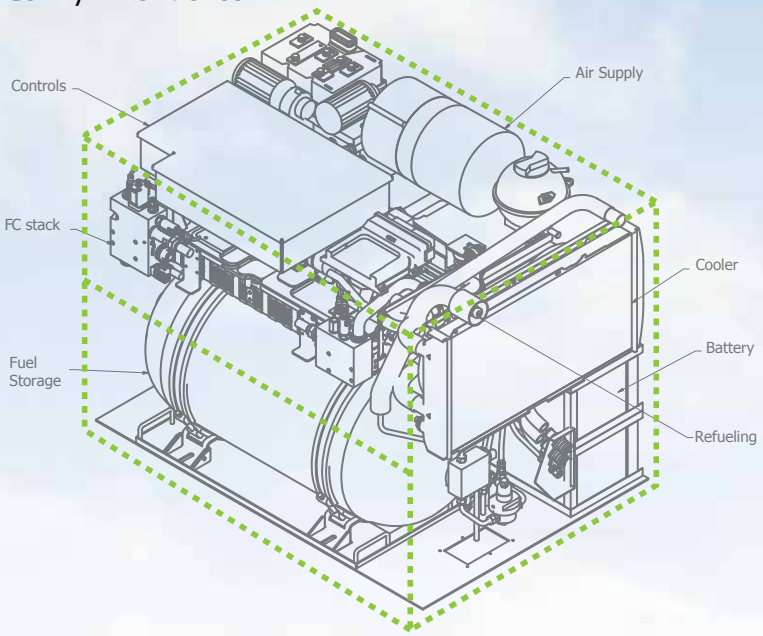
- Continuous full performance 24/7 operation
- Costs competitive with diesel and LPG
- Quick refueling like LPG/diesel
- No power reduction in cold/warm surroundings
- No charging or swapping of batteries
- No need for extra batteries
- Zero emission, no C02 or particle emission
- Energy efficient, lower fuel costs
- Silent, no vibrations
- Quick driver acceptance: "Feels like a fully charged battery at all times"

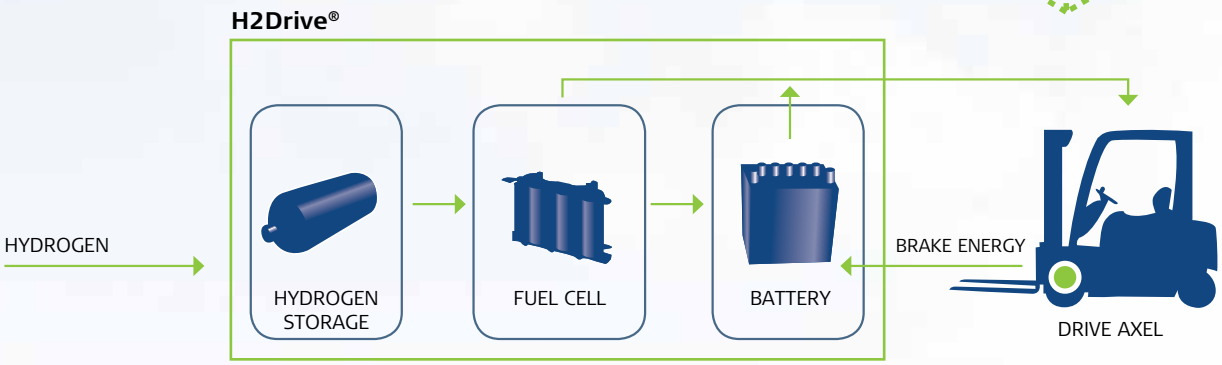
H2 Logic has always considered safety as highest priority. H2Drive certified by TÜV SÜD

H2Drive®
- from hydrogen to power!

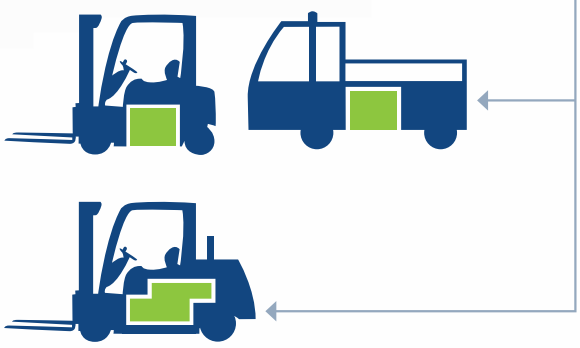
A fuel cell is a electrochemical device that converts the chemical energy in hydrogen into electrical energy – or electrical power – that is used to power the electric motor onboard the vehicle. Other than electrical power the fuel cell system will generate only water and heat – which in fact can be used for cabin heating without any loss of range.
Since fuel cell systems have no major moving parts, noise and vibration are practically non-existent. The lack of moving parts also enables very high reliability. The fuel cell system also has an integrated battery pack for storage of peak regenerative power, a hydrogen storage tank and finally a systems control unit.

H2Drive® delivers electrical power like a battery but does not run down or require recharging as long as hydrogen is provided. When the hydrogen tank is empty, a new refueling only takes a few minutes.





BATTERY REPLACEMENT
H2Drive® can be integrated into most 80V material handling vehicles with battery dimension: 711x1028x738 mm (DIN 43536-98 80V, Layout A). Please note that other dimensions can be provided. Minor vehicle adjustments can be necessary.



FULL VEHICLE INTEGRATION
Based on the broad H2 Logic´s experience of full integration of the fuel cell systems into electrical and ICE based vehicles, integration of **H2Drive®** can be offered for most material handling vehicles.

H2Drive® - when business and environment go hand in hand

We at H2 Logic are aware of the fact that at the end of the day the total cost of ownership is determining when a new technology is introduced. An increasing number of companies and application arise where fuel cells are competitive with IC powered and some even battery powered vehicles. Generally speaking the bigger a forklift fleet and the more intensively it is used the more competitive the fuel cells become.

Let H2 Logic coduct a total cost of ownership calculation based on your current forklift or tow tractor fleet and see for yourself how **H2Drive®** can improve your fleet economy and emissions footprint.

H2Drive® - the ultimate replacement of fossil fuel

The ultimate replacement of fossil fuels in the material handling and transport sectors is the use of sustainable energy to produce hydrogen as a fuel for fuel cells.

Besides the potential economical gain of using fuel cells for forklifts, **H2Drive®** can also enable a significant reduction in CO2 and particle emissions. An increasing number of forklift end-users are implementing Corporate Social Responsibility policies that dictate reduction of CO2 emissions in their value chain.

Replacing diesel and/or LPG forklifts with **H2Drive®** powered forklifts is a very cost effective way to reduce your CO2 emissions without jeopardizing performance.

EXAMPLE:
An LPG forklift with a fuel consumption of 3.6 kg per hour that operates 1,500 hours per year, has an annual CO2 emissions of more than 16 ton!

H2Station® - proven, reliable and cost effective

A hydrogen refueling station can be provided as a compact transportable module that allow for fast and easy outdoor installation. Within **H2Station®** the hydrogen is compressed and stored at ~430 bar. The fully automatic refueling is then conducted by pressure equalization through the dispenser and requires no trained staff. Time for a 350bar refueling is approximate 3 minutes.

H2Stations from H2 Logic are built on proven technology and with components commonly used in the gas supply industry. All **H2Stations** are CE marked and comply with European directives and standards for hydrogen refueling stations.

Questions & answers about **H2Drive®** Fuel cell system

Why hydrogen and fuel cells?

As fossil fuels such as diesel and LPG become more sacred and expensive, hydrogen can offer a sustainable supplement as it can be produced based on sustainable energy resources. When used in a fuel cell the only emission is pure water but still with the same performance as fossil fuels in terms of power, range and refueling time. So hydrogen and fuel cells enables continuing to enjoy the benefits of fossil fuels and transportation as today, only in a sustainable way.

Is hydrogen dangerous?

Hydrogen is a fuel that needs to be handled correctly. The **H2Drive®** is powered by hydrogen and is designed and built according to all current European directives and regulations for hydrogen fuel cell systems. **H2Drive®** is CE marked and **TÜV** approved and therefore safe to use.

What approvals are necessary?

The **H2Drive®** is 100% approved for the use in forklifts. Integration into the vehicle is to be approved by each vehicle manufacturer.

How often and who conducts the service on the H2Drive® fuel cell system?

The **H2Drive®** service intervals typically follow the vehicle normal service intervals. However it is recommended that this is no more than 300 hours. Service is done by the current service provider or H2 Logic and consists mainly of inspection and replacement of filters. In the case of repairs that require presences of a fuel cell system expert, H2 Logic offers an immediate response service. Please ask for details in your area.

Are all spare parts in stock?

H2 Logic or/and our local service provider has all spare parts in stock for day to day delivery

Where do we get hydrogen fuel?

There are several possibilities depending on location. H2 Logic can offer a hydrogen refueling station along with the **H2Drive®** systems. In many cases the hydrogen refueling station will be operated by a third party in the same way as it done with diesel or LPG, thus no customer involvement in the daily operation.

EUDP
Energiteknologisk udvikling og demonstration

Højteknologifonden

H2Drive® is a result of more than 6 years of research and development efforts partially supported by various public programs such as EUROSTARTS, EUDP and The Danish National Advanced Technology Foundation

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H2 Logic is a leading manufacturer of zero emission fuel cell systems for material handling vehicles, and hydrogen refueling stations for material handling and passenger vehicles.