



I RUN ON HYDROGEN

DISCOVER THE BENEFITS OF E-BIKING ON HYDROGEN

THE LINDE GROUP



Why electrify?

In the search for more sustainable, climate-friendly mobility choices, pedelecs (from pedal electric cycle) or electric bikes (e-bikes) are seen as an increasingly attractive option for urban mobility. They avoid the hassle of traffic congestion, allowing cyclists to cover longer distances and peddle uphill with ease. In the EU alone, pedelec and e-bike sales have risen more than ten-fold over the last nine years.

All of this makes hydrogen the perfect source of energy if you are interested in moving towards lower-carbon, zero-emissions mobility choices.



Why hydrogen?

Many e-bikes are powered by lead acid or lithium-ion batteries, which require regular charging and offer limited driving range. Now, hydrogen (H₂) is giving e-bikers a chance to go greener and further.

First of all, hydrogen is a clean fuel – releasing only water vapour when converted in a fuel cell. It can be generated by electrolysing water, for instance. And if it is electrolysed using a regenerative source of energy, it is carbon neutral. Which means that you are not contributing to climate change if you get around on hydrogen. Last but not least, hydrogen is the most commonly occurring element in nature, which means that – unlike fossil fuels – it will never run out so you don't have to worry about depleting the earth's natural resources.

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Why bike on hydrogen?

Looking beyond climate protection, H₂ bikes also offer a range of practical benefits. Unlike regular e-bikes – which can take hours to recharge – the Linde H₂ bike can be refilled in a matter of minutes. In addition to the convenience factor, H₂ bikes eliminate the need for hazardous lead acid batteries common on regular e-bikes. H₂-powered bikes also go the distance – with one tank lasting for as much as 100 km on flat to mixed terrain. And if you are fond of creature comforts, you'll be pleased to know that the heat exchanger on the fuel cell is integrated in the frame of the bike – so the heat it releases will keep your hands warm on colder days.

Why Linde?

The Linde Group has been developing and pioneering H₂ production and delivery technologies for over 25 years. We have already developed many innovative H₂ fuelling solutions for cars, busses and forklift trucks, and continue to actively drive the growing commercialisation of H₂-powered fuel cell electric vehicles (FCEV). Reaching beyond cars and busses, we are now excited to present the first H₂-powered fuel-cell electric bike (pedelec). Our H₂ bike reflects our determination to bring viable clean technologies within the everyday reach of climate-conscious citizens just like you.

SO HOP ON AND ENJOY THE RIDE!

H₂ BIKE AT A GLANCE



1. Speedometer with light on/off switch. Shows max. speed, trip distance and accumulated distance.



2. Gauge on H₂ storage tank showing remaining distance.

3. Hydrogen fuel tank with pressure regulator. Features a press-fit connection to which a fuelling nozzle can be easily attached to fill up the tank.



1.

2.

3.

4.

5.

4. Fuel cell unit with fan. Features on/off switch to turn the fuel cell on for assisted peddling. This will also start the fan.



5. Auxiliary drive for assisted peddling.

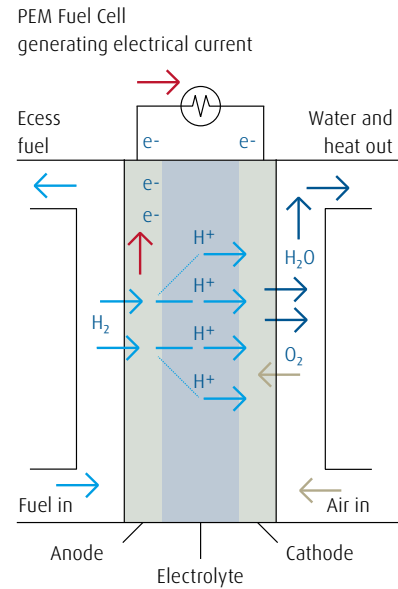


SO HOW DOES IT WORK?





SO HOW DOES IT WORK?



The principle behind the Linde H₂ bike is very straightforward. Once you switch on the fuel cell (see no. 4 on page 7), the tank supplies the fuel cell with H₂. The fuel cell uses oxygen from the surrounding air to process the H₂. This releases electrical energy and water. The electrical energy from the fuel cell flows to the buffer battery and charges it. This buffer battery ensures a steady flow of power on demand to the drivetrain (auxiliary drive). It can even store regenerative energy – which is captured by the drivetrain when you decelerate, for instance, and fed back to the buffer battery.

This auxiliary drive automatically kicks in if the peddle sensor detects that you need additional power. This happens if the voltage of the buffer battery drops below 35 V. However, the auxiliary power supply cuts out again at speeds in excess of 25 km/h for legislative reasons (this corresponds to a battery voltage of around 38 V).

There is no need to worry if you run out of H₂. The system safely shuts itself down automatically. Depending on the charge status of your buffer battery, the bike will still support assisted peddling for between 3 and 5 km. After that, you can continue to peddle your bike, but you will receive no assistance from the fuel cell.



GETTING STARTED





Before starting your trip, check that you have sufficient H₂ supplies. If the gauge on the storage tank indicates that the remaining range is less than 20 km, please refuel.

If you have enough H₂, press the ON/OFF button on the fuel cell (see page 7). This will also turn on an audible fan. The fan is required to supply the fuel cell with air (for H₂ reaction) and as a vent. The fan may turn on while you are using the bike – this is perfectly normal.



In addition, you will hear a purging sound when you turn on the fuel cell. This purge process is repeated at regular intervals.

If the outdoor temperature is below 5°C, the fuel cell takes a while to reach its core operational temperature (5°C). While it is warming up, the buffer battery supplies your auxiliary drive with power. So you can take off as soon as you turn the fuel cell on.

You do not need to turn off the fuel cell for short stops, for example at traffic lights. If you have finished your trip, however, you should turn off the fuel cell using the ON/OFF button.

PRESS
AND GO!



FACTS ABOUT H₂



- H_2 releases zero emissions when it reacts with oxygen in a fuel cell
- It is a powerful source of energy – holding about 10 times more energy than petrol (based on weight)
- Pure H_2 gas is scarce in our atmosphere – it generally exists in combination with oxygen and water, as well as in organic matter such as living plants, petroleum and coal
- H_2 does not self-ignite or detonate in open air; like all fuels, however, it will ignite in the presence of a flame or extreme heat
- H_2 is odourless, non-toxic and non-corrosive
- At -253°C , H_2 condenses into a colourless liquid





Livia H bike
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Safety first

When using and parking the Linde H₂ bike, it is important that you observe general safety precautions similar to those that apply to any H₂ mode of transport.

The H₂ is stored in a pressurised tank. These tanks have been pressure-tested to ensure they are fit for purpose. When your tank is full, it holds around 3.6 MJ of energy. This corresponds to the amount of energy contained in five cigarette lighters.

Like all fuels, however, H₂ can potentially ignite in the presence of fire or flame. Open flames must therefore be avoided within a radius of 1.5 m of the bike during operation and refuelling. Similarly, smoking on the bike or during refuelling is prohibited.

Before starting up the fuel cell, check for visible signs of damage to the fuel cell and H₂ tank, and make sure they are securely attached to the bike. If you have any safety concerns, do not start the fuel cell and contact Linde for assistance.

You may also need to check the temperature before starting your fuel cell. It must not be turned on if the temperature is outside of the -20°C to +40°C range. Similarly, the bike itself must never be stored at temperatures in excess of 40°C and must be protected against the elements. The H₂ cylinder can be stored at locations with ambient temperatures of up to 70°C.





FIND OUT MORE

Technical specifications

Bicycle

Total weight of bike	~23.6 kg
Maximum speed in electric mode	25 km/h
Motor power	250 w
Frame material	Aluminium
Gears	Shimano deore M610
Tyres	Schwalbe Big Ben 55-559/26 x 2.15
Rims	Sun Ringle Single Track 26"
Pedals	Wellgo Co98 Blk

H₂ system

Weight of fuel cell system	3.7 kg
Max. working pressure of cylinder	340 bar
Storage capacity	33 gr H ₂ , corresponding to 1,000 Wh
Range per cylinder filling	> 100 km
Fuelling time	1- 6 min
Fuel cell lifetime	5 years
Fuel cell efficiency	~50%
Buffer battery	60 Wh



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METROPOL

If you want to learn more or have additional questions,
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