hybrid fuel cell bus

VANHOOL

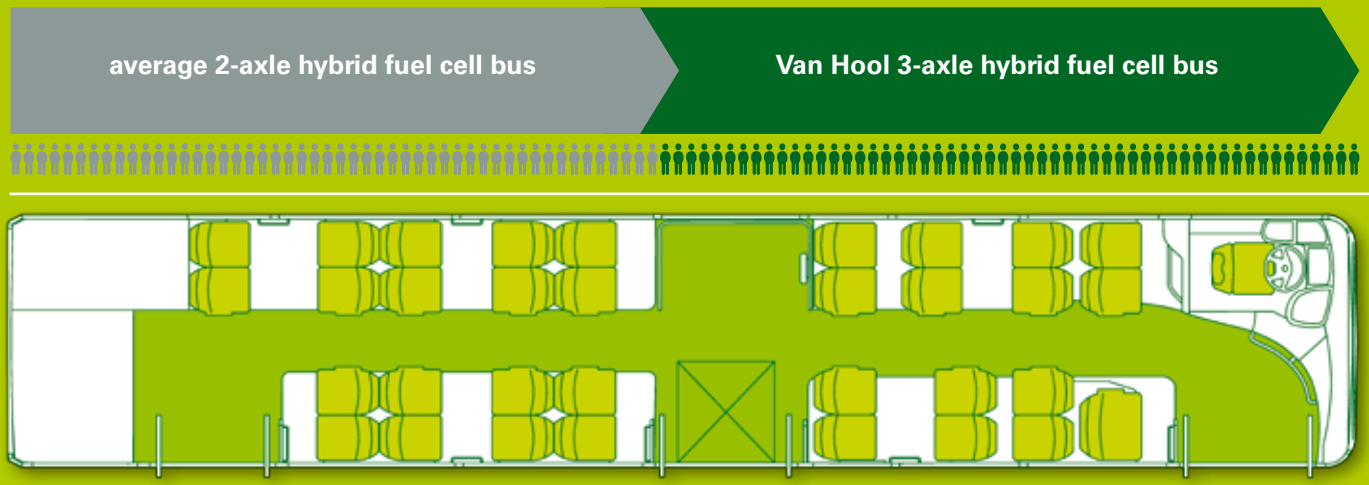
PURE EMOTION

PURE **CAPACITY**

- **The full passenger capacity of a standard diesel bus**
  - **seats ▸ 34**
  - **standees ▸ 70** (7 passengers per sqm)
  - **total ▸ 104**

- **Thanks to the three axles of the Van Hool A330 Fuel Cell bus:**
  - **more passengers**
  - **more space**
  - **more capacity**
  - **lower cost per passenger**

- **3 axles:**
  - **turning radius: 11.70 metres**
  - **more driving stability and more comfort**
  - **increased safety (3 axle braking)**



PURE DESIGN

Zero Emission

No CO_2
No NO_x
No particulates
Only pure water

Equivalent emissions reduction potential

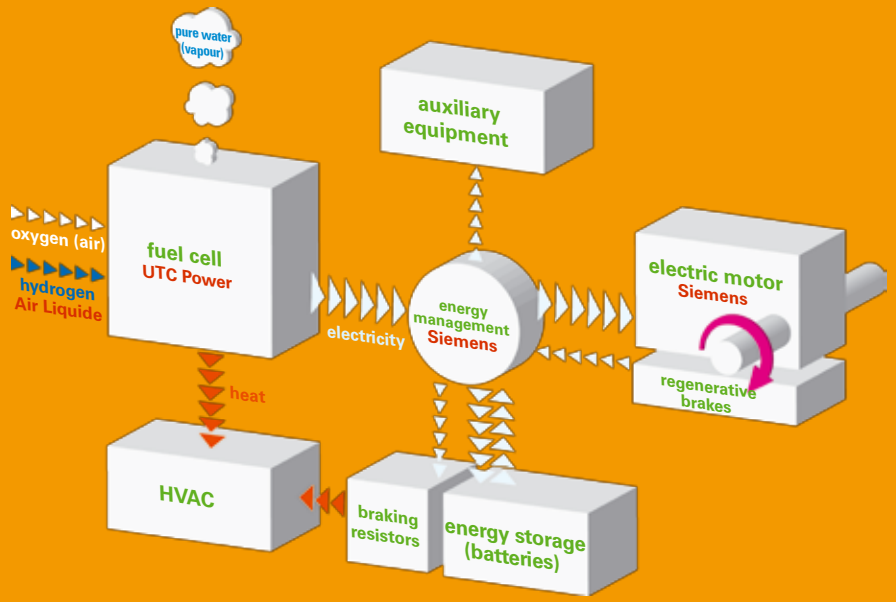
- 100 hybrid fuel cell buses give a
- CO_2 reduction
  = uptake of 3,100 acres of forest

- NO_x reduction
  = 10 km 4 lanes of cars

	NO_x (per year)	PM (per year)
100 Diesel Euro III buses	62.5 tons	1.25 tons
100 CNG buses	25 tons	0.25 tons
100 hybrid fuel cell buses	zero	zero

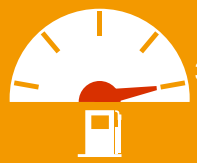
50,000 km/year, average 20 kmph, 50 kW/h

Fuel Efficiency



- Hybrid drive system
  superior fuel economy
  improved system reliability

- Virtually no energy is lost
  brake energy is regenerated
  the heat of the fuel cell is used for
  passenger comfort



The Silent Bus

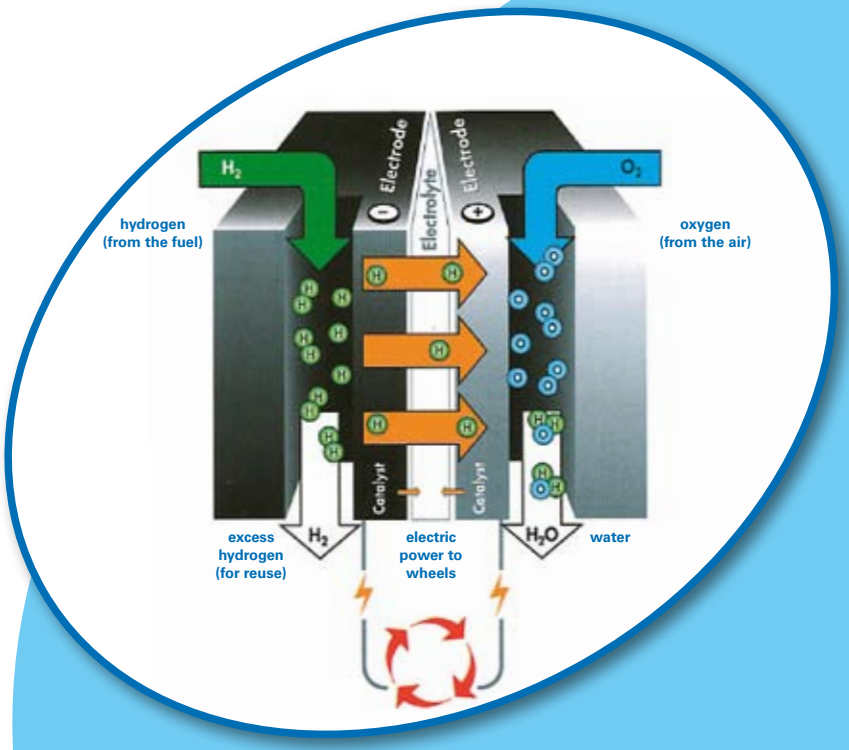
inside

outside

No moving parts in the
PureMotion™ fuel cell

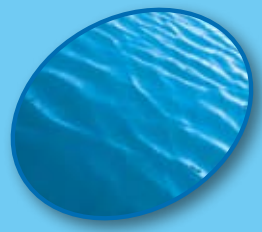
capacity	passenger seats	34
	max. passenger capacity	104 (7 passengers per sqm)
		94 (6 passengers per sqm)
measurements	overall length	13,155 mm
	overall width	2,550 mm
	overall height	3,420 mm
emissions	CO	zero
	NO_x	zero
	HC	zero
	PM	zero
	CO_2	zero
performance	net shaft power	2 x 85 kW / 170 kW
	peak torque	4,250 Nm
	grades	up to 18%
	gaseous hydrogen at ambient temperature	12 bar (min. required)
fuel (hydrogen)	on board storage	8 cylinders
	storage capacity	1,640 liter at 350 bar
	weight	38.50 kg
fuel cell	power	120 kW
batteries	number	3 modules
	energy	17.8 kWh
air supply	electric motor	4 kW
	compressor	10 bar (max pressure)
temperatures	fuel cell operating	55°C to 60°C
	ambient operating with freeze protection	-20°C to 40°C
electrical power and voltage	air compressor drive	4 kW (400 V AC)
	hydraulic pump drive	4 kW (400 V AC)
	airco system compressor	15 kW (400 V AC)
	braking resistors	2 x 60 kW
	additional cabin heater	9.5 kW
	top cooling drive	5.5 kW (variable frequency)

PURE **POWER**



The PureMotion™ fuel cell uses hydrogen and oxygen from the air. No emissions are produced, other than pure water.

The Proton Exchange Membrane (PEM) makes the system very efficient and very reliable.



Hydrogen is the most abundant element: more than 90% of all chemical substances in the universe. On earth it's found in water and in all organic matter.

Hydrogen has been produced, transported and used safely for over 50 years.

Hydrogen gas is very light and very volatile. It's colourless, odourless, tasteless and non-toxic.

Hydrogen is an energy source of the future. It can be generated with renewable energy like wind energy or solar energy, making it emission-free from well to wheel.

The UTC Power PureMotion™ fuel cell is an electrochemical device that generates electricity, the main source for the electric motors of the Fuel Cell bus.

VANHOOL

60 years of experience in bus design, manufacturing and after sales service

- Family-owned and managed
- 80% exported worldwide
- 4,300 work force
- 1,600 buses/coaches per year
- 4,000 industrial vehicles per year
- Over 6,000 coaches and buses in USA
- Product designs and production flexibility to meet specific market requirements

In today's world of challenges, Van Hool products focus on

- Enhanced
- Environmentally friendly
- Efficient

Public Transport Solutions

UTC Power
A United Technologies Company

United Technologies Corp., based in Hartford, Conn., provides high-technology products and services to the building and aerospace industries. Its UTC Power unit, based in South Windsor, Conn., is a full-service provider of environmentally advanced power solutions.
With nearly 50 years of experience, UTC Power is a world leader in developing and producing fuel cells for on-site power, transportation, space and defense applications, and a developer of innovative combined cooling, heating and power systems for the distributed energy market.

- Corporation
- UTC Power
- UTC Fire & Security
- Pratt & Whitney
- Carrier heating and air conditioning systems
- Otis elevators and escalators
- Sikorsky helicopters
- Hamilton Sundstrand aerospace and industrial systems
- United Technologies Research Center

- Facts
- 215,000 employees
- 47th largest employer in the world
- 4,000 locations in 62 countries
- Business in 180 countries

SIEMENS

One of the world's leading solution providers of innovative and sustainable mobility systems for mass transit, regional, and main line rail systems

Siemens ELFA drive system for hybrid bus applications

Proven technology with over 1000 sytems delivered cumulating over 100 million operating kilometres

- Main components
- Electrical motors and generators
- Inverters to feed main motors and auxiliary supplies
- Energy management system

- Advantages
- Compatible with any kind of primary energy source
- Flexible intermediate energy storage reduces energy consumption
- No gear shifting required with results in high riding comfort
- Low noise production
- Low maintenance requirement leads to low running costs
- Fully scalable to meet power and performance needs

AIR LIQUIDE

- hydrogen energy activities
  Air Liquide masters the entire hydrogen supply chain from production to fuel cell

- Hydrogen refuelling station
- From transportable to 150 kg/day
- From liquid hydrogen to dual pressure (350 and 700 bar) mobile cold filling station
- From Europe to Asia

- On board hydrogen storages
- From 350 full packaged system to conformable shape liquid hydrogen tanks
- From laboratory use to world breaking speed records storage systems
- Light weight LH2 on board storages
- Zero Boil off LH2 on board storages

the future. here. now.

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