

The Ballard logo is displayed in white, bold, sans-serif font on a blue rectangular background. The logo consists of the word "BALLARD" followed by a trademark symbol (TM).

BALLARD™

Hydrogen Fuel Cell Heavy Duty Transport Yesterday, Today and Tomorrow

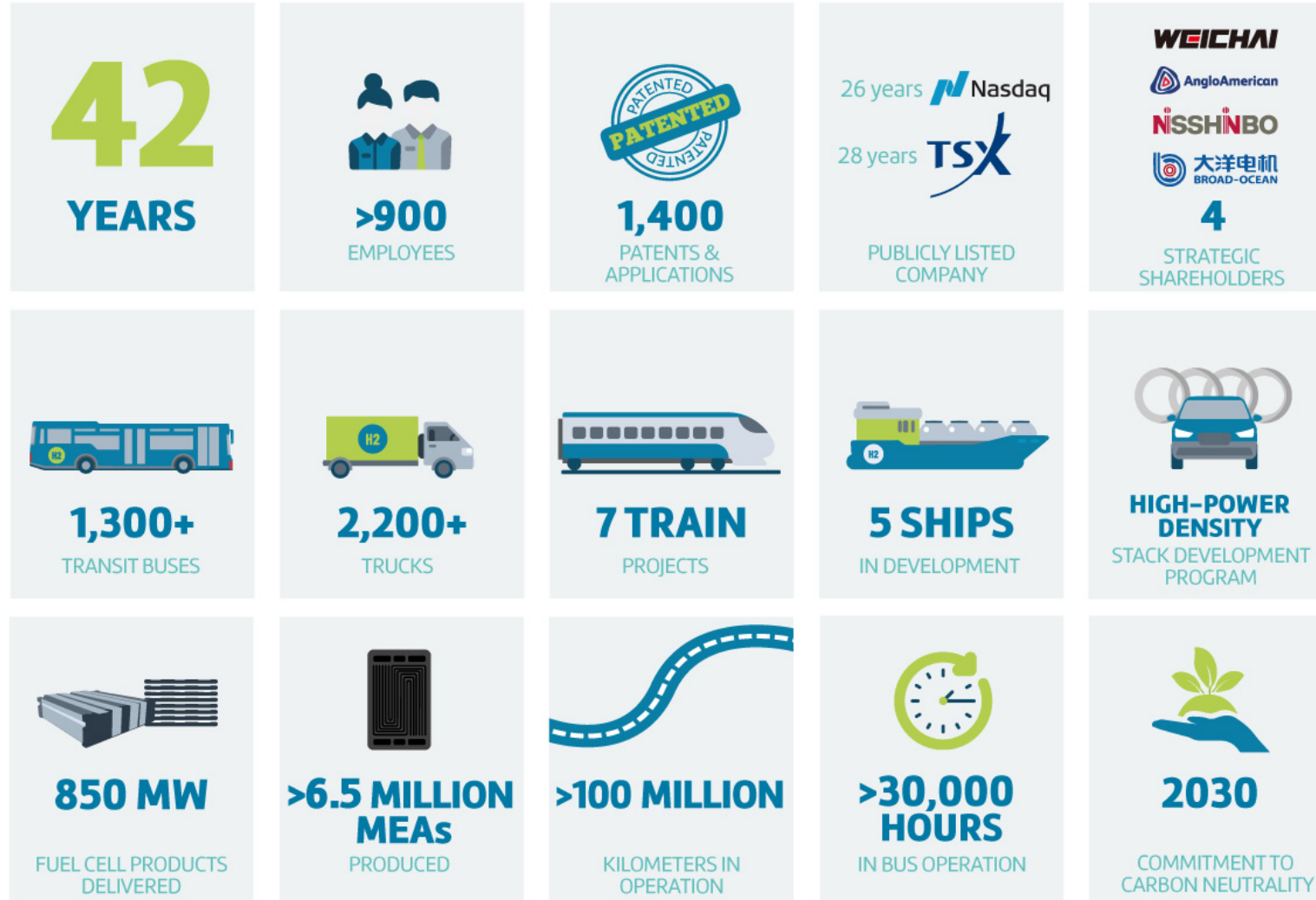
CCSHFC2021

Hydrogen & Fuel Cells: The Time is Now

16th November 2021



BALLARD BY THE NUMBERS



CUTE HyFleetCUTE

CHiC

High V.LO-City

HyTransit

3Emotion

CHiC



HyTransit



BALLARD™

JIVE / JIVE2

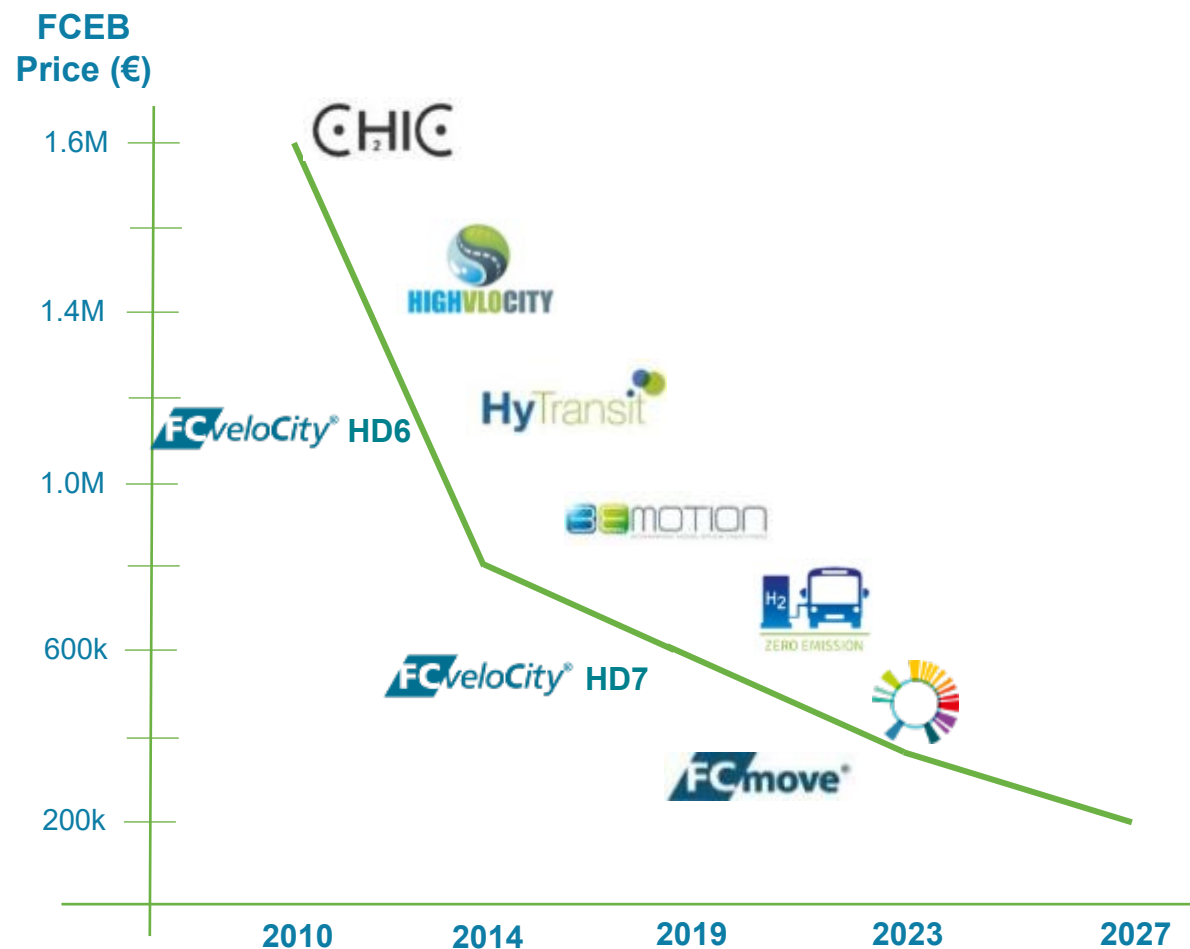
H2Bus Europe

National Funding



Fuel Cell Competitive Positioning

60% reduction in FCEB price over past 10 years



Key Drivers:

- ✓ Improvements in technology and products led to ~60% FCEB cost reduction in past 10-years (as well as ~50% service & maintenance cost reduction in just the past 5 years)
- ✓ Further lifecycle cost reductions going forward are expected to result from continued product innovation plus increased volumes, leading to –
 - Economies-of-scale in manufacturing (similar to diesel engines)
 - Lower cost of green hydrogen and lower cost hydrogen infrastructure (which is opposite for BEBs)

Hydrogen fuel cell buses are electric buses



Same electric drivetrain as battery electric buses

Battery-fuel cell hybrid configuration

Most OEMs offer common platform for their zero-emission buses



Fuel cells enhance the performance of electric buses



>450 kms

Proven range



Significant reduction in vehicle weight
(carry more passengers)

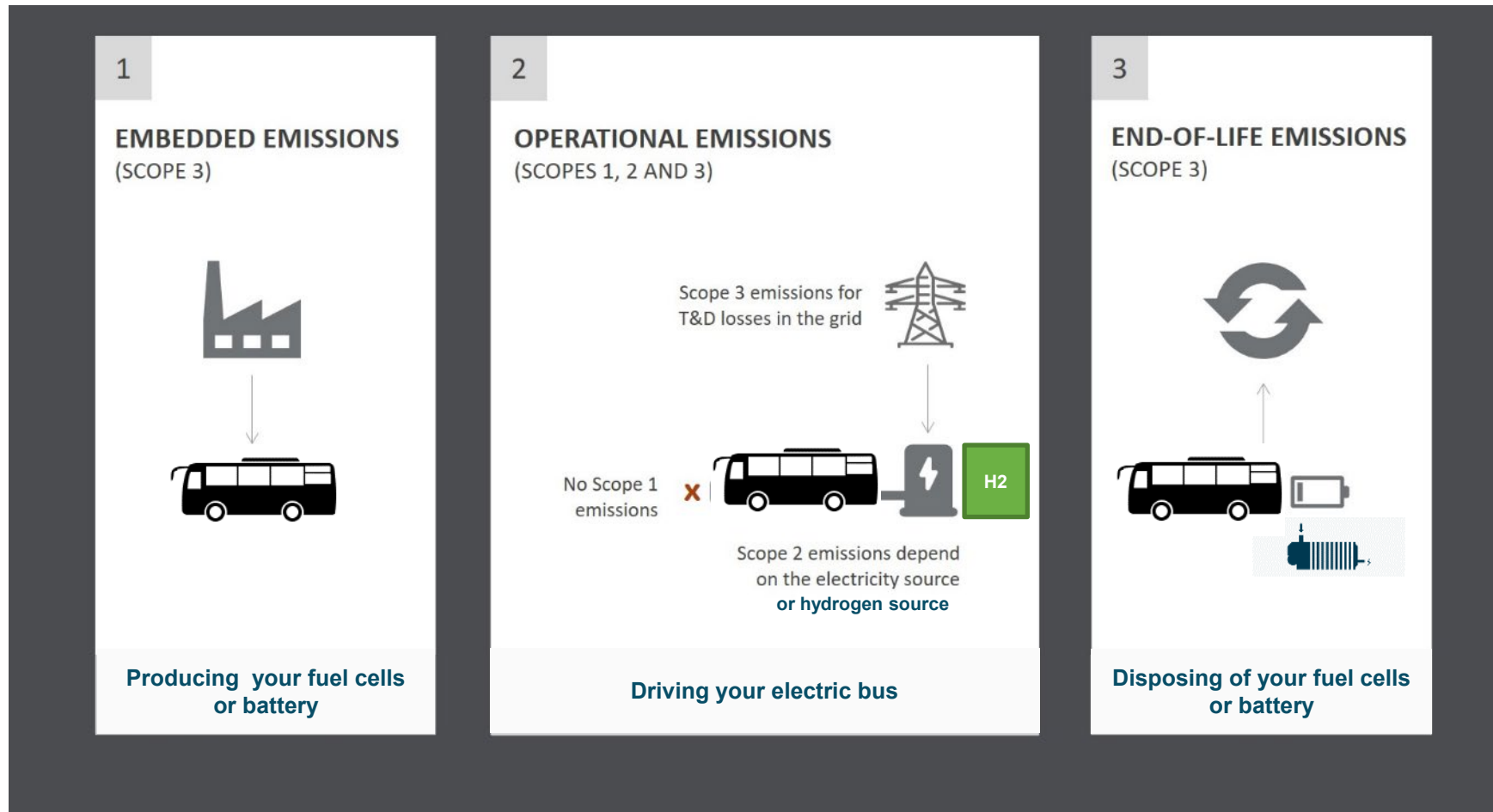


Rapid refueling speeds
(6 to 10 minutes)

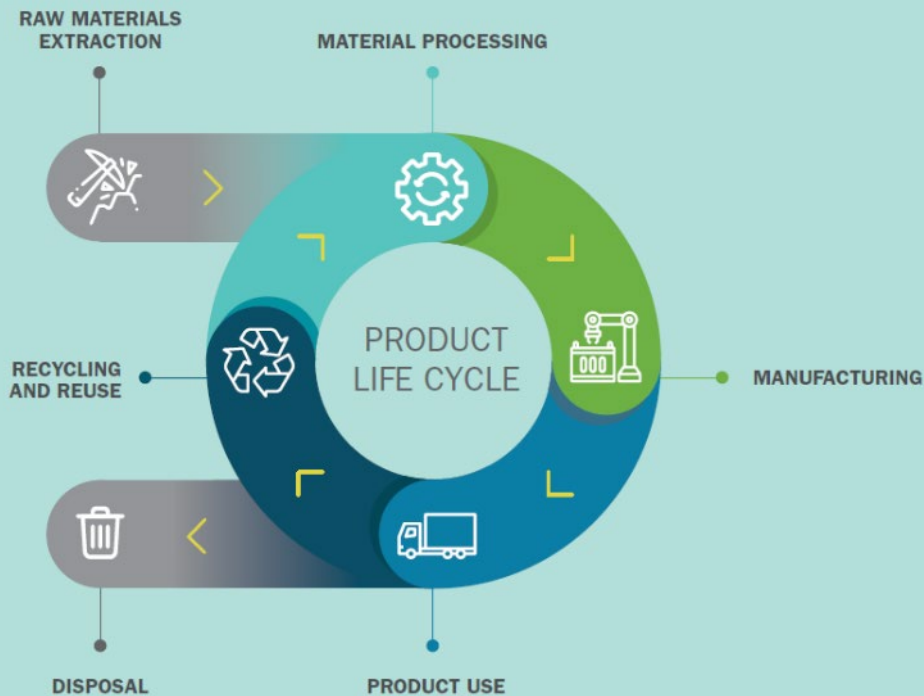


1:1 replacement of conventional vehicles

Carbon footprint of electric buses



Refurbishing fuel cell stacks has a major impact on reducing the overall GHG profile in a full “cradle to grave” assessment



TECHNICAL NOTE

RECYCLING PEM FUEL CELLS

END-OF-LIFE MANAGEMENT

FUEL CELL RECYCLING & PLATINUM RECOVERY

Proton exchange membrane (PEM) fuel cell technology generates clean electricity from hydrogen to power a range of applications, both stationary and mobile – while emitting nothing but water. Fuel cells are an environmentally friendly alternative to polluting internal combustion engines and batteries containing toxic materials, such as lead acid. PEM fuel cells contain no poisonous or hazardous materials that may impact the environment upon disposal.

With many years of fuel cell manufacturing experience, Ballard Power Systems, Inc. has developed industry leading processes designed to minimize the energy intensity and environmental impact of product production. At the end of a product's useful life, processes ensure the efficient recovery of highly valuable precious metals and minimize waste entering the landfill.

MANUFACTURING PROCESS

Ballard's production facilities are continuously monitored and optimized in all aspects of energy consumption and environmental emissions.

Our products are designed to meet very strict environmental requirements, restricting the use of certain hazardous substances in electrical and electronic equipment.

Ballard Power Systems
 We have offices around the world, near our customers and close to you.
 Reach out to us at marketing@ballard.com

www.ballard.com
 Power to Change the World™

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At Ballard we:

- Refurbish fuel cell stacks at the end of life (>25,000hrs)
- Re-use graphite bipolar plates
- Reclaim 95% of the platinum

Comparing GHG impact of a fuel cell systems with batteries in a typical transit bus

GHG Emissions Required to Produce Fuel Cell and Battery System for a Transit Bus

Based on average of 150kg of CO₂e per kWh for batteries⁽²⁾ and 70kg of CO₂ per kW for FC system

13.5 tons of CO₂ GHG emissions to produce 50kWh battery with 85kW Fuel Cell system



52.2 tonnes of CO₂ GHG emissions to produce a 350kWh battery



In summary: there are 75% less emissions generated in the production of a fuel cell power train.

Buses

Truck

Rail

Marine





BALLARD™

Here for life™

Thank you

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