



Powering Public Transport with Hydrogen Fuel Cells

Reaching Cost Parity with Diesel

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Ballard Power Systems Europe
Transport Decarbonisation Show Floor Theatre
10th May 2023

Ballard by Numbers

44

YEARS



>1,100

employees



1,400

patents &
applications



publicly listed company



2030

commitment to
carbon neutrality



>1,400

transit buses



>2,300

trucks



7 TRAIN

projects



8 SHIPS

in development



8 MW

of stationary
power projects



1 GW

fuel cell products
delivered*



>5.3 MILLION

MEAs
produced*



>150 MILLION

kilometers in
operation*



1.6 GW

production capacity

4

PRODUCTION

SITES
global footprint

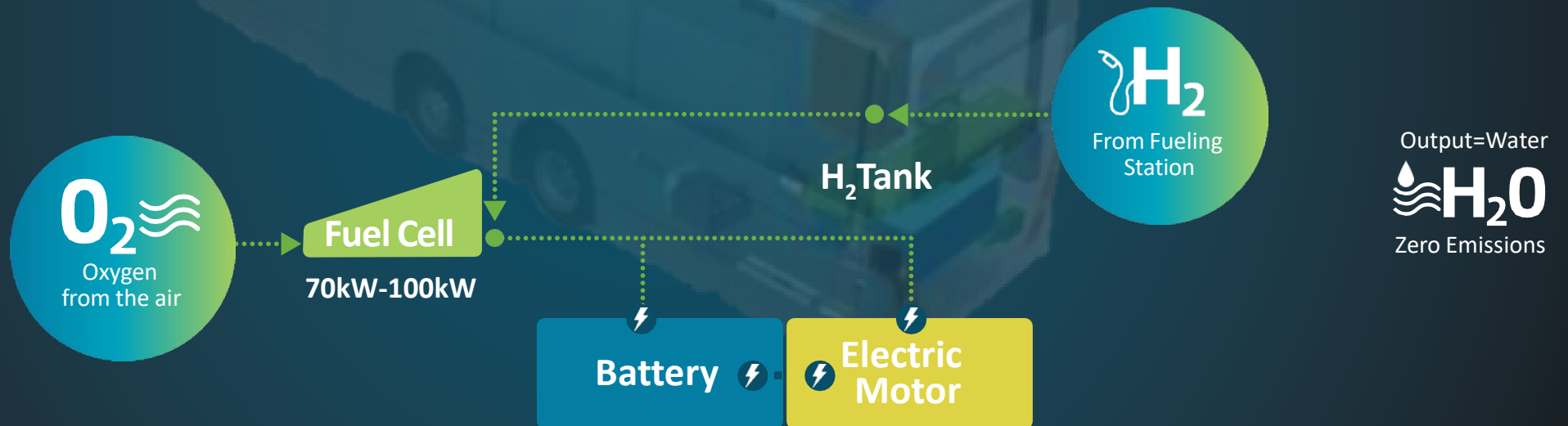
**compiled from 2015*

The future of transit will be electric

- An electric powertrain is the efficient, quiet, zero-emission energy alternative to polluting diesel engines
- Electricity for the electric drive can be supplied from batteries or from an on-board fuel cell power generator or a combination of both – a hybrid architecture



A hydrogen bus is
an electric bus



A hydrogen bus is
an electric bus



Zero emissions

High efficiency

Electric Drive

Low Noise

Low initial infrastructure costs

Lower-cost maintenance

Higher powertrain efficiency



Low infrastructure
costs at scale

Fast refueling

Passenger capacity

Long range

Extreme weather
tolerance

Fuel cell electric buses using renewable hydrogen are the most viable, true zero-emission option



Power to maintain speed on most demanding routes



Extended range for route and service flexibility



High energy density to maximize vehicle performance

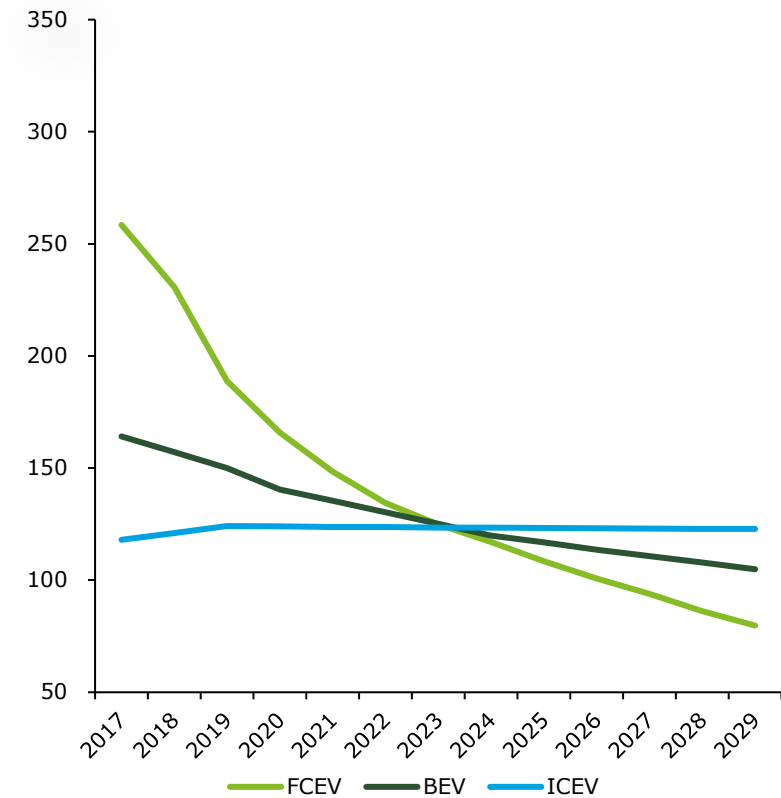


Rapid refueling ensures high utilization with scalable infrastructure

Viability of Fuel Cell Electric Buses



Bus TCO Outlook in Europe (unit: USD/per 100 km)



Source: Deloitte-Ballard white paper "Fueling the Future of Mobility: Hydrogen and fuel cell solutions for transportation", January 2020

Maintenance, Repair and Sustainability



Safety

Hydrogen, high voltage, high pressure



Workshop

Alarm, venting, tools, PPE



Maintenance

Preventative, breakdown, accident



Sustainability

Recycling

Safety - Keep it simple

- Hydrogen
- High Pressure
- High Voltage



Workshop

Nov. 19, 2020

How to Adapt Your Bus Depot to Refuel and Service Hydrogen Fuel Cell Buses

As community leaders and transit operators plan the transition to zero-emission bus fleets, the question arises: "How can we adapt our existing bus depots to fuel and...

[More >>](#)



Adapting Bus Depots for Refueling and Servicing Your Hydrogen Fuel Cell Buses

Fuel Cell
Electric Buses

Adapting Maintenance Facilities for Hydrogen
November 2020

www.ballard.com

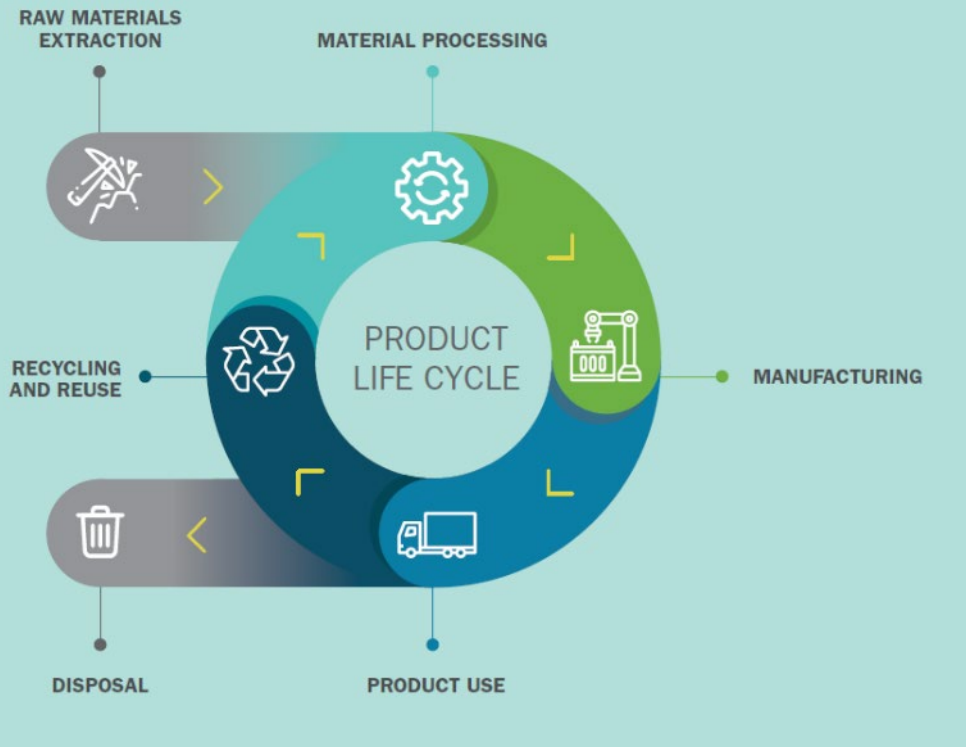
Workshop & Maintenance

Including Technicians



Zero emission transit should also be sustainable

Fuel cells have a lower impact on the environment



At Ballard we:

- Design our product to minimize carbon footprint
- Refurbish fuel cell stacks at the end of life
- Re-use graphite bipolar plates
- Reclaim 95% of the platinum
- We are committed to be carbon neutral by 2030

Hydrogen is most competitive in heavy duty motive applications

Our focus is on applications where hydrogen fuel cells have a clear advantage



Buses & Coaches



Trucks



Trains



Vessels

Fuel cell technology is needed to decarbonize the heavy duty transportation sector



BALLARD™

Here for life™

Thank you

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