

The Ballard logo is displayed in white, bold, sans-serif capital letters within a blue rectangular box in the top-left corner of the slide. The background of the slide is a scenic landscape featuring a large body of water, forested hills, and a road with a bus in the foreground.

**BALLARD™**

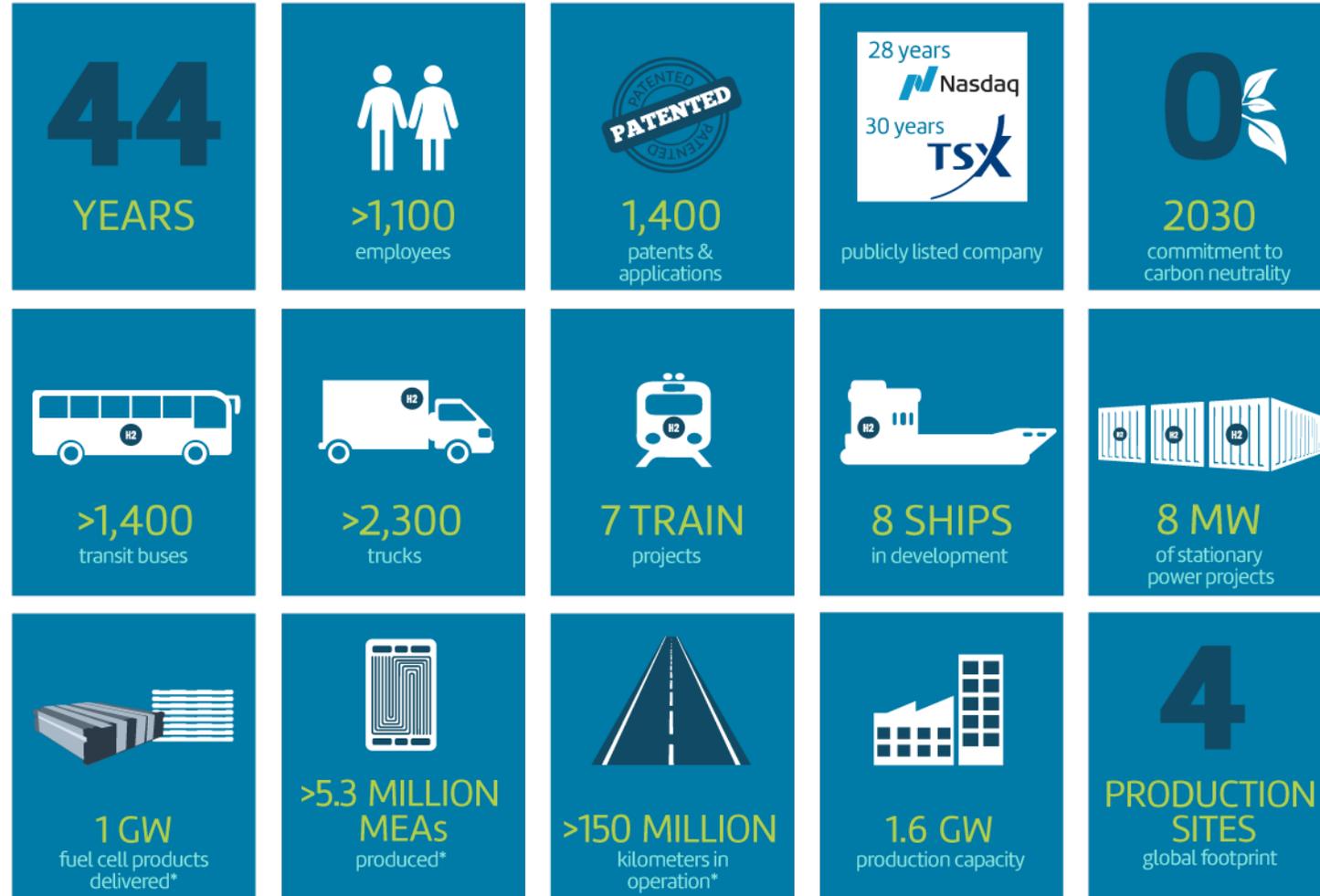
# Powering Public Transport with Hydrogen Fuel Cells

Reaching Cost Parity with Diesel

**David Yorke**

Ballard Power Systems Europe  
Transport Decarbonisation Show Floor Theatre  
10<sup>th</sup> May 2023

# Ballard by Numbers



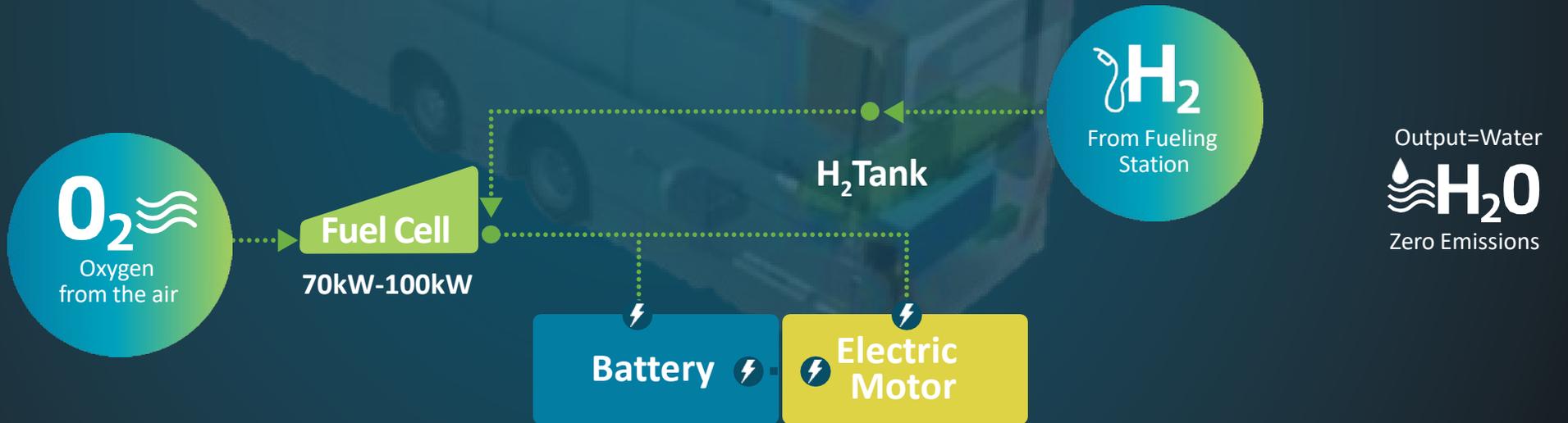
\*compiled from 2015

## 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

**BALLARD™**

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**

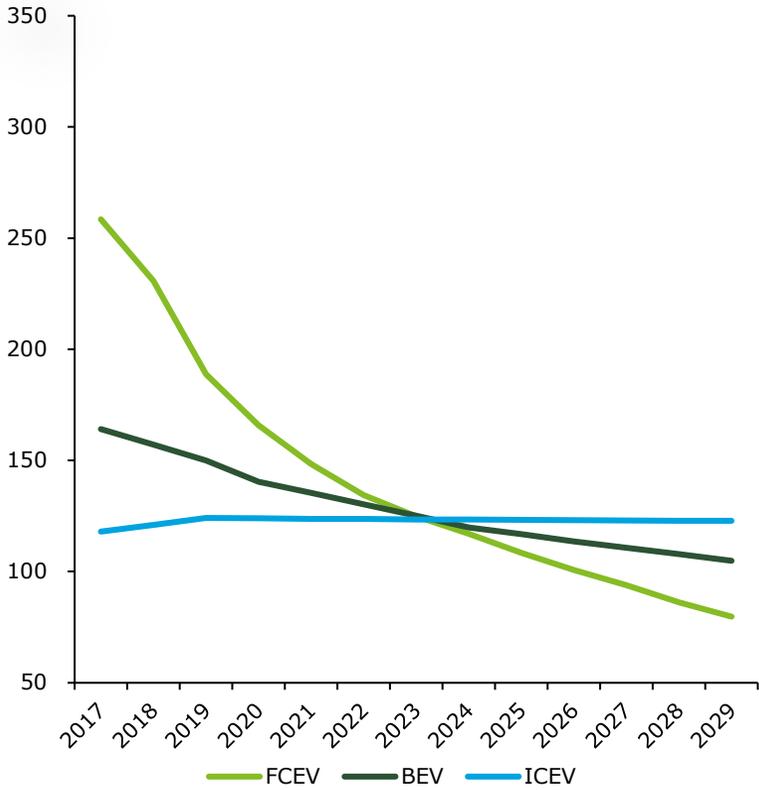


**Rapid refueling ensures high utilization with scalable infrastructure**

# 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





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 >>](#)



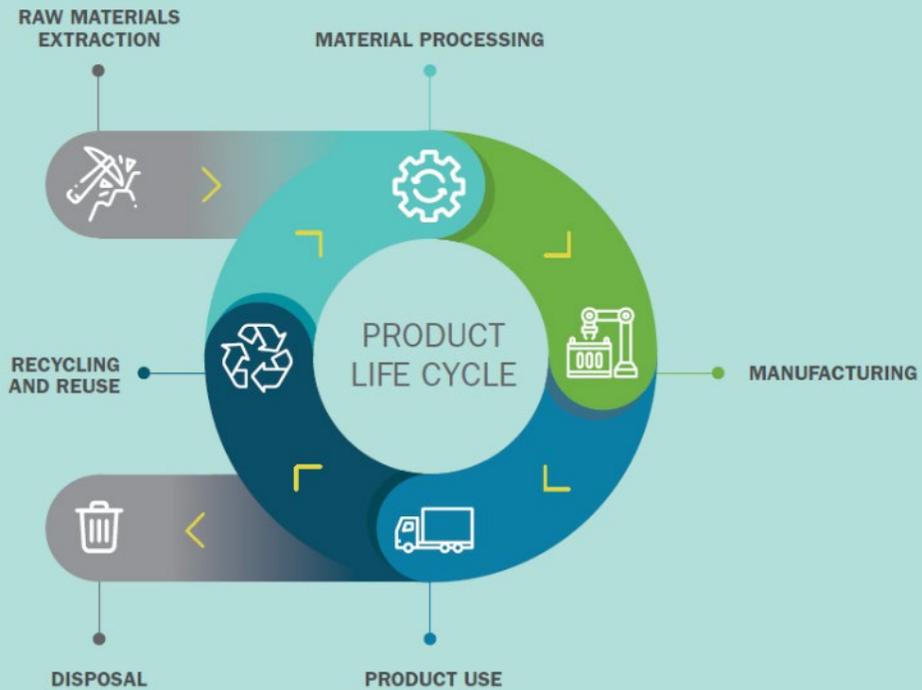
## Workshop & Maintenance

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

**David Yorke**

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