



Fuel Cell Off- Road Equipment and Vehicles

Sept. 23 2021

Ryan Sookhoo

DIFFERENTIATED HYDROGEN PRODUCTS

Hydrogen Production - Electrolyzers



- On-site & on-demand generation
- PEM & alkaline technologies
- Leading system lifecycle efficiency

Hydrogen Transport and Storage Tanks



- Recent JV confirmed with world leader in Hydrogen storage
- Most advanced cost fiber design leading to lower material costs

Hydrogen Dispensing



- Easy integration w/ on-site generation solutions
- 60 stations deployed

PEM Fuel Cell Stack & Modules



- Non-humidified, low-pressure stack enables low cost, high reliability, and long-life modules
- Integrated BOP

Solid Oxide Fuel Cells



- Thermal spray manufacturing process enables industry leading size and thus more reliable and lower total cost of ownership systems

Train

Cummins is the largest provider of fuel cells for rail applications in the world.

Semi Truck

Four Scania electric trucks with Cummins fuel cells distribute groceries to stores as part of ASKO's fleet in Norway.

Transit Bus

Commuters in North America and China rely on Cummins-powered battery and fuel cell electric buses to get them to work, school and home.

Hydrogen Fueling Station

Cummins delivered electrolyzers for more than 50 hydrogen fueling stations.

Refuse Truck

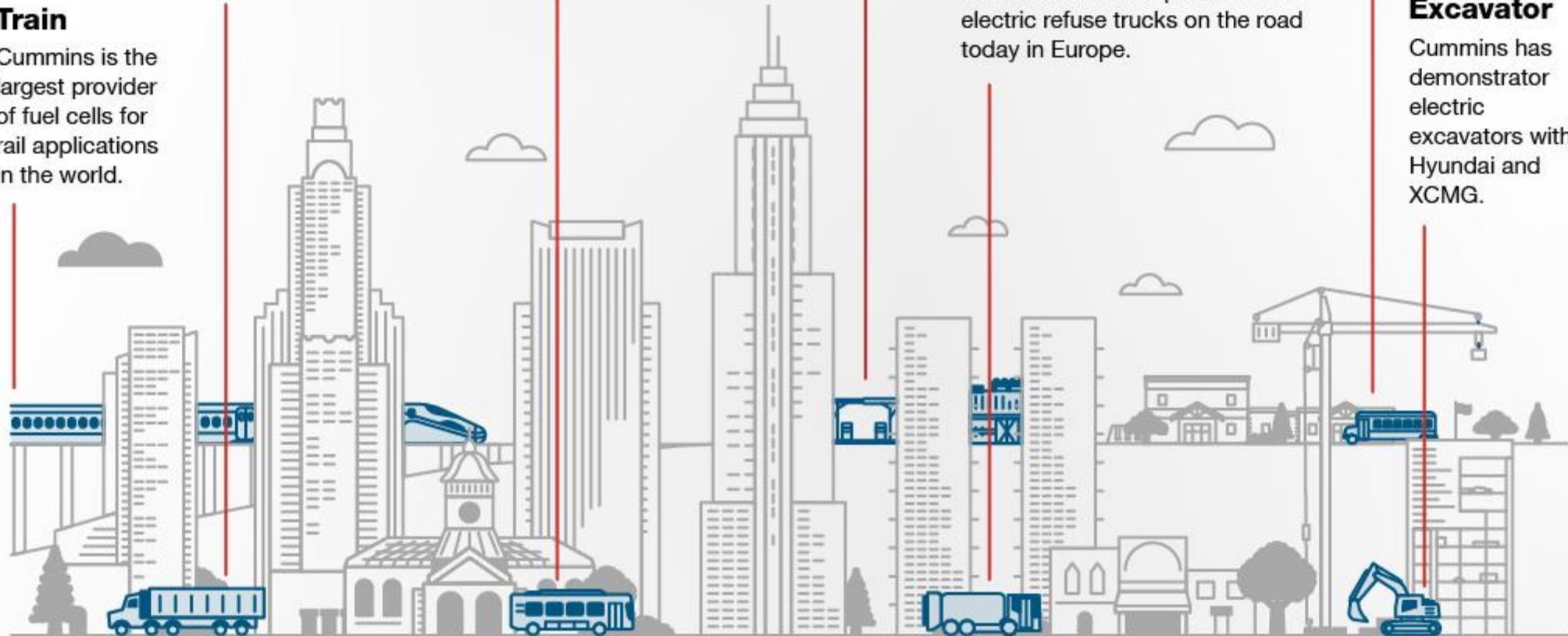
Cummins fuel cells power FAUN electric refuse trucks on the road today in Europe.

School Bus

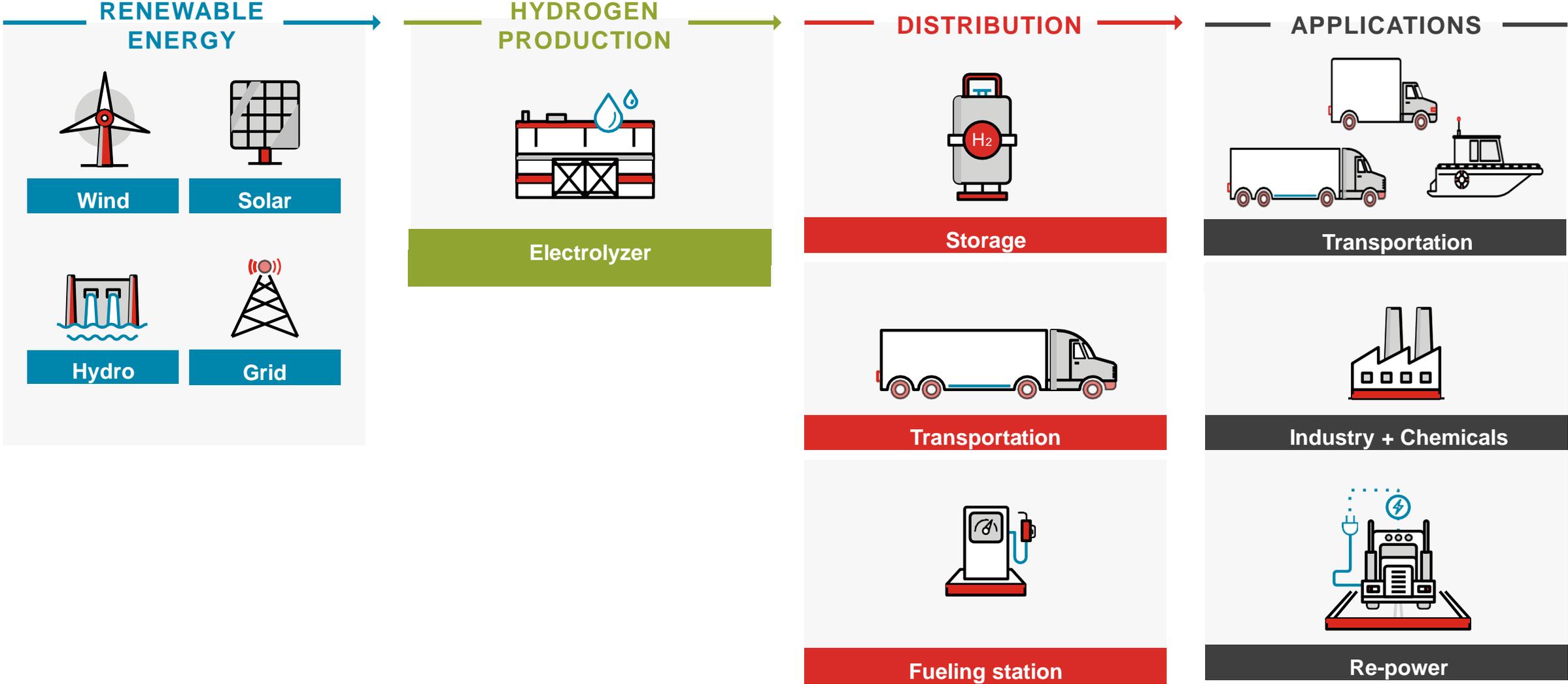
There are more than 100 Cummins-powered Blue Bird school buses in operation today.

Excavator

Cummins has demonstrator electric excavators with Hyundai and XCMG.

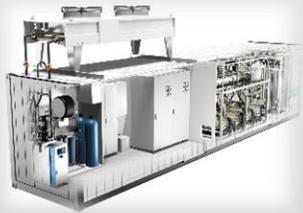


THE GREEN HYDROGEN ECONOMY



ELECTROLYZER PRODUCT SUITE

S



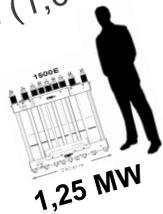
HySTAT®-100
Alkaline (0,1-0,5 MW)

1 MW

M



HyLYZER®-500
PEM (1,0-2,5 MW)



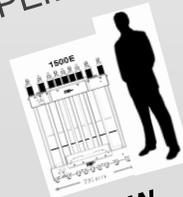
1,25 MW

10 MW

L



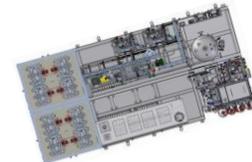
HyLYZER®-1000
PEM (5 MW)



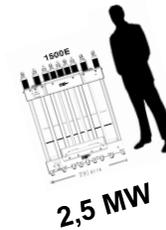
2,5 MW

100 MW

XL



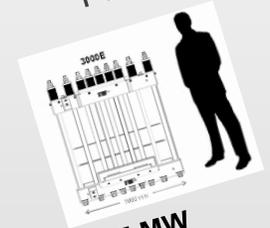
HyLYZER®-4000
PEM (20 MW)



2,5 MW

400 MW

XXL



HyLYZER®-XXL
PEM

5 MW

1 GW

Project size

Commercially available today

Under development

ONSITE FUELING SOLUTION



First Public Fueling Station in Quebec

Onsite Generation, Compression, Storage and Dispensing

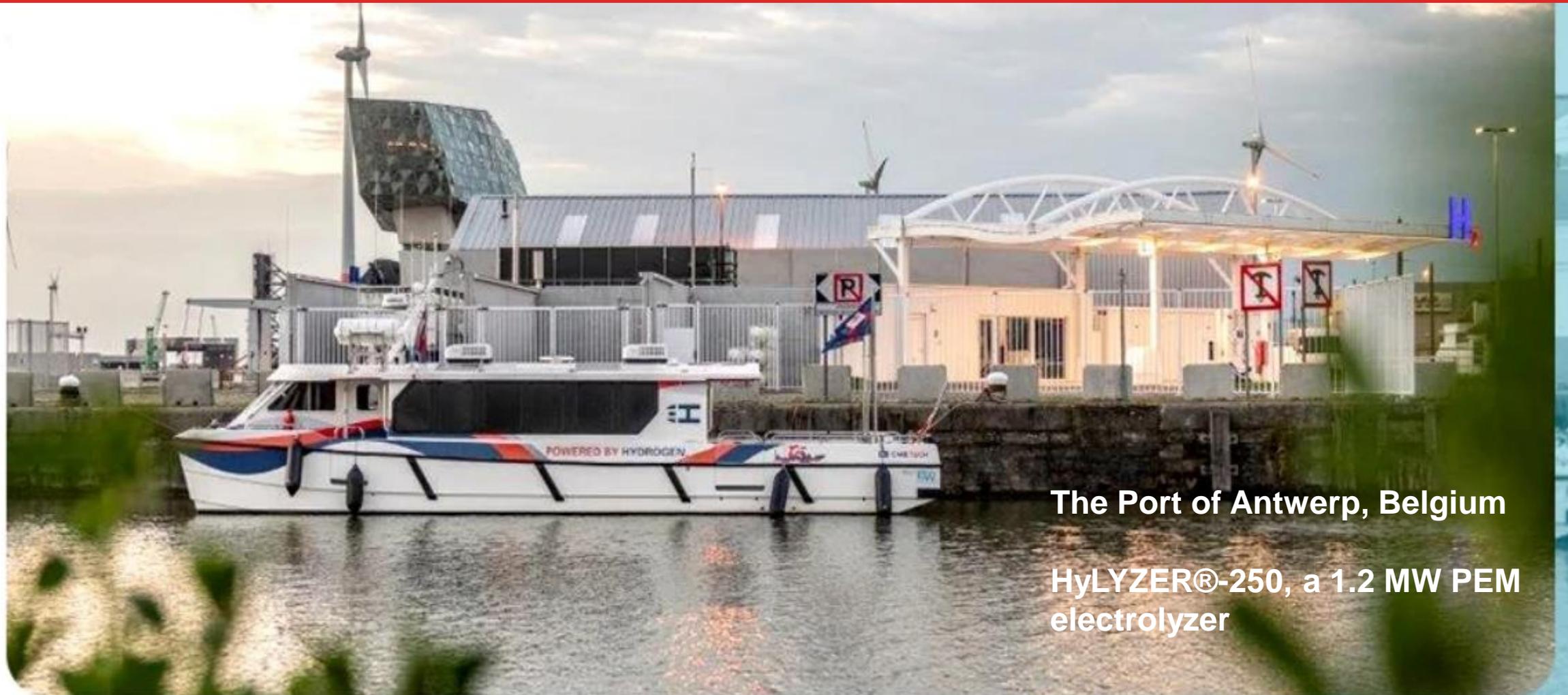
HYDROGEN HUB



Air Liquide - Bécancour, Quebec

4 x HyLYZER® 1000-30 – indoor – 20 MW – 8,000 kg/day

WORLD'S FIRST HYDROGEN REFUELING STATION CAPABLE OF SUPPLYING GREEN HYDROGEN DIRECTLY TO SHIPS, CARS, TRUCKS AND INDUSTRIAL CUSTOMERS



The Port of Antwerp, Belgium

HyLYZER®-250, a 1.2 MW PEM electrolyzer

CAPACITY EXPANSION

Capacity expansion is critical to ensure the success of meeting market demand

1. A new facility in Spain
 - 500+ MW electrolyzer manufacturing plant in Castilla-La Mancha, Spain, opening in 2023.
 - Will support the development of a 230-MW green hydrogen project for fertilizer producer Fertiberia
2. Expansion of Mississauga facility (Canada)
 - Electrolyzers and fuel cell modules
2. New facility in Herten (Germany)
 - Initial focus on the assembly of fuel cell systems for global transportation leader Alstom's hydrogen trains.
3. Expansion of Belgium facility



FUEL CELL MARKETS

FUEL CELLS



Transit buses **Railway** **Municipal vehicles** **Commercial vehicles**



Marine **Mining** **Construction** **Fire & Emergency** **Defense** **Agriculture**

Zero Emission Commuter Rail

Cummins selected by
Alstom Transport to supply
200 Commuter Train Fuel
Cell Compositions



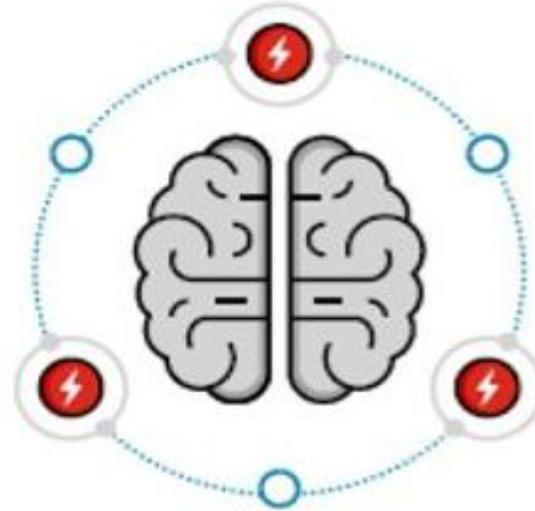
Alstom Coradia iLint – World's first hydrogen powered passenger train

ALWAYS ON AND ALWAYS IMPROVING

CONTINUED FUEL CELL SYSTEM REFINEMENT

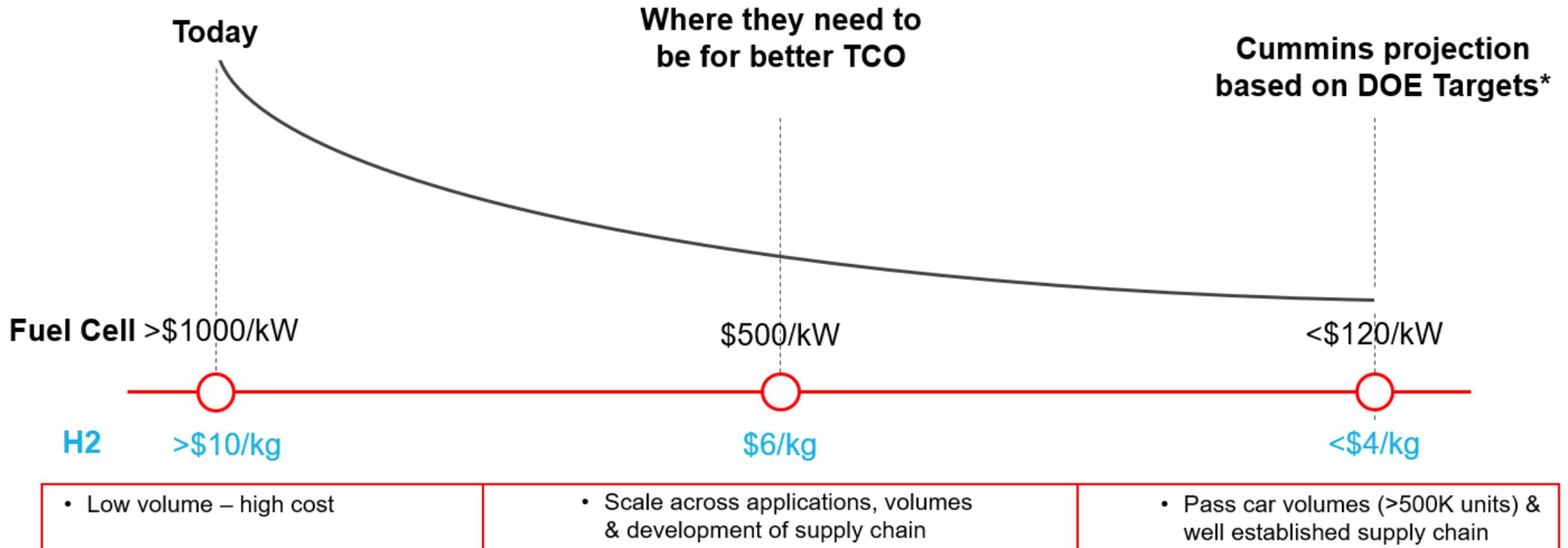


**Total cost
of ownership**

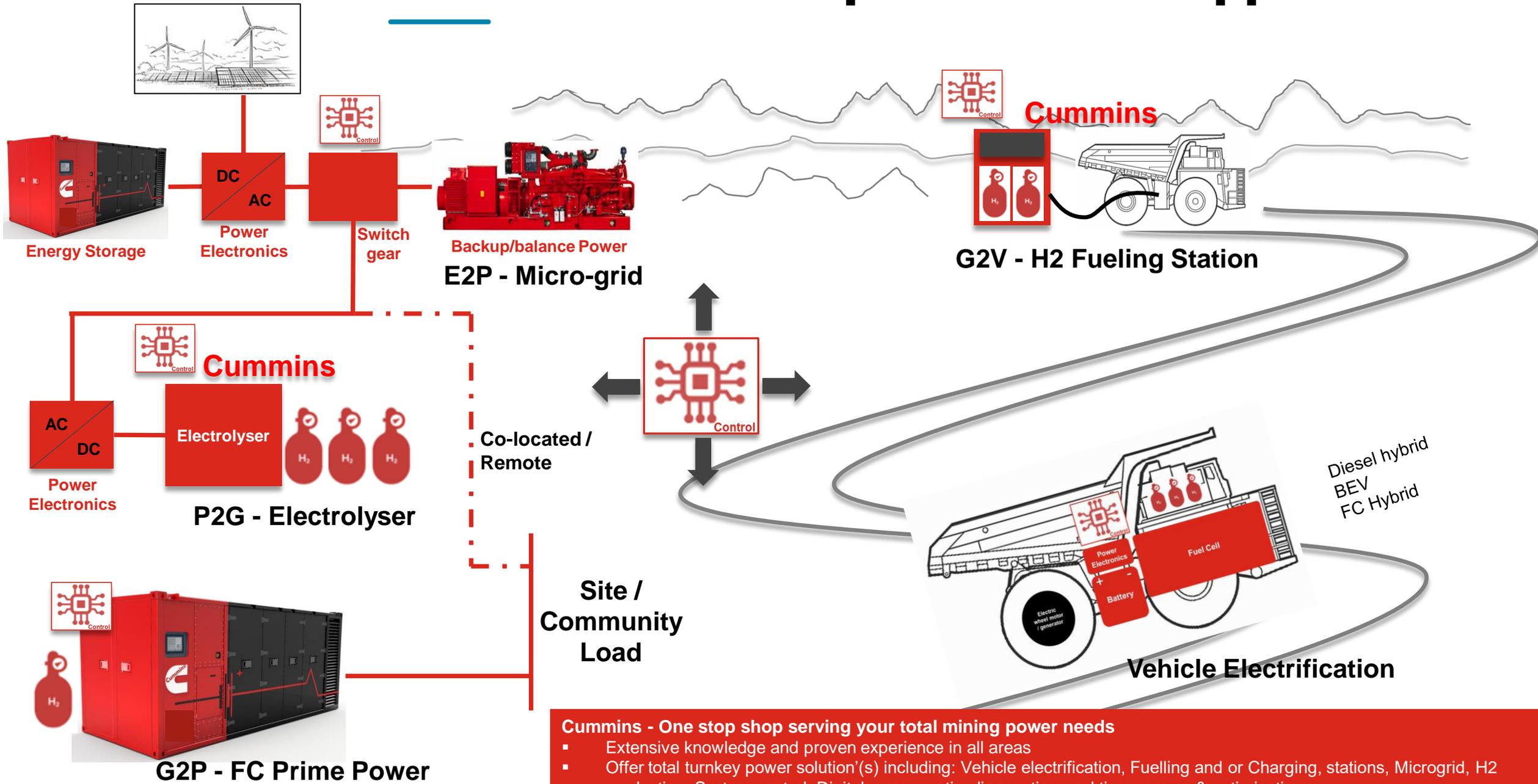


**Technical
readiness**

FUEL CELL & HYDROGEN PRICE TRENDS



Cummins Road Map - Off Road Applications



Cummins - One stop shop serving your total mining power needs

- Extensive knowledge and proven experience in all areas
- Offer total turnkey power solution' (s) including: Vehicle electrification, Fuelling and or Charging, stations, Microgrid, H₂ production, System control, Digital – prognostic, diagnostics, real time comms & optimisation

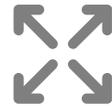
THE CUMMINS DIFFERENCE



ONE CENTURY
OF POWERTRAIN
INNOVATION



POWERTRAIN
OF
CHOICE



CAPABILITIES
ACROSS
APPLICATIONS



ABILITY TO
ACHIEVE
SCALE



SECURITY
OF
SUPPLY



GLOBAL
FOOTPRINT FOR
SUPPORT



Find out more on our new website

Cummins.com/hydrogen

