HYDROGEN POWERING THE RAILWAY SECTOR:

ALTERNATIVE DRIVES FOR THE FUTURE

As the world changes, so does the fight against global warming, climate change and resource shortage.

These challenges increase the need to reduce energy consumption and emissions and to provide sustainable solutions in nearly all industry sectors – particularly in transportation. This drives stakeholders in the rail industry to explore alternative solutions for the future.

With the latest developments in alternative drives, such as traction battery and hydrogen technologies, operators and governments around the world are increasingly leaning towards hybrid train solutions.

By 2030, the global hybrid train market size is projected to grow by a CAGR* of 5.5 %. In comparison to traditional catenary-independent drives, hybrid train solutions are more environmentally friendly as they reduce greenhouse gas emissions, other air contaminants and noise. In the long-term, they are also more efficient and potentially more cost-effective.

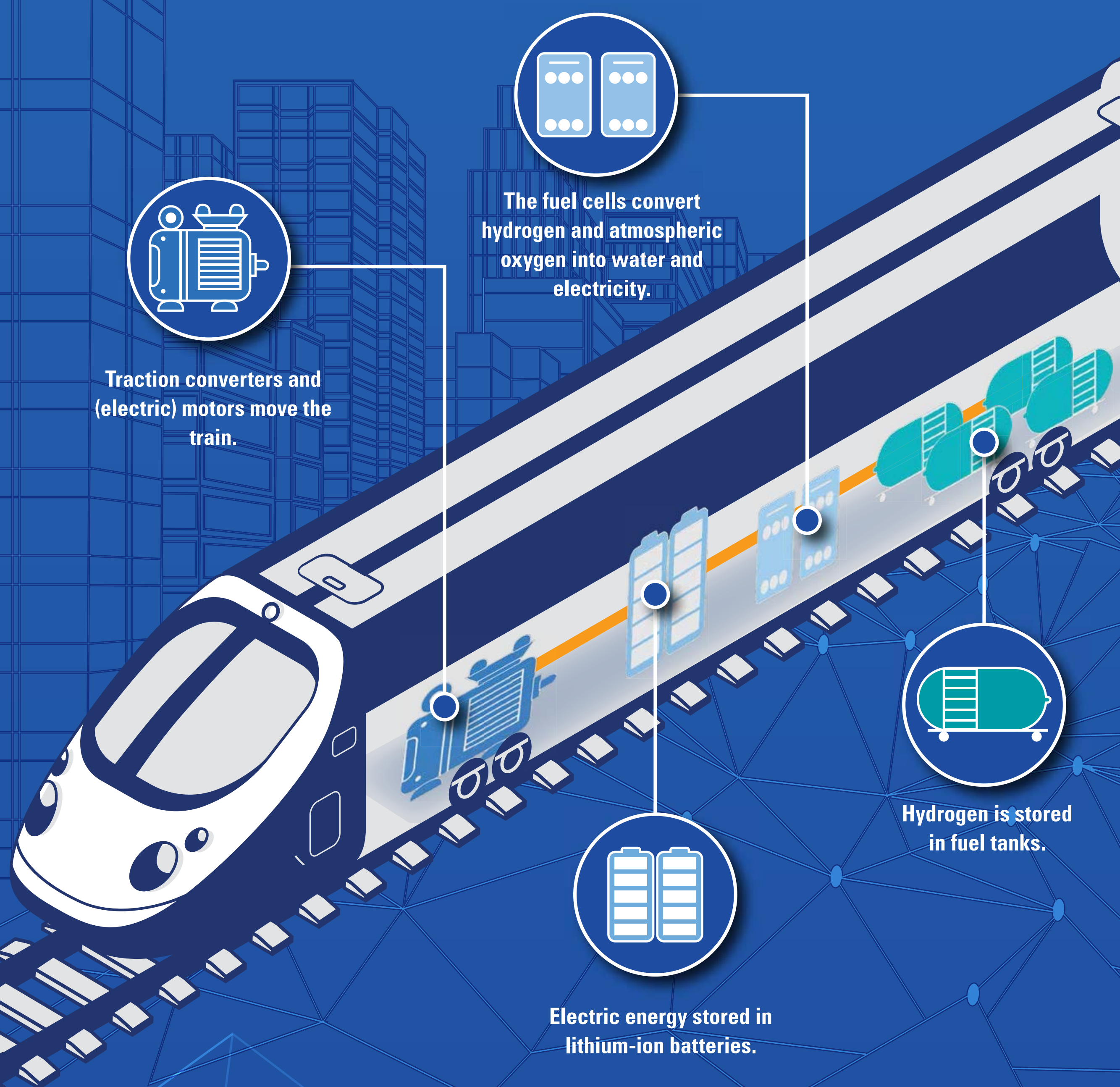
FACTS & FIGURES

- The global hybrid train market size is projected to grow from 4 904 units in 2020 to 8 389 units by 2030, at a CAGR* of 5.5 %.
- Hydrogen technologies could provide 20 % of the world's CO_2 abatement needs by 2050.
- 66 countries announced net-zero emissions as a target by 2050.
- Fuel cell and hydrogen-powered multiple units could replace 30 percent of diesel volumes by 2030.

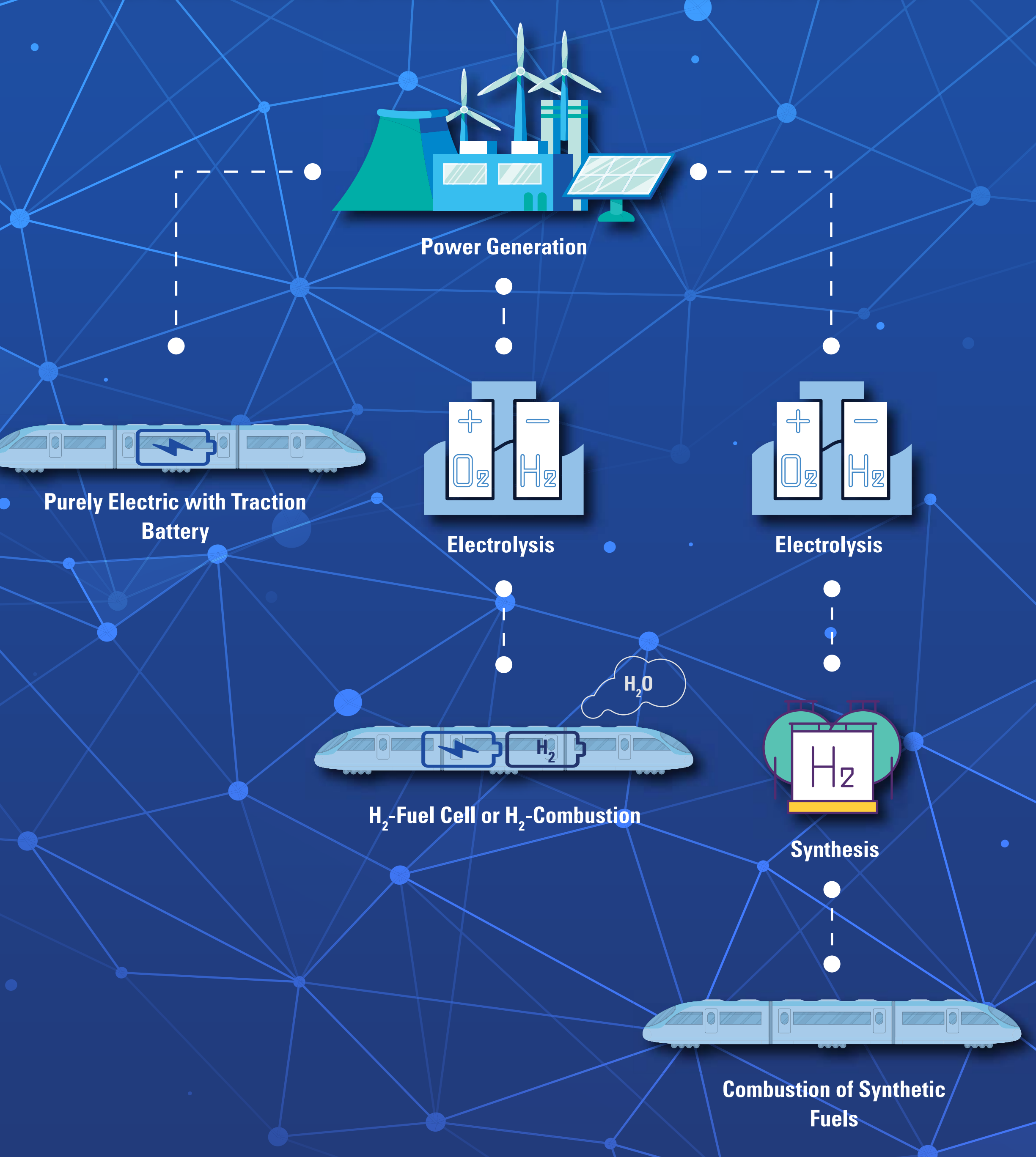
* CAGR = compound annual growth rate

HOW DO HYDROGEN TRAINS WORK?

Hydrail uses a hybrid configuration of hydrogen fuel cells or combustion engines, high voltage batteries and electric traction motors. The process begins when fuel cells convert the fuel source, hydrogen, into electricity, which then powers batteries to provide a stable power source for the traction motors. The train's braking process is used for brake energy recovery (recuperation) by converting kinetic energy into electricity, which is temporarily stored in batteries and thus further contributes to fuel efficiency.



BASIC CONCEPTS FOR PROVIDING ENERGY TO ALTERNATIVE DRIVES IN THE RAIL INDUSTRY

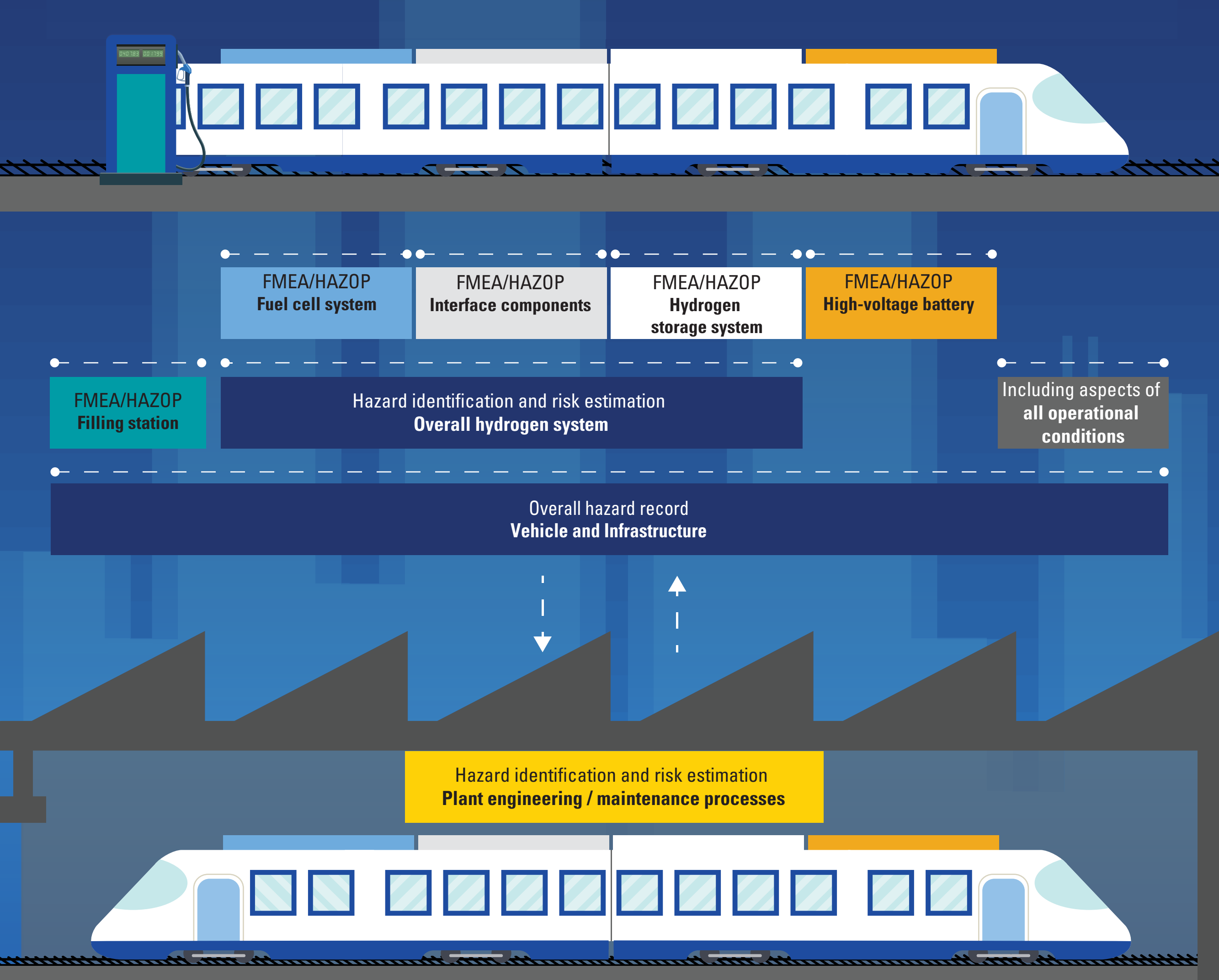


COMPONENTS REQUIRED FOR THE VARIOUS ALTERNATIVE DRIVE CONCEPTS

	Battery		Hydrail**		
Components	BEMU Battery-Electric-Multiple-Unit	BDEMU Battery-Diesel-Electric--Multiple-Unit (Diesel-Hybrid	HEMU Hydrogen-Electric--Multiple-Unit	HCMU Hydrogen-Combustion-Multiple-Unit (H_2 engine with gearbox and purely mechanical drive)	HCEMU Hydrogen-Combustion-Electric-Multiple-Unit (H_2 engine with generator and e-drive)
High-Voltage Battery	✓	✓	✓		✓
Hydrogen Storage System			✓	✓	✓
Fuel Cell System			✓		
Hydrogen Combustion Engine / Power Pack				✓	✓
Cooling System for Battery, Fuel Cell and/or Engine	✓	✓	✓	✓	✓
Separate Power Converter	✓	✓	✓		✓

** Hydrail is a neologism, representing the combination of the words "hydrogen" and "railway".

HAZARD ANALYSIS AND RISK ESTIMATION ARE KEY TO BRING HYDROGEN TRAINS TO THE RAILS



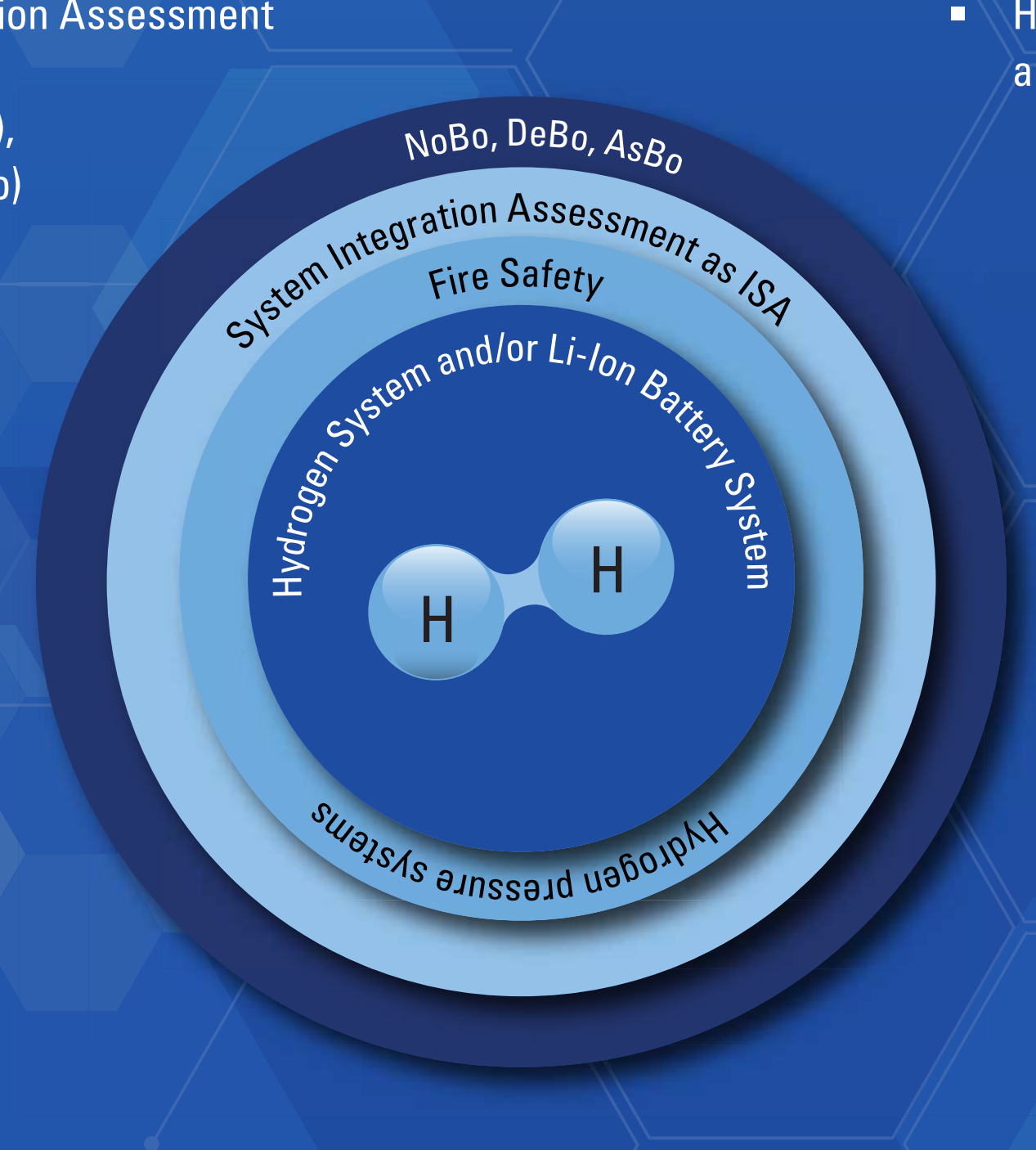
OUR RAIL HYDROGEN COMPETENCES

Rail assessment

- Rolling Stock Independent Safety Assessor (ISA)
- Review hazard analyses
- Overall/System Integration Assessment
- Notified Body (NoBo), Designated Body (DeBo), Assessment Body (AsBo)

Specific hydrogen services

- H_2-Component inspection and certification
- H_2-Infrastructure inspection and certification



Battery testing

- Battery abuse testing
- Certification

Additional services

- Training, seminars and workshops
- Moderation of risk analyses

Sources:
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