FORBLUE i-SERIES
Ionomer Dispersions

FORBLUE™ i-SERIES

Your Dreams, Our Challenge

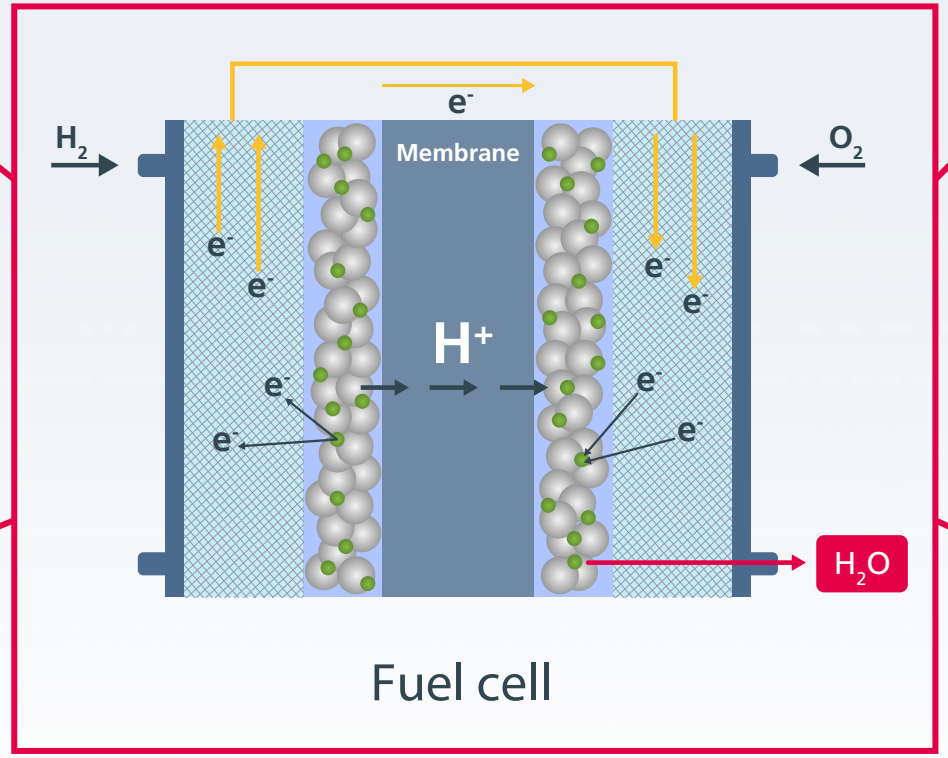
What are i-SERIES Ionomer Dispersions?

- Perfluorosulfomic acid ionomer dispersed in ethanol/water
- An ion exchange polymer in acid form
- Made from PSVE/TFE copolymer
- Contains high polymer solid
- Forms highly durable catalyst layers with less cracks
- Usable in anode or cathode electrode catalyst layers
- Ideal for high voltage fuel cell applications
- Standard and low equivalent weight grades available

Applications for Fuel Cell Technology

Vehicles

Electric Chargers



Fuel cell

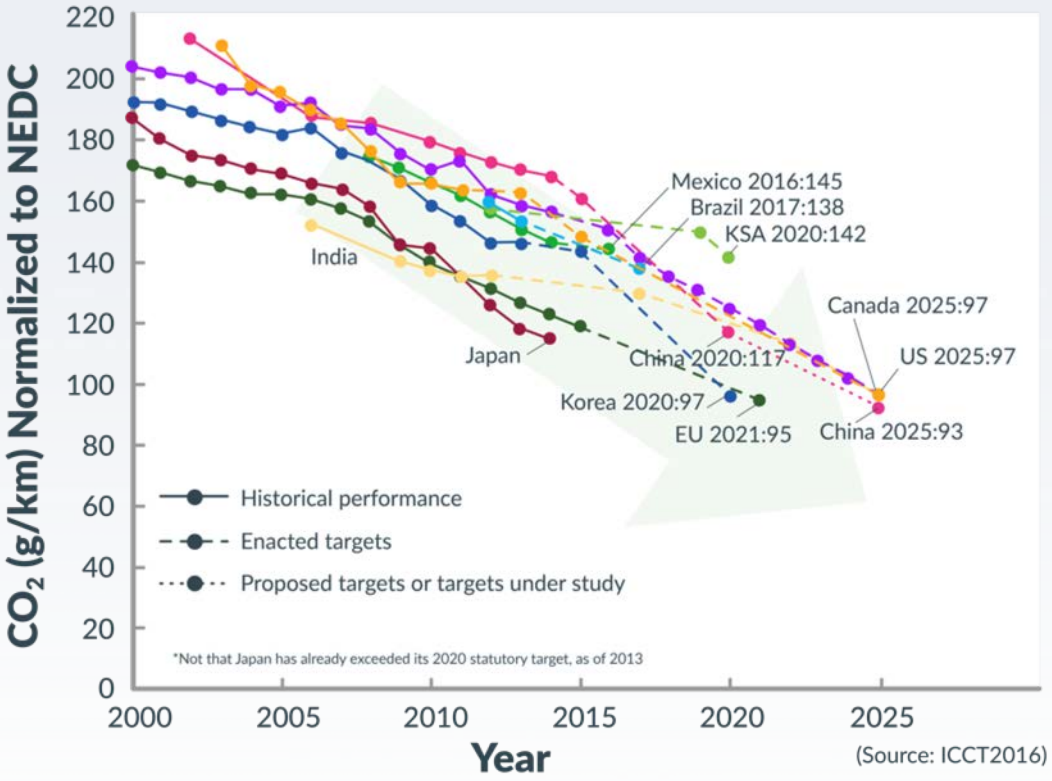
Stationary

Others

Forklift

Telecom backup power

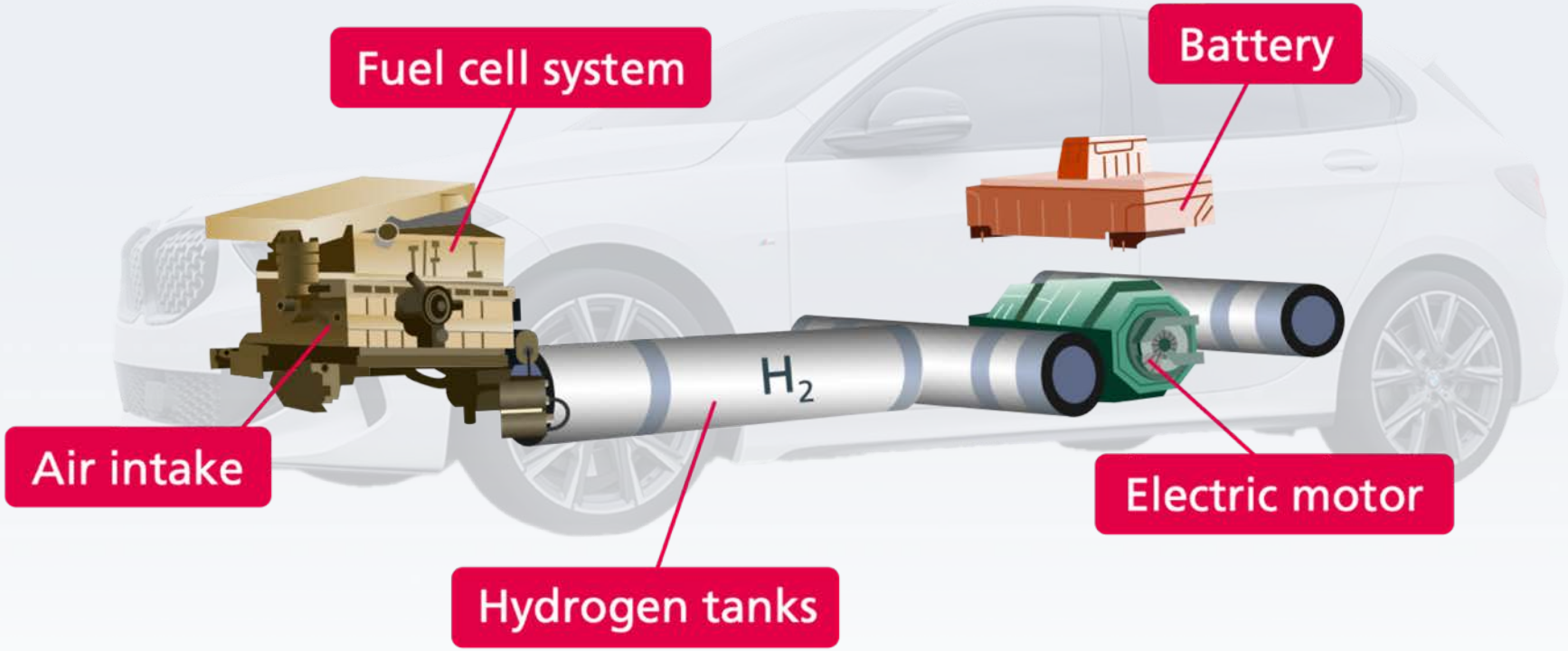
Global Trend: CO_2 Reduction Based on CAFE Standards



(Source: ICCT2016)

- Stricter CO_2 emission restrictions
- Conventional internal combustion engines can not achieve the latest regulation values
- Automotive companies pay penalties if they can not clear regulation values

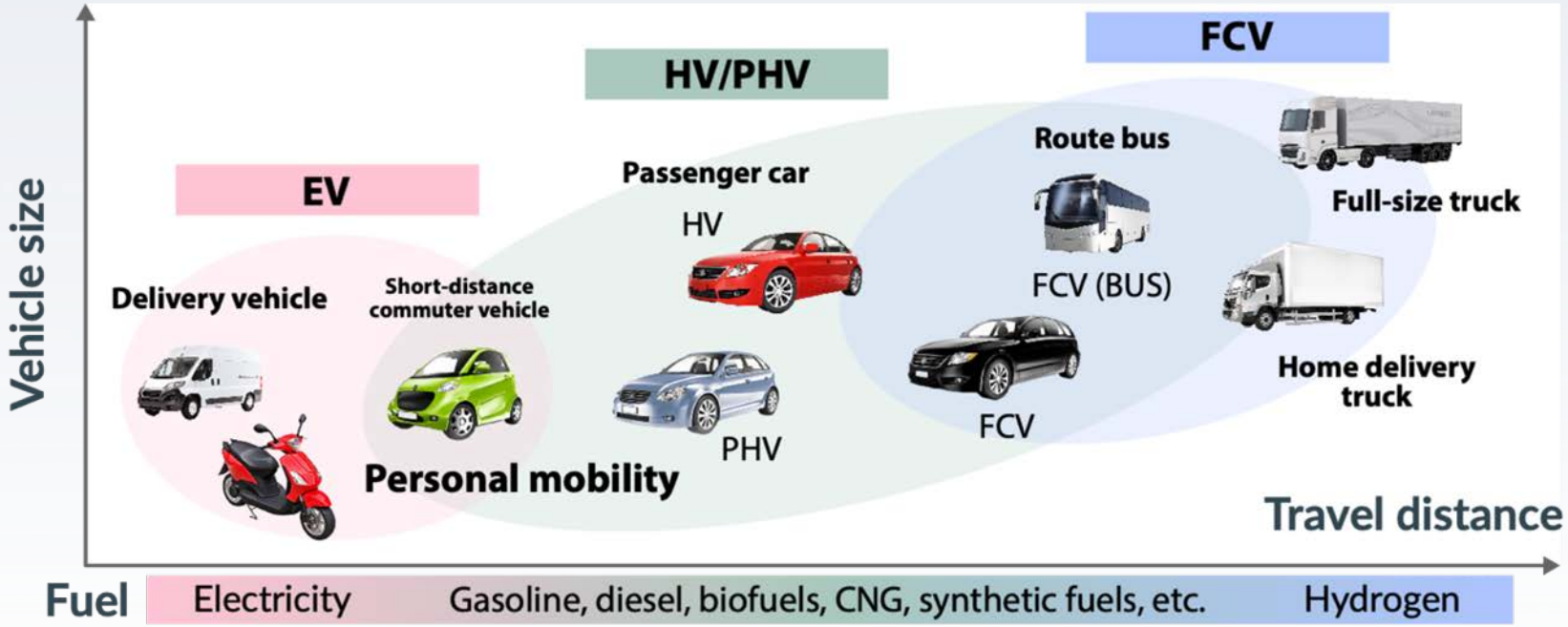
How Fuel Cells are Used in Vehicles



- The fuel cell system provides the right environment for the hydrogen to form with the oxygen to create electricity and water.
- This generates the electricity that flows to the electric motor.

Shift to Heavy Duty Vehicles

- Market is shifting to heavy duty vehicles because FCV has more benefits for bigger vehicles/longer distance
- FCEV sales forecasted to grow by 2030



EV: Short-distance, HV & PHV: Wide-use,
FCV: Medium-to-long distance

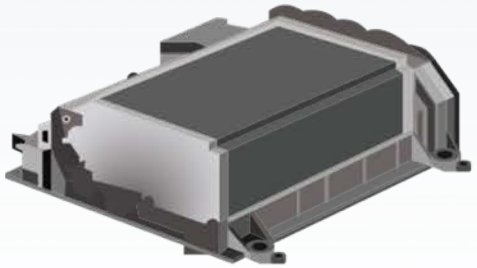
Source: Horizon Educational

Ionomers Function in Fuel Cell Products

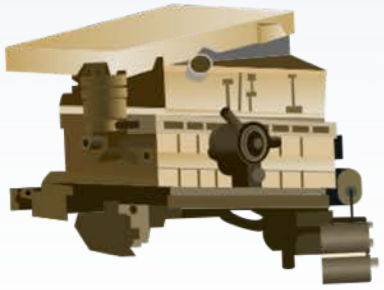
Polymer dispersions (ionomers)

Membrane/Electrode

Membrane electrode assembly



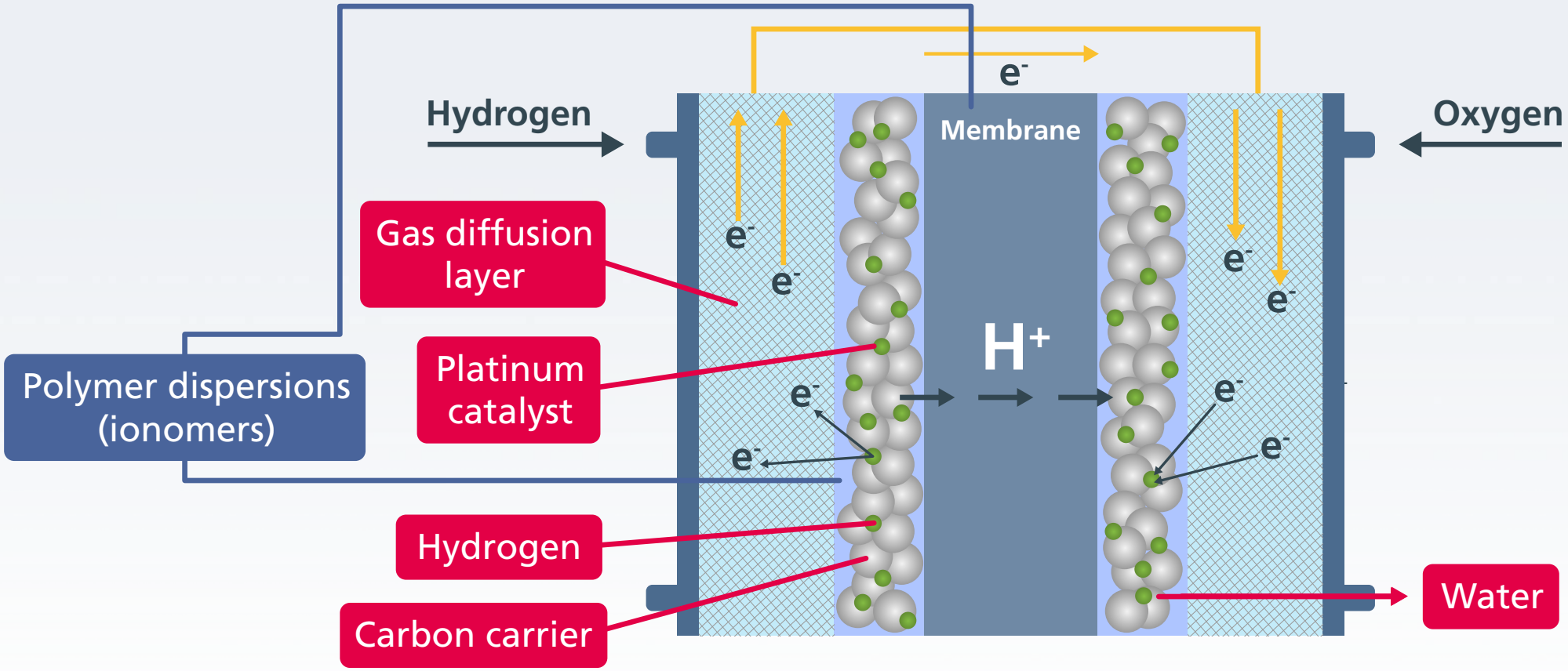
Stack



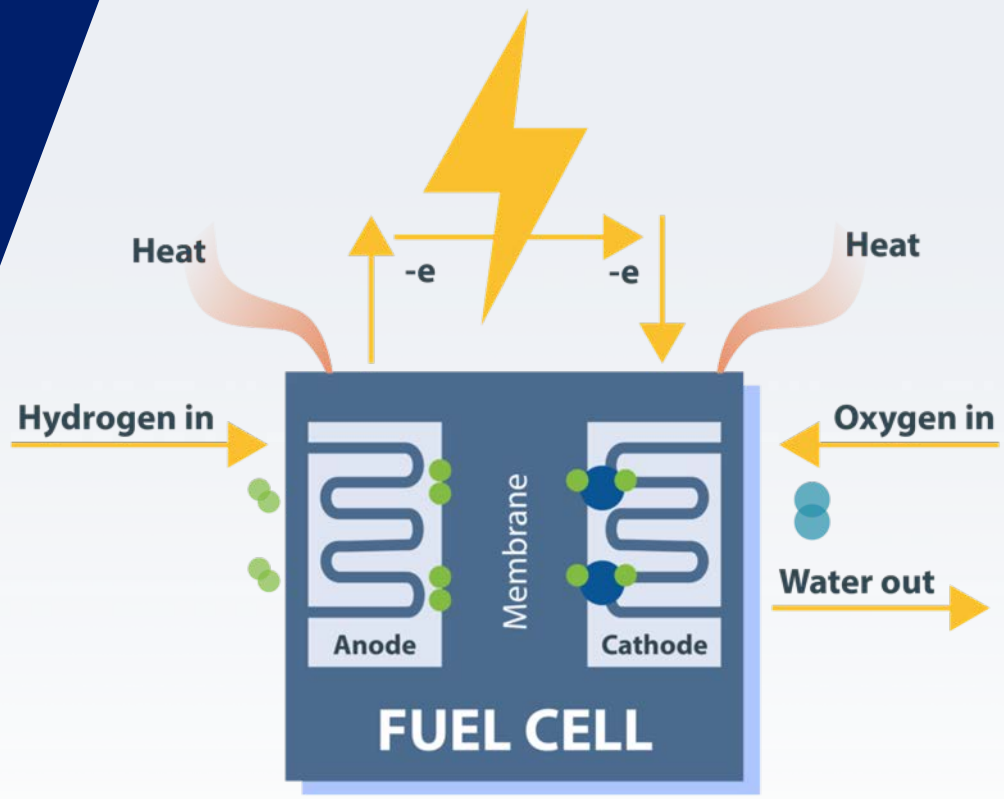
System

End Products

Ionomers in Membrane Electrode Assemblies



Proton Exchange Membrane Fuel Cell



1. Hydrogen atoms enter at the anode
2. Atoms are stripped of their electrons in the anode
3. The positively charted protons pass through the membrane to the cathode and the negatively charged electrons are forced through a circuit, generating electricity
4. After passing through circuit, electrons combine with protons and oxygen from air to generate fuel cell by-products: water and heat.

Source: FCHEA.org/fuelcells

Advantages of i-SERIES Ionomer Dispersions

- Delivers increased proton conductivity, which enables to achieve higher energy output with a smaller fuel cell stack
- Good chemical and mechanical stability, which enables robust catalyst layer after long-term operation
- Has long-side-chain sulfonic acid groups and performs comparably or better than other ionomers with short-side-chain sulfonic acid groups, even with less ion exchange capacity