



ELECTRIFICATION AND CARBON NEUTRAL TECHNOLOGIES

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TOYOTA

AGENDA

01 ELECTRIFICATION

02 CARBON NEUTRAL TECHNOLOGIES

03 CIRCULAR ECONOMY

TOYOTA IN EUROPE

SOME FIGURES

1963

Sales start in Europe

€11B+

Invested since 1990

25k+

Direct employees

€6B+

Spent with 400 European-based suppliers per year

1,080,975

Vehicles sold in CY2022

7 out of 10 are built in Europe

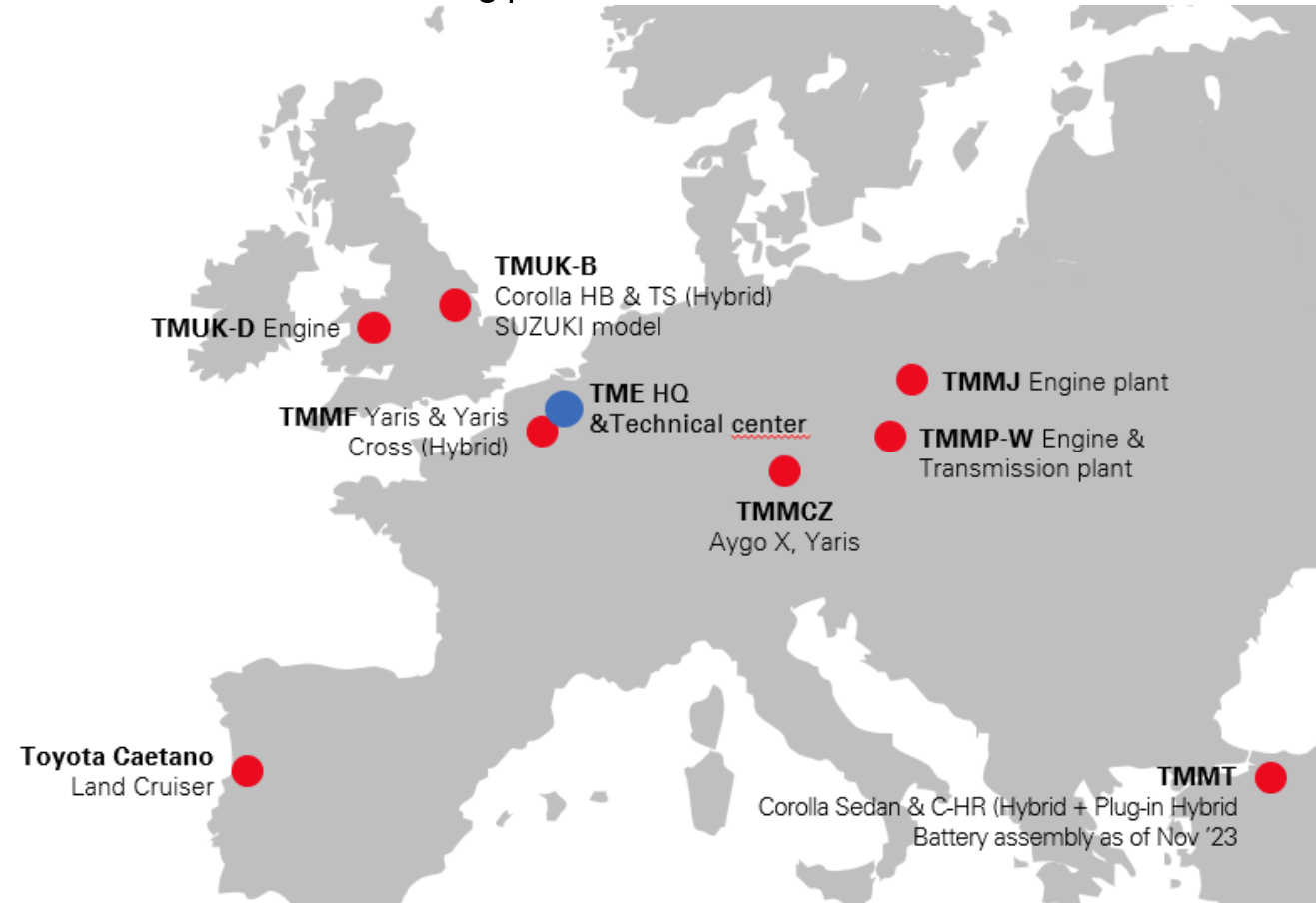
66%

Electrified mix

Market share

2nd best in Europe

8 manufacturing plants in 6 countries



TME HQ and technical center lead the development for the passenger cars produced in Europe.

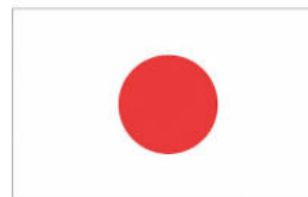
01

ELECTRIFICATION

TOWARDS CARBON NEUTRALITY



- **Carbon neutral by 2050**
- 2035: ICE ban (Euro7)
- 2030: CO₂ -55% (vs. 1990)
- > EU regulations (ELV, CRMa...)



- **Carbon neutral by 2050**
- 2035: 100% electrification
- 2030: GHG -46% (vs. 2013)



- **Net zero GHG by 2050**
- 2030: GHG -50÷52 % (vs. 2005)



- **Carbon neutral by 2060**
- 2035: BEV50%·HEV50%
- 2030: CO₂ -65% (basic unit)

TOYOTA ENVIRONMENTAL CHALLENGE 2050

New Vehicle Zero CO₂ Emissions Challenge

Challenge

CO₂ 0



Plant Zero CO₂ Emissions Challenge

Challenge

CO₂ 0



Life Cycle Zero CO₂ Emissions Challenge

Challenge

CO₂ 0



Challenge of Minimizing and Optimizing Water Usage

Challenge



Challenge of Establishing a Recycling-based Society and Systems

Challenge



Challenge of Establishing a Future Society in Harmony with Nature

Challenge

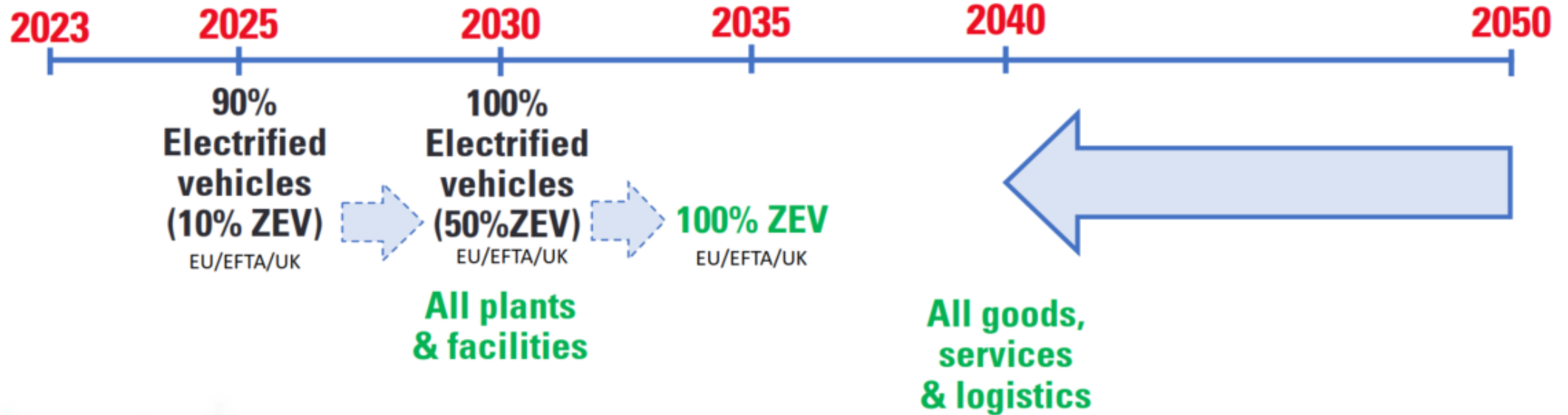


Toyota environmental challenge 2050 is our commitment to a sustainable future.

TOYOTA

JOURNEY TO CARBON NEUTRALITY

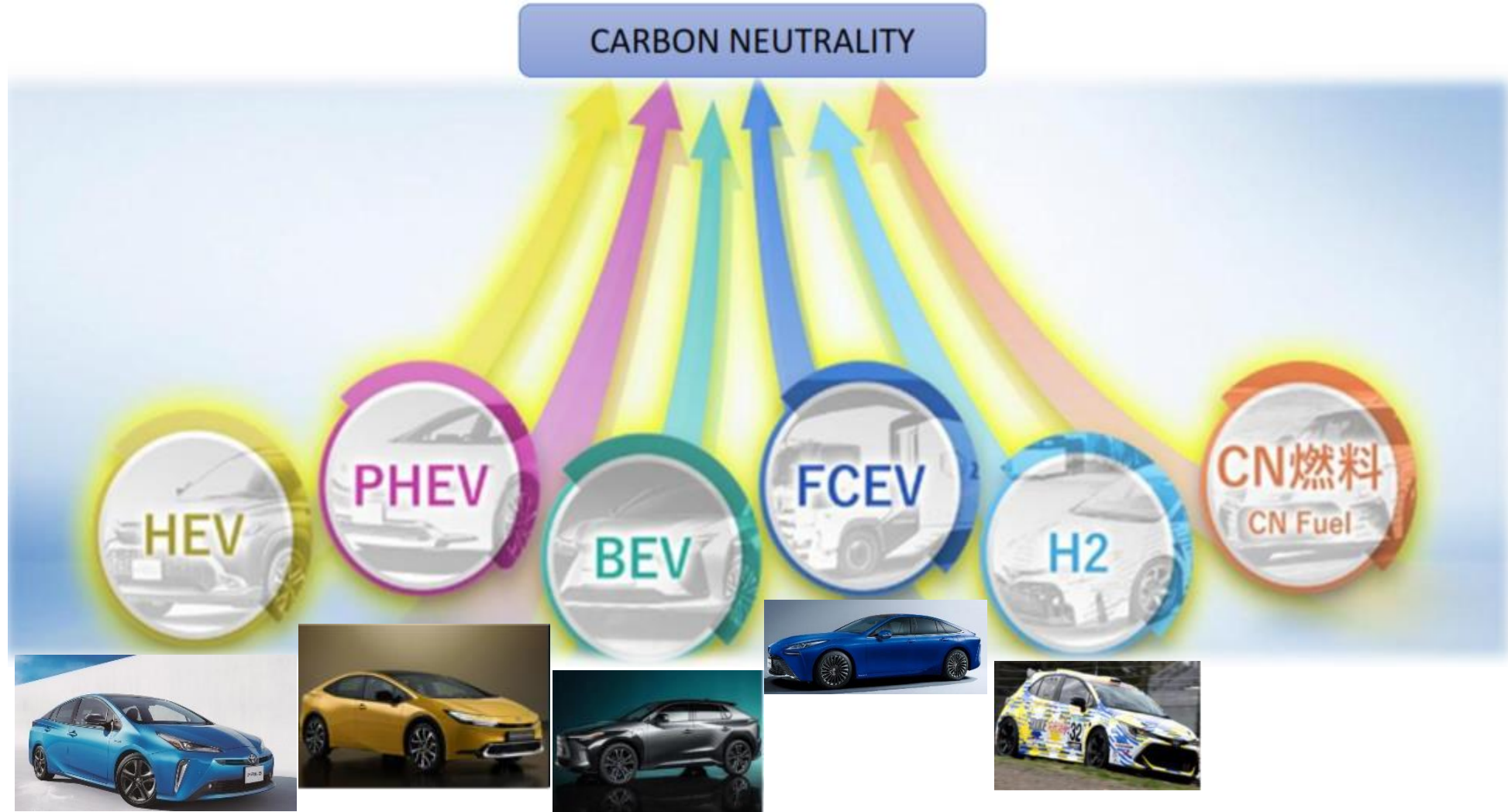
EUROPE



Toyota Europe will lead the path towards carbon neutrality – 10 years ahead Toyota global.

MULTI-TECH APPROACH

SOLUTION TO UNCERTAINTY IS DIVERSITY



Toyota has a multi-tech approach towards carbon neutrality.

WHY A MULTI-TECH APPROACH?

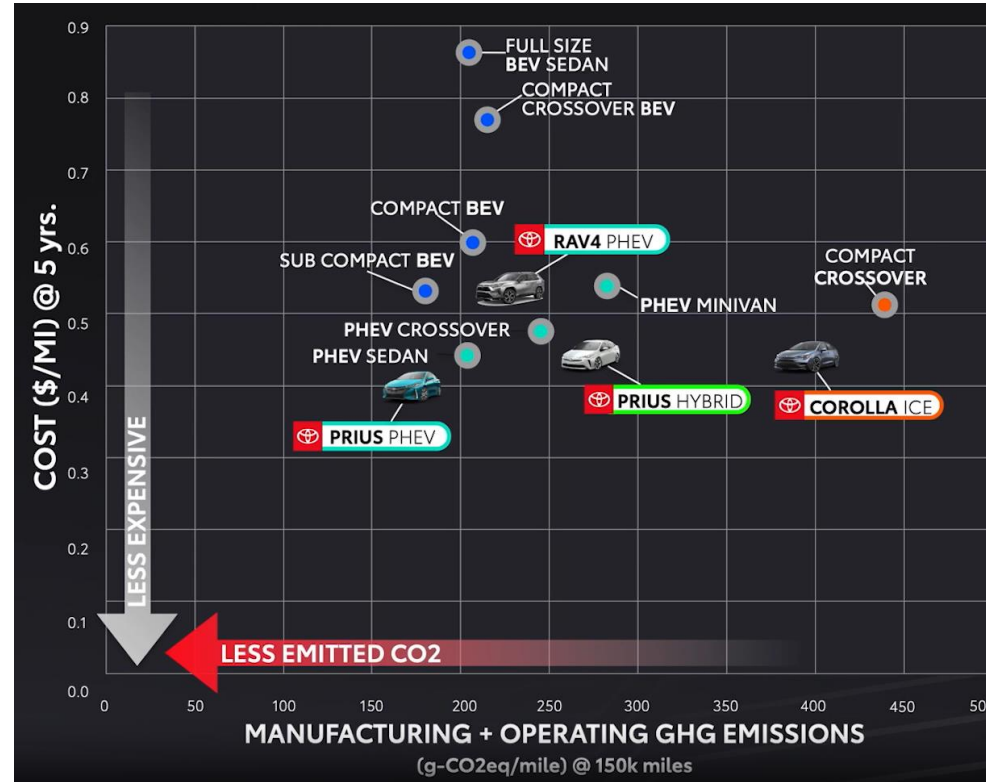
TO SATISFY EU DIVERSITY



Energy source depends on geopolitical situation.



Able to drive from/to anywhere anytime.



Full life cycle assessment under real driving conditions shows similar CO₂ emissions equivalent with different powertrains.



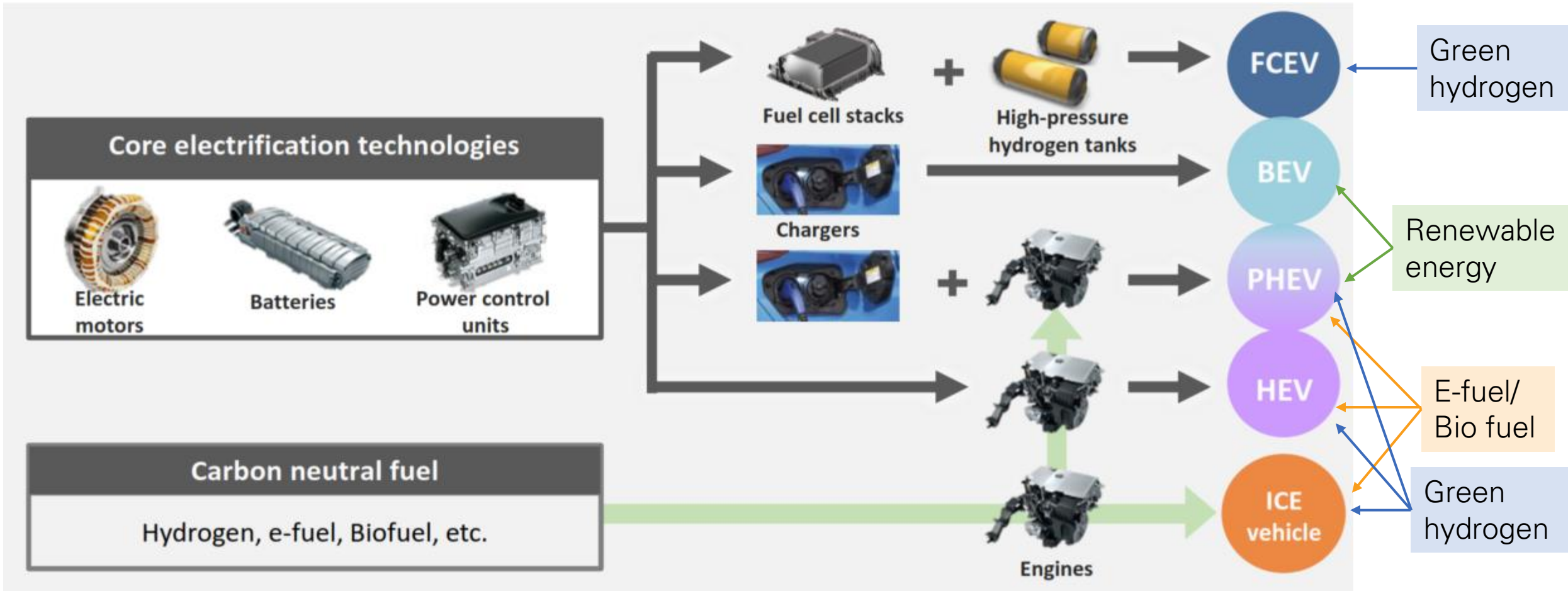
Provide a solution for everyone.

Toyota has a multi-tech approach to make best use of the infrastructure constraints and customer circumstances of every region.



TECHNOLOGY DIVERSIFICATION

FOR FAST AND ACHIEVABLE CO₂ EMISSION REDUCTION



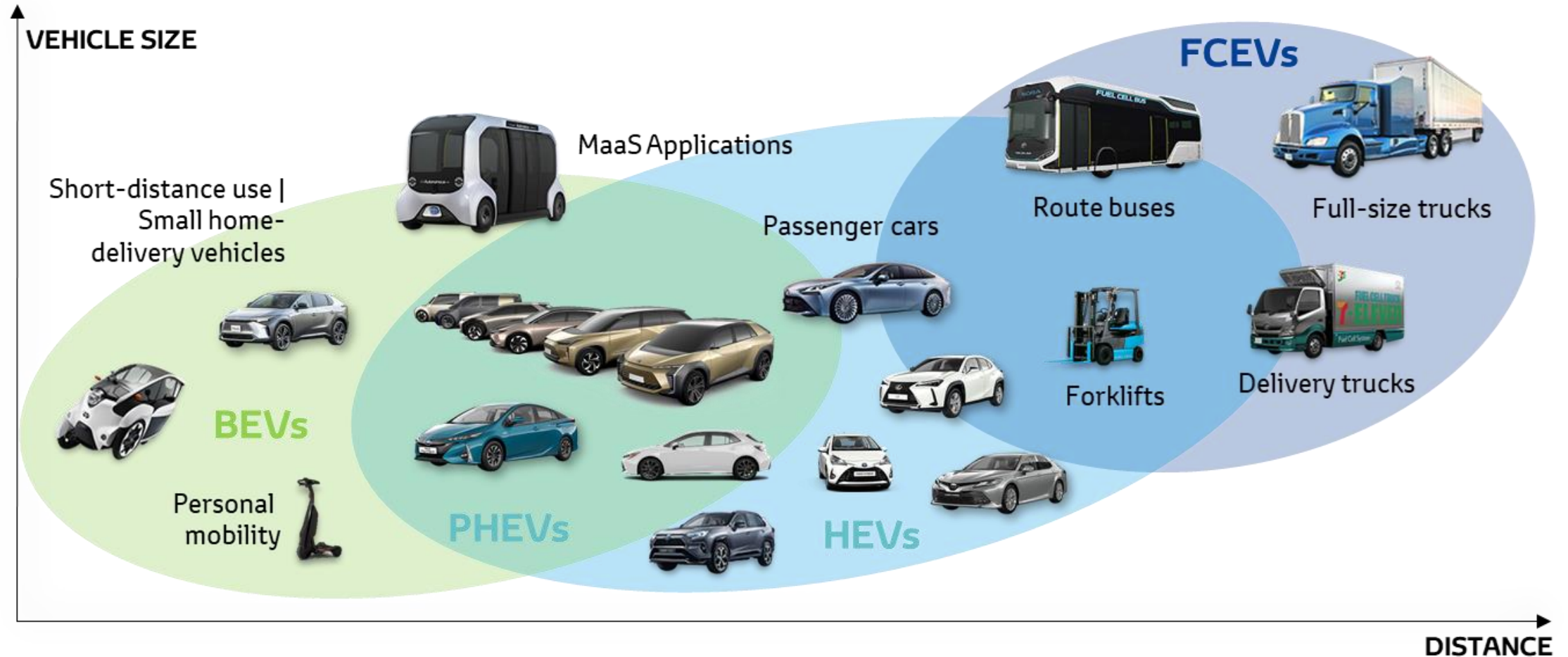
To reduce our carbon emissions, we must use all the tools from our toolbox.

02

**CARBON NEUTRAL
TECHNOLOGIES**

MULTI-TECH APPROACH

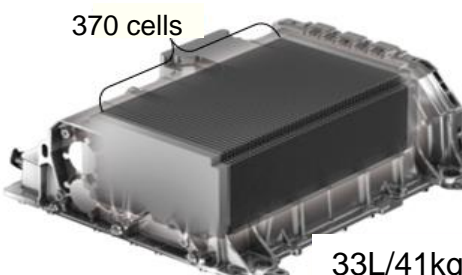
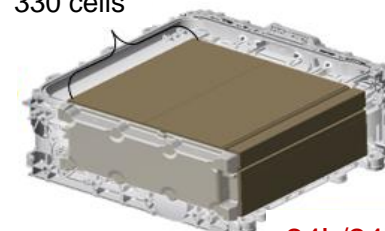
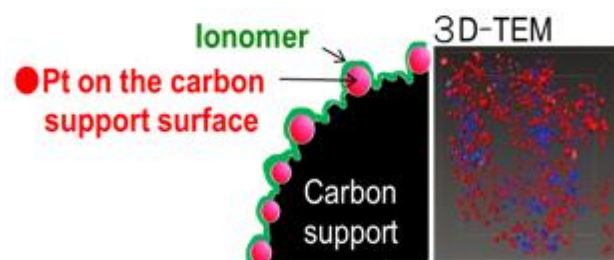
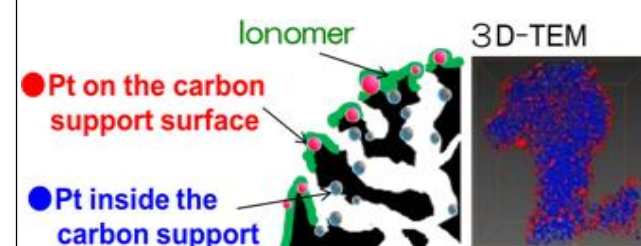
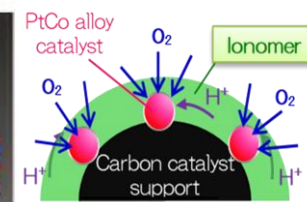
MOBILITY FOR ALL

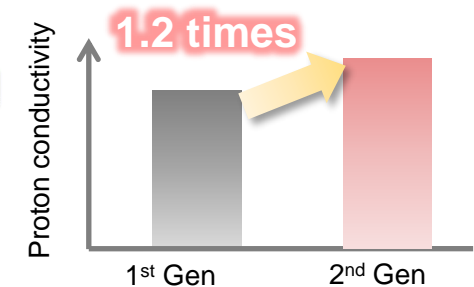
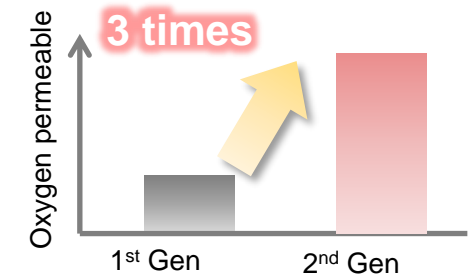
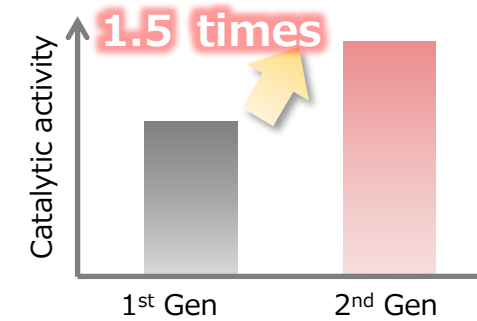


Fuel cells have key advantage in the mid-large size segment.

TOWARDS HYDROGEN SOCIETY

MATERIAL DEVELOPMENT IN H₂ FUEL CELLS

	1 st Gen. MIRAI	New MIRAI
Size Weight	370 cells  33L/41kg	330 cells  24L/24kg
Max. Power	114kW	128kW
Vol. Power Density	3.5kW/L	5.4kW/L
Cruising range (Toyota internal test)	650km	850km
	 <p>● Pt on the carbon support surface</p>	 <p>● Pt on the carbon support surface</p> <p>● Pt inside the carbon support</p>  <p>PtCo alloy catalyst</p>



Improved electrode material allow 15% power density enhancement.

TOWARDS HYDROGEN SOCIETY

DIVERSE MOBILITY SOLUTIONS

TRAINS

Partnership with CAF



TRUCKS

TMNA and Hino Trucks



FERRIES & LARGE MARINE

Partnership with Corvus



GENERATORS

GEH2: Partnership with EODEV



BUSES

Partnership with Caetanobus
H2 City Gold Bus



LUNAR ROVER

Developed with JAXA (joint research agreement)



BOATS/ YACHTS

Partnership with EODEV
HyNOVA FC yacht



FORKLIFTS

Toyota Material Handling

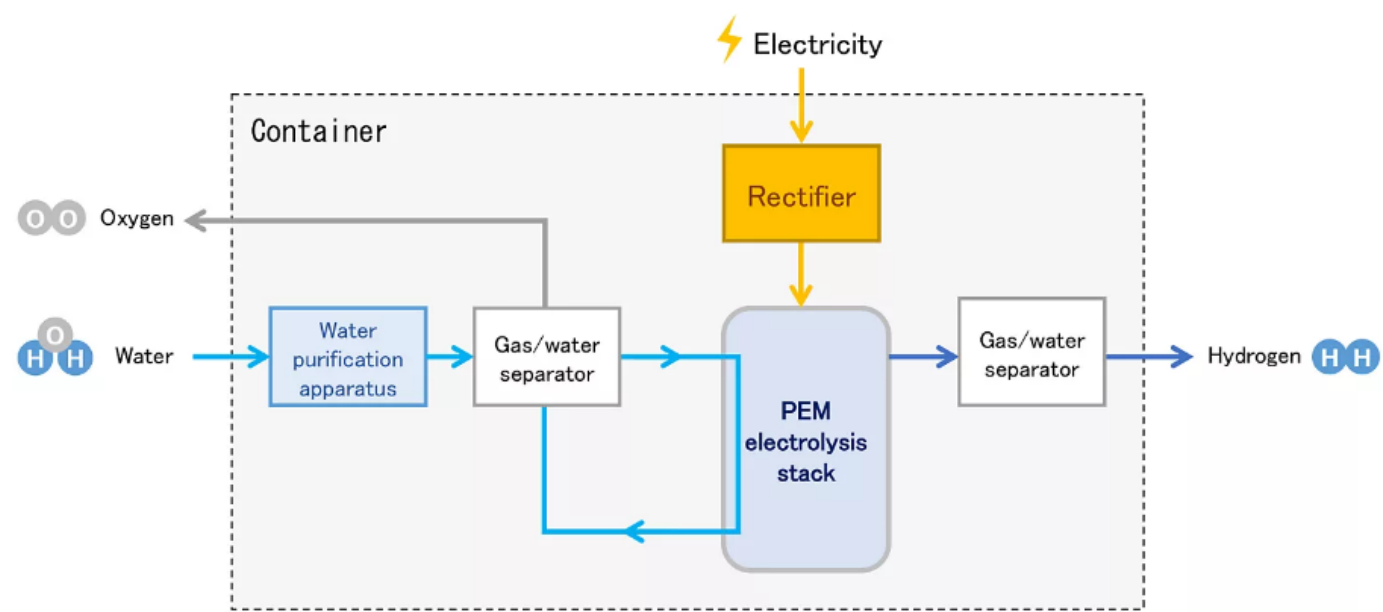
Hydrogen to enable decarbonisation beyond passenger vehicles.

GREEN HYDROGEN

PEM WATER ELECTROLYSIS

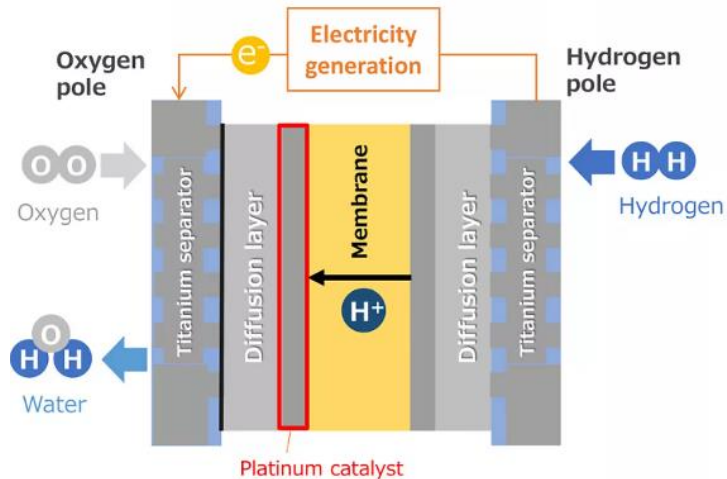
Based on Mirai and Sora FC bus technologies, Toyota in collaboration with Denso group developed a water electrolyser to produce green H₂.

- 8 kg H₂/h
- 53 kWh/1 kg H₂



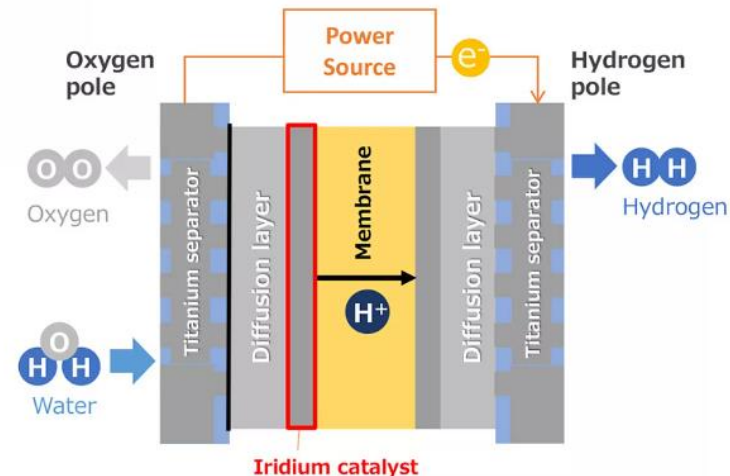
FC Stack

Oxygen in the air reacts with hydrogen in the stack to generate electricity



PEM Electrolysis Stack

Hydrogen is produced by electrolyzing water in the stack



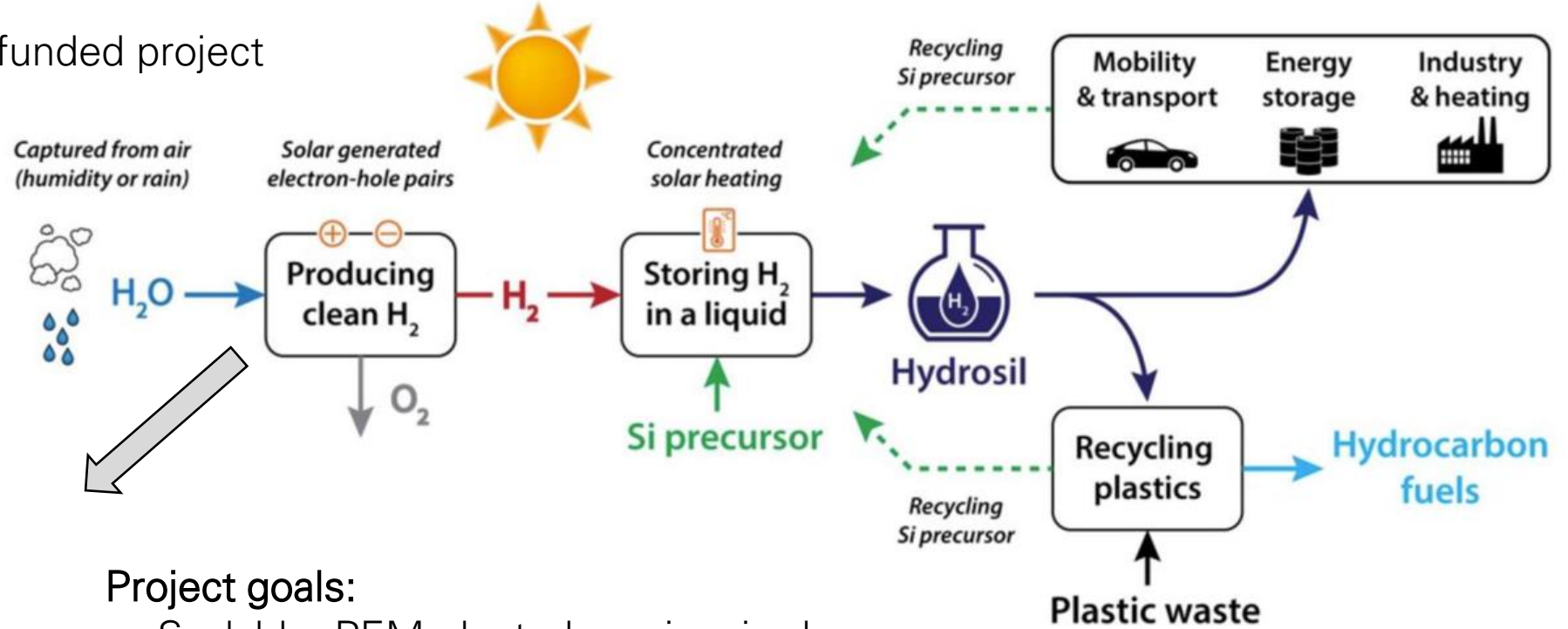
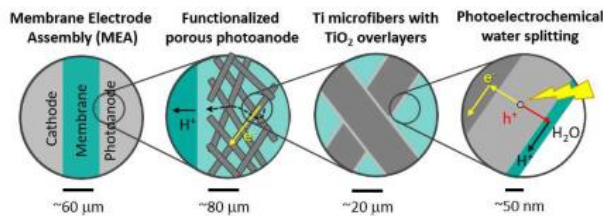
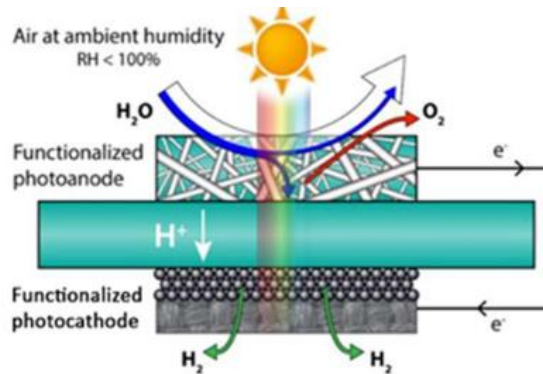
90% of FC stack components for FCEVs can be used for PEM electrolysis stack production.

GREEN HYDROGEN

SOLAR HYDROGEN

Sun-to-X:

- EU Horizon 2020 public funded project
- 42 months
- ~3 m€
- 9 partners
- 6 countries



Project goals:

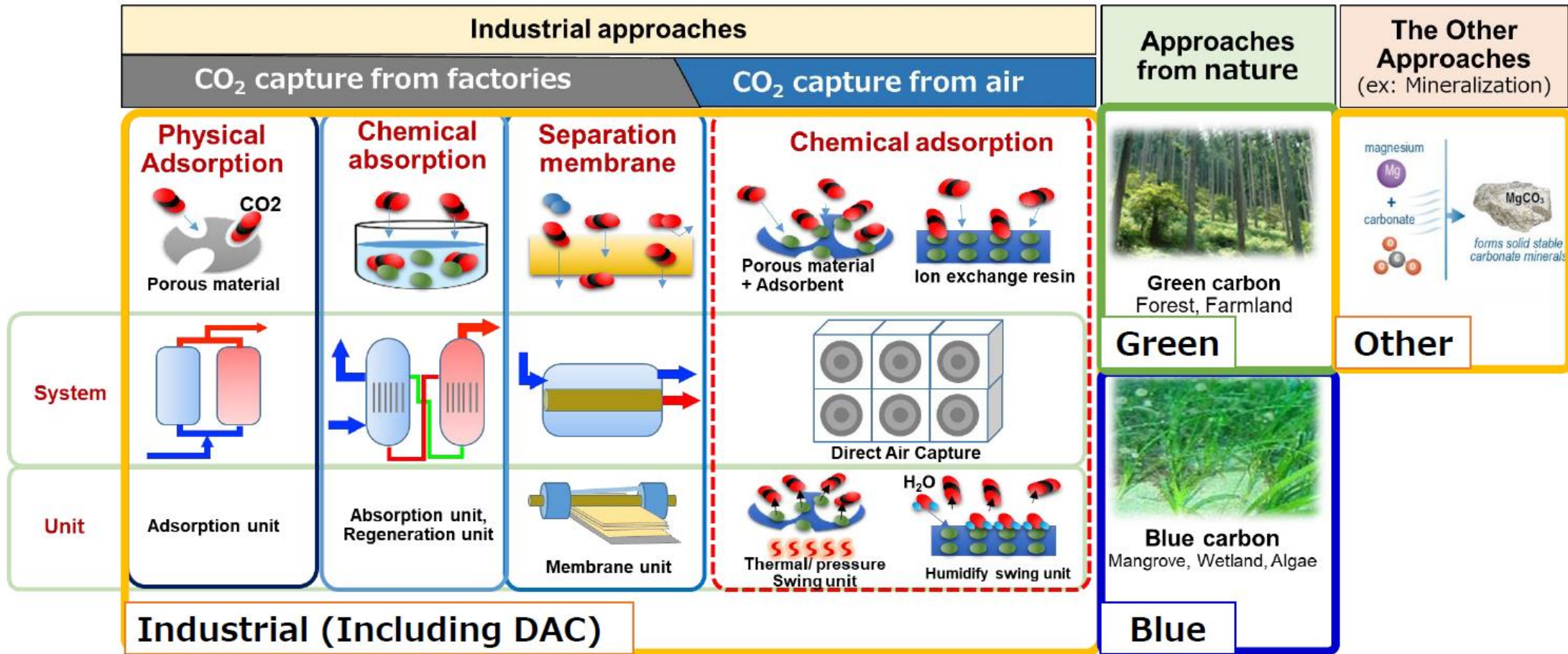
- Scalable, PEM-electrolyser inspired photoelectrochemical hydrogen production
- Storage of hydrogen in liquid hydrogen carrier (HydroSil)

Innovative solution to growing H₂ demand.



FURTHER CO₂ EMISSIONS REDUCTION

CO₂ CAPTURE

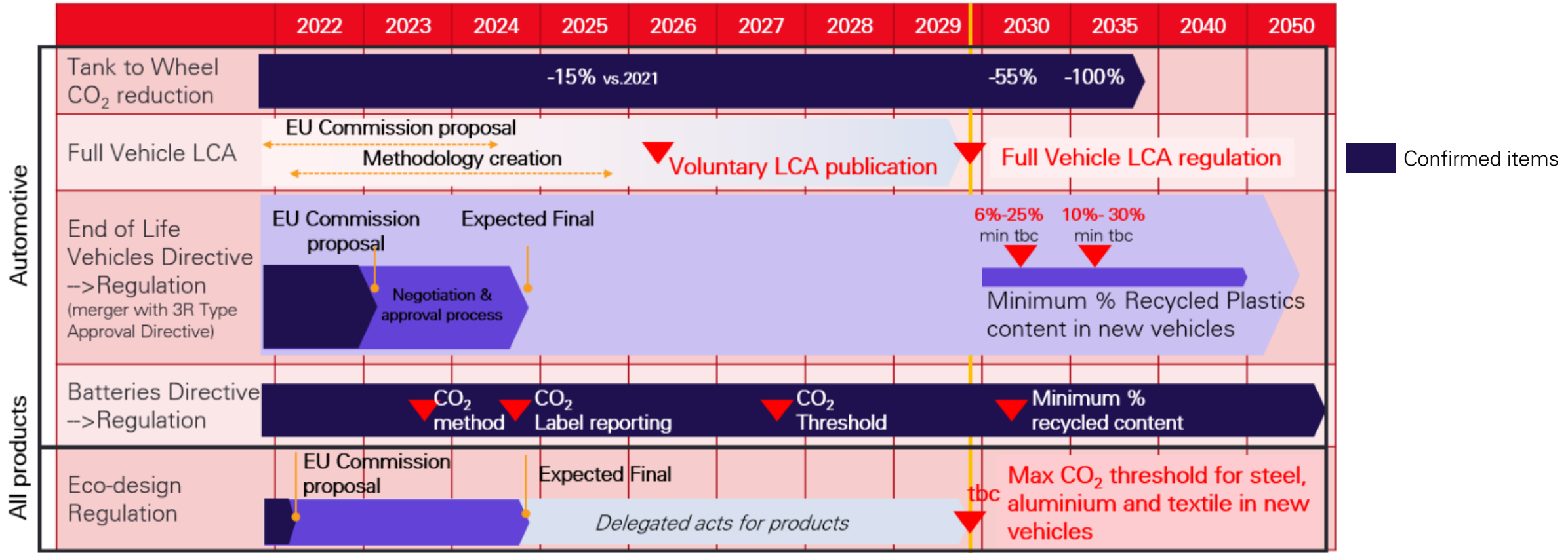


Different approaches are being investigated to reduce CO₂ emissions.

03

CIRCULAR ECONOMY

UPCOMING EU REGULATORY REQUIREMENTS



CRMa announced in March 2023 by EU commission



10%
Of annual
volume

EU EXTRACTION



40%
Of annual
volume

EU PROCESSING



15%
Of annual
volume

EU RECYCLING



Max 65%
From single
country

EXTERNAL SOURCES

Europe is leading towards a circular economy.

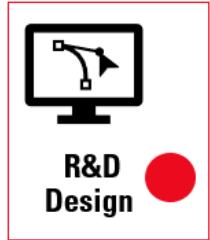
TOYOTA

TOWARDS RECYCLING

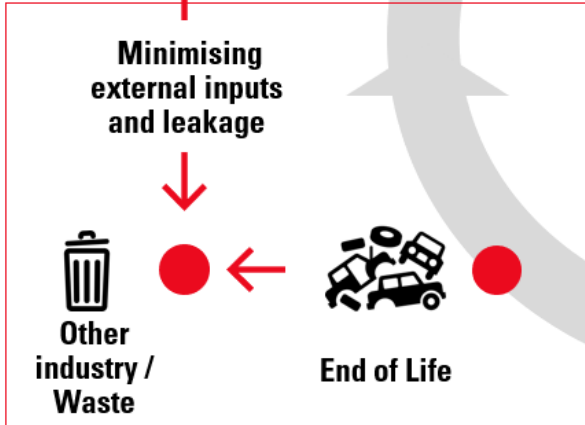
FROM LINEAR TO CIRCULAR ECONOMY

Closed loop business model

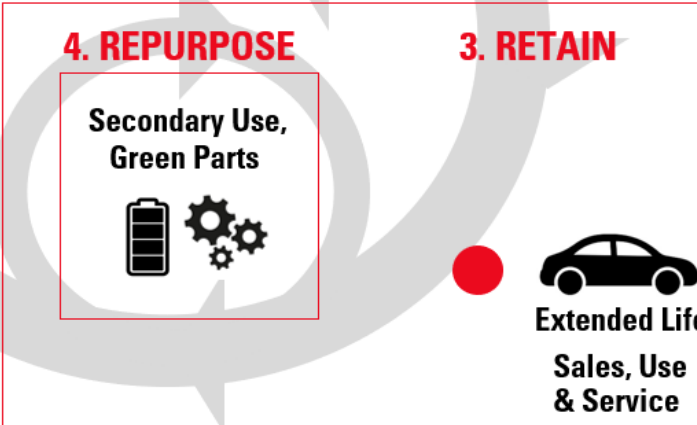
1. REDESIGN



2. REDUCE AND RECIRCULATE

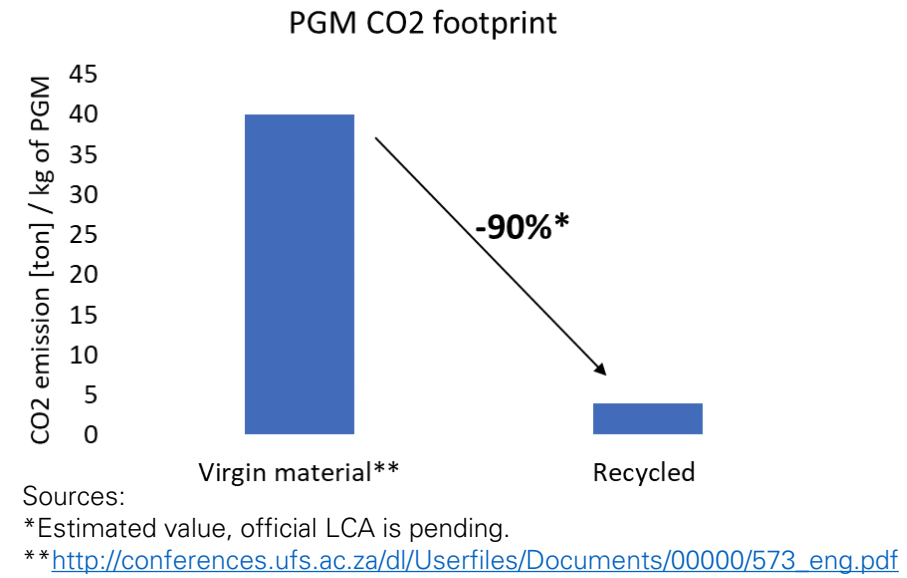


5. RECOVER

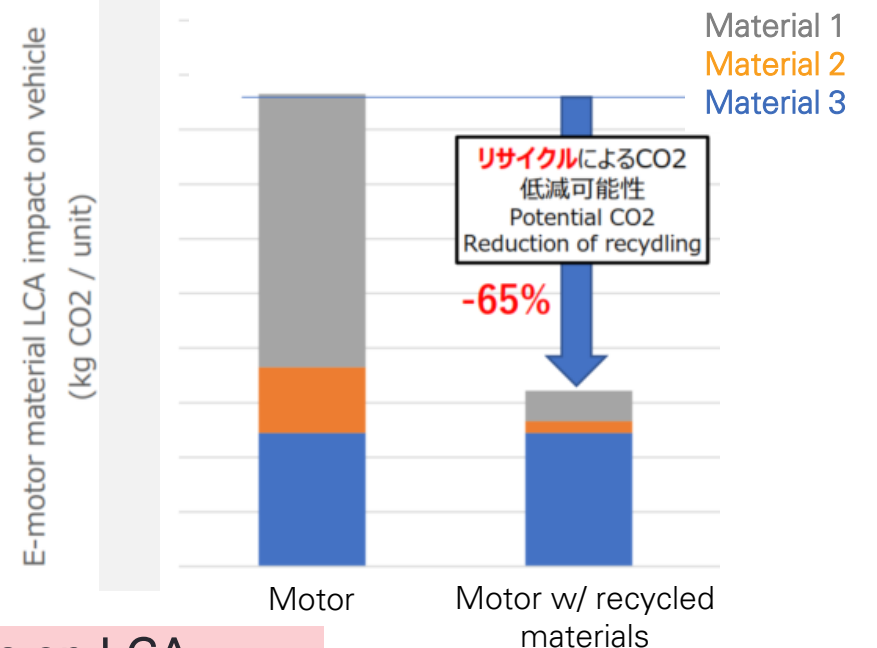


4. REPURPOSE

3. RETAIN



Impact of recycled materials on e-motor LCA

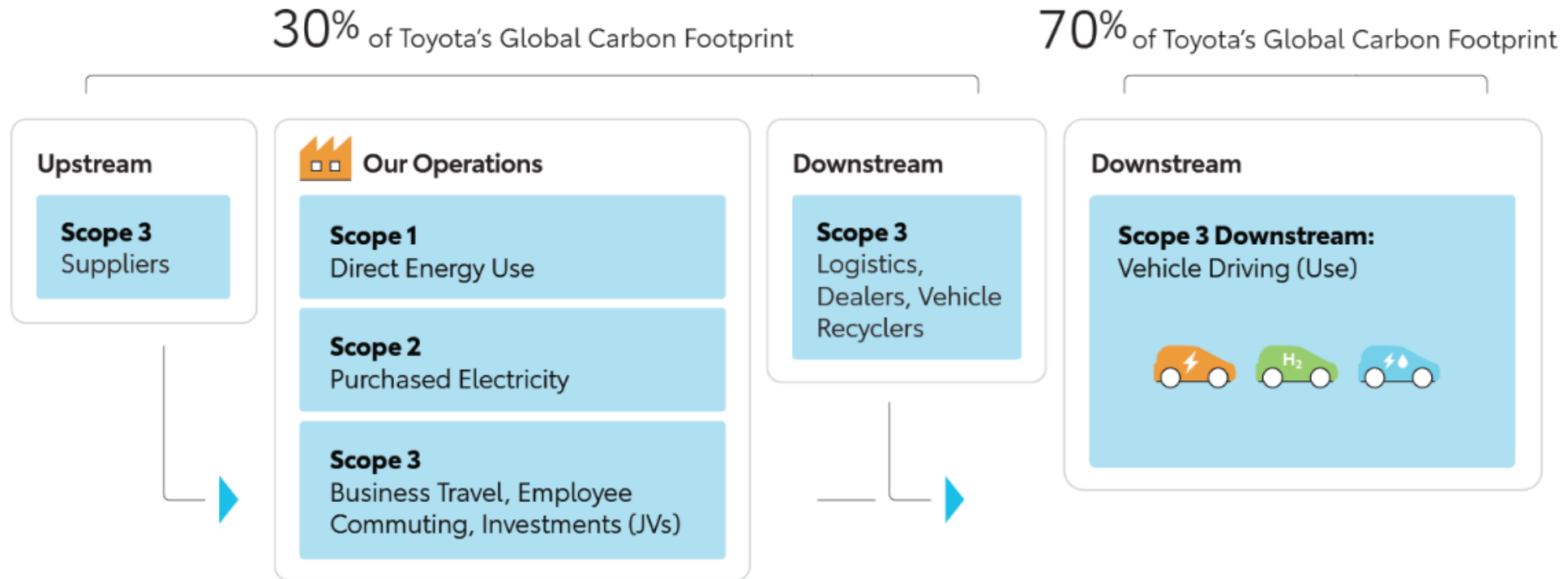


Some recycled materials have big impacts on LCA.
Circular economy will support carbon footprint reduction.



CONCLUSION AND NEXT STEPS

- ✓ Toyota commits to be carbon neutral across the vehicle life cycle by **2050**.
 - Reduce and offset GHG emissions to achieve net zero carbon emissions across operations, manufacturing, logistics, use and recycling of our products, all by 2050.



- ✓ Toyota cannot achieve carbon neutrality alone. We must **collaborate** with others to increase access to and availability of lower and zero carbon energy sources to power everything from the supplier to the final product.

THANK YOU

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