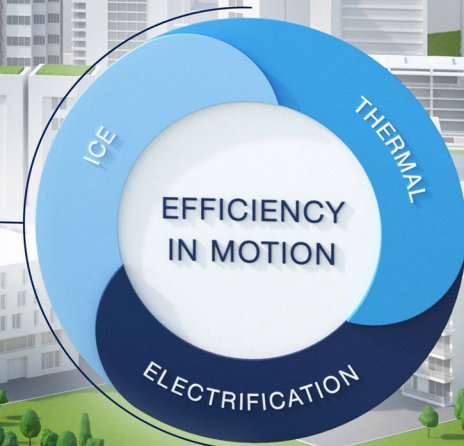


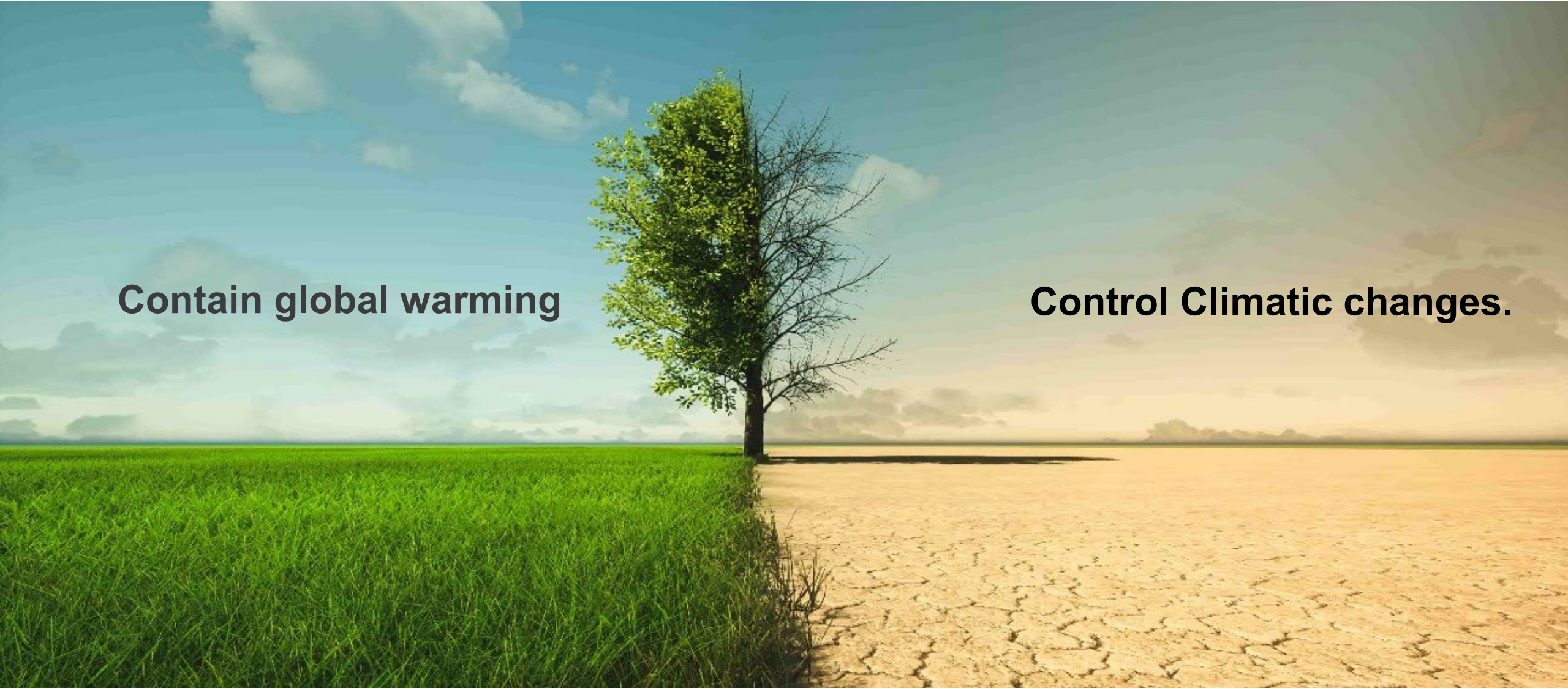
### B3 LISTED NM

WE SHAPE  
FUTURE MOBILITY



MAHLE

# Climate emergency: decarbonization is mandatory!



**Contain global warming**

**Control Climatic changes.**

# Sustainability generating megatrends

## Global

**Economic volatility**



**Digitalization**



**Urbanization**



**Transformation to carbon neutrality**



**Biofuels and alternative fuels**



**Eletrification**



## Automotive

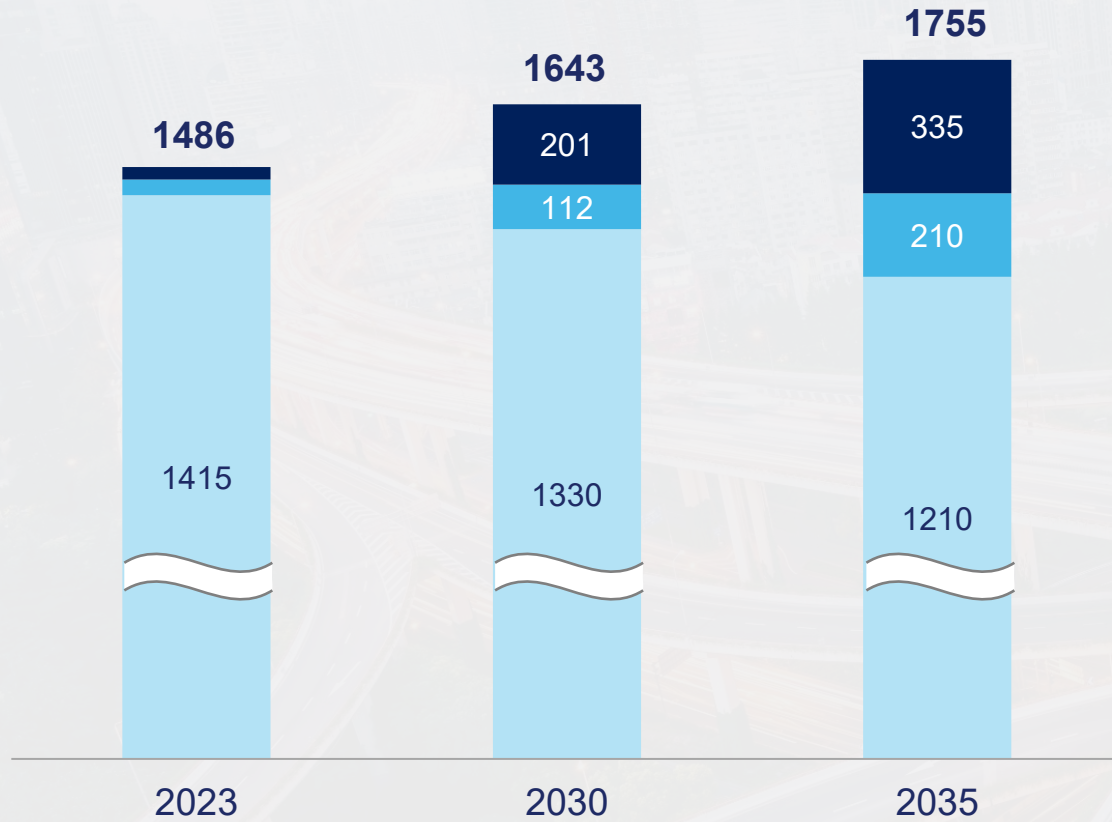
**Renewable materials**



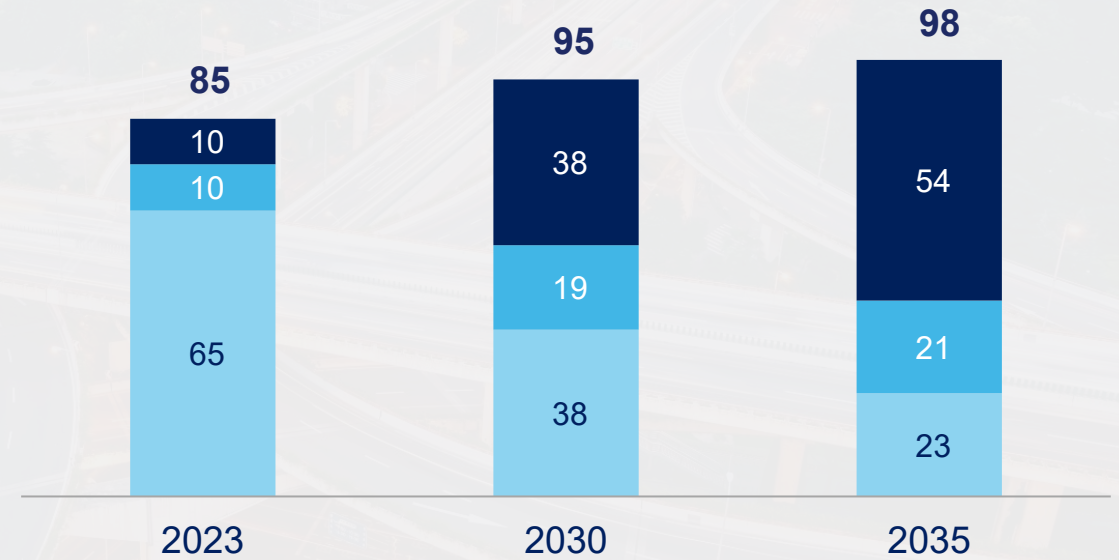
**Mobility as a service**

# Global demand for mobility will continue to grow...

Global fleet of vehicles in operation(mio)

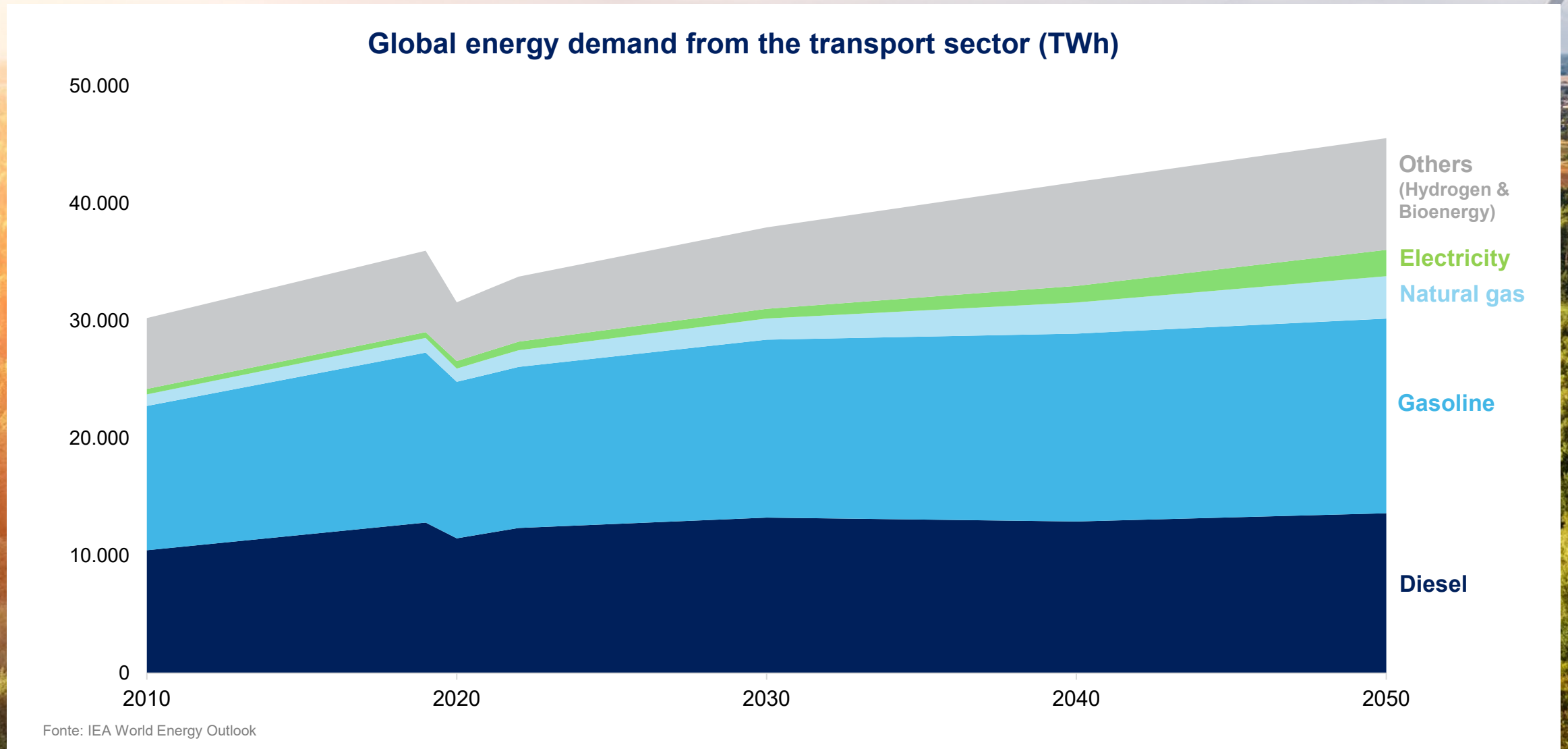


Global production of LIGHT vehicles(mio)

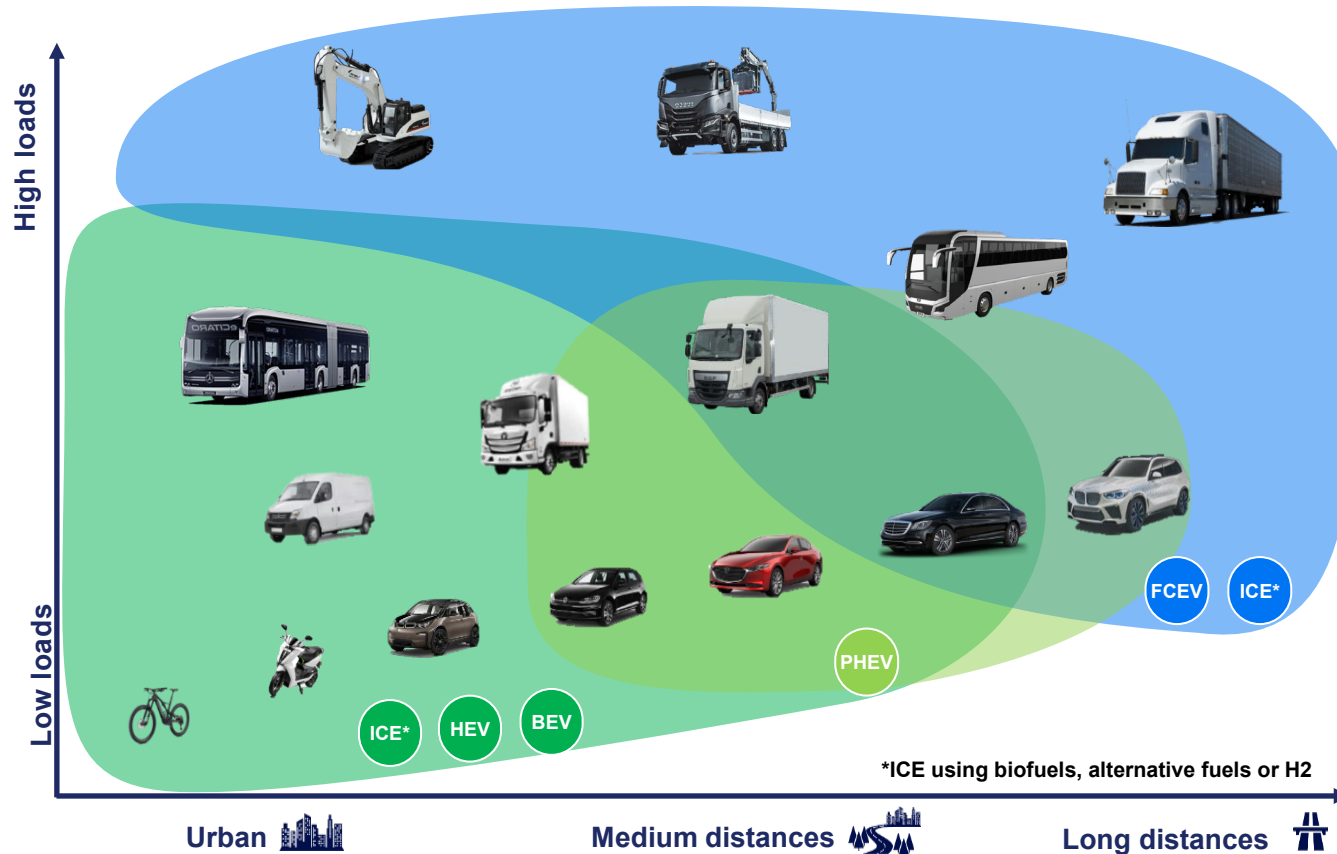


ICE Hybrid Electric & fuel cell

# Liquid fuels will remain relevant



# Mobility will be diverse



- **Sustainable**

Mobility is changing quickly worldwide in a sustainable way, to fight climate change.

- **Diverse**

Mobility of the future will be diverse, with different technologies and powertrains for different applications.

- **Local**

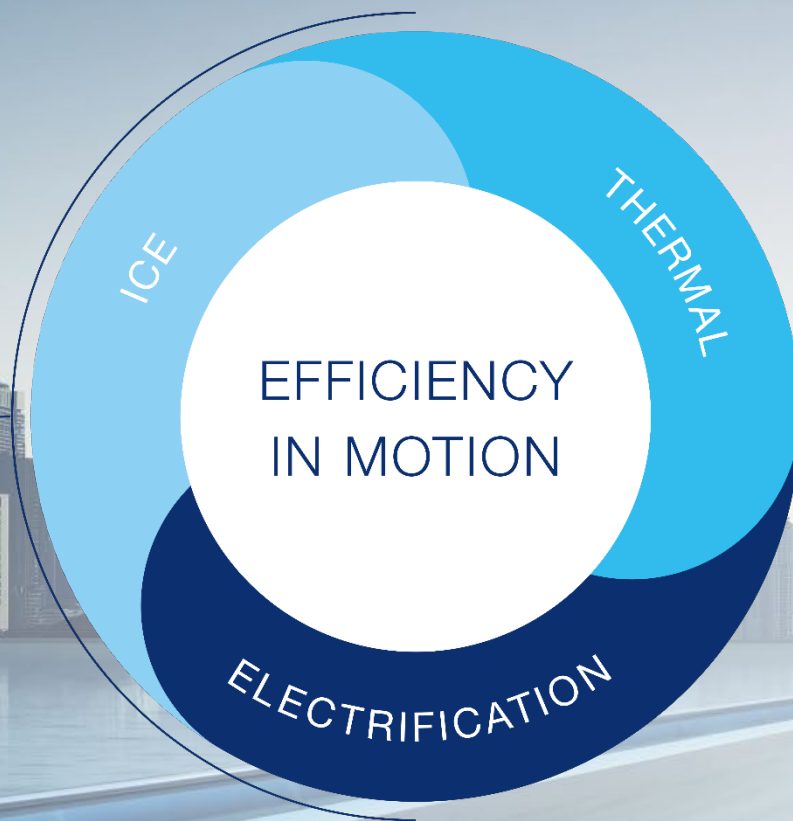
The technology are based on local conditions, economic, environmental and social needs.

# Well Positioned for the Future with our Strategy MAHLE 2030+

## Cost Leadership Strategy

ICE champion with superior products, lean cost structures and long trustful customer relationships.

WE SHAPE  
FUTURE MOBILITY



## System Solution Strategy

Leader in Thermal Solutions driving energy efficiency and superior cabin comfort for sustainable mobility.

## Focus Strategy

Creator of e-Powertrain innovations enabling profitable e-mobility leading technology with highest efficiency.

# System Champion for E-Mobility with Focus on Electric Drives and Smart Charging

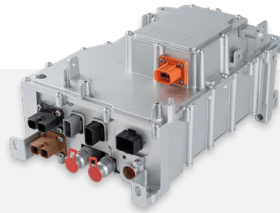


- **MAHLE electrifies all types of vehicles:**  
From bikes, volume & super sports cars, to construction and other off-road machinery



**Wireless Charging**

Easy &  
comfortable  
solution



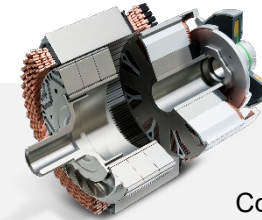
**Onboard Charger**

Safe &  
efficient  
charging



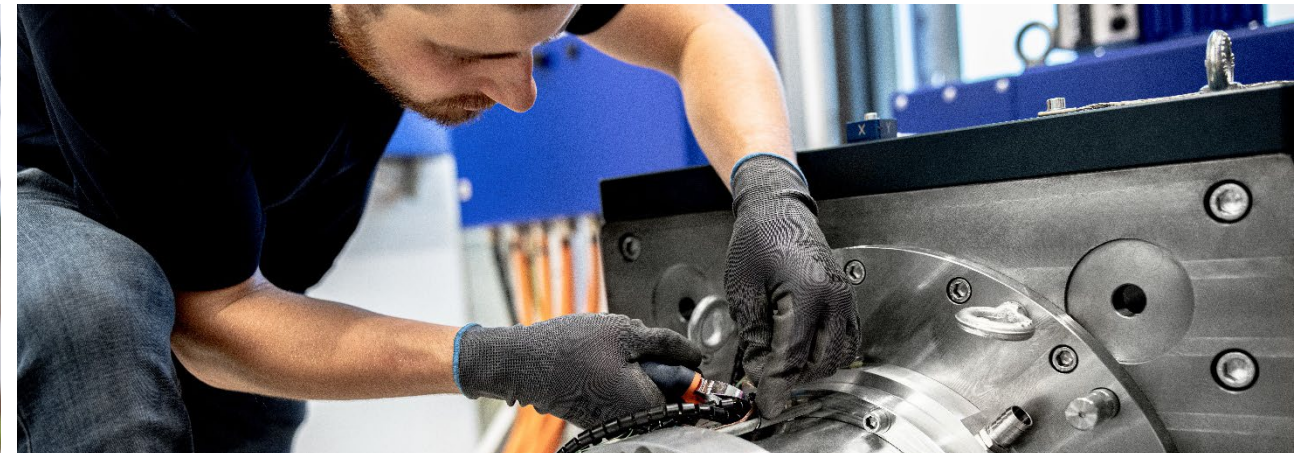
**X20 System**

World's lightest &  
smartest eBike  
rear hub system



**Technology Kit  
for Electric Motors**

Combining the  
MAHLE benchmark  
technologies  
SCT/MCT



# Driving Electrification with Innovative Thermal Management Technologies

EFFICIENCY  
IN MOTION

THERMAL

## ➤ Home of Thermal Management – System, modules and components



**E-Compressor**

Efficient &  
most high-output  
on the market



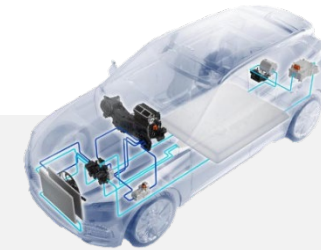
**Thermal Management Module**

Combined with heat  
pump allows for smaller,  
lower-cost batteries.



**Battery Cooling**

Battery performance  
& fast-charging



**Heat Pump System**

Benchmark in  
e-vehicle efficiency



# Remaining a Reliable Supplier for ICE

EFFICIENCY  
IN MOTION

ICE

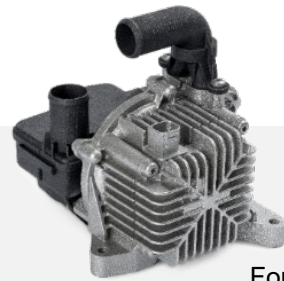
## ➤ Components green solutions with hydrogen and sustainable non-fossil fuels:

Market champion with long trustful customer relationships



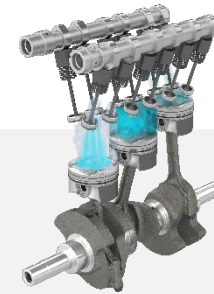
**Hydrogen Engine Components**

Enabling clean hydrogen combustion



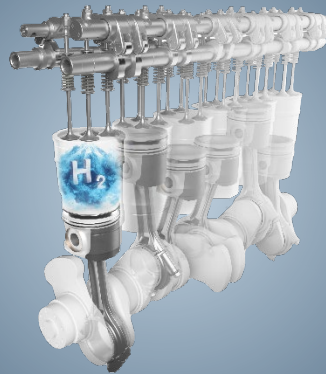
**High Pressure Impactor**

For active flushing of the crankcase of hydrogen engines



**Ethanol Power Cell Unit**

Enabling CO<sub>2</sub> neutral combustion engines





# Brazilian Drivers

# Technology Drivers – Legislation

## Brazilian active legislations pushing the evolution of the automotive sector

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**MOVER** – Successor of Inovar Auto and ROTA 2030. Pushes for **efficiency increase** and **reduction of CO2** emissions of vehicles.

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**PROCONVE** – Imposes **harmful emission** limits for light and heavy vehicles.

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**RenovaBio** – Establish carbon credits and goals for fuel distributors aiming to incentive the production of **biofuels**.

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**Fuel of the future program** – **Integrate** all national programs pushing for low carbon mobility.

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**National Hydrogen program** – Define actions to support the development of the **hydrogen economy** in Brazil.

---

# MAHLE contribution on local automotive regulation

- **MOVER**
  - Legislation text proposal (working group member);
  - Fuel efficiency and CO<sub>2</sub> targets for OEMs (coordination);
  - Well to Wheel concept (coordination);
  - **MAHLE was one of the first companies registered in MOVER.**
- **Fuel of the Future Legislation**
  - Working group for E30 implementation;
  - E35 discussion with Energy Ministry;
  - Studies for over B15 adoption;
  - Support to Energy Ministry to define R&D incentives.

























































Events with automotive industry to introduce Mover Program



Fuel of the future launch, Brasilia, Oct/24

# After MOVER launch, over R\$100bi investments were announced

OEM	Investments (R\$)	Technologies
STELLANTIS	30 bn	 
	16 bn	 
	11 bn	 
	10 bn	  
	7.0 bn	 
	5.5 bn	  
	5.4 bn	 
	4.2 bn	 
	4.0 bn	 
	3.0 bn	  
	2.8 bn	 
	2.0 bn	 

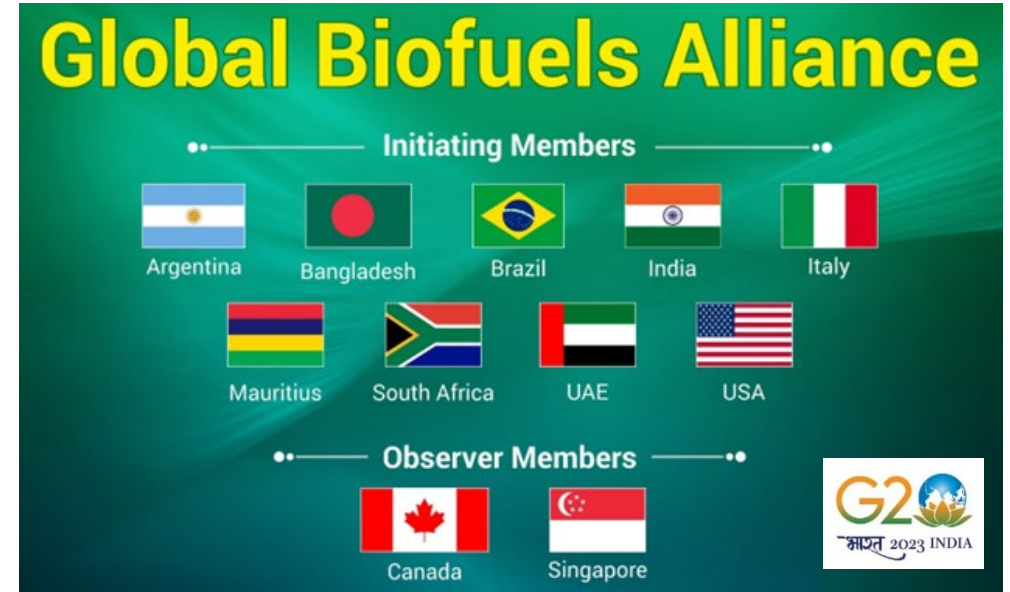
OEM	Investments (R\$)	Technologies
 Caminhões e Ônibus	2.0 bn	 
<b>V O L V O</b>	1.5 bn	
 <b>SCANIA</b>	1.4 bn	
<b>IVECO</b>	1.0 bn	
 <b>AGCO</b>	1.0 bn	 
<b>DAF</b>	0.4 bn	 
	0.3 bn	  

Majority of the investments directed to ICE and hybrid Flex developments, indicating the technological trend for the coming years

# Global mobilization



Agreements aimed at carbon neutrality

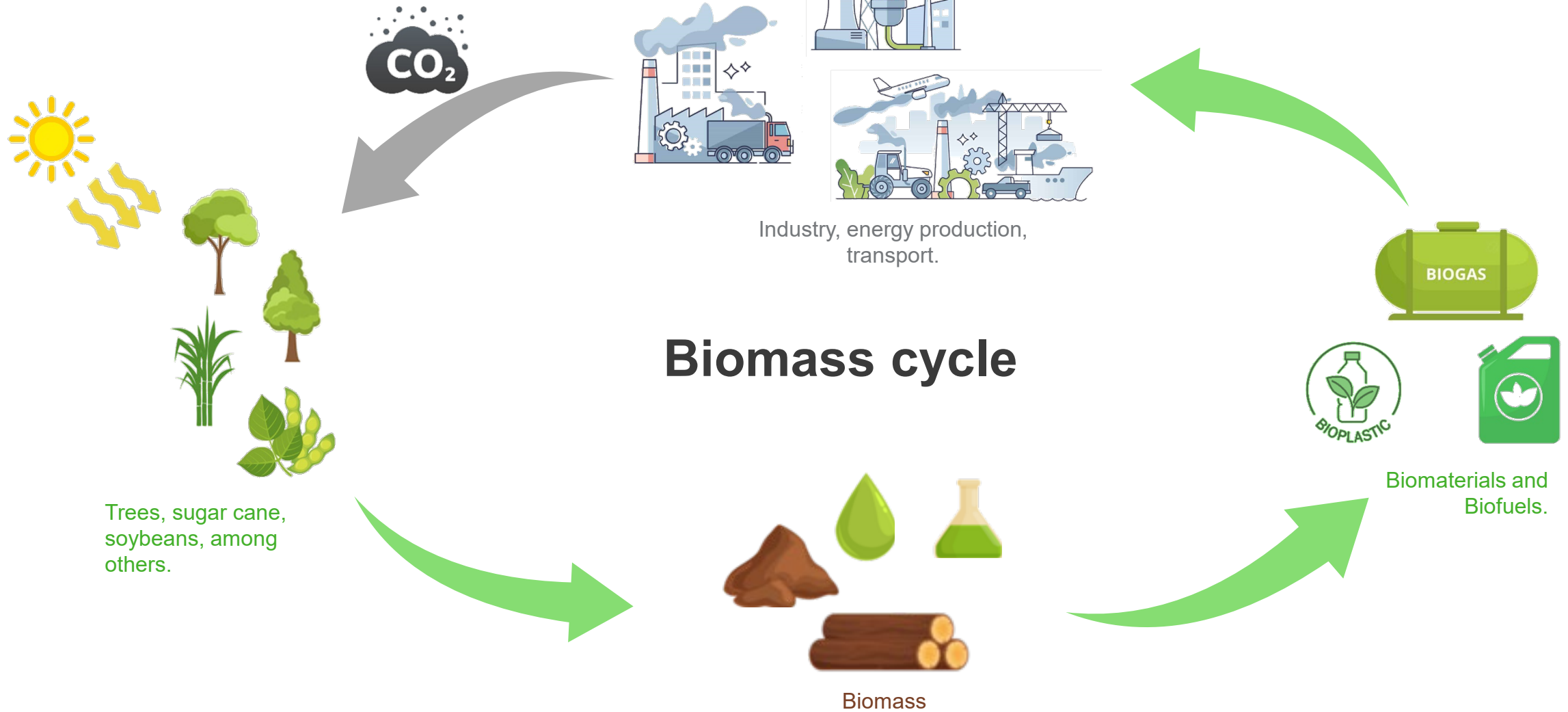


Global alliance for fast mobility decarbonization

## Global alliance objectives:

- Facilitate and promote the use of biofuels.
- Bringing together governments, industries and organizations to drive development and implementation.
- Exchange knowledge, skills, technologies, policies and provide technical support.

# Why Bioenergy?



Considering the carbon cycle, bioenergy can reduce CO<sub>2</sub> emissions by up to 90%.

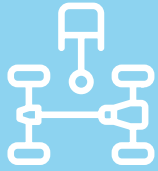
# Vehicle life cycle

## Manufacturing phase

### Cradle-to-Gate



Raw material  
extraction



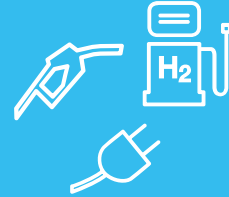
Component  
production



Vehicle  
assembly

## Usage phase

### Well-to-Wheel



Fuel  
production



Vehicle use

Well-to-tank

Tank-to-Wheel

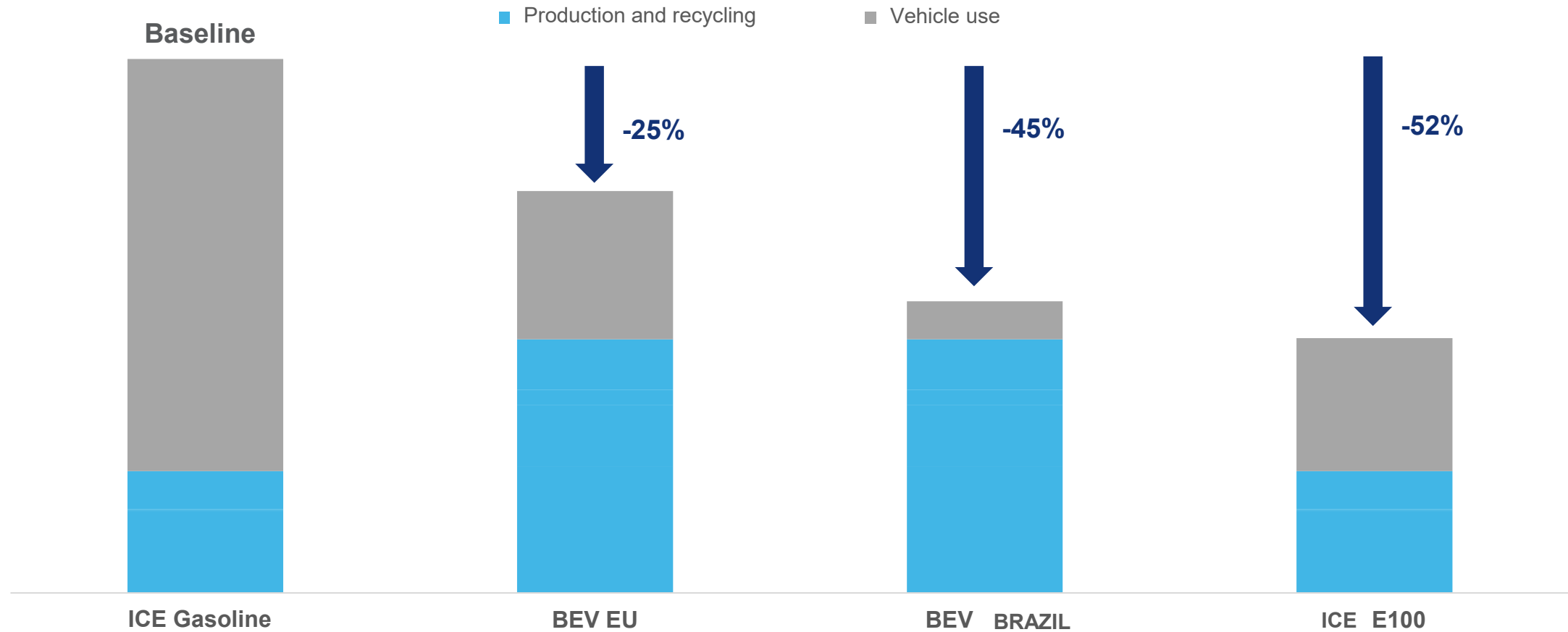
## End of life



Recycling

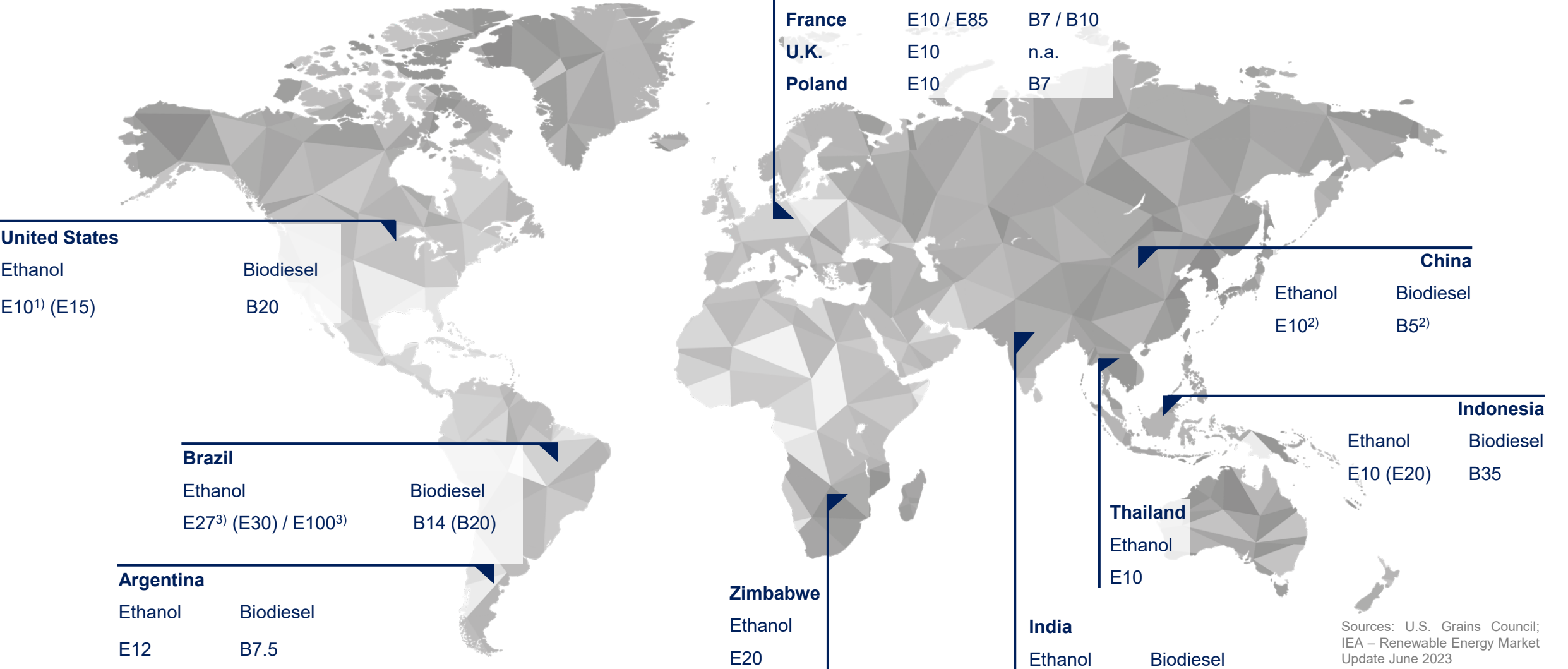
The effective reduction of CO2 emissions must consider the entire life cycle.

# CO2 emissions from cradle to grave



# Global Biofuel Blending Rates

## Status Quo and Mandates

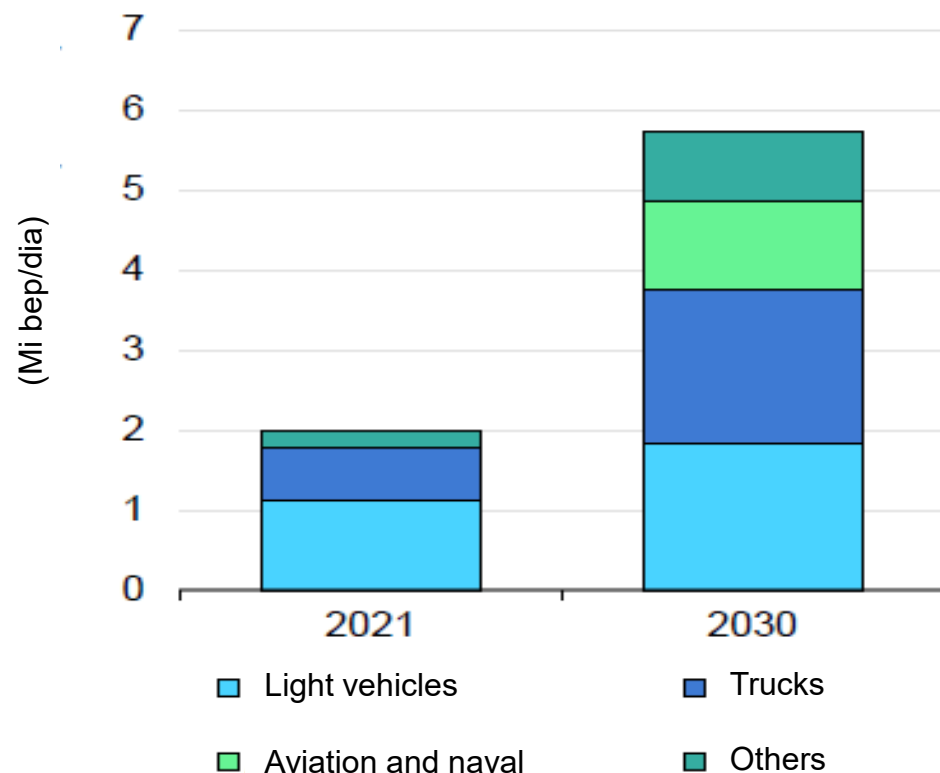


Sources: U.S. Grains Council;  
IEA – Renewable Energy Market  
Update June 2023

Note: Blend rates in brackets represent target values  
<sup>1)</sup> some gas stations already offer E15 or E85 (for Flex Fuel vehicles) today, especially in the Midwest  
<sup>2)</sup> E10 mandated nationwide since 2017, but ethanol capacities are not sufficient; B5 only in Shanghai and Hainan province  
<sup>3)</sup> for Single Fuel Vehicles / Flex Fuel vehicles

# Global incentives





## Demand for biofuels 2021-2030



“We recognize the importance of sustainable biofuels in our strategies for developing carbon-neutral economies and highlight the creation of a Global Biofuels Alliance.”

*Statement by G20 Leaders in New Delhi. New Delhi, India, September 9-10, 2023.*

# Potential for production of renewable fuels globally (Brazilian Scenario)

		Production/Market current (annual)	Potential production	Main operators
	<b>Ethanol</b>	<b>29,6 Bi Liters</b>	<b>66,8 Bi Liters</b>	Power plants
	<b>Biomethane</b>	<b>1.8 Bi m3</b>	<b>82,6 Bi m3</b>	Landfills, livestock farms, ethanol producers
	<b>HVO(*) /Biodiesel</b>	<b>6.6 Bi Liters</b>	<b>28,4 Bi Liters</b>	Renewable energy producers
	<b>Green Hydrogen</b>	<b>0</b>	<b>3.8bi ton</b>	Brazilian coast using solar and wind energy (on and off-shore)

(\*) HVO - Hydrotreated Vegetable Oil

Great potential in renewable fuels for the decarbonization of various modes of transport.

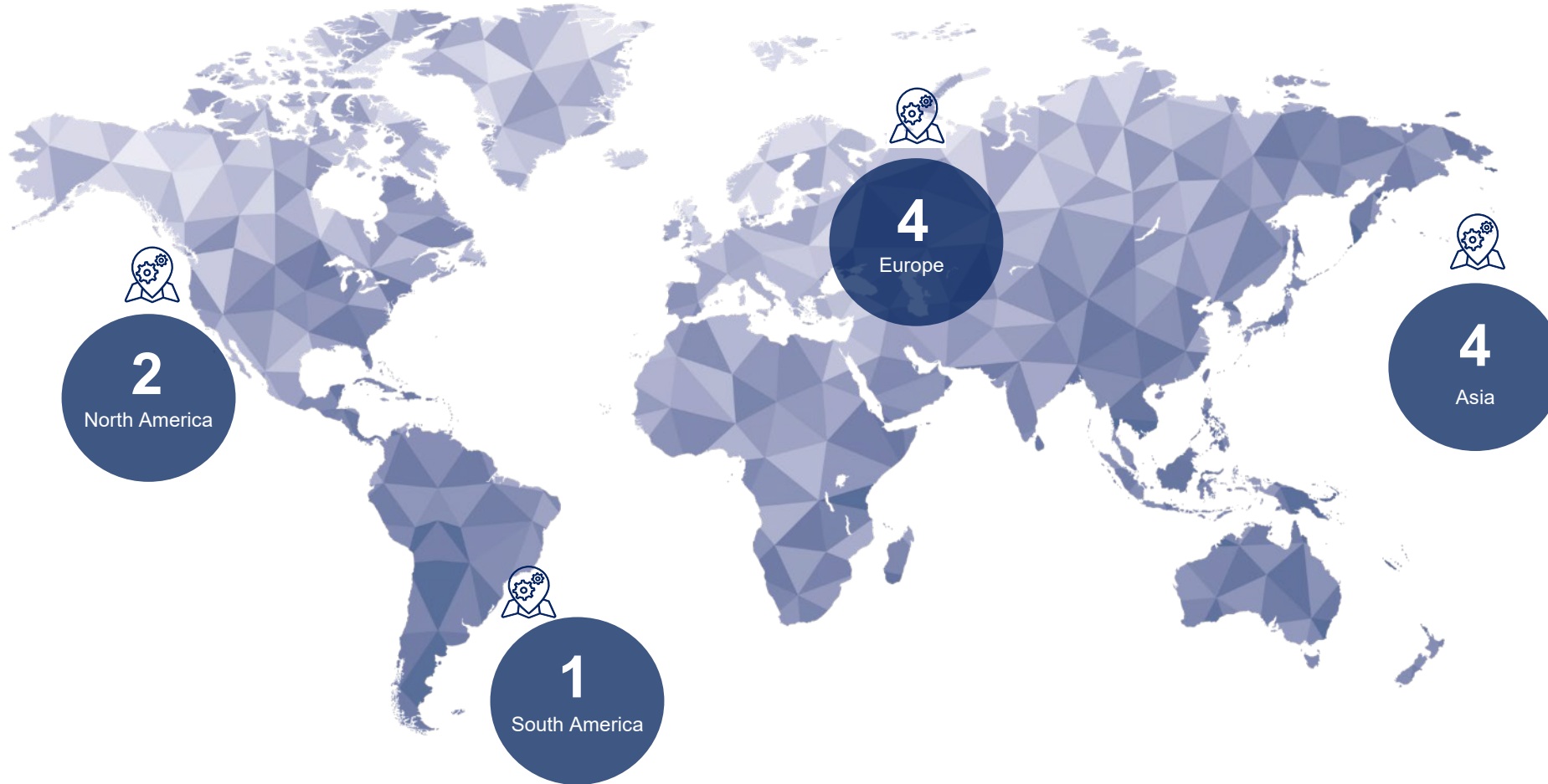
# Global Support | Global Biomobility Center

## Goals

- Connect vehicle manufacturers, biofuel developers, research institutes and funding agencies to develop biomaterials, biofuels and optimize the efficiency of ICEs using biofuels.
- Lead MAHLE's global developments on topics related to biofuels and biomaterials.
- Support the development of system solutions for high-efficiency internal combustion engines using biofuels and the application of biomaterials.
- Strengthen connections with customers interested in biomaterials and ICEs using biofuels.



# MAHLE Research and Development Network



**5.3%** Strong  
R&D Power as  
system supplier



**11** major  
R&D locations with  
> **5,700** engineers

# Tech Center South America at a glance - 2025



**2nd largest** engine development center in South America.



**Global Competence Center for BioMobility**



**Americas Engineering Center for Fluid Systems**



**~60 customers** developing technologies (OEM and Suppliers)



**~320,000 hours** of testing and validation



**~ 180 employees**

## Capabilities and areas of development



Development Laboratories



Additive Manufacturing



Digitization in Development



Engine Components



Filters and peripherals



Thermal management



Biomaterials



Renewable fuels

# Global Biomobility Center Activities Status



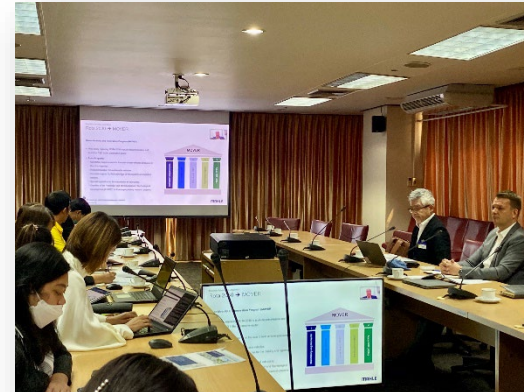
- Technology development:
  - 8 projects on going
- Global technical support:
  - India
  - Thailand
  - Indonesia



## INDIA – Customer and Associations



## Thailand – Government



*Official inauguration*

# Brazil has a biofuel development network

## Technology centers and universities



## Companies



## Development Funds



## Government and entities



(\*) Global level

MAHLE maintains close contact with all participants in the biofuels network in Brazil.

# On going projects

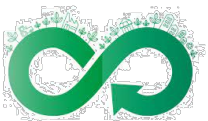
## Clusters



Biofuel



Biomaterial

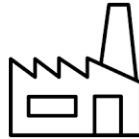


Circular Economy

## Established partnerships



11 Universities



9 Companies



5 Funding agencies

## Topics



Increasing ethanol efficiency  
Multi-fuel ICE



Single fuel ethanol  
Use of biomethane  
Advanced biodiesel  
Use of biogas




Emissions reduction for new legislation (PL8)



Recycled materials  
Biomaterials

# Summary

- The global technology path will be eclectic, considering all alternatives to fast mobility decarbonization and Strategy MAHLE 2030+ supports it.
- GBA (Global Biofuel Alliance) encourages the global growth potential in biofuels, especially in the Southern Hemisphere.
- Biofuels have proven to be the cheapest and most effective way to reduce CO<sub>2</sub> in transport.
- Life cycle analysis is the most appropriate way to compare technologies.
- Brazil has more than 40 years of experience in biofuel application and MAHLE Brazil participated actively in this development.
- MAHLE is ready to support the biofuel ICE implementation globally, through technologies available in our portfolio.
- MAHLE Brazil is driving strategic topics related to regional technology roadmap in local automotive cluster.



MAHLE Global Biomobility Center  
Jundiaí - Brazil

Thank you!

# LEVE

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## B3 LISTED NM

**SMLL B3**

**IDIV B3**

**IGC-NM B3**

**IGC B3**

**IGCT B3**

**ICON B3**

**INDX B3**

**ITAG B3**

**IBRA B3**