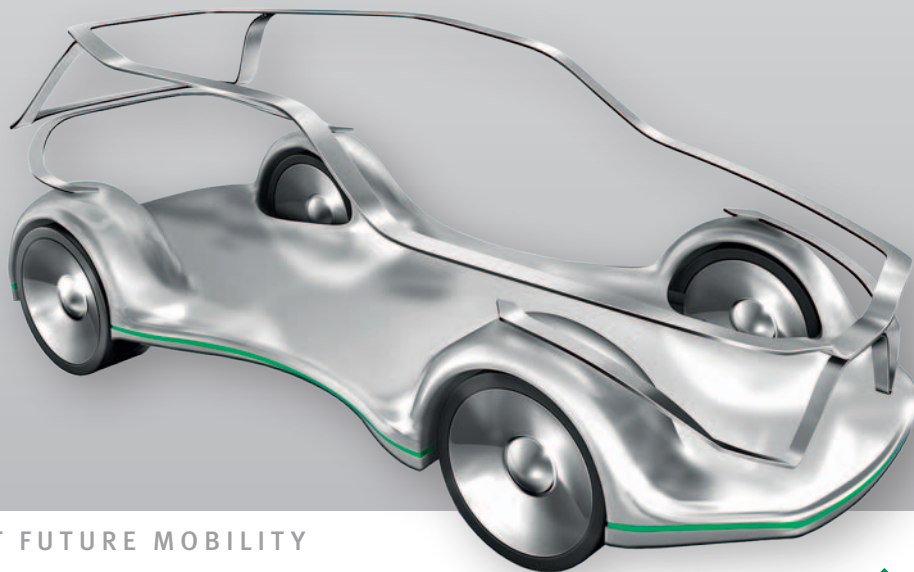


Region  
E-Mobility  
DCT systems

**SCHAEFFLER**

# Electrification of the Drive Train

EFFICIENT FUTURE MOBILITY



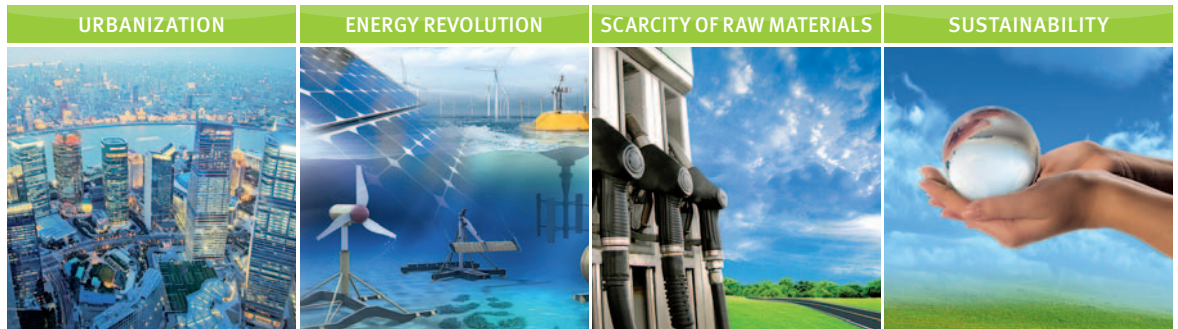
EFFICIENT FUTURE MOBILITY



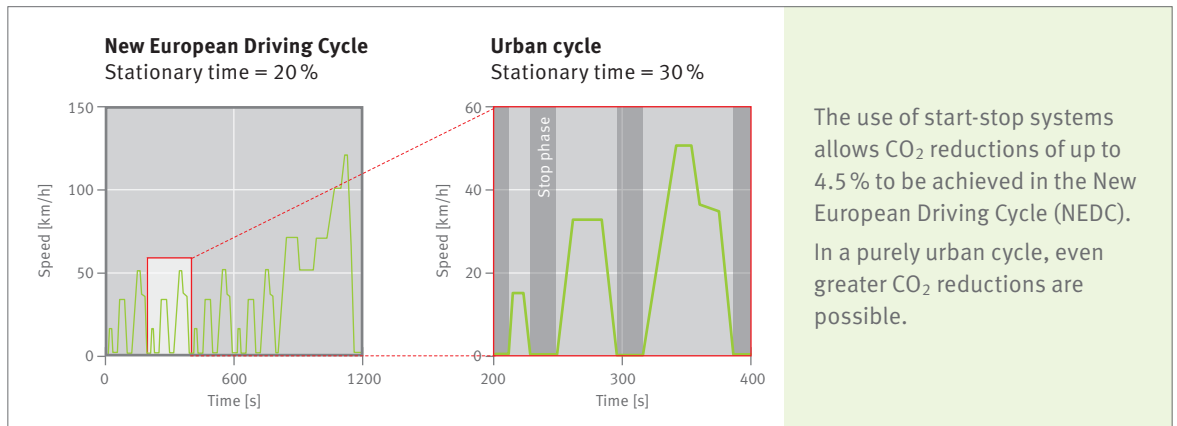
# CO<sub>2</sub> Regulations Make Electrification Necessary

Electrification in the automobile industry is constantly advancing, driven by the megatrends of sustainability, energy revolution, scarcity of raw materials, and urbanization. The emission and fuel consumption regulations worldwide are an essential driving force in the development of new technical solutions that reduce vehicles' fuel consumption (for example engine start-stop systems). Laws on the reduction of vehicle emissions promote the development of energy-efficient drive solutions and electric vehicles, e.g. through supercredits for electric vehicles.

According to many automotive manufacturers, it will not be possible to achieve emissions targets without hybrid and electric vehicles. Schaeffler therefore offers solutions covering the whole scope of electrified drive trains. The portfolio includes components and systems for drive trains, including those in hybrid and range extender vehicles (REEV) as well as battery-powered (urban) vehicles.



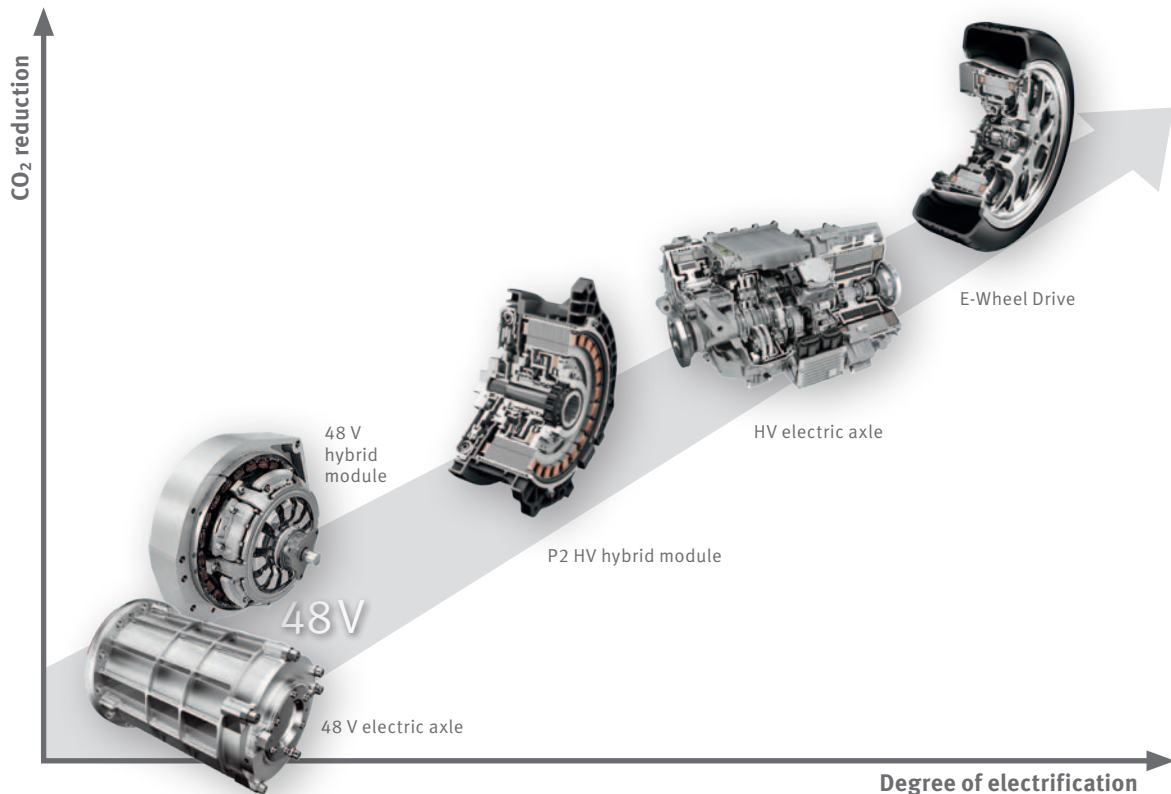
# CO<sub>2</sub> Reduction Through the Use of Start-Stop Systems



<b>Example for fuel consumption</b>	
Fuel consumption in the NEDC without a start-stop system	6.08 L/100 km
Idling fuel consumption	0.60 L/h
Fuel consumption in the NEDC with a start-stop system	5.81 L/100 km

← -4.5%

# Schaeffler Offers Solutions Across the Entire Drive Train Electrification Spectrum



## HYBRID VEHICLES WITH 48 V

- Recuperation
- E-creeping

## HYBRID VEHICLES (HEV, PHEV)

- Electric driving
- For PHEV: Charging from the grid

## ELECTRIC CARS (BEV)

- Emission-free mobility
- New vehicle concepts

# 48V as Entry-Level Electrification

## 48V hybrid module for manual transmissions

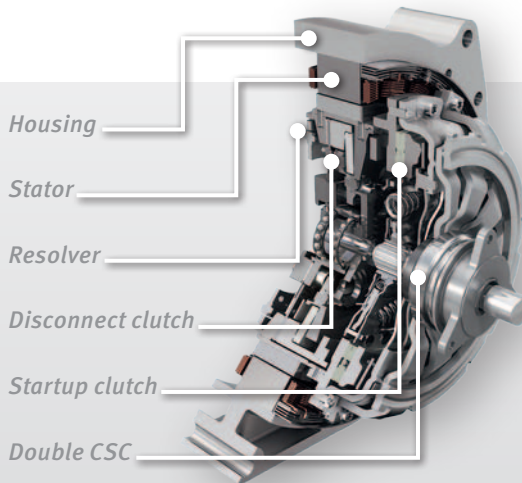
### DESCRIPTION AND CUSTOMER BENEFITS

- Hybridization of vehicles with manual transmissions
- Attractive CO<sub>2</sub> reduction potential and entry-level electrification
- Comfortable restart of internal combustion engines with impulse clutch
- One actuation system controls both the startup and disconnect clutch
- No additional damper required

## 48V electric axle

### DESCRIPTION AND CUSTOMER BENEFITS

- Developed for all vehicle segments, both for FWD and RWD
- 2-speed planetary transmission with dog clutch
- Neutral position to disconnect the electric motor
- Standardized electromechanical actuator
- Power electronics integrated into the motor
- Optional torque vectoring functionality



# Hybrid Modules

## Description

- P2 Hybrid module with clutch system integrated into the rotor
- Includes electric motor, DMF damper, dry disconnect clutch, and electromechanical actuator in an extremely compact design
- Developed for both full and plug-in hybrids with N/S or E/W configurations

## Product benefits

- High flexibility with regard to adaptation to suit various engines and transmissions
- High energy efficiency due to the dry disconnect clutch with reduced drag losses and self-locking electromechanical clutch actuator
- Suitable for application in transmissions of every kind

## ADVANTAGES

- CO<sub>2</sub> reduction
- Comfort during restarting of the internal combustion engine
- Additional drive train performance

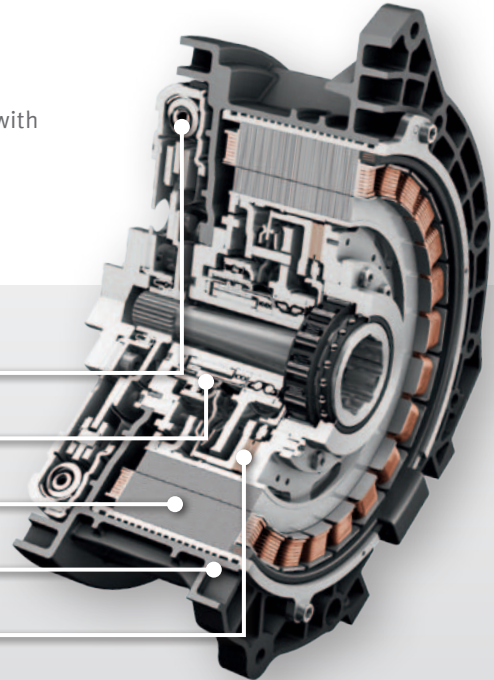
*Damper*

*Actuator*

*Electric motor*

*Housing*

*Disconnect clutch*



# Electric Axles

## Description

- Modular electric axle with neutral position that allows one or two gear stages and the option of torque vectoring
- Integrated control unit for actuation and power electronics for torque vectoring

## Product benefits

- Compact coaxial design based on Schaeffler's planetary transmission and lightweight differential technology
- Developed for both hybrid vehicles and battery-electric vehicles
- Integrated torque vectoring for sporty driving and increased safety

## ADVANTAGES

- CO<sub>2</sub> reduction
- Good packaging
- High performance
- Improved driving dynamics

*Torque vectoring motor*

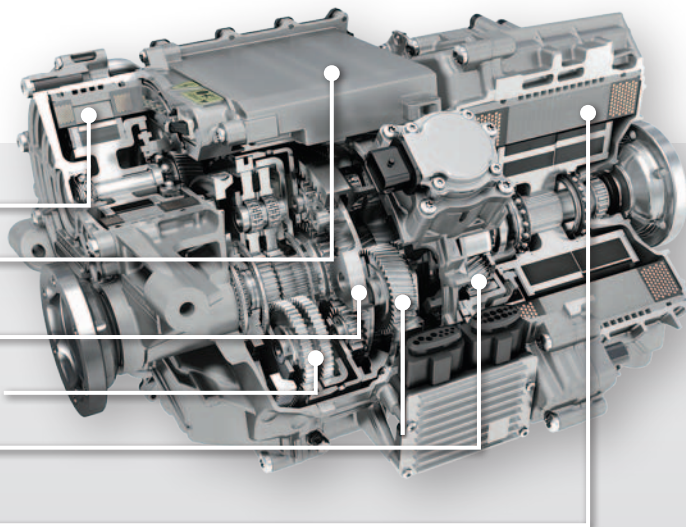
*Torque vectoring power electronics*

*Lightweight differential*

*Torque vectoring transmission*

*Transmission with 2 gear stages*

*Traction motor*



# E-Wheel Drive

## Description

Highly-integrated wheel hub drive with all components required for drive and braking installed inside the wheel rim, i. e. electric motor, power electronics, brake, and cooling system.

## Product benefits

Drive system for new vehicle concepts – specifically designed for urban use:

- Space-saving drive train concept
- Increased maneuverability due to the larger wheel steering angle
- Improved driving agility due to electric torque vectoring
- Cooperative wheel slip control and expanded ESP/ABS functions for increased safety

## ADVANTAGES

- Emission-free mobility
- New vehicle platforms
- Driving dynamics

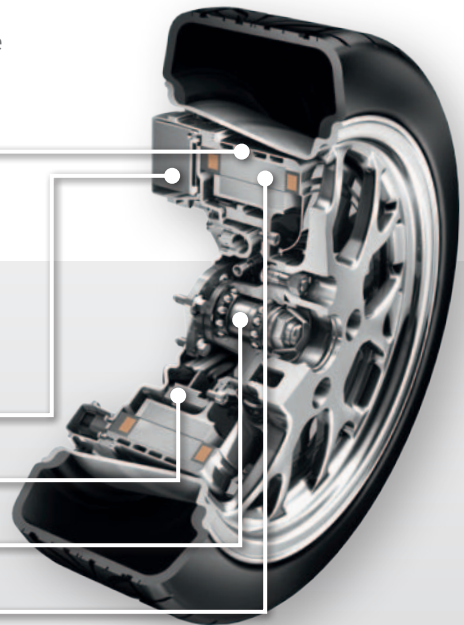
*Liquid cooling* \_\_\_\_\_

*Power electronics* \_\_\_\_\_

*Brake* \_\_\_\_\_


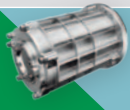
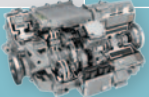



*Wheel bearing* \_\_\_\_\_




*Electric motor (internal rotor)* \_\_\_\_\_





# Recommended Applications for Schaeffler's Electric Mobility Products

	MICRO HYBRID	MILD HYBRID	FULL HYBRID	PLUG-IN HYBRID	ELECTRIC VEHICLE
FUNCTIONALITY	Start-stop	Boosting, recuperation	E-creeping, stop and go, e-sailing	Electric driving	Electric driving in all operating conditions
CHARGING FROM GRID				yes	yes
ELECTRIC MOTOR OUTPUT	0.5 ... 8 kW	8 ... 20 kW	10 ... 50 kW	30 ... 125 kW	30 ... 125 kW
VOLTAGE	12 ... 48V	48 ... 280V	48 ... 400V	200 ... 400V	200 ... 400V
RANGE OF ELECTRIC OPERATION			0.1 ... 5 km	10 ... 50 km	> 75 km
CO <sub>2</sub> REDUCTION	4 ... 6%	12 ... 16%	15 ... 25%	> 50%	up to 100%
E-WHEEL DRIVE					
ELECTRIC AXLE					
HYBRID MODULE					
START-STOP					

	12V
	48V
	HIGH VOLTAGE

**Schaeffler Technologies GmbH & Co. KG**

Industriestrasse 1 – 3  
91074 Herzogenaurach  
Germany  
Internet [www.schaeffler.com](http://www.schaeffler.com)  
E-mail [info@schaeffler.com](mailto:info@schaeffler.com)

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