

We pioneer motion

# EFFICIENCY FACTOR: THERMAL MANAGEMENT

The 4in1 e-axle – a highly integrated and compact complete system for the powertrain

**Thermal management** plays a central role in increasing the range of electric vehicles. In the **4in1 e-axle**, Schaeffler integrates the thermal management system together with the electric motor, transmission, and power electronics into one compact unit. This makes the axle drive more compact and lighter and ensures greater comfort. A particularly efficient thermal management system also ensures that a car travels further on one battery charge and charges faster.

## 4IN1: EFFICIENCY ON ALL LEVELS

The 4in1 e-axle is more than just a **propulsion system plus thermal management**: Its **holistic architecture** integrates four subsystems that were previously located in different parts of the vehicle – and uses its own **waste heat to increase efficiency**.



## BENEFITS OF THE 4IN1 SYSTEM

Efficiency, performance, comfort, installation space, production costs. The new and integrated 4in1 concept offers many **advantages for automotive manufacturers and customers**:



**10 % lower costs**  
reduction of parts, weight, assembly effort



**Increased efficiency**  
14 % less energy consumption through waste heat recovery and CO<sub>2</sub> heat pump



**Better convenience**  
high-performing climatization of passenger compartment, battery and drive components



**Integration into the space of the 3in1 e-axle system possible**  
including thermal management

## HIGHLIGHTS OF THE 4IN1 E-AXLE



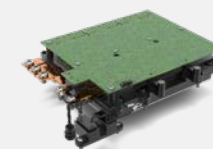
### E-motor

- high-speed with up to 18,500 rpm
- with Direct Slot Cooling



### Gear box

- with highly efficient spur gearing design
- with combined actuator for parking lock and e-motor cooling



### Power electronics system

- with highly efficient silicon carbide semiconductors
- central control of propulsion and thermal management system



### Thermal management

- with CO<sub>2</sub> heat pump for efficient climatization of the vehicle

2in1

3in1

4in1