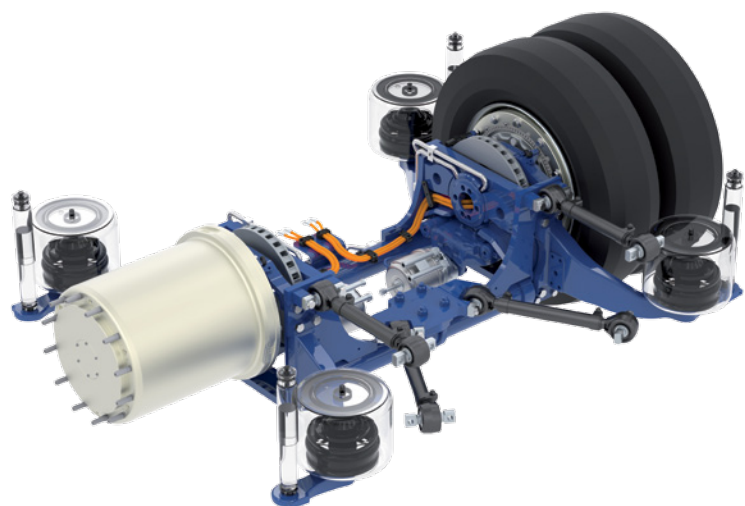


Movement by Perfection



The Royal League in ventilation, control and drive technology



**ZAwheel<sup>®</sup>**

Efficient, noiseless and 100% emission-free –  
the gearless electric in-wheel hub drivetrain for  
city, airport, sightseeing and double-decker buses



# Through the city without any fine dust

Learn where the fine-dust debate ends and a clean future begins on the following pages.



**ZAwheel®**  
**The new generation**



Many possible applications for ZAwheel®:  
city buses, sightseeing buses, refuse-collecting  
vehicles, airport buses and much else



The pioneering high-tech drivetrain system designed as a direct single-wheel drive (electric in-wheel hub drive) is delivered ready for installation as a complete axle drive module. Using direct torque technology enables buses and commercial vehicles to move through cities and municipalities without producing any noise or emissions, while saving 75% energy as compared to diesel-powered vehicles. **ZAwheel® needs no combustion engine and no gear**, which offers new options for interior design and increased space for passengers.

**The positive balance**

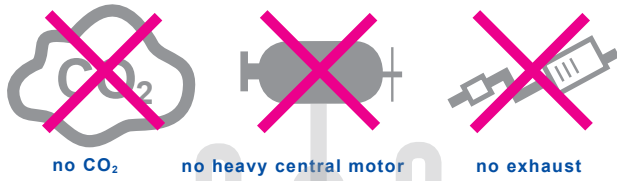
- Vehicle-neutral drive  
→ **Installation in various bus types and vehicles**
- Gaining space + full low-floor setup  
→ **Better passenger utilisation + high comfort + continuous accessibility**
- High drive efficiency  
→ **Battery size can be reduced**  
→ **More mileage**
- Lower consumption during operation  
→ **Reduced operating costs + energy savings**
- Direct drive  
→ **Low maintenance, service-friendly + market-leading low noise level**
- Online monitoring system  
→ **Relevant data such as vehicle operations as well as savings can be called in real time on the PC or Smartphone**

„ZAwheel® in the bus makes me very comfortable“

**ZAwheel® next generation**

**ZAwheel®** The drive system with the highest energy savings

ZAwheel® is clearly at the top of the energy balance: The list of advantages includes energy savings of approx. 75% as compared to diesel-engine-powered buses and up to 20% energy savings as compared to other engine concepts, such as the central motor.



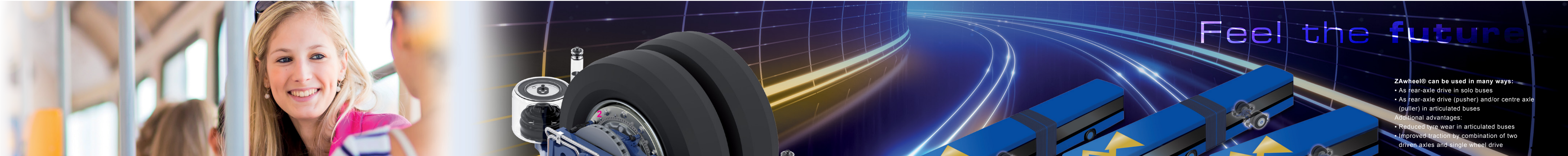
**First place and winner in the energy balance:**



**The losers:**

Central motor	up to 20% worse energy balance
Diesel engine	up to 75% worse energy balance

**ZAwheel®** makes you up to 20% more successful than other motor concepts would

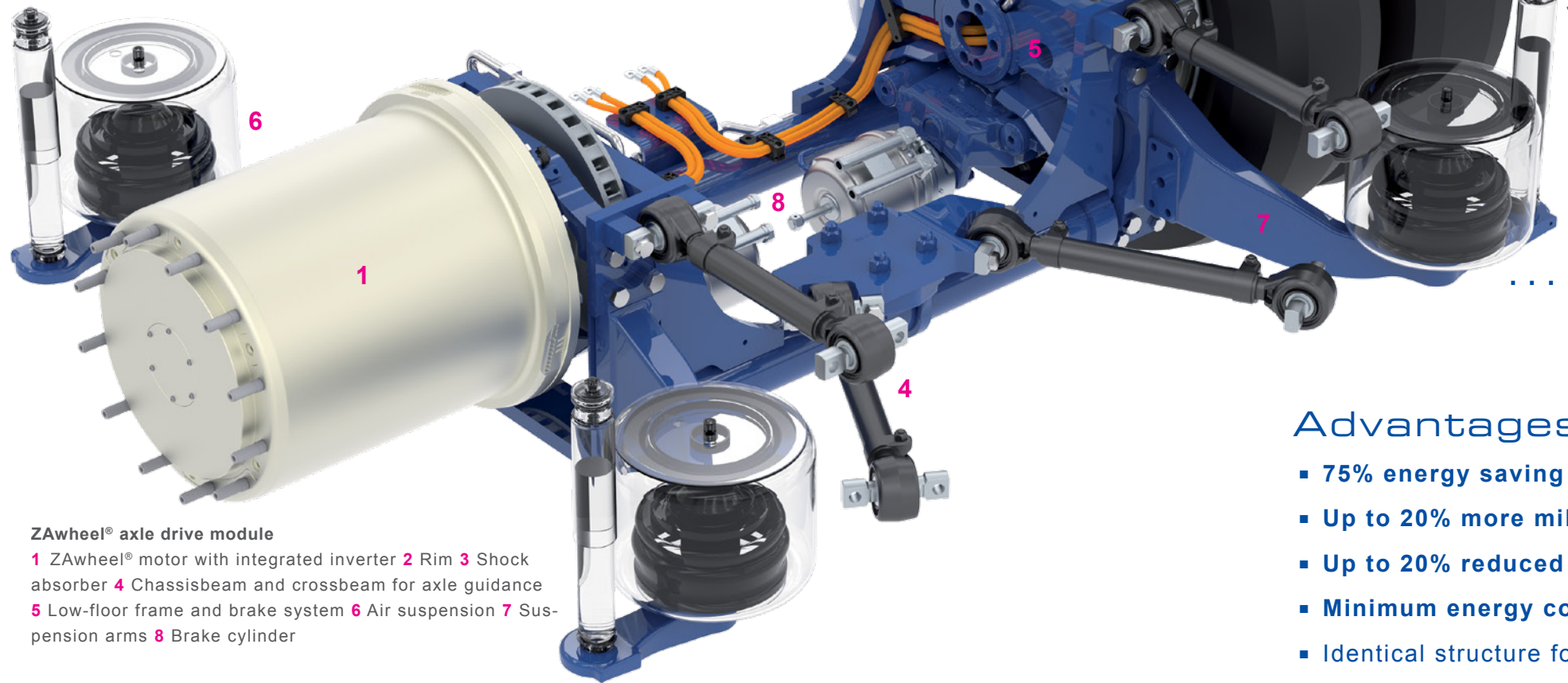


**ZAwheel® can be used in many ways:**

- As rear-axle drive in solo buses
- As rear-axle drive (pusher) and/or centre axle (puller) in articulated buses

Additional advantages:

- Reduced tyre wear in articulated buses
- Improved traction by combination of two driven axles and single wheel drive



ZAwheel® axle drive module  
1 ZAwheel® motor with integrated inverter 2 Rim 3 Shock absorber 4 Chassisbeam and crossbeam for axle guidance 5 Low-floor frame and brake system 6 Air suspension 7 Suspension arms 8 Brake cylinder

**Drive module**  
Vehicle type: **city bus, airport bus**  
Application: **solo/articulated bus**  
Execution: **low-floor axle**  
Drive: **single-wheel direct drive, gearless**  
Axle load: **13,000 kg**  
Axle weight: **440 kg (without attachments)**  
Sensors: **ABS, tachometer**  
Rim size: **22.5" x 8.25"**  
Tyre size: **275/70R22.5**  
Efficiency: **Approx. 90 % (Battery to Wheel)**

**In-wheel hub motor ZAwheel® V1.0**  
Voltage range: **400 - 750 VDC**  
Nominal voltage: **625 VDC**  
Nominal battery current: **230 A**  
Nominal power: **120 kW**  
Nominal torque: **3 700 Nm**  
Speed range: **0 ... 500 rpm**  
Max. efficiency: approx. 92 %  
Sensors: **temperature, speed**  
Cooling type: **water-cooled**  
Electronics: **integrated power electronics**

**Advantages at a glance:**

- 75% energy saving as compared to diesel vehicles
- Up to 20% more mileage
- Up to 20% reduced battery size
- Minimum energy consumption: approx. 0.6 ... 0.8 kWh/km
- Identical structure for left-hand and right-hand drive vehicles
- Improved space utilization in the rear (additional seats and/or standing places)
- 90% noise reduction (< 60 dBA at 30 km/h)
- Low-maintenance and service-friendly
- Best drive efficiency of approx. 90% (Battery to wheel)
- Can be used for new vehicles and for retrofitting
- Clearly improved driving comfort
- Online monitoring – at any time



From a single source  
**Highly intelligent control unit**

The ZAwheel® control unit developed by ZIEHL-ABEGG permits procurement of all system components of the axle drive module from a single source. The ZAwheel® control unit contains hard- and software and manages the complex interaction between the E-components, which makes the E-drive system even more efficient.

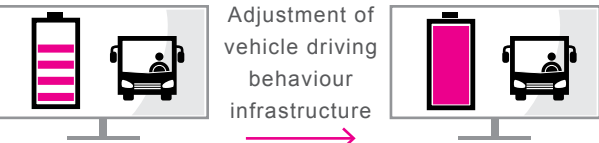
**ZIEHL-ABEGG RETROFITBLUE**  
Modernising the fleet

**Lower your operating costs by modernising your fleet with ZAwheel®**

ZAwheel® pays off even for pre-existing buses; Retrofitblue measures are amortised in a very short time. Diesel engines from city, airport, sightseeing and double decker buses as well as commercial vehicles for cargo transportation and special vehicles in the field of underground mining can be replaced easily. The positive effect is directly noticeable in terms of air improvement and noise reduction

**Opens up unexpected perspectives for new or converted vehicles (RETROFITBLUE)**

**Pursue the saving course of your buses!**



Online vehicle monitoring in real time for better ranges and reliability of the vehicle at concurrently reduced maintenance costs and lower unplanned downtimes.

- Precise online range forecast across the entire day's deployment.
- All vehicle functions are reviewed online.
- Real-time analyses will reliably discover irregularities in advance to permit proactive action.
- The system offers a new dimension of transparency in diagnosis, analysis and monitoring of your buses.



# The Royal League

