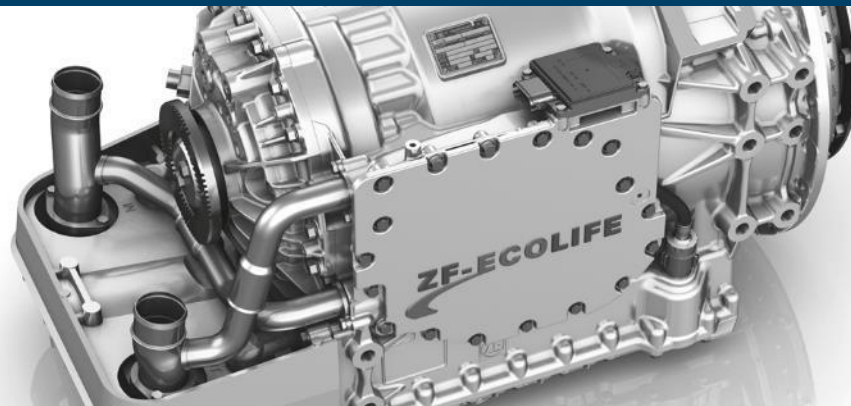


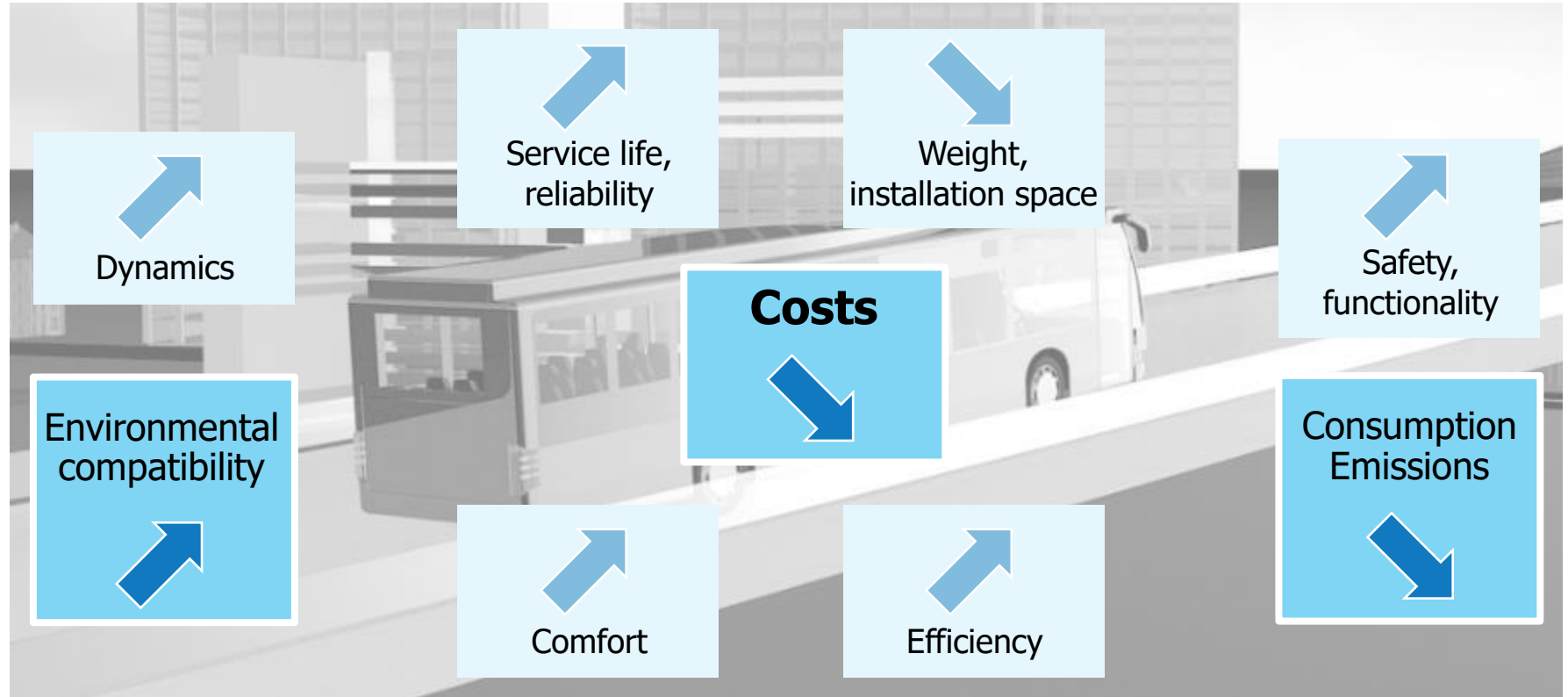


EcoLife mit TopoDyn Life

Commercial Vehicle Technology



Bus Driveline and Transmission Requirements



Costs and the Environment

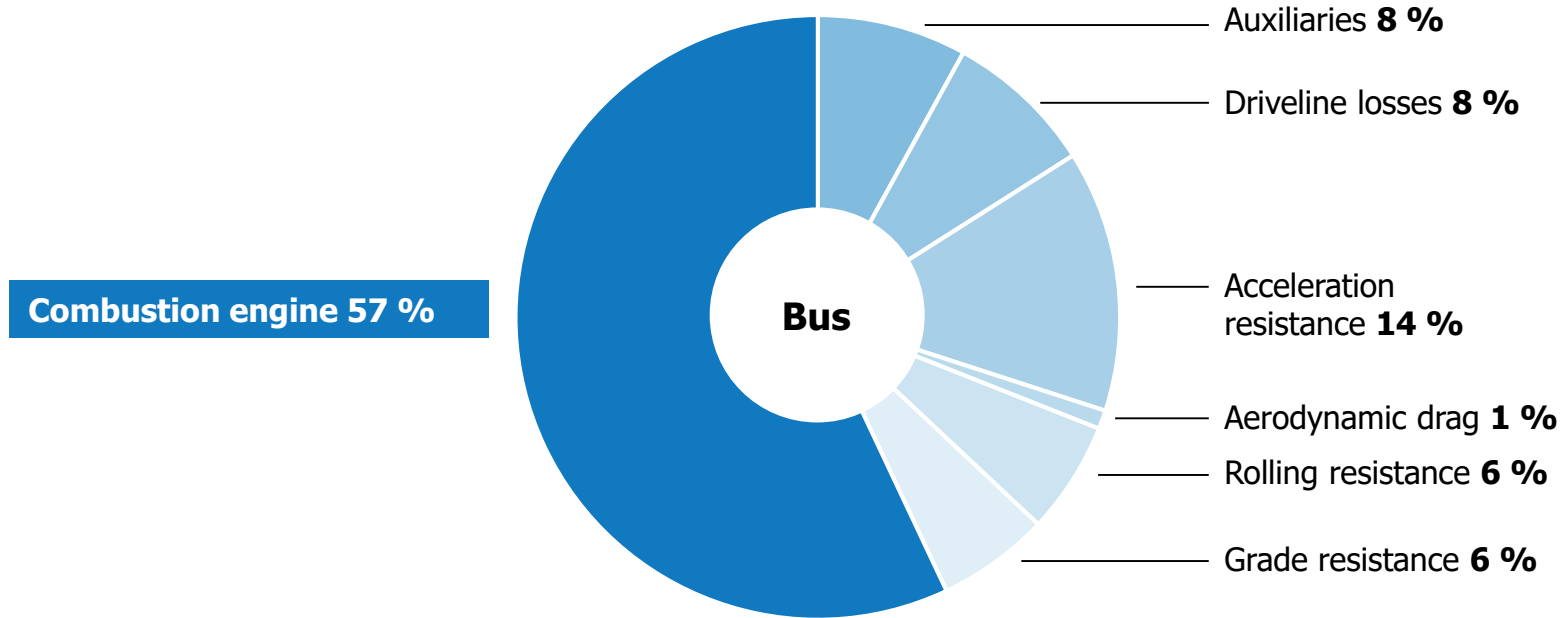
What can Bus Manufacturers and ZF do?

Objective: To reduce all vehicle emissions!

- **Fuel consumption / Engine emissions (CO₂, NO_x, etc.)**
- Brake particles
- Used oil
- Vehicle noise



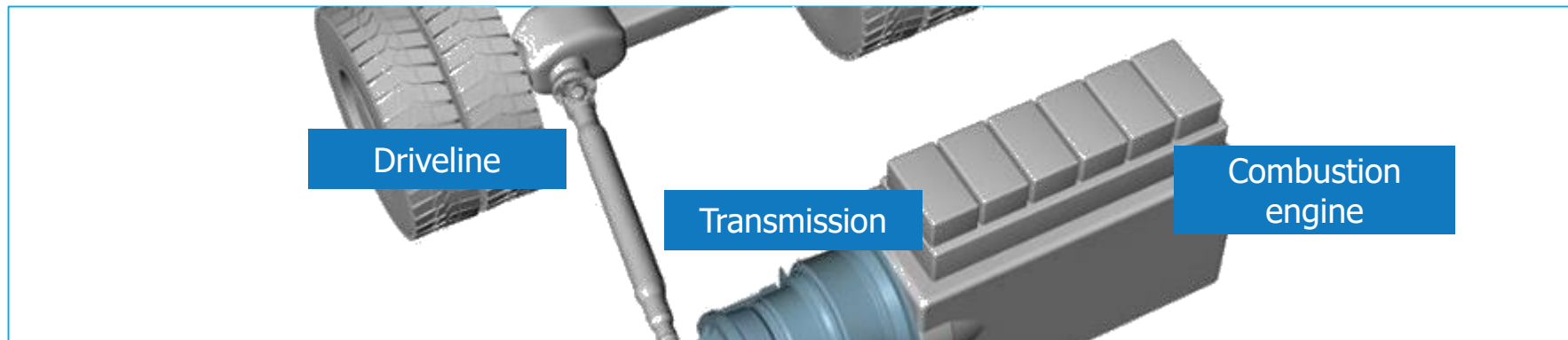
Distribution of Energy Losses



Basis: City bus 18 m, 24 t total weight, with Ecomat and TopoDyn; mixed routes

Fuel Consumption and Emissions

ZF Influencing Factors



Driveline

- Efficiency
- Weight
- ...

Transmission

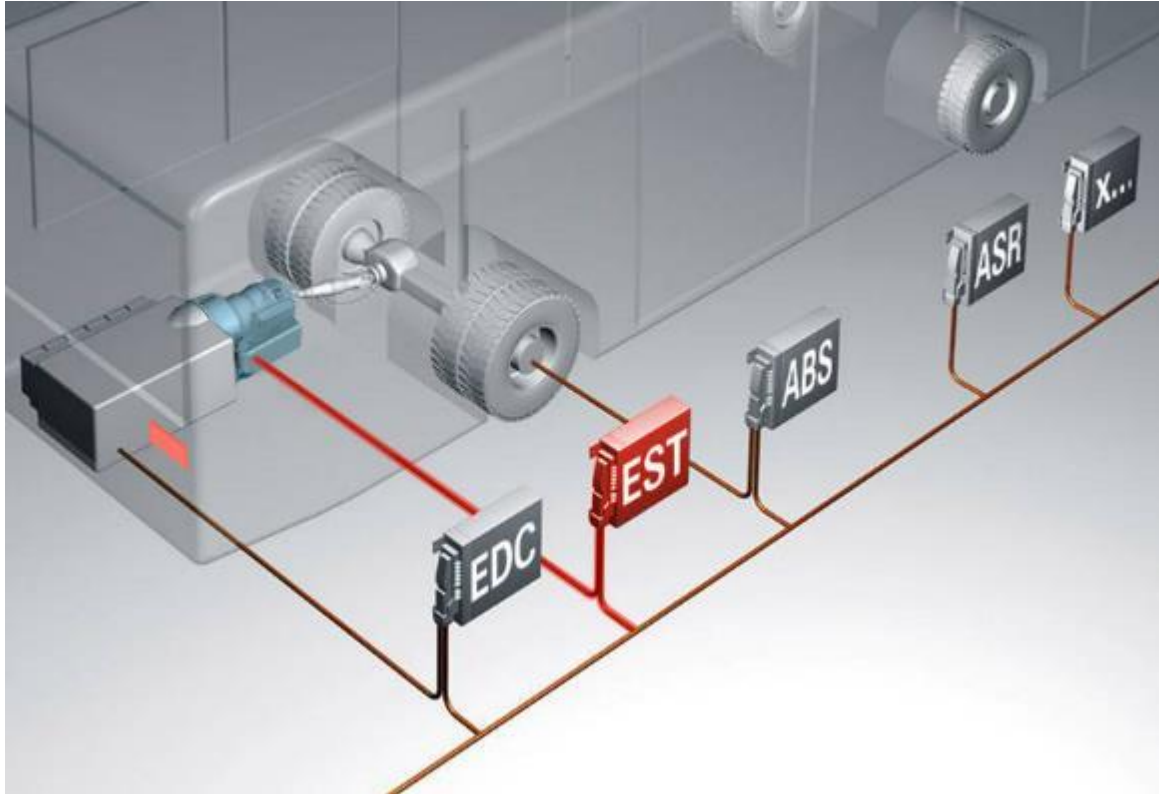
- Number of gears, ratios
- **Driving strategy**
- Efficiency
- Idling losses
- ...

Combustion engine

- Optimization of the characteristic map
- Avoiding idle position
- ...

ECU Transmission Control Unit

Factors Influencing the Operating Strategy



Basic data

- Engine torques and speeds
- Load or brake requirements
- Acceleration
- Resistance figures
- **Terrain/Road pattern**
- Vehicle data, moments of inertia

Consideration of Topography

Generations of Powershift Transmissions

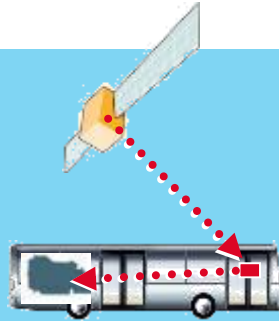
Software	Standards	TopoDyn	TopoDyn Life
Transmission generation	Ecomat Ecomat 2 / 2 Plus Ecomat 4	Ecomat 4 2004	EcoLife 2008
Recording the topography	no	Calculation	Calculation
Active drive program	Defined shift program for the entire route	Automatic changes of several shift programs	Continuously variable adjustment of the shift points

Competition

Calculating the Gradient

Other ways to calculate the gradient of the vehicle:

GPS



Sensor



Data source

GPS / route information

- Different variants on the market
- Additional electric interfaces
- Systems must be compatible
- Load can hardly be considered

Additional sensors

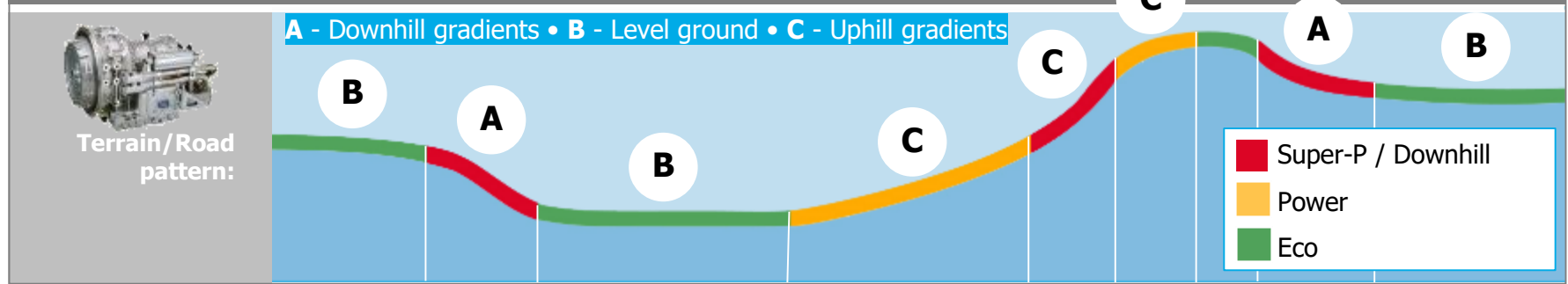
- Air-pressure sensor
- Determination of mass via air spring pressure is inaccurate
- A reinforced level of networking is required

Advantages /
disadvantages

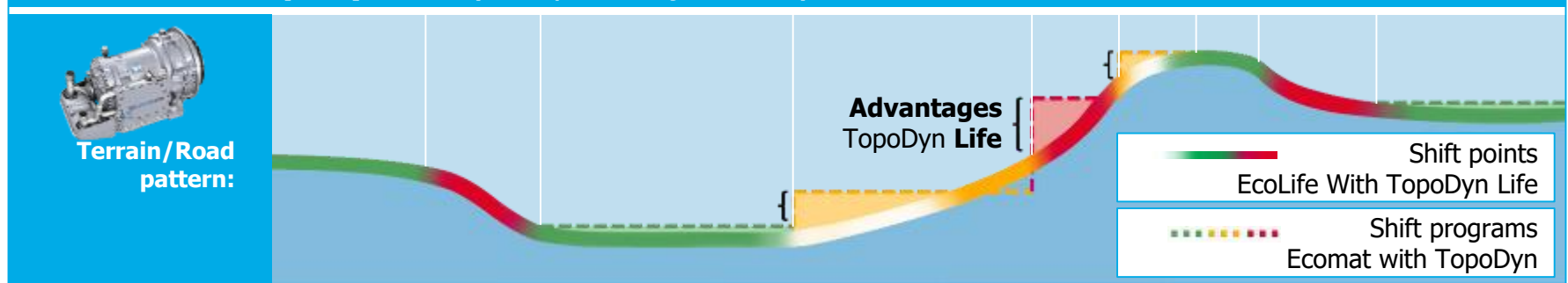
Ecomat With TopoDyn

EcoLife With TopoDyn Life

Ecomat with TopoDyn (shift program change)

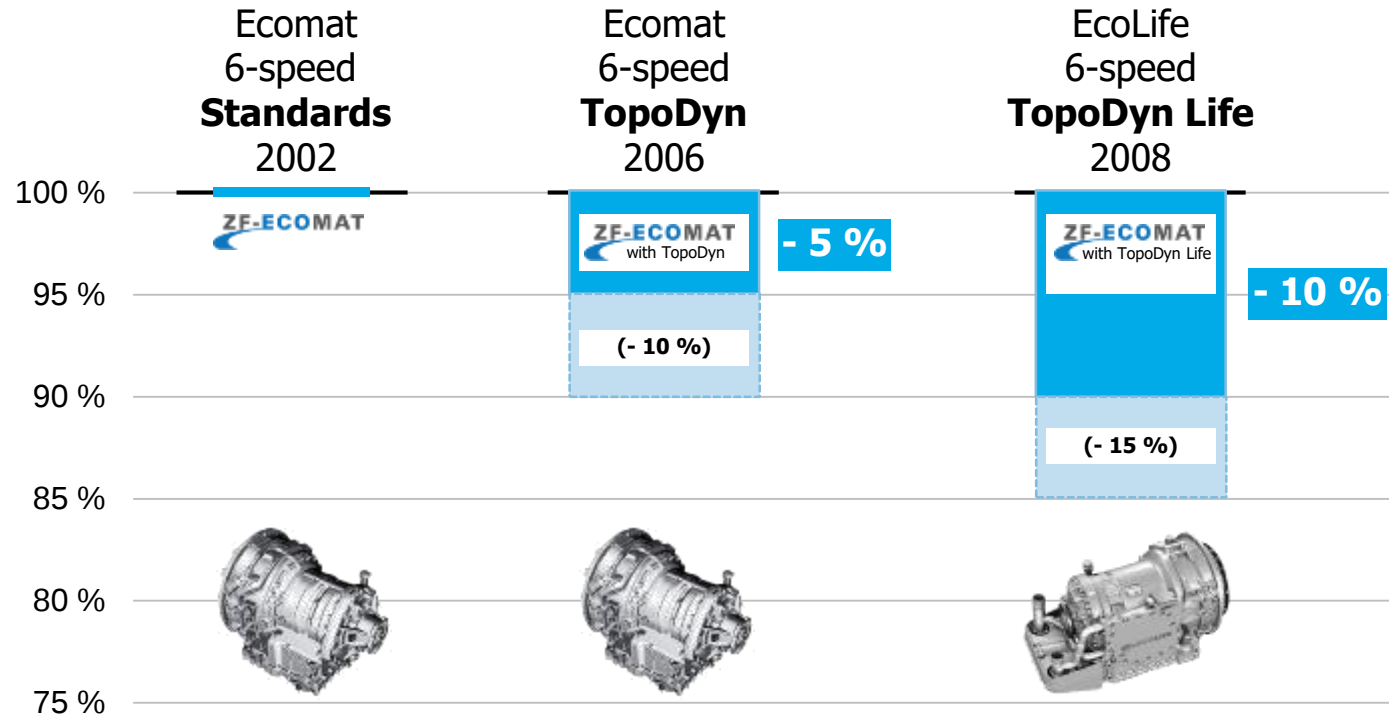


EcoLife With TopoDyn Life (shift point adjustment)



Reduction in Fuel Consumption

Powershift Transmission Generations



EcoLife With TopoDyn Life

Possible Savings (vs. TopoDyn)

City bus fleet

A sample fleet of 400 articulated buses

400 articulated buses: Consumption:
73.5 l / 100 km (*3.2 miles per US gallon*)



Sample operating conditions:

- 10 years
- 700,000 km
- 70,000 km / year
- 434,960 miles
- 43,496 miles / year

Sample calculation:

Results are based upon estimated operating conditions
(1.50 €/l; 5.68 €/US gallons).

Your results may vary.

Annual fuel costs

(Ecomat TopoDyn)

EcoLife
(- 5 % =)

400 x articulated city buses

€ 29.40 million

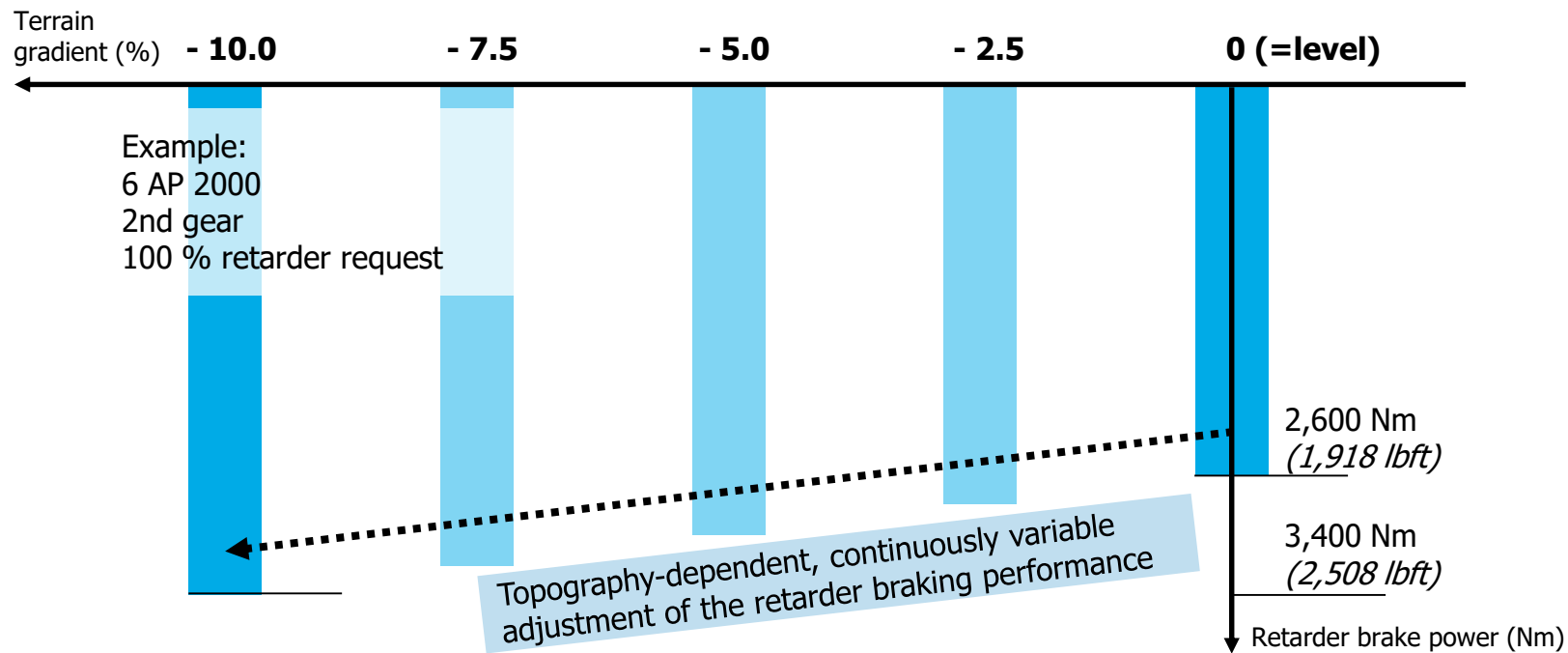
- 1,47 Mio €



EcoLife With TopoDyn Life

Adjusting the Retarder Braking Performance

TopoDyn Life is also able to adjust the braking performance of the integrated primary retarder depending on the topography!



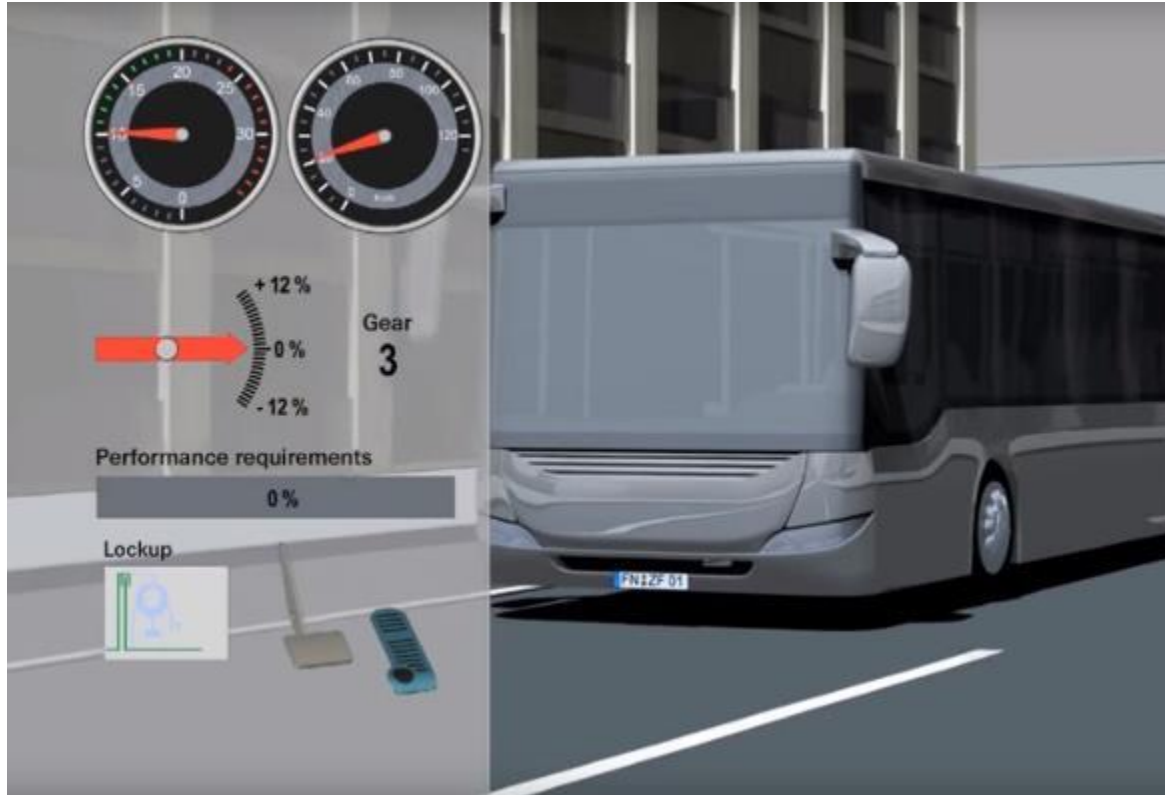
EcoLife With TopoDyn Life

Customer Value

- Optimum fuel consumption
- Noise reduction
- Excellent dynamics
- Increased flexibility in operation
- Maximum braking performance downhill
- Reduced influence by the driver
- TopoDyn Life - easy and safe



TopoDyn Life Animation



EN:

<https://www.youtube.com/watch?v=0u2RLQiBvNg>