THINK ELECTRIC.
THINK MAGNA.
LET'S DRIVE INTO THE FUTURE TOGETHER

The automotive future has many directions. However, it only has one destination: driving as efficiently and economically as possible – whether it’s on the highway, on a country road, or downtown. At Magna Powertrain, we are committed to environmental protection, vehicle efficiency, and new mobility concepts increasing the quality of life around the globe. As one of the world’s leading automotive suppliers, we are always thinking far ahead. We know that we have to continuously work with our customers on sophisticated solutions for the challenges of industry and environment. As an answer to these questions, we developed our etelligentDrive Systems that are well prepared for any future eMobility requirement.

THINK eMOBILITY.
THINK etelligentDrive.

TABLE OF CONTENTS

4 GLOBAL MEGATRENDS
6 POWERTRAIN ARCHITECTURES
8 OUR EXPERIENCE
10 ROAD TO eMOBILITY
12 48 VOLT HYBRID
16 PLUG-IN HYBRID
20 PURE ELECTRIC
24 ELECTRIFIED COMPONENTS
28 PLATFORM SOLUTIONS
30 FUTURE OUTLOOK
Global automotive trends serve as our signposts – and we have reached many milestones on our way to powertrain electrification. We actively seek out these trends and respond to them with our innovative eTelligence solutions. By continually confronting future challenges, we strive to be the first on the road and the first to cross the finish line of the eMobility race. For us, the following four main trends shape the road to the automotive future and determine our direction.

**Environmental impact**
Federal CO2 regulations and additional local requirements will significantly change future vehicle architectures and individual driving behavior. Beginning in 2020, the permitted emissions for new vehicles in the EU cannot exceed 95 g CO2/km. Powertrain electrification will be necessary to meet these requirements.

**Customer of tomorrow**
While customers’ mobility needs are becoming increasingly individualized, there are clear trends towards more safety, higher flexibility, more automation and connection to mobile services. The customer of tomorrow also expects an eVehicle to provide high performance and to be fun to drive. All those requirements make powertrain architectures more diverse and complex, and impact all major powertrain systems, including the driveline and transmission.

**Urbanization & new markets**
Increasing urbanization and the rise of megacities, especially in Asia, are creating the need for new mobility concepts that provide low-noise, zero-emission vehicles to ensure a high quality of urban life. As one of the expanding automotive markets, China alone has increased the number of electric and plug-in hybrid vehicles by 102% from 2015 to 2016.

**Conserving resources**
On the one hand, rising demand for crude oil and the increasing difficulties in supplying it force us to deal even more consciously and efficiently with existing fossil fuels. On the other hand, other resources like rare earth metals or lithium need to be considered when talking about electrification. The advances in mobile technology and a rapidly expanding public infrastructure of charging stations facilitate convenient access to eMobility that will speed up the availability of clean transportation solutions.
E-Mobility makes life easier, and powertrain architectures more complex.

With the trend towards electrification, a wide variety of powertrain architectures is rapidly emerging. In the next years, there will be more than 40 different variations of powertrain architectures available on the market. The goal is to meet the tightening emission standards and to fulfill the consumer demands for comfort, performance and driving fun. These different variations of powertrain electrification offer numerous ways to achieve cost targets and CO2 savings.

The increasing diversification and complexity of powertrain architectures, combined with uncertainties in production volumes, demand new strategies and solutions. Standardization and platform concepts for different drivetrain architectures are the key to cost efficiency and future success.

**POWERTRAIN ELECTRIFICATION**

**E-Mobility Makes Life Easier, and Powertrain Architectures More Complex.**

With the trend towards electrification, a wide variety of powertrain architectures is rapidly emerging. In the next years, there will be more than 40 different variations of powertrain architectures available on the market. The goal is to meet the tightening emission standards and to fulfill the consumer demands for comfort, performance and driving fun. These different variations of powertrain electrification offer numerous ways to achieve cost targets and CO2 savings.

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**Powertrain Electrification**

**P0**
- eMachine is assigned to the transmission input shaft between ICE and coupling (P1)
- No electric driving possible
- eMachine is connected with a belt drive to the ICE
- Recuperation
- Start-Stop functionality
- Fuel saving potential 3-7 %

**P1**
- eMachine is assigned to the transmission input shaft between coupling and transmission
- Boosting for improved acceleration
- No change in installation length
- No additional clutch between ICE and transmission required
- Torque fill capability
- Start-Stop functionality
- Pure electric driving enabled in certain driving situations
- Fuel saving potential 10-12 % for 48 Volt systems, up to 23 % for high voltage systems

**P2**
- eMachine is integrated in the hybrid transmission
- No change in installation length
- No additional clutch between ICE and transmission required
- Boosting for improved acceleration
- Torque fill capability
- Start-Stop functionality
- Pure electric driving enabled in certain driving situations
- Fuel saving potential 10-12 % for 48 Volt systems, up to 23 % for high voltage systems

**P3**
- eMachine is assigned to the transmission output shaft (either post transmission or on the rear axle)
- Enables improved driving dynamics
- Pure electric driving enabled in certain driving situations
- Recuperation
- Fuel saving potential up to 12 % for 48 Volt systems

**P3a**
- eMachine is assigned to the transmission input shaft between coupling and transmission
- Boosting for improved acceleration
- No change in installation length
- No additional clutch between ICE and transmission required
- Torque fill capability
- Start-Stop functionality
- Pure electric driving enabled in certain driving situations
- Fuel saving potential 10-12 % for 48 Volt systems, up to 23 % for high voltage systems

**P3b**
- eMachine is assigned to the transmission output shaft (either post transmission or on the rear axle)
- Enables improved driving dynamics
- Pure electric driving enabled in certain driving situations
- Recuperation
- Fuel saving potential up to 12 % for 48 Volt systems

**P4**
- For Hybrid (P4) or Battery Electric Vehicle (EV) applications
- Axle drive with integrated eMachine and optionally integrated inverter
- Enables improved driving dynamics through eAWD functionality
- Pure electric driving enabled
- Recuperation
- CO2 reduction potential from 10-12 % for 48 Volt systems, through 25 % for high voltage solutions to 100 % for BEV applications

**P2.5**
- eMachine is integrated in the hybrid transmission
- No change in installation length
- No additional clutch between ICE and transmission required
- Boosting for improved acceleration
- Torque fill capability
- Start-Stop functionality
- Pure electric driving enabled in certain driving situations
- Fuel saving potential 10-12 % for 48 Volt systems, up to 23 % for high voltage systems

**P2.5 Hybridized Transmissions**
- eMachine is integrated in the hybrid transmission
- No change in installation length
- No additional clutch between ICE and transmission required
- Boosting for improved acceleration
- Torque fill capability
- Start-Stop functionality
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**P3 Post Transmission Hybrid**
- eMachine is assigned to the transmission output shaft (either post transmission or on the rear axle)
- Enables improved driving dynamics
- Pure electric driving enabled in certain driving situations
- Recuperation
- Fuel saving potential up to 12 % for 48 Volt systems

**P3b Post Transmission Hybrid**
- eMachine is assigned to the transmission output shaft (either post transmission or on the rear axle)
- Enables improved driving dynamics
- Pure electric driving enabled in certain driving situations
- Recuperation
- Fuel saving potential up to 12 % for 48 Volt systems

**P4 Electric Axles & eDrive Systems**
- For Hybrid (P4) or Battery Electric Vehicle (EV) applications
- Axle drive with integrated eMachine and optionally integrated inverter
- Enables improved driving dynamics through eAWD functionality
- Pure electric driving enabled
- Recuperation
- CO2 reduction potential from 10-12 % for 48 Volt systems, through 25 % for high voltage solutions to 100 % for BEV applications

**Crankshaft Integrated Starter Generator**
- eMachine is assigned to the transmission input shaft between coupling and transmission
- Boosting for improved acceleration
- No change in installation length
- No additional clutch between ICE and transmission required
- Torque fill capability
- Start-Stop functionality
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**Belt Integrated Starter Generator**
- eMachine is assigned to the transmission input shaft between ICE and coupling (P1)
- No electric driving possible
- eMachine is connected with a belt drive to the ICE
- Recuperation
- Start-Stop functionality
- Fuel saving potential 3-7 %

**Belt Integrated Starter Generator**
- eMachine is assigned to the transmission input shaft between ICE and coupling (P1)
- No electric driving possible
- eMachine is connected with a belt drive to the ICE
- Recuperation
- Start-Stop functionality
- Fuel saving potential 3-7 %

**Starter Generator**
- eMachine is assigned to the transmission input shaft between ICE and coupling (P1)
- No electric driving possible
- eMachine is connected with a belt drive to the ICE
- Recuperation
- Start-Stop functionality
- Fuel saving potential 3-7 %

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- eMachine is assigned to the transmission input shaft between ICE and coupling (P1)
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Magna Powertrain is one of the preferred partners for all electrified powertrain systems. With our wide experience and innovative technologies, we are driving the transformation towards electrification in the automotive industry. Our complete system expertise is based on a unique combination of engineering and development know-how.

Complete eDrives from a single source
Our serial production competence covers all key components for modern eDrive systems. Our diverse product portfolio covers the full range of transmissions, gearboxes, axles, eMotors, inverters, control software and engineering solutions. With our profound manufacturing and development expertise we are able to deliver a modular, scalable kit for electric drives according to the specifications of our global customers.

Our cross-platform and cross-systems approach provides a safeguard against volume volatility in the eMobility market. With our World Class Manufacturing standards and our global footprint, we are able to meet customer requirements in the key eMobility markets of Europe, Asia, and North America.

Customer Benefits
• Complete system solutions with platform modules
• Serial production competence for eMotor, main transmission, gearbox/axle and inverter
• One stop shop (vehicle system architecture, vehicle integration, eDrive systems and sub systems)
• Deep vehicle know-how
• eDrive System expertise
• Global footprint
• Reduced development times
• Fewer interfaces
• Vast vehicle dynamics capability

eDrive Engineering & Services
• Complete system knowledge (motor, inverter, gearbox, software, vehicle integration): well-balanced eDrive system with highest customer benefit
• Advanced, fully-linked virtual tool chain on system level: Cost, weight, efficiency and NVH optimized eDrive system
• NVH development process from simulation to verification in the vehicle (in the loop): eDrives with best NVH behavior
• Full vehicle integration know-how and capabilities: Transfers customers’ perspective to system level
• Consistently and fully linked testing chain on high performance test benches: Well verified eDrive systems ready for the market
Magna Powertrain offers exactly the right driveline solution for all eMobility applications. In addition, we provide electrified internal combustion engine and transmission auxiliaries that operate in a fuel-efficient, on-demand basis, providing significant emissions reduction and fuel savings.

With our wide product portfolio and comprehensive driveline system know-how, we can make your road to electrification a smooth one.
THINK MILD HYBRID.
THINK MAGNA.

DISCOVER eTELLIGENT
48 VOLT HYBRID SOLUTIONS

48 Volt systems by Magna Powertrain provide an answer to multiple challenges like legislation-driven CO₂ reduction and high pressure on costs. These systems allow for electrified drivelines to be brought into high volume applications and provide the required benefit for fleet consumption at reasonable costs.

When putting the focus on electric torque vectoring and traction support, 48 Volt systems also enable improved driving dynamics. These systems even enable functions like autonomous parking and electric sailing for further fuel and CO₂ savings.
GETRAG 6HMT215
All-new small 6-speed manual transmission (6HMT215) with integrated 48 Volt electric motor as cost-efficient hybrid solution.

**TECHNICAL DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. torque</td>
<td>215 Nm</td>
</tr>
<tr>
<td>Weight (dry)</td>
<td>57 kg</td>
</tr>
<tr>
<td>Max. power</td>
<td>15 kW for 60 sec</td>
</tr>
<tr>
<td>Gear ratio spread</td>
<td>up to 6.01</td>
</tr>
</tbody>
</table>

ePOWER SPLIT 4 COST EFFICIENT
The cost-efficient ePower Split 4 supports P3 hybrid architectures. The system consists of a 48 Volt motor / powertrain generator with single-speed power mechanics and a decoupling unit.

**TECHNICAL DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Efficiency improvements</td>
<td>up to 18 % CO₂ @ WLTP</td>
</tr>
<tr>
<td>Max. power</td>
<td>25 kW for 60 sec</td>
</tr>
<tr>
<td>Max. speed</td>
<td>35,000 rpm</td>
</tr>
<tr>
<td>Inverter</td>
<td>up to 36-52 Vdc, up to 350 Aₑₐₑ</td>
</tr>
</tbody>
</table>

eRAD 48 VOLT TRACTION ASSIST
The 48 Volt torque assist eAxle with a high-speed eMachine offers significant CO₂ reduction potential due to high recuperation capability and a minimized efficiency chain.

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</table>
Magna Powertrain offers a variety of tailored solutions for future green mobility without compromising driving fun, performance or safety. The scalable plug-in hybrid systems range from hybridized dual-clutch transmissions to eDrive systems for P4 architectures. The products support pure electric driving, eAWD, torque vectoring and boosting in plug-in hybrid vehicles. Our plug-in hybrid powertrain systems have been in serial production since 2012.

Fuel efficiency and emission reduction are the premises of our plug-in hybrid solutions. Furthermore, our systems provide the highest driving satisfaction, performance, and safety. Magna Powertrain’s platform approach allows for the highest flexibility for meeting our customers’ requirements. This approach keeps us very economical and extremely flexible as electric motors are easy to integrate with various power levels, ranging from 50-250 kW.
The Highly Integrated eDrive System (Low) is a powerful unit designed for HEV and small EV applications. The offset-architecture contains an ASM or PSM eMotor and an integrated high voltage inverter.

**TECHNICAL DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. power</td>
<td>76 kW for 60 sec</td>
</tr>
<tr>
<td>Max. speed</td>
<td>13,500 rpm</td>
</tr>
<tr>
<td>Max. torque @ wheels</td>
<td>1,600 Nm</td>
</tr>
<tr>
<td>Inverter</td>
<td>Nominal Voltage: 360 V, 350 Arms</td>
</tr>
</tbody>
</table>

The Highly Integrated eDrive System (Mid) contains gearbox, ASM or PSM eMotor and inverter. It can be applied to both hybrid and battery electric vehicles.

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<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Max. power</td>
<td>140 kW for 60 sec</td>
</tr>
<tr>
<td>Max. speed</td>
<td>16,000 rpm</td>
</tr>
<tr>
<td>Max. torque @ wheels</td>
<td>3,800 Nm</td>
</tr>
<tr>
<td>Inverter</td>
<td>Nominal Voltage: 360 V, 500 Arms, with integrated park lock</td>
</tr>
</tbody>
</table>

The Highly Integrated eDrive System (High) provides a very powerful eDrive. Containing a PSM motor, it meets the demands for highest performance and driving fun.

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<table>
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<tr>
<th>Parameter</th>
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</tr>
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<tbody>
<tr>
<td>Max. power</td>
<td>253 kW for 30 sec</td>
</tr>
<tr>
<td>Max. speed</td>
<td>15,000 rpm</td>
</tr>
<tr>
<td>Max. torque @ wheels</td>
<td>5,300 Nm</td>
</tr>
<tr>
<td>Inverter</td>
<td>Nominal Voltage: 360 V, 960 Arms, with integrated park lock</td>
</tr>
</tbody>
</table>

ASM (asynchron machine)
PSM (permanent excited e-machine)
THINK PURE ELECTRIC.
THINK MAGNA.

EXPLORE eTELLIGENT eDRIVES

Magna Powertrain’s pure electric portfolio covers the entire range, from single components to complete systems – from mechanical eAxles up to highly integrated eDrives.

The eDrive provides 100% of its torque immediately, without the lag found in the torque curves of conventional boosted or non-boosted ICE platforms. Thus, the highest driving fun and dynamics are perfectly combined with environmental friendliness by zero-emissions driving.

Magna Powertrain’s eDrive platform approach provides the highest flexibility using cross-project synergies with maximum scalability from 50-250 kW.
The Highly Integrated eDrive System (Low) is a powerful unit designed for HEV and small EV applications. The offset-architecture contains an ASM or PSM eMotor and an integrated high voltage inverter.

**Technical Data**
- Max. power: 76 kW for 60 sec
- Max. speed: 13,500 rpm
- Max. torque @ wheels: 1,600 Nm
- Inverter: Nominal Voltage: 360 V, 76 kW for 30 s, 350 Arms

The Highly Integrated eDrive System (Mid) contains gearbox, ASM or PSM eMotor and inverter. It can be applied to both hybrid and battery electric vehicles.

**Technical Data**
- Max. power: 140 kW for 60 sec
- Max. speed: 16,000 rpm
- Max. torque @ wheels: 3,800 Nm
- Inverter: Nominal Voltage: 360 V, 500 Arms, with integrated park lock

The Highly Integrated eDrive System (High) provides a very powerful eDrive. Containing a PSM motor, it meets the demands for highest performance and driving fun.

**Technical Data**
- Max. power: 253 kW for 30 sec
- Max. speed: 15,000 rpm
- Max. torque @ wheels: 5,300 Nm
- Inverter: Nominal Voltage: 360 V, 960 A, with integrated park lock

GETRAG 1EDT200 eDrive
The electric drive unit 1EDT200 fits mid-size electric and hybrid vehicles. In addition to the application in electric vehicles the 1EDT200 can be used as a rear wheel drive unit for hybrid vehicles, enabling electric all-wheel drive capability.

**Technical Data**
- Max. torque @ wheels: 2,500 Nm
- Weight (dry): 20 kg
- Installation length: 320 mm
- Transmission ratio: $i = 8.61$ ($8.89$)

GETRAG 1EDT350 eDrive
The modular and compact electric powertrain 1eDT350 was developed for pure electric vehicles from mid-size up to premium class and for different vehicle configurations up to light commercial vehicles.

**Technical Data**
- Max. torque @ wheels: 3,500 Nm
- Weight (dry): 28 kg
- Installation length: 320 mm
- Transmission ratio: $i = 8.61$

GETRAG 2EDT200 eDrive
The electric powertrain unit 2eDT200 for mid-size electric and hybrid vehicles provides with its 2-speed design both a higher acceleration and a higher top speed compared to a 1-speed gearbox.

**Technical Data**
- Max. torque @ wheels: 2,500 Nm
- Weight (dry): 26 kg
- Installation length: 245 mm
- Transmission ratio: $i_1 = 12.06$, $i_2 = 8.6$

The electric drive unit 1eDT200 fits mid-size electric and hybrid vehicles. In addition to the application in electric vehicles the 1EDT200 can be used as a rear wheel drive unit for hybrid vehicles, enabling electric all-wheel drive capability.

**Technical Data**
- Max. torque @ wheels: 2,500 Nm
- Weight (dry): 20 kg
- Installation length: 320 mm
- Transmission ratio: $i = 8.61$ ($8.89$)

The highly integrated eDrive System (Low) is a powerful unit designed for HEV and small EV applications. The offset-architecture contains an ASM or PSM eMotor and an integrated high voltage inverter.

**Technical Data**
- Max. power: 76 kW for 60 sec
- Max. speed: 13,500 rpm
- Max. torque @ wheels: 1,600 Nm
- Inverter: Nominal Voltage: 360 V, 76 kW for 30 s, 350 Arms

The Highly Integrated eDrive System (Mid) contains gearbox, ASM or PSM eMotor and inverter. It can be applied to both hybrid and battery electric vehicles.

**Technical Data**
- Max. power: 140 kW for 60 sec
- Max. speed: 16,000 rpm
- Max. torque @ wheels: 3,800 Nm
- Inverter: Nominal Voltage: 360 V, 500 Arms, with integrated park lock

The Highly Integrated eDrive System (High) provides a very powerful eDrive. Containing a PSM motor, it meets the demands for highest performance and driving fun.

**Technical Data**
- Max. power: 253 kW for 30 sec
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- Max. torque @ wheels: 5,300 Nm
- Inverter: Nominal Voltage: 360 V, 960 A, with integrated park lock

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- Weight (dry): 20 kg
- Installation length: 320 mm
- Transmission ratio: $i = 8.61$ ($8.89$)
WHERE eTELLIGENT DRIVETRAINS MEET SMART COMPONENTS.

At Magna Powertrain, eDrive systems mean more than just our eTelligentDrive systems – it is all the components and infrastructure around them. Our focus are integrated systems and the resulting benefits for the complete vehicle.

We provide electrified components for transmissions and drivelines, thermal management, as well as engine combustion and boosting systems. This unique expertise in integrating systems gives us a head start in the race to eMobility innovations.
ELECTRONIC TRANSMISSION OIL PUMP
Full hybrid transmission functionality (as start-stop, sailing or electric driving) support, thanks to transmission oil supply independent from engine running conditions. Supplement to the mechanical oil pump, significantly reducing fuel consumption and CO₂ emissions. Also applicable for lubrication and cooling of EV drives.

TECHNICAL DATA
Voltage 12 V or 48 V
Power 50 W ~ 600 W
Pressure 1 bar ~ 40 bar
Communication LIN, PWM, CAN

AUXILIARY ELECTRONIC WATER PUMP
Compact lightweight design with high power density and optimized thermal management. It can provide cooling for batteries, inverters, electric motors and other ICE, hybrid and EV circuits.

TECHNICAL DATA
Voltage 12V
Power 25 W ~ 200 W
Communication LIN, PWM, CAN
IP Class IP69K

ePHASER
Ultra-compact, lightweight design. Enlarged phasing range, high accuracy and high dynamics, independent from engine conditions. Reduced CO₂ emissions thanks to its support of effective combustion processes and less oil consumption.

TECHNICAL DATA
Voltage 12 V
Phasing speed >250° CA/s
Phasing range 180° CA
Phasing during cranking yes

PRIMARY ELECTRONIC WATER PUMP
Improved fuel economy and reduced CO₂ emissions thanks to variable coolant flow, faster engine warm-up, better engine temperature control and the ability to reduce pumping power.

TECHNICAL DATA
Voltage 48 V
Max. speed 100,000 min⁻¹
Max. power 7 kW
Acceleration time 250 ms

eSUPERCHARGER
Superior engine dynamics and low-end torque. Integrated power and control electronics. Reduced CO₂ emissions thanks to its support in engine downsizing and downspeeding.

THERMAL MANAGEMENT MODULE
Smart control of multiple coolant circuits. Improved engine efficiency through faster engine heat-up and lower system power losses, leading to better fuel economy and reduced CO₂ emissions.

TECHNICAL DATA
Voltage 12 V
Max current <4 A
Communication LIN, PWM, SENT
IP class IP69K

ELECTRONIC COOLING FAN
Lower power consumption, less weight and reduced emissions. Best-in-class for noise performance and overall efficiency. Wide variety of designs and sizes.

TECHNICAL DATA
Voltage 12 V
Power 300 W ~ 850 W
Communication LIN, PWM
Efficiency >80 %
THINKING IN PLATFORMS MAKES BUSINESS EASIER. AND MORE EFFICIENT.

As one of the leading and most diversified powertrain suppliers in the world, Magna Powertrain follows a consistent platform strategy for both conventional combustion engines and eDrivetrains. This allows us to serve our customers with the entire range of eMobility solutions in our portfolio.

We provide innovative, scalable eDrive solutions with an advanced level of maturity, minimal customizing cost and reduced risk. With our platform approach, we are able to support high-volume global automotive platforms as well as low-volume applications in niche markets—all implemented with reduced time to market and competitive technologies and performance.

Platform benefits:
- eDrive system competence (eMotor, inverter, gearbox)
- Control software
- Optimized overall system expertise
- Compact design
- Fewer interfaces
- Easy integration
Automotive manufacturers always need to think miles ahead – in development as well as in production. To best support automakers with future eMobility solutions, suppliers need to develop completely new ways and mindsets in both areas. Magna Powertrain has already passed important milestones on the road to eMobility, and have charted a clear route to the future.

Drawing on their complete vehicle know-how and extensive eDrive experience, our research and development teams are moving full speed ahead on new innovations and a variety of solutions.

We are thinking beyond tomorrow, for hybrid and pure electric powertrain solutions. We are driven by the need to improve mobility for every era, for everybody, today and in the future.