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21 February 2025

Charge faster, drive further: BMW Group reveals revolutionary electric drive concept with 800V technology for the Neue Klasse

+++ Sixth generation of BMW eDrive technology marks a milestone in electric mobility +++ BMW Energy Master: intelligent central control unit for the fundamentally new high-voltage battery – developed and produced in-house +++ Expertise from the e-mobility value chain in Bavaria and Austria pooled together +++ Innovative and flexible modular principle for electric drive +++

Munich/Landshut. The BMW Group is presenting its next leap forward in the field of electric drive technology – and in the process ushering in a new era of all-electric driving. At the Tech Days event in Landshut, the company has provided some initial insights into the development and production of high-voltage batteries and electric drive systems using the sixth generation of BMW eDrive technology. Every fully electric Neue Klasse vehicle will enjoy the benefits. The first Neue Klasse model will go into series production later this year at Plant Debrecen in Hungary. Below is an overview of the technology highlights:

- The Energy Master intelligent central control unit on the high-voltage battery – developed by the BMW Group and produced at Plant Landshut.
- A new high-voltage battery concept that, together with the BMW cylindrical cell, promises to bring about a technological quantum leap – including significant improvements in energy density, charging speed and range.
- The BMW Group also demonstrates its technology-openness with electric drive systems – through the use of different electric motor types: SSM and ASM.
- A modular approach to electric motor production gives the BMW Group an exceptional degree of flexibility.
- The BMW Group pools together expertise from the entire electric mobility value chain in Bavaria and Austria – from development, via purchasing and production, to recycling.
- The BMW Group demonstrates both technology-openness and full expertise across all areas of electric mobility.

Adopting a technology-open approach while setting the pace in electric mobility

"For the BMW Group, electric mobility is the future and a key area of growth. We are leading the way with this drivetrain technology. At the same time, we are deliberately taking a technology-open approach, recognizing that mobility needs vary between different regions of the world," explains Dr Joachim Post, Member of the Board of Management of BMW AG, Purchasing and Supplier Network. "We want to offer our customers the best drive concept for every need. It is possible to do both: offer the best drive technology for every need and be at the forefront of electric mobility."

Content & Short-Cut:

- High-voltage battery and Energy Master for Gen6 P. 2
- Electric drive system of Gen6 P. 6

High-voltage battery and Energy Master for Gen6**Slimmer, faster, further: the high-voltage batteries for Gen6**

With the new sixth-generation BMW eDrive technology (Gen6 for short), the BMW Group is making a technological quantum leap. Improvements on the product side include a 30% faster charging speed and 30% increase in range, with certain models achieving even higher figures. Added to which, the Gen6 high-voltage battery concept benefits from the new 800V technology. Gen6 will make its debut this year in the Neue Klasse and subsequently be used to drive models across the BMW Group's fully electric product range. The concept for the Gen6 high-voltage batteries is fundamentally new and will find applications in all vehicle segments – right up to the high-performance models from BMW M GmbH. Its new, even slimmer design allows the high-voltage battery to be integrated into a spread of different models, regardless of vehicle height. The high-voltage battery takes on the role of a structural component in the bodies of the Neue Klasse models ("pack-to-open-body"), and the new cylindrical cells will be integrated directly into the high-voltage battery ("cell-to-pack"). The new BMW cylindrical cell has a

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20% greater energy density than its predecessor, the Gen5 prismatic battery cell. And charging in both directions will be possible: the BMW Group has confirmed bidirectional charging as standard for Gen6.

Highly intelligent central control unit: the BMW Energy Master

All of the elements that enable this technological leap forward come together in the BMW Energy Master. This central control unit is positioned on the high-voltage battery and provides the interface for high- and low-voltage power supply and for data from the high-voltage battery. It also controls the power supply for the electric motor and vehicle electrical system and ensures the safe and intelligent operation of the high-voltage battery. The BMW Group has filed a whole series of new patent applications for the vehicle electrical system, including its electronic fuses. Both the hardware and software of the Energy Master were developed fully in-house at the BMW Group. This ensures technological developments and updates for vehicles can be implemented independently and in real time via Remote Software Upgrades, providing a particular benefit for customers.

"Local for local" approach for high-voltage battery assembly and supplier network

The high-voltage batteries for the Neue Klasse are assembled in five new production facilities that the BMW Group has located close to its vehicle plants as part of a "local for local" approach. For example, cutting-edge assembly locations for Gen6 high-voltage batteries are taking shape in Irlbach-Straßkirchen (Lower Bavaria), Debrecen (Hungary), Shenyang (China), San Luis Potosí (Mexico) and Woodruff, near Spartanburg (USA). This approach safeguards production even in the event of unforeseen political and economic events. In addition, the existing locations are being strengthened, with jobs both secured and created. The "local for local" principle continues in the supplier network for battery cells: in order to cover the demand for Gen6, the BMW Group has reached contractual agreements for five battery cell factories – spread across Europe, China and the USA – with various partners.

"Cell-to-pack" and "pack-to-open-body"

Production of the Gen6 high-voltage batteries follows the "cell-to-pack" and "pack-to-open-body" principles. "Cell-to-pack" involves positioning the cylindrical cells – manufactured by the suppliers according to BMW Group specifications – directly in the housing of the high-voltage battery, without the intermediate step of a module being produced. "Pack-to-open-body" refers to the high-voltage battery's new role as a structural component in the vehicle architecture. Numerous innovations patented by the BMW Group can be found here.

Know-how from Bavaria and Austria – in demand around the world

Before series production of the high-voltage batteries gets underway worldwide, the production processes will be developed and pre-series batteries subjected to thorough testing. This will happen at the BMW Group pilot plants for high-voltage batteries in Parsdorf, Hallbergmoos and Munich. The new series production plants around the world will then be ready. The product and process expertise is centred in Bavaria. Production of the Energy Master will take place at Plant Landshut, which will then supply all the high-voltage battery assembly plants around the world. There, the highly intelligent control unit will be installed on the high-voltage battery. The electric motor with sixth-generation BMW eDrive technology is produced at Plant Steyr in Austria, which is also home to a development centre for electric drive systems and thermal management.

Production of the Energy Master at BMW Group Plant Landshut

A state-of-the-art production system for the BMW Energy Master is taking shape at Plant Landshut. The plant is currently producing the highly complex control unit in pre-series. Series production on the first production line will begin in August 2025, with a further expansion stage to follow in mid-2026. This is the first time the development and production of this central control unit has taken place in-house at the BMW Group. "As the company's largest in-house component manufacturer, Landshut plays an important role for the Neue Klasse," says Dr Joachim Post. "The plant is an innovation hub and a driver of transformation." Around 200 people will be employed in the Energy

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Master production area at Landshut when production begins, rising to as many as 700 people as it ramps up further. The BMW Group has channelled investment in the high hundreds of millions of euros into the expansion of electric mobility at Plant Landshut since 2020, strengthening both the production facility itself and Germany's status as an industrial powerhouse for the long term. The modular manufacturing system used to produce the Energy Master was also designed fully in-house by the BMW Group. It is supplied with subcomponents by a supply chain set up by the BMW Group. This extends to the n-tier supply chain for supply-critical components such as semiconductors. The benefits of this set-up can be seen in terms of both costs and supply security. The scalable production system enables the company to respond quickly and flexibly to market requirements. The high degree of automation, involving up to 400 robots in the final expansion stage, maximises efficiency. Comprehensive in-process monitoring, which includes the use of AI-based camera systems, and 100-per-cent end-of-line system checks in a clean-room environment ensure optimum quality.

Different recycling processes within the value chain

As electric mobility ramps up, there is an increasing focus on recycling of high-voltage batteries at the end of their lifecycle. Under a long-term partnership with SK tes – a leading provider of innovative technology lifecycle solutions – cobalt, nickel and lithium from end-of-life batteries are recovered from the BMW Group and integrated into the supply chain for the manufacture of new batteries. This closed-loop approach increases the efficiency and resilience of the BMW Group as part of a circular economy. The BMW Group will follow a similar path in the USA, Mexico and Canada up to 2026 with a separate partnership.

Innovative direct recycling at the BMW Group

The BMW Group is also exploring other recycling options in the value creation process. One example of this is the direct recycling method developed in-house. The BMW Group is working with its joint venture Encory to set up a competence centre for battery cell recycling in Lower Bavaria, where the company will put its direct

recycling ideas into practice. This innovative process will enable residual materials from battery cell production and whole battery cells to be mechanically broken down into their valuable constituent components. The raw materials obtained in this way will be re-used directly in the pilot production process for battery cells at the company's competence centres.

The electric drive system of Gen6

Technology-open approach for electric mobility: the new e-drive system of Gen6

The BMW Group has retained the principle of an electrically excited synchronous motor (EESM) for its Gen6 power unit. On this type of synchronous motor, the magnetic field in the rotor is generated by windings fed with direct current rather than permanent magnets. In this way, the strength of the rotor's magnetic field can be optimally adjusted to the prevailing load conditions. This results in both excellent levels of efficiency at customer-relevant operating points and constant power output at high rotational speeds. As with the Gen5 version, the synchronous motor will be positioned above the rear axle and feature a compact housing incorporating the electric drive unit, power electronics and transmission. Many of the motor's technical details were created with the help of patented expertise, with the non-potted rotor alone accounting for more than ten patent applications.

Neue Klasse additionally incorporates ASM technology

The Gen6 powertrain employs a second, additional electric motor technology in the form of the asynchronous motor (ASM). Here, instead of being generated by permanent magnets (PSM) or electrical excitation (EESM), the rotor's magnetic field is induced by the stator. On this type of motor, the rotor takes the form of a metal cage. The asynchronous motor offers the advantage of a more compact design and superior cost efficiency. The ASM motor variants will be fitted at the front axle of Neue Klasse cars with BMW xDrive.

Extensive improvements to EESM technology

Besides the addition of ASM technology, the EESM technology has also undergone a major upgrade for Gen6: rotor, stator and inverter have all been fully designed for the new 800V architecture of the Gen6 tech in order to maximise drive system performance and efficiency. This has been further helped by a complete redesign of the oil and water cooling systems. In addition to this, the experts from the BMW Group have also succeeded in improving the electric motor and central housing in terms of their weight and rigidity too. The transmission still uses a two-stage helical design, but has been further optimised by enhancements to its geometry and cooling, lower friction levels and more pleasant acoustics. The electrically excited synchronous motor's "brain", the inverter, now features 800V technology along with silicon carbide (SiC) semiconductors to boost efficiency. The inverter is completely integrated into the electric motor's housing. Its task is to convert the DC power supply from the high-voltage battery to AC for use in the electric motor. The inverter was developed in-house by the BMW Group and is produced at Plant Steyr in Austria.

Lower weight, costs and energy losses – greater efficiency in the vehicle

The results obtained from intelligently incorporating new technologies into the electric powertrain while consistently enhancing existing systems make impressive reading. When compared to a Gen5 xDrive model, a future Neue Klasse model complete with EESM and ASM technology boasts the following improvements: energy losses have been reduced by 40%, costs by 20% and weight by 10%. By combining different types of electric motor, the BMW Group's technology-open approach is therefore clearly in evidence within the field of electric mobility. In future, customers will be able to choose from models equipped with one, two, three or four electric motors to suit their individual preferences and requirements. The sixth generation BMW eDrive technology is a significant factor in the gain in overall vehicle efficiency of around 20 per cent for the Neue Klasse. This figure is based on a comparison with the current generation of all-electric vehicles from the BMW Group.

Modular concept provides crucial advantage for manufacturing electric motors

The manufacturing concept for the Gen6 electric drive system uses the principle of modular building blocks. This forms the basis for highly flexible manufacturing of various electric drive variants across the entire Neue Klasse model range. The modular "building block" concept leads to positive economies of scale and cost savings in development and production. It also has the effect of improving the scalability of production volumes. The modular approach ensures a high degree of flexibility in production, the supply networks and procurement.

The Gen6 electric drive systems: made in Steyr

Series production of the Gen6 electric drive systems will commence at BMW Group Plant Steyr in summer 2025. Pre-production already got underway at the Austrian facility in September 2024. The pre-production motors are undergoing rigorous testing and some are already being fitted in Neue Klasse test vehicles from Plant Debrecen. By 2030, the BMW Group will have invested over one billion euros at the site since the project's launch in 2022 to expand its development and production expertise for electric drive systems. Thanks to the increase in capacity, the plant will retain its status as the BMW Group's leading facility for drive systems. The plant has been developing and building combustion engines for the BMW and MINI brands for over 40 years. Plant Steyr's many years of experience and high level of expertise in the field of drive systems make it the ideal site for manufacturing the Gen6 electric motors. It has an annual production capacity of 600,000 electric drive units. Diesel and petrol engines continue to be manufactured there alongside the electric motors. By 2030, around half of the on-site employees should be working in electric mobility – a vital step for safeguarding the more than 4,700 jobs at the plant in the long term. In future, all key components of the innovative, highly integrated electric drive unit – i.e. the rotor, stator, transmission, inverter and housing – will be produced at Steyr. This will include manufacturing the inverters in an in-house clean room environment for the first time, thereby taking the engine plant into the realm of electrical engineering. The electric drive components will be built on two new assembly lines at Steyr.

Thermal management: complex interaction, crucial for performance

Thermal management involves highly complex interaction between various systems in an electric vehicle and is of critical importance for a host of performance parameters, including range, real-world consumption, acceleration and charging time. Thermal management is a question of constantly keeping the temperature of the electric motor, power electronics and high-voltage battery in the optimum range, while maintaining standards of passenger comfort at the same time. Efficient thermal management is important for fast charging too. Here, the battery temperature must be kept within a defined window in order to make optimum use of the available charging capacity. Unlike combustion engines, electric motors give off little heat. This means that, depending on the operating state, the battery and the passenger cell have to be not only cooled, but heated too. The Steyr site develops the thermal management systems for all electric vehicles from the BMW Group. The plant's development centre is also responsible for the brain at the heart of the electric motor – the inverter.

BMW Group Plant Landshut – a multi-talented component manufacturer

BMW Group Plant Landshut is the BMW Group's largest component plant anywhere in the world, supplying components to all the company's vehicle and drive system plants. Its workforce of around 3,700 employees produces a broad spectrum of cutting-edge components for vehicles from the BMW Group. Working closely with the BMW Group's Research and Innovation Centre (FIZ) in Munich, Plant Landshut plays a pivotal role as a hub of innovation for the automotive industry. It develops pioneering technologies and manufacturing processes that serve to maintain the company's competitive edge. Over the course of the Neue Klasse project, the site is investing some €200 million in its light metal foundry to increase annual production capacity for the electric motor housings. The Injector Casting (ICA) process developed and patented in Landshut is a prime example of the plant's innovative strength. This globally unique process is used to manufacture the electric motors' highly complex aluminium housings that set new standards for lightweight design and functional integration.

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The BMW Group

With its four brands BMW, MINI, Rolls-Royce and BMW Motorrad, the BMW Group is the world's leading premium manufacturer of automobiles and motorcycles and also provides premium financial services. The BMW Group production network comprises over 30 production sites worldwide; the company has a global sales network in more than 140 countries.

In 2024, the BMW Group sold 2.45 million passenger vehicles and more than 210,000 motorcycles worldwide. The profit before tax in the financial year 2023 was € 17.1 billion on revenues amounting to € 155.5 billion. As of 31 December 2023, the BMW Group had a workforce of 154,950 employees.

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The economic success of the BMW Group has always been based on long-term thinking and responsible action. Sustainability is a key element of the BMW Group's corporate strategy and covers all products from the supply chain and production to the end of their useful life.

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