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# BMW Concept ActiveE. Profile.



## Character:

- Concept study of a purely electrically powered model based on the BMW 1 Series Coupé. The BMW Concept ActiveE represents a consistent continuation of the research and development activities of the BMW Group relating to electromobility as part of project i. A concept which realizes CO<sub>2</sub>-free mobility in BMW style is presented.
- The BMW Concept ActiveE is the BMW Group's second vehicle after the MINI E to be developed as part of project i. After the successful launch of the pilot project MINI E, the BMW Group announces the development of another field test of electric vehicles for private and selected fleet users. The aim is to test the use of electric drive for everyday purposes in a vehicle which offers the driving pleasure which is characteristic of BMW automobiles.
- The specific features of the BMW Concept ActiveE include rear-wheel drive as is characteristic of BMW, a powerful drive system for dynamic acceleration maneuvers and a high level of efficiency to enable the vehicle to be used for purposes which go beyond urban mobility.
- The vehicle concept also comprises an extended range of functions with a high level of practical relevance. The intelligent arrangement of the drive components makes it possible to provide four full-size seats and a luggage compartment volume of some 200 liters (7 cubic feet).
- On the way to achieving CO<sub>2</sub>-free mobility, the BMW Group continues to develop electric drive as an additional mainstay of BMW EfficientDynamics. Electric drive provides an additional option for a lasting form of individual mobility alongside the ongoing optimization of all models with a pure combustion engine, the market launch of BMW ActiveHybrid technology in serial production vehicles and the BMW Hydrogen 7 as evidence of the suitability of hydrogen drive for everyday use.

## **Technology:**

- The BMW Concept ActiveE is powered by a new synchronous electric motor specially developed for this vehicle. Its maximum output is 125 kW/170 bhp, the maximum torque of 250 Nm / 184 lb-ft is available from standing as is typical for electric motors and remains available over an unusually broad load range.
- For the first time, electrical energy is stored in a lithium-ion battery pack developed jointly by BMW and the co-operation partner SB LiMotive especially for the BMW Concept ActiveE. A new stable temperature regulation function optimizes the battery pack's performance.
- Other characteristics of the drive technology used in the BMW Concept ActiveE are the weight-reduced construction and the package-optimized arrangement of all components. The electric motor is completely integrated in the rear axle, the power electronics is positioned above the motor. Space is used for energy storage which in vehicles powered by a combustion engine would be taken up by the conventional drivetrain and fuel tank. With a weight of some 1,800 kilograms / 3900 lbs (unladen weight according to DIN), a low center of gravity and an axle load distribution which is typical of a BMW, the vehicle has everything it requires to provide the dynamic driving properties and agile handling in the style of the BMW 1 Series.
- Predicted driving performance figures: acceleration from zero to 60 km/h (37mph) in less than 4.5 seconds and from zero to 100 km/h (62mph) in less than 9 seconds, maximum speed: approx. 145 km/h (90 mph, electronically limited). As with the MINI E, the real-world range is expected to be about 160 km / 100 miles on a single charge, depending on conditions (FTP72 cycle range is calculated to be 240 km / 150 miles in simulation).
- Flexible charging technology enables the lithium-ion battery pack to be recharged by a conventional power outlet at public charging stations or at a special wall box. On the European grid, the battery pack can be fully charged at a high-current power outlet (50 ampere) in as little as 3 hours. In North America, using a high-current (32 ampere continuous) residential wall box, the charge time is about 4.5 hours.
- The drive components used in the BMW Concept ActiveE have been developed as part of project i. The objectives on which this is based are

derived from the requirements for the serial production development of a Megacity Vehicle.

- In the BMW Concept ActiveE, new BMW ConnectedDrive services are presented which have been designed exclusively for use in an electric vehicle. This includes specific remote functions which enable the use of a mobile phone to check the charge status of the battery, search for public charging stations and activate the vehicle's auxiliary heating and air conditioning functions.

### **Design:**

- The BMW Concept ActiveE is based on the BMW 1 Series Coupe. It embodies a new interpretation of the agility which is characteristic of the 1 Series. For the first time, CO<sub>2</sub>-free mobility and the driving pleasure characteristic of BMW are combined for up to four vehicle occupants in an electric vehicle concept.
- There is a clearly recognizable differentiation from the serial production model of the BMW 1 Series Coupe with the body finish in Liquid White metallic, as well as graphic elements derived from printed circuits in Electric Blue on the hood, doors, roof and trunk lid, as well as the lettering "ActiveE", "eDrive" and "EfficientDynamics" on the doors and side panels. Specific light-alloy wheel wheels, the lack of an exhaust system and blue illuminated elements such as the roof fin and charging connection highlight the special character of this electrically powered concept vehicle.
- The interior of the BMW Concept ActiveE includes specific leather seats with embossed graphic elements and blue accentuated seams as well as interior strips in Liquid White with rear-lit three-dimensional graphics. The instrument panel and the central display have been enhanced to include display items specific to electric drive. The use of innovative remote functions as part of BMW ConnectedDrive is shown with the example of a smartphone connection which is fully linked into the vehicle infotainment system.

# **Electromobility in BMW style: BMW Concept ActiveE.**



The BMW Group presents yet another milestone along the way to achieving CO<sub>2</sub>-free mobility. The BMW Concept ActiveE provides a taste of a purely electrically powered BMW. Focused on the requirements of practical use, the study is based on the BMW 1 Series Coupe and embodies the outstanding agility and characteristic driving pleasure of the 1 Series for the first time as part of an emissions-free drive concept.

With the world premiere of the BMW Concept ActiveE at the North American International Auto Show (NAIAS) 2010 in Detroit, the BMW Group is highlighting the continuation of its research and development activities in the field of electro-mobility. The field tests with the MINI E as part of project i in the US and Europe have already provided important insights into the demands required of future production electric vehicles. As a second step, project i has begun development of a second trial fleet of electric vehicles based on the BMW Concept ActiveE. These vehicles are likewise intended for everyday use by private and select fleet customers as part of a large-scale field test. The insights gathered in the process will be fed into the development of an electrically powered serial production vehicle which the BMW Group will put on the market under a sub-brand of BMW in the first half of the next decade.

The BMW Concept ActiveE has allowed BMW to explore new vehicle packaging solutions and components which will be crucial to the success of the Megacity Vehicle. The intelligent integration of drive components within the existing vehicle package of the BMW 1 Series Coupe offers the opportunity to provide four full-size seats and a luggage compartment with a capacity of some 200 litres / 7 cu ft. The motor, specially developed for the model and located in the rear axle, delivers 125 kW/170 bhp and provides maximum torque of 250 Nm / 184 lb-ft. It accelerates the vehicle in less than 9 seconds from zero to 100 km/h (0-60 mph in approx. 8.5 seconds).

The electric drive system draws its energy from new, advanced lithium-ion battery pack optimized developed jointly by BMW and the co-operation partner SB LiMotive especially for the BMW Concept ActiveE. They enable a range of approx. 160 kilometres (100 miles) in everyday use. An intelligent battery management system helps achieve this range largely independently of external climatic conditions. Additionally, the charging period required for

the lithium-ion batteries is very short. On the European power grid, the battery pack can be fully charged in just 3 hours at a wall box with a current of 50 ampere at 230/240 volts. In North America, using a high-current (32 ampere continuous) residential wall box, the charge time is about 4.5 hours.

**Innovative technology for sheer driving pleasure  
without CO<sub>2</sub> emissions.**

The BMW Concept ActiveE embodies a whole new dimension of purely electrically powered mobility. The dynamic potential and high torque of the drive system, along with the rear-wheel drive which is a hallmark of the brand, guarantees the characteristic sheer driving pleasure which is typical of BMW – but without any CO<sub>2</sub> emissions. An impressive range of functions and a high level of suitability for everyday use are additional features of this concept, which defines electromobility in true BMW style.

The BMW Group attaches key importance to electro-mobility in the development of future-oriented vehicle concepts and drive systems as part of its EfficientDynamics strategy. In the medium term, BMW Group is developing innovative vehicle concepts for emissions-free mobility in urban areas. This so-called Megacity Vehicle will also be offered with an electrical drivetrain. The BMW Concept ActiveE represents a further step towards the realization of this concept. Components of the vehicle may be developed further for later integration into the Megacity Vehicle.

**Electric drive: emissions-free, powerful and compact.**

The BMW Concept ActiveE offers the prospect of characteristic BMW driving pleasure without exhaust emissions. The requirements for electro-mobility with characteristic BMW properties are being created based on ongoing development in the powertrain. The latest outcome is a new synchronous electric motor tailored to the BMW Concept ActiveE. It offers a high level of efficiency, power delivery, and compact construction.

The maximum output of the new electric drive is 125 kW/170 bhp. The maximum torque of 250 Nm / 184 lb-ft is available from a standstill as is typical for electric motors. The torque remains available over an unusually broad load range. Unlike asynchronous electric motors, the new power unit provides a relatively high level of torque even at higher engine speeds and road speeds; at increased load the torque is not reduced abruptly but decreases gradually. The torque curve at higher engine speeds is therefore much more similar to the pattern familiar from combustion engines.

The vehicle concept and drive system provide the agility and dynamic acceleration performance which are characteristic of the

BMW 1 Series Coupé. Based on realistic simulations, a figure of less than 9 seconds was measured for the sprint from zero to 100 km/h (0-60 miles in 8.5 seconds), with the 60 km/h mark being reached after less than 4.5 seconds. The maximum speed of the vehicle is electronically limited at around 145 km/h or 90 mph.

The innovative character of the electric drive is also reflected in the optimized ratio between engine output and space requirements: the compact power package is fully integrated in the rear axle of the BMW Concept ActiveE. Here the drive system occupies the space required in conventional vehicles by the differential, whose function is integrated in the drive system.

### **Recuperation of energy increases range.**

In the purely electric powered BMW, the driver may control deceleration as well as acceleration through the movement of the accelerator pedal. As soon as the driver's foot is removed from the accelerator, the electric motor performs the function of a generator, converting the vehicle's kinetic energy into electric power and storing it in the battery pack. Intensive use of this so-called energy recuperation process by the motor increases the range by up to 20%.

At the same time, a brake torque is created which results in effective deceleration of the vehicle. This response enables a very comfortable driving style, especially at medium and constantly varying speeds. In urban traffic, some 75 percent of all deceleration manoeuvres are initiated without the need for the brake pedal. During Brake Energy Regeneration function, the vehicle's brake lights are illuminated.

This brake effect acts on the rear wheels only. When the driver requires a higher level of deceleration, stepping on the brake pedal engages the conventional hydraulic braking system. If an emergency braking maneuver is required during braking, the Dynamic Stability Control (DSC) system applies selective braking and motor management measures to ensure that safe braking is always guaranteed.

The brake system is fitted with an electric vacuum pump which is activated on demand. Along with the Electric Power Steering (EPS) familiar from the production models of the BMW 1 Series, these features contribute to an increase in the overall efficiency of the vehicle.

### **Innovative lithium-ion battery pack with its own liquid cooling.**

The lithium-ion battery pack specially developed for this vehicle supplies energy to the motor and all other functions of the BMW Concept ActiveE. The high-voltage battery units offer a particularly high storage capacity and

durability. For the first time, storage cells are used which were developed especially for use in automobiles by the BMW Group in collaboration with the co-operation partner SB LiMotive. Powerful battery cells are key when it comes to designing production vehicles with electric drive. Through the collaboration of the BMW Group with a joint venture of the companies Bosch and Samsung SDI [SB LiMotive], leading expertise in the area of battery technology and electro-mobility has been brought together. The aim is to use the best available technology in the area of energy storage as part of the development of the Megacity Vehicle.

For some time now, lithium-ion technology has demonstrated its particularly high storage capacity and deep-cycle resistance – for example in mobile phones and laptops. The technological expertise of SB LiMotive ensures that these properties are retained even under the special conditions of use in an automobile and the relevant demands in terms of durability, endurance and safety.

The lithium-ion batteries of the BMW Concept ActiveE have their own liquid cooling system and intelligent battery management system, which are key elements in increasing both the storage capacity and the durability of the battery cells. These systems also ensure that the long range can be maintained largely independent of external climatic conditions. The high storage capacity is the decisive factor in achieving as long a range as possible. The storage system developed for the BMW Concept ActiveE enables a real-world range of about 160 km / 100 miles on a single charge, depending on conditions (FTP72 cycle range is calculated to be 240 km / 150 miles in simulation).

#### **Modular structure, compact construction, space-saving integration.**

Another special feature of the battery pack is its outstanding compactness, despite its output and capacity. The arrangement of battery cells, grouped into several modules, is ideal in terms of packaging, functionality and vehicle balance. The battery pack is located where a combustion engine and fuel tank would normally be located. The largest portion of the battery pack in the BMW Concept ActiveE is located where the conventional propshaft and fuel tank would be in the lower section of the vehicle. In addition, a portion of the battery pack is located where the combustion engine would normally reside. Using intelligent lightweight design and the highly-efficient lithium-ion battery cells, vehicle curb weight is limited to about 1800 kg / 3900 lbs.

#### **Characteristic BMW driving experience, space of a BMW 1 Series Coupe.**

The positioning of the battery pack shifts the vehicle's center of gravity downwards. Also, the battery cell layout within the vehicle preserves



the near 50-50 weight distribution characteristic of BMW vehicles. In this respect, the BMW Concept ActiveE offers ideal conditions for driving experience characterized by a high level of agility.

In terms of the space available in the interior, the BMW Concept ActiveE has no disadvantage compared to the BMW 1 Series Coupe with conventional combustion engine. It offers four full-size seats with the same measures of head, leg and shoulder space.

The optimum positioning of the power electronics above the motor integrated in the rear axle, for reasons of safety and functionality, results in a reduction of trunk capacity. Nonetheless, the BMW Concept ActiveE still has a luggage compartment which provides considerable versatility in everyday use. With a volume of approx. 200 litres / 7 cu ft, it even exceeds the trunk capacity of the BMW 1 Series Convertible with an open top and can hold two 46-inch golf bags, for example.

#### **Reliable and safe: power electronics control and monitor vehicle functions.**

The power electronics of the BMW Concept ActiveE regulate the supply of electrical current to the motor at the required amperage and voltage. It also controls the supply of energy to the vehicle power network. By means of a voltage transformer and an intelligent battery management system, a reliable supply of power to all vehicle functions is ensured, including the comfort and entertainment features familiar from the production model of the BMW 1 Series. Drive components, energy supply, and battery pack comply with the integral safety standards for electric vehicles as defined by the BMW Group.

Central monitoring functions integrated both in the power electronics and the battery pack ensure the continuous monitoring of all components. The driver is immediately informed of malfunctions and if necessary there is an automatic system discharge and shutdown.

#### **Modern charging technology: fresh energy both swiftly and flexibly.**

The consistent development of serial production vehicles with electric drive also includes innovative solutions for flexible, user-friendly charging of the energy storage systems in the vehicle in a way which is appropriate to everyday use. The lithium-ion battery pack of the BMW Concept ActiveE can be recharged using a range of different power sources. This means that the vehicle is not dependent on a specific charging station and energy of varying power levels can be fed into the battery pack according to availability. Any conversion required is taken care of by the high-performance battery control system.

This gives the driver considerably greater flexibility in using the vehicle. In addition to using a high amperage wall box – a supply system installed in the user's home optimized to reduce charging times– it is also possible to use conventional power outlets or publicly accessible charging stations made available in co-operation with energy suppliers. In this way, stopovers can be used to extend the travel range of the vehicle when needed.

The lithium-ion batteries of the BMW Concept ActiveE set a new benchmark for energy storage systems in electric vehicles. Regardless of the voltage and amperage available, they build up a remarkably high energy capacity within a very short time. On the European power grid, the battery pack can be fully charged in just 3 hours at a wall box with a current of 50 ampere at 230/240 volts. In North America, using a high-current (32 ampere continuous), 220 volts residential wall box, the charge time is about 4.5 hours.

**Innovative comfort features: auxiliary heating and auxiliary air conditioning complete with remote control.**

In conjunction with the powerful battery technology, the concept of a purely electrically powered vehicle presents additional opportunities for the integration of innovative comfort features. For the BMW Concept ActiveE, a special heating and air conditioning system was developed which is supplied with energy from the high-voltage battery via the vehicle power network. The fact that the heating system and air conditioning compressor are electrically powered means that the desired temperature can be provided inside the vehicle even when it is stationary. The driver can heat or cool the interior before a trip using the auxiliary heating or air conditioning system – an option which is available when the vehicle is connected to a charging station and the battery is fully charged. This ensures that the range is not reduced by the comfort function, but in fact increased. The reason for this is that the energy required for heating or cooling the vehicle with an existing connection to the power supply does not need to be drawn from the battery during travel.

The air conditioning systems developed for the BMW Concept ActiveE can also be activated via mobile phone. This option also includes a timer function so the driver can ensure that the vehicle is conveniently pre-cooled or pre-heated before getting into it in the morning, for example. Climatic pre-conditioning optimizes not only ride comfort but also the operating status of the energy storage system in the sense that it maximises the range of the vehicle.

The control of the heating and air conditioning system by mobile phone is made available through BMW ConnectedDrive. The BMW Concept ActiveE

demonstrates the extensive range of options for using these services with the full integration of a smartphone connection into the vehicle infotainment system.

### **Specific remote control functions via BMW ConnectedDrive.**

In addition to the intelligent remote controlled operation of the auxiliary heating and air conditioning, BMW ConnectedDrive offers additional services specially developed for the BMW Concept ActiveE. The main focus here is on the user-friendly and practically oriented relay of precise information on the condition of the vehicle. No matter how far he is from the vehicle, the driver can obtain details of the charge status of the lithium-ion battery and the range of travel this permits. The remote control functions also provide support in searching for a nearby public charging station.

The configuration of the remote control functions is specifically oriented to use scenarios arising in everyday traffic. For example, the driver can go shopping or eat at a restaurant while the vehicle is supplied with electrical current at a charging station. Within a very short time the driver can obtain information on the current charge status of the batteries by mobile phone. The driver can also determine how much charging time is required for the batteries to achieve sufficient energy capacity for the trip home, thus allowing other activities to be planned. Providing sufficient charge is available, the driver can also activate the heating and air conditioning during an excursion when the battery is fully charged and the vehicle is connected to the power supply. In this way a pleasant temperature can be generated inside the car within just a few minutes and in good time before setting off.

Additional trips can also be conveniently prepared using the innovative remote control functions. For example, the driver can check the charge status of the vehicle batteries and the currently available travel range while at his workplace or sitting in a café. This makes it quick and convenient to find out whether an additional trip can be made before driving home before the energy supply runs out. The driver gains additional flexibility in being able to search for public charging stations in the vicinity of any given location. Based on the information relayed to the mobile phone, he can quickly determine whether a spontaneously planned stopover can be used to charge the vehicle batteries.

### **Design: unmistakably a BMW 1 Series Coupe, clearly a very special concept.**

The technology of the BMW Concept ActiveE is highlighted through unique design features. The BMW Concept ActiveE is unmistakably based on the BMW 1 Series Coupe, well-known for its outstanding agility and efficiency. With its powerful proportions, the BMW Concept ActiveE also embodies an

especially sporty form. Its side view is dominated by the striking shoulder line and the short overhangs. In addition, the BMW Concept ActiveE boasts striking light alloy wheels which are aerodynamically optimized. The distinctive appearance is partly created by the concept-specific rear apron which is completely closed, demonstrating that the vehicle is entirely emissions-free due to the lack of an exhaust system. There is a recognisable differentiation from the production model of the BMW 1 Series Coupe with the body finish in Liquid White metallic, as well as graphic elements derived from printed circuits in Electric Blue on the hood, doors, roof and trunk lid, as well as the lettering "ActiveE", "eDrive" and "Efficient Dynamics" on the doors and side panels. The following elements also reflect the special character of this electrically powered vehicle: a blue illuminated charging connection behind a translucent filler cap, a glowing blue roof fin and kidney rods finished in blue. Blue rings on the tyres also make for a visual enlargement of the 18-inch wheel rims.

In the interior, individual details highlight the distinctive style of the study and are functionally associated with the electric drive. Among other things, the interior of the BMW Concept ActiveE has special leather seats with embossed graphic elements and blue contrasting stitching. The instrument panel and door trim panels have strips in Liquid White. The decor strip in the instrument panel is finished with a three-dimensional rear-lit ActiveE graphic. The blue illuminated start/stop button and the selector lever knob emblem in White/Blue round off the overall graphic concept. What is more, the instrument panel and the central display have been enhanced to monitor the electric drive.

Instead of the tachometer there is a battery capacity display in the instrument panel. The current charge status of the battery pack is shown in percent. There is also a second instrument which shows how much current is being drawn from the battery as well as the amount of energy being fed back into the battery from Brake Energy Regeneration.

In addition to the familiar features, the central information display also has a battery level indicator, an active system status display function and the positions of the nearest electric charging stations.

In the luggage compartment, an illuminated plexiglass screen provides a view of the power electronics of the electrical drivetrain. The charge cable is housed conveniently in an additional storage compartment between the left-hand wheel arch and the power electronics.

**A future-oriented technology which runs across all brands:  
electro-mobility as a mainstay of EfficientDynamics.**

With the BMW Concept ActiveE, the BMW Group demonstrates the continuation of its project i research and development activities geared towards achieving emissions-free mobility independent of fossil fuels. For the first time, the concept of a purely electrically powered vehicle is combined with the characteristics of a BMW 1 Series Coupe.

The BMW Group is developing electro-mobility as an additional central mainstay of its EfficientDynamics strategy. Electric drive provides an additional option for individual mobility, alongside the ongoing optimization of the pure combustion engine, the market launch of BMW ActiveHybrid technology in production vehicles and the BMW Hydrogen 7 as evidence of the suitability of hydrogen drive for everyday use.

Project i brings together the BMW Group's activities relating to the development of production vehicles with electric drive. The focus is on the conception of a production Megacity Vehicle which fulfils the requirements of a sustainable mobility solution for urban areas, with one option being electric drive.

With project i, the BMW Group is carrying out a unique worldwide field test in the use of electrically-powered vehicles in everyday traffic. The MINI E, of which some 600 were produced, is currently being used by private customers in the states of California, New York and New Jersey as well as at several European locations. This pilot project aims to gather important insights into user behaviour, the requirements of the vehicle concept, its specifically electric components and the energy supply infrastructure.

The BMW Concept ActiveE creates a basis for the expansion and intensification of this field testing on electro-mobility, oriented towards enabling large-scale production in the future. The aim is to produce a fleet to a scale which will exceed that of the MINI E.

With its extended range of functions, including four seats, an intelligent arrangement of the ActiveE technology and dynamic qualities provided not least by the rear-wheel drive which is so characteristic of BMW, the concept vehicle reflects a new approach while remaining loyal to BMW brand values. The components of the electric drive system have been designed bearing in mind the requirements of a future Megacity Vehicle so as to advance the development of a production vehicle. The BMW Concept ActiveE moves a little closer towards the future of an individual mobility which will combine driving pleasure with CO<sub>2</sub>-free travel.