The new BMW C evolution.
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1. The new BMW C evolution.
Short version.

The new BMW C evolution – innovative e-mobility on two wheels.
For years now, there have been drastic changes in the demand for individual mobility concepts, in particular in conurbations. Constantly expanding traffic volumes, rising energy costs and increasingly rigorous CO_2 restrictions on inner-city traffic – these are the challenges that electrically powered vehicles consistently set out to tackle. Following the BMW Group's sustainability strategy and parallel to BMW i in the automobile sector, BMW Motorrad moved into the field of electric mobility at a very early stage in 2012, ultimately putting forward a convincing statement in the form of the C evolution e-scooter.

Increased e-performance and a European version that meets the requirements for the A1 driving licence. Ranges of 160 and 100 kilometres respectively.
With the new C evolution, available in two variants in future – the Long Range version and the European version that meets the requirements for the A1 driving licence – BMW Motorrad now raises the benchmark in the e-scooter segment to a new level. Featuring a new generation of batteries with a cell capacity of 94 Ah, as used in the current BMW i3, the range has been significantly extended. What is more, a new charge cable with a smaller diameter is now included as standard. New optional accessories such as the smartphone cradle also mean there are now many more ways to customise the BMW C evolution.

In the new C evolution Long Range the continuous output is 19 kW, 8 kW more than in the predecessor model, while the range has been significantly extended to approximately 160 kilometres. The top speed is 129 km/h (electronically limited).

In the A1 driving licence version (Europe only), the new C evolution has an output of 11 kW. The range here is around 100 kilometres, with a top speed of 120 km/h.

Dynamic paint finishes in Ionic Silver metallic / Electric Green.
Last but not least, the new BMW C evolution now steps into the limelight with a refined visual appearance. Both versions of the new C evolution are available in the new paint finish Ionic Silver metallic / Electric Green, combined with the contrasting colour Blackstorm metallic. A new graphic has also been added to

the centre tunnel trim in the Long Range version. Already available in Germany, France, Italy, Spain, the United Kingdom, Switzerland, Austria, the Netherlands, Belgium, Luxembourg, Portugal, Ireland and China, the C evolution is now also due to be launched in the USA, Japan, South Korea and Russia.

An overview of the highlights:

- Innovative electric drive via drivetrain swing arm with liquid-cooled e-motor, tooth belt and planetary gear.
- Significantly increased range due to enlarged battery cell capacity of 94 Ah (previously 60 Ah).
- Long Range version: 19 kW continuous output and 35 kW peak output. Top speed 129 km/h, range approx. 160 km.
- A1 driving licence version (Europe only): 11 kW continuous output and 35 kW peak output. Top speed 120 km/h, range approx. 100 km.
- Intelligent recuperation in coasting mode and when braking.
- Standard charge cable with smaller diameter.
- Short charging times possible.
- Synergy effects with BMW automobiles and electrical safety according to car standards.
- Hybrid chassis with agile handling due to low centre of gravity.
- Powerful braking system with ABS.
- Extensive range of standard features including multifunctional TFT instrument cluster, LED daytime running light, LED turn indicators, several riding modes, reverse assist and Torque Control Assist (TCA).
- New paint finishes Ionic Silver metallic / Electric Green.
- High-end details such as tinted windshield and colour seat seams.

2. Vehicle technology and design.

Electric performance at the level of a combustion engine.
With a continuous output of 19 kW (homologation according to ECE R85 to determine motor outputs) and a peak output of 35 kW, the new C evolution offers considerable power and a high level of riding fun. The A1 driving licence version for the European market likewise provides sufficient drive power, with a continuous output of 11 kW. The top speeds are 129 (Long Range) and 120 km/h respectively, while in terms of acceleration from 0 to 50 km/h the performance figures of the C evolution are on a par with if not better than current maxi scooters with a capacity of 600 cc.

As a result, both versions of the new C evolution can handle motorway riding and overtaking with perfect ease – even when carrying two people. It is even capable of effortless hill starts on steep slopes with a pillion passenger. Compared to conventional combustion engines, the electric drive of the new C evolution in fact offers significant advantages – especially at low speeds. Thanks to an elaborate power electronics set-up, the e-motor offers the rider an instant, spontaneous yet sensitive response. There are no delays in torque build-up at all, as are typical of combustion engines due to the clutch engaging and disengaging.

Further increased range of approx. 160 and 100 kilometres respectively due to enlarged battery capacity.
With 94 Ah instead of the previous 60 Ah, the new C evolution has a significantly increased battery cell capacity, ensuring a range of approx. 100 kilometres in the A1 driving licence version as before but increasing that of the Long Range variant to as much as 160 kilometres. This means that realistic zero-emissions riding is no problem at all in the city and in urban environments. Here, BMW Motorrad has benefited from synergy effects with BMW automobiles. For example, the C evolution uses the same lithium-ion storage modules as those installed in the current BMW i3. Developers paid particular attention to the high quality and durability of the batteries here so as to ensure the rider is able to make full use of the long range even after many years of service life and in very cold weather.

Due to the optimisation of the package inside the cell with more electrolyte and adaptation of the active material, BMW was able to increase cell capacity to 94 Ah in collaboration with Samsung SDI.

One of the main technological challenges here was to achieve optimum cooling of the high-voltage battery. On the one hand it was necessary to avoid excessively low temperatures due to the fact this heavily increases the cells' interior resistance, thereby reducing power. On the other hand, high temperatures have to be prevented since this would impact negatively on the cells' lifetime.

While in electrically powered cars a cooling agent is normally used to cool the battery, in the C evolution this function is performed by air cooling in order to save space and weight. The heat of the high-voltage battery is dissipated by means of an aerodynamically optimised cooling air shaft at the centre of the battery casing through which there is a constant flow of air. To ensure optimum heat dissipation, the battery base has longitudinally arranged cooling ribs.

The battery casing in die-cast aluminium not only holds the cell architecture, however, but also the entire electronics unit required for monitoring the cells. It also acts as a load-bearing chassis element.

The power electronics for the electric drive is installed behind the battery casing. The power electronics not only takes care of controlling the e-motor within a range of 100 to 150 volts, it also feeds in rider commands such as the position of the throttle grip. The system also processes information from the brake system and decides whether recuperation is to be activated and how much recuperation torque is to be applied to the rear wheel if required.

Innovative electric drive via drivetrain swing arm with liquid-cooled e-motor, tooth belt, planetary gear and reverse assist.
The C evolution is powered via a drivetrain swing arm. The e-motor positioned behind the battery casing acts as an integrated component of the swing arm. The physical proximity of the e-motor output shaft and the swing arm axle minimises the moment of inertia around the swing arm centre of rotation, thereby enabling an optimum suspension/damping set-up and a sensitive response.

The secondary drive is via a tooth belt from the e-motor to the rear belt pulley on the output shaft. From here, power transmission to the rear wheel is via the planetary gear. The total gear reduction is 1: 8.28, while the maximum rotational speed of the e-motor is 9,200 rpm. The e-motor and power electronics are liquid-cooled.

A particular comfort feature of the new C evolution is the reverse assist. It is activated from the left-hand handlebar panel, and the rider's attention is drawn to it by a slight jerk and the relevant indication in the TFT display. When the

activation switch is pressed down, the C evolution can reverse at walking pace only, thereby facilitating manoeuvring.

Intelligent recuperation in coasting mode and when braking.
BMW Motorrad has conducted lengthy road tests to develop a form of recuperation which is unique in single-track vehicles and very transparent for the rider. The C evolution is ridden in exactly the same way as a scooter with a combustion engine. The rider does not have to actively initiate recuperation: the vehicle does so automatically whenever possible.

For example, recuperation commences when the throttle grip is closed and – as in a combustion engine – the generator function of the e-motor creates a drag torque which depends on the degree of recuperation. The drag torque generated by the e-motor is like the familiar “engine brake” that takes effect when removing the accelerator in a vehicle powered by a combustion engine.

Recuperation also takes place during braking, converting kinetic energy to electrical energy so as to charge the battery. Here, a system of sensors is used to tap into the brake pressure levels on the front and rear wheel brake. When the power electronics detects that the rider is braking, the e-motor builds up drag torque, thereby supporting the brake manoeuvre and recuperating. If recuperation takes place during coasting or braking, this increases the range by between 10 and 20 per cent, depending on the riding profile.

Slip control by means of Torque Control Assist (TCA).
The new C evolution features Torque Control Assist (TCA), similar to Automatic Stability Control in BMW motorcycles powered by a combustion engine. TCA limits engine torque in relation to rear wheel slip.

In order to enable optimum controllability of the drive torque, the power electronics of the e-motor monitors the rotational speed of the rear wheel and reduces drive torque when a plausibility level is exceeded – in a similar way to Automatic Stability Control in BMW motorcycles powered by a combustion engine. In this way, TCA especially supports the rider when setting off, preventing uncontrolled spinning of the rear wheel on road surfaces with a reduced friction coefficient such as wet cobblestones.

In addition, Torque Control Assist serves to prevent locking of the rear wheel during intense recuperation and the resulting drag torque, especially on slippery road surface.

Various riding modes for efficient everyday use.
In developing the C evolution, BMW Motorrad attached particular importance

to providing opportunities for the rider to make an individual choice between maximum efficiency and maximum riding fun. As a result, the new C evolution has four riding modes.

Road mode: Here, full acceleration is available and when the throttle is released, recuperation during coasting uses approx. 50 per cent of maximum motor drag torque. The same applies to recuperation during braking. The standard range is available in this mode.

Eco Pro mode: In this mode, drag torque during coasting is significantly increased, while maximum recuperation combined with a limitation on acceleration and therefore energy consumption allow an extension of the range by 10 to 20 per cent. The rider feels the increased drag torque as a slight intensification of deceleration torque when releasing the throttle. The highest range is achieved in this mode.

Sail mode: In this mode, the e-motor does not build up any drag torque and recuperation occurs only during braking. “Sailing” manifests itself to the rider in that, when the throttle is released, virtually no brake torque is built up and the vehicle rolls almost entirely freely – a completely new riding sensation that is not familiar in this form from two-wheel vehicles powered by a combustion engine.

Dynamic mode: In this mode, full acceleration is combined with intense recuperation and therefore a powerful “engine brake” for highly dynamic riding.

Short charge times and charging technology based on the system used in cars.

The battery is charged via the integrated charging device, either at a regular household socket or a charging station. The charging time for a completely flat battery is approximately three hours for the 11 kW version and four to five hours for the Long Range variant, depending on the power supply available. A standard feature of the new C evolution is a new space-saving charging cable with a reduced wire size.

The charging socket is based on automobile standards and located underneath a cover in the front left-hand leg area. Opposite this in the right-hand leg area there is a storage compartment for the charging cable. The latter has a plug for the power grid which matches the specifications of the country in question.

The fact that the charge socket is identical to the standard automobile type has the advantage that the C evolution can be charged at charging stations

with integrated charge cable and standardised plug - as are used throughout the USA, for example. For charging stations in other countries, specific charging cables are offered as optional accessories.

Synergy effects with BMW automobiles and technical safety according to car standards.
Unlike any other motorcycle manufacturer and due to its integration in the BMW Group, BMW Motorrad is able to draw on in-house experience and expertise in the automobile field in the development of electrically powered vehicles. The synergies available here range from the use of the same technical components through to high voltage technology expertise and the associated safety requirements as applicable to cables, plugs, battery electronics and safety shutdown.

This also includes the insulation monitoring device, the high-voltage indicator, the high-voltage distributor and the DC-DC converter which serves to convert high voltage to low voltage so as to feed the 12 volt vehicle power system and the control units.

High voltage safety and functional reliability standards established by leading automobile manufacturers (> 60 volt direct current) have been applied to an electrically powered two-wheel vehicle for the first time here. Development in accordance with ISO 26262 is currently unique among (electrically powered) two-wheel vehicles: this ensures that all functionally relevant features are developed in accordance with the appropriate standards and reflect the current state of science and technology.

Hybrid chassis with agile handling due to low centre of gravity.
Unlike existing maxi scooters powered by a combustion engine, the new C evolution does not have a main frame in the usual sense. The aim of chassis development for the C evolution was to combine the best possible directional stability at high motorway speeds with agile handling in urban traffic. Engineers also set out to make full use of the advantages provided by an extremely low centre of gravity – which results from the low position of the battery. For this reason, chassis design is based on a torsionally rigid hybrid composite structure consisting of a load-bearing, torsionally rigid battery case made of cast light alloy with integrated mounting for the single-sided drivetrain swing arm. Bolted onto this are the steering head support and the rear frame in steel tubing.

In urban traffic in particular, the riding experience is characterised by extremely light handling and excellent slow-running properties. The weight of the vehicle is comparable to that of a maxi scooter powered by a combustion engine.

Wheel control, as well as suspension and damping, is taken care of at the front by an upside-down fork with a generous fixed fork tube diameter of 40 mm. The rear wheel suspension consists of a single-sided drivetrain swing arm. At the rear, suspension and damping are performed by a spring strut placed on the left-hand side, directly controlled and adjustable at the spring mount. The spring travel is 115 millimetres at front and rear, thereby offering a high degree of comfort.

At the front, the new C evolution rolls on a 5-spoke light alloy die-cast wheel, size 3.5 x 15 inches, while the size of the rear wheel is 4.5 x 15 inches. The tyres of the new C evolution are generously sized, with 120/70 R 15 at the front and 160/60 R 15 at the rear.

Powerful braking system with ABS.
At the front, a twin disc brake system with a diameter of 270 millimetres and 2-piston floating calipers ensures powerful, safe deceleration. At the rear there is a single disc system, likewise with a diameter of 270 millimetres and 2-piston floating caliper. In order to achieve a stable pressure point and optimum controllability, all brake lines are steel-wrapped.

BMW Motorrad ABS ensures maximum active safety. Weighing just 700 grams and extremely compact in size, the Bosch 9M 2-channel ABS allows independent regulation of the two brake circuits for the front and rear brake. However, the ABS software has also been adapted so as to control the recuperation process in line with the specific requirements of the C evolution. As in the BMW Motorrad maxi scooters C 650 Sport and C 650 GT, the hold brake is activated automatically when the side stand is folded out.

Multifunctional instrument cluster and LED daytime running light.
The instrument cluster of the C evolution has a large, easily legible TFT display that is conceptually based on that of the BMW i3. It features the obligatory speed display as well as offering a wealth of other information. This includes display of the battery charge state (SOC = State of Charge) and the energy balance. The latter is displayed by means of a progress bar, indicating to the rider whether energy is currently being converted into forward propulsion or being recuperated. This information helps the rider in his efforts to ride as efficiently as possible.

In addition to the familiar status indicators, the instrument cluster also includes those which electrically powered vehicles are required to have by law. There is a display to indicate an insulation error, for example, as well as a warning light that goes on when power limitation occurs in the event of overload (see ECE R100).

The front lighting unit includes headlamps for high and low beam. The C evolution also features a centrally located daytime running light. In addition to a rear light in LED technology, there are also LED turn indicators.

Innovative colour concept and design.
The new C evolution draws on the innovative styling of the BMW Motorrad family, offering a thrilling, inspiring design that arouses an emotional response to the new drive technology. As in other BMW motorcycles, the so-called split face runs across the upper trim section, giving the scooter a distinctive and dynamic front view.

The interplay of the paint finish Ionic Silver metallic and the accentuation colour Electric Green in conjunction with the contrast colour Blackstorm metallic conveys specific vehicle characteristics such as maximum ecological compatibility, supreme dynamic performance and straightforward handling. The Long Range variant of the new C evolution also features a newly designed graphic on the trim elements of the centre tunnel.

The characteristic BMW Motorrad design style is also reflected in the styling of the twin-tipped spoiler in the front trim and in a boomerang-like floating panel in the front side trim. The short, sporty rear with integrated helmet storage compartment underscores the active riding character of the C evolution, as do the tinted windshield and the coloured seat seams.

Already available in Germany, France, Italy, Spain, the United Kingdom, Switzerland, Austria, the Netherlands, Belgium, Luxembourg, Portugal, Ireland and China, the C evolution is now also on the market in the USA, Japan, South Korea and Russia.

3. Equipment program.

BMW optional equipment and Original BMW Motorrad Accessories for wide-ranging customisation.

An extensive BMW Motorrad program is available to individualise the new C evolution.

BMW optional extras are supplied directly ex works and are integrated in the production process. Original BMW Accessories are installed by the BMW Motorrad dealer or by customers themselves. These are features which can be retrofitted, too.

BMW optional equipment.
- Comfort seat (seat height: 785 mm / inside leg length: 1,770 mm).
- Heated grips.
- Alarm system (DWA).

Original BMW Motorrad Accessories.

Storage.
- Topcase 35 l (lid covers finished in Ionic Silver metallic).
- Back pad for topcase 35 l.
- Liner for topcase.
- Luggage bridge.

Ergonomics and comfort.
- Touring windshield.

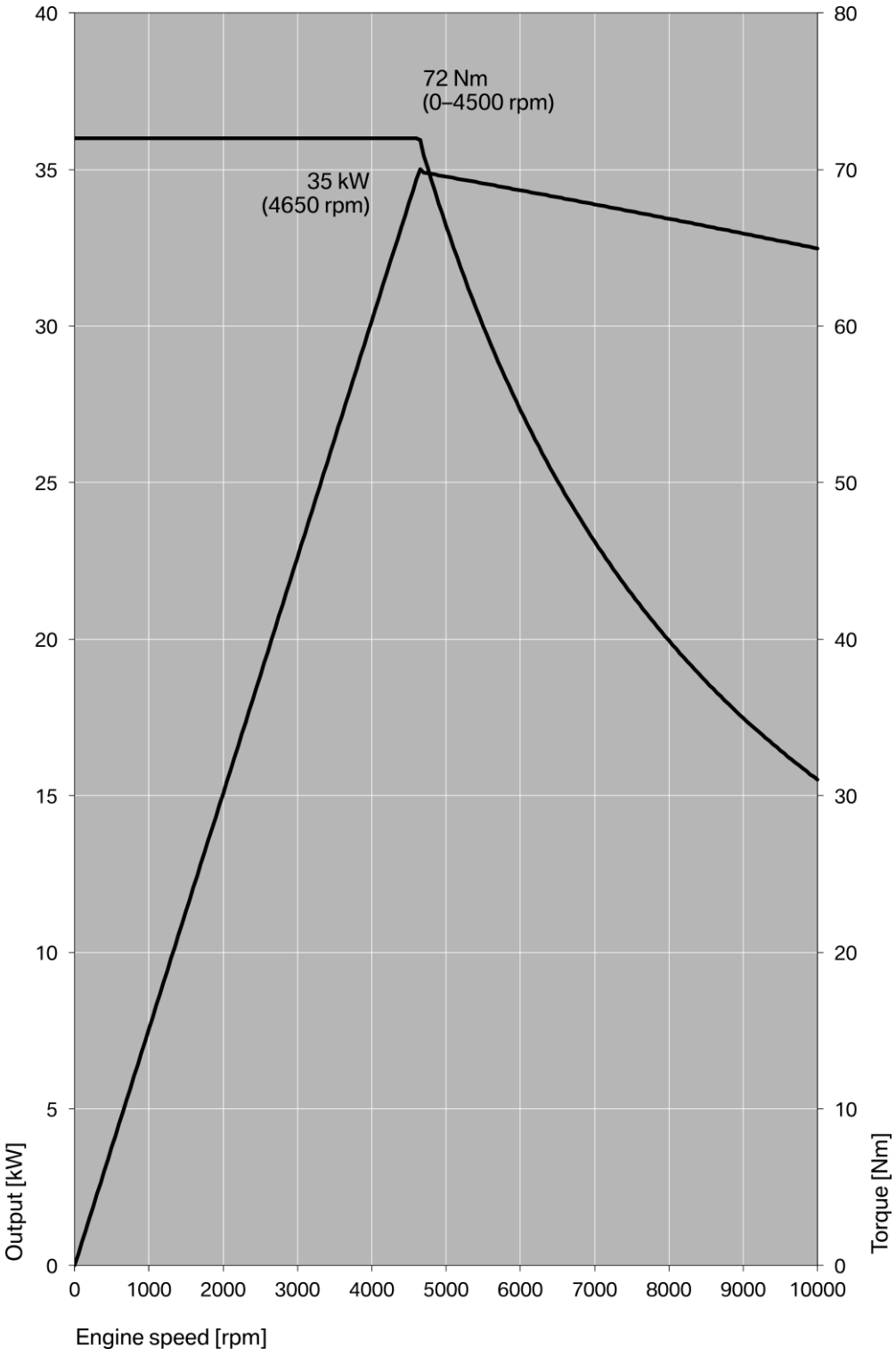
Navigation and communication.
- BMW Motorrad Navigator.
- Smartphone cradle.

Safety.
- Mirror glass, aspherical.

Charging.
- AC quick-charge cable CEE.
- AC quick-charge cable Type 2.
- AC quick-charge cable Type 3.

BMW Motorrad has also expanded its range of rider equipment to include attractive products for urban mobility to match the new maxi scooters.

4. Output and torque.



5. Technical specifications.

		BMW C evolution Long Range // BMW C evolution
Drive		
Rated output	kW	19/26
Maximum output	kW	35
At engine speed	rpm	4,650
Torque	Nm	72
at engine speed	rpm	0 to approx. 4,500
Type		Drivetrain swing arm with liquid-cooled e-motor; permanent magnet synchronous motor with surface magnets. max, engine speed 9,200 rpm
Electrical system		
Drive battery		Air-cooled lithium-ion high-voltage battery with additional fan
Battery capacity	kWh	8 (3 modules with 12 cells of 94 Ah each)
Battery voltage (nominal)	V	133
Charging capacity	kWh	3 (integrated charging device)
Charging duration (depending on power supply)		With 220 V / 12 A charge current: approx. 4:30 h for 100 %; approx. 3:50 h for 80 % With 220 V / 16 A charge current: approx. 3:50 h for 100 %; approx. 3:05 h for 80 %
Secondary battery	V/Ah	12 / 8
Generator	W	DC/DC converter integrated in charge device, 475
Headlamp		High beam/low beam: 12 V/55 W, halogen; LED daytime running light/parking light
Rear light		LED brake light/rear light
Power transmission - gearbox		
Secondary drive		
Total gear reduction		1: 8.28
Suspension		
Frame construction type		Hybrid suspension with load-bearing battery casing made of die-cast aluminium, bolt-on steering head support and rear frame in steel tubing
Front wheel suspension		Upside-down telescopic fork, ø 40 mm
Rear wheel suspension		Single-sided swing arm with directly mounted strut; spring rest manually adjustable to 7 levels
Spring travel, front/rear	mm	120/115
Wheel castor	mm	95
Wheelbase	mm	1,594
Steering head angle	°	65.9
Brakes	Front	Hydraulically activated twin disc brake, Ø 270 mm dual piston floating caliper
	Rear	Hydraulically activated single disc brake, Ø 270 mm, dual piston floating caliper
ABS		BMW Motorrad ABS
Wheels		Die-cast aluminium wheels
	Front	3.50 x 15"
	Rear	4.50 x 15"
Tyres	Front	120/70 R15
	Rear	160/60 R15

		BMW C evolution Long Range // BMW C evolution
Dimensions and weights		
Total length	mm	2,190
Total width with mirrors	mm	947
Total height	mm	1,301
Seat height (without rider)	mm	765 (comfort seat option 785)
DIN unladen weight, road ready	kg	275
Permitted total weight	kg	445
Performance figures		
Top speed	km/h	129 // 120 (electronically cut off)
Acceleration		
0-50 km/h	s	2.8
0–100 km/h	s	6.8
Range according to WMTC	km	up to 160 // up to 100
Fuel consumption according to WMTC	kWh	9
Recuperation		Automatic recuperation during coasting and braking, simulated drag torque (“engine brake”)