With instant throttle response, a top speed of 80 and a range near 100 miles, BMW's new C-Evolution electric maxi-scooter offers a low cost, luxuriant and attractive means of getting around town.

LEADING THE CHARGE

BMW C-EVOLUTION ELECTRIC SCOOTER HITS STREETS IN U.S.

> By **Moshe K. Levy**

It's a brave new world and one need look no further than BMW's C-Evolution scooter for ample proof. Borrowing three Li-ion battery modules from its i3 electric car, BMW has created the first mass production electric maxi-scooter available in the U.S. MCN received the very first press C-Evolution in the country and put it through its paces in a real-world commuter scenario, to judge whether electrification is a verifiable option, or a passing fad.

ENGINE AND DRIVETRAIN

The C-Evolution has a liquid cooled electric motor that punches out a claimed 48 horsepower and 53 pound-feet of torque. That's 15 percent more torque than BMW's conventional gas-powered C650GT scooter, continuously available in a perfectly flat plateau, from 0 rpm to 4500 rpm. The motor is enclosed within the swingarm assembly, to the rear of the battery casing. A toothed belt handles final drive, connecting the motor to the rear pulley on the output shaft. A reverse mode is also available, allowing the scooter to be walked backward, including uphill.

Every time the rider lets off the throttle to decelerate, the motor builds

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up drag torque and feeds that electrical energy back into the battery, which can increase range by 10-20 percent. The rider can vary the effect of the drag torque from mild to very aggressive by selecting from four separate drive modes.

Sail mode provides full acceleration, with near zero regen available during coasting. Road mode offers full acceleration, with regen set at 50 percent of maximum. Eco Pro mode gives limited acceleration, with maximum regen, for highest range. Finally, Dynamic mode, with full acceleration and maximum regen. These modes are very helpful in balancing range and performance, as required for different types of riding.

Even with the limited regen in Road mode, the C-Evolution can come to nearly a full stop without applying the brakes at all. Once riders adapt, the C-Evolution can be ridden primarily with the throttle and limited use of the mechanical brakes, thanks to regen.

Acceleration from 0 to 30 mph can be achieved in less than three seconds and 0 to 60 mph in less than seven seconds.

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The great surprise when riding electric is not waiting for clutches to engage or the engine to rev for power to build–the e-motor's maximum torque is available instantly from 0 rpm onward.

BMW Torque Control Assist limits motor output in relation to rear wheel slippage, for traction control, and top speed is electronically limited to 80 mph.

BATTERY AND ELECTRONICS

The C-Evolution has 36 Samsung SDI lithium-ion cells divided among three battery modules, each 100-150V (133V nominal). Total capacity is 12.5KWh. Advertised range is up to 99 miles in Eco Pro mode. The battery is mounted low in the frame for better center of gravity and entirely air cooled via a ventilation shaft in the middle of its die-cast aluminum casing, which itself acts as a load-bearing chassis structure.

A 3KW integrated onboard charger allows charging from fully depleted in approximately 9 hours, 20 minutes using 120VAC utility power, or in 4 hours, 30 minutes using 240VAC "Level 2" type chargers. A small Level 1 (12A, 120V AC) charger is stored under the passenger seat when not in use, and the standard J1772 charging receptacle lives behind a panel near the rider's left knee, a convenient and accessible location.

The most common concern is running out of juice, but electric vehicles provide much more warning than gas vehicles when running out of energy. An amber warning light illuminates when 20-percent battery capacity remains. The battery indicator turns from green to orange when 15 percent remains, then to red at 5 percent and blinking red a 3 percent.

Soon after, the indicated miles remaining read "---mi," but the scooter soldiered on, albeit with reduced acceleration, displayed as red bars at the top of the ePower graphic on the TFT. This continued until the 3.2-mile mark, when propulsion grew noticeably weaker. The C-Evo crept forward at 30mph, gradually getting slower, until finally coming to a gentle halt, a full 3.7 miles after showing 0 miles remaining.

A gentler throttle hand could have stretched this number further. Contrast this with internal combustion, which flashes a low fuel warning light when 1 gallon of fuel remains, then abruptly dies as soon as the gas is consumed.

The C-Evolution does not have BMW's existing ConnectedDrive suite (available in their e-cars), meaning owners cannot monitor the scooter's state of charge remotely or even connect a smartphone. It's extremely disappointing that there is

no connectivity, as electric vehicle owners routinely check charging status and compare efficiency data, even sharing findings online. This appears to be a disconnect between BMW AG and Motorrad, and a huge missed opportunity.

The bike also includes an 8ah, 12V DC battery, to run gauges and other electronics, but there is no power port for phone charging, GPS, etc. One could run a cable to the battery, but the missing power port is another inexplicable exclusion.

BRAKES AND SUSPENSION

BMW's proven two-channel ABS is standard equipment. 270mm dual floating discs with 2-piston floating calipers handle stopping duty up front, while the rear gets a single matching 270mm disc and caliper. They're strong, with a slightly wooden feel, though aggressive regen assists braking dramatically.

The brakes automatically apply when the kickstand is down, which prevents riding away with the stand down and doubles as a parking brake.

Every electric vehicle manufacturer should follow Tesla's lead and offer brake lights which actuate based on rate of deceleration, not only when the brakes are physically applied. The regen mode on the C-Evo can be as aggressive as a downshift at high rpm on a conventional bike, and having the brake light engage would be a great safety feature. We hope BMW eventually adds this as standard equipment.

A 40mm upside-down fork up front and direct-link spring strut out back soak up the bumps. Suspension travel is a generous 4.7 inches front and 4.5 inches rear, and the rear shock has seven manually adjustable preload settings.

Light alloy, five-spoke die cast 15-inch wheels are shod with meaty Metzeler Feelfree tires, 120/70R15 up front and 160/60/R15 out back.

ERGONOMICS AND HANDLING

The chassis is tubular steel frame, oriented toward urban duty. The unladen, road ready weight of the C-Evolution is 606 pounds, about 31 pounds more than BMW's conventional C650GT scooter.

A high-pitched whine at low speeds quickly disappears as the speed ramps up, and the wave of instantaneous torque pushes the bike forward effortlessly. All you hear is wind noise getting progressively louder as you approach top speed, with no vibration whatsoever. Experiencing the heighted awareness of hearing everything around you, including traffic behind, is truly a revelation.

Seat height is 30.1 inches with the standard seat, or 30.9 inches with the optional Comfort Seat, which our test model was equipped with. Seating position is neutral and there is a commanding view of surrounding traffic thanks to the "floating" mirror pods, which have LED turn signals integrated into their housings. The floorboards are roomy, and the comfort seat is supportive, if a bit too soft. Dual-mode heated grips were toasty on cold mornings.

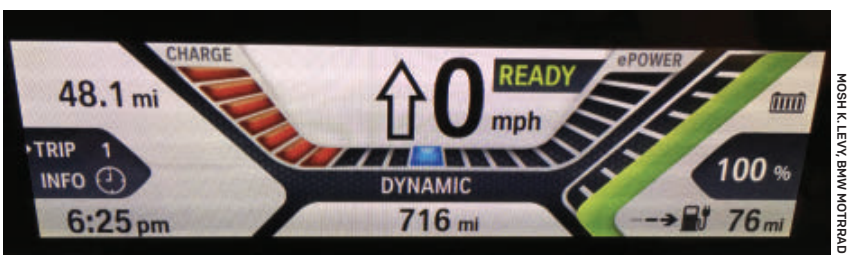
Handling is sharp and precise, with the low center of gravity making slow speed maneuvers a breeze. Zipping around the city is as fun as it gets, since the C-Evo's acceleration off the line is brisk enough to leave almost everyone well behind. The rush of torque is very visceral, despite the complete lack of noise and vibration.

Likewise, highway duty is comfortable enough, with a compliant ride and decent wind protection from the fixed-position standard windshield. A larger touring windshield is optional, but was not available for this test.

There is enough storage under the passenger seat to swallow one full face helmet (assuming the charger is removed), and there is a small lockable glovebox by the rider's right knee.

INSTRUMENTS AND CONTROLS

Switchgear ergonomics are typically logical BMW and the 7.25-inch wide by 3-inch high TFT display contains a wealth of information in addition to the usual speedometer, odometer, trip computer and myriad warning lights.



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A graphical interface displays the battery's state of charge and whether energy is being expended from the battery or fed into it via regen. A review of the manual is recommended to decipher the Expert menu, which toggles through time, date, average speed, average, current and overall energy consumption, energy recovery, bonus range via regen, high voltage and vehicle voltage power, and more.

Despite the multitude of choices, it's easy to navigate and customize the display. Oddly, there is no cruise control, even as an option, but we believe cruise could extend range under maintained speed, where it's needed most.

ATTENTION TO DETAIL

The C-Evolution is a handsome scooter, with a clear family tie to BMW's other C-Series models. It's currently only available in Ionic Silver Metallic with Electric Green and Blackstorm Metallic accents.

Starting the machine is conventional–twist the key, hold the brake and thumb the "starter" button. There is no starter motor, but the screen lights up with a READY signal, then twist the throttle and go.

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VALUE

The C-Evolution can be summed up in one word: Efficiency. In the city, riding assertively, we coaxed an average of 9.8 miles per KWh out of it, and over 11 miles per KWh when babied. In a worst-case test, with the throttle pinned for 46 miles, it still returned an astonishing 4.9 miles per KWh, and that was in cool weather.

Using data from a three-week test regimen and information gathered from C650 owners as a baseline, the graphic below shows how the numbers break down over a hypothetical 12,000 mile riding season. Readers should substitute their own electric rates and local gas prices.

Coupled with a near absence of any maintenance requirements, the C-Evolution is exponentially less expensive to operate and maintain than its gas counterpart. Commuters, take notice!

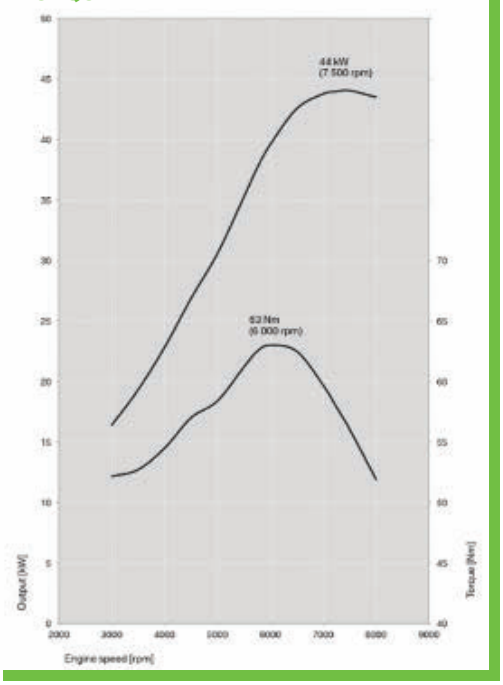
FINAL THOUGHTS

Electric vehicles are not a fad, they are the future. The efficiency gains are incredible, dramatically reducing the operational cost per mile, a windfall for frequent short rides.

The absence of noise, vibration and harshness is a safety benefit, since one can hear much more of their surroundings. The wave of instantaneous torque is downright addictive.

The C-Evolution is available in California for $13,750. A video breakdown can be seen at: *youtube.com/c/motomouthmoshe.* MCN

TORQUE



2018 BMW C EVOLUTION ESTIMATED COST, 12,000 MILE RIDING SEASON

Model	MPKWh / MPG 50/50 City/Hwy	Energy Cost per Mile x 12000 [1]	Maintenance Costs, per BMW [2]	Total Operating Cost at 12,000 mi.
BMW C-Evo	**7.7 MPKWh**	**$140.26**	**$455 (est.)[3]**	**$490.26**
BMW C650GT	51.3 MPG	$666.66	$1,716.00	$1,986.66

1—Average energy $0.09 per KWh and $2.85 per gallon in New Jersey, October 2017.
2—BMW recommended shop time at rate of $130 per hour.
3—First-year estimate includes a "running-in check" at 600 miles, which is only performed once, and a brake fluid flush, performed at the end of year one and every two years thereafter. Year two operating costs should be significantly lower for the C-Evolution.