

Redline

NEWS, VIEWS AND A BRUSH WITH THE LIMITER

► JANUARY 2012



POWER
LINE

EV Commodore

Aussie ingenuity puts local hero on a charge

IT'S THE MOST radical Commodore ever created, and the sound it makes is ... silence. Only five days earlier, EV Engineering powered up this development mule for the very first time, lifting a lithium-ion battery pack into the space where engine, auto and driveshaft used to be. *Wheels* is the first outsider to see the electric-powered Holden, first prototype for a batch of seven that will be produced in 2012. And, though there's a lot of work to be done, we're also the first to drive it...

The Commodore isn't registered, so this first experience of full-size Australian-flavoured electro-mobility is restricted to the parking lot behind EV Engineering's Port Melbourne

headquarters. Still, this is enough to get a taste of the performance from the rear-mounted electric motor and its single-speed transmission. Floor the accelerator pedal and the Holden's smooth and silent take-off is rapidly followed by a solid surge of silky thrust. The electric Commodore isn't going to have any problem keeping up with internal-combustion-powered traffic.

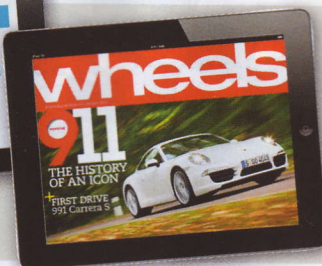
Similar performance to a V6 Commodore is one of EV Engineering's objectives and this was the primary reason an electric motor with peak outputs of 145kW and 400Nm was chosen. A 0-100km/h time of 9.0 seconds "or less" is expected, says chief

engineer Tim Olding. "Top speed will be 130km/h," he adds, a product of the motor's 8000rpm maximum speed and the single transmission ratio selected for strong acceleration. Driving range? The target is 160km, measured according to the NEDC (New European Driving Cycle), which is the basis for Australia's ADR81 efficiency standard. The real-world range expected by EV Engineering is 80-140km, depending on driving style and conditions.

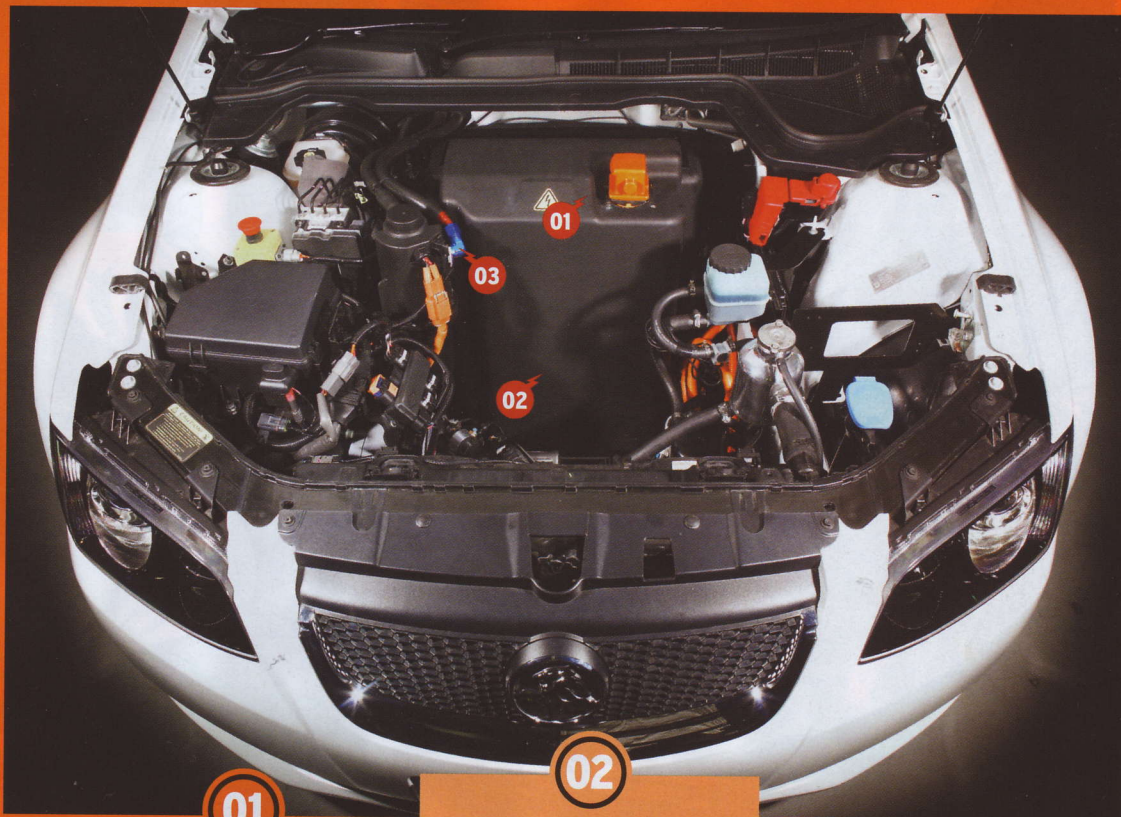
Funded in part by a \$3.55 million grant from the Federal Government's Green Car Innovation Fund last February, the aims of the project are to prove that electrification makes sense for big cars, at the same time

as stimulating the development of EV know-how in Australia. The EV Engineering consortium is made up of electric car charging network operator Better Place, automotive component makers Bosch, Continental, Air International and Futuris, plus fleet manager GE. Holden is providing in-kind engineering support, including use of its Lang Lang Proving Ground for development and testing.

The seven 'production' EV Engineering Commodores will be completed by late June, and handed to the consortium partners in time for Better Place's Australian launch. This Israel-based company aims to be a leading service provider for all kinds of electric cars, those with



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01

Black box

This black box is the front end of the electric Commodore's 30kWh battery pack, which fills the transmission tunnel as far back as the rear seats. The pack consists of 210 lithium-ion cells, arranged in modules of four to 18. The cells are made in Korea by SB LiMotive, a joint venture between Samsung and Bosch. Total weight is 400kg. The Australian team came up with a new design for the cell-connecting and current-conducting busbars inside the pack. Their innovative bimetallic screw-on terminal has been patented.

02

Vacant lot

No motor here, it's down the back. Powerful and torquey permanent magnet electric motor (below) is a compact cylinder. Made by UQM Technologies, the 50kg PowerPhase 145 is 90-95 percent efficient through nearly all its 0-8000rpm range. Rolls used two in its 2011 Geneva concept, the 102EX Electric Phantom. Lots of vacant space in the nose should mean the electric Commodore is even more crashworthy than a standard one.

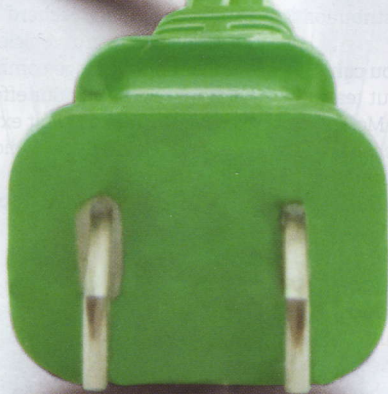


03

Cold pack

Without the waste heat of a combustion engine, the electric Commodore needs another source of cabin warmth. This is the solution, basically a fast and energy efficient electric water heater plumbed into the standard heating, ventilation and air-con system. Although the battery pack requires liquid-cooling, it doesn't give off anything like the bulk heat of a running engine. Consortium member Air International is contributing battery thermal management and air-con expertise.

WIRED ANGLES





Rolling on Dubs

VW is set to overtake GM and Toyota as the world's number-one car company. The German giant was number three last year, but is on track to end the year with 8.1 million sales, while GM is set to retain second place with 7.55m. Toyota, hit hard by the natural disasters that befell Japan and Thailand this year, will record a near 10 percent drop for around 7.27m.

CURRENT
THINKING



CAREY REVELS IN THE SEAMLESS TORQUE DELIVERY, AND, THANKS TO THE GREEN ENERGY USED, THINKS OF HAPPY POLAR BEARS

fixed batteries like the Nissan Leaf and Mitsubishi iMiEV, swappable batteries like the Renault Fluence ZE and even plug-in hybrids like the coming Holden Volt. For a fixed monthly fee, Better Place will cover all energy costs, install a charge point at customers' home or workplace, and provide swipe-card access to public chargers. Better Place believes battery swapping is a key technology for EV acceptance, so the electric Commodore's weighty chunk of energy storage will be removable. In other markets where it is already active, like Denmark, Better Place also takes care of the risks – such as depreciation and degradation – that go with an expensive battery pack. The owner gets a cheaper EV, but the battery costs are built into the monthly fee.

In Australia large cars typically do more kilometres each year than the 13,700km national average, according

to EV Engineer chief executive officer and former Holden exec, Ian McCleave. Driving the large-car average of 23,000km using internal combustion produces around 6000kg of CO₂, he estimates. So the emissions savings potential with a large electric car, especially if run on the 100 percent renewable energy Better Place will supply all its customers in Australia, is huge.

The EV Engineering team is taking the proof-of-concept role very seriously. The electric Commodore was designed in just four months, but it's a very cunning piece of work. The plan was always to create a potentially manufacturable car at a cost competitive – minus battery – with existing technology.

Packaging the electric drivetrain has been achieved with few modifications. The battery pack occupies most of the same space as a Commodore powertrain. In place of

the fuel tank is a box enclosing the motor's power electronics. A modified rear subframe cradles the electric motor and its gearbox. The subframe mounts to the body in exactly the same places as a conventional Commodore, and the car's rear suspension is completely standard. While the electric Holden weighs an extra 150kg, its weight distribution is barely altered.

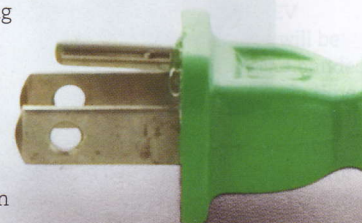
"We wanted to show you can electrify some cars without tearing the whole thing up," says McCleave. Consider this objective achieved; in most ways – performance, interior space, boot size, spare wheel, and crashworthiness – the EV Engineering Commodore is just as Holden designed it, only way quieter.

So the electric Commodore involves just one important compromise ... the distance it can drive on a single dose of electrical energy. While EV Engineering's design

has obvious merit, the big unknown is the market's readiness to embrace a large car with a small range. Holden is interested, but...

"We're keen to see the level of market interest in a large electric vehicle, but we're making no promises about bringing it to market," says Holden energy, environment and tech director, Richard Marshall. "Putting an electric vehicle into production is a huge commitment, and we're focusing our efforts on the local launch of our Volt extended range electric vehicle, which arrives late next year."

JOHN CAR



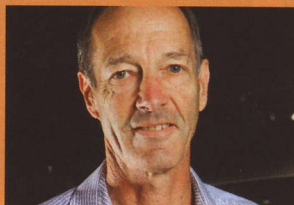
M

US
MANUAL

BMW's M Division is again preparing a six-speed manual version of its new M5 ... but again, only for the US market. A manual version of the V10-powered E60 was available in US, but denied the rest of the world, and now the situation is repeating with the manual-mad States demanding a stick as an option to the seven-speed dual-clutch in the F10 M5.

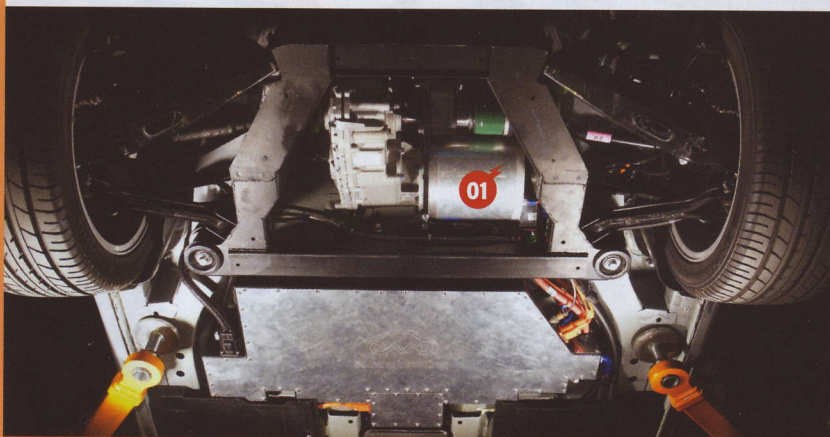
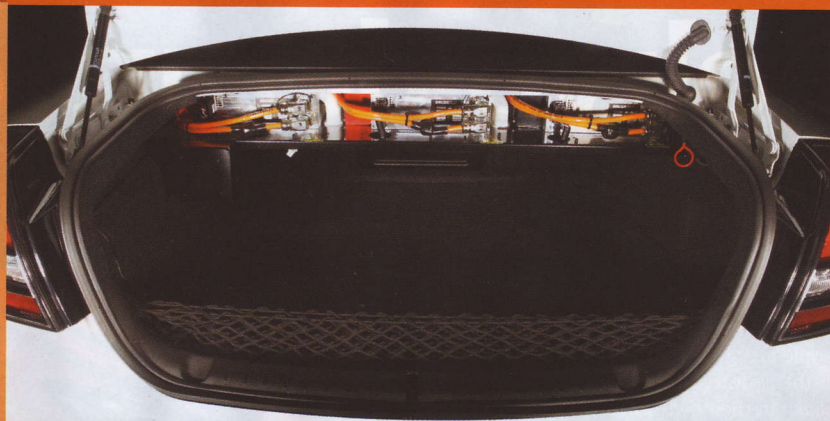
Fill 'er up

'Production' version of the electric Commodore will give drivers three options when charge runs low. First is single-phase recharging, taking about nine hours at 3.3kW. Second is DC quick charge, where a whopping 50kW gives 80 percent of full charge in just 30 minutes. Repeated quick charging isn't good for battery life. Automated battery swap tech from Better Place is the third and final choice. The two development mules will have three-phase charging hardware (right, top) installed beneath their parcel shelves.



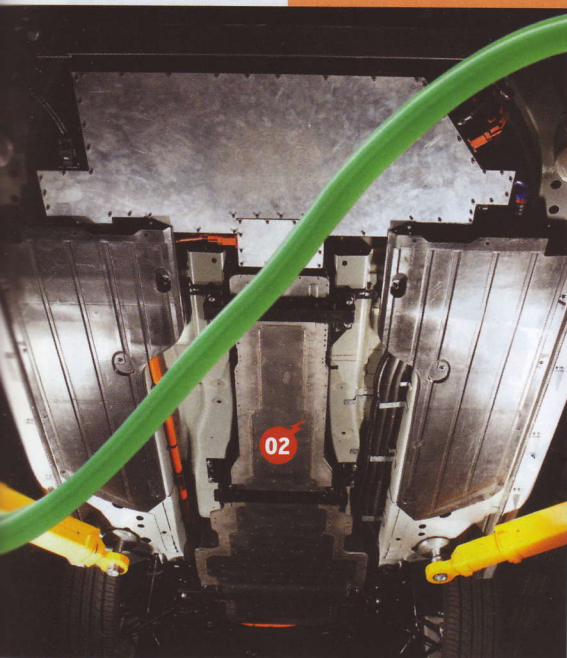
"We wanted to show you can electrify some cars without tearing the whole thing up"

IAN McCLEAVE,
EV ENGINEERING CEO



01

02



Motor and BorgWarner reduction gear and diff assembly are bolted into modified Commodore rear subframe. Motor control electronics occupy adjacent space

Bottom of battery pack is perfectly flat, lowering aero drag. In mule it's bolted in place, but a quick-swap system is being developed.

