

The Power of 3

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Driving the future further

"[We] will not stop until every car on the road is electric." ~ Elon Musk

Overview

The first edition of *The Power of 3* considered the rapid development and deployment of lithium-ion (Li-ion) battery technology, impelled in large part by the growing interest in, and evolution of, electric vehicle (EV) technology, including plug-in hybrids.

Global energy, metals and mining research and consultancy group Wood Mackenzie says the cost of Li-ion batteries is now approaching the point at which mass adoption of EVs is feasible, despite lingering (and irrational) range anxiety on the part of some.

Nearly a year on, the EV marketplace is going from strength to strength – just ask Volkswagen, Audi, Daimler, BMW, Volvo, Fiat Chrysler, NEVS (formerly Saab), Nissan, Toyota, Hyundai, Mitsubishi, General Motors, Ford, even Jaguar ... and, of course, Elon!



Clean and green

Early last century, with petrol-powered cars edging out EVs, Clara Ford (wife of Henry) eschewed the Model T, preferring her 1914 Detroit Electric, which she described as simpler, cleaner, safer and nicer to drive.

Echoing those sentiments a hundred years on, [the Union of Concerned Scientists](#) asserts that EVs are clean now and will get even cleaner with time, something internal combustion engine vehicles won't ever achieve.



Carrots and sticks

As noted in *Australian Mining Magazine*, **China** has deemed it mandatory that all new residential buildings, and at least 10 per cent of large public buildings and parking lots, be fitted with EV charging stations. China's central government hopes to have five million EVs (preferably made there) on-road by 2020.

Tesla China, which has battled to create a comprehensive charging network in such a vast country (and one with very complicated political mores), is to launch the Tesla Charging Partner Program there, in line with the country's recently developed national EV charging standard.

It's only a matter of time before China introduces an air-pollution levy, so EV uptake there is a no-brainer – sales are up 162 per cent this year alone.

In **Germany**, the government has introduced an incentive program aimed at seeing a million plus EVs on its streets by 2020. Moreover, a resolution has been passed to end sales of internal combustion engines, both petrol and

diesel, by 2030, with only zero-emission vehicles allowed on-market after that.

Norway too has acted decisively to encourage EV ownership. Propelled by generous government incentives that include exemptions from VAT, road taxes, parking fees and tolls, EV sales constitute 20 per cent of all new vehicle sales.

Indeed, **all western European countries** offer incentives for EV uptake, among them tax reductions and exemptions, bonus payments and premiums and fiscal incentives for fuel efficiency.

In the **United States**, President Obama, who envisioned a million plus EVs on American roads by the close of the

decade – initiated rebate incentives on EV purchases to achieve that end.

Even the US Army is on track, awarding Navitas Systems a \$72 million contract to develop next-generation Li-ion batteries for military vehicles, which will replace the current lead-acid technology.

Canada too is doing its bit in offering incentives for EV uptake (albeit on a province-by-province basis). **India**, which aims to have seven million EVs on the road by 2020, proffers various subsidies, and **Japan** has had a range of incentives in place since 2009. Sadly, **Australia** remains unutterably unenlightened in this regard.

Commercial EVs

Electrification of commercial vehicles takes emission control to the next level, not least in the realms of public transport.

Mid-year, Elon Musk proposed expanding Tesla's product range to include, eventually, an electric pickup and heavy-duty truck, as well as new forms of urban transport with a high passenger density. Also, once fully autonomous driving is perfected, Tesla plans to operate its own fleet in cities where demand exceeds the supply of customer-owned cars ... all in the interests of "accelerating the advent of sustainable energy ..."

Last month, electric bus manufacturer Proterra Inc. unveiled its newest zero-emission vehicle, the Catalyst E2 series. With a nominal range of 194 to 350 miles, it's capable of servicing the full daily mileage needs of just about every US mass transit route on a single charge – so range anxiety be damned!

Norway's postal service Posten has ordered 240 Renault Kangoo Maxi Z.E.s to complement the company's current fleet of 900 EVs (cars, bikes, quadricycles and trailers). Posten's electric version of the Kangoo light-duty commercial van will be deployed mostly in high-density urban areas.

With respect to larger commercial vehicles, Li-ion battery technology shifted up a gear recently when German manufacturer Akasol – a pioneer of e-mobility battery storage solutions – unveiled a compact, modular system for commercial vehicles. Completely scalable, Akasol's AKASystem is well suited for use in buses, lorries, construction and other, similar vehicles.

Even the Grand Duchy of Luxembourg is getting in on the EV act. Sales-Lentz, a large public transport operator there, already has 24 Volvo hybrids and 12 Volvo electric hybrids in its fleet. Now the company is amping up its electrification with the purchase of four Volvo 7900 electric buses.



In the Antipodes, the first autonomous, driverless and electric shuttle bus to operate on a public road in Australia has taken to the streets of Perth to begin a three-month trial. Owned by the Royal Automobile Club

of WA, the 11-seater French Navya will traverse a short stretch of the Swan River foreshore at speeds of up to 25 kilometres an hour.

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Britain's Smith Electric Vehicles, headquartered in Kansas City, Missouri and with manufacturing facilities there and in The Future Technology Centre, Sunderland, UK, manufactures and markets zero-emission commercial EVs that it supplies to multiple industries worldwide – including food and beverage, utility, telecommunications, retail, grocery, parcel and postal delivery, school transportation, military and government.

In Europe, EVs are already making inroads into taxi fleets. Visitors to Amsterdam can grab a Tesla taxi at the airport, while the continent's leading e-cab manufacturer, Nissan, has more than 550 electric taxis on European roads (including the LEAF and commercial vans). The top e-taxi countries in Europe at present are the Netherlands and the United Kingdom.

At Sydney Airport, meanwhile, Australia's first electric airport bus forms part of a \$5 million investment in environmentally friendly ground transport technology there. The Electric Blu is the first of six commercial EVs that will replace the airport's existing diesel buses by the end of 2016.

The future

According to Dr Peter Harrop, chairman of UK market research firm IDTechEx and co-author (with Raghu Das) of two reports on the future of commercial EVs, the next step is vehicles that charge themselves.

Energy-independent vehicles (EIVs) will create their own electricity from ambient energy such as light, wind, waves and tide and, where necessary, store it until needed. Often, they will be navigationally autonomous and 'pure' rather than hybrid EVs, relying on technologies such as energy-harvesting shock absorbers, regenerative active suspension and regenerative braking.

"The logical extension of these one-dimensional movement harvesters is to devices converting movement in all three dimensions into electricity: Caterpillar and Witt Energy have done that experimentally already," the authors say.

Harrop and Das maintain that the commercial EV sector will "grow 4.2 times in the next decade," with transport and logistics already on the right path and scope for earthmoving and lifting vehicles to follow suit. "Excitingly, EV technologies are changing and improving hugely, and innovation often comes [in the commercial sector] before being seen in the more publicised EV sectors, such as cars."

And, finally ...

If sporty electrified transport is your thing, what could be better than this?



The German-made Volocopter, which can take off vertically, has the potential for use away from airports. [Photograph: Volocopter/Nikolay Kazakov.]

Which Perth-based company would love a fleet of Teslas by the decade's end?



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