



The rapid development of battery technology will change the world

ALAN KOHLER



I have just spent the weekend driving the remarkable Tesla Model S. A week ago I caught up with the video of Tesla founder Elon Musk presenting the company's new products, the Powerwall and Powerpack.

I get it now. It's all about the batteries.

The car itself is a big leap forward, for sure, but it's the batteries that will kill the internal combustion engine and, eventually, coal and gas electricity generation.

The rapid development of battery technology is truly disruptive, to several industries at once. It is, undoubtedly, a technology that will change the world.

First, a bit of gushing about the car. It's silent, simple to operate and very powerful. The big touch screen in the middle is easy to use and is basically a computer; once, as I drove off, it informed me of a software update which would download as I drove.

The camera at the front of the car "sees" speed limit signs and tells you when you go over them. It also sees the white lines on the road and the steering wheel vibrates when you drift onto them.

The car is "on" when you get in; you put it into gear and take off, smoothly and silently. When you need to overtake, or burn off some smart-arse at the lights, the power is phenomenal.

By the end of the weekend, I just wanted to keep driving it. Like a smartphone, it's the sort of product you wonder how you got along without. In fact, it's a similar innovation to the iPhone — an existing product (phone, car) taken to another level.

And in both cases it's the batteries that underpin the advance. You can drive 400km on a full bat-

tery, then recharge it at home. You'd probably charge it every night like the mobile phone.

By the way, this is where the other great electric vehicle evangelist, Shai Agassi, got it wrong: at least 80 per cent of charging will be done at home, so his company, Better Place's battery-swapping stations, could never be viable.

Elon Musk now has launched the lithium-ion battery used in the Tesla as an energy storage system on both a home and industrial scale, called Powerwall and Powerpack respectively.

As Simon Hackett, founder of Internode and Australia's first owner of a Tesla (he now has three), wrote last month: "Despite being based on existing lithium-derived battery chemistry, and arguably constituting nothing new

in a technical sense compared with what already exists in the floor of the Model S, Powerwall has nonetheless done something unique: it has made the concept of electrical energy storage sexy, in a realm where batteries have previously been viewed by consumers as being about as interesting as a bag of rocks.

"This is not something any previous battery manufacturer has managed to achieve... perhaps because others have simply failed to realise that it matters!"

Redflow Ltd, the Australian zinc-bromide battery start-up in which Hackett has invested some of the proceeds of selling Internode to iiNet, welcomed Tesla to the large-scale battery market at the same time as announcing a \$16 million capital raising last month (a lot of which came from Hackett).

Business Spectator's energy specialist, Tristan Edis, wrote last month that Tesla's Powerwall would not really justify its cost, saving about \$980 a year on a typical power bill and thus produce an 11-year payback on the investment.

"However, there are plenty of people who don't care about purely maximising financial returns,"

Edis wrote. "They get emotional value from being at the leading edge of technology, or by snubbing the power company."

However, Edis also says there is value in large-scale storage for the grid as a whole, as exporting power into the grid can help smooth out the peaks and troughs.

The problem with solar and wind generation is that power is needed 24/7, especially at night.

According to Hackett: "In some countries, we are now seeing

periods in which the levels of renewable-energy generation are exceeding total grid energy demand during solar or wind strength peaks.

"(But) when clouds occlude solar-panel or CSP arrays, their energy output can fall away so fast that baseload power generators may not be able to be spun up fast enough to fill the gap.

"This leads to pathological outcomes, such as the need to burn more coal in parallel to operating renewables, just in case clouds move rapidly across the sun."

The answer, obviously, is storage. Grid-scale batteries can replace the need for peak generation — hydro and gas turbines, or larger coal generators, would then be needed for just average usage.

Musk's presentation launching Tesla's Powerwalls and Powerpacks goes a step further, proposing batteries as a means for making a complete transition to sustainable energy.

"With the 160 million Powerpacks you can transition the United States. With 900 million you can transition the world," Musk says.

"You can basically make all electricity generation in the world renewable and primarily solar, it will be so. And then, going a little further, if you want to transition all transport and all electricity generation and all heating to renewable you need approximately two billion Powerpacks."

He goes on to point out that although that seems like a lot, there are about two billion cars and



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trucks on the road in the world, and every 20 years that stock gets refreshed.

In any case, it's not just Musk and Tesla working on this but many other companies, including Redflow (which is targeting mobile phone towers).

China now has the world's largest installed base of wind and solar power generation, as well as the largest manufacturing system for wind turbines and photovoltaic cells.

According to this research, thermal generation in China declined 1.1 per cent last year and renewable increased 20 per cent. Solar power rose "a staggering 175 per cent".

BYD, the Chinese electric car company partly owned by Warren Buffett, is further advanced than Tesla in building large-scale energy storage.

I'm reminded of the scene in the 1967 movie *The Graduate*, when Mr McGuire says to Benjamin: "I just want to say one word to you. Just one word, are you listening?"

"Yes, sir."

"Plastics."

In 2015 he'd say: "Batteries."

The Tesla Model S was lent to Alan Kohler by Powershop, the local subsidiary of New Zealand's Meridien Energy.

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Tesla boss Elon Musk unveils the Powerwall last month