

The Power of 3

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Driving the future further

Overview

In the latter part of the 20th century, silicon became an elemental game-changer, no more so than when, courtesy of Silicon Valley, it helped revolutionise electronics and computerisation, altering forever the ways in which we work, play and communicate in our interconnected, digital world.

Now, in the 21st century, will lithium, the lightest and least dense metal in the periodic table (atomic number 3), be the revolutionary element *de jour*?

Commentators such as **Vikram Mansharamani** of *PBS News Hour* wonder whether lithium will 'one day eclipse oil as a source of geopolitical and economic power' and if, as a consequence, demand will outstrip supply. Pundit **Keith Kohl** is in no doubt, touting lithium as 'metal oil', the 'oil of the 21st century', capable of relieving the planet's dependence

on fossil fuels and radically reducing carbon emissions in the process.

Lithium was first produced commercially in 1923. Since then, the element and its compounds have become intrinsic to numerous commercial applications, not least the production of lithium-ion (Li-ion) batteries.

Although Li-ion batteries do have certain limitations, not least in terms of safety and stability, three industry groups in particular are driving the research and development of better battery technology:

- > **electric vehicles (EVs)**
- > **electronics**, and
- > the **energy sector**.

In this, the first issue of *The Power of 3*, we discuss EVs (and a beguiling hybrid or two) past, present and future, autonomous or otherwise. As the saying goes, it's the quiet ones you have to watch out for.

EVs – from unicity to ubiquity?

Even in 2012, the number of modern, mass-produced, highway-capable EVs already on the market was impressive. Now, evidence suggests that, in the years to come, universal uptake of EVs will depend less on their price and size and more on the performance of the batteries that power them.

Some manufacturers are still at the starting line in terms of EV development, while others already have traction.



The Americans

One of the highest-profile proponents of EVs is, of course, arch disruptor and legend-in-the-making Elon Musk, purportedly the inspiration for Robert Downey Jr's character in *Iron Man* and definitely one to watch.



The South African-born, Canadian-American business magnate, engineer, inventor, investor and billionaire – co-founder of PayPal, a backer of SolarCity and CEO of Tesla Motors and SpaceX – has plans to not only develop futuristic 'hyperloop' transport but also transform high-speed internet access via satellites and, one day soon, to colonise Mars.

Right here, right now, Tesla is producing arguably the world's first truly viable (and desirable, albeit expensive) EV.

Whether the Tesla S P90D is currently the world's fastest four-door sedan in 'Ludicrous' acceleration mode is for others to decide, but what really sets the Tesla vehicles apart are the following.

- > They're designed around the battery to optimise performance, and that battery is larger than those of its competitors, extending the vehicles' range beyond anything achieved elsewhere.
- > Tesla offers long-distance 'destination charging' at free **Supercharger** stations, of which hundreds have been set up in the US and Europe (with plans for more). These stations can charge a Model S in minutes rather than hours.

Elsewhere in the US, traditional car manufacturers are also gearing up for the EV stampede: General Motors, which has already unveiled its hybrid Volt, will release The Chevrolet Bolt in 2017, Cadillac is busy promoting its 2016 ELR Coupé and Ford is charging ahead with its 2016 Focus Electric.

The Japanese

In terms of EV ubiquity, Nissan maintains that the LEAF – introduced in the US and Japan in 2010 and evolving ever since – is the most popular electric car on the planet. The company plans a new 30kWh battery pack to extend the LEAF's driving range, and it will soon incorporate an 'intelligent driving system' as well. Nissan aims to produce fully autonomous cars by 2020.

Toyota, meanwhile, has so far focused on hybrid vehicle technology but is 'exploring ways to make EV power cleaner and more practical', while Honda has mooted production of two all-new plug-in cars by 2018.

Mitsubishi, too, has plans for an EV, unveiling its eX concept at the 2015 Tokyo motor show. According to Richard Blackburn of *Cars Guide*, this compact SUV will be 'powered by next-generation batteries and electric motors', with the new technology stretching its range to what only Tesla has so far achieved: 400 kilometres. The company currently mass-produces the i-MiEV, an electric version of the Mitsubishi i.



Mitsubishi eX concept

The Europeans

In luxury European sports mode, Porsche's Mission E concept car was unveiled at the Frankfurt motor show earlier this year. Porsche claims it will be as fast or faster than Musk's Model S and also faster to charge.

Still in luxury sports mode, Audi has filtered the winning technology in its R18 e-tron Quattro™ into the A3 Sportback e-tron, hailing it as a 'revolutionary plug-in hybrid' that strikes a balance between environmental impact and performance.

Speaking of emission levels, Volkswagen (current difficulties aside) has presaged an intensified interest in EV development, while at BMW, new chief executive Harald Krüger is keen to reboot the company's E-Car strategy after record sales of the BMWi3. This model, says *autoblog*, is particularly popular with emergency services, 'in locations as varied as Milan, London and Los Angeles' ... even Warsaw in Poland.

Mercedes-Benz, which invented the gasoline-powered motor vehicle in 1886, pioneered its first hybrid electric car in 1906. Its current EV, the much-admired B-class Electric Drive, is based on the standard production car but has an electric drive system sourced from – wait for it! – Tesla. With an eye to the further reaches of the future, Mercedes also revealed two innovative hybrid concepts at international motor shows recently:

- > in Frankfurt, a sleek autonomous concept car that, by 'talking' to traffic lights and other vehicles, makes conventional headlights and indicators redundant, and
- > in Tokyo, the even sleeker Vision Tokyo, also self-driving and described as a 'chill-out zone amidst megacity traffic mayhem'.

Other major corporations with autonomous EV ambitions include Google, currently refining its expanding fleet of driverless vehicles, and Apple, which, says the *Wall Street Journal*, plans to apply its expertise in battery technology, sensors and hardware-software integration to its own version of a driverless EV sooner rather than later.



BMW i3

Thomas Bartman of the *Harvard Business Review*, however, predicates the role of EVs on humanity's ageing:

Disruption from electric vehicles ... won't announce itself with high-profile product launches or flashy products. Instead, it'll drive retirees (slowly) to and from bingo, provide cheap transport to thousands of people in emerging markets, and unceremoniously deliver packages to Londoners and New Yorkers.

Whoever's correct, prescience suggests that, with ongoing improvements in design and energy storage to increase their range, and with opportunities to charge from cleaner grids, EVs are set to become mainstream.



And finally ...

As demand grows for more and better Li-ion batteries (for EVs and otherwise), which fledgling Perth company is exploring the use of innovative technology to produce battery-grade lithium carbonate from lithium micas, a 'forgotten' lithium resource?

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