

The Power of 3

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Driving the future further

Overview

As discussed in *Issue 1*, better battery technology is the Holy Grail of not only the electric vehicle (EV)¹ and consumer electronic² industries (both burgeoning) but also the domestic and commercial energy sectors³.

In light of emission goals set in Paris last year, investing in cleaner technologies has become imperative, not least for energy utilities, which need to manage their usage loads more efficiently and perhaps even decommission plants altogether or delay building

new ones, as is occurring in the United Kingdom. And, while Li-ion battery development is 'in its infancy' in terms of grid-scale and particularly home storage⁴, the perceived need for more efficient reservoirs of renewable energy is indeed a powerful precursor to innovation⁵.

At present, annual Li-ion battery production worldwide is around 35 GWh⁶. Keep that figure in mind as you read on ... if all goes to plan, it could increase three or fourfold, or even more, by 2020.

Giga? Mega? Whatever! The behemoths are coming...

Given the potential for massive growth, battery producers worldwide are gearing up on a scale hitherto unforeseen. Manufacturing and R&D are expensive and larger plants can leverage to maximum advantage; hence the plethora of super-sized factories currently commissioned or in the pipeline.

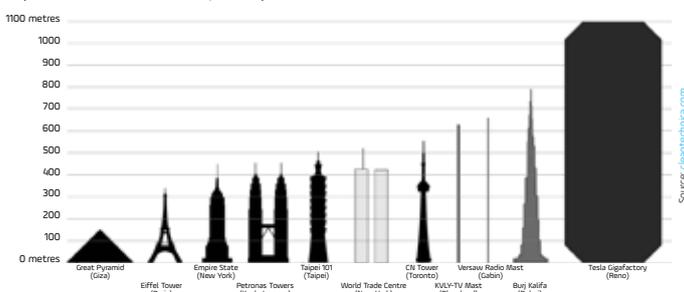
While Tesla's facility has possibly the highest profile, numerous other companies are also investing in large-scale battery production, among them BYD, Foxconn, Boston Power, LG Chem and Samsung. A123 Systems is another to watch, as are Faraday Future, Dyson and Bosch, all of which are girding their loins to join the fray.

Tesla's Gigafactory (35 GWh)

Last year, in its 'New Establishment' series, *Vanity Fair* mused that billionaire disruptor Elon Musk's most ambitious endeavour ever⁷ (rocket recycling, space travel and releasing the 'more affordable' Tesla Model 3 aside) could well be relatively mundane: *batteries*.

In symbiosis with his role at SolarCity⁸, Musk aims to electrify the planet by way of battery storage systems for homes and businesses⁹, as well as – you guessed it! – energy utilities¹⁰.

Tesla, in a joint venture with Japanese battery manufacturer Panasonic¹¹ and others, will this year begin mass-producing Li-ion batteries for both EVs and energy storage systems at its vast new, US\$5 billion Gigafactory (covering up to 10 million square feet) in the US state of Nevada. And, while full operational capacity is some years away, Tesla has also bought 1,200 acres next door, fuelling speculation that future expansion could create the largest building (in terms of footprint) on Earth!



Foxconn (15 GWh)

Taiwanese giant Foxconn Technology Group is China's largest private sector company. Best known for producing Apple iPhones and iPads (but it also supplies Microsoft, IBM, Samsung, Dell, HP and Sony), the company has been newsworthy in recent years for all the wrong reasons¹². Foxconn is adding 15 GWh of capacity to its Anhui factory.

BYD (20 GWh)

Chinese EV and battery producer BYD ('Build Your Dreams') is shaping up to be a serious contender in the megafactory slug-fest. The company plans to ramp up its current production capacity of 10 GWh to 34 GWh by 2020. However, BYD will not limit its production options to a single factory, as Tesla has, but will also build a facility in Brazil, targeting US and Latin American markets for its electric buses in particular.

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Boston-Power (10 GWh)

Founded in 2005, Boston-Power is a world leader in next-generation EV battery design and production, in particular for Chinese auto-makers. In 2014 it secured US\$290 million from Chinese government agencies to upscale its facilities there. Manufacturing capacity at Boston-Power's Liyang factory will increase fivefold by year's end, while capacity at the Tianjin factory is expected to reach 8 GWh by 2018.



Samsung SDI

Sixteen years after entering the Li-ion battery business in 2000, Samsung claims it ranks #1 in terms of global market share. In 2015, Samsung SDI opened a new production facility in China – in Xi'an, Shannxi Province – to mass-produce EV batteries (around 40,000 per annum). The company, which already supplies bus manufacturer Yutong and truck manufacturer Foton, has plans to invest US\$600 million (in phases) to achieve a billion sales by 2020. Products will include a lower-profile, higher-energy-density EV battery and a low-voltage system to replace lead-acid batteries in regular vehicles for 'greater eco-friendliness and fuel efficiency'.

Faraday Future

US-based, Chinese-backed EV start-up Faraday Future, which gained notoriety last year for poaching employees from Tesla Motors, Google and Apple, is investing US\$1 billion in a 900-acre workshop for 'passionate creators and diligent visionaries' in north Las Vegas, in the same state as Tesla's Gigafactory. Having recently unveiled the FFZero1, a futuristic concept car that looks a lot like the Dark Knight's Batmobile, the company says it will build cars in a wholly original, and much quicker, way.



LG Chem (7 GWh)

Korea's LG Chem, described by Nissan CEO Carlos Ghosn as the best battery-maker in the world, produces mobile phone and automotive batteries, as well as grid energy-storage solutions. With EV battery plants in Ochang in South Korea (slated for further expansion) and Michigan in the US, the company is also investing vast sums in its Li-ion facility in Nanjing, China and plans an EV battery plant in Europe¹³. In China alone, LG Chem aims to generate US\$1.3 billion in sales of batteries for all types of EVs over the next five years.



A123 Systems

Acquired by Chinese auto-parts maker Wanxiang after going belly-up in 2012, A123 Systems plans to invest US\$800 million over the next few years to expand its plants in the US and China and build new ones in Europe. The company produces both high- and low-voltage Li-ion batteries for car manufacturers.

Dyson

Die-hard fans of Dyson products may be intrigued to learn of the company's purchase of battery start-up Sakti3. UK-based Dyson, which wants to improve the battery life of its cordless products using Sakti3's cool, quick-charging solid-state Li-ion technology, is to invest up to US\$1 billion in the mass-production of next-generation battery technology, possibly in the States. While some speculate that Dyson will enter the EV market, it's their cleaning robots that many can't wait to see.



Bosch

In August 2015, German auto-parts giant Bosch bought California-based battery start-up Seeo Inc., a developer of next-generation Li-ion batteries that may double the range of EVs.



The challenge ahead?
One very real issue facing all these massive facilities is sourcing enough raw materials – including lithium chemicals – to meet production targets.

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Notes

- ¹ As reported by Peter Ker in *The Australian Financial Review* of 27 October 2015, Citibank analyst Matthew Schembri expects 1.04 million EVs to be in production by 2020 – a sevenfold growth over the next five years. A subsidy system for new-energy vehicles in China will fuel the trend, as should VW's announcement of its BUDD-e EV concept vehicle, able to travel 600 km on a single charge. Faraday Future may give Tesla a run for its money, with plans to deliver intelligent EVs and mobility solutions, while Navitas Systems LLC's release of heavy-duty Li-ion batteries for forklifts underlines their potential for use in many commercial, industrial and government/military vehicle applications. As always, a key factor is greater energy density.
- ² Improvements in both performance and longevity are the aim and much is happening in this arena. In *engadget*, [Jon Fingas](#) reports that researchers have developed new Li-ion batteries that reach a 70% charge in two minutes and should last more than 20 years; this, of course, has immense implications for the consumer electronics and EV markets especially.
- ³ The concept of generating 'clean' energy via solar panels, wind turbines and even wave power is becoming ever more accepted, as is awareness of the need for efficient energy storage at both the grid and household levels. That's because renewable energy generation rarely coincides with peak periods of demand. Moreover, says *VSA Capital* (7 Jan. 2016), developing economies like Africa, with hugely dispersed populations and lack of grid infrastructure, represent a potentially massive market for off-grid power storage.
- ⁴ [Edison Investment Research](#).
- ⁵ [CleanTechnica](#) lists companies to watch.
- ⁶ 'Giga' (derived from the Greek word for 'giant') denotes a factor of 10⁹ (1,000,000,000). One GWh is the equivalent of generating (or consuming) one billion watts for one hour.
- ⁷ See Issue 1 of the *Power of 3*.
- ⁸ Chaired by Musk and founded by his cousins Peter and Lyndon Rive, SolarCity – the largest installer of residential solar panels in the US – is ready to mass-produce what they claim is the world's most efficient rooftop solar panel ever.
- ⁹ Tesla's Powerwall offers home-owners freedom from total reliance on the grid, as well as back-up during power outages, while the larger-scale Powerpack – comprising 100 kWh blocks that can be clustered to suit a project of any size – is designed for commercial applications. The Powerwall will be available in Australasia, South Africa, Germany and America this year. Australia, of course, is an ideal destination due to the ubiquity of sunshine and rooftop solar panels, the high price of electricity (the grid component in particular) and its utility tariff structures. Despite this, argues [Giles Parkinson](#) in *Renew Economy*, the potential of Tesla's battery storage solutions to disrupt energy business models may lead antipodean networks and retailers to set up as many roadblocks as they can. That said, [The Guardian](#) reported mid-January that Energex, a Queensland power company, has installed a Tesla system and that of another US manufacturer, in a 12-month trial aimed at rewarding consumers who reduce their reliance on the grid. Meanwhile, in New Zealand, Auckland-based Vector Energy aims to integrate new technology into both its network and the homes it services, and will be among the first to sell these Tesla products.
- ¹⁰ Tesla, says Musk, has already been approached by a utility seeking a 250 megawatt-per-hour installation. Powerpack customers in the US to date include Wal-Mart, Amazon and Target.
- ¹¹ Panasonic (which already produces Li-ion batteries for Tesla, as well as other auto-makers, and is supporting Tesla's advance in China through its operations there) will invest up to US\$1.6 billion in the Nevada Gigafactory.
- ¹² After a large number of employees attempted suicide at its Chinese factory, Foxconn's solution was to install 'safety nets' around its premises.
- ¹³ In close proximity to the giant Cinovec lithium/tin project in the Czech Republic.