

Insight: 06/2017

## Electric Vehicles Charge Ahead

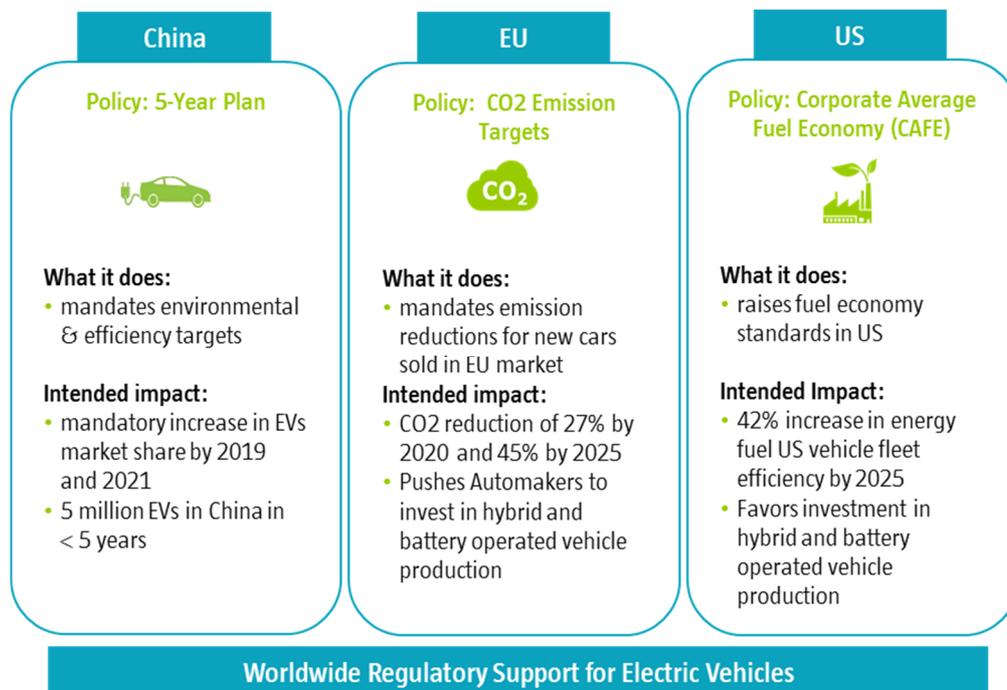
*Cleaner air and global warming are driving demand for electric vehicles — and the batteries that power them*

### A Solution for Pollution

Transportation is responsible for about 25% of global greenhouse gas emissions, with passenger cars and other light vehicles accounting for 17% of the total.<sup>1</sup> In China, the situation is particularly alarming. One-third of pollution comes from internal combustion engines (ICE)—engines which burn gasoline and diesel—and air pollution is the primary cause of over 1 million deaths per year.<sup>2</sup>

To combat air pollution and address this public health emergency, the Chinese government has aggressively supported the Electric Vehicles (EV) market through subsidies for EV purchases and a combination of regulations restricting the licensing of ICE vehicles in smog-choked cities. EVs currently make up only a fraction of China’s total passenger vehicle sales (2%), but with 507,000 EVs sold in 2016, in terms of absolute volume, it is the world’s largest EV market.<sup>3</sup> Chinese government estimates project a 400% increase in EVs on its roads in the next 3 years ending 2020.<sup>4</sup> With such favorable supply and demand factors, clearly, China’s auto market is primed for growth.

Air pollution is also a disturbing issue in Europe, where EU mandated exhaust emission limits are consistently exceeded. Major cities like Paris, Athens and Madrid announced diesel-powered vehicle bans by 2025, while other cities like Stuttgart will enforce lower emission standards beginning in 2018. Europe is already the 2<sup>nd</sup> largest EV market. Despite falling behind China in size, with its unwavering commitment to clean energy initiatives, it will remain a strategically important market for energy efficient vehicles. Underscoring this reality, China’s fastest growing battery maker CATL, bought a 22% stake in a Finnish auto supplier in January of this year.<sup>5</sup>



<sup>1</sup> Credit Suisse Connection Series, «Drive Train to Supply Chain,» April 14, 2016, p. 40.

<sup>2</sup> Financial Times, «India air pollution deaths poised to exceed China’s» February 14, 2017

<sup>3</sup> <http://www.ev-volumes.com/country/china/>

<sup>4</sup> Financial Times, «Electric cars: China’s battle for the battery market» March 3, 2017

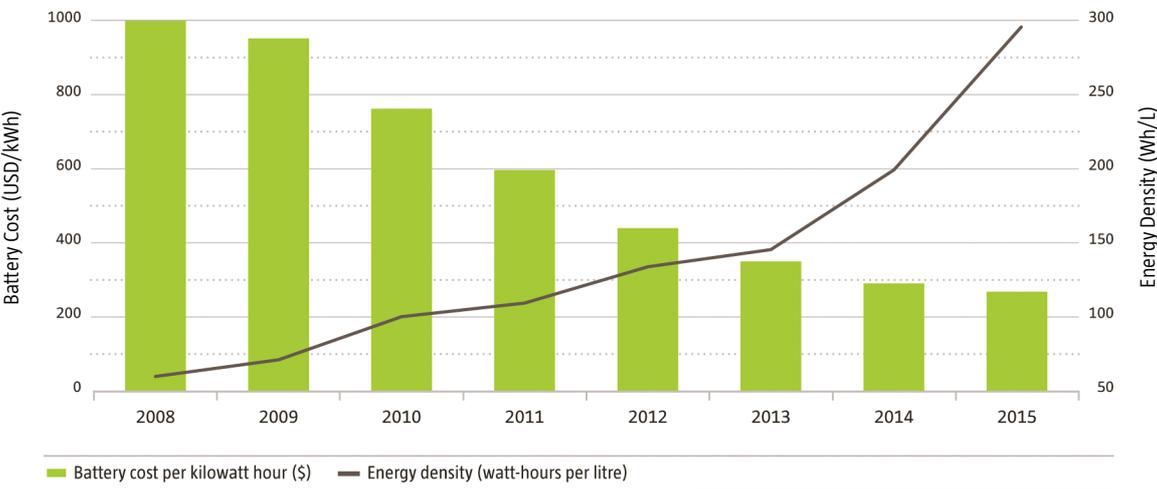
<sup>5</sup> Ibid

Regulators around the world are pushing carmakers to reduce their CO<sub>2</sub> emissions. Failure to meet these targets is not a viable option, as automakers may be forced to pay more than EUR 12,000/vehicle for exceeding limits. As a result, automakers are stepping up production of EVs. VW expects EVs to make up to 25% of its total sales by 2025, and in the same timeframe, Volvo plans to sell 1 million energy efficient vehicles offering hybrid versions of models across its product line-up.<sup>6</sup>

**EV penetration—lowering costs and increasing capacity**

The three main challenges for the EV market are the lack of charging station networks, limited distance range, and the high cost of batteries. While progress is underway to improve charging network infrastructure, we see mass production of lower-cost and denser lithium-ion batteries as the ultimate path to achieving higher penetration of electric vehicles. Technological advances and efficiency gains in battery production have already resulted in significant cost reductions and improvements to battery-energy density, which in turn, enables longer driving ranges on a single charge.

**Evolution of lithium-ion batteries**



Source: US Department of Energy

Since 2008, battery costs have fallen by 73% from USD 1,000/kWh to USD 268/kWh in 2015.<sup>7</sup> And RobecoSAM expects battery costs to further decline to USD 130/kWh by 2020, thanks to continued improvements in production processes, economies of scale and lower labor costs.<sup>8</sup>

To address inadequate charging networks and boost demand for their own electric vehicles, six automakers – Volkswagen, Daimler, BMW, Ford, Audi and Porsche—have joined forces investing EUR 1 billion to build 400 high-speed charging stations on major highways across Europe by 2020.<sup>9</sup> In China, the government requires any newly-built residential buildings to include charging stations, and at least one charging station for every 2,000 vehicles.<sup>10</sup> EU policymakers plan to implement similar legislation.

**Lithium demand –a tipping point**

The growth in rechargeable batteries has seen industry capacity soar, increasing five-fold in the last decade (~10GWh in 2005 to ~60GWh in 2016) as EV batteries increase in size and capacity. Consequently, demand for raw materials such as lithium, graphite and cobalt—all key battery components—has dramatically increased and will continue this upward trajectory along with growing EV vehicle production volumes.

<sup>6</sup> [Volvo Press Release, April 21, 2016](#)

<sup>7</sup> International Energy Agency (IEA) Global EV outlook 2016

<sup>8</sup> Credit Suisse Equity Research, «Drive Train to Supply Chain» April 14, 2016, p. 20.

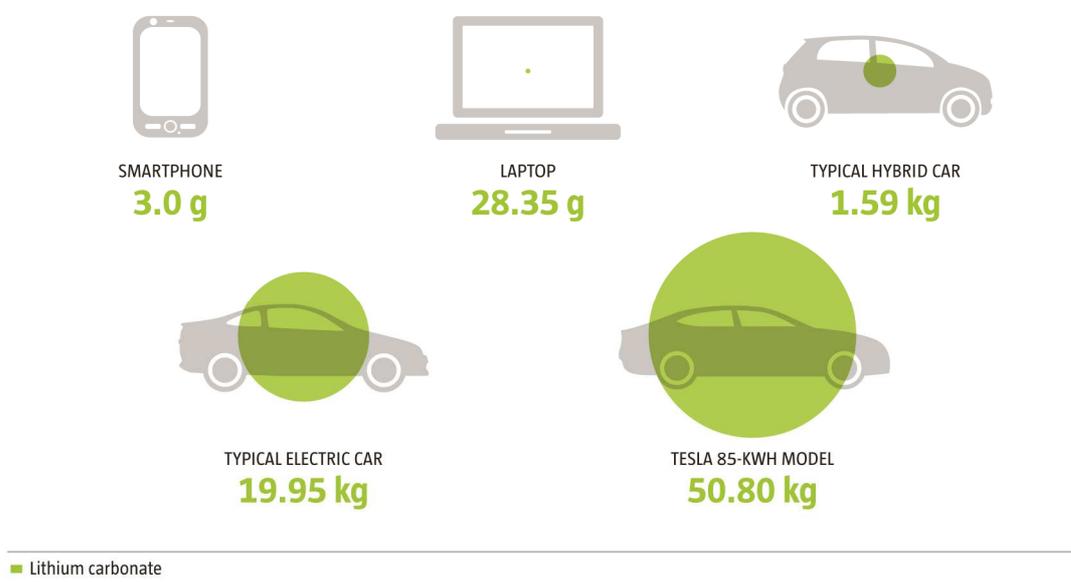
<sup>9</sup> [Ford Press Release, Nov 29, 2016](#)

<sup>10</sup> Credit Suisse Equity Research, «Drive Train to Supply Chain» April 14, 2016, p. 28.

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## Amount of lithium in different devices

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Source: Washington Post

Similarly, the lithium-ion-battery industry is continuing to gain traction with significant resources committed to new projects that expand production capacity. Given the importance of battery technology, it comes as no surprise that Tesla opened its own “gigafactory” in 2016 with a target capacity of 35 GWh to supply its own vehicle production. In China, where government regulations strongly favor domestic battery and EV manufacturers, battery producers are ramping up production to meet domestic demand, and could have a capacity of up to 121GWh by 2020.<sup>11</sup>

Lithium-based batteries have become the preferred storage technology for portable electronics and electric vehicles thanks to lithium’s high energy density, its light weight and continued improvements in its energy retention over time. Although lithium batteries are used for a range of applications, the automotive sector is by far the largest consumer of lithium. According to Goldman Sachs, driven by EV sales, the auto industry is expected to consume 24% of total lithium output by 2020, up from around 7% in 2015. As a result, demand for lithium is expected to increase by 16% per year between 2015 and 2025.<sup>12</sup>

### Conclusion

The dangerous reality of global climate change means tighter regulations on GHG emissions are here to stay. Electronic vehicles (EV) running on lithium battery power present a powerful solution to curbing CO2 emissions. China, grappling directly with the consequences of transportation pollution, is betting big on EV to solve its traffic smog problem and is investing heavily in public and private measures to support the EV market. Despite individual or government opinion on global warming, technological innovations within EV are making it a viable economic alternative to fossil-fuel powered vehicles. The lithium-ion battery is the single most critical component with the EV equation so rapid growth for the EV market means a surge in demand for lithium resources as well.

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<sup>11</sup> Financial Times, «Electric cars: China’s battle for the battery market» March 3, 2017

<sup>12</sup> Sanderson, Henry “Lithium the next speculative bubble?” January 6, 2017



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