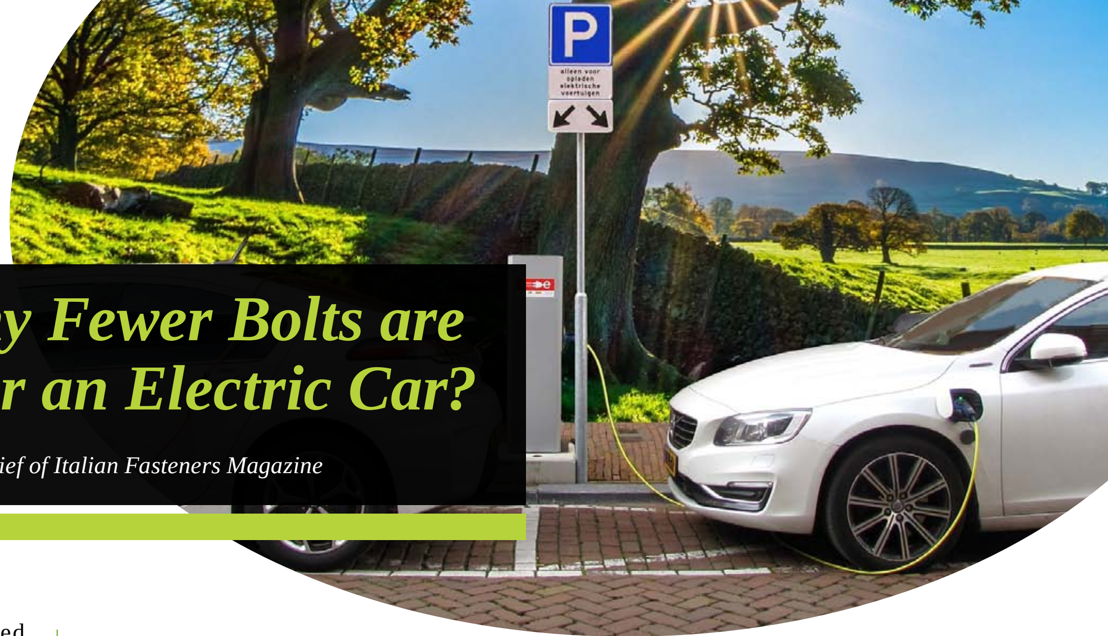


But How Many Fewer Bolts are Needed……for an Electric Car?

by Marco A. Guerritore, Editor in Chief of Italian Fasteners Magazine

It has taken more than one hundred years for the collectivity to finally realise that cars with internal combustion engines pollute the air in our cities and contribute to global warming. It has taken more than one hundred years for the general public to become aware of the problem of pollution.

As a consequence, city authorities and governments are today looking for solutions to drastically reduce the emission of harmful gases. And so, like a backwards Cinderella fairy tale, we now want to turn our polluting carriage into an eco-friendly pumpkin. And our 'green' pumpkin is the electric car.

Historically, the electric car (BEV – Battery Electric Vehicle) is nothing new; the first prototypes appeared as long ago as the nineteenth century, such as the electric carriage built by Robert Anderson between 1832 and 1839. The first evolved BEV model was designed and produced in 1884 by the Briton Thomas Parker, who had perfected special high-capacity batteries. However, the first real electric car is unanimously attributed to the German Andreas Folcken for his "Folcken Elektrowagen" in 1888.

While the electric car had many advantages, in time, with the evolution and fine-tuning of internal combustion engines it lost out on competitiveness and was therefore relegated to a niche sector.

The big problem with this means of locomotion is its autonomy. Unlike combustible cars, which could count on a steadily increased autonomy and rely on an efficient infrastructure, electric cars were limited by the quantity of energy they received from batteries that were still under-developed.

From an efficiency point of view, an electric motor is decidedly superior to its internal combustion counterpart.

It is well known that, as per Carnot's Theorem, a petrol engine has an energy efficiency of around 28% and a diesel engine is closer to 40%, whereas an alternating current electric induction motor achieves a gross efficiency of 90%. We say gross as, for correct calculation, we must consider the entire production cycle and use of the energy in play. In other words, the electrical energy stored in the batteries is a part of secondary energy mainly obtained in plants powered by fossil energy such as petroleum, even if there is some contribution from renewable energies.

Considering all this, the net efficiency of the electric production/use cycle is about 50%, from which you must then further subtract energy losses in the electrical wires, estimated at around 6.5%.

The Achilles' heel of all electric cars, however, is their battery, whose autonomy varies widely depending on type.

The autonomy declared by BEV manufacturers for their models fitted with lithium batteries stands at around 200 km and for some of the latest models on the market, up to 600 km before it needs charging.

The autonomy of a BEV is further increased by the use of an automatic charging system, like the KERS, which, as the car slows down, goes down hills and brakes, recovers an average of 15% of the energy used on a medium-range journey.

It must not be overlooked that the battery is perhaps the most expensive element in an electric car, accounting for about 50% of its total price.

The various manufacturers are however making huge efforts to reduce the price of batteries; an increase in demand and consequently in production should lead to a drop of 20 to 50% in the current price.

But even if the obstacles represented by cost and battery autonomy are overcome, the inconvenience of charging times still remains.

Most electric cars like the Nissan Leaf, Tesla Model S. Renault Zoe, and BMW i3 can currently be charged to 80% of their capacity in 30 minutes, which is however too long for those on the road with long distances to cover. This is another deterrent to the diffusion of BEVs for which a remedy is being sought, for example with a rapid battery replacement service which however in practice does not appear to have met with great success, as shown by the experience of "Better Place". Set up in Israel in 2011 by Shai Agassi, it aimed to replace drained batteries with a quick pit stop lasting a few minutes instead of hours of charging, but unfortunately the company folded in 2013 having lost large amounts of money.

The efforts made by many researchers and manufacturers in an attempt to produce a fast charging battery will definitely be more successful. Some of the most promising initiatives under development include lithium-titanate batteries (lithium titanium and lithium titanium dioxide).

Since 2011, Toyota has been working on a new series of lithium-ion batteries that charge in seven minutes, while scientists at Nanyang University in Singapore are experimenting a titanium dioxide gel battery, whose prototype charges up to 70% in two minutes.

In 2017, the Israeli start-up "StoreDot" presented a working model of a battery that fully charges in five minutes with an autonomy of about 480 km.

Over time, science and application will certainly solve the battery charging hurdle; what remains now is to complete construction of the infrastructure needed to guarantee mobility for BEVs, namely the charging columns. The big industries are already showing a keen interest, evident in the words of Francesco Storace, CEO and Director General of ENEL, a multinational and the biggest producer of electricity in Italy.

"It is true that the electric car was a niche phenomenon. It is rather like what happened with renewable energies: in 2007, 50-60 MW of photovoltaic energy sounded like an enormous amount. Ten years later, these megawatts have become 20,000 in Italy alone. Like renewable energies then, today there are fallacies about the electric car. This is a period of great acceleration and right now we are preoccupied with what will happen over the next three to four years and what we must do in order not to find ourselves wrong-footed from an industrial and technological point of view. We believe that the famous electric columns for charging are our responsibility. It would, on the other hand, be strange if we were to set to and make the cars, and the car manufacturers saw to the columns.

In the USA, Tesla is doing it because nobody else has stepped up to the plate. We believe that we are responsible for the structural part and we are dealing with this in advance and in a business-like fashion. Then I am convinced that the cars will come. There will be a boom year. We will go from 10% to 40% and then 100% electric cars on the roads. The truth is that this is unstoppable technological development and we want to be there. This is why we will be installing 14,000 columns by 2022."

The words of Franco Storace at ENEL highlight how the electric car is increasingly becoming a reality destined soon to be the main means of locomotion, replacing internal combustion engine cars.

In 2017, the world rankings of electric car sales saw China in first place with 652,000 electric cars out of a total of 28,900,000, followed by the USA with 199,826 cars out of a total of 17,200,000 and then the European Union with 142,086 cars out of a total of 15,100,000 licensed. Italy brought up the rear with just 1,967 electric cars licensed out of a total of 1,970,000.

The record holder in Europe for electric mobility is definitely Norway, which has reached a milestone with half of the cars on its roads by now eco-friendly thanks also to big incentives put in place by the government. Norway is also the country that has decided to completely eliminate petrol and diesel cars by 2025.

Holland too has started up a plan to discourage purchases of polluting cars with heavy taxes and tight restrictions on circulation and they expect to totally suppress sales of internal combustion engine cars by 2025.

Germany, the biggest car market in Europe, has set 2030 as its cut-off year for sales of petrol and diesel cars.

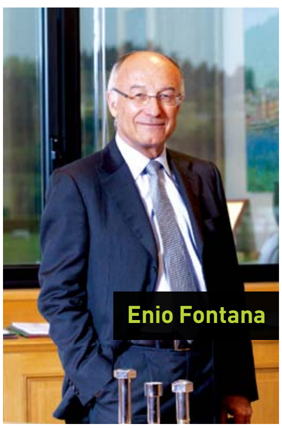
Meanwhile, in Italy a resolution passed by the Senate has set 2040 the end of sales of petrol and diesel cars.

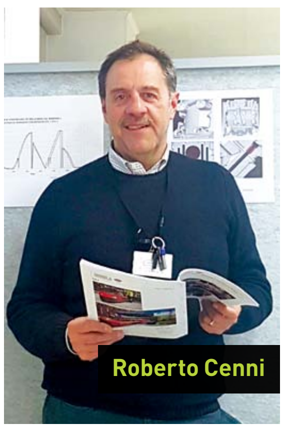
The end of production of cars with petrol or diesel engines will definitely bring about a huge swing in market equilibrium.

On the one hand there will be an exponential increase in the demand for electricity, which will call for the construction of new power plants, both coal and petroleum powered and those powered by solar or wind energy, not to mention nuclear.

Battery manufacturers will benefit from the electric car, the demand for copper and other minerals will grow, as will the relative ancillary industries. On the other hand, filling stations will disappear, as will fuel transporters, and there will be a drastic drop in the number of workshops offering car repairs and assistance, and the ancillary industries related to car manufacture will also see changes. Producers of catalytic exhausts and other components will disappear.

The phenomenon of “technological volatility", in other words the replacement in time, often quite a short period, of applied technologies will also affect the sector of mobility. Forecasts are not always easy to make, so it is easier just to hypothesise what will happen. We can imagine an epoch-making change throughout the mobility system, which from being prevalently individual will increasingly become more collective, focused, for example, on the car-sharing system.


Enio Fontana


Roberto Cenni


Paolo Pozzi

Whatever solution is adopted, this change in car propulsion systems will happen in stages.

“The shift to electric propulsion for road vehicles,” comments Enio Fontana, Chief Executive Officer of the Gruppo Fontana, leading Italian fastener manufacturers, “while seemingly inevitable to date, will however happen gradually over the next few decades.

If you consider that the number of vehicles circulating on Europe’s roads far exceeds 300 million, you will understand how this migration from traditional ICE vehicles to vehicles with lower environmental impact will require quite a long time.

Another consideration is that what we today call an "Electric Car" is actually the sum of a series of different technologies that meet different mission profiles (from urban to long distance and transport of goods). The change in the propulsion system will therefore mean (only in cases of 100% electric powered vehicles) a change in the fixing system due to a demand for different performance."

It has by now been ascertained that consolidation of the electric car will impact the consumption of fasteners.

"With the introduction of BEVs," says Roberto Cenni, Research and Development Director at Brugola OEB, leading Italian manufacturers of critical fasteners for the automobile sector, "the traditional screws used for internal combustion engines will disappear. The nuts and bolts in electric motors are mainly traditional, classes 8.8 and 10.9, M6-M8 and, rarely, M10. Simple M5-M6 screws for the battery pack."

"The impact of the electric car on the consumption of fasteners," agrees Paolo Pozzi, CEO of Agrati Group Fastening Systems, Italian multinational fastener manufacturers, "can be pretty quickly calculated if you think of the content of a BEV: at least 25% less."

The engineer Giuseppe Marzorati, President of Ferriere di Stabio SA, comes straight to the point: "The advent of the electric car will have devastating impact on volumes of special fasteners."

With the gradual consolidation of the electric car, manufacturers will have to compensate somehow for the drop in demand for special fasteners by the automobile sector.

"Each supplier," explains Paolo Pozzi, "will obviously be affected differently by this evolution. However, in the medium term, **even suppliers of fasteners for chassis or interiors will be affected by a greater supply of fasteners on the market.**

Compensation will lie in the ability of each individual manufacturer to try and intercept new needs and new products attainable through processes similar to the current ones or diversify into new technologies/processes that could however call for new competences."

Giuseppe Marzorati agrees with Paolo Pozzi; for him the option for today's manufacturers will be to integrate their residual production into the component workstream.

Enio Fontana however is convinced that it is not only the advent of the electric car that will bring about changes in the fastener sector. He reveals how any drop in demand for special fasteners will not be linked to modifications in the propulsion system of vehicles.

"The shift in propulsion systems," he says, "will lead to different technical characteristics. The current strong points in development of special products for the automobile market are not only and exclusively linked to resistance to strong mechanical vibration due to the stress generated by ICEs. Or at least, they aren't any longer. Today prevalence is given to other extremely relevant characteristics for our automobile clients such as reduced weight, geometry, and surface treatments. These are all characteristics relevant to electric propulsion vehicles as well.

Therefore, in a nutshell, a changed propulsion scenario will not lead to lower demand for special fasteners, but rather to different characteristics."

It is a given that the path leading to the total success of the electric car will be long and insidious. We will need to overcome many obstacles, both technical and organisational. Furthermore, the introduction of BEVs will modify some equilibria of an industrial nature. New products will appear and old ones will disappear. But we must not underestimate the electric car; it has a great objective—that of solving the eco-friendly mobility problem. This is a great civil undertaking, not only for us but, above all, for the new generations.