Retrofit versus series production

The French Dion-Bouton created one of the fist motorcars from an existing horse carriage. Like in the early days of motoring, the first modern electric cars were built by pioneers or specialists. Today's development started with retrofitted serially-produced combustion vehicles. This is a logical way of innovation since it's less capital intensive and relatively fast to realize. In its pioneer days, Tesla used a Lotus Elise chassis to hand build and electrify the first Roadster.

Image: one of the first electric cars designed by Dion-Bouting

Small series EV specialists, like the Dutch Spijkstaal, were already in business for many decades. As soon as 2009 they realized the first dedicated electric garbage trucks, the Eco-Truck. The first electric city bus, the e-Busz, was based on a retrofitted standard VDL diesel bus. After the diesel was removed, it was converted into an electric bus with in-wheel motors. The inventor of 'the Wheel' e-Traction led a consortium to build two buses plus charging infra.

Great achievements, but most pioneers and small series specialist lack large investment power. Moreover, the cost of small series production and retro-fitting is fundamentally too high. These products were depending on innovation subsidies but cannot compete in the long run. Last but not least, most prototypes where not reliable and lacked design for serviceability. There was no adequate after sales service, which is needed to keep the vehicles in operation.

On the way to industrialisation

Still, without the pioneers, we would not be at the development level of today's EV's. Many of them are more or less industrialized successors of these prototypes. In 2013 the example of E-Busz led to the world premiere of the OEM build VDL Citea Electric. The new product led to the complete new business unit Enabling Transport Solutions.

The pioneer Elon Musk had the investment power to build the mind-blowing Teslas. A new car brand, now including a global service network and super charging infrastructure. In fact, Tesla is the first new Automotive Original Equipment Manufacturer in a long time. Existing OEM's now really benefit of the innovation by the pioneers and new companies.

This is also true for the new developments in the charging infrastructure. One of the current technology leaders in fast charging is ABB EV Charging Infrastructure. This new business unit emerged in 2011 from the pioneer student startup company Epyon. ABB now is the technology partner of, among others, BMW,

VDL and Fastned. Fastned builds one of the largest fast charging networks in the Netherlands and Europe. Innovative partners in the supply chain, with added value, are crucial to change the business.

Added value in the EV value chain

Electric platforms can easily be shared for a whole vehicle family to achieve economies of scale. Other mass-produced parts can be crossed over from other models, to further reduce the cost. This is best practice in the Automotive industry, and EV's will not be an exception to the rule. But, due to simplicity of the electric drive-train, small series niche products will be more affordable as well.
In Automotive industry, most parts are supplied by so called Tier One parts or system suppliers. The added value of the OEM car manufacturer in production is often quite low, only 15% - 25%. That's why for traditional OEM's electrification is difficult: they depend on a reliable supply chain.

Traditional manufacturers have to balance current business with loss making new EV business. This includes decisions about investing in downstream battery production or upstream charging. Tesla, however, can concentrate on a gradual upscale of their new dedicated EV production chain. They are more vertically integrated, since the want control of innovation and value in the chain.

Rethinking the supply chain is still a big challenge. What has most added value at lowest cost: include everything in-house or outsource crucial parts of the value chain to specialist suppliers? Especially battery-pack production and dedicated

charging solutions can have high added value. But these down and upstream activities also ask for large investments in R&D and production.

Make no mistakes in the planning

History proves that one model failure can put the existence of a whole car company at stake. For instance, in 1958 the failure of the new Edsel brought the mighty Ford in great trouble. Therefore, good and sustainable product planning is of eminent importance for a long-term success. In this transition phase, a lot of new companies will emerge and disappear.

A lot of innovative ideas will fail deployment, not in the last place because lack of funding. Good ideas are the key, but as front-runner it's even more difficult to realize a healthy business. Especially in Automotive, success needs a long breath, deep pockets and good overall planning. A balanced product planning, with a consistent production start from job one to full capacity. Looking at Tesla's production hell the last point seems to be an increasing problem for them. With every new model, the delay gets longer and also quality issues seem to increase.

Avalanche of new electric cars

Moreover, offering electric auto mobility is a business of well synchronized systems. The new charging infra-structure and the new service network should be available in time. If one of the new elements is missing or is a misfit, the whole product offer can fail in practice. Also, here Tesla is a good (and in this case a positive) example of a total system approach. Their co-developed worldwide super-charging network is as important as the appealing cars.

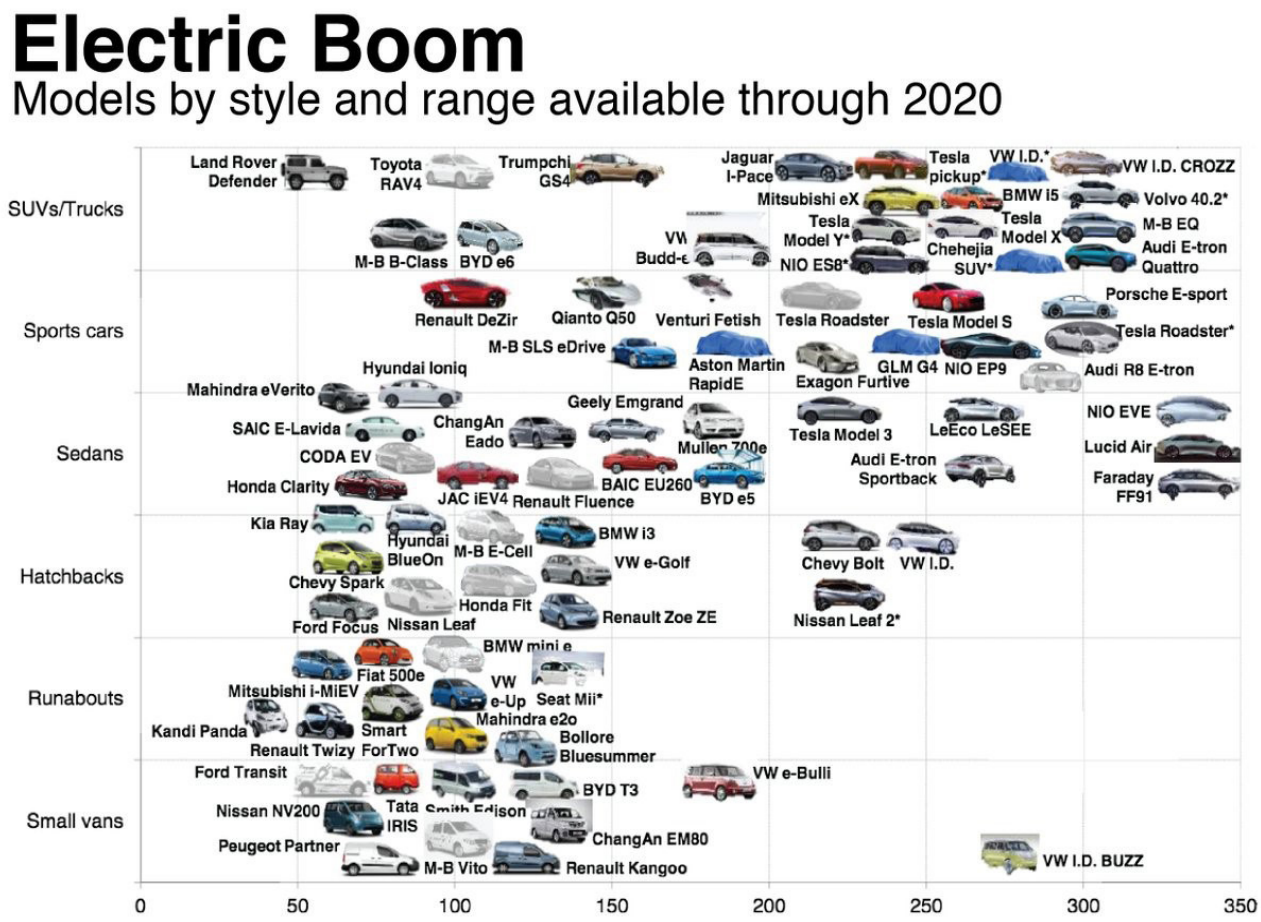

Image source: Bloomberg New Energy Finance. Electric vehicle models expected until 2020.

Electrification of road transport not only means high development cost. Also, the capital-intensive production facilities make financial risk of a product failure high. This is also true for suppliers to the OEM's and the companies in the charging infrastructure. Small may be beautiful, but in Automotive, because of the intrinsic investments, size counts. That's why existing OEM's are hesitating; they prefer a well-planned and big step in e-Mobility. But, with the announcement of dozens of new electric cars in the next 5 years as a result.

Bus & truck will prefer electric in little time

But there is much more than passenger cars. In Trucks and Buses, there are a lot of retrofitting activities by small companies. By chassis design and lower volume assembly, these vehicles are relatively easy to electrify.

So, if the market asks for heavy EV's, the Truck and Bus OEM's will follow very fast. A nice example is VDL ETS case, which just opened a new division with over 100 engineers. Also, as BYD, Volvo and Solaris stepped in this e-bus business, a market is starting to be formed. Finally, Daimler Trucks & Buses bundled the know-how for electric propulsion systems. E-Mobility Group is the name of a new global organization of Daimler in utility vehicles. Truck and Busses of 18 tonnes and more are about 10 times more energy consuming than cars. A lower total cost of ownership over a long service period is the killer argument in this sector. This as well as Zero Emission Cities will make transporters or operators preferring electric in no time.

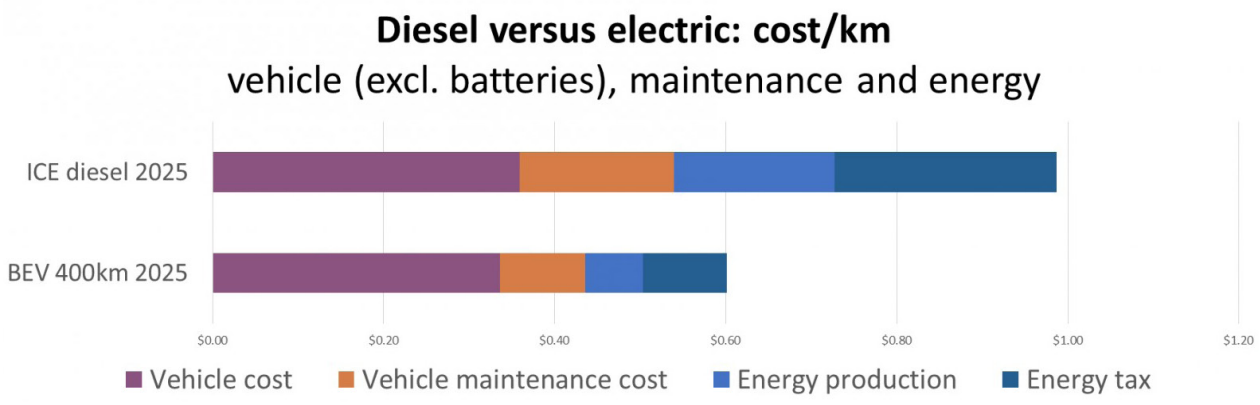

Image: Total cost of ownership prediction for buses, Hoekstra (2018)

Small, but a promising low energy niche

On the other side of the spectrum, especially popular in China, are the Light Electric Vehicles. For this course, we focus on the Automotive four wheelers in the EU categories L6e and L7e. It's the category smaller than the city car or N1/M1 class delivery van with a max weight of 3,5 tonnes. Often, LEV's are limited in speed so they may be driven by chauffeurs without a driving license. Depending on the class there is a maximum power and pay-load of 750 or 1.200 kg.

Image: PostNL Stint, source: PostNL

If fact, these small vehicles are also very suitable for automated driving. The speed is low and weight is small and the relative benefit of avoiding driver cost is high. That's a reason that self-driving POD's are an attractive last mile solution for people or cargo. Small vehicles, but a promising low energy niche, that can benefit a lot from electrification.