

CHAdEMO's **Tomoko Blech** explains the dynamics to be found within today's fast charging systems

Navigating the charging business

Choosing a single charging standard has become the focus of on-going European electric vehicle policy discussion, while it is not yet well recognised that the key for a successful EV market is about how the charging service business can become sustainable. Consequentially, industry stakeholders are converging towards multi-standard chargers that can service all types of fast chargeable EVs, so that they can gain a larger and more robust customer base. The European policy should support this industry movement and support the multi-standard solution in order to keep the emerging EV market on its steady growth trajectory.

Fast charge infrastructure accelerates EV adoption

According to the recently published Global EV Outlook report (April 2013) by the International Energy Agency (IEA), the global EV stock in 2012 has grown from 50,000 to 180,000. In 2013, with the announcement of more automakers coming into the market, EVs are now entering into the stage of mass-market adoption. This growth has not only been enabled by the technological innovation in such vehicles, but also by a growing network of publicly accessible fast charging infrastructure.

The auto industry is keenly aware that the sale of EVs is positively affected by the availability of fast charging infrastructure. For example, a cross-sectional analysis across 47 prefectures in Japan with an overall sample of 23,144 EVs clearly indicates a high level of correlation (a coefficient over 0.9) exists between the number of EVs sold and the number of fast charging stations installed. There are also reports evidencing that the average daily driving range of EVs is extended with the wider dissemination of fast charging infrastructure.

Taking this principle as a point of departure, automakers had hoped for a ubiquitous fast charging network as a pre-condition for the adoption of EVs across Europe, and there already are a significant number of fast chargers in service. Now, a number of automakers are coming into the market this year and their EVs will be equipped with another type of connector, while there is no fast charger with this technology in service. How can we reconcile this situation?

EV fast charging market and investment made to date

The vast majority of all EVs in the world today are compatible with existing DC fast charging technology; CHAdEMO. Over 26,000 passenger EVs that are on the road, or over 90% of fast chargeable passenger EVs across Europe, are compatible with this original DC charging technology.

Today, one DC fast charger costs about €15,000-20,000 and requires another €10,000-15,000 for installation. This represents €20-28m of investment that has gone into CHAdEMO, often subsidised by all layers of government from local municipality to the EU level. This does not include the R&D investments that went into developing such chargers, which should add up to over €100m to date. In addition, many new jobs

have been created in the manufacturing and deployment of DC charge infrastructure across 23 countries in Europe.

Nor does this include the enormous investments made by automakers to develop and produce these vehicles, and their impact on the local economy, as these EVs and batteries are produced here in Europe. This means thousands of direct manufacturing jobs in the UK and in Spain, neither of which can afford further manufacturing losses.

All of such investments may be at risk if the existing standard is not supported by the EU policy.

Viable business case for charging service providers

The early adopters of fast charging technology, who are among the most passionate advocates of e-mobility in Europe, have experimented with various EV charging business models in many European regions.

The focus of today's discussion is around how to make this profitable or how to shorten the time to recover costs, as well as how public policy can provide support until the market grows to a certain scale, where private sector investment will keep flowing in. Building a fast charging network, like any infrastructure deployment, requires high upfront costs and uncertain payback times for investments. How to accelerate the recovery of this initial cost is a key question in order for this business to make sense to savvy private investors.

One answer to this question is quite simple; the frequency of usage per charger must go up. The ballpark target figure in the industry is five to ten charges per day. For simplicity, let's take a basic 'pay-per-charge' model and say that each EV user pays €5 for a full charge at a fast charging station. If there are ten users at this charge station, €5 x 10 charges x 365 days will give the operator some €18,000 of revenue per year. If it took him €30,000 to purchase and install the charger and it takes €10,000 per year for energy and maintenance costs, this can be recovered in three to four years.

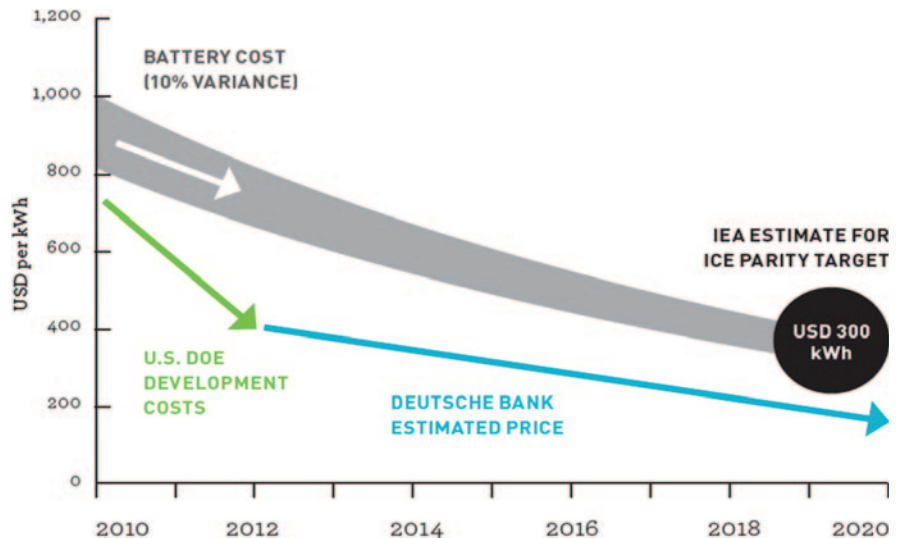
Joining forces with another standard

CHAdE MO will be joined by another DC fast charge technology protocol, Combo, supported by German automakers such as BMW and Volkswagen Group that announced the launch of fast-rechargeable EVs by the end of this year. Expecting the release of these new cars, European charger manufacturers have already developed multi-standard chargers that can charge both existing CHAdE MO EVs as well as the upcoming Combo EVs, and are starting the installation preparation.

Charger manufacturers like ABB, EVTEC (Switzerland), Efacec (Portugal), and DBT (France) are installing their first demo multi-standard chargers in countries like Norway and Switzerland. For example, Fastned, a Dutch start-up for nationwide charging infrastructure, has just announced its plan to install over 200 multi-standard fast chargers along Dutch highways. Even where these multi-standard chargers are not yet installed, operators start to purchase the new type of CHAdE MO chargers that are convertible to dual standard chargers when the vehicles are ready.

European charger manufacturers were able to prepare multi-standard chargers so quickly because the two technologies share the same architecture. They use different shapes of charger connector (CHAdE MO is dedicated to DC, Combo uses AD&DC combined connectors) and they use different means of communication (between the car and the charger), but as they can share most of the basic components, by equipping a charger with two types of connectors and communication boards, the overall incremental cost of making it a multi-standard charger can be contained to 5-10% of the charger cost, which can be made up by the increased revenue from the larger customer base served by a multi-standard charger.

With these multi-standard chargers, most importantly, all EV users are serviced. EV users can pick the charge protocol at these charge stations, just as they choose diesel or regular petrol pumps at gas stations. The coexistence of the two standards in one station is welcomed by users, as this means more charging stations for all. Automakers are positive, because this solution will allow them to compete with EVs and not with charging standards. Operators and investors are also happy to be able to recover costs sooner.



Estimated costs of EV batteries through 2020 (Global EV Outlook © OECD/IEA 2013 fig.16 p17)

The charging operators, early adopters of this innovative technology, have chosen the CHAdE MO technology, because CHAdE MO cars and chargers were the first (and the only) movers in this DC fast charge infrastructure. With a new group of charging technology, Combo, entering the market soon, they have made a rational decision to serve them both by asking for multi-standard chargers. The multi-standard charger, in itself a testimonial of European technological competitiveness, was a logical solution for all stakeholders, and it will only make sense if policy makers in Europe support this by allowing multiple standards to coexist, and not singling out a standard.

The big picture

If this can be made possible, it will boost the sale of EVs and eventually lead to an acceleration in battery price reduction. The IEA report cites data from the US Department of Energy that EV battery costs halved in the past four years, and was \$485 (~€372) per kilowatt hour at the end of 2012. The report estimates that with the current rate of cost reduction at 9.6% annually, the ICE parity (where the costs of EV shall be equivalent to internal combustion engine vehicles) target of \$300/kWh shall be reached in 2020.

With a concerted effort among industry stakeholders supported by European public policy, this parity could be achieved sooner than the report estimates. After having reached this ICE parity target, the EV market and charging service business will grow without government subsidies. A healthy competition among automakers, and among charging service providers, will stimulate a further cost reduction and enhance the performance and convenience of e-mobility.

To that effect, the policy should be an 'igniter' and 'accelerator' of such a positive spiral, not the other way around.

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