

DELTA-EE

EVs and the electricity sector: Friends or foes?

A Delta-EE Whitepaper based on a Roundtable event held with Octopus Energy, NewMotion and Enedis

Key takeaways

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It may still be early days, but the electric vehicle (EV) revolution is firmly underway. Change will be sweeping, resulting in new demands on (and from) the EV customer, innovative business models will be developed, and there will be increasing strains on our electricity networks, particularly at peak charging times. Are energy suppliers, grid operators and customers ready?

- **10s of millions** of electric vehicles on European roads by 2030 – putting significant additional demand on our electricity networks.
- **Smart charging** will be critical in shifting electricity demand - due to vehicle charging - away from peak times of day.
- **Customer propositions** are evolving towards the provision of mobility services with electric vehicles, energy tariffs and charging provided in one bundle. Companies that offer simple propositions – with great customer experience - are best placed to succeed.
- **Vehicle-2-Grid** – bi-directional charging – offers huge potential but costs must fall further to generate mass-market appeal.
- **New business models** are being developed to ease congestion – and capture new value streams – at all levels of the electricity grid, from individual homes, to distribution grids and to the high-voltage transmission network.

Roundtable discussion

Delta-EE brought together voices from across the stakeholder spectrum to join a Roundtable event to discuss these issues and others as the EV and electricity worlds increasingly intersect.

Participants:

Those participating in the Roundtable:

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|  <p>JM: John Murray, Principal Analyst, Delta-EE</p> |  <p>FH: Fiona Howarth, CEO, Octopus Electric Vehicles</p> |
|  <p>SZ: Syste Zuidema, CEO, NewMotion</p> |  <p>DL: Dominique Lagarde, Director of E-Mobility, Enedis</p> |

What impact are EVs already having on the electricity sector today?

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JM: Right now, I would say that EVs aren't having a material impact on electricity grids. They will, but right now there are about 1.5 million EVs on European roads, which is significantly less than one per cent of all vehicles. Sales are good and growing, but we're still in the foothills of the EV transition – there is a mountain left to climb.

That said, our recent research shows there are more than 500k home chargers spread across the top five European markets – so the UK, France, Germany, the Netherlands and Norway. If they were all turned on at the same time, at full power, then total consumption from those devices would exceed 7.5 gigawatts, which is around 15 per cent of the UK's peak electricity demand. So, even at this stage, you can start to see how the impact could start to swell.



FH: Exactly. You talk about Europe there, but if we narrow in on the UK for a moment: National Grid has forecasted up to 11 million EVs on the road by 2030. Say they are all plugged in at once – maybe between 5-7pm when people get home from work – and were all using standard 7 kW chargers, that's 77 gigawatts of demand. That's the equivalent of the UK's peak electricity demand more than doubling.

And though 11 million may sound like a lot from where we are today, this growth absolutely will happen.

Electric cars are just so good and I think people will come to see them as convenient, charging them up overnight like a mobile phone. There are risks and challenges, but we're already seeing that consumers want something new – and with the right charging technology this can help us unlock a renewable economy.

A successful transition to a smart grid can save an estimated £2.5-6.7 billion for the UK.



SZ: If we are talking about impact, we need to distinguish between different levels and locations, because the story can be very different. Look at the individual home: if you are lucky enough to have an EV and a driveway, electricity consumption may double in your home – a big impact. But actually, if you are somewhere like Switzerland or Austria where many already draw on electricity heavily to heat their home, the impact is less pronounced. In places like the UK and Netherlands that rely on gas, it will be more of a jump.

Then you have the DSO level, the distribution system operators: there is a big push here at the moment. However, I'm not sure the impact will be as big as some think. There are certainly hot spots in networks that will need strengthening to accommodate EVs at scale, but the tech is there and the operators have time to find the right model. We are all still learning, but in general there is some exaggeration from those who own the networks and some underestimation from those who want to make business models out of the constraints. If you ask me, the biggest impact is at the high-voltage transmission level, where EVs and charging will influence and be influenced by intermittent renewable production.



DL: If I can comment on something you said there: I agree that it's important that we operators aren't hysterical about the impact of EVs. Volumes are low today, but even with large figures it won't rank as highly as, say, heat in terms of power peak. We must be realistic but also understand how all these demand sources interact together.

We must also keep in mind this is a distributed phenomenon: EV usage patterns will be very different in urban areas like Paris with low car use and extensive public transport, versus towns and rural environments. It is not one size fits all and the advantage we have as a DSO, as opposed to a TSO [transmission system operator], is that we have great visibility at that level.

And how does uncertainty around the pace of EV uptake affect grid planning? How will it be managed?



DL: Well, you make your forecasts but accept there will always be uncertainty. We set forecasts for the next 15 years and have included EVs for a few years. Our current thinking is that EVs won't be the biggest driver for grid investment. You have heat, solar and wind integration, new commercial and industrial locations, data centres etc to consider. However, we must always look at social aspects alongside the technical. There will be different patterns of mobility and car use in the future including trains and bicycles, too. This will differ again between rural and urban scenarios. There are a lot of variables.



FH: As Dominique says, it's the network operators that will be looking at this most closely. However, I've been looking at these forecasts for years and every time I look, predicted EV numbers go up, so the pace may take some by surprise. Compared to just a few years ago, EVs have come of age – with a great range of cars available today and more being launched all the time. This, combined with a rapidly growing charging network, is rapidly driving increased demand. And we can see other countries like Norway, where EVs are already 50% of new car sales. It's a very different level of certainty – EVs are coming now – and we need to manage for this uptake in a smart way now, to remove any tendency to implement extreme measures later that negatively impact customer experience (for example, remotely switching off chargers at times of peak demand to avoid black outs).



JM: It does move quickly, and that's the challenge. Grid investments have very long lead-times and the upgrades that will be needed in five- or ten-years' time need to be planned today. So, utilities are forced to take a view, which is difficult for all the reasons Dominique described. We don't know exactly how tomorrow's consumers will use their cars, how they will charge them at home, at work and on the road – those factors affect where and how distribution networks are upgraded.



SZ: It is difficult to make predictions of course, but a note of reassurance: the EV roll-out can't go faster than manufacturers can produce the cars at a price people will buy them at. Factories must be re-tooled, new supply chains built, there are copper and cobalt shortages. It may be slower than people expect, giving us some time. However, it may be that the roll-out bunches up depending on national incentives, as in Norway, putting pressure on specific grid operators.

From another perspective, how important will V2G technologies be in balancing the grid?



JM: We should distinguish between vehicle-to-grid [V2G] and smart charging. V2G is bidirectional, allowing EV owners to sell electricity in their battery back to the grid at times of high demand. It's interesting, with great potential, but perhaps a little way off commercially. By contrast, smart charging is simpler: unidirectional charging but optimised to match grid supply and demand patterns to lessen strain on the grid and reduce costs. So, for example, you charge your car overnight, it is plugged in for eight hours and automatically does so at the cheapest time – i.e. when there is reduced demand on the grid.

There are no two ways about it, smart charging will be critical in how we balance our networks in future. As EV volumes continue to rise, this is the smart approach we'll need to avoid power cuts or charging curtailment,

as well as helping energy suppliers to match what they buy with what they sell to customers. V2G is a step further, and time will tell on whether it fulfils its promises, but there have been quite a few trials and demonstration projects in the UK to help us find out. A lot of unanswered questions remain though.



FH: I completely agree – smart charging is critical and we need to ensure market conditions exist to reward drivers for charging at off-peak times. And on V2G – again, I agree – it's technology with huge potential and there is already progress. Domestic V2G chargers used to be the sizes of large fridges with two-feet of sunk concrete for the base, now they are neat little wall boxes. Prices also have come down. When we started our Octopus Powerloop project 2 years ago, they cost around £10k. They are now half that and we estimate that should reach £1-2k with scale. Charging protocols are important too. At the moment, only Nissan and Mitsubishi really use the CHAdeMO protocol that allows for bidirectional charging; all other OEMs use CCS which doesn't support V2G today. We understand it's coming, but it's currently a barrier to mass-market adoption for V2G.



DL: **As a DSO, we are very interested in the potential of V2G. In theory it could be a great tool for helping to balance the network at a local level, as well as a national one – smart charging too. However, as John says, there are still many questions. We expect to conduct some real-world trials in the near-future but it is not easy to find real people with real cars and bi-directional charging points.**

There was an experiment in the Netherlands which only included five cars – which goes to show the difficulty.



SZ: To understand the full potential of bidirectional charging we should broaden our thinking beyond V2G. We prefer 'V2X' because there are many possibilities. For example, in Japan there is a trend for vehicle-to-home where the EV battery can be used to power the home when prices are high and charge itself when they are low. No doubt new models will emerge too, hence V2X. We have completed several pilots with this technology already, for example with Mitsubishi and grid operator TenneT. Together we tested the implementation of

our bi-directional chargers in order to understand how electricity can be better balanced and redistributed into the network.

That said, one-directional smart charging is underestimated. This is a tremendously powerful technology itself and probably enough to manage any EV-grid challenges for the next five years. In further testing of our V2G technology, we installed the world's first public charge points capable of delivering electricity back into the grid, together with Enervalis and Alliander. The pilot was run alongside the City-Zen programme which aims to create more effective and energy-efficient cities throughout Europe. Right now, we see the most impact from smart charging so let's focus on that first.

What countries are already leading the way on V2G technologies and how? And which are seeing new EV business models start to appear?



DL: We have seen a lot of commitment from companies here in France, they are serious about making this work. However, it has to be said that the early trials and developments have centred on the Netherlands and the UK, which has championed bidirectional and smart charging and how to extract value and pass it on to the consumer. These are markets where the costs are high and the constraints significant, making the 'prize' greater.



SZ: Yes, the UK has done well. OLEV [the Office for Low Emission Vehicles] will now only provide subsidy to smart chargers, which helps take-up and prevents overinvestment in non-connected chargers that will become obsolete. Innovate UK has also invested a lot in V2X projects. Here in the Netherlands, we have seen the TSO, TenneT, looking seriously at smart charging too. For instance, in the 18 months period where we connected and operated 12,000 chargers to the FCR (Frequency Response) markets in 2017. And the earlier mentioned V2X implementation with Mitsubishi. Beyond that, there are many local initiatives worth looking at. Hamburg, for example, has incentivised a smart charging model that gives a lot of power to the DSO there. This model enables the grid operator to inform charge point operators in case of grid constraints, so that the charge point operators can react accordingly and thus contribute to a balanced grid. NewMotion is the first whose charge points have been certified for this new system. The rise of these new models feeds into questions around business models and who should control and capture value from charging.



FH: The UK is our home market of course, but it really has been fantastic to see how the likes of Innovate UK have invested here. We have been looking worldwide at what's happening and not found anyone doing nearly as much as the UK. I think in part that is down to the UK's pretty unique market, which stands out for two reasons.

One, the UK was one of the first markets to deregulate, so there is healthy competition among suppliers, some of whom take a very tech-orientated approach in order to differentiate themselves. Two, the UK has separated the DSO and the energy retailer, where a lot of countries still maintain the integrated monopoly approach, which might lower incentives a little on pricing or solving these problems. It's encouraging – the UK really could be a green tech leader and exporter on this front.



JM: Our research echoes what others have said: the four markets that stand out in Europe are the Netherlands, Germany, France and the UK, these are at the forefront of smart charging but are all interesting in different ways. The Netherlands, for example, has the lowest rate of home charging per EV as there is less off-street parking, but of those that do home charge, there is the highest percentage of smart charge points (88 per cent). This is probably because Dutch consumers have a peak demand component to their electricity bills, so there is extra incentive to smooth out use. The Netherlands, along with Germany also has a high level of interoperability, so is in a good place to layer in smart charging into public networks, while the UK is rather fragmented. France and the Netherlands also have the highest percentage of time-of-use tariffs in Europe, creating good conditions for smart charging.

Business models have come up a few times. Who do you think will own the EV/electricity customer relationship in future? Will it still be the utility in an EV world? Or is there a threat from new competition such as EV companies and tech platform providers?



SZ: There are two big trends at play here. On the one hand, mobility is changing: car use will transition, to a significant extent, from private ownership to shared mobility and connected cars. Secondly, the fuel is different, moving from fossil fuels to electricity, which is at the crossroad with the energy transition. In this context, everyone sees a revolution, that we are at the peak of chaos and is reconsidering their role. If I am a car manufacturer I think: 'why not sell the electrons too?' but I would never have sold petrol before.

Companies that offer an end-to-end solution for their customers, and that provides ease of use, reliability and excellent service will win the trust of the customer and therefore the market.

Considering our position in the market as a provider of high-quality charging solutions across hardware, software, back-office, infrastructure, service and the added value of a parent company that can facilitate the need for renewable energy, I'd say the EV charging solutions provider will own the customer relationship.

An easier entry point is consumer data and experience, which is where the tech companies may spy opportunity.



FH: It's interesting you bring up the tech companies because – putting aside their potential entry into the market – there's a lesson to learn from them. Ultimately, why did Amazon get to where it is? It did it by focusing on consumer satisfaction above anything else and making its customers' lives easier. The same applies here: whoever is serving the consumer best has the right to win.

We are striving to do just that. We have experts on hand as you choose your EV, and then enable you to access great lease rates and better EV service from our selected leasing partners; get smart charging solutions for home, work and customer destinations; and enjoy smart charging with clean green electricity from our sister company Octopus Energy.



DL: You are right, it is about the customer – but there is a risk that we focus on consumer choice and forget about simplicity. There will be different business models for charging your car at home, at work, at a mall or on the motorway. Does the customer want a different relationship and tariff for every one? The winner will be the one who can make it simple, hiding the complexity behind an understandable, attractive proposition. As a DSO, we are lucky to be fairly neutral in that regard. Our job is not to win the consumer's approval but to build the infrastructure – but still, the end-user must be at the heart of everything.



JM: **It really is all to play for. A lot of players are muscling in, jostling for position. It's very fluid and in the future, it may well be that lines between energy suppliers and transport providers become blurred.**

You have Octopus here, which will provide your energy tariff, your charger, your car and I even saw a promotion for 'free miles' too. On the other hand, you had Volkswagen launching their energy business, Elli, which can supply your home and car with renewable electricity. And it's not just about cars – what about a company wanting to provide solar panels or other connected home solutions all in an integrated way? That's where you can conceivably see the tech companies wading in in future. Some might think of them as a bit of a wild card, but they are more than that: these are the companies with the resources and track-record for getting into people's homes, utilising their data and joining things together. Why not cars and energy? The prize really is great, so expect some fairly fierce competition in the years ahead.

Find out more

If you would like to know more about any of the issues covered in this Whitepaper, or if you would like to find out about Delta-EE's 'EVs & Electricity Research Service', please contact John Murray on +44 (0)131 625 1007 or email john.murray@delta-ee.com.

You can also find out more at our website – www.delta-ee.com.