

Individual Response Number 32

Theme 1 Competition and incentives

1. How is the EV charging sector developing?

The EV charging sector has multiple, unconnected services. Some work well, most don't. This chaos isn't helping anyone.

The key technical developments have already been made: up to 350kW charging, standardised connectors (to replace several obsolete types), plug and charge standards under development (vehicle recognised when it plugs in, no need to pay on site), street-side batteries to match charging demand with electricity supply, time of day tariffs (for the EV charger, not the driver, to make the street-side batteries worthwhile), contracts for renewable electricity, online vehicles, charger-aware satnavs built into cars.

Electric wiring regulations are regularly updated to support EV charging, though electricians update their skills less frequently.

There is a lingering technical issue with the charging equipment, which still relies on multiple low power chargers in parallel inside the big white boxes. This allows the use of cheap electronic components, but the cost saving then gets wiped out by having to connect hundreds of them together. There are better components, but they are in short supply and the EV makers have contracted for all of that supply at the moment (they need them to turn the battery electricity into a form suitable to drive the electric motors).

Unfortunately, only Tesla have understood and implemented the technology fully, and other EV makers are still trying to come to terms with it. Teslas are easy and cheap to charge, anywhere in Western Europe: you are given an account when you buy the car, the built-in satnav knows where the superchargers are, how many stalls are free, and where some third party chargers are, and the car warms up the battery 10 minutes before you reach the charger so you get the fastest charge rate. Nobody else has done all of this.

Every other make of EV has to rely on third party charging services which are country-specific, though Ionity does have some manufacturer support but with very high prices and/or a subscription fee.

Likewise, only Gridserve understand how to do charging whilst the other EV charging services fall well short of what is possible: too few charge points, too low power, few street-side batteries so prices are too high, special RFID cards or accounts required but all are network-specific, cards frequently not recognised due to poor quality comms connections, rely on third party or proprietary apps for drivers to find them on their phones (which are illegal to use when driving).

This means the sector can't develop because it acts as a barrier to EV adoption rather than an enabler. Fewer EVs means a smaller market for charging which means less competition as they all struggle to make money. It is no surprise that legacy vehicle makers aren't keen to build charging networks, which they see as hastening the end of their petrol-engine products in which they have massive long-term investment.

The answer to this question is: do what Tesla do (for their EVs and their superchargers) and what Gridserve do (for multi-brand EVs). Nothing to develop, we have all the technology we need, we just need some vision.

2. How well is competition working?

I don't think EV charging companies are trying to compete. They are struggling just to make the technology work (except Tesla and Gridserve, see above). So there is no effective competition: if a given supplier has an EV charger service in a given geographic location, they try to run it as a monopoly in that location so as to make the money they need to pay the huge cost of getting it set up. And because they run their network of chargers independently of other networks, they don't have an economy of scale and won't get one any time soon for the same reason. People buy Teslas partly because their superchargers work. They avoid other makes because the islands of EV chargers don't work very well and aren't joined up with each other (even accepting contactless cards would be a step forward, but no – not if they can avoid it).

The huge setup costs, notably DNO charges but also the charging equipment and ground rents for prime sites, cannot be avoided. So having multiple “competing” providers acts mostly to replicate those costs, putting up the cost of charging for all EV drivers. That said, the government's early plan for bypassing competition to build an “electric highway” saddled us with Ecotricity (who asked Nissan to help fund it, which resulted in priority for CHAdeMO connectors which promptly went obsolete) and the world's least reliable, and slowest, “rapid” chargers, with often only one charge point per site. Right idea, very wrong execution.

Gridserve have the right idea and apparently good execution, with 36 charge points at their first site. They also include retail and hospitality on site, plus a vehicle leasing business. They link to a solar farm for renewable energy, and have huge batteries that provide grid services as a related business, and can arbitrage electricity tariffs. A competing set of sites like that would be good. But only if they can make a profit (which remains to be seen).

3. How can competition be strengthened?

Let's talk about the elephant in the room. You can't build an EV charging station unless you contract with the local DNO (it is theoretically possible to contract out of area, but this is rarely done). Competition between EV charging providers is desirable. DNOs are a regulated oligopoly with a de facto geographic monopoly. DNOs have to meet all reasonable demands for electricity, but they are allowed to recover the reasonable cost of doing so. This means you can find a location that would work for EV drivers, but if it doesn't work for the DNO you will face huge “reinforcement” charges for supplying the power you need. You can mitigate the power by fitting street-side batteries, but unless you make batteries (as Tesla do), that adds significantly to the cost.

So the DNOs effectively control where EV chargers can be economically located. And once an EV charger sets up there, any nearby competitor will get a huge quote for reinforcing the supply network (which the first EV charger essentially monopolised by taking all the spare capacity).

Good job I like elephants.

And then there's Tesla, who occupy prime spots (and take all the available power) because they don't compete for the supply of electricity to drivers, they compete for the supply of vehicles (and use the superchargers as a tool to do this). It helps that Tesla have lower battery and vehicle manufacturing costs than anybody else, which means they can afford to run the superchargers at cost and still compete on vehicle sales. It doesn't help when the DNO tells you “sorry, there's no electricity left, but we can reinforce the supply network for you....at a cost”.

Gridserve are very clear: they need to pick sites where there is sufficient power available at reasonable cost. But the location of those sites keeps changing, as

electricity-hungry businesses come and go, and as other demands (and supply) on the electricity network change (home EV charging, replacement of gas boilers with electric heat pumps, onshore wind and solar farms).

The solution: find a site formula that works (perhaps like Gridserve, perhaps something else), then find sites that work (sufficient power at reasonable cost, close to major roads or embedded in suburbs for the home charging market). If businesses can do those things, normal competition rules should be sufficient to keep them in check. But if too many (which may mean more than one) EV charging businesses try to set up in the same location, there will be issues with power supply (the DNO has to allow for full power to all EV charging companies, even if they end up sharing the available customers and actually run at much reduced power).

The problem is most acute, and possibly insoluble, in the home charging market. Which is why medium sized villages have only one petrol station with very expensive petrol, and residents of small villages have to drive to a town to buy petrol. A hundred years of competition shows you how the EV charging market will probably end up.

What to do in villages is covered by question 8.

4. Barriers to EV charging providers

Motorway service areas are fairly easy to serve given a high volume of EVs and a necessarily short occupancy. Competition probably increases cost because there is a finite capacity for electricity supply at a given site, and finite space to charge cars. Adding more chargers means that more of them will be blocked by non-EV drivers who don't need a charge but don't want to walk far for a cup of tea.

Residential areas are very difficult, given that EVs are only there when they aren't being used, and will tend to stay there until they need to be used again (which could be some days later, resulting in a EV charger being unusable until the vehicle drives off).

Competition in residential areas is very unlikely to be profitable for suppliers, yet significant numbers of EVs will need to be charged there by owners without off-street parking. Some kind of distributed charging is essential, with lots of chargers sharing a power supply so that total power supply (and DNO costs) are minimised and drivers have some chance of a short walk between their car and their house.

Tesla have the basis of a technical solution. Their self-driving software includes a "summon" function – you can tell the car to drive to you rather than walk to where it was parked. If you combine this with a robotic charging plug (which they have patented) or charging loops embedded in the ground (which have a much slower charge rate), you could drive up to a motorway services front door, tell the car to go and find a charger, have the car unplug when charged (releasing that stall for another car) and go and find itself a parking space (it doesn't matter where). When you want to set off, you summon your car and it will drive to you (from the charger if charging hadn't finished, or from wherever it had parked if it had). The only drawback of this cunning plan is that other EV makers are years behind Tesla in this respect.

Wherever EV chargers go, they will need to contract with the DNO, who will have to provide power but will charge for the network reinforcement they need to make. Competing charging companies would make less efficient use of available electricity capacity unless they cooperate to share that capacity (which is likely to be seen as anti-competitive). In most cases the DNO would need to over-provide capacity because they can't know which of the competitors will take business from one day to the next.

A further issue is DNO supply capacity, which is thought to be largely sufficient for widespread EVs provided that most charging takes place at times of low demand. Even with that, Western Power Distribution have issued a list of “at risk” sub stations where they are monitoring capacity carefully (until recently, they were hardly monitored at all, rather left for 40 years or until they broke down or were vandalised – EVs are having an impact all over the place). Public chargers can only use off peak electricity if they have street-side batteries, which means extra cost and space to install them, and increased maintenance. And DNOs will likely want to impose “diversity” on public chargers in residential areas, which means they won’t allow enough capacity for all chargers to run at once, only enough for the expected combined peak load (they will assume that only a percentage run simultaneously). This is normal in electricity supply, but massive growth in demand (as may happen with EVs) is not normal for a DNO, so some form of intelligent load shedding may be needed as a precaution and at extra cost to the EV charger provider (as ever, Tesla have already worked out how to do this, but only for their charging equipment). Crucially, there is no technical standard for this at present. And finally, some maths. Known to supermarkets as queueing theory and to telecommunications engineers as Erlang’s formula, and to mathematicians as a Poisson distribution. If you have one of something (a checkout, a telephone line, an EV charger) it might be available when you arrive, or it might be busy (for EVs, blocked or ICED in the jargon is the same as busy). So you can queue, or drive on (if you have enough electricity in your battery). You might decide to return half an hour later. It might still be busy, or it might have become free a couple of minutes after you left. The maths shows that small numbers of things have significantly less real world capacity than large numbers. So an EV charger with just one plug will hardly ever get used, which makes it expensive to operate. But an EV charging station with two plugs can charge significantly more times as many vehicles per day (assuming the demand is there, obviously) but will cost twice as much to install and take up two parking spaces. The maths is quite refined but not really up to the job given that “fast” EV chargers can take three or four hours to charge and EV drivers are not diligent at removing their cars when the charge finishes (and petrol drivers are known to treat them as parking spaces, which doesn’t help). The maths is difficult to explain and depends on how long drivers are prepared to wait for a charger to become available. I am familiar with the telecoms application of this, where holding times are quite short (a few minutes) and the number of available lines is often quite large (dozens to hundreds). EV chargers are typically used for at least 30 minutes (rapid chargers 50kW+) or several hours (AC chargers at 7.5kW). The maths works by using the percentage of charging time a driver is prepared to wait. If that is 1% then he or she might wait for less than a minute (rapid) or a couple of minutes (for a 3 hour charge). If it is 10%, they might wait 3 minutes for a fast charge or 20 minutes for a slow charge. The maths doesn’t care that 20 minutes is a long time to wait (and would be unacceptable for buying petrol, though petrol can be bought in about 5 minutes once you can get to a pump). The table below is pure maths and shows the throughput of a given number of chargers with 1% and 10% wait times. It is clear that it is impossible to use small groups of chargers at anything like full capacity, which is good news for the DNO but bad news if you are buying the chargers and hoping to make a financial return by selling electricity.

chargers	Throughput with 1% wait	Throughput with 10% wait
1	1%	11%
2	8%	30%
3	15%	42%
4	22%	51%
5	27%	58%
6	32%	63%
7	36%	67%
8	39%	70%
20	60%	88%

Clearly, a site with three competing charger groups, each with 6 plugs, functions as a group of 18 chargers, though if they are priced differently the cheapest may attract a small queue at busy times and most of the business at quiet times. This differential loading has a huge difference on potential daily throughput, and thus on the time (in years) to recover the fixed costs from a mark-up on electricity pricing.

Equally clearly, single chargers are hopelessly inefficient in terms of potential throughput, though cheapest to install. Two or more chargers at a site is the minimum practical and economic solution. But if multiple charge points share a limited power supply, then charge times will be extended, which is a trade off with efficient usage.

I said the maths was difficult to explain.

5. Deploying charge points effectively to meet demand.

See also response to questions 3 and 4.

One key factor is DNO capacity. It can always be bought, but it is expensive if you exceed currently available capacity. This in turn limits where charge points can be sited economically. Given that charge points need to be located where drivers will find them convenient to access, the number of “good” sites is quite limited.

Competition doesn’t help much. Each competitor at a given site needs to have lots of charge points, plenty of power from the DNO so that they can all charge at full power if necessary, batteries so that they can buy off peak electricity cheaply and achieve a high mark-up, and nearby amenities so that drivers can leave their cars to charge and use the time productively. The owner of those amenities has a natural advantage (and doesn’t care which charge point you are using). The cheapest competitor, which may be the cheapest electricity or possibly the cheapest monthly fee, will get the most business, resulting in a winner takes all advantage. Not an easy model for competition. And not especially for a regulated oligopoly either (though the DNO is treated that way).

Technical standards are essential, and they need to be dominant. At the moment CCS is dominant but CHAdeMO remains a standard (used mostly by Nissan and Mitsubishi). Having two standards means either dual plugs per charge point (expense we don’t really need) or islands of different plugs (which e.g. only Nissans can use and other vehicles can’t, which makes inefficient use of the capacity. If a third standard emerges in the future, it will be a big issue to roll it out. Given that you are studying “electric vehicles” it should be noted that there is not yet a global standard for “Megachargers” of 1MW or more that the electric truck industry will need – a CCS charger would be too slow for a 30 tonne truck even at full power, so they will need something else. And the DNO will have to deal with the significant extra power that a truck stop (if co-located with cars) would require.

Idle fees have recently been introduced by Tesla. Once your vehicle has charged, and given a few minutes to return and move it, per minute charges apply. This is a good way to get more throughput, but clearly another cost structure to consider for competition.

Plug-in hybrids are a potentially significant problem. They can't hold much energy (30 miles range is high for PHEVs) but some have rapid charge capability (e.g. Mitsubishi Outlander) and so use a rapid charger that could perhaps deliver 200kW, but only take 50kW and only for a few minutes until the small battery is full. This effectively blocks the charge point for BEVs that need more energy and can take full power. Unfortunately PHEVs won't be banned until 2035, so will still be in widespread service until 2050. They increase costs (by under-using infrastructure) for all electric vehicle users.

6. Incentives

7. Public subsidy

Public subsidy could be helpful with the high up front costs of establishing a UK-wide charging infrastructure. Costs can only be recovered when charge points can be fully used, which requires a significant percentage of vehicles to be electric, which in turn requires a perception that the charging infrastructure is there. Classic chicken and egg.

Public subsidy could also help in areas which large numbers of vehicles pass through, but which have very few local residents. Without this, vehicles need to navigate "last charge for 100 miles" issues, for which not everyone will have prepared by charging fully before entering the area.

Conversely, areas with large numbers or clusters of residents but few vehicles passing through (urban and rural residential areas for example) will probably require public subsidy since competitive supply would simply ignore them. We can't meet net zero carbon by 2050 unless all vehicles become zero carbon by then, and they will need to be charged. For this reason public subsidy is effectively assumed by government policy (but that may not make it happen).

8. Rural and remote communities

In villages, people need vehicles for basic tasks such as shopping, eating, getting children to school, going to a GP, etc.. Vehicles aren't optional because services have developed over decades on the assumption that people have vehicles. But charging an EV is quite different to buying petrol: it takes much longer. At present, with very few EVs, it is possible to drive to a rapid charger once a week or so if you have a Tesla (which have very high power chargers at sites with multiple stalls) but not really for anything else (which rely on the chaotic, competitive market with usually only a couple of stalls per site – if they are working). This will work less well as EVs become more numerous. So villages (and to some extent suburbs) need public EV chargers in their community. Great, we have a strategy.....but.

Villages are often strung out. A public charger at one end is not practical for somebody living at the other end. Easy: put the EV charger in the middle, yes? No, because that's where the pub and shop are, and that's where the tourists park when they go for a bike ride round the local lanes – they go to the shop when they arrive, and the pub when they get back. And they park as close as they can to those amenities, and will use an EV charger if there is one, or just park in front of it (and block it) if they don't have an EV. So the only way forward is multiple EV chargers distributed throughout the village, replicating the ideal situation of homes with off-street parking and their own EV charger. But multiple EV chargers costs multiples of single chargers and massively reduces occupancy and therefore won't make

money. So it won't get done by market forces, and it will need to be subsidised, both to build and to maintain (if you don't maintain them they soon stop working, but I mentioned Ecotricity earlier).

As a second order issue, EV owners with their own chargers frequently sign up for a time of day electricity tariff, and get cheap electricity when the grid has a surplus (at a fixed time overnight, or based on real time tariffing, both are available). It is more difficult for a public charger to explain time of day charging to EV drivers, and in any case cheap electricity at 1am means that when you get home at 6pm you would find a charger, plug in, block it to other users, and not charge until 1am and not remove the car until 8am. No way to make money from that.

So serving small communities is expensive, and fraught with operational issues, especially blocking by inappropriate vehicles or inconsiderate EV drivers. Competition cannot solve these problems. Some kind of universal service obligation with a regulated operator might work, but there is some fairly dismal precedent in the UK for that. And tow-away enforcement of drivers parked but not charging might help, but isn't practical in rural areas because of the distances involved. So whatever gets done will be expensive and will need state subsidies. But petrol has to go, so something has to give.

Looking at the maths in question 4, single charge points are hopelessly inefficient. Villages will need charge points with multiple plugs, even if those plugs load share a power supply – this way they stand some chance of meeting demand. But this requires space to park multiple vehicles, which can be impossible on narrow lanes. Each village is different, but most have a pub, a shop, a village hall, or some other site with some off-street public parking. These are practical places for charge points, but EVs would then block spaces for the intended purpose of the parking. And they may not be easy for the DNO to supply.

9. Local Authority involvement

Involving local groups is essential when deciding where to put chargers, but if you ask 10 people what to do you will get at least 12 answers. At present, very few people have a clue what an EV is, how to charge it, what the issues are, or how frustrating it is to find a charge point blocked by somebody not charging. And parish councils have effectively zero budget for maintenance, which is essential to keep chargers running safely (or at all). District and County Councils will need funded teams to go out into the villages to explain what the issues are, and where funding will come from. A long time ago, (nationalised) electricity boards went out to villages to explain what freezers were, and to show people how to use them – it worked, and villagers now rely heavily on their freezers (and have negligible access to the online food delivery services now taken for granted in urban areas).

Parish Council activity varies widely between communities. Some have other groups that take the lead. A tailored approach will be needed. A good precedent (very little exploited, sadly) was the County / District / Parish cascade of support and volunteering that sprang up at the start of the Covid pandemic. Villages can achieve a lot if they are supported, funded, guided, and left to get on with things. Use the force, Luke.

10. Devolved Administrations

The situation in Scotland is widely admired on EV blogs – lots of free charging, a push to serve most remote communities, and a single scheme that doesn't require complicated rules or membership fees. It is subsidised and there is little competition.

Wales and Northern Ireland by contrast are widely seen as no go areas. Charge fully and proceed with caution. There are large areas with no charging. England looks better on Zap-Map, but in reality is a mess of incompatible systems (the way you pay), multiple technologies (AC, DC, slow, fast, Type 2, CCS, CHAdeMO), grace and favour destination chargers (you can charge, but you need to buy lunch), and poor signage.

All have suffered from policy changes, notably a requirement to accept debit cards that isn't retrospective (so you need to know when the charger went live, good luck with that).

Some EV drivers venture into the EU, where each country has a different approach. If the EU develops a common system (as opposed to just the common plug that already exists), it would be essential that the UK adopts the same system. That requires compulsion rather than competition.

Theme 2 Consumer interaction

1. Challenges

The challenges are fairly clear.

- Where to charge – home or away?
- Will there be a spare plug – competition or subsidy?
- Pre journey planning is essential – fossil drivers don't need to do this.
- Lack of government taxation strategy – how will the £25bn fuel duty be replaced with £25bn in taxes on EVs, and when?
- Where will the taxed price of electricity settle? For home chargers will there be per kWh or per mile taxes? Will VAT remain at 5% on home electricity? For public chargers likewise but with more expensive electricity and probably 20% VAT on service charges.
- Price of EVs relative to fossil vehicles. There are few second hand EVs presently. EVs will continue to fall in price but the disposal cost / scrap value remains unclear. Fossil vehicles might be an appreciating asset for a while, which would impact the 2050 zero carbon target.
- Reliability of public charge points has been an issue, and if charge points are not well maintained (which has a cost) will continue to be one.
- Technical standards are key, which means that future changes to them will be a big issue.

Some of the challenges are intractable. Either you have off street parking or you don't. Charging takes longer than filling up with petrol. Petrol is widely available, and charge points are not.

Tax policy is key. EVs are presently cheaper to run than fossil vehicles. They also produce less pollution, which has a hidden benefit to our NHS which needs to be quantified, tracked and published. Some EV taxes are inevitable, but the hidden benefits need to be taken into account.

Environmental policy is also key, especially in relation to end of life costs. Fossil vehicles are subject to scrapping rules (drain fluids, remove tyres, remove battery, etc.). EVs need clear and stable rules too.

2. Early adopters

Existing EV drivers rely quite heavily on user groups and social media. They exchange experiences, recommend workarounds, and offer practical advice. This will not transfer to a mass market, where an EV needs as little thought as a refrigerator.

Key topics discussed are:

- When will my Tesla arrive? (demand exceeds supply, one of the most popular blogs tracks the ships delivering them - really).
- What is the best home charger? (cost, safety, aesthetics).
- Can I bodge my own charge point? (please – don't).
- Has my electrician bodged my charge point? (probably).
- Do I have to tell the DNO I am charging a car? (yes, but many don't).
- How do I charge when abroad?
- What are the latest developments? (Teslas get updated every four weeks, for other makes it is about new models).
- Public chargers – where they are, what they cost, how reliable they are.
- Public chargers – which app is best for finding them.
- Public chargers – horror stories, rants, and some praise.
- Public chargers – attempts to navigate the confusion and muddle.
- ICEing - when an internal combustion vehicle parks at a charge point. PHEV users get particular hatred from BEV users in this respect.
- Why am I using more electricity / getting shorter range than I expected? (drive more carefully, wear a jumper in winter, turn the heating down).
- How long can we get away with paying 5% VAT on electricity (or getting paid to generate it with solar panels and the Feed In Tariff) and thus being much cheaper to run than a fossil car?

So a mix of “how do they work” and “should I wait for something newer”.

Clearly the technology is moving fast (even if the ships carrying Teslas don't). It will slow down as the key technologies (batteries, power electronics, manufacturing techniques) mature.

How they work won't change. If you don't charge your battery you can't drive. This is about infrastructure, and that is cumulative (you only need to dig up your lawn to run a cable once).

What doesn't work might never be sorted. And competition may make things worse if it takes the form of proprietary technology (Tesla helps with their proprietary technology at the moment, but only because they are market leader and their technology is far ahead of the others).

PHEVs are going to be a nuisance for 30 years, unless they get priced out of the market (paying for an engine, catalyst, electric motor and battery is expensive, and the result is over-weight and inefficient, so perhaps there is some hope). Differential purchase and annual taxes might fix it.

Public chargers are going to have to consolidate, move to pay per charge (like buying petrol), deal with ICEing and PHEVs, have more plugs per site (more efficient and ultimately cheaper), roll out to villages (subsidised), and stay compatible (no new standards, please).

Satnavs sometimes cover public charge points, but often people use proprietary apps for this. Over time they may be included with general maps as an essential infrastructure.

Tax is not a challenge at the moment. It will become one over time.

3. Which charger to use

If your battery is nearly flat this is easy: the first one you come to that is working and which doesn't require an RFID card or pre-registration to use.

More generally, EV users soon realise they need to plan journeys. Tesla does this for you, by just typing your destination into the satnav it will tell you where to charge, how long for, and will pre-warm your battery for when you get there. It also has real time information on occupancy. For other EVs, you need an app and probably a

pencil and paper – and if you're lucky it might have reliable information of whether or not they are working or in use.

If you don't plan, you probably will get stranded – that's just how it is.

Sometimes you have no choice given your range, state of charge and destination. A classic captive market.

Where there is a choice on site (which is rare) the cheapest / easiest to use / fastest charge points get filled first. You can wait for a good one or settle for a slower one that at least gives you some charge – at a price.

4. Comparing tariffs

There is no standard in place for tariffs. There are charges:

- Per kWh.
- Per minute while charging.
- Per minute idle fee after finishing a charge.
- Per charge (often replicated if the charger keeps restarting).
- Per charge (even if the charge doesn't in fact take place).
- Per month / annum scheme membership.
- Varying by kW drawn.
- Varying by plug type.
- Discounted for certain makes of vehicle.
- Discounted for scheme members.

These can be combined in every possible way.

Receipting processes also vary, an issue for business users reclaiming VAT.

Lots of barriers, not at all easy to compare anything.

Tesla has the simplest model: you need a Tesla, they register it when you buy it, no cards, no buttons, not even a screen (you use the screen in the car), you link a debit card to your Tesla account before you buy the car, they prompt you when the card expires. You turn up, you charge, the cost is shown in real time in the car and on the app (if you have gone for a coffee). If you don't leave once charged, you get a warning message, then a charge per minute (also shown in real time). The rates apply country-wide and are readily found online. This is the charging model to follow.

5. Consumer challenges

You need to be online to plan a journey. Anyone not online won't have much idea where to charge, particularly on an unfamiliar journey. You might for example think that all LIDL car parks have chargers, but they don't. You can flatten your battery and get stranded if you drive round looking for a charger.

I would not like to charge an EV from a wheelchair. There is often very little room to get to the socket on the vehicle. You sometimes need access on one side to reach the plug, and the other side to plug it in. Embedded charging loops are an obvious solution, but they are rare and run at lower power.

6. Tools

Standardised tools for complex pricing structures such as electricity bills are annoying in their sweeping assumptions but are a good way of comparing multiple tariffs (they just don't relate well to your actual electricity bill).

Clear pricing online helps, but only if you have the skills to model them for your usage pattern. And you may have an accurate idea of what a charge will cost only to find that there are no spare plugs so you have to use a completely different charger a few miles further on about which you know very little.

A sticker showing a comparative price for a BEV and a PHEV might help, but such stickers get gamed and they won't warn you that every time it stops and starts for no

reason there is a £2 charge to add insult to injury. Or that you may have a 30 minute wait if you call the support desk, only to find they have closed for the day by the time you get through (as if).

7. Consumer protection

There are trading standards, but it is difficult to enforce a transaction for which there is no physical product. There cannot really be a problem with the quality of the electricity, but there can with the way the charges were applied.

There are particular regulations for electricity pricing, but the electricity customer is the charge point operator, not the EV driver.

8. Open data measures

Comparison sites are rare in the conventional sense – they tend to be charge point location maps with notes on various tariff schemes. The location of charge points changes very quickly (they come, they go, they get fenced off).

A comparison of, say a 200 mile charge in a typical EV might help, but doesn't take account of per charge fees where the charger stops and starts. And EVs are not typical and vary considerably in how much electricity they need for 200 miles, if they can even get that far, and on whether you are using the heater or the air conditioning, or have the window open, or drive fast or slow, or which energy mode the vehicle is in. A comparison of, say a 30kWh charge is not meaningful to many people and difficult to relate to miles driven.

Third party data gathering sites such as Teslafi give massive detail on just about everything, but you need to tell it the price per kWh (if that is how the electricity was priced). Over time you can see what particular journeys cost, and how they are affected by driving style and ambient temperature, but you need to be a spreadsheet geek to enjoy that level of detail.

At present, the EV enthusiast blogs do a reasonable job of comparing charging systems, but as with all social media are not free of personal bias.

9. Anything else

It is essential that the DNOs are dragged into any regulation of the EV sector. They are a regulated monopoly that is essential to using EVs at all.

For now, charge points are rolling out in a haphazard way, but they are rolling out. The sector needs to, and will, mature and consolidate. As it matures, monopolies will tend to form, first round charging hotspots such as motorway service areas and along major trunk routes.

Public subsidy will be essential to get essential infrastructure installed in residential areas - urban and rural – for people without off-street parking. This is a problem that fossil vehicles don't face (all fossil refuelling takes place in regulated public petrol stations). Further public subsidy will be required to maintain residential area charge points, and to the price for electricity.

Taxation is likely to be a major issue as the volume of fossil fuel falls. This could make the government the key player in determining how fast EVs roll out, but they have mandated an end to fossil car sales so should (but judging by the number of consultations at the moment, probably don't) have a plan.

Individual Response Number 33

I am a private individual so I would like you to keep my personal details private
On pages 17 and 18 you ask many complex questions .

I can only respond in general terms because I do not yet own an EV, but hope to purchase one during the next two years.

Firstly I am in the lucky position of being able to have a home charger installed in my garage.

I think that being able to offer on street charging for EV's is very complex.

Unless a charger is provided for every house I can see many neighbours in disputes, and health and safety concerns over trailing cables etc, and building the infrastructure is an immense undertaking.

[✂]

RE National charging providers

I think that there must be an element of competition especially at motorway services, and also geographically

The use of RFID cards which limits you to one provider is a bad idea, all payment should be made by contactless Credit or Debit card or smart phone app. Or has Octopus is planning charging to your domestic electricity bill if you use them as your supplier

The future is definitely for fast chargers .

All companies who provide these should be licenced , and if they don't meet certain standards I.E. regular maintenance and repair of their chargers within a certain time frame

They are fined or lose their licence

Also they should ensure that services such as ZAP MAP are constantly updated, so an EV user can see which charger is in use ,time left to charge and if its servicable.

Finally Non EV drivers should be clamped and fined for using the special parking charging spaces

Individual Response Number 34

To whom it may concern

I would like to know if [redacted] local authority will be looking to estates where the infrastructure needs looking at for points to be installed. I live in [redacted] with one parking area outside where the houses are situated. You cannot therefore park your car at your property.

I would love to be able to buy a self charging car because of this charging problem, but most people won't have the need for self charging only fully electric.

I hope my opinion helps?

Individual Response Number 35

Hi I hope this is open to all forgive me if not but I would like to comment, I was considering an ev as my next purchase but an incident occurred that made me reconsider.

I had just got home in my car (ice) and unexpectedly had to go out again the reason entailed a journey of 125 miles a one hour stay and then a return home of the same distance.

The ev car I was considering could have managed to 125 miles but not 250. A public charger may have sufficed had there been one but the issue is these only tend to charge to 80% and thats 20% off the range. That would be cutting it very close, to close for comfort.

The car in question has a quoted range of 206 miles but that is not realistic in real world terms. It comes on low rolling resistance tyres which are not good in winter where I drive and cold kills range as does motorway use and driving at night which was the case in this instance.

Sure there are cars with bigger ranges but I can't afford one and bigger batteries take longer to charge.

Another issue is my drive has a slope and low cars just won't go up. My neighbours drive is same.

A hybrid seems my only choice but I'm going to be stung by gov taxes if I buy one even though I would only use it in non electric mode occasionally. An ice car is still my cheapest option with non of the above concerns.

Individual Response Number 36

This response is as a consumer. I have driven ICE powered cars for over 40 years; in March 2020 I bought a new all-electric Nissan Leaf [🔌] model for use as my sole vehicle.

The car is a fantastic vehicle - easy to drive and cheap to run. Most charging (probably 95%) is done overnight at home and the car has a range of up to [🔌]

HOWEVER on the rare occasions I wish to make a longer trip where I need to rapid charge en route - even with detailed forward planning it is usually VERY stressful, for the following reasons :

- chargers are faulty or not accessible (technically faulty, or occupied by other cars charging or just blocked by parked vehicles)
- working chargers may not useable, as I'm not in the right 'club' (e.g. don't have the right 'access card') and/or downloading the app at the time usually fails for some reason. I currently am a member of 2 clubs, but will probably need to join more!
- there may be additional restrictions that prevent or deter use : chargers located in pay and display car parks, private car parks (e.g. restaurants, health clubs, etc.), ANPR controlled parking (e.g. supermarkets)
- there are limited numbers of rapid chargers (50kW or more) available - this type of charger is essential to facilitate longer trips.

Most, if not all, new EV owners are used to driving ICE cars : as you have stated are used to "Being able to easily stop off at a petrol station as a standard part of a journey and... trust that electric chargepoints will provide a similarly straightforward service."

When was the last time a petrol/diesel car driver was (a) charged to park their car on the forecourt while filling up, and/or (b) refused to settle payment using a valid credit/debit card?

Buying charge should have a universal methodology - probably based on CONTACTLESS payment.

It is not uncommon for me to drive miles out of my way to find a suitable charger - all the time getting stressed that I am running out of charge.

I would venture that currently PRICE is almost irrelevant as an arbiter of where to charge - if you need juice now then cost is of very low importance.

Ease of payment WITHOUT the need for phone apps is really important : CONTACTLESS payment is well established for much of retail, including conventional liquid fuel for cars.

EV charging almost feels like "well, if we must provide it we will, just to tick the box". Most chargepoints are fully exposed to the weather and may not be supervised - this does not help with their reliability. Faulty chargepoints also need to be quickly repaired.

EV take up is influenced by word of mouth - I tell people I love the car, but get increasingly frustrated by the difficulty of public charge points.

Perhaps, the recent opening of a proper EV charging forecourt in Braintree, Essex, is the way forward?

Individual Response Number 37

Hello,

Whilst I don't think I'm the target group for comment on this "Invitation to comment", as an EV owner of 2 years I think my experiences might help inform the direction of travel for one important area of the project.

As an owner of a non Tesla BEV for 2 years I don't see myself as an early adopter however I must say I was really quite terrified during the period after ordering my BEV and before taking delivery – even though for 85-90% of all our journeys are well within our cars WLTP of 250+ miles. It really was the fear of the unknown.

However it is the 10-15% of journeys that aren't covered by home charging has garnered our cars reputation as the "white elephant" within the family..... and here is the rub, you would hope that once people have actually experienced an Electric car their next cars would be electric too – however until one serious flaw with UK EV charging infrastructure is addressed that is unlikely to happen – that being motorway charging for non-Tesla EV's in England.

You talk about "range anxiety" in your introduction but it is actually "charging anxiety" that is the biggest issue for EV owners travelling distances longer than 170 miles in the UK.

As the owner of an ICE vehicle, in 30+ years of driving I think I only ever filled up with fuel at a motorway service station once, yes, I used the toilets, bought food & stuff – but I'm sure I only ever filled up with fuel once. I hope I don't need to tell you that (current) EV's are not like ICE vehicles in one very crucial area, you can't store the quantities of energy in an EV that you can in an ICE vehicle, plus as an EV runs much more efficiently, once you hit motorway speeds wind resistance takes a much bigger hit on your range than it does in a much less efficient ICE vehicle – add into the mix the sweet spot for charging your EV is probably from 20% to 60-70% battery capacity (i.e. most miles gained for shortest time charging) then suddenly Motorway Service Station charging (refuelling) takes on a level of importance (i.e. utterly essential) in a way it never did with ICE vehicles. I appreciate these figures will change over time but I think banks (10+) of ultra-high speed charges (150kW or higher) every 50-60 miles on the UK motorway network is what is required now.

Now compare that with the current situation.

Hopefully you are aware there is a monopoly of EV charging provision here in England Motorway Service Stations – I'm not sure if it's true of the whole UK – but somehow England has sleepwalked into a situation where one small company with no visible financial reserves has signed monopoly agreements with all Motorway Service Providers with what appear to be absolutely no service level agreements whatsoever. So we appear to have the worst of all worlds. Very few chargers, 2 at most Motorway service stations, slow chargers, none are faster than 50kW /per hour and when they are replaced they are being replaced by 50kW chargers - the fact you can buy cars with 350kW charging speeds in 2020 shows how hopelessly out of date these chargers are now, goodness only knows what charging speeds cars will be capable of by the time these “new” chargers are end of life. Motorway service stations should have the best (easiest to use) and fastest chargers (at least 150kW /hr in 2020) currently available – my local supermarket has easier to use, faster and more reliable chargers than any public chargers at Motorway Service Stations on the M4.

For my family the damage has been done, by the 3rd motorway journey beyond home charging, trying to find a working Motorway “fast” charger and failing miserably – having to go off the Motorway on a round trip of 20 miles yet again in the hope of finding a working fast charger, my family said enough is enough and now will not come with me in the EV for these journeys – choosing to drive an ICE car instead.

Hopefully this “Invitation to comment” will lead to some serious and rapid change.

I would like to see.

The Ecotricity Motorway Service Station Monopoly broken up now – surely it's illegal anyway.

EV charging on the Motorway is not like a Burger franchise – it is transport infrastructure – it needs proper rules and regulations – it needs service level agreements – there is no point in having chargers if they don't work 90% of the time and don't get fixed for months.

I would imagine that the biggest cost for ultra-fast EV charging plazas is the connection to the grid – so why not make the connection available to multiple suppliers at each service station – that would drive real competition.

Proper competition between providers – we have seen already that Charging networks owned by car manufacturers are able to exclude the

general public or price-out their competitors so in effect become like the Tesla supercharger network. A facility only a few car owners can afford to use, not really public chargers.

Tesla – with their cars now clogging up what few public chargers there are – yet we are not allowed to use their chargers even though they use the same connectors as we do – surely the “all new chargers should be accessible” rule should apply to them too.

Can we please have some imaginative designs & new ideas when it comes to these fast charger hubs – this is a new way of travelling / refuelling – can we have some fresh thinking about how to design these plaza’s – unlike a traditional Motorway service station where the object is to slow people down – a typical EV owner will need to visit 2-4 of these hubs on a long journey and speed of getting in / charging / and getting out should be a design priority. I don’t think that I was very unusual in my ICE fuelling habits – now imagine just 50% of the cars on the motorway being EV’s and needing to charge regularly – the current design of motorway service stations simply would not be able to cope as most are full of roundabouts and stop & start crisscross car parks. We need purpose built charging plaza’s designed like pit stops. My understanding is that it’s the Grid connection that is the most expensive part of a charging station build so why not locate these new charging plazas at the most cost effective place to connect to the national grid. Remember EV’s are virtually silent and don’t produce local pollution so arguments for not allowing them to be constructed should be pretty minimal. We are currently at the “worst case scenario” part of the charge per mile equation – from here on in with advances in batteries and charging techniques the time people will spend charging will continue to drop and I can see in the not so distant future charging times of 5-10 minutes will be the norm. Quick throughput of large volumes is what will be needed especially when white van man & HGV join the fast charging mix. I also think if the general public see large scale charging provision being visibly installed that will also have a knock on effect with consumer confidence. I often struggle to find a high speed charger even when it’s on the sat nav because it’s buried way out of sight and at the back of a car park. In addition if there was a requirement for these plazas to have large battery farms attached to them, these charging plazas would have the added benefit of smoothing out national demand without the need for more power stations and public funds being used to store excess wind & solar energy when produced – a win/win.

EASE OF PAYMENT!!!! I always try and use Instavolt chargers as you just touch your credit card to start the charging process and touch your card to stop, they always work – it’s great, it doesn’t seem like rocket science but

they are the only ones that have this payment method for all their chargers - and they don't have ANY chargers on English Motorways. Many other companies use Apps (and invariably there's no mobile signal!) or specialist RFID cards (sods law you don't have the card for the charger in front of you) – or pre buy amounts – which means I have 10's of £'s sitting in accounts just in case I need to charge with that brand of charger – it's a nightmare. All these non touch-to-start, touch-to-stop systems invariably fail when it's pouring with rain and you are having to talk to their customer services outside getting drenched to the skin – it really doesn't feel like the future of travel or even 2020.

There is a lot more I could say but fundamentally the issues we have in the UK stem from the fact that one company ill equipped to provide a core future proofed EV charging infrastructure to move the country towards a zero carbon future is holding the whole process up and doing a lot of damage in the process – this needs to be addressedand very quickly.

Individual Response Number 38

Background

1. I have owned a Tesla [X] electric vehicle (“EV”) since December 2017, so for 3 years. It has been in daily use and is my main car. It is my first EV. I have covered 50,123 miles in the car in this time.
2. I live in [X] in a semi-rural location. I have off-street parking and a home 7.4kW ‘charger’ (recognising it isn’t really a charger – the AC charger is actually in the car, and the wall unit or ‘charger’ is simply an ‘intelligent’ and ‘safe’ plug). The correct terminology is I believe an EVSE.
3. [X] so the car is used for short and long journeys.
4. I enjoy technology and have spent some time educating myself about EV’s.

Synopsis

In my experience it is possible to drive an EV as a main car both for short and long journeys in Great Britain (I have no experience regarding Northern Ireland).

That said it is not without its problems, and there are a number of areas where there seems to be ‘low level’ resistance that cause difficulties in installing sufficient numbers of chargers, i.e. DNO’s local infrastructure for home chargers, or Wayleaves across land for getting new power supplies put in for Rapid chargers. The current network of Rapid chargers provided by the Chargepoint Network Operators is also something of a mess and seems like the ‘Wild West’. They all have their own subscription services, payment cards, Apps, tariffs, geographic areas – so it is impossible to know in advance for a long journey which Operator(s) you should join / be a member of (you can end up with 10+ payment cards, memberships and Apps). This wouldn’t be acceptable for traditional petrol stations and isn’t acceptable for EV charging. You should be able to just plug in and charge.

Reliability also leaves much to be desired. In short, the ‘mechanical’ reliability of the actual chargers is poor and they are often not working, either due to mechanical failure or communication failure. This leaves motorists in difficulty, and either spending significant time on helplines to get chargers ‘re-booted’ or having to crawl (at a low state of charge) to another charger location (as chargers are often only installed singularly or in pairs).

Chargers can also end up being ‘abandoned’ and not working, for example a Local Authority may have paid for a charger(s) to be installed by Polar (BP Pulse).

However, after 1 or 2 years the LA don’t have the money for maintenance and Polar thus won’t repair it – and neither party takes responsibility for it. It then falls into dis-use, and neither party will take ownership.

Lastly, it’s my understanding that one operator, Ecotricity, has a monopoly for chargers on Motorway Service Areas. I believe this shouldn’t be allowed to be the case and if nothing else is something the CMA should resolve to allow i) competition amongst operators at MSA’s, and ii) increase the availability in terms of numbers of chargers at MSA’s (Ecotricity seem to only install 2 chargers as a maximum).

My comments are written in layman’s terms, and as a member of the public and EV owner. I hope they provide insight into my real life experiences over the last 3 years – and balance out the corporate ‘everything is fine’ view, that I’m sure the Chargepoint Network Operators will be lobbying with!

I will now turn to the points the CMA raises in its Invitation to Comment dated 2nd December 2020.

Ease of Use

You need to be able to simply turn up at a charger and use contactless (and reliable) payment by debit/credit card and at a fair cost. There should not need to be a need to have an operators RFID card, use an App (often there can be no mobile signal), or have subscribed to a monthly plan, etc..

Despite this seeming obvious there are still a large number of Operators and Chargers that require this, either to use them or to access at a fair cost, e.g. Polar (BP Pulse).

In my experience a good example is Instavolt. For their chargers you simply drive up, tap your debit/credit card, plug in and start charging. No Apps, Membership, or Subscription required (you can end up with having 10 different cards, memberships, or Apps).

Podpoint are also good – their AC chargers starts for free and you then have 15 minutes to ‘activate’ it, albeit via App (in my experience this has been reliable). The requirement for contactless debit/credit card payment should be made retrospective for all chargers.

In this respect Polar/Chargemaster (BP Pulse) are particularly bad, in terms of ease of use, for both its App and contactless payment (how Polar make contactless payment so tortuous is beyond belief (of course they want you to sign up as a member!)).

In terms of Charger location relative to the parking bay and length of cable, you can from time to time find you physically can’t use the Charger. As an example the Polar Rapid Charger at [🗸] is positioned such that you can only use it if your car’s charge port is at the front of the car (the charger is at one end of the on road parking bay) otherwise you would be on a Yellow Line / Blocking the Road. Not sure of the solution, other than for tethered cables to be longer and attention paid to designing installations.

Lighting, Location and Weather Protection also form part of the ease of use. More often than not the chargers are located in some remote part of a car park with no lighting and no weather protection, i.e. roof or shelter from rain. Thus, the process of plugging the car in and using a card, App or Website to start the charge when dark or raining is less than pleasant.

Mapping / Location Services

Free to use services such as ZapMap, Plugshare, Abetterrouteplanner, and Wattsup are a godsend. With these free Apps you can find nearby or en-route chargers and plan routes (thus removing range-anxiety).

You can also see whether chargers are working or in-use, but this depends on the operators sharing real time information and a lot of them don’t. It should be a requirement that this information is made available for the consumer.

Inter-Operability

Generally, now the charging standards seem settled on Type 2 for AC and CCS for DC.

Inter-operability between chargers and car manufacturers seems okay as far as I’m aware.

There can be issues when new cars are released not talking to a particular brand/manufacturer/ operator’s Chargers but manufacturers tend to address these via software updates to the cars.

There are some legacy vehicles with old charging standards, i.e. Type 1 for AC and CHAdeMO for DC, but given the relatively low number of these cars I'm not sure new chargers need to account for them (and for example Tesla will convert older Model S and Model X cars from CHAdeMO to CCS).

Reliability

I am surprised at how unreliable the Chargers are – whether AC or DC. You frequently find Chargers to be broken or having lost communication. The Operators also seem poor / slow in fixing broken Chargers, and the phrase 'that's been broken for weeks' is all too common.

Sometimes a Charger can be got working by calling the Helpline – but these tend to only run during office hours and not 24/7 – who can remotely 're-boot' it. This can however take 30 minutes or more in the phone standing by the Charger.

Some sort of fine mechanism for the Operators should be implemented for chargers not working, in order to incentivise them to keep reliability high.

Chargers should also default to 'Free Vend' if a fault won't allow authorisation / payment.

'ICEing'

When a Charger is ICE'd this is a colloquial term for a petrol or diesel car blocking a Charger so an EV can not charge. It is most prevalent in busy car parks when people struggle to find a space, but it can also be malicious (ICE standing for internal combustion engine).

The best car parks police this and will issue fines, but they are in the minority – most of the time the car park operator doesn't want to get involved.

I don't know the answer, but better signage and better enforcement/fines would be progress.

Cost

I understand Ionity charge up to 69p per KWh for charging at their sites. This is simply usury and shouldn't be allowed.

Home charging can cost as low as 5p per KWh (some tariffs can be negative and pay you to charge – Octopus for example), but more normally say 14p per KWh on a standard tariff.

I therefore think something along the lines of 25-30p per KWh for Rapid charging (100kW and higher) is acceptable. At higher prices then consumers will avoid those sites, again leading to them not being used and falling into dis-use / being closed.

As consumers can charge at home at low cost, then the cost of public charging will be sensitive. A similar parallel doesn't exist with Petrol / Diesel as there isn't a low cost home alternative.

At 30p per KWh, this is a similar cost to Petrol / Diesel assuming £1.20 per litre and an average of 45mpg, and that an electric car averages 3 miles per KWh.

Correct choice of Charger to install

This a complicated area and can also be split between AC and DC charging.

In my opinion AC charging should be limited to i) Home use, ii) Workplace parking use, and iii) long-stay and overnight destinations, i.e. hotels. This is because it is otherwise too slow, i.e. if you use one at a supermarket and your shopping takes 45min, on a 7kW charger you might add 15 miles of range in that time.

As a result EV users generally don't bother and so the chargers remain unused and supermarkets think it's a waste of time installing them.

You could install 22kW AC chargers, but unfortunately most cars can not take advantage of this as their onboard AC charger is restricted to 3.6kW or 7.4kW. This is something that should definitely be addressed with the car manufacturers to install 22kW onboard chargers as standard (and hence why I say the issue is complicated).

Thus, for supermarkets and other short-stay destinations, i.e. pubs and shopping centres, then DC charging should be installed. A 50kW DC charger would give a worthwhile charge in 45 min, say 100 miles (versus 15 miles on a 7kW AC charger). I appreciate there is a significant increase in cost for installing DC chargers, but this is something that needs to be addressed, otherwise AC chargers are installed and then just not used.

For long distance journeys, so on A Roads and Motorways then Rapid DC charging above 100kW should be installed. Again, often you can find 50kW DC chargers at MSA's (e.g. Ecotricity) which in reality only give 45kW at best and thus overall a slow charging experience for long journeys, e.g. taking 1 hour to charge. To come back to the car manufacturers, you again find them designing cars with only 50kW to 80kW DC charging capability – which again results in slow charging on long journeys. 100kW DC charging capability should be the minimum (and a repeated ability – on a long journey some cars gradually slow down / restrict their DC charging speed (Nissan Leaf) due to poor design).

Operators

I think some of the legacy Operators such as Polar, Charge Your Car, Source London, and Ecotricity are more problematical than some of the newer operators such as Instavolt and Ionity.

The newer Operators all seem to have contactless payment and competitive pricing (Ionity aside) with no need for RFID cards, memberships, Apps, etc.. Whereas the older operators do seem to want to be more restrictive and 'club' like where you have to join (and pay a subscription) in order to use their chargers, and appear to be slow in wanting to change.

Planning Permission

In terms of 'low level' hinderances, then I believe Planning Permission is one.

I do not have details, but am aware that Charging sites can require planning permission and Councils are not always willing to give it.

One example I am aware of was for a new Tesla charging site [X], that was declined planning permission by the local Council. This was to be situated at the [X].

I'm not saying the Council did anything wrong, other than that Planning Permission was refused and highlighting the need for this area to be looked at so that it doesn't become a bigger problem (you mention giving guidance to Government in your Invitation to Comment).

Monopoly on Motorway Service Areas (Ecotricity)

I understand Ecotricity have some form of Monopoly agreement with the MSA operators and so only they can install their chargers. This dates back a number of years I believe to when EV's were first launched, i.e. the Nissan Leaf in 2011/12.

This may have served a purpose at that time, but in my opinion it is now a hinderance and anti-competitive. In my experience Ecotricity provide a poor offering,

with only two chargers installed at MSA's. These chargers are very unreliable and Ecotricity are poor/slow at repairing them. They are therefore often out of service, and let EV drivers down. Anecdotally a lot of EV drivers avoid using them due to their unreliability – so again you get the downward spiral of them not being used.

Additionally, the Chargers are now out of date and slow. They are mostly only 50kW chargers and the type of Charger is not a very good model, so usually isn't capable of producing 50kW of output.

Ecotricity are always offering 'jam tomorrow', with better reliability, new chargers, and faster chargers – but it hasn't happened.

Notwithstanding all of the above, I don't think it is in the consumer's best interest for one operator to have such a monopoly.

As an aside, I know Tesla have managed to install some chargers at MSA's, but I believe this is the result of some sort of side-deal between Tesla and Ecotricity (presumably at some financial cost to Tesla), and they are the only other operator to have done so (and can only be used by Tesla cars).

DNO

I bring up DNO's as I believe they are a 'low level' hindrance (whether it's fair to blame them or not I don't know).

Often they currently limit domestic houses to one charger – due to supply infrastructure limitations. Thus if a family buy two EV's they can only charge one at a time. There doesn't seem to be a way to insist the DNO upgrades the infrastructure from a consumer's standpoint.

Single phase or 3 phase supply – I know a lot of Europe, e.g. Germany tend to have 3 phase supplies to domestic houses which we don't. Thus, a single phase supply can be restrictive, and it is cost prohibitive to upgrade to a 3 phase supply, as the DNO's charge large sums to do this.

As an aside, whether the UK electricity network (especially the 'last mile') will need wholesale upgrading to allow for removal of gas heating and gas cooking will need to be considered by the Government.

Ability for significant numbers / all houses in a street to be simultaneously charging EV's at once. Are local supplies / sub-stations / cabling capable in this regard.

I also understand it is difficult / expensive to get large power supplies installed for Rapid chargers, so Chargepoint Network Operators are often restricted to only installing 1 or 2 chargers. Hence the historic practice of only installing 1 or 2 chargers. This needs to change somehow going forwards.

There should perhaps be a requirement for DNO's to provide power supply as and when requested, to ensure the infrastructure is able to be rolled out.

Summary

Tesla have one of the best networks for rapid charging, where you just stop off and plug in (and is integrated into the car's navigation system and also show real time availability). Most importantly they are highly reliable (I've never found one not working). They are also high powered (150-250kW) so the car is charged in 20min (and not 1 Hour+ as would be the case at a 50kW charger) and they are installed in sufficient numbers (12 or more chargers per site). The car and charger communicate automatically, and your stored debit/credit card is simply debited for the cost. It is offered at a reasonable price of c.24p-29p per kWh.

The other Charger options for EV drivers are not so easy and the overall consumer experience does need significantly improving ahead of the huge roll-out of chargers

needed for 2030 and beyond. There was a recent article in The Guardian (28th November 2020 – Why did it take nine hours to go 130 miles in our new electric Porsche) that while slightly sensationalist, gives an idea of EV drivers' experiences today.

We really need to avoid endless subscription requirements across multiple operators, and poor reliability and service at extortionate costs; which is where it seems to be heading. I believe drivers should just be able to plug in and charge (I believe there is an industry standard that allows this, but it doesn't appear to be being developed). The charging network should also be integrated into the cars navigation system and with real time availability.

I firmly believe the staff involved in this study should have the use of EV's for period of time (6 months or more) and the opportunity to use and charge them; so this isn't simply a desktop exercise.

Individual Response Number 39

Response to Invitation to Comment on the Electric Vehicle (EV) Charging Market Study

1. Background

I am an existing EV owner (a Tesla Model 3) and am responding to your study from a consumer perspective. I have no affiliations or commercial ties to any EV related supplier or organisation.

I thought it would be useful for you to know:

- Why I bought the Tesla EV in the first place
- What my charging experience has been over 15 months and 19,000 miles
- What I say to other prospective EV owners when they ask my opinion as to whether they should buy one or not
- What, in my opinion, the CMA and other Government agencies such as OZEV can do to assist a successful transition to EVs. There's one "obvious" big thing that's easy to do – please read on.

2. Why did I get a Tesla Model 3 in the first place?

It's actually a company car [✂]. It was a bit of a no-brainer decision – although [✂] at the time of ordering I am a relatively early adopter of technology and had been fascinated by the Tesla story for some time. In addition, the car is good looking (in my opinion), had no extra company charge to me over and above a petrol or diesel executive sedan, was very likely going to attract a zero or very low Benefit-in-Kind tax (obviously very important), was going to cost much less to run (electricity vs petrol), was full of tech gadgets, was "green" etc. The unknown was the range on a full charge [✂] and the main worry was the ability to charge when I needed to.

3. What my charging experience has been

As you correctly point out in the consultation document, the chargepoint infrastructure is divided up into several different types – at home, at workplaces, along travel routes and so on. I shall only comment on those areas where I have some experience.

3.1 Off-Street Home Charging

As you point out, much EV charging is done at home and had I not had a garage I don't think I would have started on the EV adventure. Getting a charger installed last summer wasn't that easy. The house fuse box needed upgrading, cables needed laying, OLEV grant forms needed filling in etc etc. The first (supposedly "smart") 7kw charger failed and needed replacing. The second one has also needed on-site maintenance. The desired goal of trying to set up the car to use cheaper off-peak electricity has been, for me, been impossible even with substantial effort. I'm currently trying to try and figure out (again) how the combination of the Octopus Energy EV Tariff (cheaper at night but more expensive than normal at other times, my "smart charger", smart meters and the Tesla scheduled charging facility work together. It's not the biggest problem in the world as I am maybe spending £20-25 a week extra on electricity for EV charging compared to maybe £75 per week on petrol previously. I think I pay 15p per kw at home which is much less expensive than any commercial network.

3.2 The Tesla SuperCharger Network

You are probably familiar with this network and it works very well indeed if there is one on the route you are travelling. It works just great – they are fast (150kw) or very fast (250kw), reliable, inexpensive (26p per kw) and you are automatically charged to the debit/credit card associated with your car. The charger recognises your car and there is

no need for RFID cards or anything like that. My longer weekly trip [✂] can often require more than “one tank of gas” (especially in cold weather) and depending on the route taken I have two Tesla SuperCharger options where you can stop for a quick top-up and grab a coffee. It’s a utility just like all EV charging should be. There aren’t enough of them of course and I have other occasional trips where there are no SuperChargers but the network is expanding.

3.3 Other Charging Locations

Its when you have to go outside of home charging and the Tesla network that the problems begin and boy, are there problems. Any journey outside my normal routes involves careful planning, a dose of good luck and some severe range anxiety. Luckily, Government agencies can fix half that problem at the stroke of a pen and you don’t have to wait until the end of the consultation to do so – just stop giving Government money to proprietary EV charging networks that require multiple RFID cards, apps, accounts etc and only give Government grants/loans/incentives etc to networks and installations that take standard contactless payments!!

Let me expand on this. Now and again, even with careful route planning, you have to have an alternative charging facility to either home or a Tesla SuperCharger. I’ve learnt to somewhat trust a couple of the networks that do take contactless payments with the best being Osprey (used to be called Engenie), Instavolt and Shell Recharge. You cannot however rely on just one option – EV charging points seem to be very unreliable (I don’t know why) and if there is only one station that can be in use of course. The majority of outlets are 50kw outlets and that is really pretty slow unless you need a coffee, buy a paper, go to the loo etc. On a trip earlier this year to [✂] I could never make it on one charge and a SuperCharger visit meant a 20-mile detour so I had to have options. It took literally a couple of hours on Zap-Map figuring out I’ll try this Instavolt first and if that doesn’t work I can try this Shell and will still have 20% charge etc. Luckily it all worked out but was pretty stressful. I have another trip next year to [✂] for a holiday and can definitely get there and back starting at 100% from home and using two Tesla SuperChargers. However, if I want to drive around whilst I am there, there’s only one contactless option within 30 miles. If that isn’t working I’ll have difficulties. It’s stressful already!

That brings me to my main bugbear and something you can largely fix at the stroke of a pen being the huge number of proprietary networks. I’ve had to try them on 3 occasions. Once (a PodPoint 7.5kw in a carpark [✂] was ok but only because I had plenty of time, it was a nice sunny day and I had a friend with me (also a Tesla owner) who had used it before. I had to download an app, create an account, register a debit card and then fund that account before using any power i.e. I put maybe £10 in there and then only used £6-7 worth of electricity so there’s still money sitting there. The second time was just awful – I was heading up the A1 [✂] and the Tesla said I would get home with only 2% battery so I stopped to try an Ionity fast charger. I knew it would be expensive (69p per kw for heavens sake) but only need a few kw. It needed a new app, a new registration, a new payment method etc and I’m standing there on a cold and rainy night trying to get this done but something went wrong. I was besides myself with frustration. I gave up after a while and drove up the rest of the way home on the motorway at 50mph and got home, very nervously, with that 2% left.

The last occasion I was wanting to use a new public EV charger was in my home town of [✂]. We had builders in so the garage was difficult to get into so I drove into town to use a new public EV charging place (4 stations) that the local newspaper has just announced – funded by £45,000 of central Government money and £18,000 of local Government money. You guessed – yet another proprietary network (Swarco – never

heard of them before) and it needed a new app/account/card etc. I wrote to OLEV (see attached email) and nearly 3 weeks later have not heard back from them.

It seems to make such obvious sense that I don't know why I'm telling you but if Government is to fund or subsidise hundreds of millions of pounds in improving the EV charging network, why are you encouraging the spread of multiple proprietary payment networks?? PLEASE – only fund or subsidise networks that take contactless card payments!

Lastly on this point, I have no problem at all if Shell or anyone wants to encourage a Frequent Flyer approach i.e. sign up to our app / get lots of junk emails but its 5p a kw cheaper, as long as I can not sign up to the app and just use contactless.

4. **What I say to other prospective EV owners**

If they can afford one and have long and/or unpredictable journeys then always get a Tesla. Only the Tesla SuperCharger network is fast, reliable and somewhat well spread. Otherwise you are potentially up for stories like this <https://carbuzz.com/news/130-mile-trip-in-a-porsche-taycan-took-nine-hours>. That's not an isolated story – another friend at work [✂] took it on holiday recently and had a similar experience.

The only exception to the Tesla rule is if you can charge at home and have entirely predictable short journeys and have use of another car for longer journeys.

5. **Other Thoughts**

1. It seems to me that the greatest need for additional EV charging infrastructure is en-route rather than at destinations. New dedicated EV charging “superstations” such as the one at Braintree <https://gridserve.com/braintree-overview/> are a great idea but its just going to take very long time for them to become commonplace. I don't know what's preventing a more rapid spread – suggest ask Gridserve.

2. I don't know why Shell and BP (who have recently installed a contactless payment option – hooray!) are rolling out EV so slowly or why other networks such as Esso don't seem to be doing anything at all. Shell have over 1,000 service stations in the UK and “hope to” have 200 EV charging points on their Recharge network by the end of 2021. Why only 1 in 5? Additionally, as best I know all the service stations that have Recharge only have 1 outlet compared to much higher numbers of petrol and diesel pumps. Why? Is it because they don't have sufficient power to the sites? Is it because they can't make as much money selling electricity as petrol or diesel? Is it because they are slow lumbering giants who, deep down, don't want the change from fossil fuels?

3. What I do know is that if every Shell, BP, Esso, Texaco etc service station had at least 1 EV charging point (and preferably 2 or 3) then my travel anxiety would substantially diminish. What would also be nice to see is if they advertised it by making an extra space on those big tall signs they have outside (the ones that say Unleaded 115p/L and Diesel 118p/L) such that you could see they had an EV charging point from a distance rather than rely on an app and see what the price was for using a contactless debit or credit card.

4. Your consultation uses (to me) the very confusing terminology of rapid/ultra rapid, fast and slow. What the heck is the difference between fast and rapid? I'd strongly suggest that you and all EV charging point suppliers move to show the actual charging speed i.e. 7kw, 43/50kw, 150kw etc. Even the otherwise pretty good ZapMap makes it difficult to choose what you want – try it yourself and say you have a Tesla Model 3 (Type 2 or CCS2) and want to find public charging points (not

private) that takes contactless (don't need an app) and that are 43/50kw minimum with faster ones shown in a different colour. Its not easy and I'm not sure if I trust it.

6. Summary

The Government is doing a good thing by committing to net zero emissions by 2050 and it has been a bold move to ban the sale of petrol and diesel cars from 2030. I am sure that you want to see rapid improvement in the EV charging network in the short term (preferably starting this year) rather than wait until the end of the period and hoping a miracle will happen in 2029. The steps to success are really not very complex:

1. There need to be more chargers

I don't have the facts at my disposal to know whether the roll-out can happen fast enough without Government grants or subsidies. Assuming those are needed, and probably at increased rates, then the key is to fund the right chargers and not the wrong ones. You know my views about Central and Local Government funding proprietary networks. You can improve the situation **now** – just announce that as from 1st February that no more grants will be made for any charging stations that are proprietary and do not take contactless debit/credit cards.

2. Chargers need to be in the right places

That is pretty self-evident. At home is the key place and that's obviously easier for people with garages. If I can charge at home then having chargers at local supermarkets, cinemas, restaurants and pubs etc isn't much use to me but its obviously different for people in different circumstances. My main need, and I'm guessing that's also true for most people, is to have charging on the road on the way to places. Having big installations like Tesla SuperChargers or more GridServe centres is great but its unlikely there'll ever be enough of them. Having one charger (or preferably two or three) in most or not all existing Shell / BP / Esso / Texaco etc service stations would be a he step forward.

3. The chargers have to be faster

There's definitely still a place for 7kw chargers i.e. at home or overnight parking on the street though my 75kw Tesla takes a good 12 hours to go from completely empty to completely full as it slows down considerably towards the end. That isn't usually an issue for me as my long trips are not on consecutive days.

43/50kw chargers (as per the majority of the Shell Recharge network) are ok but really just for topups as no-one wants to be sitting there for 1-2 hours. 150 kw chargers (and above) are obviously better.

4. It has to be easier to get new power laid on

I don't have a lot of experience at this apart from at home but when I have asked my workplace [✂] and two hotels [✂] about putting in EV chargers they all said that it was an issue. Firstly you have to know what the existing power to the site is, how much you need for normal purposes, and then, if you need more, my sense is that it is a long, difficult and expensive process to get extra power supplied and laid. I am guessing that this is the reason that many businesses have held back, including the service station chains.

5. It has to be an easy to use utility

This comes in several pieces. The first piece is obvious in that there need to be common connectors. Luckily there seems to be a strong move towards Type 2 and CCS2 and away from weird things like CHAdeMO to CCS – see <https://chargedevs.com/newswire/the-war-is-over-nissan-to-switch-from-chademo-to-ccs-in-us-and-europe/>. Please please don't fund any new weird connectors that only a

small minority of consumers can use. It would be even weirder than Government funding small proprietary networks with proprietary apps and payments.

Secondly, there needs to be an easy way to pay for charging. Lots of major stores and supermarket chains have their own credit card / shopping card / loyalty card but I have never been in one that didn't take a regular debit/credit card. EV charging needs to be the same.

Thirdly, the mystery needs to be taken away. Every EV charging station should have a sign above it or built into it that has a) the power output – 50kw, 150kw etc and b) the price per kw. Its amazing to me but this isn't the normal case.

6. The cost needs to be reasonable

This is not a particularly high priority issue for me as any EV charging (apart from the ridiculous Ionity network at 69p per kw) is way cheaper than using petrol or diesel. Home charging (always first preference) is 15p per kw, Tesla SuperChargers (always second preference) are 26p and then there is the rest. Shell Recharge is 39p, Osprey's cost is 36p per kw and InstaVolt's is 35p. The BP Pulse contactless options is 42p with a minimum charge of £1.50 and they take a pre-authorisation charge of £15 or £30 on 50kW or 150kW chargers respectively. I haven't used one yet as they only just moved to allow contactless but I would be very unlikely to use that much power and the various EV charging bulletin boards say that BP take a very long time to refund the unused portion of the charge.

If you can't charge at home or on a Tesla SuperCharger Home then I'm not really price driven though there is quite a difference between InstaVolt at 35p and BP at 42p. One is just thankful to find one (one that works) when needed. I generally look for either Osprey or InstaVolt as they usually come in pairs. Shell's advantage is that they can be easier to find and you more often find coffee/toilet facilities. If we ever get to the day when the Shell station has a big sign outside saying EV Chargers / 150kw / 39p a kw and the BP station a hundred yards down the road has a big sign saying 42p a kw then I would absolutely go to the Shell one, especially as I happen to know that BP will take a pre-authorisation of £30 and Shell take nothing. Also, please do not let BP put up their sign saying 27p per kw as that is only the per kw price if you also pay for a monthly subscription, regardless of use.

7. Lastly

I know some of this is complex and good solutions will take a while to devise and implement but some of it is simple. **Please stop wasting public money now on funding proprietary payment methods.**

[✂]

Individual Response Number 40

I comment as an EV driver:

- No account seems to be given for use by disabled drivers. EVs by their very nature can be driven with little adaption and can expect to be adopted early and used by the disabled and wheelchair users. Unlike petrol stations, most charge points are unstaffed, have kerbs and barrier posts and high to reach connectors which can be stiff to remove. The new motorway service area at [⌘] has located EV charging away from the services building thus requiring the disabled to have to move their vehicle during a visit to the service area. The operator cites that the location of the chargers is to prevent ICEing. That simply isn't good enough; though ICEing is a serious problem in supermarket car parks.
- Local Authorities have taken grants to provide EV charging but some are failing to maintain them so adding to the voice that EV rapid chargers are unreliable. They also locate some in places which after dark may be unsuitable for use by some women and the elderly. Lonely locations in unlit car parks.
- If private concerns have taken grants to provide charging then some means of preventing over-pricing needs to be in place. Yes the cost of installing some chargers will be significant but the cabling for provision of the power and ducting provision for growth should have a 20 year or longer write down. The cost of power is assumed to be around 10p per kWh consequently there is scope for profit once more than 200 kWh are dispensed on average each day at 20 per kWh (plus VAT). That would be approximately 4-5 hours use daily. Clusters of chargers are likely to be more profitable because the risk of breakdown and vandalism of all chargers at once is less likely. EV drivers need to be able to rely on getting a charge and not coming to a halt, consequently multi charger sites will be favoured.
- The Motorway facilities seem to be monopolised by Ecotricity whose chargers are now getting old and have reliability issues. Given that they have only provided the bare minimum of chargers there should be a penalty for failing to repair and have serviceable chargers available 24 hours a day, 7 days a week. I acknowledge that there are planning applications lodged for improvements at some MSAs but given that 10% of new vehicles are now EVs there is an urgent need to get many multiple chargers installed at all MSAs. Whilst the economics of providing 50 or more chargers is not there immediately there is no excuse for not planning for them and installing ductwork and draw ropes

whilst sites are prepared for more chargers. There is a need for an urgent appraisal of provision; in Scotland a strategic approach was taken to electrify routes, the A9 and tourist centres. England and Wales need a similar approach; the M4 west of [⌘] is dire at the moment.

- There is confusion over the ownership and payment system for chargers. With so many providers it should be simple to consolidate payment arrangements. Yes new machines are required to read credit cards but there seems to be a premium payable to some providers, e.g. BP Pulse for not using their app. Why should this be?
- Signage to chargers is inconsistent and poor. Early adopters take the trouble to plan journeys and locate chargers with plans for alternatives; lack of signage is an indication that there are very few chargers which in itself is not true. That will dissuade many people from buying EVs and quickly reducing CO2. Many more chargers on primary routes will be needed quickly.
- Another issue on pricing is that whilst currently the taxation of driving an EV is light that is not likely to remain the case. We have paid a premium for our cars to date in anticipation of lower running costs; It would be wrong for charging providers to gouge pricing which when including taxation (or road pricing) makes EV ownership and use more expensive than emitting CO2. This is certainly likely to be the case for those unable to install a charger at home.
- Is there real competition on pricing? Gridserve's new facility at Braintree charges 24p per kWh, this seems entirely reasonable, BP Pulse charges a significant premium for its ultra rapid chargers, yet in some locations that is the only choice (Diss) with 47p per kWh the price for casual credit card users against 27p for subscription users. Ionity charge 69p per kWh for non club members, that is those cars not manufactured by the group investing in the chargers. Whilst it is understandable that 'members' will not want to be waiting in a queue to use the ultra rapid chargers, 69p is way beyond an at cost price and therefore seems very excessive. If we want to encourage take up of EVs quickly then pricing needs to be more commensurate with the cost of power. In the future we should expect groups of chargers being used continuously and therefore the overheads to be much reduced and costs at 20p per kWh normal.
- Are cars with smaller batteries at a disadvantage when it comes to long journeys. The cost of large batteries and the weight of them makes it more reasonable to produce cars with smaller batteries. Drivers of

these cars are possibly being disadvantaged by the pricing at chargers. Whilst drivers will choose a car with a range that suits their normal driving habits we can assume that for some people they will be required to drive higher mileages to work or in the course of their work but can't afford the higher priced longer range cars; they should not suffer excessive pricing particularly as we need to encourage as many as possible to adopt BEVs.

Individual Response Number 41

Hi there

The business that I have serious concerns about is the market for Public Rapid Chargepoints for EV's at motorway services. This market is dominated by one supplier - Ecotricity. In fact, there are only a handful of motorway services that have any other charging provider.

Ecotricity has approximately 180 charging locations, almost all of which are at Motorway services. In reality, there is no competition for EV charging at motorway services across 90% of the motorways in the UK.

This has resulted in a complete distortion of the market for Motorway EV charging :-

1. The provision is completely inadequate and is not improving. Most new EV's now use the CCS connector standard. Many motorway services have no CCS connector available (just Chademo) and those that do, have only one CCS connector. EV's are rapidly gaining popularity (5.8% of the total cars registered in the UK in 2020) and the provision of one charge point at a motorway services will soon be akin to having one petrol pump for petrol cars. There are already often queues for the charge point and most EV users just avoid the motorway services - they divert off the motorway to find a charge point in a nearby town. The UK motorway charging network has barely changed in the four years that I have owned an EV! In contrast, the non-motorway charging network has changed dramatically in that period with many thousands of charge points installed by more than 20 operators.

2. Because there is no competition for Ecotricity the network is unreliable. In the last Zap-Map survey Ecotricity was categorised as one of the worst charge networks for reliability.

3. The Ecotricity chargers are now some of the oldest charging hardware in the UK. They can only charge at 50Kw whereas many of the newer charging networks have chargers that can manage 100Kw or more. This age contributes to the lack of reliability but the lower power also increases the charge time and therefore the journey time for EV's.

4. Price - whilst Ecotricity aren't the most expensive charging network they are still expensive at 30pence per KwH. Many other networks are cheaper.

This issue is in my opinion the key factor (aside from the price of an EV itself) which is holding back the EV market in the UK. EV's can only be used for long distance travel if the charging network is fit for purpose, which currently it clearly isn't. I have written to [✂] making similar points but received a cursory reply, effectively saying they were doing very well and had a clear vision for the future.....

I have no idea why Ecotricity has a stranglehold on this market but I suspect there are contracts and legal issues involved. However, this is clearly anti-competitive and needs to be changed rapidly, not only to improve our chances of meeting the government 2030 ICE ban but also to prevent our children dying from NOx poisoning - as evidenced in today's news headlines.

Individual Response Number 42

For Attention of :- Dr.Andrea Coscelli, Chief Executive Officer, Competition and Marketing Authority

Dear Dr. Coscelli,

Please forgive me for contacting you through this address - i didn't know how else to reach you.

Your were quoted in a Daily Telegraph article today written by Mike Wright and entitled 'Charging Electric cars must be easier to realise Britain's green ambitions'. I thought you may be interested in an idea that I have related to this subject.

[✂]

What I propose is that EVs are built with removable battery containers which I have called 'Battery Trays', These trays are designed to an internationally agreed specification and are loaded with EV industry standard specification batteries. The size of the Battery Tray would be common to all vehicles and the number carried by an EV would depend on the size of the vehicle. Commercial vehicles would probably have multiple, stacked trays.

There are vast numbers of filling stations around the UK and around the world. These can be recommissioned as 'Charging Stations'. These stations will be equipped with multiple battery chargers and a supply of loaded and fully charged battery trays. The Charging Stations will be fitted with 'bays' which contain equipment capable of automatically removing a depleted battery tray and installing a charged one. The whole process could be completed in a shorter time than a current liquid fuel replenishment. The driver does not need to leave the vehicle and payment can be made via a contactless system within reach of the vehicles driver or by an app on a smartphone. This system will particularly benefit elderly and handicapped drivers. The vehicle would not be released from the 'bay' until payment is made. This will help prevent theft. EVs fitted with the Battery Tray system will stile able to use current charging points if unable to get to a charging station.

Current filling stations often have large canopies over the forecourt which can be fitted with solar panels. This has just been undertaken at a site in Braintree, Essex. Also, where possible, a co-located wind turbine could be installed. The Charging station would use off-peak electricity at night to charge the depleted battery trays. This system would be significant source of *energy storage*. Thousands of charging stations with many thousands of battery trays would be a huge store of energy which would relieve the load on the National Grid during daylight hours.

In an ideal world, the oil companies (who will be loosing a vast amount of income) could be involved with the supply of batteries. They already have an investment in many of the filling station sites.

Whilst I accept that there are significant technical hurdles to overcome to embrace this system, I believe that overall it will be no more expensive or disruptive than the current rather chaotic plan of installing slow charging facilities at random places around the country.

Thank you for reading this far Doctor [✂]

7. The future of battery swapping: will there be another Better Place?

Though Better Place failed due to a mix of overstretch, over-investment in battery swapping technology, general mismanagement, and a misunderstanding of its first two core markets, there are several reasons that battery swapping may still be in the future of electric vehicles. Tesla has recently investigated battery swapping technology (but putting off large-scale development until interest develops) (Korosec, 2015), and battery swapping remains the only way to recharge an EV to a similar rates to traditional gasoline vehicles. One major driver that may lead to the future development of battery swapping stations is the drastic historical and projected future decreases to battery costs (DOE, 2014). Since Better Place was in operation, battery prices per kWh capacity have dropped by about half, and are projected to drop by another half in the coming years. This would have greatly reduced the cost of having extra batteries stored in the swapping station network. At the same time, the development of vehicle-to-grid (V2G) technology could have also presented another use for the batteries in the swapping stations (Battistelli and Conejo, 2014). Both of these would have reduced the operational cost of the charging and battery swapping network, and this financial stability may have

allowed Better Place more time to get Israelis and Danes to adopt EVs.

On the other hand, there are several reasons that battery swapping may already be obsolete. Because batteries are becoming cheaper, combined with future technology developments increasing capacity (DOE, 2014), the future electric vehicle will likely have a range of 200–300 miles, greatly reducing the times where charging outside of the home or work is even necessary (Zhang et al., 2015). Second, the average charger will continue to increase in capacity, becoming more efficient and has become less costly, thereby reducing recharging time, and decreasing the marginal benefits of battery swapping (Yilmaz and Krein, 2013; Burger and Reichert, 2011; Korosec, 2015). Finally, large-scale implementation of battery swapping would likely require standardization across car manufacturers, but car companies would have limited incentive to all agree to a single standard (Budde Christensen et al., 2012). Thus, the future of battery swapping is at a critical juncture, where it could become obsolete or relegated to a niche role in the EV infrastructure system.

As an addendum to my email to you and the attached document, and for your information, I would like to add the following:-

Since writing my document on this matter and my email to you, I have undertaken more research and discovered that a company called 'Better Place' was launched in Israel in 2007. This company invested a huge

amount of money in a project that tailored production EVs and fitted removable battery trays that could be swapped at charging stations owned by the company. Better Place also owned the batteries and leased them to the Better Place EV owners. The company failed, basically because it was conceived at the wrong time and in the wrong place. Better Place tried to expand too rapidly (initially into Denmark) before the Battery Swap concept was a proven technology. Also, the company did not risk share with other parties involved in the EV general scenario. To make their business model profitable, Better Place had to charge their customers unrealistic lease fees for the batteries and effectively priced their concept out of the market. Poor management and planning contributed to their demise. I have attached an extract from a paper entitled:- 'Why Did Better Place Fail? : Range anxiety, interpretive flexibility, and electric vehicle promotion in Denmark and Israel'. This extract summarises these failures and looks to the future of the battery swap concept.

Also, there is a Chinese company called 'NIO' which is currently mimicking the Better Place technology. Whilst it looks very impressive, NIO appears to be making the same mistakes as Better Place made. They are building their own upmarket SUVs, and they own the battery trays and charging stations associated with these vehicles. NIO is about to introduce it's third model in the range. They appear to have an extensive spread of charging stations around the more prosperous regions of South Western China. Bearing in mind where this is happening, the business risks may not be the same as in western countries.

The actual battery swapping technology adopted by both of these companies is very sophisticated and, in my opinion, unnecessarily complicated. I am sure a side loading, slide-out, slide-in system would be more straightforward and a cheaper infrastructure installation in current filling stations. Also, my proposition is to risk share the concept with those businesses associated with the EV project (eg. vehicle and battery manufacturers, oil companies, utility companies and others). My document expands on these issues.

For your interest, I am providing you with the following links to sites that showing promotion videos for both the Better Place and NIO:-

Better Place Demonstration:-

<https://www.youtube.com/watch?v=qd0WPw3p2MQ>

NIO Video (provided by the 'Fully Charged' TV station):-

<https://www.youtube.com/watch?v=hTsrDpsYHrw>

I hope you will find this interesting .

Thank you again and I hope something positive will become of this.

Individual Response Number 43

Dear CMA,

I am providing my views as an interested individual/consumer with experience of the charging network as an existing electric vehicle owner. I would like my views to be anonymised in any published material.

For context I own a flat with access to off-road parking but do not have home charging. The relative location of meters, parking and shared footways means that installation of home charging is not economically viable and would impact on neighbouring properties. Many of the properties in my area are in a similar situation. I have driven a Renault [✂] for the past year and have noticed changes and new challenges as a result of COVID restrictions. I am changing my EV earlier than planned as a result of these challenges and technological developments.

Responses to key questions in order

Theme one: developing competition while incentivising investment

1. The past year has already seen a shift in technology that is changing the charging provision. Previously provision provided for fast AC, Chademo and CCS. CCS has become the dominant standard in Europe with faster charging speeds possible. Only 2 manufactures are still using Chademo in the UK, however, Chademo and AC are the only rapid connector available at the motorway services on my most frequent journeys. I recently met a new EV owner (uber driver) that had stopped at the services expecting to be able to get a rapid charge. As this was the only charger and the charge had timed out, the only charger was blocked from further use. I was able to suggest a nearby charger off the motorway network that would suit his vehicle better, but this experience will deter transition.

Fewer Fast AC chargers are available as a result of COVID removing access to some existing installations and newer installations not providing connectors for AC.

2. I am not aware of any competition between different providers. I chose a charger provider on what is available more than any other factor. For competition you need a choice which currently there isn't with chargers spaced so far apart.

3. –

4. –

5) Provision needs to be made for multiple vehicles charging. Tesla charges allow 2 cars to charge at the same time. Most Rapid chargers from other networks only allow 1 car to charge. 1 charger per services is not going to be enough as demand increases.

Gridserve has the right idea with multiple charging bays available for all connectors currently is use. In residential areas provision is needed for households unable to charge at home. This currently an area for Local authorities to improve, my local authority is only adding chargers to sites it owns and none in my home area.

8) Those without home charging need a communal area where overnight charging is possible within a reasonable distance. When I

visit family I can use a charger at a local carpark. Except there is only 1 unit and if it fails, it can be days before it is operational again. Any provision needs to be reliable and at a cost comparable to home charging tariffs to encourage switching from fossil fuels.

Theme two: effective consumer interaction with the sector

1. Barriers and challenges that I have experienced are the lack of reliable charge connectors. Currently it appears that anyone can advertise a charger as available for public use but there is no requirement to maintain the unit or ensure that it is available as described. Where local authorities have not provided provision, the network is reliant on local businesses and hospitality. Due to COVID many businesses have closed or removed access to the chargers on their premises, even when these are managed and operated under a national brand. How do you expect drivers to transition to EV if all they see are chargers turned off or behind locked gates. This is in addition to the lack of provision at motorway services already mentioned. It is not uncommon for EV drivers to leave the motorway for a charge rather than trust that the motorway services will have provision.

Reviews and social media often say the network is fine or assume that all charging will be done at home because the early adopters had home charging capability. For others without this luxury this gives a skewed impression or suggests that you have to have home charging in order to own an EV.

2. As mentioned under point 8 above, a charger can cease functioning but remain as available on charger maps. This winter I have had to contact three different networks about a charger that I needed to use to get home. On the first occasion the charger was available but had stopped being shown on their app. Without the app the charger couldn't be used and the support team couldn't find a solution remotely. Other times a fault had been reported that needed a site visit and would be out of action for a few days until resolved. I can't imagine a petrol station closing for a few days due to an app not functioning. These issues occur when the network has a low level of use, as demand grows these issues will occur more frequently.

3. I chose a network based on cost and convenience. I have some local chargers that charge 30p per Kw plus a connection fee, I do not use them, I drive across town to use those that charge 15p or 20p per Kw and are in more pleasant locations. I used to shop at Sainsburys, they do not have chargers and are still actively subsidising fossil fuel use.. I now shop at Tesco because I can charge while I shop. I have ended up with a lot of apps on my phone for different networks, I chose Polar for the convenience of an RFID card without needing to mess about with an app or have signal anxiety.

4. -

5. I expect that anyone that doesn't have a smart phone will have great difficulty using the charging network. For some reason the transition to EV has made manufactures and charging networks believe that key features and charging should only be accessed via a smart phone app with different services available depending on if you use apple or android. This wasn't a requirement of fossil-fuels and will be a barrier to some.

As indicated above I used to have a Renault [🚗] that charged at 22kw AC maximum, due to a loss of charging provision in my area and newer installations

not even providing for AC, I decided to change my EV before the situation worsened. For those with home charging the [🔌] remains very popular. I hope this helps demonstrate the difference in experience between those with home charging and those reliant on the public network.

Thank you for taking the time to consider my comments

Individual Response Number 44

I have owned an electric car for (BMW i3 Rex) for a year. Up until recently I used it on [X], going [X] and [X]. I am pro electric, but worry that the "average motorist", used to the convenience of petrol/diesel, will not tolerate the existing charging network. These are my thoughts

- 1) The ecotricity network is unreliable, they have old charging units, the app doesn't always work or unlock the charge. Their presence in the UK service station network is too great. I have met numerous drivers unable to get a charge. I have a rex so I could move on to try and find another unit elsewhere, down the motorway, or often leave the motorway. The units don't accept credit cards and the charging time, before the unit shuts down is too short to charge the car fully, which is important for long [X] trips.
- 2) The Polar (BP Pulse) network has been much more reliable, but further charging points are required. The monthly fee is too high if only using occasionally. The new Pulse app does not work well, and it unclear how to have a "pay as you go" arrangement. It is clear BP don't want that arrangement, and want the subscription profit
- 3) More charging points are required in supermarkets, mcdonalds etc, to give the business traveller many more options
- 4) All chargers should allow contactless payment, to allow pay as you go, as well as a membership option.
- 5) The government should reverse the decision on the rex, so people can have a backup propulsion system to prevent breakdowns. Given the cost and size of the fuel tank, no right minded driver would abuse this option, in front of cheap electricity.
- 6) Government needs to provide grants to old peoples sheltered housing, new housing developments to provide adequate charging point for people without their own drive. The networks in hotels need expanding considerably

Individual Response Number 45

Box 1: Our themes and key questions

Theme one: developing competition while incentivising investment

1. How is the EV charging sector developing and how will technological or other developments (for example smart technologies) impact sector development and competition?

This is not a complaint, but almost all the “smart” developments assisting EV usage seem to be commercial Apps etc.

2. How well is competition between EV charging providers working at present in the different sector segments and what are the key risks to effective competition (including any emerging competition concerns)?

As an EV user based in Scotland [✕] most of the chargepoints are operated by ChargePlace Scotland. These are poorly maintained and, in many instances, seem to be old equipment with poor software. As such, and with painful experience, they cannot be relied upon which minimises operating an EV as the first option. I surmise that commercial providers do not see an attractive enough proposition yet to invest in a wider network, which is to be regretted as their equipment is far superior in most cases, and can be relied upon, albeit with a financial charge.

3. How can competition in the different sector segments be strengthened as the sector develops, either by building on current policies and/or through other approaches?

I suspect that the “monopoly” type impression here in Scotland with ChargePlace, is off-putting to competitors, but I have no proof of this.

4. What are the main existing and potential barriers to entry and expansion for EV charging providers and how can these be addressed? As above.

5. How can chargepoints be effectively deployed to ensure there is sufficient supply to meet future demand? What factors need to be taken into account?

Providing an accurate and up to date mechanism for EV users to see that a charging point is working, available and what charges apply would be useful. I personally use many apps but it remains a fact that it really is “pot luck” as to whether you are going to be supplied a charge. Travel, and more importantly, sustainable travel depends on being able to tap into an ample, operating and reliable method of receiving a charge whilst travelling.

6. What incentives are there for private investment in EV charging infrastructure including within the different sector segments? How might incentives need to change for the future growth of the sector and development of competition?

Providers must be asked to demonstrate that they have actually done their best to ensure that a charging point is working. If there is a reported malfunction, there should be a reasonable SLA for them to return it to full operational status.

7. What impact does public subsidy have on private investment incentives; are there any areas/gaps where public support is most likely to be needed?

Other than the loan to buy the car which I found useful, I’m not really in a position to say.

8. What is required in order to ensure that rural / remote communities and those without off-street parking are well served by charging infrastructure? T

here needs to be some investigation of how to instal charging points from existing electrical power assets, such as lampposts, street signs etc. I do appreciate that the hardware and software enhancements would need to be significant, but a more ample, accessible, and convenient supply source needs to be made available. In

some cases, I would even have welcomed access to a publicly positioned 240v 3 pin supply to gain a “granny” charge.

9. What role should local authorities play to help deliver EV charging in a way that promotes competition? What support would they need?

I’m not suitably qualified to answer this, but I do suspect some form of out-sourcing would need to be agreed. Currently, it is my view that the 9-5 weekday approach of a local authority to ensuring that Central Government dictates are actioned in as “efficient” way possible, is not conducive to ensuring the average EV driver’s requirements being best served. Although, when I do get the opportunity to speak to the Local Authority individuals, they do normally seem to be enthusiastic about sustainable travel etc, but frustrated by government dictats.

10. What can be learned from the different policy approaches taken in the devolved administrations for the EV charging market’s development?

I’m not sure I can answer this question.

Theme two: effective consumer interaction with the sector

1. What challenges or difficulties related to chargepoints might act as a barrier to consumers switching from a conventionally fuelled passenger vehicle to an EV and how might these be overcome?

As an EV driver I am often challenged, even at charging points, by ICE drivers who cannot see how the demand requirements for the EV transition can EVER be met with the current infrastructure, and indeed I am often told that we would need 20 times more charging points. Having made the switch by choice, I see that there are actual barriers to travelling by EV, but I want to make it work. It appears those who feel that they are being forced to make the change, are not so ready to accept the current status or anything like it!

2. What are the key challenges for consumers already interacting with the sector and how might these change over time as the sector grows?

The main issue is range! Having a home charging point is great for travelling around and about, but when I need to travel to a destination, the key factor is how will I achieve that. Planning is essential. Reliability in the infrastructure actually working is also essential. Until we all have cars with 350+ mile capacity, we will need to be able to take in a charge whilst in transit. The fact that it takes some time to take on that charge is secondary, we expect that. But to have to reroute to find another charger, which may also be inoperative, is unacceptable. Currently, user demand at chargers isn’t too much of an issue but as numbers of EV driver increase, so the capacity issue will heighten.

3. How do consumers decide which chargepoint services and providers to use?

What information do consumers need to make this decision and at what stage in the decision-making process?

Again, due to the scheme in Scotland, we are pointed to the use of ChargePlace Scotland sites, and there is very little alternative. For my home charge point, I simply asked my current electricity supplier for their recommendation, as I also have PV cells and feed into the FIT

4. Can consumers easily understand and compare charging tariffs in this sector and what barriers, if any, do they face?

Yes, after a short while you soon get to know what a reasonable rate is and what is not. But with reference to my previous point, I don’t mind paying a

comparatively high rate such as 35p/KwH if I know that I will definitely be successful in getting a fast, reliable charge.

5. Do particular groups of consumers face additional challenges to interacting with the sector and if so, who and why? How might these be overcome?

I don't know as I have no point of reference for an alternative. Being in rural Scotland does have disadvantages purely with the distance between towns, particularly if the required charger isn't operating. But I'm sure city dwellers also have different concerns.

6. Are there any technological developments or tools that could support consumers to navigate the sector, for example by helping to make more informed choices?

Yes, as I said earlier, the main thrust for development seems to come from commercial providers. It would be good to see the government(s) or their agencies being far more proactive. I think Education and Awareness are critical; better information exchanges between providers, governments, and local authorities, individual EV users, car manufacturers and technology businesses to make information easier and more reliable, without commercial or political "spin". True real-life expectations of range from manufacturers and improved capacity and maintenance of the charger infrastructure are essential.

7. Are existing protections offered by consumer law and other measures (such as sector regulations) sufficient?

I'm not sure what protections actually assist EV drivers? Benefits such as zero rate road tax are appreciated, but I'm not sure what is meant by protection.

8. What, if any, open data measures are needed to support consumer interaction, such as through the growth of comparison sites and apps?

Comparison sites for charge point providers might be useful and clearer advertising measurement comparisons from manufacturers. But from governments, we need to see action to support the political rhetoric and we need to see some accountability from government and local authority level, rather than just being blinded by stats that describe how much better things will be.

9. What else is required to help ensure that the EV charging sector develops in a way that is responsive to consumer needs?

More thought about the driver experience. In Scotland if I am making a 200 mile journey, I need to factor in not only the travel time but also the stationary time whilst charging. So often, the charger is in a municipal car park with absolutely no facilities and quite some distance from any amenities.

Also, can government agencies such as transport, energy efficiency, business support and tourism please improve the conversation levels between themselves. Why advertise and support travel/itinerary holiday routes such as the North Coast 500 etc. with such poor level of operational support for an EV driver to undertake this with confidence and comfort.

Individual Response Number 46

Hi,

As a 5 year EV driver on his [🔪] EV I would just like to say a few words about en-route charging.

1. They should be in multiples. Single chargers will soon be overwhelmed and liable to outages due to break downs. (One charger broken = no charge for anyone).
2. Attention should be paid to where they are located. Some dingy, unlit gravel car park is no place for a charger. It's open to all sorts of skulduggery. Well lit locations with plenty of facilities are needed. Not only from the point of lone female drivers, but for the older driver, [🔪] who paces charging with other physical needs. It's also more pleasant to have somewhere to sit with a meal and a drink whilst the car is charging. We try to time a charge to fit in with a meal break.
3. Signage. One problem, at the moment, can be the difficulty actually finding the charger. You can be a few hundred yards from a charger and still not be able to see it. On the road and in car parks. Next time you are on an MSA car park play find the charger. It's something we quite often play.
4. Ecotricity. Whilst they were stalwart leaders in the advance of Electric driving. Since around 2017/18 they have taken their eye of the ball and become a drag on the uptake of EV. Due to their monopoly of MSA no-one can place (save Tesla in certain MSA) their chargers along the motorway network. Ecotricity have either to be forced to improve thier charging network (which they have (falsely) promising to do ever since 2017/18) or the monopoly needs to be taken from them to allow others to create the motorway charging network this country needs and deserves. We must be the laughing stock of Europe it is in such a poor state.

Individual Response Number 47

I am now retired but have served as [REDACTED]

My interest is that my working life involved [REDACTED]

My comments are in response to paras 3,4 (consider I represent a “consumer group”), 11,12,13b,17 and 38, and address box 1 cl 5, and box 2 cl 1 and 5. They are a comment on safety, and I note the only reference to safety in the document is to electrical safety in footnote 14 on p6.

Much work was done in these committees I mention on slip resistance of floor coverings, and the industry was very aware of its responsibilities. The consequence of a slip or a trip is very similar for the victim, and accident statistics do not discriminate between the causes. In a TV interview last night an NHS spokesman drew attention to icy winter conditions, with slip accidents creating an increased load on the NHS, which gives an added emphasis to my comments. My first attachment is often seen in press coverage on street charging points, where a very casual approach is taken to a loose cable which could trip any pedestrian passing. Compare this to the care we see with wet floor cones in public toilets (often on dry floors) and in supermarkets. Similarly, when offices are cleaned, the cleaners regularly alert staff to loose cables around their equipment.

My concern is with charging points at the kerbside – any pedestrian crossing the road will primarily be looking out for traffic, and will not expect a hazard from the cable of a car being charged. A dedicated charging point in a car park will only be accessed by the driver of the vehicle, who will be aware of the hazard and able to avoid it.

There has already been a fatality from a trip accident – a Maida Vale resident tripped over her charging cable, broke her hip, and died from complications arising from her operation. The casual attitudes shown in the illustration will result in accidents and reduce the public acceptability of street-charging – if the technology is to gain full acceptance, it will need to be done safely, and safe procedures will need to be introduced now, before on-street charging becomes widespread.

My other attachment is a comment to the proceedings of a Westminster Forum seminar on air quality at the [REDACTED] on 21.5.19. which expands on my points above.

Clause 9 refers to the ban on the sale of petrol and diesel cars by 2030. The introduction of diesel cars was done on environmental grounds, and was highly promoted and encouraged by Government at the time, but has now been reconsidered, leaving diesel car owners aggrieved.

An obvious consequence of the introduction of electric vehicles is the loss of tax from petrol and diesel fuels, which will need to be replaced from elsewhere. Whatever economic benefits there are from electric transport will be short-lived, as Government will seek to replace these fossil fuel revenues from other forms of transport. It would be wise not to promote the “economy” of electric transport, as it will only lead to electric car owners feeling as aggrieved in the future as diesel owners do now.

Thank you for the opportunity to comment,

Westminster Forum seminar on Air Quality, 21.5.2019

[X]. The seminar accepted that charging is a necessary part of a move to electric vehicles.

[X]. Some London boroughs have kerbside charging points, and it is common to see them illustrated in the press with considerable lengths of loose charging cable. There has been a fatality when the owner of an electric car tripped over her charging lead, at her home, broke her hip, required an operation and died as a result of complications.

Outside the toilet at the [X] there were a number of “wet floor” cones, and it is common to see these used to alert people to wet conditions, to avoid slip accidents.



Accident statistics combine slips, trips and falls – the consequence of slips and trips is a fall, and the injury resulting is much the same, however it is caused. The HSE advise that slips, trips and falls are the most common cause of injury to employees, causing the loss of 2 million working days each year, and represent a major financial burden to business. The possibility of slip accidents is guarded against zealously, as the ROL's cones show, but the possibility of tripping, which can have the same consequences for the victim is overlooked completely.

Any realistic risk assessment would identify the possibility of tripping from loose charging cables and take action to minimise it. Without this precautionary approach there is every possibility of accidents. This will prejudice the acceptability of electric vehicles, and the aspirations for improved air quality that they represent.

[✂]

Individual Response Number 48

- Current/past cars:
[✂]
- Home charging set up: Great!
 - 7kw
 - Octopus Agile (low overnight rates - sometimes we get paid to charge!)
- Non-motorway public chargers: Improving
 - BP and other major 'gas stations' helping to expand the options
 - I agree with <https://www.autoexpress.co.uk/news/352089/best-chargepoint-providers-2020> that (apart from Tesla), Instavolt provide the best model and service for charging
- Motorway: Bad
 - For most EV users, they'll charge at home (like myself) and rely on motorway charging for longer journeys.
 - This is where Ecotricity lets everyone down with unreliable, tricky-to-use and small numbers of chargers at each service stop. Really poor.
 - A range of suppliers competing at each service station would be great. Is there a commercial reason why Ecotricity dominate this area of the market
 - For anyone needing very frequent motorway charging, I'd say it's got to be a Tesla choice.
- Generally - for public chargers
 - Hard to tell if unit being used before you aim for one. Zapmap, Open Charge, Google, etc. helps at bit.
 - Cars parked (blocking) or elec cars left parked after charging.
 - Far too many ways of paying for and operating the chargers (I have around 6 supplier registrations / phone apps). I understand that this may be changing <https://www.gov.uk/government/news/all-new-rapid-chargepoints-should-offer-card-payment-by-2020>. But will this bring a premium in pricing?
 - No evidence during/after use what the average charge rate (kw) was for a visit - yet I have to pay a premium for the fast-chargers (eg. BP Chargemaster <https://bpchargemaster.com/ultracharge-150/>)
 - I'd rather pay a competitive and reasonable rate using 'touch' card payments, and drop the registration/monthly process. (The latter may be useful for folks with no home charging option?).

Hope that helps. Happy to talk through if required.