



Paua CMA response

5th January 2021

Paua Tech Limited (Paua) is pleased to provide the following information to the CMA to support their market study into the electric vehicle charging market.

Paua is a small innovative business providing public electric vehicle charging services to fleets by addressing the public charging interoperability question. Paua's solutions are based on a full digital interface between the driver and the chargepoint enabling drivers to find, charge and pay for electric vehicle charging. Our solutions seek to enable drivers to know whether the chargepoints are broken or occupied before arriving, to filter them to the car drivers vehicle and to enable access via digital authentication and charging and receipts through software integrations with the UK's leading chargepoint operators.

We have won financing from UKRI to better understand the challenges that both fleets and CPO's see in the public charging market and the following responses include anonymised material gathered from these engagements.

We are responding to the CMA to highlight three areas that we believe need to be taken into consideration.

1. The market for electric vehicle charging infrastructure is very nascent. Only around 1% of drivers drive cars with a plug on them and less than this drive pure battery electric vehicles. The introduction of too much legislation and change early in any market penalises early movers and reduces innovation.
2. Innovation is supported by the provision of open and standardised data. Government has started this work for public charging infrastructure with the National Chargepoint Registry providing data on public charging locations and data on charger type, and price. However this is woefully inadequate and underutilised. Government needs to do more to support open data resources such as this to enable a vibrant ecosystem that works in favour of the consumer.
3. Government subsidies provide a useful stimulus to early markets, but consideration always needs to be given as to how to ween the market off these subsidies. It is likely with EV charging infrastructure that ongoing support will be required to some geographic locations to ensure an even coverage of charging infrastructure and ensure social equity for EV charging infrastructure. This is a tricky balance to achieve but one that Government should start to consider now to avoid market distortion with poorly focused subsidies.

In the response below slow charging is that of 5kW or less, fast charging is 7kW – 22kW and rapid charging is 50kW or greater. Most of our responses pertain to the market area that we are focusing on; public EV charging.

Paua would be delighted to follow up on any of these points.

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?*
 - The public charging sector is expanding to continue to meet demand. Much of the investment made to date has been anticipatory of future use through the growth of EV drivers.
 - However, it should be noted that the present isn't always a good indicator of the future and there is a risk (as with all infrastructure investment) that there will be some stranded assets.
 - Most chargepoints being developed now in the public domain are connected devices (i.e. they have either full control or an element of control via some form of internet connectivity).
 - There remain some legacy devices in the field, mainly operated by the early pioneers, that do not have any smart capability and where the supply of electricity is free from legacy Government funding programmes.
 - With most chargers being connected, many (if not all) new electric cars being connected and most drivers owning smart phones there is a real opportunity to improve the customer engagement with the public charging landscape.
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)?*
 - There remains strong competition within the public charging sector albeit distorted by Government funding on occasion.
 - The deployment of public charging points is based on a series of considerations by the investor.
 - These include (but are not limited to) the quantum of anticipated use of the chargepoint by passing drivers (x), the ease and cost of connection to the electricity network, the ability to engage a landowner to become the host of the chargepoint all developing a view on the cost of the deployment of a chargepoint in a given location.
 - A drivers decision to use a chargepoint at a given location will include price to charge (usually p/kWh), charger speed, local amenities (what will they do whilst charging), safety, how far from their route the location is, hidden fee's (eg parking charges) and importantly whether they believe the chargepoint to be available to them when they arrive (i.e. not broken or occupied) amongst other things.
 - It is important for the reader to note that the deployment of a single electric vehicle chargepoint (particularly rapid chargers) naturally impacts the attractiveness of the surrounding area with regard the deployment of a second chargepoint as it naturally reduces the number of drivers utilising that chargepoint (users now $\sim x/2$).
 - Considering all of the above there is naturally an element of "land grab" going on currently with premium locations being identified and developed rapidly. Most of this is to the benefit of the driver.
 - Therefore, whilst two closely located chargers from different network providers will impact on each other there remains competition particularly where a new developer can make a charger more attractive through price or amenities.

- It is important to note that the competitive dynamic outlined above is distorted by the deployment of Government funding toward electric vehicle chargers.
 - A simple case study is to review the number of privately deployed rapid chargers in Scotland relative to those deployed by Scottish Government funding. This illustrates the distortion in this market driven by this approach and by the free charging the Scottish Government offers making it challenging for a private company to deploy capital in a sensible manner. This dynamic will start to change if Scottish Government chargers start requiring a market payment rate for their use.
 - A similar effect can be seen with money deployed into rapid taxi chargers although this is more subtle. A similar effect is anticipated with the on-street residential charging scheme (ORC's)
 - And this effect is likely to be occurring through the utilisation of the Charging Infrastructure Investment Fund (CIIF). Whilst it may be argued that the money is deployed on commercial terms it is quite clear that the cost of capital is reduced and the quantum of capital to be deployed is significant enabling a more aggressive approach to be taken to risk in the sector thereby influencing the deployment strategy of the fund managers and inadvertently distorting the charging market.
 - However public electric vehicle charging is likely to become a social good. As such there will be a clear need for Government intervention where the infrastructure may not otherwise be deployed to ensure social equity and a good coverage for public EV charging.
 - For example the deployment of rapid charging infrastructure in the highlands and islands or mid Wales is likely to require ongoing support. A quick review of sources shows that there are no rapid chargers in mid-Wales currently as there is no support but that there are chargers across less populated areas in Scotland due to the Scottish Government support.
 - Further on-street slow and fast charging is a challenging business case (laid out in the appendices of additional information). There is a higher relative cost of capital required relative to the revenue earning potential. This makes the return on investment more challenging. Innovative companies such as Ubitricity and Char.gy have done a lot to reduce capital costs but this solution is limited to locations with the right infrastructure. More may be required to electrify council car parks and roadsides without appropriate street-light infrastructure.
 - Government (led by OZEV) will have the complex task of establishing how to wean this emergent market space off subsidies in such a way that it minimises market distortion but also continues to provide infrastructure where there remains a determined need.
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?*
- Please note the responses to question 2 particularly with regard distortion caused by Government subsidies.
4. *What are the main existing and potential barriers to entry and expansion for EV charging providers and how can these be addressed?*
- A number of points were raised in question 2 above focused on public EV charging.

- The main barrier to entry for capital tends to be a combination of risk appetite and understanding of market dynamics. Many of the early pioneers in this space were entrepreneurial companies backed with Venture Capital money. That dynamic is changing with the entry of large utilities and oil majors into this space.
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?*
 - As noted in response to question 2 there are a number of factors considered by those deploying infrastructure. These factors will lead to infrastructure being deployed in locations that satisfy these conditions to make a satisfactory return on investment.
 - A key area for Government to consider is those areas where there is a lack of commercial incentive to deploy charging infrastructure. This likely means some form of subsidy or support and the challenge is getting the level correct so that it does not distort competition.
 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?*
 - See responses to question 2.
 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?*
 - See responses to question 2 where the potential market distortions are noted.
 - Specific areas of support are those geographical locations where a commercial case cannot be developed and potentially for slow / fast charging business cases where the return on investment is weaker.
 8. *What is required in order to ensure that rural / remote communities and those without off-street parking are well served by charging infrastructure?*
 - As noted in question 2 these are areas that likely require support. Government needs to find the balance to identify what these areas are and minimise distortion particularly edge effects.
 - An edge effect occurs where a region may be considered worthy of Government support and the neighbour is not. However the provision of subsidised charging in one area will likely distort delivery of unsubsidised charging in the next.
 9. *What role should local authorities play to help deliver EV charging in a way that promotes competition? What support would they need?*
 - Many local authorities would benefit from further support and guidance. Finding mechanisms to share best practice and case studies is beneficial.
 - Local authority zoning could be considered as proposed by Field Dynamics in their white paper on this topic.
 10. *What can be learned from the different policy approaches taken in the devolved administrations for the EV charging market's development?*
 - As noted the Scottish Government has distorted the market for private investment. But it has developed a significant network to the benefit of the driver. Introducing fees on this network will make it more attractive for commercial operators to consider this region.
 - Experience from the Go Ultra Low programme indicates that better consideration needs to be given to the ongoing operations and maintenance costs of charging

infrastructure. The use of funding to ensure maintenance of infrastructure, and dedicated bodies and contracts, to support this is as important as the initial capital outlay to build the charging network.

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?*
 - Public charging. This is the primary focus of Paua and as such this is considered our biggest barrier to those adopting EV; in particular fleets.
 - Fleet challenges include similar challenges to the every day drivers. These include
 - Finding a chargepoint; whilst there are a number of mapping tools including the Governments own National Chargepoint Registry (NCR) few have complete coverage.
 - The NCR is unfortunately outdated, badly structured, filled with errors and does not have any live data associated with chargepoint status.
 - The nearest is Zap-Map who have developed an impressive coverage of the UK. However this is privately operated as a closed resource and not available to the wide range of developers seeking to resolve this consumer barrier.
 - Once at a charge point another suite of barriers appear for the driver. These include
 - Does the chargepoint work? Broken chargers remains an issue.
 - Is it actually there / is it easy to find? Sometimes they are challenging to locate in large carparks
 - How to access (or authenticate) such that you can start a charge? A range of authentication methods exist including pure digital solutions, RFID cards, NFC readers and in some circumstances direct from the car via a standard called ISO15118 which enables “plug & charge”.
 - What do I do whilst charging? Charging a reasonable amount (say 50 miles) at a 50kW charger will take around 20 minutes. This period of time needs to be safe and for many people include some form of local amenities including toilets or refreshments.
 - Fleets face a range of additional challenges on top of these including the ability to extract a receipt from a chargepoint and the miss-guided intent to offer credit card charging everywhere.
 - It is clear that credit cards offer a valuable ad hoc access route for charging but fleets don't want to issue all drivers a credit card and then have to reconcile all the receipts.
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 points raised above in question 1 are the most pertinent and further information is provided in question 3.

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?*
 - A range of charging behaviours can be observed in EV drivers. Those who are comfortable with the technology and understand their vehicle have moved beyond simple range anxiety and now have differing concerns including experience anxiety and availability anxiety.
 - As noted a vehicle already charging or a broken charger often means that a driver cannot proceed to charge.
 - EV drivers will often frequent the same charging locations or networks where they know that the chargers are well maintained or that more than one is provided at a certain location such that they avoid the concerns noted above.
 - Price is a consideration but it is not clear how important this is particularly when considering rapid charging. A rapid charging event is often a necessity and therefore price is less crucial.
 - However rapid charging is important to business as it avoids idle time for the vehicle and the driver and enables business to get back on the road. Therefore the price paid is likely less important than the time saved for business drivers.
 - In the UK few roaming operators exist unlike mainland Europe. In Europe drivers often have a membership or relationship with a particular partner that enables them charging with particular networks and this determines their selection of location.
4. *Can consumers easily understand and compare charging tariffs in this sector and what barriers, if any, do they face?*
 - With regard to public EV charging, and in particular rapid charging it is not clear that tariff is a large determinant of consumer behaviour. Rapid charging is often a necessity and like petrol stations the price is what it is when you need to recharge / refill.
 - However, it is not as simple as it could be and this is a specific area that we are seeking to address. As noted in Question 1 the NCR is failing consumers in acting as a central source of this data. Should this resource be more effective then developers could provide better insights to drivers. See notes in question 8 pertaining to how this could be improved.
 - It is Paua's view that a standardisation of charging prices to p/kWh would simplify the public charging experience for EV drivers. The intent should be to avoid confusing mixed costs such as connection fee's, time-based fees or other costs such as parking. This approach better enables comparison of prices to ensure that drivers can find the cheapest prices.
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?*
 - The limited amount of public rapid EV charging infrastructure deployed to date means that it is not always developed with the optimal ergonomic considerations. Developers have as a necessity deployed infrastructure where space is available. This on occasion means that the cables don't reach all the ports on the cars and that the infrastructure is not well considered for impaired users.

- As noted in question 1 there are additional challenges for fleets in getting the best from the modern infrastructure. This is in part reinforced by the misguided notion that credit cards serve all users as a lowest common denominator for access. Whilst credit cards are important a better solution involves a full digital control based on software to control the charge event.
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?*
- A first priority should be a common open list of basic details on chargepoints ideally held on a source such as the NCR. Data should include chargepoint locations, connector types available, power rating, date of installation, operator, fees, and any specific details associated with parking or access.
 - As outlined in question 8 this presents a range of benefits
 - As a side note it should be recognised when presenting this data when a chargepoint is actually located in a “residents only” area as technically these are not public locations. See the Alternative Fuels Regulations for a definition.
 - In the present day it does not seem logical that we should have an internet connected chargepoint, an internet connected car and an internet connected phone and still rely on a credit card, multi-day pre-authorisation locks on credit and limited access to receipts.
 - The future of charging should seek to meet the standards expected of a Tesla driver; the car knows where the chargers are, the car prepares the battery to charge on approach, the driver plugs in the car and walks away. On the drivers return the car is ready to depart and they leave. Costs are deducted where applicable and a single receipt is issued to the drivers app/car.
 - Such a solution, whilst challenging across many chargepoints and cars, is not impossible. A key criteria is that the market needs to innovate towards this solution and regulation tends to stifle innovation and discourage first movers.
 - Paua is focusing on delivering a solution as outlined above based on OCPI and other software interfaces with chargepoints. These solutions enable the development of a roaming solution with all the capability that a modern car driver expects from a modern, vibrant technology sector.
7. *Are existing protections offered by consumer law and other measures (such as sector regulations) sufficient?*
- Yes subject to appropriate enforcement of the alternative fuels regulation as noted in question 8.
8. *What, if any, open data measures are needed to support consumer interaction, such as through the growth of comparison sites and apps?*
- As has been widely evidenced by Government itself the National Chargepoint Registry (NCR) is no longer fit for purpose. There is ongoing work to update this resource such that it acts as a single source of information for those developing solutions in the public EV charging space.
 - The Alternative Fuels Regulations state that all Chargepoint Operators should either present static information on their charging network on their website or add it to the NCR. This doesn’t seem to be consistently

happening. The team supporting the NCR should ensure that the additional static data from the CPO own websites is also gathered to the NCR such that it is a consistent and comprehensive resource.

- To date Government have relied on relationships with private providers of data for public charging; mainly being the resources provided by Zap-Map which is not comprehensive. Moving forward Government should seek to develop NCR, rather than Zap-Map, such that it is a comprehensive open source of data on public EV charging.
- The delivery of such a solution will enable developers to present consumers with information that better enables them to make informed decisions and to reduce barriers to driving electric.
- As noted in question 6 a common open list of basic details on chargepoints should be held on a source such as the NCR to enable developers to improve the consumer experience. Data should include chargepoint locations, connector types available, power rating, date of installation, operator, fees, and any specific details associated with parking or access. An approach could be to licence those delivering public EV charging infrastructure but as noted in question 9 too much regulation can stifle innovation.
- Importantly any approach to open data should be led by the Government. All chargepoints that have received money from Government should be beyond reproach when it comes to exhibiting best in class consumer experience including the provision of basic data on chargepoints. This should include capital deployed under ORCS (the on-street residential charge point scheme), Go Ultra Low cities and the CIIF (Charging Infrastructure Investment Fund).
 - The recipients of these funds should go further and demonstrate best in class infrastructure and associated open data wherever possible. In future government funding for infrastructure it could be considered a requirement for new recipients to provide open data to align to the national chargepoint registry.

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

- It is important to recognise that this is a nascent industry. Only 1% of drivers today drive vehicles with plugs on (even less than this drive pure battery electric vehicles). Whilst the rate of change (as evidenced by the share of new battery electric cars being sold is higher) the market is still early.
- It is widely recognised that too much regulation in an early stage market is restrictive of innovation and can reduce the competitive ideas coming to market. It is imperative that the Government maintains as light touch an engagement as it feels it can whilst protecting consumer needs and nurturing early stage innovation.

Appendix material

The following worked examples are presented, largely unevidenced, as an illustration of the considerations that chargepoint operators make when deploying infrastructure in the public domain. They are purely illustrative to support the CMA in developing their own views on areas that they should consider when undertaking their investigation.

Worked example of a rapid charger business case

- 50kW Rapid EV charge points cost £50-70,000 to install (Fleet News 19th September 2018).
- Operations and maintenance of such a charger is around 7% of the capital cost per annum and covers insurance, maintenance, chargepoint back office, call centres, payments to landlord
- Businesses can buy electricity at around 12p/kWh.
- Lifetime of chargepoints is around 8-10 years.
- Assuming a public charging costs of around 35p/kWh (market average) at 15kWh (c. 50miles of driving in a 20minute session) then (Ceteris parabis) around 8 charge events leads to a breakeven investment.
 - Anecdotal evidence suggests that the average charge events occurring on a rapid public EV network are around 1-2 events per day with some individual locations receiving more charge events than this. The underlying assumption is that market growth enables the chargepoints to break even over time.

Simplified rapid charger business case											
Opex (%capex)		7.0%	Covers insurance, maintenance, chargepoint back office, call centres, payments to landlord								
Charge event size	kWh	15									
Charge events	event / day	8									
Elec cost	£/kWh	£0.12									
Charging cost	£/kWh	£0.35									
		Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Capex		-£50,000									
Opex		-£3,500	-£3,500	-£3,500	-£3,500	-£3,500	-£3,500	-£3,500	-£3,500	-£3,500	-£3,500
Elect cost		-£5,256	-£5,256	-£5,256	-£5,256	-£5,256	-£5,256	-£5,256	-£5,256	-£5,256	-£5,256
Revenue - charging		£15,330	£15,330	£15,330	£15,330	£15,330	£15,330	£15,330	£15,330	£15,330	£15,330
Net		-£43,426	£6,574	£6,574	£6,574	£6,574	£6,574	£6,574	£6,574	£6,574	£6,574
NPV @ 10%		-£5,060									
IRR		7%									

Worked example of a fast charger business case

- 7kW fast EV charge points installation costs vary significantly on location. A car park charger well situated could be delivered for around £3,500 on average. Street works are significantly more expensive leading to a cost that could be in excess of £10,000. Innovations that reduce the cost of charger installations could improve this business case
- Operations and maintenance of such a charger is around £500/year inclusive of back office support and an assumption on landlord payments being low.
- Businesses can buy electricity at around 12p/kWh.
- Lifetime of chargepoints is assumed around 8-10 years.
- Assuming a public charging costs of around 30p/kWh (the solution is less convenient than a rapid charger so generally costs less) at 15kWh (c. 50miles of driving which is double the average UK drivers daily distance)

