

Consultation on Managed Electric Vehicle Charging: Summary of Responses

Issue 1.0

HELPING ELECTRICITY NETWORKS FACILITATE ELECTRIC VEHICLE
UPTAKE

DELIVERED BY EA TECHNOLOGY ON BEHALF OF A CONSORTIUM OF KEY
GOVERNMENT, INDUSTRY, UTILITY AND CONSUMER STAKEHOLDERS

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1 Context

1.1 Introduction to the Smart EV project

The aim of the Smart EV project is to achieve consensus on the mechanism that can be used to facilitate the roll out of managed electric vehicle (EV) charging. In doing so, it will enable significantly larger numbers of EVs charging on today's local electricity distribution networks, with sizeable reduction in investment costs, and customer bills and disruption. This project will seek to inform a national engineering recommendation (or equivalent) for the connection, charging and control of new EV load to domestic properties.

The Smart EV project is funded by Scottish and Southern Electricity Networks through its Network Innovation Allowance, and delivered by EA Technology. All six GB Distribution Network Operators are project partners, and the project is supported by a cross-sector steering group. Smart EV is a follow on to the My Electric Avenue project, evidence from which suggests that plug-in electric vehicles will cause an impact on the local electricity network, requiring significant investment by Distribution Network Operators (DNOs) – an estimated investment of £2.2bn by 2050 needed to support EV uptake. The project has been through an initial consultation exercise to understand cross-industry views on managed EV charging. The results of that consultation, and next steps for the project, are explored in this document.

1.2 The Challenge of Electric Vehicles

The forecasts for EV uptake are significant, with around 8 million vehicles expected to be on UK roads by 2040¹. Between 2011 and 2016 alone, there was a 30-fold increase in cars eligible for the UK Government's plug-in car grant². Increasing numbers of EVs driving on UK roads will create additional electricity demand at peak times as each electric vehicle effectively adds the same demand as an additional household³. Clusters of EVs will add substantially to the peak electricity consumption on local networks, requiring network reinforcement. The cost and associated disruption of this reinforcement (i.e. laying more cables in the ground) will be met by electricity customers.

Distribution network operators expect that the most efficient solution for some networks will be to manage EV charging load at peak times. If acceptable, deployments of this solution would begin in the early 2020s, with substantial numbers of deployments in the late 2020s. However, to avoid retrofitting charge points, the deployment of this technology solution should be considered now.

The Smart EV consultation initiated the cross-industry process of defining such a managed charging solution which could meet this need; any solution will need to be technically feasible and backed by widespread industry consensus.

1.3 Other Initiatives in the Energy Sector

The consultation responses highlighted a range of initiatives ongoing in the energy sector. These may have a part to play in the long-term support of EV charging, but for either technical or market-readiness reasons they do not meet the near-term challenges of supporting EV charging on local distribution networks.

¹ National Grid (2016) "Future Energy Scenarios" <http://fes.nationalgrid.com/>

² SMMT Vehicle Data (2016) <https://www.smmt.co.uk/vehicle-data/>

³ My Electric Avenue (2015) "Learning Summary" <http://myelectricavenue.info/learning-outcomes>

1.3.1 Smart Meters

The GB Smart Meter Rollout is aiming to install a communication-enabled smart meter in every customer home. Smart meters include the capability for half-hourly settlement and control of external devices, potentially (but not definitely) including smart charge points; smart meters do not currently have the technical functionality to be able to manage EVs. In addition to this, half-hourly settlement is not sufficiently responsive to meet local network needs which can arise in much shorter time periods.

1.3.2 Time of Use Tariffs

It is widely expected that smart meters will support increased usage of time of use tariffs by residential customers. The impact of time of use tariffs on EV charging behaviour has been explored through innovation projects, but understanding of customer behaviour remains limited. A key obstacle to using time of use tariffs to meet local distribution network needs is the variety of tariffs which customers will choose, and the varying local needs which cannot be met by nationwide tariffs.

1.3.3 Smart Homes

The smart homes initiative is likely to supersede any measures targeted at EV charging. However, the implementation and timeline of smart home uptake is unclear.

1.3.4 Vehicle to Grid

Vehicle to grid technology may be suitable for support of distribution networks, and can be viewed as an extension of smart charging technology, from the grid perspective. The Smart EV output (the solution) will not preclude use of vehicle to grid, but we do not believe the current technology readiness justifies separate treatment from other managed charging technologies.

2 Smart EV Project Overview

This document sets out a summary of the responses received to the Consultation on Managed EV Charging in support of the Smart EV Project; this further work should achieve the following outcomes:

- Provision of industry agreed material to inform an ENA Engineering Recommendation (or equivalent) available to third parties for supply and manufacture of the home end and the substation end controllers (the Solution).
- A functional specification describing the system components and operation to allow vendors to produce a compliant Solution.

The development of the Consultation on Managed EV Charging was supported by a Steering Group of representative members* from the customer, Government, automotive, electric vehicle supply chain, power engineering and utility (distribution network operator) sectors. Steering Group views were sought on the approach taken to define a list of possible options to inform a mechanism (such as an Engineering Recommendation or equivalent) to facilitate plug-in vehicle uptake on GB electricity networks. Steering Group views were not sought on any one or more technical solutions; it was the intention of the Consultation to seek stakeholder views on the list of possible options.

The Steering Group endorsed the fair and equitable approach taken in defining the options that informed the Consultation. The Consultation and its Steering Group recognises the wider consultative work through the Department for Business, Energy & Industrial Strategy; Ofgem; and Office for Low Emission Vehicles on wider market mechanisms to facilitate smart and low carbon technologies, including plug-in vehicles⁴.



⁴ In particular, the Call for Evidence on Smart Energy, produced by Department for Business, Energy and Industrial Strategy (BEIS) and Ofgem.

3 Smart EV Consultation

The Consultation on Managed EV Charging opened on 12 October 2016, and closed on 16 December 2016. Several stakeholders requested extensions to this deadline. All responses were received no later than 7 January 2017. The Consultation asked for views on managed electric vehicle (EV) charging. In particular, we encouraged and welcomed stakeholder views from those with an interest in low carbon energy relating to any of the following sectors:

- Automotive
- Charging points
- Consumer energy issues
- Demand side response aggregation
- Electricity
- Electricity networks
- Electric vehicles
- Energy

For the purposes of this summary report, stakeholder responses are collated under the following groups:

- Automotive manufacturers
- Charging point manufacturers and supply chain
- Consumer bodies
- Distribution Network Operators / other utilities
- Government
- Personal

The Consultation was based on nine questions split into four focus areas. The four focus areas and component questions are restated below; the key response themes are drawn from each respective stakeholder group under each focus area:

1. Is managed EV charging acceptable if it can reduce cost to electricity customers?
2. What situations and safeguards are applicable?
3. What level of choice and reward should customers experience?
4. Does the technical 'straw man' presented move us in the right direction?

4 Consultation Responses

4.1 Responses Received

We received 28 responses to the Smart EV consultation from a range of stakeholders:

- Automotive: 2 representative bodies, 1 OEM, 2 senior individuals from OEMs, 1 supply chain
- Charge Point Manufacturers: 2 representative bodies, 5 OEMs
- Consumers: 2 individual consumers, 1 representative group
- Academia: 1 response
- DNOs: 5 responses
- Energy Suppliers: 1 representative group, 2 of the 'big six'
- Public sector organisations: 3 organisations

4.2 Is managed charging technology beneficial for distribution network applications?

A summary of responses is set out in Section 5. The remainder of this section draws out the key messages, as they relate to the Smart EV Project aims.

The Smart EV consultation showed a wide variety of views on the need, acceptability, and implementation of managed charging. Therefore, we have focused on this area.

4.2.1 Is some form of managed charging desirable?

There is strong consensus that managed charging is desirable for the GB energy system *in some form*⁵. 94% of respondents agreed that managed charging would be beneficial for the UK, although this was based on a range of different views around:

- Role of distribution network operators
- Operation of a market
- Safeguards for customers
- Responsibility for cost of EV uptake
- Technology

Whilst this consensus is very high-level, it does provide a basis for considering the more targeted application of support for the electrical networks using managed EV charging.

4.2.2 Managed charging to support distribution networks

The consultation documentation deliberately did not set out a very specific use case for managed EV charging to support distribution networks. Respondents indicated different use cases which could be envisaged and provided very different feedback on each use case. The different use cases are set out in Figure 1, and respondents clearly indicated the different requirements for a solution addressing each of these use cases.

⁵ 94% of respondents were agreed that managed charging would be a positive development for the market, this does not mean they agreed with the Smart EV proposals, particular technology options, or means of implementing managed charging.

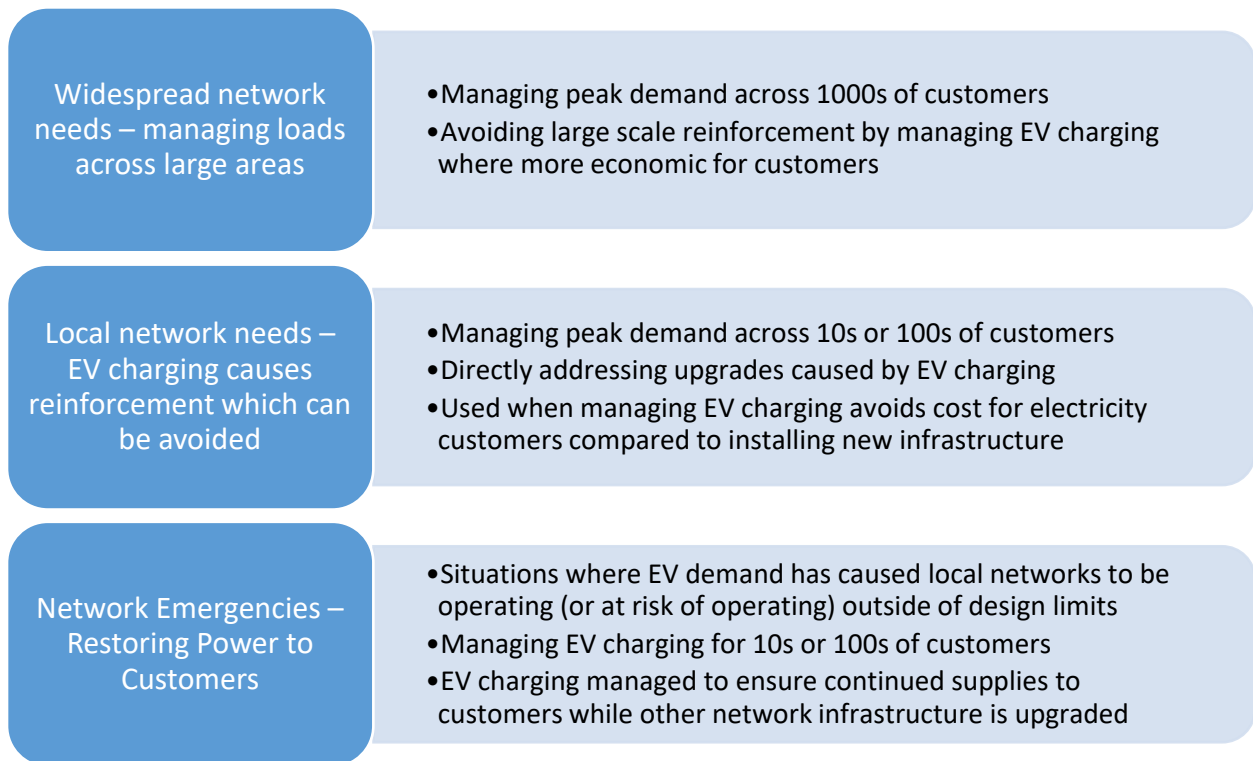


Figure 1 – Different applications of managed EV charging for distribution network support

There was some consensus around the appropriate mechanism for managing these different use cases, summarised in Table 1. Two key messages are:

- A large majority agreed that an open market, without special access for DNOs, was the appropriate mechanism to deliver wide network needs.
- Around two thirds of respondents, who gave a view, felt that a DNO led use case was reasonable in *network emergency* situations.

Use Case	Likely mechanism for delivering flexibility from EV charging	Respondents' input on the mechanism for delivering flexibility	
		% Agree	% Disagree
Widespread network needs	Open market	89%	4%
Local network needs	?		
Network emergencies	DNO led	36%	14%

Table 1 – Consensus around DNO use cases

The Smart EV project will publish a definition of network emergencies, together with an assessment of how customers would experience both managed charging alternative solutions to deliver the electricity network capacity needed by EVs.

4.3 Areas of consensus

A wide range of views was sought from stakeholders across several industry sectors. It was expected that this would result in a wide range of views. Despite the range of perspectives, some significant points of consensus were clear from the consultation responses.

4.3.1 Consensus on the Market for delivering Managed EV Charging

The following points of consensus were clear, considering the customer experience and market for managed EV charging:

- The customer must be at the centre of any market or technology offering managed EV charging, both in terms of market design and the benefit provided.
- In the long term, EVs should be treated in the same way as other household demands such electric heating.
- The market for managed EV charging is at an early stage and lots of space is needed for market development and innovation.
- The customer should only need to interact with one ‘purchaser’ of flexibility: Interaction with all the stakeholders in the electricity system is not desirable.
- If a DNO mandated response is appropriate for some situations, it must not interfere with normal market operation.
- There may be a short-term need to act to ensure that local electricity networks can deliver power for EV charging. However, the short-term solution will not be in place indefinitely as the market matures and with the shift to low carbon technologies.

4.3.2 Consensus on the Technology for delivering Managed EV Charging

The following points of consensus were clear, considering the technology options for managed EV charging:

- Smart charging points are the most mature technology for managing EV charging
- Customer choice is desirable under most circumstances, but increased choice seriously undermines the reliability of a managed charging solution to deliver the reduction in demand at very local levels.
- Increased reward for customers, flexibility and customer interaction will increase the overall cost of a managed charging solution.
- There are a very large number of customer groups with different needs from their vehicles. Anticipating these needs, and codifying them, would be almost impossible to achieve.

4.4 Areas without consensus

Despite the positive consensus set out in Section 4.3, there were many areas without consensus. The Smart EV Project acknowledges these areas, and they will be invaluable in targeting the scope of the project and defining further supporting to work. Areas without consensus were:

- Whether DNOs have provided sufficient evidence to support a mandated response from managed EV charging
- Whether (and how) managed charging should be mandated to support distribution networks
- How a mandate for managed charging would impact customer acceptance of EVs
- Whether it is justifiable to treat EV charging as separate from other home energy consumption in the short to medium term
- Which parties should be responsible for the cost of infrastructure necessary to support EV uptake

4.5 Other Consultation Responses

There was significant response to the consultation which did not directly relate to the questions posed. We recognise the significant value of this response and will ensure it feeds in to the later stages of the Smart EV Project. In addition, several respondents offered to engage to provide further input, and we intend to take up these offers.

Some examples of the input provided are shown below:

Ideally, customer flexibility would be at the home-level not the appliance level

Increasing generation capacity to manage peak EV demand is expected to cost more than delivering increased electricity network capacity

Standardisation routes for technologies are well established and the Smart EV output should make use of them

The Smart EV output may well only be a stop-gap measure which will be updated and superseded. But there is great value in ensuring the infrastructure requirements we understand can be met

Examples of UK and international initiatives that the Smart EV output must complement

Little is known about customer EV usage, once it becomes mainstream

5 Next steps

5.1 Wider benefit of managed charging availability

Based on the consultation responses, we believe there is widespread consensus that managed charging can benefit GB energy customers. We also believe that the sooner this technology is deployed, the sooner customers will have access to flexibility markets, if desired. It is beyond the scope of the Smart EV project to consider the widespread roll-out of a managed EV charging market. However, we will work with the Smart EV Steering Group to make this recommendation to the appropriate parties.

5.2 For the Smart EV Project

The Smart EV Project will now focus on the use of managed EV charging to mitigate *network emergencies* caused by EV charging. The consultation has provided a strong foundation upon which to develop the next stages of the work, which are:

1. Definition of the *network emergency* use case with an assessment of the customer impact of managed EV charging in this scenario, compared to alternative solutions.
2. Development of a customer engagement and messaging strategy to ensure that customers remain central to the Smart EV output.
3. First draft of the technical requirements necessary to support managed charging in the *network emergencies* use case
4. Engagement with key stakeholders throughout the drafting process
5. Formal consultation to provide input to the draft technical requirements
6. Publication of a final version of the technical requirements document

Outside of the project scope, the following key work areas will be necessary:

- Engagement with existing standardization bodies to allow a process for translating technical requirements into a formal standard.
- Review of regulatory limitations to ensure that any recommended mandate falls within existing DNO authority.

6 Conclusion

This Consultation summary is a key deliverable under the Smart EV project. The Smart EV project will report to stakeholders and close in December 2017. All respondents to this Consultation will be kept informed of progress and will be included in the dissemination of the final project report; if you do not wish to be included in this circulation, please email smartEV@eatechnology.com.

The Smart EV Steering Group would like to extend sincere thanks to every respondent to the Consultation for the time and effort taken to produce each individual response.

Appendix - Summary of Responses

Question 1 - Managed EV Charging

Q1.1 If electricity network operators show that managed EV charging will reduce the overall cost to customers, what are your views on whether managed EV charging is necessary or desirable to support low carbon vehicle uptake in Great Britain?

Automotive & Supply Chain

- All but one respondent viewed managed EV charging as positive, assuming there is no impact to customers' ability to use their vehicles as needed.
- Transparency is needed regarding direct and ongoing costs of managed charging relative to its benefits.
- EV charging should not be the only managed load type.
- One representative group questioned the premise of DNO management for specific appliance groups, advocating for management of household consumption with the householder responsible for determining which appliances respond.
- One representative group queried whether time of use tariffs and customer education had been sufficiently explored as viable solutions to DNO requirements.

DNO

- Smart charging is a desirable tool to allow DNOs to support EV uptake, at the lowest cost to electricity customers.
- DNOs can deliver the capacity to support EV uptake without managed charging. However, managed EV charging would reduce costs for customers.
- Policy makers and customers should decide whether the potential inconvenience of smart charging is outweighed by reduced electricity costs.
- There are different use cases:
 - Short-term/urgent: Need to limit EV charging demand at peak times to prevent overload on the network and maintain customer supplies. This would operate whilst other solutions are deployed.
 - Medium-term: Need to limit EV charging demand at peak times, until demand increases to require alternative solutions; or demand decreases removing the need for managed EV charging; or customer acceptance cannot be maintained.
- The DNO network is essential for customers to remain on supply and for other flexibility purchasers to access managed EV charging. Therefore, it is reasonable to consider its needs as a special case from other purchasers of flexibility.

Energy – supply and generation

- Smart or managed charging solutions can be desirable from a distributed energy system perspective.
- A DNO-centric solution is not acceptable, whole system costs and benefits must be considered.
- It is important to ensure the principle of the supplier hub is protected.
- Oppose any mandated smart charging system, with exception of existing provision for network emergencies.

- It may not be appropriate for DNOs to concentrate solely on avoiding network reinforcement costs – the justification for managed charging should be related to whether managed EV charging has the potential to offer system wide benefits. Avoiding network reinforcement should not be assumed to be the optimal solution.
- Three key points need to be answered before DNO managed EV charging can be considered and do not believe these have been demonstrated:
 - Materially greater avoided costs for DNOs than for other areas of the industry (such as increasing generation capacity).
 - Usual market price mechanisms cannot operate with sufficient granularity to avoid network reinforcement.
 - There is justification to treat EV charging, or other devices, differently to other uses of electricity.
- Practicality for operation of a managed charging system, via smart meters, depends on classification of EV charger points, as ‘trusted devices’ in the smart meter specification. This is not currently the case.
- In the current energy system, increasing EV uptake will result in increased unit costs of electricity. Fairness demands this should be met by the EV customer. However, this would become an obstacle to EV uptake; policy intervention is likely to be required to avoid this situation.
- The market transition towards half-hourly settlement, more sophisticated tariffs, wider use of ‘smart’ devices, and increasing use of workplace and rapid charging, challenges the conclusion that DNOs need access to managed charging to accommodate EV uptake.

Charge Point Manufacturers

- Consensus, but with one strongly dissenting view:
View of one representative body:
 - Not convinced by the arguments that DNO networks will require substantial high-cost reinforcement if managed charging solutions are not made available.
 - Most EV users are unaware of network capacity issues and would expect infrastructure to support their default behaviour.
 - View any initiative targeting EV charging as discriminatory, given that other loads have similar power requirements.
- Other respondents (one representative body and individual manufacturers):
 - View smart charging as necessary to allow low carbon transport without significant grid costs, but not necessarily likely to influence EV uptake.
 - Believe that smart charging can benefit society, but that its uptake needs incentives from policy makers to capture the opportunity.
 - Important to ensure a consumer centric approach (communications, convenience and continuity of supply).
 - Any mandated activity should be the minimum required to ensure supplies are maintained. Any further response should be market led.
- Suggest consideration of other solutions: Smart homes; education to encourage drivers to charge off-peak; time of use tariffs. Understand that these benefits have not been demonstrated, particularly for local DNO applications.

Public and Innovation Bodies

- Supportive of managed charging, but recognise the wider context (including generation capacity, alignment of low carbon generation with EV charging, system stability).
- Customers must be the focus, both to allow their priorities to be met and to ensure benefits do not outweighed by cost of inconvenience.
- There are questions over the interaction between the Smart EV output and the wider smart homes initiatives, particularly in the allocation of capacity between different appliances (i.e. what is managed, what is not).
- Note that the expected cost of building generation to accommodate increased peak demand is greater than the anticipated DNO reinforcement costs.

Consumer

- All respondents viewed managed EV charging as positive development, if it lowers electricity costs to customers and other solutions (whether lower cost, or higher choice to consumers) are not viable.
- One respondent questioned whether time of use tariffs had been sufficiently explored as tools for DNOs.

Question 2 - Safeguards for Customers

Q2.1 If a managed EV charging system is developed, what are your views on safeguards needed to ensure customers can continue to use their vehicles as normally as possible?

Automotive & Supply Chain

- Customers must be able to operate vehicles as needed, regardless of use patterns associated with different types of customer (premium sector, shift workers, commercial vehicles and unforeseeable journeys were all cited). In particular, commercial customers' livelihoods rely on their vehicle being available.
- Transparency, choice and simplicity for consumers are key.
- Important to show that grid is not being protected by overly relying on EV user.
- Two respondents expected that small changes (between 5% and 15%) to charging demand could be enacted without customers noticing.
- In the long term, one respondent expected that use of home charging will reduce as the battery capacity increases make filling the battery overnight less achievable.

DNO

- There is a need for protection for customers, this could come from: Licensing/regulation of managed charging, freedom to opt-in/out, or preferences such as priority time periods, minimum range or charge required.
- Use of existing tools such as the Priority Services Register (for vulnerable customers) would allow managed charging to flex the response around critical customer needs.

Energy – supply and generation

- Opposed to any system which mandates customer behaviour. Market signals and well-designed tariffs etc. should encourage customers to move usage voluntary. Any developed system should

be consumer-centric, and mandatory obligations are likely to create resistance to mass roll-out of EVs.

- Managed charging should use a market-centric approach, with DNOs acting as neutral market facilitators.
- EV drivers should not be put in a position where they cannot use their vehicle (this would be a poor implementation of a system where vehicles spend 95% of time parked).
- A large range of customers need 24-hour access to fully charged vehicles. Any effort to safeguard these customers would result in customers ‘falling through the gap’.

Charge Point & Supply Chain

- Customers should have access to information on charge status if requested.
- Safeguards: Override functionality; baseline functionality such as minimum charge rate; and user preferences such as desired range, next journey time, availability, maximum number of operations within a time-period. The more users feel they are in control, the more they will allow smart charging. User preferences could be set during use or per journey (e.g. purchase of vehicle or charge point).
- Recognise that different protections or payments could apply to different charge rates.
- Expect a wide market for flexibility, separate from DNO control.
- Increased flexibility for users increases complexity and user interaction (which may produce acceptance challenges). Some respondents expressed a preference for a regulated approach to DNO managed charging to maintain low cost and user simplicity.
- One respondent: Expect that service providers who use a battery for demand response should be accredited by the vehicle manufacturer, and keep high-resolution records of usage.

Public and Innovation Bodies

- It is important not to expect that ‘normal’ usage of a vehicle will remain static.
- Different safeguards are reasonable depending on usage of constraint. Under an “emergency only” scenario, safeguards can be relatively light as system usage is almost always based on a market.
- Expect that customer behaviour and/or preferences will be considered to allow vehicles the charge required by customers.
- Emergency services, fleets and vulnerable customers will all need consideration, expect some level of input – either by understanding customer requirements or through direct opt-out.

Consumer

- There was an expectation from individual consumers of control of a managed charging system; individual consumers also anticipated a price based system which would allow consumers to make a financial decision, for each curtailment, on whether to restrict charging.
- Respondents highlighted the challenges of supplying electricity to vulnerable customers – both to protect these customers from overly sacrificing vehicle charging and avoiding a scenario where EV drivers cause outages or price increases to vulnerable consumers.
- The scenario where EV charging causing outages and/or increased electricity prices for non-EV drivers was raised; this included the view that the highest priority when considering EV uptake ought to be given to ensuring non-EV drivers are protected from the impact of EV uptake.

Q2.2 Are there any situations where you would expect electricity network operators to particularly use, or not use, a managed EV charging system?

Automotive & Supply Chain

- One group suggested that managed charging not be applied to mode 2 charging; mode 3 charging at power levels equivalent to mode 2; customers who have paid for a three-phase supply; and charge points installed ahead of any standardisation.
- Expect different levels of management are appropriate for different grid situations.
- Commercial users with high densities of EV charging should be included.
- Expect usage of a managed EV charging system to be mapped and forecast then communicated clearly to customers.

DNO

- DNOs would use this solution on a case by case basis where it is the most economical solution for customers and is technically feasible and reliable. This would be a local need, where a network is at risk of overloading or following a fault.
- Would not use managed charging where customers have paid for a secure supply (mostly business customers).
- DNOs may look to the solution as a short-term, time-limited, solution (like a hosepipe ban) which allows supplies to be maintained despite an unexpected increase in EV usage, pending reinforcement.

Energy – supply and generation

- Oppose any DNO-led or operated managed charging system, including direct control of third-party charging infrastructure.
- View low power charging solutions (up to 16A) as not requiring third-party management other than in the context of value added energy efficiency services behind the meter.
- DNO charging arrangements should not be used as a proxy for policy intervention to support EV uptake.

Charge Point & Supply Chain

- One respondent (representative group) is strongly opposed to any scenario which separates EV charge points from the home and believes any flexibility service should be applied to the home.
- Some respondents expect DNO managed charging to occur at peak times during winter.
- Times when customers make frequent journeys, such as holidays, should have limited use of managed charging.
- Essential that DNO management is considered in conjunction with National Grid services. Some respondents: Any wide area use of managed charging by DNOs, should be via a marketplace.
- DNO action to avoid EVs accelerating network upgrades is a plausible scenario.
- One respondent expects the system to be deployed if there is a demonstrable near-term risk of network overloads which would not be economically managed by other means. Only expect system operation within householder's consent.

Public and Innovation Bodies

- There will be customers, situations (e.g. high renewable penetration), and locations which are more suited to managed charging.
- Black-start or significant fault events will require different capabilities and restrictions for DNOs. Respondents were more supportive of managed charging in these scenarios.
- There will be significant innovation in this space; we cannot anticipate its outcomes. Managed charging should not set “rules”, as far as possible, to allow this innovation to benefit customers.

Consumer

- No specific situations were highlighted as inappropriate for managed EV charging.
- Expect that managed EV charging would be used by DNOs in targeted (high-cost) locations as a stop-gap measure to ensure ongoing supply whilst requirements for low carbon technologies become clear.

Question 3 - Concept Solutions

Q3.1 What are your views on the level of choice offered to customers during operation of any managed EV charging system?

Automotive & Supply Chain

- Expect a high level of customer choice, including immediate opt-outs, but this could be accompanied by significant pricing if a customer has agreed to provide response.
- Choice is particularly critical for consumers who have effectively been forced to purchase a plug-in vehicle due to air quality restrictions, or similar.
- Note that too much choice can be difficult for customers and reduce acceptance. Choices made as settings or preferences are likely to be better, if the customer can make immediate changes if needed.

DNO

- Increased customer choice will reduce reliability of a managed charging solution. DNO requirements will be highly localised. If a relatively small number of customers did not respond, the system would be ineffective which would risk local electricity supplies.
- Customer acceptability is critical and recognise that choice is an integral part of this.
- If managed charging was used for non-critical reasons by the DNO (e.g. optimisation of networks or demand reduction across wide areas) or by other stakeholders through a market, then customer choice is entirely appropriate; whether through opt-ins, pricing or other measures.
- If managed charging is needed, as a short-term or emergency measure to maintain supplies, then a DNO should be able to override customer choice. This would allow the DNO to continue to supply electricity to all customers on that network. Would expect this to be a regulated area, with clear definitions and communication to customers.
- It could be unfair to increase usage of managed EV charging for customers who opt-in, as a result of others opting-out, especially if the opt-in is more prevalent amongst more poor, or vulnerable, customers.

Energy – supply and generation

- The customer should have the right to opt in or opt out from flexibility services offered by their Charge Point Operator.
- Choice is essential, but there are significant differences in how choices are framed and how far they extend. Achieving a level of choice for a DNO managed system comparable with a market-based solution would be difficult.

Charge Point & Supply Chain

- Customer choice is critical to support uptake and allow customers to be confident that they will not be inconvenienced. This is key for the messaging around any managed charging solutions.
- Choice should be agreed at the outset of the customer relationship, but the customer should never be entirely prohibited from charging their EV. Expect that most customers would set preferences and then make no further adjustments.
- May be necessary to financially, or procedurally, limit the use of any override by customers to avoid constant override.
- One respondent: Choice will increase complexity and reduce customer acceptance during initial rollout.

Public and Innovation Bodies

- Customers need to be able to control the outcomes that they care about, without needing to get involved the mechanisms for achieving this.
- An opt-in to a longer-term commitment is one option. However, protection is needed to avoid wealthier customers pricing others out of the market.
- Value proposition needs to be clearly set out to customers, and could/should appeal through saving money and/or CO2.
- “Important to recognise and manage the tensions between what the customer wants (e.g. high vehicle range and rapid charging) with what suits the electricity system (low charging currents and avoiding the peak).” Do not believe that a simple market based system will deliver the desired outcome.

Consumer

- Individual consumers expected that a level of choice or override would be required, subject to some financial or procedural restrictions
- The likely increased cost, with increasing choice, is a concern.
- Clear communication of the conditions under which charging could be restricted are required before EV purchase.
- View a regulated approach as positive for EV uptake by reducing likelihood of electricity outages due to EVs.
- Highlight the possibility of mandating service provision by suppliers and DNOs, rather than mandating customer behaviour.

Q3.2 What are your views on the level of reward offered to customers for the operation of any managed EV charging system?

Automotive & Supply Chain

- Customers should be recompensed for additional cost of installing smart chargers.
- A flexibility market, which rewards customer behaviour that aligns to low system cost, is preferable to any mandate.
- Any initial reward may need to be much higher than the long-term reward, as the saving from transition to an EV is much greater than any saving from optimising electricity pricing.
- Rewards do not need to be financial.
- Important to remember that the priority of the driver is using the vehicle, not charger technologies.

DNO

- Rewards DNO can offer are related to the marginal cost savings from using managed EV charging.
- Expect that most reward will come from other market participants for the flexibility customers offer to those parties.
- Value of the flexibility to the DNO is highly location specific, and would need a complex process to determine this and communicate (via the energy supplier and/or aggregator) to each customer, which must then be kept updated.
- All rewards paid by DNOs would be ultimately met by all electricity customers, when also considering the complexity, the social value of rewards from the DNO questionable.
- Opinion on use of a market based system was split:
 - Some expected a market based outcome in which they would participate if cost-effective (and use other tools if needed) but reliability of response would be a key challenge.
 - Some recognised that rewards may be necessary to support continued ULEV uptake and customer acceptance, but did not expect a market to provide best value to customers overall (due to socialisation of cost and complexity of implementation).

Energy – supply and generation

- Customers should be incentivised for participation in a managed charging system. The reward for participation should reflect the market value of the flexibility provided.

Charge Point & Supply Chain

- Expect that any reward should allow customer to recover increased cost of a smart charge point.
- One approach to reward is varied electricity pricing, although the mechanism for this is unclear.
- Critical that rewards encourage customers to participate, a marketplace will both encourage a range of mechanisms for reward and determine the value of flexibility from the customer.
- Subsidies and grant could encourage participation and willingness to accept demand control.
- Some view that rewards are unlikely to drive significant customer behaviour and deliver necessary response, citing low statistics for switching energy suppliers in the UK and the small p/kWh reduction which could be achieved.
- Appropriate reward is highly dependent on use case. For rare operation, a minimal reward could suffice.

Public and Innovation Bodies

- Charges should be cost-reflective. If costs are socialised then customers will expect incentives rather than recognising the costs their EVs impose on the system.
- Do not wish to see costs of opting-out becoming a barrier to managed charging.
- Value to individual depends on degree of inconvenience, and the consistency of the allowed inconvenience, this will change for different customer demographics.
- Monetary reward is not the only option, free parking, air miles, etc. are all examples of low-cost incentives.

Consumer

- The increased cost to all consumers of increasing reward was raised as a key consideration, although it was noted that DNO regulation will mean that managed charging is only used where it saves money for consumers.
- Increased reward would provide increased acceptance of managed charging.
- There is a high level of uncertainty on effectiveness of a market based solution.
- Adaption of existing grant schemes is not desirable due to likelihood of grants being phased out, at some point, and the national nature of grants compared to local nature of need for managed EV charging.

Question 4 - Other Questions

Q4.1 As a system is designed, providing customers with some additional features may be beneficial. This may include features such as providing prior warnings and perhaps giving customers the mechanism to opt out. What features do you believe would be important and/or useful to customers?

Automotive & Supply Chain

- The priority should be a system which ensures opt-out to allow use of the vehicle as needed.
- Integration with home energy management and smart meter systems would be desirable.
- Prior warning of EV management and information about system operation would be beneficial to customers, via app, in home display or other technology.

DNO

- Forecasts for managed charging usage with sufficient notice to customers (and ideally other stakeholders).
- Availability of managed charging flexibility to other stakeholders (including suppliers, aggregators, system operator).
- Any opt-out should be communicated to the DNO so they can determine appropriate tools to manage each local network.
- Ability for customers to set preferences regarding range, next journey, etc.
- Data on availability and response to managed charging should be collected.

Energy – supply and generation

- Feature selection should be left to the market, specifically charge point or e-mobility operators.

- Smart charging needs to be considered in the context of the wider flexibility market, offered by a range of products including EVs, and a range of suppliers including aggregators and CPOs.

Charge Point & Supply Chain

- Information from DNOs regarding location and timing of constraints; accompanied by positive reports of operation and its benefit to customers.
- Information available to customers on the current charging status – should not be framed as a warning.
- Opt-out, to enable customers to use their vehicle as needed, and encourage customers to stay plugged in.
- Integration with home energy management systems is desirable (one respondent suggests this should be capable of addressing the EV concerns cited by DNO – and are opposed to any direct interaction with EV chargers).
- One view that a minimal feature set (for simplicity and lower cost) is the best solution.

Public and Innovation Bodies

- “Good timely information is likely to be key most vehicle users, as is diversity of offering to engage as broad a population of drivers as possible.”
- Advanced warning would allow customers to plan around managed charging.
- Fairness is critical.
- One view is that routine automatic warnings should be avoided as they would produce undesirable unintended consequences in customer behaviour.

Consumer

- Opt-out is required, both for urgent needs and for those customers who require charge at peak times.
- There is value in a forecast so consumers can anticipate charging.

Q4.2 The [Smart EV Technical Options Paper](#) sets out the approach to the Smart EV project, including a *straw man* for how a managed EV charging system could operate. What are your views on the content set out in the Smart EV Technical Options Paper?

Automotive & Supply Chain

- Challenges with percentage reductions (low power charging could fall underneath the minimum 6 Amp charge); and with caps (disproportionately impacts high power charging).
- There is less focus on opportunities relating to consumers and energy suppliers.
- A significant variety of incentives and tariffs will be required to accommodate customer preference.
- The Smart EV project may benefit from articulating the potential future vision of dynamic, bespoke pricing and then describing the steps and hurdles to meet it, then determining how far and how best to progress.
- There should be extensive customer consultation to understand their needs in developing the straw man further.
- The cost of a managed charging system is not clear, this should be determined and the apportionment of cost between different stakeholders should be clarified.

- The platform for demand management will be key – the duplication and confusion associated with public charging infrastructure should be avoided.
- An open standard such as IEC 15118 should be adopted for V2G.
- One automotive OEM clearly indicated that they would not be entering the market for operating charge points.
- Mode 2 charging has substantial disadvantages compared to mode 3. Mode 3 charge points should be mandated.

DNO

- Broadly supportive of the strawman.
- Significant changes to connection and charging arrangements may be needed if DNOs were to pay a management service to provide managed EV charging, and for any system that did not include opt-outs.
- DNOs remain agonistic towards technology choices and rewards/penalties to customers.
- Any negative incentive would need to be considered very carefully to ensure it did not appear as a penalty imposed on EV owners.
- View legislative change as the best route to uptake of managed EV charging.
- Care needed with exemptions for customers to ensure reliability of managed charging is maintained.
- Need further work to elaborate on the key questions set out by the options paper.

Energy – supply and generation

- Do not support the technical options paper on the following grounds:
 - Do not support the need for a DNO-operated managed charging solution.
 - It does not consider EVs as part of a holistic system including other technologies.
 - Market developments on Time of Use tariffs means they should be considered further.
- The straw man is too limited in commercial requirements to provide feedback.
- The service provider role is undefined, this would be likely to be filled by suppliers and aggregators who should be consulted. Do not support DNOs appointing service providers.
- More analysis is needed to consider the merits of the various payment and cost-allocation options.
- It is not appropriate to leave allocation of costs/benefits/liabilities to bi-lateral contract negotiations between DNO and Service Providers. These relationships should be exposed and explored at the earliest stage of the project.

Charge Point & Supply Chain

- Consideration needed on how different priorities are managed when determining charge profile (i.e. home energy management system vs vehicle vs network).
- Mobile metering solutions should be able to deliver the services highlighted in the straw man.
- Any market mechanism should not be limited to EVs, but should include other demand response and energy storage.
- Consideration needed on data requirements – data capture for every customer would become prohibitively expensive. Pooling by geographic area is more likely to be effective, but consideration is needed to ensure that installations are related to network location and that geographic area is suitably defined.

- Any standard proposed by Smart EV should come out of established mechanisms and be in harmony with EU standards.
- The solution should not be considered in isolation of other DSR solutions including the smart homes communications standards. Recommend a technology audit is conducted to account for solutions on the market.

Public and Innovation Bodies

- Do not expect short term opt-in to be feasible, as it will reduce the reliability from a DNO perspective. However, removing customer choice is not desirable.
- Impact on suppliers needs to be considered, as their trading positions may be influenced by changing charging behaviour.
- Expect that monitoring and control capabilities will be needed by DNO to ensure effective operation.
- Other features such as frequency measurement would benefit non-DNO stakeholders.
- Any specification, particularly one requiring bilateral arrangements between stakeholders, is contrary to the attempt (set out by the FPSA project) to reduce energy system complexity. Expect that a myriad of communications and commercial tools will be available to the DNO to influence EV charging in the long term.

Consumer

- Any system that requires consumer data would need explicit opt-in from consumers.
- There is not significant detail on a market based system (option 3), recognise that this has not been thoroughly tested by innovation projects.

Q4.3 What are your views on how the Smart EV project should align its outputs to support, or not impede, other initiatives and developments in the market relating to managed EV charging?

Automotive & Supply Chain

- Existing smart charging technologies should be used for the Smart EV output.
- Standards and communications protocols should be established to ensure that customers can change providers as appropriate.
- Any data which relates to mass market consumer expectations of EV usage, which is not widely understood.
- Smart meters and smart homes initiative, including links to local renewable generation.
- Disruptive technologies such as V2G, home energy storage and off-grid solutions.

DNO

- Need to ensure this aligns with, and can be superseded by, the smart homes initiative as it delivers; this is particularly true on networks where heat pumps become prevalent
- Smart EV should ensure it does not replicate existing initiatives by Ofgem, BEIS, OLEV etc. and provides outputs to fill gaps in those efforts.
- The Smart EV outputs should align to inform primary/secondary legislation currently being considered by Government related to smart energy systems and EVs.

Energy – supply and generation

- A more market-led, more holistic solution needs to be developed. The outputs should be aligned to the Ofgem/BEIS work on a Smart, Flexible Energy System.
- There is a chance that the outputs of Smart EV will be superseded by market developments in smart charging before they are published.

Charge Point & Supply Chain

- EV charging must not be different to other “smart appliances”, reference to EV specific technologies such as OSCP risks diverging development of different flexibility solutions which is undesirable.
- Recognise tension between timelines of different technology developments, but this must be carefully managed to avoid long term damage to the market.
- Ongoing proposals/consultations: Ofgem/Elexon’s mandatory half-hourly settlement, Modern Transport Bill Consultation, Ofgem/BEIS flexible energy system.
- Smart Meter roll-out.
- Smart Homes initiative.
- Any powers taken under the UK Modern Transport Bill.
- International experience is crucial, it is not in consumers’ interests for the UK to act in isolation.

Public and Innovation Bodies

- FPSA: Ensure that the Smart EV project does not contradict the direction of travel indicated.
- Ofgem/BEIS call for evidence and its outputs.
- Smart EV must be based on outputs of trials and evaluations with real customers.

Consumer

- Expectation of alignment with wider government initiatives.
- Suggestion that international examples could be further explored (e.g. mandatory EV tariff in Minnesota).

Q4.4 Are there any other comments related to managed EV charging which have not been captured elsewhere?

Automotive & Supply Chain

- Query on the fair approach to manage multiple car households with multiple EV charge points
- Some customers self-build EV chargers which may not be covered any proposed regulation. At present, only 50% of EV purchases then claim the available grant for an EV charge point.
- Ensuring the capability exists should be the priority, the best use case can then be determined based on evidence and customer engagement.
- It is important to note that existing data on EV consumer behaviour is based on early adopters not the mass population.

DNO

- Which party operates the managed charging is a key question which should be addressed as a priority.

- We do not understand how often customers will charge their vehicles with 7kW chargers and long (200-300 mile) range vehicles. This is a key consideration.
- The original Smart EV aims are critical for any managed charging solution (cost effective, acceptable to customers, technically and commercially feasible, capable of delivering response needed by local electricity networks).

Energy – supply and generation

- The Smart EV project considers roles of the different stakeholders and in particular the role of the customer in flexibility in a way which is limited to the traditional style energy system, which is undergoing major change. This may become an obstacle to innovation.
- There has been a lack of engagement with market participants, particularly energy suppliers and aggregators.
- This consultation is being led by EA Technology who is also named as the manufacturer of the Esprit product (one of the existing proposed solutions for controlled charging). The potential conflict of interest risk may de-value this work.

Charge Point & Supply Chain

- If a technical solution is mandated then enforcement must be considered to ensure that unsafe or unsuitable charge points do not proliferate.
- Commercial customers should also be considered for managed charging, and may be more receptive to this proposal than residential customers.
- Consideration should be given to avoiding second peaks as charge management ends.
- There is value in aligning local generation to EV demand so that customers with lower electricity network usage benefit (whether due to local generation or reduction in other electricity usage).
- Smart chargers are currently £200 more expensive than other chargers, expect intermediate measures to be needed whilst economies of scales diminish the cost difference.
- OCPP is the de facto open standard for smart chargers to communicate with back-office systems in Europe. OSCP is gaining traction for communication between DNO and charge point operators.
- Care is needed to ensure that suppliers of low-cost products, which are not able to offer the necessary flexibility, are not rewarded.

Public and Innovation Bodies

- Impact of V2G and local energy storage should be considered.
- Important not to pre-judge the wider value of smart charging.
- It is important to ensure that this (engineering-led) initiative does not pre-judge customer behaviour or opinion without evidence to support the judgements.

Consumer

- There is a need for clear and effective communications with both EV customers and non-EV customers.
- The organisation with responsibility for managed charging has not been made defined, this would help understanding.