2018

Consultation on the Interim Solution for Domestic Managed Electric Vehicle Charging

protecting local electricity network assets in the absence of market-led solutions

HELPING ELECTRICITY NETWORKS FACILITATE ELECTRIC VEHICLE UPTAKE

DELIVERED BY EA TECHNOLOGY ON BEHALF OF ALL GB DISTRIBUTION NETWORK OPERATORS, AND LED BY SCOTTISH AND SOUTHERN ELECTRICITY NETWORKS

1 Background to this Consultation

Electric vehicles (EVs) are set to play an important role in improving our air quality, with both UK Government and Scottish Government stating that by 2040 and 2032 respectively, they will end the sale of conventional petrol and diesel cars and vans. Technology and commercial models operating on our local electricity networks will need to evolve to cope with the growing trend towards electrification of both transport and heat. These changes will include traditional upgrading of networks, but also a new and increasingly viable range of smart and market-based solutions.

Distribution Network Operators (DNOs) are improving the way they monitor and model their networks, so that they can anticipate where they will need to either upgrade or use flexibility services to avoid constraints. This will go a long way to allow the network operators to proactively meet customer demands going forward. However, DNOs need new tools and methods to allow them to achieve this smoothly and efficiently.

Distribution Network Operator

A DNO is not an energy supply company. DNOs look after the electricity distribution cables that run under our streets to homes and businesses; energy supply companies sell us the energy that runs through those cables.

Managed charging

Managed electric vehicle charging is a 'system' that can manage the time and/or rate of charging of one or more electric vehicles. Managed EV charging systems generally consist of three key components; a smart charger, a management system and the service user.

The focus of this Consultation is to seek stakeholder views on an interim technical solution that can be used by network operators to manage infrequent overload events on localised areas of the network as a consequence of increasing numbers of EVs. This technical solution will, in clearly defined circumstances, manage individuals' charging of their EVs, to avoid supply interruption, whilst at the same time minimising the disruption to EV users.

This is an *interim* technical solution which supports wider work on smart systems and flexibility. It aims to deliver a managed and near-immediate emergency response at a local level until such time as either the market is able to deliver a solution, or a permanent network reinforcement option can be implemented. The interim solution can be viewed as an insurance policy to protect against issues caused by unpredictable local clusters of EVs within the next few years.

1.1 The aims of the Consultation

This Consultation seeks feedback from stakeholders on the interim use of residential Managed EV Charging for the protection of the local electricity network.

The primary purpose of this Consultation is to seek stakeholder views on the following:

1. Interim solution – optional and only in the absence of market-led solutions

To highlight the need for an *interim solution* and seek feedback on the method to achieve that. An interim solution would be deployed strictly for emergency use cases until such time as a more market-based solution can be called upon, or a permanent network reinforcement option can be implemented. Essentially, any interim solution would be intended to safeguard the customer against an imminent issue with supply. Feedback received to date is that this interim solution should be optional, i.e.

a customer would need to consent to its implementation. However, we welcome views on this, particularly given the value of this solution in near-fault situations.

This Consultation has a secondary objective, and that is to invite initial stakeholder views on a longer-term solution involving smart meters.

2. Longer-term option of using smart meters to control EV charging rates

This Consultation is also taking the opportunity to seek views on the use of smart meters as a longer-term technical solution for managed EV charging. This option has potential uses for many stakeholders in the energy industry, not just DNOs.

1.2 Smart EV – the project behind the Consultation

This Consultation has been developed under the Smart EV project. The project is delivered by EA Technology on behalf of Scottish and Southern Electricity Networks (SSEN), one of the six GB Distribution Network Operators, with the support of the other GB DNOs.

SSEN, through the Smart EV project and specifically this Consultation, is seeking views on a proposal to implement managed charging technology at customers' premises where the network has faulted, or where network monitoring and analysis shows that there is a high risk of fault due to the number of EVs charging in a local area. Reassuringly, studies done through the Smart EV project have shown that managed charging is likely to have little or no impact on an EV driver's ability to drive to where they need to go the next day[1]. This is not intended to impede demand-side response offerings from a flexible energy market – the interim solution would only come into play if the market is unable to deliver.

Market-led

In this context, 'market-led' is where services are openly sought by DNOs from suppliers to address and manage the situation.

Stakeholder

'Stakeholder' in this context refers to any person, organisation or body with an interest in managed electric vehicle charging.

The Smart EV project is keen to invite views from a wide range of stakeholders. Any technical solution adopted should put the customer first, should encourage innovation and should only be used when absolutely necessary to protect the network and its customers from outages.

[1] Smart EV Use Case and Managed EV charging Impact Report: https://www.eatechnology.com/wp-content/uploads/2018/01/Smart-EV-Managed-EV-Charging-Use-Case-and-Customer-Impact-Report.pdf

1.2.1 Who is issuing this Consultation?

This Consultation is being issued on behalf of SSEN by EA Technology[2], the company contracted by SSEN to deliver the Smart EV project. The Smart EV project is funded by SSEN's Network Innovation Allowance (NIA). It is supported by all six GB DNOs.

Network Innovation Allowance

The NIA is a set allowance each DNO receives from Ofgem as part of their price control. It is used to fund network innovation projects, such as Smart EV.

1.3 The drivers for managed electric vehicle charging

It is worth bearing in mind a number of key industry facts when considering the drivers for managed electric vehicle charging:

- Most networks are historically designed to <3kw
- DNOs do not currently monitor load in detail on a street by street basis
- Low Voltage cables are protected by fuses
- A site visit is required to replace a fuse
- Domestic EV-related upgrade costs are socialised
- Domestic EV charge point connections do not require advance permission

It is likely that we will start to see a rapid increase in electric vehicles (EVs) on our roads, in line with the desires of the UK Government. On average a typical EV being charged at home is equivalent to the additional demand of an entire house. Smart technology interventions can readily manage this additional demand to support clusters, or groups, of EVs on residential streets[3]. Let's consider the projected uptake of EVs, as the backdrop to the need for managed charging. Figure 1 shows the projected uptake of EVs to 2030.

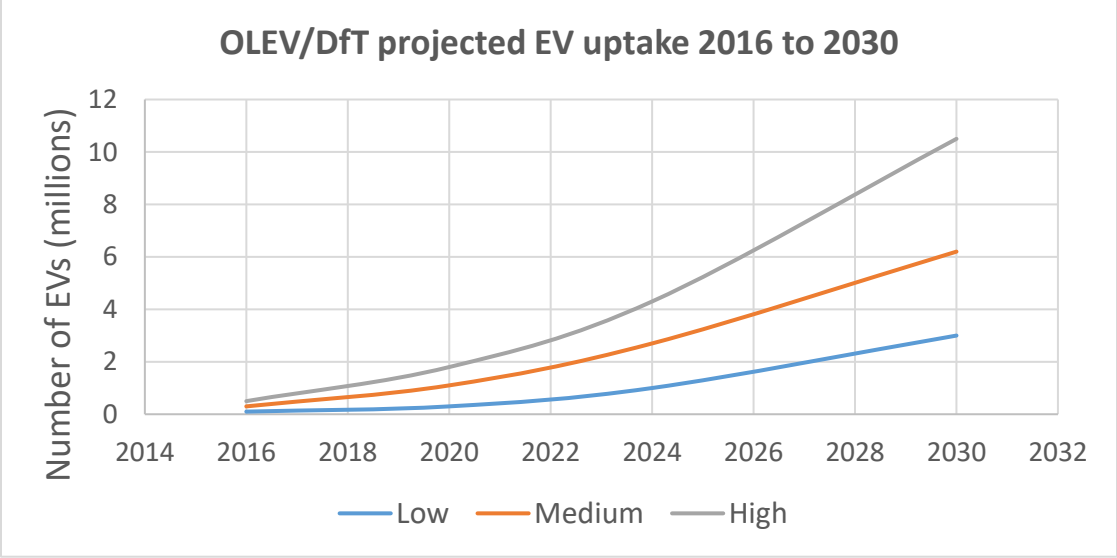

Figure 1: Projected uptake of EVs (source: OLEV/DfT)

[2] https://www.eatechnology.com/

[3] For example see the work being undertaken by Electric Nation to trial domestic smart charging and understand customer acceptance of managed charging: http://www.electricnation.org.uk/

The *My Electric Avenue*[4] project showed that one third of low voltage networks will need reinforcement at between 40 – 70% EV penetration; most forecasts indicate that this will be around 2030. In real terms, that is estimated to equate to roughly 300,000 individual reinforcement actions. Initial modelling work estimated the financial benefits of managed charging at £2.2 billion up to 2050, but we should also be mindful of the associated inconvenience of reinforcement such as digging up local roads and driveways. The effect of clustering is key to understanding the importance of the need for DNOs to be prepared for EV growth as soon as possible. Factors such as socio-economics, housing type, local policy and peer pressure have seen the creation of local clusters, or concentrations, of technology uptake. A good example of this is the clustering of solar panels. This same clustering effect is anticipated with EV uptake and some early signs of the effect can already be seen on GB networks. This concentration means that in some locations the network impact of EVs will be seen far earlier than the national uptake levels would otherwise suggest.

Reinforcement

Reinforcement is the activity undertaken by DNOs to lay more cable underground or replace overhead lines on streets, to upgrade the local electricity network.

The majority of our local electricity networks were designed and built before the growth of EVs could have been predicted. Many do not have sufficient spare capacity to charge large numbers of EVs at our homes. DNOs are taking a range of measures to ensure that their networks are reliable.

Managed EV charging is just one of a suite of initiatives being considered to help to ensure the smooth transition from internal combustion engine to EV.

In the interests of safety, all existing local Low Voltage networks are already fitted with fuses in the substation to prevent the overload of the network. They achieve this by disconnecting all customers in the affected area when an overload occurs. These are effective, however clearly have significant impact when they operate, even if the overload they have managed only lasts a few minutes. Fuse replacement can take up to three hours; this is an inconvenience for customers affected. The interim solution at the heart of this Consultation is aimed at actively managing demand just before the point at which a fuse would operate i.e. in an emergency situation.

Figure 2 shows the additional demand in winter on a local network when an EV is charging. The overload scenario depicted in Figure 2 will generally be an abnormal occurrence, associated with the times where there is more coincident charging than normal during high demand days (e.g. cold evenings when perhaps some customers use supplementary electric heating). On these rare occasions where the local (Low Voltage) network is about to reach capacity, Managed EV Charging can be used as an emergency measure to alleviate the peak. For minimal shift, or even pause, in charging patterns, customers and the network can realise maximum benefit – the lights stay on and the EV still gets enough charge for travel that night or the next day.

[4] http://myelectricavenue.info/

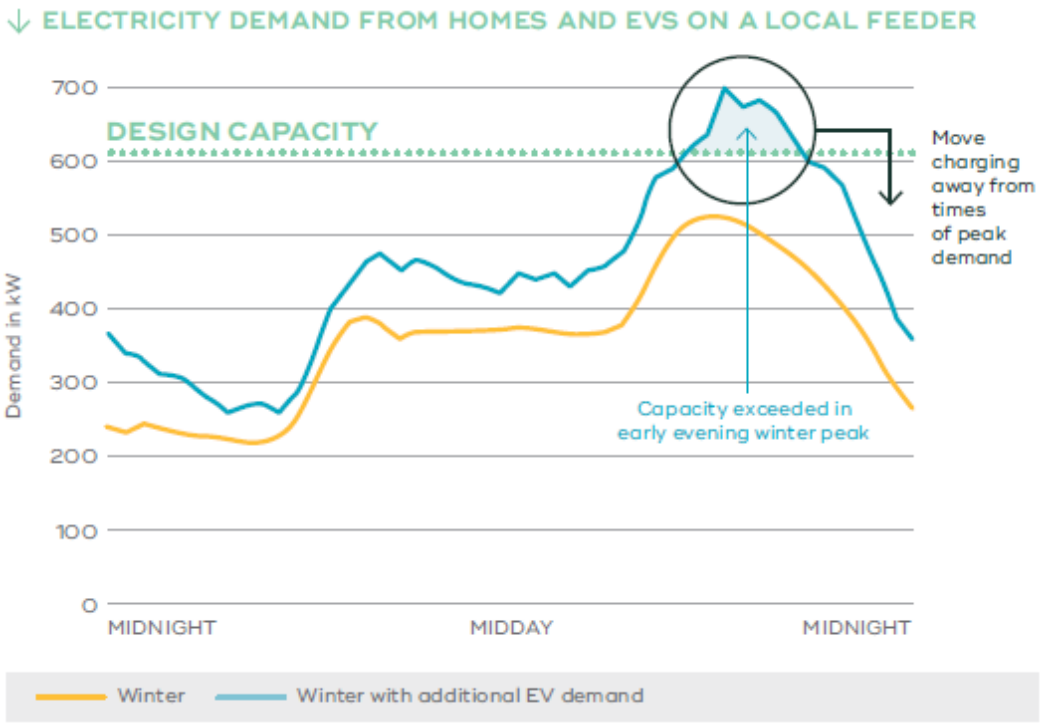

Figure 2: Graph of electricity demand increase due to EVs (source: Electric Nation's Smart Charging: A brief guide to managed electric vehicle home charging)[5]

A key consideration relating to clusters is that at a local level where small numbers of customers are affecting the demand on the network, the usual "average" daily load profile of domestic customers may not apply; effectively, the "Rule of Large Numbers" is not applicable. This means that the demand profiles associated with local EV clusters may be particularly volatile and subject to occasional peaks throughout the year.

1.4 The Impact of Managed Charging on Customers

Under the Smart EV project, a customer impact assessment has been undertaken to understand the likely impact of managed charging on EV drivers. The results from this modelling exercise show that the number of EVs that can safely charge from the local network can be substantially increased with small amounts of charge management.

[5] http://www.electricnation.org.uk/wp-content/uploads/2016/08/EN-Smart-Charging-Guide-Summary-SCREEN.pdf

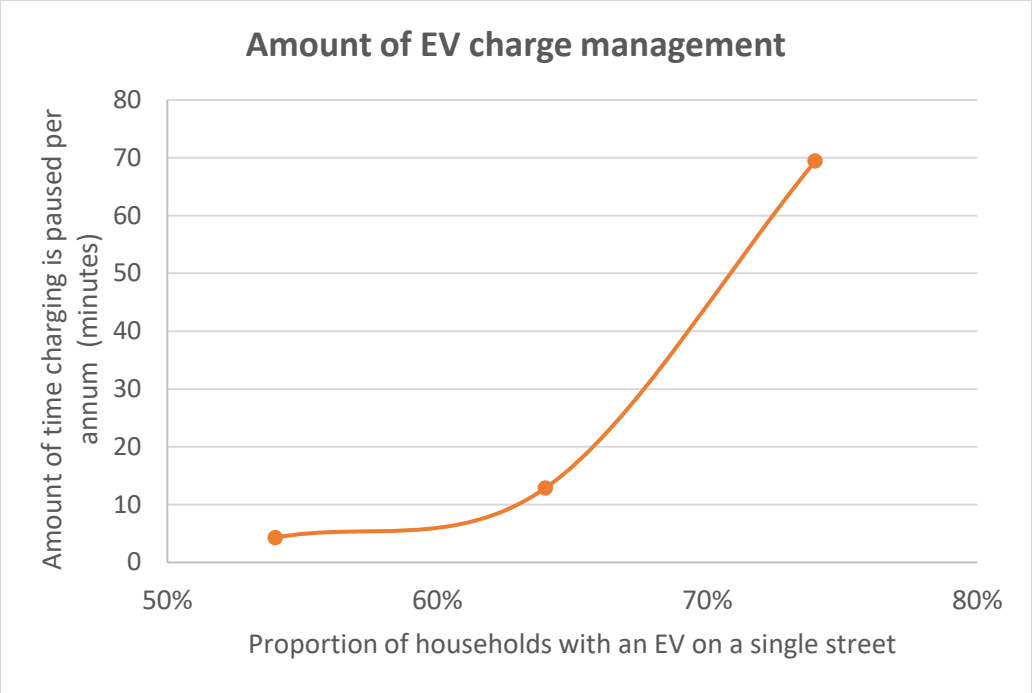

Figure 3: Example of the amount of charge deferral needed to increase the number of EVs that a network can accommodate

The analysis shows that each charge management event would typically be of short duration (less than 30 minutes) and, within each event, would usually still permit at least half the charging rate. This means that managed charging for the protection of the local electricity network is likely to have negligible impact on an EV driver's ability to drive as desired after a managed charging event has taken place.

Figure 3 shows an example of the customer impact modelling for a specific area of network. In this case the proportion of households that could charge without causing an overload is around 50%, yet with charge management equivalent to pausing the charging for just over one hour per annum, an additional 20% can be accommodated. **In other words, if we take a suburban housing estate with 100 households, and 50 of those households have EVs, the local electricity network may be at its capacity limit. If we can reduce, or pause, the charge rate for around one hour, it will enable an additional 20 EVs to charge before capacity is reached.**

Capacity limit

Electricity networks were designed to accommodate the household electricity load at the time when those houses were built; the capacity limit was set to reflect assumed maximum electricity use at that time; EVs are a new, large and sustained additional demand that can take local electricity networks up to or beyond their capacity limit, hence the need for a solution.

2 Managed EV Charging: The Interim Solution and how it would be used

The focus of this Consultation is an interim technical solution to enable managed EV charging to minimise the risks of overload in early clusters of EVs. The interim solution is intended to be a short-term, economic, tactical solution that can be technically ready within 12-18 months from the DNO going out to procurement to seek suppliers for equipment aligned to the description of the solution.

Importantly, this interim solution would be deployed only on networks that have either lost power, or are at high risk of losing power, and where other solutions have been ruled out.

In parallel, SSEN will continue to assess all emerging market mechanisms.

We envisage the interim solution would consist of three main components:

- A substation controller: monitors network loading and send signals to reduce or pause EV charging when the network is in danger of overload
- An EV charge controller: installed in the customer's home this receives signals to pause or curtail charging
- Back-office: this would manage operation of the substation and EV charge controllers and record data to ensure the system is being used in line with the governance criteria described below

Figure 4 shows these components; for more detail see the Annex.

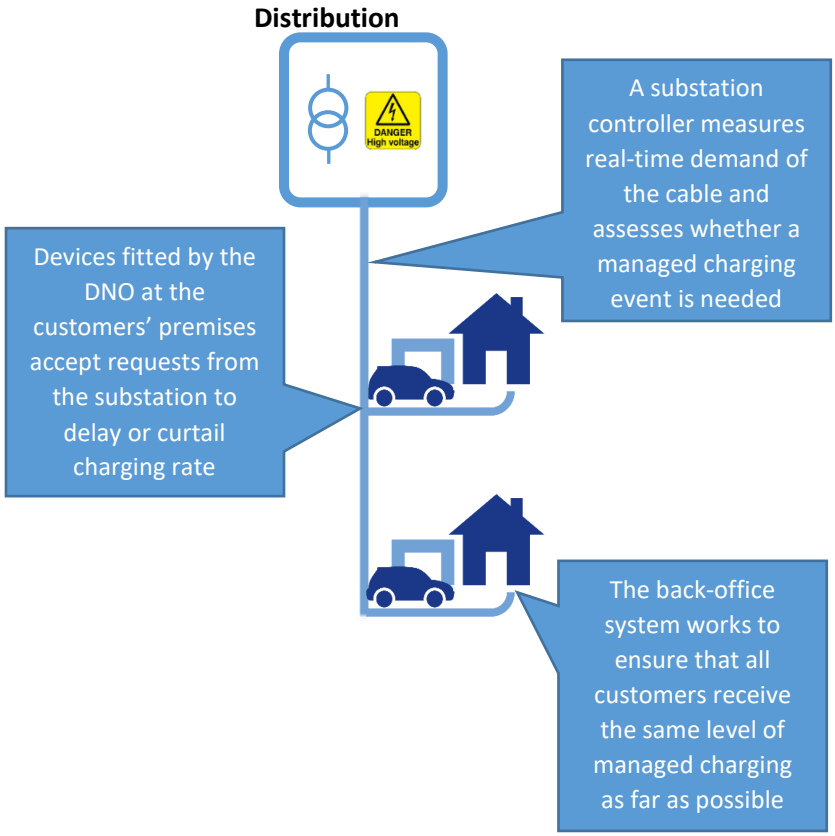

Figure 4: Graphic of the interim Managed EV Charging (MEVC) solution

2.1 The Use Case

It is recognised that solutions to manage overloads on DNO networks should be provided through market-led approaches in the future. Ofgem and BEIS's Smart Systems and Flexibility Plan sets expectations that domestic consumers should be able to offer flexibility services, including via EVs. The industry is progressing with key enablers for this (including smart meter roll out) and innovative business models to facilitate demand side response services are emerging. Through the Open Networks project, DNOs are working towards business as usual procurement of flexibility services as an alternative to reinforcement. Ofgem's current work on reform of network access rights and forward-looking charges could also lead to changes which influence uptake and use of EVs in ways that reduce local network constraints or alter reinforcement signals. However, this work is all ongoing and interactive, hence there is uncertainty about when and how markets and services will develop.

SSEN is actively participating in the work discussed above. Engagement with potential providers of market-based charging management solutions during the Smart EV project through Energy UK and BEAMA has not yet revealed any options to meet DNOs' very locally specific requirements, but we continue to monitor this position, both now and going forward. For now, the interim solution described in this consultation is needed due to the *risk* that market-led mechanisms may not reach maturity before issues are encountered. There is also the risk that market-led solutions cannot yet be deployed quickly enough to respond to power outages.

As such, the interim solution would only be deployed in the following critical situations, in the absence of other, market-led solutions:

- **Fault:** Where the number of EVs on a street is such that the network has already reached its load capacity limits, and have already lost supply; or
- **Pre-fault:** Circuits at high risk of overload, see section 2.1.1

DNOs are expected to be pro-active in the management of their networks and it is recognised that improved visibility of the local (Low Voltage) networks will be an increasingly important requirement in the future. The description below explains how the interim solution would be used, and how it fits into the overall staged process of demand / fault management on the local network:

1. Modelling work will be carried out to highlight where the network may become stressed in the near future as EV uptake grows. This will take into account existing spare network capacity, the existing level of EV uptake and the anticipated future uptake given the nature of the characteristics of the local customers and real estate.
2. Monitoring will be deployed at local "at risk" substations to gain a deeper insight into the prospect of overloads.
3. Where the risk of overload is severe, the DNO will deploy the MEVC and initiate a permanent reinforcement or other smart/market-led solution, where this is appropriate.
4. Where the monitoring alerts the DNO to a high risk of overload, the DNO will deploy the MEVC and continue to monitor the solution against the criteria stated in the Annex (A-2). Where the risk is medium the DNO will continue to monitor network demand.
5. The interim solution may be deployed where an overload related fault may develop. During a fault which is suspected to be caused by overload, for example where the substation fuse has blown but there is no sign of damage to the network, the DNO may seek to install the interim MEVC solution immediately to avert the risk of further outages due to overload.

In all cases, operatives working on behalf of the DNO would discuss the installation of the interim solution with the customer and seek their consent. From decades of experience of liaising with customers during faults, it is believed that the vast majority of customers would be happy to assist the DNO, for the benefit of themselves and their neighbours, who would otherwise be affected by power interruptions. Similar discussion and co-operation is regularly shown by customers in situations such as locating temporary generators, undertaking excavation work and undertaking tests for fault finding.

It is recognised that clear and effective messaging to customers, to allay any fears, will be important.

2.1.1 Identification and management of "at risk" networks

Before deployment of the interim solution on networks following the "Pre-Fault" use case, it is recognised that DNOs would need to implement an analytical method of assessing the risk of overloads on local (low voltage) networks.

This analysis would likely be a risk-based approach that considers current substation demand patterns, quantity of data and potential for changes in EV ownership, perhaps through the use of demographic datasets, to define a probability of overload in the coming months.

This analysis could form a key enabler, an alert ahead of need, to signal to the market that a solution is required, which may ultimately avert the need for the DNO-led interim solution.

DNOs should use this type of analysis to proactively manage their networks to avert power outage risks, and thus the need for the interim solution, before they occur. However, there will be cases where due to unpredictable circumstances (e.g. rapid EV uptake within a year), DNOs are prevented from acting more proactively. The interim solution is therefore intended as a backstop and only deployed where there are timescale issues in deploying other solutions.

2.1.2 Existing Alternative Options

It is important to consider the alternative solutions that DNOs currently have at their disposal which could be used to manage demands on local networks following power outages due to overloads, remembering that the scenario is one of a fuse operating and an immediate solution being required to avoid a repeated loss of power in the area:

- Diesel generators – these can be reasonably rapidly deployed to back feed electricity onto networks which are under stress, however they are costly to operate, noisy and polluting and clearly misaligned with the aims of our transition to EVs.
- Asking customers to disconnect – in the event of a power outage due to overload, customers could be asked to temporarily disconnect their vehicles to allow the power to be safely restored, however, this is only a short-term fix as customers could not be expected to find longer-term alternative charging arrangements.
- Asking customers to manage their EV charging manually – customers could be asked to limit charging or other domestic loads during local peak times, however, without a system to manage their charging, this is very inconvenient, and it is unfair to put the onus on the customer; also the response rates are likely to be poor. As stated earlier the nature of the peaks on a local network are often very different from the national average and as such providing simple time bands to avoid may not be effective in all cases.

Additionally, it is possible, as has been demonstrated by some automotive manufacturers, that the vehicle charge rate can be managed remotely by interfacing to the vehicle through the telematics/communications systems and on-board equipment. The challenge to this approach as an alternative mechanism, again stressing the issue of locality, is that the energy industry would need to impose strict standards to allow inter-operability of charge management between various makes of vehicle. These standards would very likely be specific to GB. As vehicles are designed to an international market, this route has been discounted as a feasible option for this use case, in particular given the desire to have a solution available swiftly.

2.1.3 An EV-only Solution

It should be noted that the focus of the Smart EV project and therefore this Consultation is on managing EV uptake on local electricity networks. We know that EVs are a critical load and that they will have an impact on low voltage (LV) networks as evidenced by the My Electric Avenue project, that demonstrated the need for intervention across one third of GB LV networks when EVs reach a penetration rate of between 40 – 70%. Whilst there are other intensive loads, such as heat pumps, to which the interim solution could be applied, these other loads are outside the scope of this Consultation.

2.2 Governance arrangements

SSEN recognises that there will need to be specific governance arrangements put in place to give assurance to the customer and to the market in general that the interim MEVC solution will be deployed within a fair and equitable set of parameters. These are explored below. Reader views are sought in the subsequent questions in section 4. As a starting point to aid feedback, SSEN proposes the following metrics and limitations on the use of an interim MEVC solution:

Maximum amount of charge management within 24 hours: the system would not be used to limit charging for more than the equivalent of each charger being switched off for **two hours** on any given day for any individual connected customer in a managed zone.

Maximum amount of charge management within a 30-day period: the system would not be used to limit charging for more than the equivalent of each charger being switched off for **eight hours** within a **30-day period**.

Maximum period of operation: once the interim MEVC solution is operational (i.e. has been used to manage EV demand on a local network), the DNO would have a maximum of **18 months** to reinforce, or otherwise resolve the constraint through smart or market-based solutions.

Additionally, the system would need to consider the protection of sensitive data. It is believed that the interim solution could be developed such that no sensitive information is generated or stored beyond that required to monitor the amount of charge limiting being applied.

2.2.1 Test for market-based solutions

DNOs will be obliged to periodically test the market to assess whether a demand-side response service is available to avoid continued reliance on the interim solution. This should manage any concern that a DNO-led interim solution, once deployed, could block the prospect of an enduring market-based solution from taking hold. We appreciate that more work needs to be done to describe this process in detail, however at this point, this is seen as a two-stage mechanism:

- A periodic general assessment of market offerings to understand capability and how service providers could offer solutions aligned with the use cases;
- Sharing of specific information on network areas, ideally ahead of need, to give the market warning that solutions are likely to be required linked to specific network areas/geographies.

We recognise that going forward market models-based solutions will become the preferred response. It is therefore envisaged that any interim solution would be decommissioned once it can be shown that the same result can be achieved through a reliable, robust market offering.

2.2.2 Parameters of Use – Customer Safeguards

As an interim solution, it is important that the domestic customer and the market in general is assured that there are limitations on use. Key usage parameters and customer safeguards will need to be put in place, i.e.:

- The interim solution is an optional programme of roll-out only at the specific point of local network need.
- The DNO would only deploy the interim solution with customer consent; any consent given e.g. by signature would be stored in accordance with data protection laws under General Data Protection Regulation. Consent in this context means that the DNO would seek customer consent ahead of installation of the MEVC, rather than consent for each separate charge management event.
- The interim solution would apply to existing and new customers who are retrofitting EV chargers.

2.2.3 Customer Consent

We have noted in sections 2.1. and 2.2.2 that the MEVC would only be deployed where customer consent has been granted, ahead of deployment of the MEVC. To recap on the use cases, the DNO would only seek customer consent for deployment of the interim MEVC in two critical scenarios: in order to protect the network from fault, where the number of EVs on a street is such that the network has already reached its load capacity limits, and have already lost supply; or at pre-fault stage, where circuits with high EV uptake and high uncertainty over the risk of overload. Early indications from EV drivers interviewed as part of the Smart EV project for the purposes of the project's Customer Messaging Strategy[6], are that customers are likely to agree to having their charging managed for the purposes of network protection, where the impact is negligible. The customer impact of managed charging is explored in section 1.4; modelling has determined that the impact of charge management will be minimal and should not impact an EV driver's journey needs.

Where a minority of customers do not consent to deployment, the interim MEVC is still likely to be a viable solution, although for each non-consenting customer would mean that other customers will be impacted more. Careful customer messaging will be key to not only ensure acceptance but also to ensure customers are comfortable with the solution. SSEN is taking steps to understand best routes to engaging with the customer in this regard, as per the Smart EV Customer Messaging Strategy that is intended as a starting point to this engagement.

[6] See the Smart EV Customer Messaging Strategy: https://www.eatechnology.com/projects/smart-ev/

2.2.4 Customer Complaints

Any customer complaint relating to the MEVC will be handled in accordance with existing customer complaints procedures and align with guaranteed standards, with the ombudsman able to intervene if the DNO is still unable to respond satisfactorily.

Clear information to reinforce the procedure would be provided to customers at the point of deployment of the interim solution.

As the solution is optional for customers, it should therefore be possible for customers to rescind their consent, in which case the DNO would be obliged to decommission the household equipment and 'make good'.

2.2.5 Compensation to Customers

We are also consulting on the prospect of providing compensation for customers, which could be linked to the level of charge management that has been applied.

SSEN's current view is that it is not appropriate to compensate EV owners for the relatively de-minimus level of charge management that this solution requires, when controlled by clear governance arrangements. Our principle rationale for this view is that under existing charging arrangements, domestic customers do not pay for the upgrade of the network when they connect an EV charger (of 7kW rating or below), instead any network upgrade costs are socialised at the expense of all GB electricity customers; this solution is aiming to minimise these costs.

It should be noted that if a customer chooses to apply for a connection upgrade for a fast charger they would pay the cost of that upgrade, and as such, the MEVC would not be required or appropriate.

SSEN does recognise that customers consenting to the installation of this solution are being inconvenienced. There is also a cost to the customer in terms of the power draw from any equipment installed at the customer premises. We are therefore seeking views on the appropriateness, application and suggested levels of compensation.

In all cases it will be incumbent on the DNO to seek a more enduring solution through available market mechanisms.

3 Key facts about this Consultation

The development of this Consultation has been overseen by a Steering Group of representative members from Citizens Advice, Government, automotive, electric vehicle supply chain, power engineering and utility sectors. The Steering Group has met either face-to-face or via teleconference at least eight times during the course of the Smart EV project to date, its first meeting being held in June 2016. The role of the Steering Group has been to review key project deliverables including a suite of technical reports, the first Consultation (December 2016), and the Customer Messaging Strategy. All project outputs can be found here: https://www.eatechnology.com/projects/smart-ev/.

For the purposes of this Consultation document, the Steering Group has offered feedback on earlier drafts. This feedback has been incorporated into this final document where feasible, along with feedback received from Ofgem and the Department for Business, Energy & Industrial Strategy (BEIS). This Consultation and its Steering Group recognises the wider consultative work through Ofgem, BEIS, and the Office for Low Emission Vehicles (OLEV) on wider market mechanisms to facilitate smart and low carbon technologies, including managed charging for plug-in vehicles[7]. It should be noted that final decisions on the content of the Consultation and the technical solutions presented have been retained by SSEN and EA Technology.

SSEN and EA Technology would like to extend sincere thanks to the Steering Group members, to Ofgem, BEIS and OLEV, for their invaluable input. The Steering Group members are listed below.

3.1 Who Should Respond?

The ethos behind the Consultation is to facilitate EV uptake for the benefit of Great Britain. We encourage and welcome your views as a valued stakeholder with an interest in low carbon energy and transport. In particular, we anticipate that this Consultation will be of interest to the Electric Vehicle Supply Equipment (EVSE) supply chain (which encompasses EV charging equipment manufacturers, suppliers and installers), consumer bodies, household smart technology providers, Distribution Network Operators (DNOs), electricity suppliers and automotive OEMs.

[7] In particular, the Automated and Electric Vehicles Bill: https://services.parliament.uk/bills/2017-19/automatedandelectricvehicles.html

3.2 Timescales

This Consultation opened on 23 March 2018. It will close at midnight on 30 April 2018.

3.3 How to Respond

Please submit your response to SmartEV@eatechnology.com.

For alternative response methods, or if you have any queries, please contact Gill Nowell on 0151 347 2359 or gill.nowell@eatechnology.com.

All responses will be treated in confidence and personal details anonymised for Consultation reporting purposes. All information supplied in response to this consultation will be used solely for the Smart EV project and not for any other purpose.

3.4 Consultation Format

Section 4: Questions on the interim solution for managed electric vehicle charging.

Section 6: Questions on the possible longer-term solution.

For background, it may help to first read through the 'Recommended Reading' listed in section 3.5.

3.5 Recommended reading

- My Electric Avenue Summary Report (Impact of EV Uptake)
- Smart EV Managed EV Charging Use Case and Customer Impact Report

You may also like to read:

- Smart EV Customer Messaging Strategy

4 The Interim Solution – Consultation Questions

Please respond to these questions as fully as possible and provide evidence for your response where feasible and appropriate. Feel free to use this editable pdf for your response or submit your response on a Word document or by email. Whichever your method of response, please let us have your contact details:

Name	
Job title	
Organisation	
Email	
Telephone number	
Sector (Auto OEM & supply chain, Charging point OEM & supply chain, Consumer body, DNO, Energy Supplier, Government body, academic, Other (please describe)	
How did you hear about this Consultation?	

Question 1	Do you agree that the interim solution, deployed within the use cases and governance arrangements described, would be in customers' best interest?
Answer	Yes [Please explain why]

	No [Please explain why]

Question 2	Do you believe that the market (i.e. technical readiness of potential manufacturers / suppliers of the interim solution) is mature enough to supply the interim solution within the next two years at roughly the costs outlined?
Answer	Yes [Please explain why]

	No [Please explain why]

Question 3	The use case of the interim solution has two key requirements: 1. Rapid deployment in any street (within a day). 2. Available to deploy at required volumes (i.e. a reasonable proportion of households on a given street) within the next 2 years Are you aware of any demand-side response market-led solutions/services that could be provided to DNOs that could viably and economically meet these criteria at a local level that we may have overlooked or discounted prematurely?
Answer	Yes [Please explain why]

	No [Please explain why]

Question 4	Do you believe that the interim solution is technically feasible to provide a robust method to manage demands on local networks?
Answer	Yes [Please explain why]

	No [Please explain why]

Question 5	Do you agree that DNOs should be able to deploy the interim solution, or a variant of it, as described in the use cases in section 2.1?
Answer	Yes [Please explain why]

	No [Please explain why]

Question 6	Do you agree that the interim solution should be optional, even in emergency situations, i.e. that the customer should give consent to its use?
Answer	Yes [Please explain why]

	No [Please explain why]

Question 7	Do you believe there should be any additional safeguards for customers, other than those cited in section 2.2? Do you have any comments on the governance arrangements outlined?
Answer	Yes [Please explain why]

	No [Please explain why]

Question 8	Do you believe that customers should be compensated for the installation and/or operation of an interim managed charging solution? If so, please comment on how you believe the compensation could be applied, for example, whether the compensation should be a one-off “inconvenience” sum or perhaps more directly related to the amount of charge management applied.
Answer	Yes [Please explain why]

	No [Please explain why]

Question 9	Do you have any comments on proposals to test for market-based solutions as described in section 2.2.1?
Answer	

Question 10	Would you like to offer any general feedback on the interim solution?
Answer	

5 Managed EV Charging: A Possible Longer-term Solution

5.1 Background

The UK is progressing with the rollout of smart meters and the technical specification includes features that may be used to manage household demand. An option exists to further build on the infrastructure that could enable DNOs and other energy companies in the supply chain to use the infrastructure to manage demands.

Smart meter

A smart meter is a new kind of gas and electricity meter that can digitally send meter readings to your energy supplier for more accurate energy bills. Smart meters come with in home displays, so you can better understand your energy usage.

We recognise that using the infrastructure that supports smart meters for managed EV charging could offer the following benefits:

SMETS1

Smart Metering Equipment Technical Specification: SMETS1 is the first generation of smart meter technology.

- A potentially lower overall cost of wide-scale implementation due to the use of existing infrastructure
- Security environment that is safe, robust and well defined
- Consistent technical standard to maximise interoperability between household and back-office systems
- Use of a communications infrastructure that has clear quality of service metrics to reliably 99% of GB
- Integration of managed EV charging within the familiar smart meter environment could help with consumer confidence and trust.

Additionally, the industry, overseen by our energy regulator, Ofgem, is working on reform of network access and forward-looking charges[8], and BEIS has published a policy paper on the future energy system[9] which includes removing barriers to smart technologies, enabling smart homes and businesses and improving access to energy markets. Developing and supporting the mass adoption of technology to allow EV charge flexibility could be a key enabler for these policy aspirations.

SMETS2

Smart Metering Equipment Technical Specification: SMETS2 is the second generation of smart meters; it differs from SMETS1 in that it has functionality to support DCC, meter variants and a standard smart meter Home Area Network.

Therefore, under this Consultation we wish to take the opportunity to seek feedback on the prospect of using smart meter infrastructure for managed EV charging (by any party, not just DNOs) as a long-term option compatible with a range of market-based charging models. In pre-consultation with the BEIS Smart Meter team and the Smart EV project Steering Group, a desire amongst some stakeholders emerged to explore the use of smart meters as a platform by which to manage EV charging – particularly in a future world where the majority of the UK population has second generation smart meters installed (SMETS2), and some of our home energy devices can be connected.

[8] https://www.ofgem.gov.uk/electricity/transmission-networks/charging/reform-network-access-and-forward-looking-charges

[9] https://www.gov.uk/government/publications/upgrading-our-energy-system-smart-systems-and-flexibility-plan

The Smart EV project team has explored the technical viability of using smart meters to manage EV charging demand. This option could contribute to the requirement for all charge points to be smart, as set out in the recent Automated and Electric Vehicles Bill. We present this option here and seek feedback to better understand the implications if it were decided to roll-out the solution.

5.2 Solution Description

Smart meter equipment sets up a wireless Home Area Network (HAN) which allows ancillary devices to communicate with each other within the home. Smart EV chargers could be developed which have the capability to connect onto the HAN and receive signals to prompt changes to the rate of EV charging; see Figure 5.

Home Area Network

A HAN is a network that is deployed and operated within a small boundary, typically a house or small office/home office (SOHO). It enables the communication and sharing of resources (like the Internet) between computers, mobile and other devices over a network connection.

With customer consent, this option could technically allow multiple parties to influence the rate of charging of EVs. Such parties could be:

- Energy suppliers, who may benefit from modifying the demand of their customer base in line with energy price drivers
- Aggregators / third parties, who are interested in using the solution to help balance supply and demand participating in System Operator services
- Network operators, who may use the solution to maintain network resilience.

A consistent, long-term solution may allow the benefits to be ultimately passed onto customers in the form of bill savings.

There is keen interest in the prospect of using existing smart meter infrastructure for EV charge management as:

- There is the opportunity to leverage the investment being made to rollout the infrastructure
- The security framework is comprehensive and was developed with oversight by the National Cyber Security Centre
- The solution would use the existing smart meter communications platform, through the Data Communications Company (DCC), which carries minimal incremental cost
- This solution, initially geared towards EVs, could also pave the way for demand management of other appliance types, giving customers the choice of which appliance they wish to manage.

Data Communications Company

The DCC manages the smart metering data and communications infrastructure, under licence from Government.

To achieve management of smart chargers through the HAN, it is understood that a new or modified interface would be required with the DCC to permit end-to-end control from (e.g.) DNOs through to individual EV chargers. It is also recognised that governance changes would be needed to allow this, which are currently being investigated through the Smart Energy Code (the governance arrangements for Smart Meters).

Smart Energy Code

The SEC is a multi-Party agreement which defines the rights and obligations of energy suppliers, network operators and other relevant parties involved in the end to end management of smart metering in Great Britain.

This long-term solution would involve a change to the technical requirements for EV chargers installed at domestic premises. EV chargers would need the ability to connect onto the HAN and receive and act on instructions.

The instruction would likely be in the form of the maximum rate (amperage) at which the charger can operate.

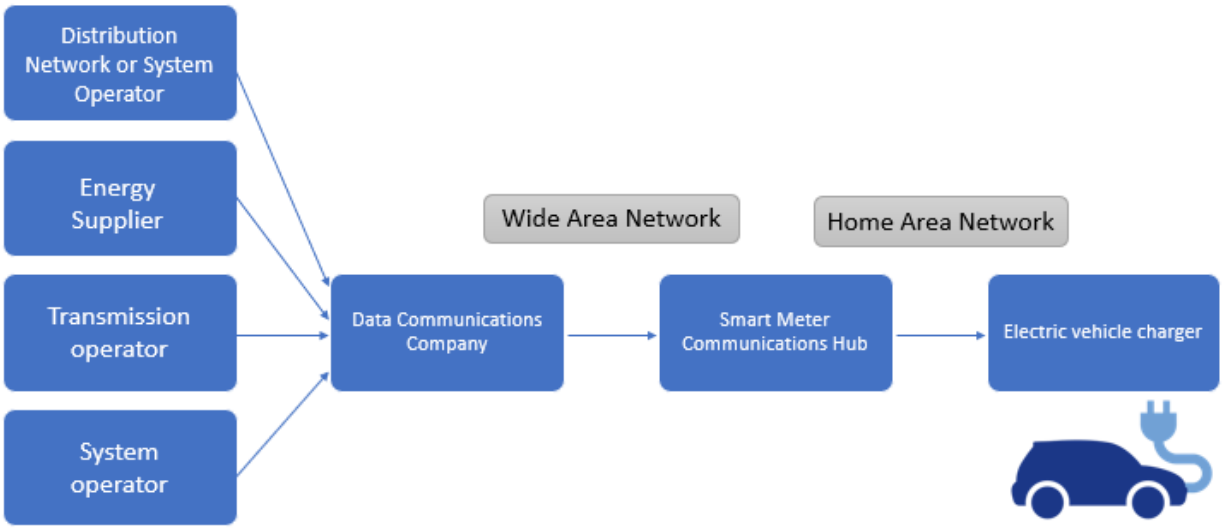

Figure 5: HAN Controlled Smart Charger System Diagram

For this solution to be utilised for protection of distribution networks, the DNOs would need to develop an interface with the DCC to allow them to pass signals, derived from their monitoring solutions, to command chargers to temporarily reduce demand. This signal would likely contain a list of all relevant Customer IDs on the relevant section of network.

Flexibility

Is to modify generation and / or consumption patterns in reaction to an external signal (such as a change in price) to provide a service within the energy system' (Ofgem).

The interfaces between the DCC through to the charger would need to be developed. It is anticipated that this signal would allow proportional control i.e. sending the charger a parameter (e.g. maximum amperage) rather than an on/off signal. Should this solution be investigated further, it would be important to design the system such that it is not EV-specific, and that the same technology/interfacing arrangements can be readily applied to a range of household appliance types. As more flexible energy devices become prevalent, this would give the customer a degree of choice over which appliance they wish to respond to calls for flexibility. For example, this would allow a customer to choose to discharge a home energy storage system rather than reduce EV charging rate if desired.

Home energy storage system

Home energy storage systems store electricity and heat, so you can use the energy when you need it. If you already have home renewable energy, it can reduce bills. Most offer smart operation so you can monitor and manage your energy use more efficiently.

A clear benefit to this solution is that the communications infrastructure is being separately provided by the DCC under the Smart Metering programme. Also, the security arrangements have been developed following recommendations by GCHQ in consideration that, aggregated, the system is critical national infrastructure.

Critical national infrastructure

Describes assets that are essential for the functioning of a society and economy e.g. facilities, systems, sites, property, information, people, networks and processes.

5.2.1 Smart Energy Code Modification

At present, the governance arrangements for smart meters do not permit DNOs the technical ability to manage the load of household appliances through smart meter infrastructure – only energy suppliers are currently permitted to do this. The fact this ability is only available to suppliers was identified by the DECC/Ofgem Smart Grid Forum as a potential limiting factor on realising value of demand side response, which should be further investigated [10]. SSEN has raised a modification proposal with the Smart Energy Code to investigate the prospect of DNOs having access to control functions to manage EV charging equipment connected to smart meter infrastructure. The modification reference is SECMP0046.

It should be noted that SSEN is not seeking to control load using smart meter infrastructure, nor is any preference of approach decided at this stage. The modification has been raised to *investigate* the process and it has become apparent that the most efficient way to fully understand the implications is to raise a modification. The modification process itself is a relatively lengthy activity and is specifically designed to engage and seek input from all Smart Energy Code members.

5.2.2 Roll-out and Timescale Considerations

It is considered that this solution is a longer-term option, the timescales being dictated by the following factors:

- The solution is dependent upon the widescale rollout of SMETS2 meters to those households with EVs, such that there is a suitable proportion of EV chargers that could be managed
- The timescale to develop specifications and/or standards for EV charging equipment, to describe the required functionality and interfacing requirements to smart meter infrastructure

[10] The Customer-focused smart grid: Next steps for regulatory policy and commercial issues in GB. Report of Work Stream Six of the Smart Grid Forum, 2015

- The speed of development by EV charging equipment manufacturers to develop products aligning to the new specification
- Allowing the EV charging equipment supply chain, including installers, a grace period to allow them to exhaust existing stock of “non-compliant” charging equipment
- Specifically for DNO access to HAN-controlled EV chargers, working through the SEC modification process to permit DNOs access is expected to take at least two years

There is also the prospect that SMETS2 installations are targeted towards customers who drive EVs which may have an impact on the timescales of when there is a useful proportion of load that can be influenced.

It is expected that the shortest timescale for an effective implementation of managed charging following this solution architecture is three years. The governance process itself will also take time but is expected to be shorter than the above factors.

6 The Possible Longer-term Solution – Consultation Questions

Question 10	Do you believe that the energy industry should make steps to implement the smart meter solution in the best long-term interest of energy consumers?
Answer	Yes [Please explain why]
	No [Please explain why]

Question 11	Do you have any comments of the technical feasibility of the described longer-term solution using smart meter infrastructure?
Answer	

Question 12	It is considered that there could be significant benefits to using smart meter infrastructure (e.g. enhanced security, use of existing communication facilities, robust governance), however, there may be implications around fostering innovation and promoting other market-led alternatives. Do you believe the benefits of using smart meter infrastructure for managing EV charging outweigh any potential drawbacks?
Answer	

Question 13	Would you like to offer any general feedback on the possible longer-term solution?
Answer	

7 Timing and next steps

This Consultation opened on 23 March 2018 and will close at midnight on 30 April 2018. The Consultation responses will be analysed with the aim of informing the next steps and potential for SSEN / other DNOs to move towards a final specification for an interim managed EV charging solution.

This Consultation is a key deliverable under the Smart EV project. The Smart EV project will report to stakeholders and close in August 2018. 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 advise on submission of your Consultation response.

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

ANNEX: The Interim Solution

A-1 Description of the Interim Solution

Curtailment

In this context, it is the reduction or pause of the rate at which the electric vehicle is charging.

The interim Managed EV Charging (MEVC) solution would consist of rapidly deployable hardware and software devices to provide temporary real-time control of demand on Low Voltage networks through curtailment or pausing of EV charging. The solution would monitor demand at the local substation, which would trigger the requirement for demand reduction when load on the local network is above a pre-defined threshold. A signal would be sent to devices at the customer's premises to enact a reduction in charging rate to avert a power outage.

It is envisaged that the system will consist of three main components:

- A substation controller
- An EV charge controller
- Back-office

At this stage, we describe the component functions without being prescriptive over the specific technical methods to allow organisations to innovate and adapt products to meet the requirements.

A-1.1 Substation Controller

The solution would involve the installation of a device in the local distribution substation that measures demand on one or more outgoing cables; this may optionally interface with existing monitoring. The monitoring values would be compared with the maximum capacity of the cable (rating) and voltage design limits to understand whether the cable is subject to overloading. The monitoring and cable rating data would be used to decide whether a managed charging event is needed.

A signal would be generated, either directly by the substation controller or via a back-office system, to action a curtailment of EV charging demand.

The substation controller would define the amount of de-loading required which would be translated into commands to the EV charge controllers.

A-1.2 EV Charge Controller

The EV charge controller(s) would be devices installed by the DNO at customers' premises, connected to the existing EV charging infrastructure. They would have systems to permit communications between either the back-office or the substation controller.

The EV charge controllers would receive curtailment signals from the back-office or the substation controller and act to reduce or pause the charging rate. The charge controllers would also have systems in place such that should communications with the substation or back-office be lost, any charge restrictions are automatically lifted after a pre-determined period of time.

A-1.3 Back-Office

It is likely that the successful implementation of the solution would require a back-office system to allow configuration and manage the operation of the substation controller and EV charge controllers. The back-

office function would also likely record the operation of the system to facilitate reporting on the governance arrangements.

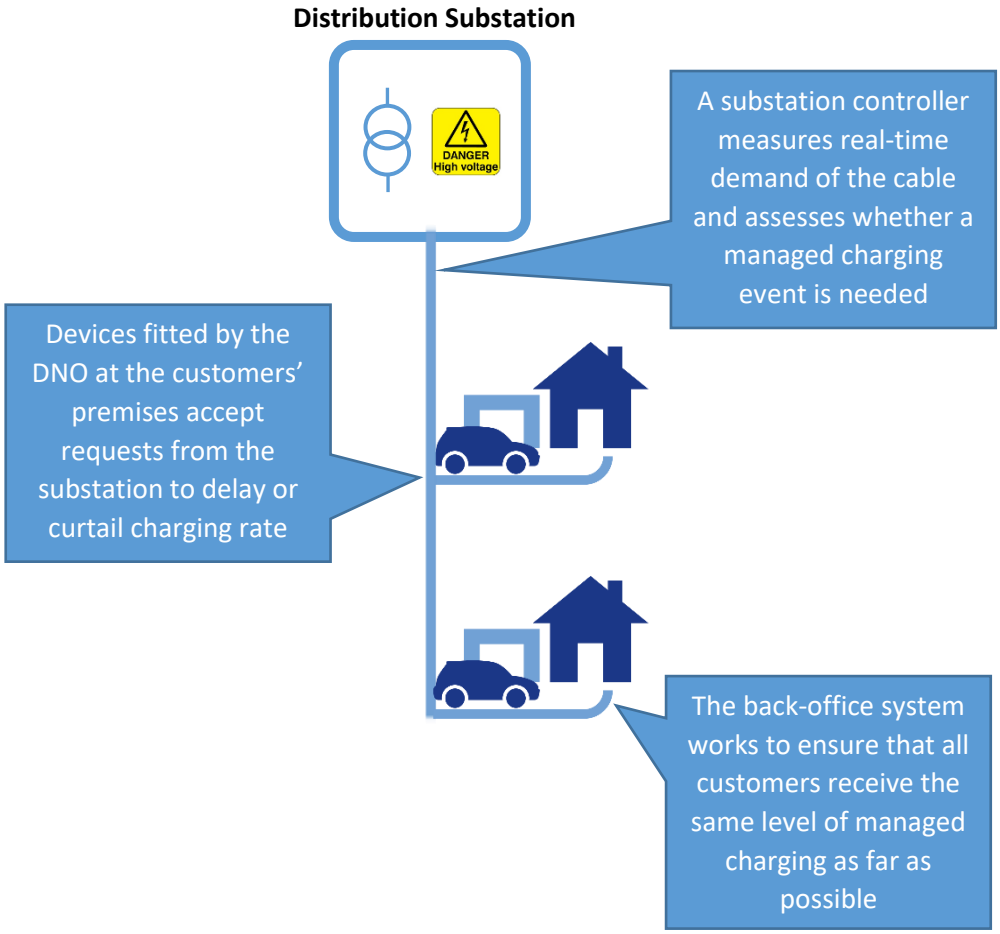

Figure A-1: Graphic of the interim Managed EV Charging (MEVC) solution

A-2 Feature Set

The interim MEVC solution would be procured from the market against a specification, which would ultimately be informed by this Consultation. At this stage we can describe the high-level feature set for the solution:

Reduce or pause the charging rate: the system will have the ability to change the rate of charging, which may be through temporary disconnection of the power supply to charging equipment, or through other techniques to instruct the charger or vehicle to transfer less power.

Rapid deployment: the overall solution would need to be rapid to deploy to minimise the inconvenience to customers.

Deployable to most domestic EV chargers: the solution should be capable of being installed on a high proportion of domestic EV chargers.

Temporary opt-out mechanism: the system should have the ability to permit the customer to temporarily opt-out of charge management where their circumstances dictate that they need uninterrupted charging.

Automated operation: the system should not rely on customer interaction to operate. It may be desirable in some circumstances for the customer to interact with the system, (e.g. to opt-out where necessary) but the system should be largely autonomous.

Be proportional to need: the system should have the ability to estimate the amount of charge management needed and seek to only limit charging when strictly necessary to maintain a safe network.

Act rapidly: the system should be able to respond to overloads within around ten minutes.

Act fairly: the system would need to manage the chargers such that customers are treated fairly and no customer(s) are subject to more intensive charge management than others.

Operational recording: the system will need to include features to record key metrics for the system. This may include a tally of the amount of charge management a local network has needed (to assess for over-use) and tally the amount of charge management that individuals have provided to keep within the governance arrangements.

Transparency of operation: The system should indicate clearly to the customer if the charger is currently subject to a load management intervention.

Resilience: it is recognised that communication links can be unreliable is certain circumstances. The solution would need to have resilience features such that the effects of patchy communication links are minimised as far as possible.

A-2.1 Potential deployment costs

The procurement of the interim solution would ultimately be tendered to give a wide range of suppliers the opportunity to provide solutions to DNOs. An estimate of the costs to provide the solution is provided here as a guide:

- Substation controller: approx. £2,000 per substation
- EV charge controller: approx. £250 per EV owning household
- Back office: approx. £500 per substation
- Operating costs: approx. £1000 per annum

Therefore, the estimate to provide a managed charging system on 30 EVs would be around £11,000. It should be noted that when a permanent solution is commissioned, the interim solution can be re-deployed at another network location. It is also expected that procurement competition and volume will drive this cost down.

This estimated cost per local network area would only be incurred for the small proportion of networks that may require support before market-led methods take hold – it should not to be viewed as a statement of the expected cost of managing EV charging demand on a wider scale.

The DNO would bear the costs of all procurement, installation and operation, recognising that these would ultimately be passed onto all customers through their energy bills.