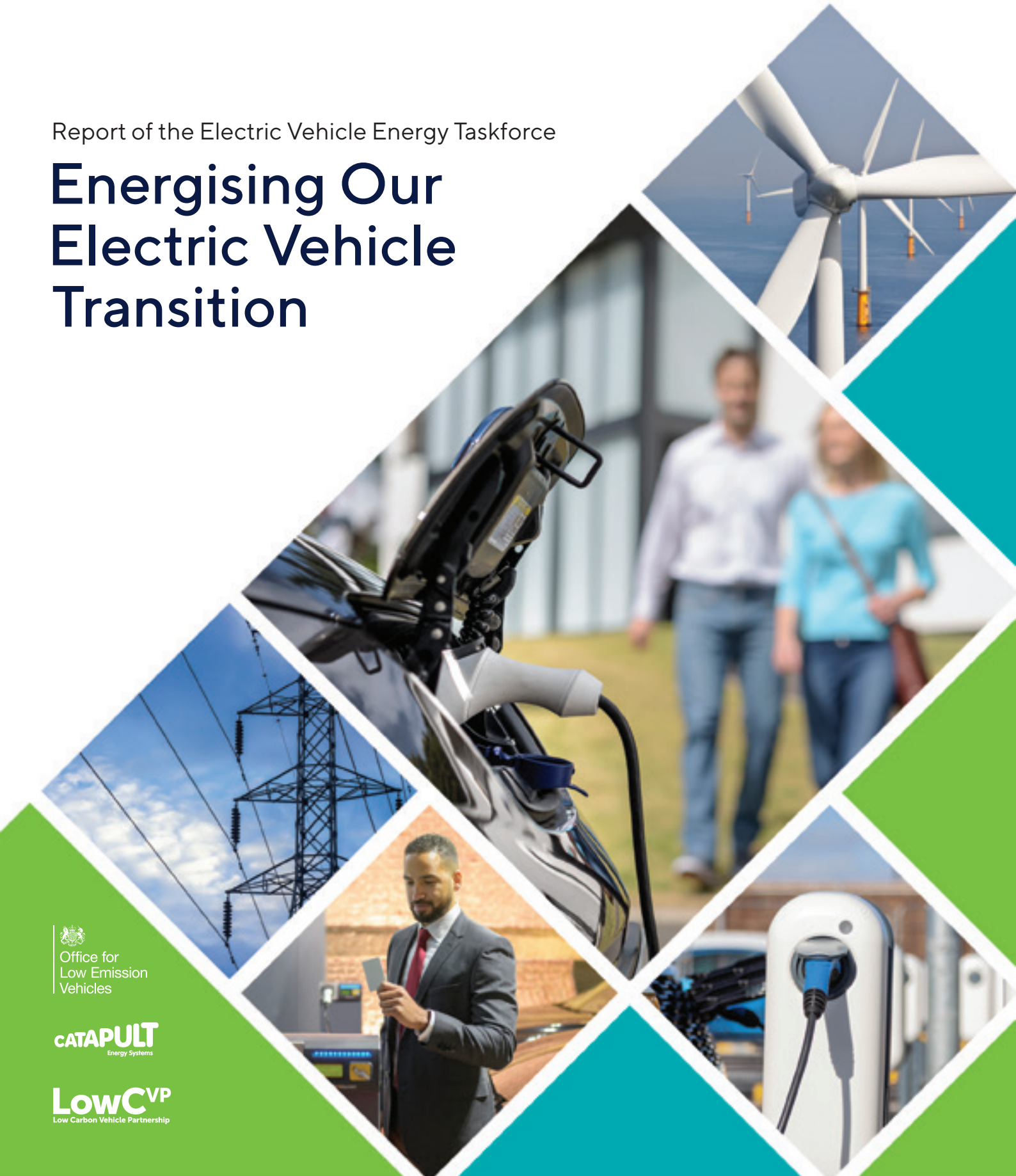
energy taskforce

Report of the Electric Vehicle Energy Taskforce

Energising Our Electric Vehicle Transition



Office for Low Emission Vehicles

CATAPULT Energy Systems

LowCVP Low Carbon Vehicle Partnership

The Electric Vehicle Energy Taskforce was convened by the Office for Low Emission Vehicles on behest of ministers; chaired by Philip New, Chief Executive of the Energy Systems Catapult; facilitated by Jonathan Murray of the Low Carbon Vehicle Partnership; and overseen by the members of the Steering Group.

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Foreword

Cleaner, quieter, more enjoyable transport. UK leadership in innovative technologies. High value jobs and economic growth. New markets that not only support the decarbonisation of mobility but also lead to greener, more comfortable and connected homes. If we manage the transition to electric vehicles well, the possibilities are compelling. The excitement – and the challenge – of achieving this future lies in successfully joining together, for the first time, two massive and fundamental economic systems, both going through once-in-a-generation transitions: transport and energy. The Electric Vehicle Energy Taskforce has been asked to provide a range of proposals to help ensure that our energy system is ready to play its part. This is a "system of systems" question on a grand scale.

The proposals set out in this report are the result of the engagement, cooperation and goodwill of hundreds of organisations, spanning electricity distribution and supply, transport, energy retailers and charge point operators, the automotive industry, investors, local authorities, data and tech companies, consumer advocacy organisations, equipment manufacturers, regulators and central and local government. Attention has been paid to international developments, prior research and the work of other related task forces.

Three key priorities have emerged. The first is the urgency of developing standards and codes of practice to enable interoperability and the sharing of data within the Electric Vehicle (EV) sector and with the electricity system. The second is the need for effective local and national planning and coordination to enable efficient investment, mediating the balance between future-proofing and asset stranding. And the third is the criticality of smart charging, underpinned by a resilient network and clear market signals, to reduce the cost of supplying millions of EVs.

These three priorities run through the twenty-one proposals made by the Electric Vehicle Energy Taskforce. Underpinning the proposals is a key defining principle; the EV transition is best served by always aligning with the best outcome for the consumer – typically the EV driver. The most important question used to test the proposals has always been "is this in the best interest of the EV driver?" Our belief is that if a positive experience cannot be provided to the EV driver, the potential development of this new market and its ability to contribute to our 'Net Zero' ambition will be compromised. This focus on the best customer outcome supports our determination to ensure the electricity system is not a blocker to the rapid EV uptake required to achieve 'Net Zero'. We have also been concerned to boost innovation and participation, taken economic equity and social impact seriously and adopted a whole-system view over both the long and the short term.

This report focuses on steps to remove actual or potential barriers and reinforce actual or potential enablers. It provides a focus on key issues and states when important questions have to be resolved. The proposals are not just for Government. Success will need collaboration and compromise from all stakeholders, both in the energy and the automotive sectors. We hope that the report will catalyse action: agreeing standards, establishing new governance mechanisms, testing new propositions, developing implementation pathways. Pathways that bring us closer to 'Net Zero', unleash the innovation we need, and have the consumer at their heart.

Philip New
Chief Executive Officer,
Energy Systems Catapult

Acknowledgements

The Electric Vehicle Energy Taskforce report is the culmination of over a year's intensive work involving over 350 different stakeholder organisations. The Taskforce Steering Group would like to thank everyone for their valuable contribution in producing this pivotal report.

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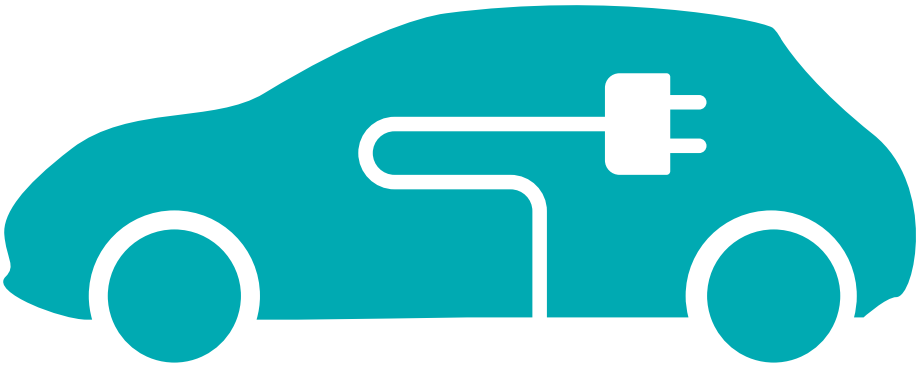

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ABB, Accenture Industry X.0, Addleshaw Goddard, Adrian Parker, Aeris Europe, Air Products, Alexander Dennis, Alfa Power, Alfen, Allego Charging Limited, Amey, Analysys Mason, Arcadis, Aston Martin, Atkins, Aurelia Turbines, AVERE, Aviva Investors, Babcock International, Bangor University, Barratt Developments, Belhinny NRG, Bennamann, Black & Veatch, Blaenau Gwent County Borough Council, BMW, Bord na Móna, BP Chargemaster, BP, Bridge-It Advisory Services, Bristol Energy, British Cables Association, British Gas, British Standards Institution, British Vehicle Rental and Leasing Association, Broadspeed, Bryan Cave Leighton Paisner, BT, Bulb, Burges Salmon, Burns & McDonnell, Cadent, Cambridge Electric Transport, Campbells Consultancy, Capgemini, Capita Consulting, Carbon Smart, Cardiff University, CBI, Cenex, Centrica, CEPA, Certsure, CGI, Chameleon Technology, Char. gy, ChargePoint, Charging Around Britain, Cherwell District Council, Citizens Advice, CleanCar.io, CM Energy Insights, CMS Cameron McKenna Nabarro Olswang, Community Works, Complete Strategy, Connected Places Catapult, Cornwall Insight, Cosworth, Coventry City Council, Crown Commercial Service, CRRC Times Electric Innovation Centre, Cummins, D&G Electrical Services, Deloitte, Delta Energy & Environment, Department for International Trade, Direct Insight, Downing, Drivenergy, DriveNow, Dyson Technology, E. A. Technical Services, E.ON, E4tech, EA Technology, Easee AS, East Lothian Council, East Sussex County Council, Eastleigh College, Eaton, Eco2 Solar, EcoCa, EDF Energy, EDMI Europe, ElectraLink, Electric Blue UK, Electric Miles, Electric Zoo, Electricity North West, Electricity Power Network Consultants, Element Energy, ELEXON, Endress+Hauser, Energy Saving Trust, Energy Technologies Institute, Energy Technology Partnership, Engenie, ENGIE, Environmental Defence Fund Europe, Enzen Global, ESB Networks, eSmart Networks, Essex County Council, Eurasia Partners, EV Box UK & Ireland, EV Centres, EV Consult, EV Driver, EV Energy, EV Hub, ev.energy,

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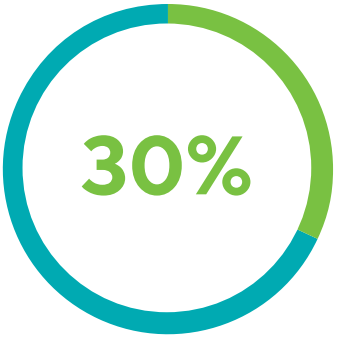
Please Note:
The output from the Electric Vehicle Energy Taskforce contained in this final report constitutes a broad consensus of opinion on a wide range of issues developed through the activities of the individual work packages, synthesis and steering groups. However, the views and opinions of organisations and their representatives that participated in the Electric Vehicle Energy Taskforce may differ from those in this report. All details correct at time of publication October 2019 but may be subject to change.

Contents

Executive Summary

The UK is committed to achieving net zero greenhouse gas emissions by 2050. Road transport is currently a major source of these emissions. It accounts for 29% [1] of the UK's total energy consumption and is responsible for 25% [2] of the total greenhouse gas emissions.

In July 2018, the Government set out its strategy to deliver cleaner road transport in The Road to Zero [3]. This set an ambition that all new cars and vans would be effectively zero emission by 2040. The Road to Zero recognised that the most credible technology currently available to deliver this strategy is the plug-in electric vehicle (EV) and that significant new charging infrastructure will be needed to support its adoption. A key challenge is to ensure that the timely provision of this infrastructure encourages the transition to EVs. Range anxiety and concerns about the accessibility of public charging infrastructure are frequently cited by consumers as a key obstacle to acquiring an EV.



The Road to Zero could potentially increase today's electricity consumption by about 30% by 2050

The Road to Zero strategy also recognised that the electrification of road transport will have significant impacts on the energy system, potentially increasing today's electricity consumption by about 30% by 2050†. This represents a fundamental restructuring of the energy supply infrastructure and brings challenges that should not be underestimated. The cost of meeting this new demand will be heavily influenced by the way consumers choose to charge their EVs; increases in peak electricity demand will have the greatest cost impact but there is also real potential for EV charging to provide benefits to the electricity system. It is vital that the challenge of meeting this demand growth is addressed with a strong consumer perspective.

With the publication of The Road to Zero, the Government launched the Electric Vehicle Energy Taskforce to explore this challenge with stakeholders. It was charged to bring forward proposals to ensure that the GB electricity system acts as an enabler of the EV transition and that opportunities to positively engage and deliver benefits to consumers can be realised. The underlying goal is to encourage the growth of EVs without incurring unnecessary costs.

The Electric Vehicle Energy Taskforce has, for the first time, brought together key stakeholders from the automotive and energy industries. It has consulted widely in developing its proposals, involving over 350 companies and institutions. It has recognised that the electrification of road transport will impact the whole electricity system, including the devices in peoples' homes. It has also recognised that providing affordable, convenient charging is a pre-condition for the creation of a mass market for EVs. The work of the Electric Vehicle Energy Taskforce has focused on two key challenges: how can the impacts on the electricity system be managed efficiently; and how can consumers be provided with a good EV charging experience.

† based on 2018 electricity consumption 300TWh [39] and projected 2050 road transport demand of 96TWh [40]

EV Charging and the Electricity System

The electricity system is already undergoing its own process of transition. Developments in recent decades have presented challenges to its 20th century design. In particular, the rapid growth of renewable generation technologies has brought new challenges across the whole system. The capability to meet these challenges is being enhanced by deploying Smart Grid solutions; providing better monitoring and active management of the electricity system. The Department for Business Energy and Industrial Strategy (BEIS) and Ofgem published the Smart Systems and Flexibility Plan [4] that sets out clear actions to help deliver the Smart Grid.

The increasing demand from EVs, potentially compounded by growth in the electrification of heat, brings further challenges, but also opportunities, for the planning and operation of the electricity system. Chargepoints can act as autonomous, active components of the whole electricity system. If these chargepoints and their supporting infrastructure are not designed and operated as an integrated part of the developing Smart Grid, significant costs will be incurred which will ultimately be met by consumers. There is an opportunity for these costs to be significantly reduced if the charging of EVs is used as a flexible resource that is responsive to the needs of the electricity system. For example, charging EVs overnight when the electricity system has surplus capacity or helping to balance the output from renewable generators. This is commonly referred to as 'smart charging'. It allows the charging of an EV to be intelligently controlled, whether autonomously or by a third party. This control might be related to the price of electricity, its carbon intensity or the availability of electricity system capacity. Smart charging has the potential to deliver savings in reinforcement costs for Distribution Network Operators (DNOs), and in the costs of operating the system associated with the Electricity System Operator (ESO). The present value of these savings to 2050 could be between £2.7bn and £6.5bn [5]. The Electric Vehicle Energy Taskforce believes that it is essential to ensure the widespread adoption of smart charging for the benefit of consumers and the electricity system.

EV Charging and the Consumer

The full benefits of smart charging can only be realised with the willing support of consumers. This support can be gained in a number of ways. Consumers' trust and confidence needs to be won; they need to be offered choice and convenience; they need to be properly rewarded for any services they provide to the electricity system; and they need to be sure that their privacy and data are safe. It is also recognised that smart charging will have to be complemented by a significant network of fast and ultra-fast chargepoints to cater for charging during journeys.

A key issue that directly impacts the consumer is interoperability. This is the ability of different physical and commercial systems to work together seamlessly and invisibly to the consumer. Ideally, it means that any EV can be plugged in to any public chargepoint and the electricity that it uses can be paid for in a way that is both transparent and fair for the consumer. It also means that a consumer can easily switch between service providers, avoiding lock-in situations and encouraging competition. The Electric Vehicle Energy Taskforce believes that achieving a high degree of interoperability is essential to increasing the appeal of EV ownership.

The Electric Vehicle Energy Taskforce's Main Themes

The work of the Electric Vehicle Energy Taskforce has highlighted three key priorities:

- Agreeing common standards and codes of practice to enable interoperability and the sharing of data within the EV sector and with the electricity system.
- Developing effective and connected national and local approaches to planning and coordination of network and chargepoint infrastructure enabling efficient investment, mediating the balance between future-proofing and asset stranding.
- Realising the value of smart charging, underpinned by a resilient network and clear market signals, to reduce the cost of supplying millions of EVs.

These three priorities run through the Electric Vehicle Energy Taskforce's 21 proposals. They are designed to help facilitate the growth of a smart, accessible, public and private charging infrastructure integrated with the whole electricity system. The proposals have a strong consumer perspective. A key driver has been to identify actions that can be mutually beneficial for consumers, EV drivers and the electricity system.

Delivering consumer benefits through interoperability

Achieving a high degree of physical and transactional interoperability across the EV charging sector is fundamental to making EV ownership/use a compelling consumer proposition. Interoperability is also an essential prerequisite to building a resilient charging infrastructure that works efficiently and securely with the electricity system and other smart domestic appliances, for the benefit of consumers.

The Electric Vehicle Energy Taskforce therefore proposes that Government should work with industry to accelerate the journey towards the adoption of common standards to achieve agreed interoperability goals linked to the growth of EVs. This journey should be aimed at delivering positive consumer outcomes, taking lessons from other industries such as telecoms. This is an immediate priority.

The Electric Vehicle Energy Taskforce recognises that the EV charging infrastructure sector is at an early stage of development so fostering innovation is essential. This should be recognised when setting interoperability goals. The risks of premature regulation must be taken into account but balanced by the benefits of common standards.

Rewarding consumers for charging smartly

There is a real opportunity to boost the take-up of EVs by making it easy for EV drivers to be properly rewarded for the services they provide to support the electricity system by smart charging. Markets already exist to trade these services, but they are not designed to interface with millions of EVs, or other domestic devices. The operation of these markets needs to be reimagined from a consumer's perspective in order to do this.

Government and Ofgem should accelerate their current joint programme exploring flexibility in the electricity retail market to ensure that its value is made easily accessible to retail consumers. The Electric Vehicle Energy Taskforce also proposes that Government and Ofgem should take positive steps to encourage consumers to install a smart meter with every domestic chargepoint to allow full access to flexibility markets. Again, delivering positive consumer outcomes should be a primary driver.

Utilising and protecting data for better consumer outcomes

The Electric Vehicle Energy Taskforce considers that two key principles should be applied in relation to EV data management. First, EV drivers should see value in allowing their data to be shared with third parties. Second, they must be assured that their data will be protected. EV drivers will expect easy access to comprehensive chargepoint data: location, availability and speed of charge. The Electric Vehicle Energy Taskforce proposes that chargepoint operators make this data available.

A key theme underlying the work of the Electric Vehicle Energy Taskforce has been whole-system thinking. The parties developing the EV charging infrastructure will work closely with, in particular, the electricity industry and the national and local planning authorities. The Electric Vehicle Energy Taskforce supports the recommendations made by the Energy Data Taskforce (EDTF) [41] and believes their implementation in the EV sector is crucial. Industry, including EV manufacturers, should cooperate to put in place data acquisition and sharing mechanisms that facilitate efficient planning and operation of the EV charging infrastructure and ensure consumer interests are served and protected.

Winning consumers' trust and confidence

There is an opportunity to make the transition to EVs a really positive consumer experience. The aim should be to make consumers want to drive an EV in a way that's similar to their desire to use their smart phone. However, clearly committing to an EV is a significantly bigger decision than buying a smart phone, therefore winning consumers' trust and confidence in all aspects of the EV proposition is essential.

The Electric Vehicle Energy Taskforce proposes that industry and Government should provide appropriate support, advice and protection throughout the EV customer journey. It is proposed that an independent body should promote the benefits of smart charging; Government should fund an independent advice service; and Ofgem and industry should ensure robust consumer protection and effective complaint handling.

Developing and maintaining the charging infrastructure consumers need

Private sector investment must be unlocked in order to deliver a geographically sufficient charging infrastructure, providing equitable access for all. This requires sufficient confidence that the electricity system will facilitate and not constrain the growth of the charging infrastructure. Government and Ofgem must make certain, in part through the RIIO-2 price control process, that this precondition is met. They must ensure effective forward planning and coordination of the development of EV and electricity network infrastructure, nationally and locally. This will include the digital as well as physical integration of the EV charging infrastructure to deliver whole-system benefits. The Office of Low Emission Vehicles (OLEV) must offer support to local authorities and other public bodies concerned with providing and maintaining publicly accessible EV charging infrastructure so that it quickly becomes a reliable, trusted national asset.

Further Observations

Recent Developments

Since the launch of the Electric Vehicle Energy Taskforce, a number of significant developments have taken place that are of particular relevance. Firstly, in response to the request from Government to reassess the UK's long-term climate change targets, the Committee on Climate Change published its report, 'Net Zero – The UK's contribution to stopping global warming' [6]. This stated clearly that the Road to Zero ambitions for the uptake of electric vehicles, or other low-carbon alternatives, would need to be increased to achieve 'Net Zero' by 2050. Subsequently in June 2019, the Government amended the Climate Change Act, adopting the net zero target for 2050 and in the following October, published its response to the Committee on Climate Change's report [7]. This stated that a Transport Decarbonisation Plan is now under development that would bring forward proposals to ensure that transport is on a pathway to Net Zero. The Road to Zero targets are used as a benchmark in this report as they have not as yet been replaced. However, the Electric Vehicle Energy Taskforce would highlight that they will have to be made more ambitious and the proposals in this report should be considered with this in mind.

Also in October 2019, the National Infrastructure Commission published "Strategic investment and public confidence"[8]. This report highlighted the importance of building confidence amongst investors to deliver a first-class charging infrastructure which would, in turn, give consumers the confidence to switch to an electric vehicle. This links directly to the Electric Vehicle Energy Taskforce's proposals relating to the development of the charging infrastructure.

Regulation and Governance

The Electric Vehicle Energy Taskforce's proposals do include ideas relating to regulation and governance in the growing EV sector. It is recognised that there is lively debate in this area right now, particularly in relation to electricity. In taking the proposals forward, a strong commitment to whole-system principles should be made to avoid duplication of governance mechanisms and to encourage innovation.

Chargepoint access for all

During the course of its work, the Electric Vehicle Energy Taskforce has become very aware of the need for a wide range and combination of business models and government support to deliver a geographically sufficient charging infrastructure, providing equitable access for all. This is an urgent issue which has real traction with the general public. However, it is outside the scope of the Electric Vehicle Energy Taskforce's work. The Electric Vehicle Energy Taskforce is confident that commercial incentives will deliver a significant proportion of the required charging infrastructure but are unlikely to ensure that it is sufficient to fully address range anxiety. It is proposed that the Government should give urgent attention to this challenge.

Future innovation

The Electric Vehicle Energy Taskforce is also aware that over the timescale of the electrification of transport, new technologies and opportunities are likely to arise across the energy system. This should not be a reason to pare back ambitious plans. However, it is recommended that Government ensures that horizon scanning forms a vital part of a whole-system strategy so that currently unknown opportunities and synergies are not missed. It is likely that the changes made to enable the electrification of transport will have a strong influence on the capacity of the electricity system to handle other future increases in demand. If the development of an EV charging infrastructure is managed well it can provide valuable learning to meet further challenges; if not, it could hamper them and reduce economy-wide decarbonisation options.

Next Steps

The Electric Vehicle Energy Taskforce has for the first time bought together stakeholders across the automotive and electricity sectors. Its formation has found the value and necessity in collaboration and to build momentum to support the EV transition. However, its proposals only offer a starting point. The Government is strongly recommended to maintain the momentum and cooperative working that has been achieved through a joint industry forum that is properly resourced and sustainable into the foreseeable future.

1 Introduction

Background

The UK is committed to achieving net zero greenhouse gas emissions by 2050. Road transport is currently a major source of these emissions. It accounts for 28% [1] of all the energy consumed in the UK and is responsible for 25% [2] of the total greenhouse gas emissions.

In July 2018, the Government set out its strategy to deliver cleaner road transport in The Road to Zero [3]. This set an ambition that all new cars and vans would be effectively zero emission by 2040. The Road to Zero strategy recognised that the most credible technology currently available is the plug-in electric vehicle. It also recognised that the electrification of road transport will have significant impacts on the energy system. In particular, it could increase today's electricity consumption by around 30% † by 2050. This represents a fundamental restructuring of the energy supply system and brings challenges that should not be underestimated. In order to better understand these impacts, the Government launched the Electric Vehicle Energy Taskforce. It was charged to bring forward proposals to ensure that the GB electricity system is ready for this transition and that the opportunities it brings can be realised.

This report sets out the Electric Vehicle Energy Taskforce's proposals to Government and industry and the justification for them. They recognise the need to inform and engage consumers in the EV transition to achieve efficient outcomes. In particular, the report proposes actions and strategies to ensure that the growth of EVs can be facilitated while minimising the need to increase the capacity of the electricity system.

The Electric Vehicle Energy Taskforce's Scope of Activity

The terms of reference set for the Electric Vehicle Energy Taskforce [38] focused on the interactions between the EV, the electricity system and the consumer. They required the impacts of the growth of EVs on the electricity system to be understood. They charged the Electric Vehicle Energy Taskforce with developing proposals to engage consumers to help minimise these impacts. The Electric Vehicle Energy Taskforce has responded by concentrating its work on passenger cars, which account for almost 15% of total energy consumption and 61% of total road transport energy consumption in the UK [9]. It has sought to identify near-term, least regrets actions that will be mutually beneficial for EV drivers, consumers and the electricity system.

A key concept that links the consumer to the electricity system is smart charging. This allows the charging of an EV to be intelligently controlled, whether autonomously or by a third party. For example, this control might be related to the price of electricity, its carbon intensity or the availability of electricity system capacity. Smart charging has the potential to transform EV charging from a static demand on the electricity system, to a flexible resource. It can reduce the required capacity of the entire electricity supply chain and associated operating costs. The work of the Electric Vehicle Energy Taskforce has focused on measures to ensure the widespread adoption of smart charging for the benefit of consumers and the electricity system. However, smart charging will have to be complemented by a significant network of fast and ultra-fast chargepoints to cater for charging during journeys.

It is recognised that the electrification of road transport will impact other decarbonisation strategies, particularly the growth of the electrification of heat. Where appropriate, therefore, we have sought to recognise these broader impacts and dependencies, without seeking to resolve them. There is a growing consensus that energy system planning, embracing heat and transport, has to adopt whole-system thinking, reflected in both national and local strategies.

During the course of its work, the Electric Vehicle Energy Taskforce has become very aware of the need for a wide range and combination of business models and government support to deliver a geographically sufficient charging infrastructure, providing equitable access for all. This is an urgent issue which has real traction with the general public. However, it is outside the scope of the Electric Vehicle Energy Taskforce's work. The Electric Vehicle Energy Taskforce is confident that commercial incentives will deliver a significant proportion of the required charging infrastructure but are unlikely to ensure that it is sufficient to fully address range anxiety. It is proposed that the Government should give urgent attention to this challenge.

† "based on 2018 electricity consumption 300TWh [39] and projected 2050 road transport demand of 96TWh [40]

Electric Vehicle Energy Taskforce Remit

The Electric Vehicle Energy Taskforce was formed to make proposals to Government and industry on "how to ensure the GB energy system is ready for and able to best exploit the mass take up of electric vehicles."

Objective
To put engaging the electric vehicle driver at the heart of preparing the electricity system for the mass take up of electric vehicles, ensuring that costs and emissions are as low as possible, and opportunities for vehicles to provide grid services are capitalised upon for the benefit of the system, energy bill payers and electric vehicle drivers.

The Electric Vehicle Energy Taskforce considered:

- The impact of electric vehicles on the electricity system of Great Britain
- EV driver engagement
- Co-ordination of consumer protection
- Near and long-term effects
- Facilitation of charging infrastructure connections
- The role for smart charging
- Data requirements, sharing and protection

However, the Taskforce did not consider issues which were out of scope, including:

- Forecasting EV uptake
- Where chargepoints should be deployed
- Definition of standards
- Non-smart chargepoints

To consider these issues the Taskforce assembled a wide range of stakeholders drawn from the energy, infrastructure, automotive and government sectors.

The Electric Vehicle Energy Taskforce's Approach

The Electric Vehicle Energy Taskforce has brought together key stakeholders from the automotive, energy and related industries. It has consulted widely in developing its proposals, involving over 350 companies and institutions. The electrification of road transport will impact the whole electricity system, including the devices in peoples' homes. Further, providing affordable, convenient charging is a precondition for the creation of a mass market for EVs. The work of the Electric Vehicle Energy Taskforce has accepted these positions as opportunities and has focused on two key challenges: how can smart charging be most effectively deployed to efficiently manage the impacts of EVs on the electricity system; and how can consumers be provided with a good EV charging experience, whenever and wherever it is required.

The Electric Vehicle Energy Taskforce established four Work Packages focusing on: the strategic energy system impacts; the engagement of EV drivers; the technical requirements for smart charging; and the provision of data to stakeholders to assist decision-making. Each Work Package engaged proactively with stakeholders to ensure that the proposals were properly informed by them. The work of the Electric Vehicle Energy Taskforce was guided by a Steering Group of senior representatives from Government, the automotive and energy industries, academia, local authorities, LowCVP and was chaired by Philip New of the Energy Systems Catapult.

This report brings the work of the four Work Packages together. It highlights potential constraints to the growth of EVs and proposes actions and strategies to help mitigate them.

Firstly, it describes the progress that has already been made and the ambitions for the growth of EVs set out in the 'Road to Zero' strategy. This is set against the current state of the electricity system, the challenges it faces and the development of the Smart Grid.

It then paints a picture of what a 'good EV driver experience' might be. This focuses on all aspects of an EV driver's interaction with chargepoints, both physical and transactional. It then uses five themes to explore the challenges of delivering a smart charging infrastructure and offers proposals to address them. These proposals are designed to optimise benefits for the consumer and the electricity system.

The themes are:

- Delivering consumer benefits through interoperability – this can deliver choice and convenience to consumers, increasing the appeal of EV ownership
- Rewarding consumers for charging smartly – simple, transparent products are needed to beneficially influence consumers' behaviour
- Utilising and protecting data for better consumer outcomes – consumers need to be assured that data they share will be protected
- Winning consumers' trust and confidence – a vital part of achieving behavioural change that will benefit consumers and the electricity system
- Developing and maintaining the charging infrastructure consumers need – bringing stakeholders together to deliver cost-efficient, whole-system solutions.

The detailed evidence that supports the Electric Vehicle Energy Taskforce's proposals is contained in the Work Package reports. The linkages between the proposals and this evidence base are described in Annex 1, which offers a route map to show how the proposals have been synthesised from the work of the four Work Packages.

UK and International Standards

There is a great deal of activity in the UK and internationally focused on developing standards for EVs and their associated charging technologies. The key programmes are summarised in Annex 3. This work has informed the work of the Electric Vehicle Energy Taskforce and has been taken into account in its proposals.

Recent Developments

Since the launch of the Electric Vehicle Energy Taskforce a number of significant developments have taken place that are of particular relevance. Firstly, in response to the request from Government to reassess the UK's long-term climate change targets, the Committee on Climate Change published its report, 'Net Zero – The UK's contribution to stopping global warming' [6]. This stated clearly that the Road to Zero ambitions for the uptake of electric vehicles, or other low-carbon alternatives, would need to be increased to achieve 'Net Zero' by 2050. Subsequently in June 2019, the Government amended the Climate Change Act, adopting the net zero target for 2050 and in the following October, published its response to the Committee on Climate Change's report [7]. This stated that a Transport Decarbonisation Plan is now under development that would bring forward proposals to ensure that transport is on a pathway to Net Zero. The Road to Zero targets are used as a benchmark in this report as they have not as yet been replaced. However, the Electric Vehicle Energy Taskforce would highlight that they will have to be made more ambitious and the proposals in this report should be considered with this in mind.

Also in October 2019, the National Infrastructure Commission published "Strategic investment and public confidence" [8]. This report highlighted the importance of building confidence amongst investors to deliver a first-class charging infrastructure which would, in turn, give consumers the confidence to switch to an electric vehicle. This links directly to the Electric Vehicle Energy Taskforce's proposals relating to the development of the charging infrastructure.

Horizon Scanning

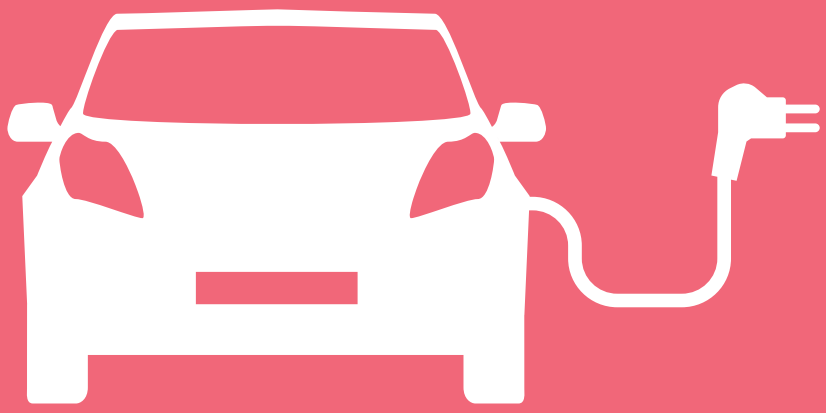
The Electric Vehicle Energy Taskforce is aware that, over the timescale of the electrification of transport, new technologies and opportunities are very likely to arise across the energy system. The development of Connected and Autonomous Vehicles (CAV) is progressing rapidly and the concept of 'Mobility as a Service' (MaaS) is also gaining ground. Of particular relevance to this report is the chargepoint model for EV charging on which this report focuses. It is recognised that this could be superseded by new technologies. It is recommended that horizon scanning should form a vital part of a whole-system strategy so that currently unknown opportunities and synergies are not missed. It is likely that the changes made to enable the electrification of transport will have a strong influence on the capacity of the electricity system to handle other future increases in demand.

Because of the multiple uncertainties that have to be managed, including the extent to which heat will be electrified, the Electric Vehicle Energy Taskforce has focused on enablers that balance optionality and flexibility with a degree of standardisation. If the development of an EV charging infrastructure is managed well it can provide valuable learning to meet further challenges; if not, it could hamper them and reduce economy-wide decarbonisation options.

'Our belief is that if a positive experience cannot be provided to the EV driver, the potential development of this new market and its ability to contribute to our 'Net Zero' ambition will be compromised.'

Philip New, Energy Systems Catapult, CEO

2 The GB's Electric Vehicle Landscape



The UK's Electric Vehicle Journey – Achievements so far

The journey to electrify road transport in the UK is very much in its early stages. But there are clear signs that progress is being made towards the Government's ambitions set out in the Road to Zero. At least 50% of new car sales and 40% of new van sales are to be ultra-low emission by 2030 and all new cars and vans effectively zero emission by 2040. The Government has committed to take the steps necessary to facilitate the roll-out of charging infrastructure to support the electric vehicle revolution. This is a key part of the Net Zero strategy.

EV Sales and Chargepoint Growth

The sales of EVs is growing steadily in the UK. Registration of EVs grew between 2013 and 2018 by 616% to 15,545 [11]. Sales have continued to grow during 2019 with the introduction of new EV models, with the year-to-date market share for EVs reaching 1.3% [12] of new car registrations. There are now estimated to be approximately 70,000 EVs on the road in the UK. The Government is taking a lead by setting out plans in the Road to Zero strategy to make its own vehicle fleets completely ultra-low emission over the next decade. The Electric Vehicle Approved (EVA) accreditation scheme was launched in Spring 2019 to recognise car dealers who have trained their staff on how to sell and service EVs. It has been developed by the National Franchised Dealers Association (NFDA) and endorsed by the Government's Office for Low Emission Vehicles (OLEV) and the Energy Saving Trust (EST).

'Developing a multi-stakeholder co-ordinated view on what is needed to liberate the electric vehicle smart charging sector has been vital in providing 'no regret' proposals to government and industry'

Andy Eastlake, LowCVP, MD

The number of public chargepoints is also increasing. Government funding and leadership, alongside private sector investment, has supported the installation of more than 21,000 public chargepoints. This includes over 2,100 rapid chargepoints - one of the largest networks in Europe [ZapMap, October 2019]. Major companies have significant plans to increase this number rapidly.
In September 2019 the Go Ultra Low scheme launched a new advertising campaign, celebrating EVs. It will be run through multiple media channels. Go Ultra Low is a joint government/industry communications campaign designed to promote EVs. Its support base is growing and now includes energy providers in addition to EV manufacturers.

Government grants to catalyse growth

The Government is taking steps to further encourage the transition. The Plug-in Car Grant helps with the purchase of an EV. The Electric Vehicles Homecharge Scheme provides support for the installation of domestic chargers. There is also funding to encourage local authorities to install charging infrastructure in residential areas, the On-street Residential Scheme, and measures to incentivise the growth of workplace charging facilities. In September 2019, Government announced [13] a £400 million fund to help develop rapid charging infrastructure chargepoints for electric vehicles.

Home chargepoints installed with a grant are now required to be 'smart', having the ability to receive, process and respond to information they receive. This requirement is a part of the Government's broader strategy to prepare for smart charging and the integration of EV charging with the Smart Grid, which were set out in its smart charging consultation [14]. The Government will soon decide [15] whether building regulations should be changed to require chargepoints to be installed in all new, and certain refurbished dwellings, and non-domestic buildings.

Delivering the UK's Industrial Strategy

The Road to Zero strategy recognised that more innovation and investment will be required in current and emerging technologies to achieve the mass adoption of ultra-low emission vehicles; passenger and freight. The Government has expressed a clear ambition to put the UK at the forefront of the design and manufacturing of zero emission vehicles. It is investing in the Advanced Propulsion Centre [16], the Faraday battery challenge [17] and Driving the Electric Revolution [18].

The opportunity for business is very significant. The Road to Zero presents the findings of independent analysis of the global market for low emission vehicles. It has been estimated to be worth £1-2 trillion per year by 2030 and £3.6-7.6 trillion per year by 2050 [19].

The UK is well positioned to exploit this opportunity. One of the world's best selling electric vehicles, the Nissan LEAF, is manufactured in Sunderland; the world's first electric 'black cab' is made by LEVC in Coventry; and the UK's research and development capabilities are world-class. New manufacturers such as Arrival and Tevva are also based in the UK.

Electric Vehicles and the Electricity System

Growing Electricity Demand

The transition to EVs will, over time, require the electricity system to supply a very significant new demand. It could increase today's electricity demand by about 30% by 2050. National Grid's Future Energy Scenarios estimate that without smart charging and vehicle-to-grid technology, EVs could add 24GW to the peak demand by 2050 [20]. This could be compounded by growth in the electrification of heat. It follows that opportunities to efficiently manage this growth and reduce peak demand on the electricity system should be taken to benefit consumers in the future.

Electricity System Context

There are two fundamental criteria that must be met in order that the increase in demand can be met by the electricity system. First, the electricity system must have sufficient generation, storage and network capacity to reliably meet the highest demand that is likely to occur. In order to make sure that this criterion is met, good quality forecasts of demand are needed for years into the future as the provision of extra capacity involves a range of potential solutions, some of which require new assets to be commissioned and this has significant lead times.

The second criterion is more complex. The electricity system must be able to respond to changes in demand, as well as unexpected generation and network faults, in real time. This is a unique feature of electricity systems as compared to any other commodity supply chain. It means that the electricity produced by generators, or supplied from storage devices, must exactly balance the demand for electricity on a second-by-second basis. This is generally referred to as maintaining system stability. If this balance is not maintained the system can fail. In August 2019, unexpected generation faults occurred simultaneously creating such an imbalance. This triggered emergency actions causing nearly a million consumers to lose their electricity supply [21], whilst a wider loss of supply was averted. This is a challenge that is met in operational timescales by the energy system operator (ESO). In a future with smart EV chargers, the chargers could react to imbalances of this kind and reduce demand automatically. This could be a valuable protection to the system as non-critical load would be reduced, therefore minimising disruption to other system users.

EVs can present challenges to both of these criteria but there are also opportunities for them to provide valuable services to the electricity system as well. This is because most cars are stationary for most of the day and can therefore offer a flexible resource to the electricity system. They can charge when the electricity system has spare capacity. There is also potential for them to discharge when requested to do so, supplying electricity back to the system. This is commonly referred to as Vehicle to Grid (V2G) capability.

Considering the capacity criterion, the worst case is that all the EVs are being charged at the time when other demands are at their highest. If this happens, the need for additional capacity is maximised and the cost of providing this new capacity will, assuming current practice, be met by consumers. The implementation of smart charging can help address the capacity challenge. Smart charging can time-shift EV demand away from peak times reducing the need for extra capacity.

Turning to the system stability criterion, it is yet to be seen how the charging of EVs will develop. However, it is possible that EV owners will allow a third party to manage the charging of their vehicles if this provides benefits to them. In this model, it is possible that a chargepoint operator, electricity supplier or aggregator could have control over very large numbers of chargepoints. This presents a potential risk. If the chargepoint operator changes the charging rates of too many EVs too quickly the electricity system may not be able to respond fast enough. In this event, protection systems would react, and electricity supplies could be lost as they were in August 2019 [21].

The ESO already operates the system to protect against the risk of system instability. The ESO could increase the safety margin that it maintains to keep the system stable, but this would present extra costs to consumers. As EV demand increases it will be vital to manage this risk through market coordination and/or an agreed control hierarchy. Otherwise, there is a risk of conflicts and lost synergies leading to missed opportunities for EV drivers and electricity system efficiency, and ultimately risks to electricity system stability.

The Smart Grid

The electricity system is currently undergoing its own process of transition. The model that prevailed for most of the second half of the 20th century was based on a relatively small number of very large power stations connected together by the high voltage transmission system. Distribution systems took electricity from the transmission system and supplied consumers through their medium and low voltage networks. The distribution systems had little or no generation connected to them; they were passive systems. This allowed them to be designed and operated in a way that minimised the need to actively control the flow of electricity through them.

Developments in recent decades have presented challenges to this model. The most significant of these is the growth of decentralised generation, including smaller renewable generation technologies, which are connected to distribution systems. These include, for example, solar PV installations and wind generators. To illustrate this growth of decentralised generation, National Grid's 'Community Renewables' Future Energy Scenario [22] shows the percentage of peak demand supplied from the transmission system falling from 71% in 2018 to 42% in 2050. The connection of these generators, and other innovative technologies, introduces new complexities for distribution networks and the operation of the whole electricity system. One way of addressing these challenges is to enhance the monitoring and control of the networks so that they can respond to changes in demand or network faults intelligently and automatically. This is commonly referred to as the development of a Smart Grid which also embraces new market mechanisms and the engagement of consumers.

The need to develop the Smart Grid has been recognised by BEIS and Ofgem. In 2017 they jointly published the Smart Systems and Flexibility Plan (later updated in October 2018)[4] . This set out 29 actions that the government, Ofgem and industry would undertake. These actions were designed to support clean growth, reduce the costs of the energy system, and help keep energy bills low for consumers by:

- removing barriers to smart technologies
- enabling smart homes and businesses
- improving access to energy markets for new technologies and business models

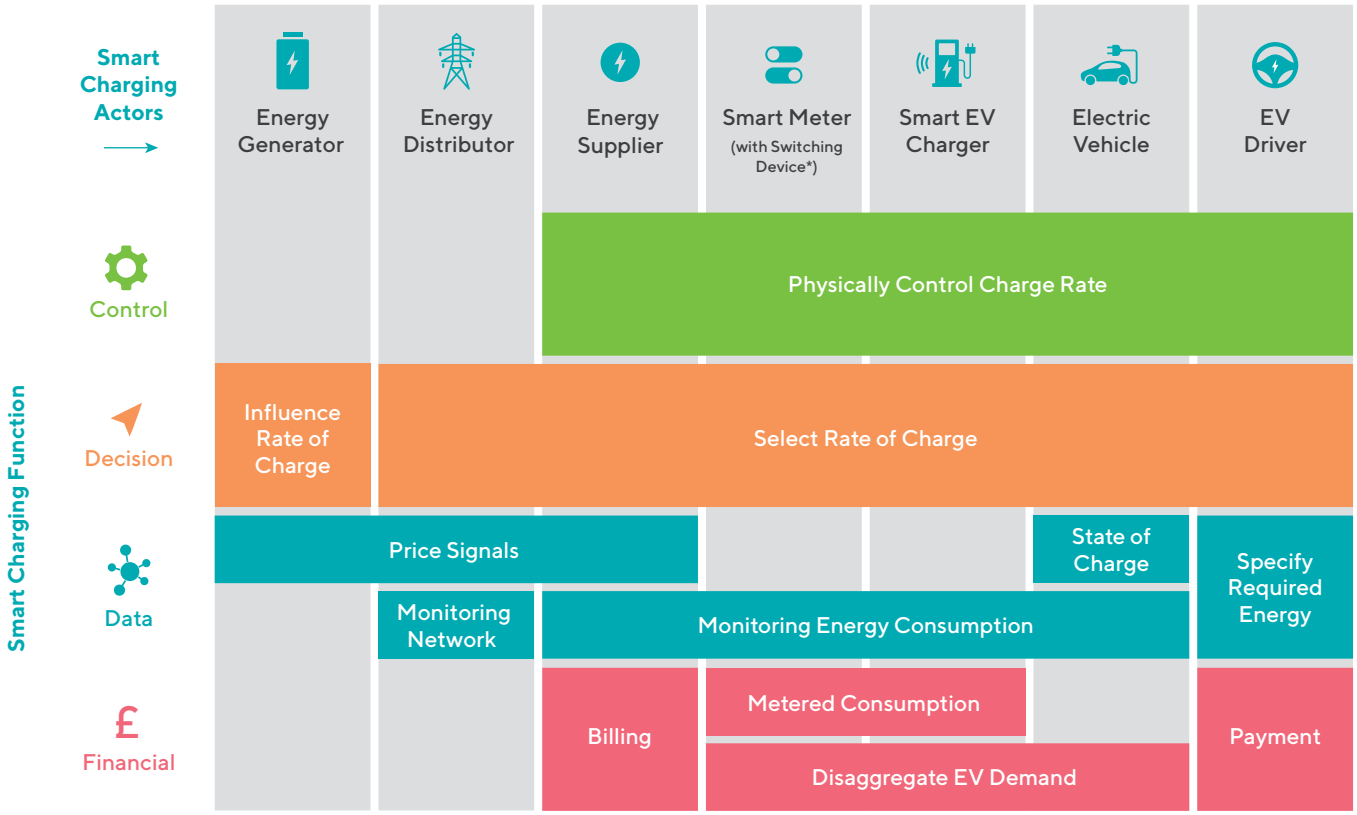
The Smart Grid and Smart Charging

The Electric Vehicle Energy Taskforce sees a very significant opportunity in bringing together the concepts of the Smart Grid and smart charging and there is good evidence that this can deliver material benefits. If the charging infrastructure is not designed and operated as an integrated part of the developing Smart Grid, significant costs will be incurred which will ultimately be met by consumers. There is an opportunity for these costs to be significantly reduced if the charging of EVs is used as a flexible resource that is responsive to the needs of the electricity system. Smart charging has the potential to deliver savings in reinforcement costs for DNOs and in the costs of operating the system associated with the ESO. The present value of these savings to 2050 could be between £2.7bn and £6.5bn [5] .

‘The recent growth in electric vehicles shows there is appetite for these exciting technologies. Industry is investing heavily to provide more choice but, to really drive uptake, this must be supported by a long-term commitment to incentives and infrastructure. Drivers must feel confident that it’s as easy to charge as to pull up at a forecourt and refuel.’

Mike Hawes, SMMT Chief Executive

Smart Charging Architecture



*Switching device may or may not act independently from the smart meter

This Smart Charging Architecture provides a high-level representation of the functions and actors involved in smart charging. Where there are alternative means of delivering a function, the function is shown under multiple actors. For example, it is possible for the physical charge rate to be controlled by the EV owner, EV, chargepoint or even a smart meter in conjunction with a switching device.

There is inevitable uncertainty as to how technologies and service offerings will evolve and how future consumers will choose to charge and travel. The convenience of being able to charge in the normal course of people's day-to-day journeys – especially at home, workplaces and other destinations – rather than requiring dedicated visits to service stations is widely cited as an appealing benefit of EVs. There is evidence from trials with both very early adopters [23] and future mainstream consumers that this is reflected in how users choose to charge. In the case of the Consumers, Vehicles and Energy Integration (CVEI) trials, for example, the vast majority of participants charged almost exclusively at home – electricity they had to pay for – despite being given free access to local public charging [24] . Trial evidence also points to consumers preferring smart charging, with between 76% and 96% of mainstream consumers reporting they would choose smart charging [24] . Fortuitously, charging at or near homes and at workplaces and many destinations is very conducive to smart charging. In combination this offers consumers convenience and cost savings, whilst also reducing the impact on the electricity system. This should not be taken as being at the exclusion of other forms of charging,

particularly rapid charging, which will also be essential to meeting EV ambitions [24] .
Indeed, the offerings are complementary as no single charging solution will be able to cater to all drivers charging needs all of the time. Each of the charging solutions requires focussed effort to progress the charging infrastructure and systems necessary to support the rapidly evolving uptake of EVs.

Different models of smart charging have been and continue to be tested with consumers and their likely system effects assessed. For example, tariff models with fixed peak and off-peak periods can successfully move charging away from times when other demands are at their highest but also have a "herding" effect, which creates the system stability risks discussed earlier [5][24]. Other forms of smart charging allow EV owners to delegate control to a third party. This allows more flexibility and the ability to support more EVs, whilst also offering greater cost savings for consumers; but has so far only been shown to be more appealing once consumers have experience.

Encouraged by this evidence, the work of the Electric Vehicle Energy Taskforce has focused on measures to ensure the widespread adoption of smart charging for the benefit of consumers and the electricity system. It believes that they should be developed together as part of the whole electricity system. This can ensure the ongoing integrity of the electricity system and deliver cost savings for consumers. For this reason, a key objective of the Electric Vehicle Energy Taskforce's Proposals is to encourage the growth of smart charging.

The smart charging process requires a number of functions which can be influenced by different organisations in addition to the EV driver. In some cases, a function might be controlled by a number of different 'actors' making a complex picture of alternative ways to deliver smart charging. The Electric Vehicle Taskforce has sought not to be prescriptive in developing its proposals to encourage the take up of smart charging.

Putting Consumers First – A good consumer journey

The EV already offers consumers real benefits compared with petrol and diesel vehicles. In addition to its environmental benefits an EV is quiet and it can be charged at home; many EV owners may never need to use a public chargepoint. Based on today's energy costs it has lower fuel costs and being mechanically simpler, it should have lower maintenance costs as well. However, in relation to refuelling away from home, EVs have a hard act to follow. Petrol and diesel vehicles offer high levels of convenience to their users. Many vehicles can travel 500 miles without refuelling. When refuelling is required it can be done quickly and the network of refuelling stations is extensive. In short, range anxiety and day-to-day convenience are not concerns. Additionally, there are no interoperability issues. Any vehicle can use any refuelling station and payment can be made in whichever way the user requires. This is a model that the EV charging infrastructure should aspire to emulate or enhance. It is why interoperability should permeate the EV driver experience. This position is supported by recent research including the CVEI project [24].

The work of the Electric Vehicle Energy Taskforce has focused on measures to:

- Ensure the widespread adoption of smart charging, where appropriate, for the benefit of consumers and the electricity system.
- Achieve a level of interoperability necessary to deliver the choice and convenience necessary to help make EV ownership a compelling proposition.
- Ensure effective local and national planning to enable efficient investment, balancing the benefits of future-proofing with the risk of asset stranding.

Achieving these goals has several dimensions and these have been developed as five themes. These themes relate to the journey of a potential EV owner/user: before committing to an EV; at the point of sale and owning/using an EV.

Delivering consumer benefits through interoperability – the goal should be to offer an equivalent or better level of choice and convenience than consumers currently experience with petrol and diesel vehicles. The interaction of an EV with the electricity system and electricity markets adds new dimensions to this challenge compared with the extant world of liquid fuels. However, there is real potential to deliver a very positive consumer experience by employing the innovations that digital technologies can now offer.

Rewarding consumers for charging smartly – most consumers currently have a very simple relationship with their electricity suppliers. The introduction of smart meters and half-hourly tariffs will bring new opportunities. Suppliers are expected to bring new, more sophisticated products to market that benefit consumers. Smart charging transactions will require careful explanation and well-designed products that appeal to consumers. They will also offer consumers a revenue stream that can reduce their overall electricity costs.

Utilising and protecting data for better consumer outcomes – consumers will need to give their consent to safely share their data with third parties to gain many of the benefits of smart charging and interoperability. They will need to be assured that they can do this safely and securely.

Winning consumers' trust and confidence – this applies to every stage of the consumer journey from the information available before purchase to the advice and guidance needed to help enjoy the benefits of EVs.

Developing and maintaining the charging infrastructure consumers need – apart from the chargepoints that they use, the charging infrastructure should be 'invisible' to consumers. It should be simple to get a domestic chargepoint installed and easy to find a public chargepoint when they need to that can charge the EV in an acceptable time. However, delivering a geographically sufficient charging infrastructure that provides equitable access for all requires planning and coordination and involves many parties. The Electric Vehicle Energy Taskforce has considered how this might be most effectively facilitated.

The Consumer Benefits

The Electric Vehicle Energy Taskforce believe that providing drivers with access to a robust, reliable, readily available and cost-effective public charging network is critical to the future growth of EVs.

1

Easy charging for all
Charging an EV has to be simple, straightforward and convenient, wherever you are. Consumers need to easily be able to find, access and pay for charging at home, at work and whilst travelling, with minimal extra effort.

2

Good value charging
EV drivers should be offered cheaper electricity if they charge smartly at off-peak times, giving them the opportunity to lower their EV running costs, if they wish.

3

Personalised charging experience
Intelligent use of data will provide EV drivers with an optimised charging experience that's personal to them.

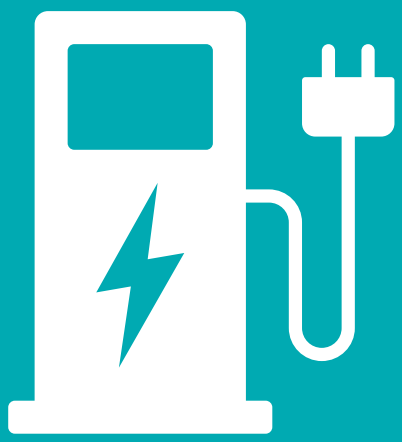
4

Confident informed drivers
Well-informed consumers who are aware of the latest automotive technology and understand how to charge, with the trust and confidence to drive an EV themselves.

5

Right infrastructure in the right location
A well-planned, coordinated, highly visible national EV smart charging network that provides consumers with the ability to charge wherever they are.

3 The Electric Vehicle Energy Taskforce's Proposals

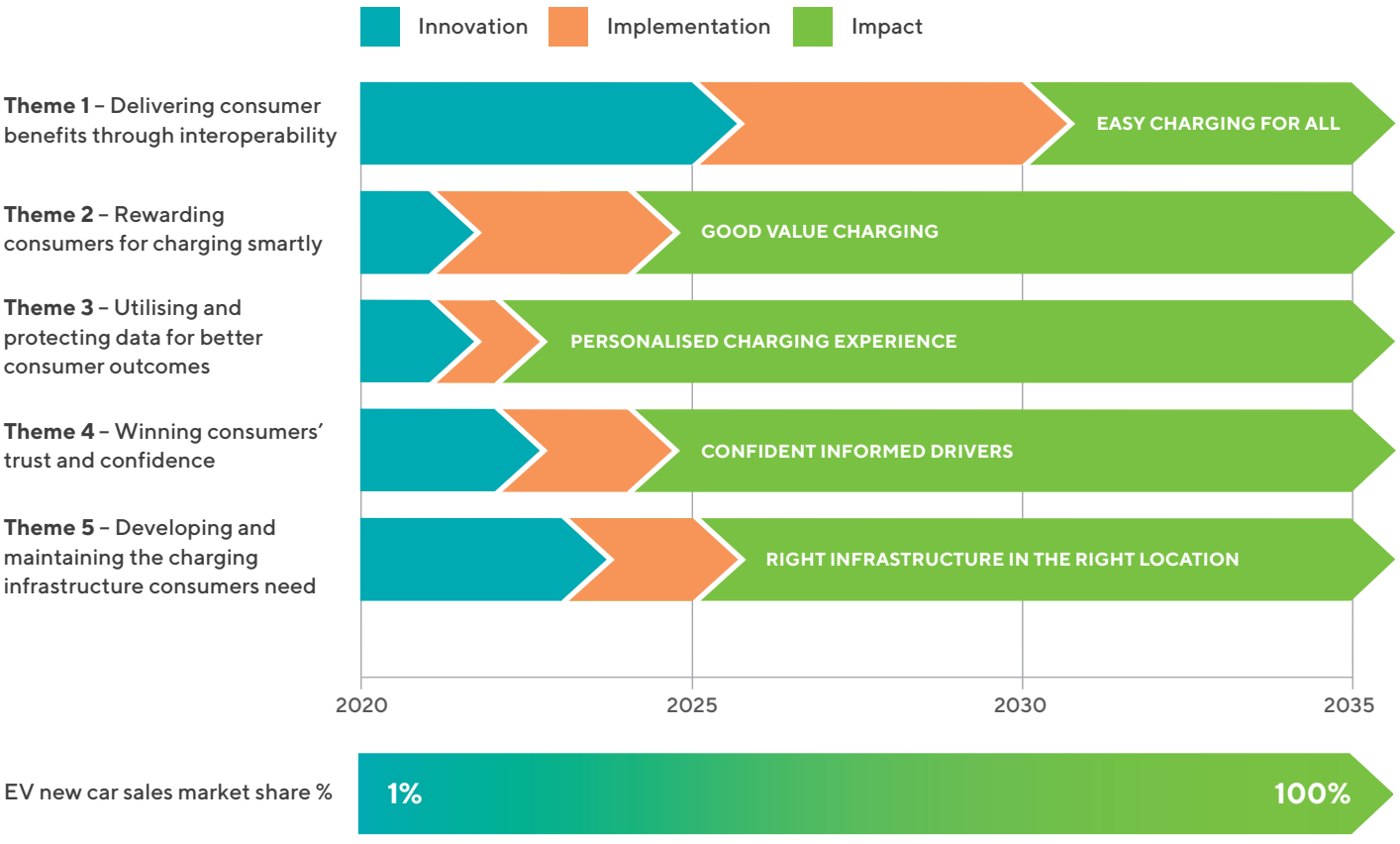


Enabling the Electric Vehicle Transition – Summary of Proposals

The Electric Vehicle Energy Taskforce has made 21 proposals to help facilitate the growth of a smart, accessible, public and private charging infrastructure integrated with the whole electricity system. In particular, these proposals aim to deliver a high degree of interoperability and widespread smart charging to bring real benefits to consumers and reduce the impacts on the electricity system.

A guiding principle behind them has been to encourage innovation and market solutions so that regulatory interventions are minimised.

The proposals are presented in the five themes already described.



Source: Committee on Climate Change: Net Zero report EV targets 2019

Theme 1 – Delivering consumer benefits through interoperability

Introduction

Achieving a high degree of physical, transactional and technical interoperability across the EV charging sector is fundamental to making EV ownership/use a compelling consumer proposition. Interoperability is also an essential prerequisite to building a resilient charging infrastructure that works efficiently and securely with the electricity system, and other smart domestic appliances, for the benefit of consumers.

The Electric Vehicle Energy Taskforce therefore proposes that Government should work with industry to accelerate the journey towards the adoption of common standards to achieve agreed interoperability goals linked to the growth of EVs. This journey should be driven to deliver positive consumer outcomes, taking lessons from other industries such as telecoms. More specifically, it is vital to the delivery of effective smart charging. There are many ways to implement smart charging and the Electric Vehicle Energy Taskforce has recognised this by avoiding a prescriptive approach in its proposals.

The Electric Vehicle Energy Taskforce recognises that the EV charging infrastructure sector is at an early stage of development so fostering innovation is essential. This should be recognised when setting interoperability goals. The risks of premature regulation must be taken into account but balanced by the benefits of common standards.

The Proposals

Interoperability has many dimensions. The Electric Vehicle Energy Taskforce has made seven proposals relating to different aspects of interoperability ranging from international standards to product labelling. They are:

Proposal 1 – to lead the way on reviewing international interoperability standards in order to establish and agree a preferred set for adoption.

Proposal 2 – to ensure that best international practice is applied in the development of the charging infrastructure to ensure resilience and mitigate against physical and cyber system vulnerabilities.

Proposal 3 – to enable roaming services to deliver a seamless EV charging experience between public chargepoints.

Proposal 4 – to ensure overall operational coordination of industry parties seeking to exploit EV flexibility through smart charging technologies and electricity market products.

Proposal 5 – to agree the minimum technical requirements for EV chargepoints necessary to facilitate the management of the electricity network.

Proposal 6 – to develop governance arrangements for the use of emergency charge limitation by a network company.

Proposal 7 – to develop common labelling standards to ensure that the interoperability performance of EV supply equipment is clearly communicated to consumers.

Proposal 1 – Leading the way on international standards

UK to take a leading position in defining international interoperability standards.

The interoperability needed to give consumers convenience and choice will only be achieved if common design approaches are adopted across the EV sector. Against this ambition, it is important to recognise that EV charging is an evolving marketplace where technical innovation is to be encouraged. Premature standardisation can have a dampening effect on this innovation. Proposals have been developed that seek to balance these objectives, with greater market freedom earlier but a clear direction of travel that the development of appropriate standards, combined with market forces, will lead to greater interoperability sufficiently quickly. It follows that Government should encourage industry to move towards interoperability in the short-term whilst monitoring developments with a view to intervening if interoperability is not delivered by industry.

Government should work with industry to encourage the adoption of common international 'whole-system' standards to cover all aspects of EV charging (cyber security and grid security are discussed in Proposal 2), whilst allowing companies to go their own way, if needed, for new services that are beyond current standards. Given the wide range of industry stakeholders who will benefit from this process, a coordination body should be identified by government and industry to oversee the proposed review. This work has been started by BEIS and OLEV who have sponsored the development by the BSI of two Publicly Available Specifications (PAS) to cover Energy Smart Appliances (ESAs) [25] and Demand Side Response (DSR) [26] .

It is proposed that Government should:

- In collaboration with industry, establish a body to coordinate their involvement in agreeing the adoption of international and open standards as the basis of EV charging based on the outcome of PAS 1878 and PAS 1879;
- Support interoperability between all EVs and chargepoints, including internationally;
- Support interrogation and control of public chargepoints by legitimate 3rd parties;
- Protect consumers through transactional traceability;
- Mitigate whole-system risks by designing robust approaches to data sharing, automation and fault diagnostics, across all industry stakeholders;
- Refrain from mandating specific choices of standards in the immediate future in order to allow innovation in technology and commercial offerings to deliver consumer benefit;
- Encourage the development of common standards that will enable the remote change of a smart chargepoint operator; and
- Retain an agreed level of 'smart' performance in the event of loss of communications or if the chargepoint operator ceases to support the chargepoint.

Proposal 1
By no later than 2025 industry must have reached convergence on a preferred set of standards that meet interoperability requirements across the EV charging infrastructure. Government must intervene if this is not achieved. Government and industry should, as a matter of urgency, review, define and propose international standards for communications, data and security protocols in order to meet this goal.

To support this work government should establish a body with industry to coordinate the involvement of industry stakeholders.

Proposal 2 – Delivering a resilient charging infrastructure

Government and industry to agree common standards to manage cyber and digitalisation risks.

The digital integration of EVs needs to be delivered by applying a 'system resilience by design' approach. This will address and mitigate against both physical and cyber system vulnerabilities which can have far reaching consequences. Efficient and effective safeguards must be in place to ensure clear accountabilities for all market actors, covering data access, privacy requirements and traceability of digital transactions and decision-making to prevent system failures. Cyber security must be ensured regardless of the form of interoperability. Agreeing common approaches to assure cyber security will be an essential task for successful interoperability.

The purpose of smart charging is to modify network electrical load to reduce peak demands and help manage network constraints. The control of this will primarily rest with the CPOs who will potentially have the ability to modulate the output of large numbers of chargepoints. This capability could have potentially damaging impacts if poorly designed and operated, or if it falls under the control of hostile actors. Government must ensure that CPOs are aware of their responsibilities for ensuring the security of their systems. This will require the adoption of appropriate standards dealing with all aspects of the system from the back office to the chargepoint. It will also likely require certification of the chargepoint and possibly other devices in the system. The choice of standards typically follows a risk assessment of the full end-to-end system and can be different for different service offerings. Even for similar systems, it is possible to choose different sets of standards to support cyber security and it is not recommended that a single solution is mandated. Indeed, this is also an area subject to significant international development, so that some standards have not yet been published. However, Government can work with industry to identify a preferred set of standards. Given that the UK is one of many EV markets, as far as possible these should be international standards and be aligned with international best practice. BSI has reviewed standards for smart chargepoints [27] and this should provide the starting point for this work. Failure to use these standards to ensure their cyber security protection would require the CPO to provide their own risk analysis and justify how they have mitigated the risks. This would have a strong effect in moving industry towards adopting a common approach. Government could also work with industry to put in place any product testing and assurance processes needed to comply with the standards.

It is proposed that:

- Government and industry must ensure that best international practice is applied in the development of the charging infrastructure to ensure resilience and mitigate against system vulnerabilities (physical and cyber);
- Building on the BSI review of standards, Government, working with industry, should identify a 'preferred' set of standards based around international standards that will receive all necessary support, including product certification and testing. It is expected that this will include the security elements of ISO/DIS 15118-2:2018(E);
- Failure to use these standards to ensure their cyber security protection would require the CPO to provide their own risk analysis; and
- Government, working with industry, should ensure that the normal operation of smart charging does not create risks to network security.

Proposal 2
Government and industry must ensure system resilience by design. This includes ensuring that CPOs are aware of their responsibilities for ensuring the security of their systems. Government with industry should agree a common standards base for cyber security but not mandate a single solution, however, Government should provide support for the preferred set of standards, including device certification.

‘Providing EV drivers with a hassle-free, seamless charging experience requires the urgent development of further standards and codes of practice that ensure full interoperability and sharing of data between the vehicle and the electricity system.’

Howard Porter, BEAMA Chief Executive

Proposal 3 – Making public chargepoints easy to use

Industry to deliver roaming services for a seamless EV charging experience everywhere.

When driving petrol and diesel vehicles, consumers can use any filling station without having to offer loyalty or contractual commitment to any supplier and can pay for fuel in many ways. They will expect the same when using their EVs.

In July 2019 Government announced [28] that it expected industry to deliver a roaming solution whereby EV drivers could access any public chargepoint through a single payment method without needing multiple smartphone apps or membership cards.

The Electric Vehicle Energy Taskforce supports this ambition along with the proposed industry-led approach to its delivery: it believes that while roaming is important to simplify the experience for users, it should be left up to chargepoint operators to define their own commercial arrangements and preferred technical solutions to deliver this outcome.

To progress the July announcement, Government should consult on the deadline for delivering a roaming solution across public chargepoint networks.

It is proposed that:

- The deadline for delivering a roaming solution should be the end of 2021. However, additional time should be considered for converting legacy systems and units. Chargepoint operators should not be penalised for investing in charging infrastructure in good faith;
- Roaming should allow drivers to access any public chargepoint, without signing up to multiple apps or memberships, through a single identification or payment method or through use of an existing subscription;
- Roaming must not prevent market models that offer discounts to reward loyalty, as a perk of another service, different pricing structures within membership packages – for instance for access to high powered chargers – or valued added services;
- Roaming should apply to all public chargepoints (i.e. slow, fast and rapid). The definition of public chargepoint under the Alternative Fuel Infrastructure Regulations excludes networks that are for the drivers of a particular vehicle brand or company (for instance Tesla's Supercharger network). However, the Electric Vehicle Energy Taskforce would encourage the development of a universal system in time, for the benefit of all EV drivers; and,
- In line with Government's announcement in July 2019 [28], that from spring 2020 all new rapid and high-powered chargepoints must offer credit and debit card payment options, the Electric Vehicle Energy Taskforce believes that chargepoints that offer contactless payment options should be seen as meeting roaming requirements.

Proposal 3
Industry should enable roaming services to deliver a seamless EV charging experience between public chargepoints by end of 2021.

Proposal 4 – Delivering effective smart charging

Government and Ofgem to ensure that smart charging delivers benefits to consumers whilst ensuring electricity system security.

Smart charging systems can be complex with multiple parties, including the network and system operators, energy suppliers and aggregators, requiring the ability to modify the charging programme of an EV or groups of EVs. There is currently no industry code governing the order of precedence that would be applied in the event that more than one party requests control of an EV's charging at the same time. Precedence could be governed by a market or by deterministic rules. It is also expected that consumers will expect clarity about which party has the ability to modify their EV's charging programme and, in the event of the programme being modified, which party was responsible.

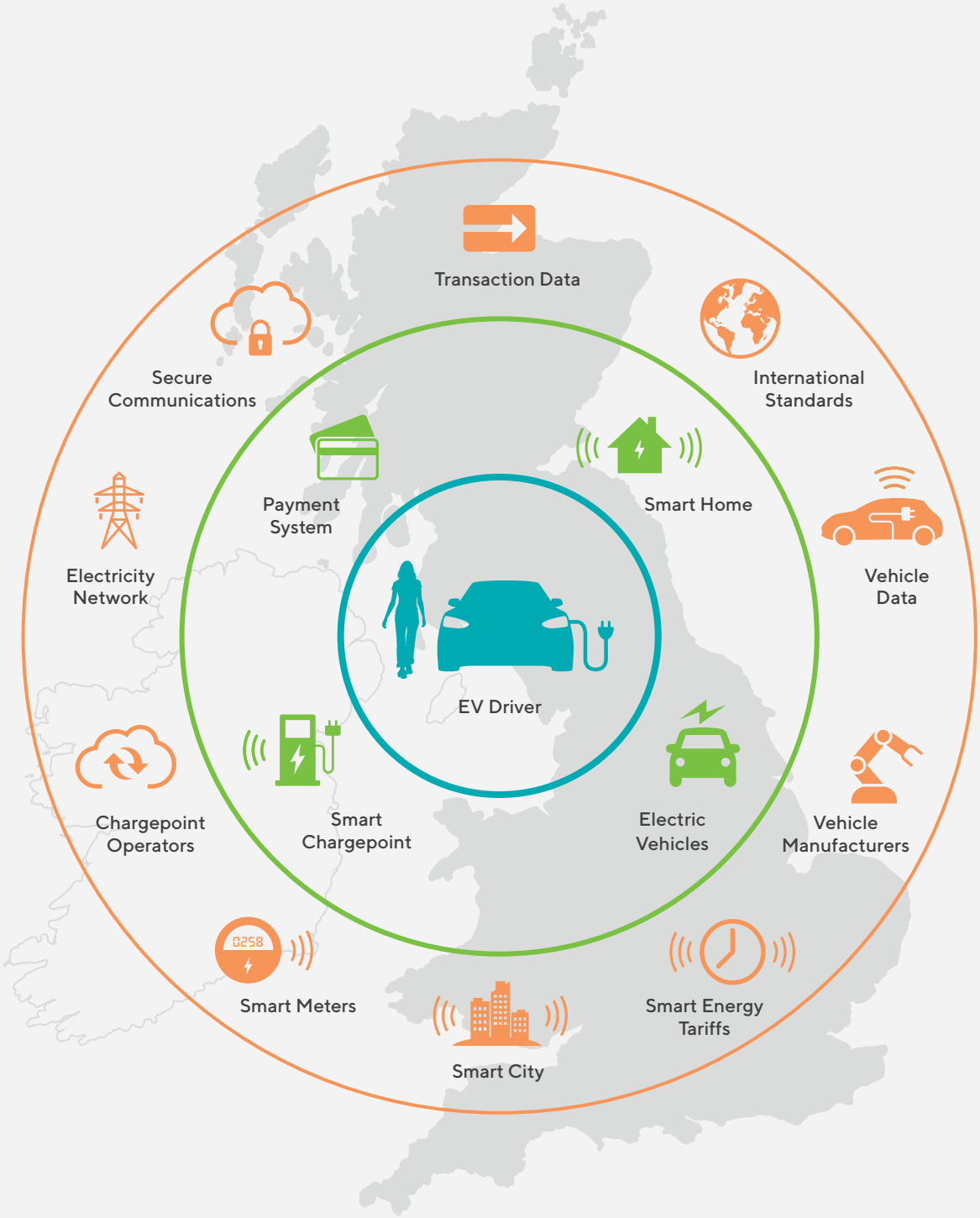
A lack of coordination and visibility in terms of which parties are exploiting flexibility from smart chargepoints, might lead not only to missed opportunities for electricity system efficiency and monetary benefits for EV drivers, but also risks to electricity system security and stability.

Ofgem and Government, should ensure that:

- Effective governance is in place to ensure coordination of smart charging through appropriate codes governing dispatch of smart charging control and/or price signals. Coordination of the installation of any control or metering equipment at the interface with the consumer's smart charger should also be guaranteed;
- Consumers using smart charging have a clear understanding of the parties (or party acting on behalf of multiple parties) that have the ability to control their chargepoints;
- Consumers have a clear understanding of the rules under which they operate and the consumer's ability to override the control signal;
- Consumers must receive information on which parties have been responsible for modifying their charging programme; and
- Consumers receive clear information that enables them to understand the remuneration or cost savings they should receive as a result of transactions over a given settlement period.

Proposal 4
Government and Ofgem, through the electricity industry technical and market code governance frameworks, should ensure overall operational coordination of industry parties seeking to exploit EV flexibility through smart charging technologies and electricity market products by 2021. Clear visibility as to which market products are in play must be evident to both industry and users at any time, as well as which transactions have occurred over a settlement period. It must also ensure that the operation of smart charging does not present a risk to the stability of the electricity system.

Interoperability - Making It Easier for EV Drivers



Proposal 5 – Establishing minimum technical requirements for smart chargepoints

Industry to agree minimum requirements to facilitate the management of the electricity network.

A fundamental driver for smart charging is to reduce the need to provide extra electricity network capacity, especially for the low voltage network, and generation capacity to support the uptake of EVs. EV chargepoints could play an important role as part of a smarter and more flexible energy system. Smart charging is most relevant when the EV is connected for longer than normally required to achieve a full charge. These are typically the 'duration' charging events: off-street residential, on-street and destination charging. The requirements for smart charging should be restricted to these forms of charging. This is in line with the proposals in the OLEV Electric Vehicle Smart Charging Consultation and the Electric Vehicle Energy Taskforce supports this proposal.

To be effective, this will require further forms of interoperability, meaning that a smart chargepoint must retain its full functionality without intervention when:

a) the user switches electricity supplier; and/or

b) the user switches to another EV brand and/or model.

Consumers should also have confidence that their charger will continue to give a degree of smart operation, such as being locally programmable, even if the charge point operator ceases to support the charge point, for whatever reason.

To achieve this will require further minimum technical requirements for EV smart chargepoints to be introduced to OLEV's EV minimum technical specification , setting out the detailed functional capabilities of the chargepoint as appropriate for the chargepoint's application (on-street, off-street, destination and any others). It is further proposed that V2G should have its own minimum requirements but these should not be included in the other applications at this time. The powers set out in the Automated and Electric Vehicles Act [30] provide the foundation for the introduction of such requirements and can be used to enforce these requirements. In particular:

- The consumer information that must be collected by the chargepoint;
- The ability for users to opt out of smart charging default settings;
- The rate of charge that domestic chargers revert to in the case of a communication network disruption;
- The minimum functional requirements for a smart charger or chargepoint, as appropriate for its application (these are set out more fully in the detailed Work Package 3 Report); and
- The provision of smart operation when the chargepoint is no longer supported by the CPO.
- Consideration of how to ensure compliance with the minimum requirements when this is no longer ensured by compliance with the Electric Vehicle Homecharge Scheme.

Proposal 5
Industry should agree to extending the minimum technical requirements for smart chargers set out by OLEV to facilitate the management of electricity network capacity and energy availability (based on the details set out in the Work Package Three report). These requirements should be introduced in line with the powers set out in the Automated and Electric Vehicles Act by 2021.

Proposal 6 – Ensuring the safety and security of the electricity system

Ofgem and industry to develop arrangements to curtail charging in emergency circumstances.

As well as delivering direct consumer benefits, smart charging will also be key to protecting the energy networks by helping to relieve operational constraints.

Smart charging should be delivered by the market for the consumer. In rare cases however it may be necessary to undertake 'emergency charge limitation' – whereby a network operator issues an instruction to a chargepoint to stop or curtail charging – to prevent network failure and loss of supply to consumers.

Emergency charge limitation would only be used in limited circumstances as a short-term, last resort action to meet a proven need and in the absence or failure of market-based solutions (e.g. extreme weather events, loss of gas in an area temporarily creating electrical heat demand peaks, faults on the network, etc.).

Ofgem has yet to determine whether emergency charge limitation is justifiable and should be permitted. The Electric Vehicle Energy Taskforce does not wish to pre-empt Ofgem's decision and has instead laid out key considerations to help inform its decision-making process.

If permitted, network and system operators must work with Ofgem, industry and consumer representatives to develop governance arrangements for the use of emergency charge limitation which must require the following:

- Emergency charge limitation must only ever be used to protect the safety and security of the electricity system and in response to an immediate issue on the network (e.g. faults, imminent overloads, disruptive events, etc);
- When emergency charge limitation is used in a certain area, deployment must be time-limited with a requirement to implement a long-term solution (e.g. network reinforcement; procurement of a market-based flexibility solution);
- Limits must also be set on usage over a 24-hour period and a 30-day period with penalties and incentives set under Ofgem's RIIO ED2 to ensure that network operators only use emergency charge limitation as intended;
- Industry must work together to ensure that vulnerable customers are not put in danger and/or other arrangements are put in place when emergency charge limitation is used, including by using the Priorities Services Register; and
- Consumers should be informed about emergency charge limitation events, as soon as possible.

Issues that will need further consideration include:

- Whether consumers should be compensated for an emergency charge limitation event;
- Whether consumers should have a temporary override button to get immediate charge in the case of need;
- Whether emergency charge limitation should be delivered by a third party rather than the network operator; and
- Whether the Clean Energy Package limitations on network operators owning and operating EV chargepoints permits emergency charge limitation.

Proposal 6
If permitted, network and system operators must work with Ofgem, industry and consumer representatives to develop governance arrangements for the use of emergency charge limitation by a network company. Emergency charge limitation should only be used as a last resort to maintain the safety and security of the electricity system.

Proposal 7 – Introducing consumer-friendly product compatibility labelling

Industry to ensure that chargepoint equipment has clear and understandable labelling to support consumer choice.

Consumer choice is important to drive competition and innovation. Empowering consumers to make informed decisions and to 'vote with their feet' is the most effective way of delivering consumer choice in a new and fast-moving market. This forces industry to compete for customers by constantly adapting their product offerings to users' wants and needs and offer the best consumer experience.

The Electric Vehicle Energy Taskforce has identified three main aspects to delivering consumer choice and competitive markets with regards to private chargepoints:

1 A chargepoint retaining full smart functionality when the energy supplier is changed;

2 A chargepoint retaining full smart functionality when the vehicle brand is changed; and

3 A chargepoint operator being able to remotely take over a unit and offer the same level of smart functionality, for instance in response to a consumer request or because the previous operator has ceased operating. This is sometimes referred to as "smart interoperability".

The Electric Vehicle Energy Taskforce believes that points one and two are important and realistic deliverables for competition and should be required as standard for all smart chargepoints, subject to specific time-limited contractual arrangements (if, for instance, a chargepoint is part of a bundle).

On point three, it is proposed that – at least in the short-term – it is left to consumers to choose whether or not this is a desirable product attribute as described in Proposal 1 above. Consumer preferences will then force chargepoint manufacturers to respond accordingly. It follows that it must be clear to consumers, from the product labelling and other product material, what interoperability the electric vehicle supply equipment (EVSE) can provide.

The Electric Vehicle Energy Taskforce therefore proposes that Government and industry identify and define preferred labelling standards. This will allow the market to offer a range of products, with different capabilities to a consumer base that is free to make an informed choice. This proposal is complementary to Proposal 18.

Proposal 7
By 2021 industry must develop common labelling standards for EVSE, enforced by Government if necessary, so that consumers are aware of the forms of interoperability available from clear, comprehensible EVSE package labelling and other product material. There are a number of types of interoperability and it is proposed that generally, offering these is left as an option for EVSE providers.

Theme 2 – Rewarding consumers for charging smartly

Introduction

There is a real opportunity to boost the take-up of EVs by making it easy for consumers/EV drivers to be properly rewarded for the services they provide to support the electricity system by smart charging. Markets already exist to trade these services, but they are not designed to interface with millions of EVs, or other domestic devices. The operation of these markets needs to be reimagined from a consumer's perspective in order to do this.

Government and Ofgem should accelerate their current joint programme exploring flexibility in the electricity retail market to ensure that its value is made easily accessible to retail consumers. The Electric Vehicle Energy Taskforce also proposes that Government and Ofgem should take positive steps to encourage consumers to install a smart meter with every domestic chargepoint to allow full access to flexibility markets. Again, delivering positive consumer outcomes should be a primary driver.

The Proposals

The Electric Vehicle Energy Taskforce has made three proposals under this theme. They are:

Proposal 8 – to require private EV charge points to charge smartly by default.

Proposal 9 – to develop electricity markets to properly reward consumers for the benefits their actions deliver.

Proposal 10 – to maximise the number of consumers who have a smart meter installed before or alongside the installation of a chargepoint.

Proposal 8 – Making smart charging the norm

Asking consumers to opt out of smart charging rather than opt in.

To ensure that the benefits of smart charging – to the user and the system as a whole – are realised in the short-term and that less engaged consumers participate, smart charging should be the default from which consumers can opt out if they wish.

By increasing participation in smart charging, this will deliver direct energy bill savings to the EV driver (when combined with a 'time of use' tariff) and indirect savings through reduced energy system costs, benefiting all energy bill payers.

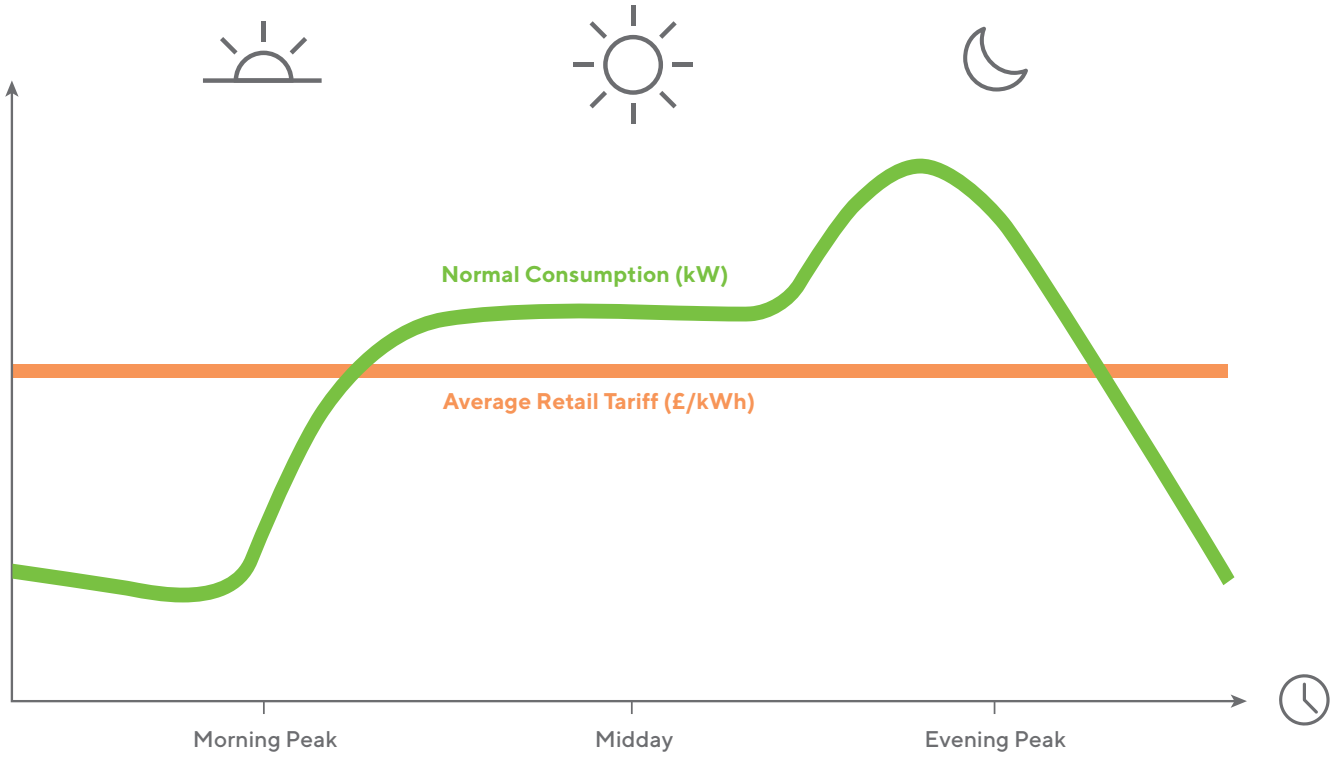
Key considerations of this proposal include:

- To ensure that this proposal supports rather than hinders competition, companies should be given discretion on how to interpret and apply this proposal. A requirement for users to input their own default settings when they first set up their unit, for instance, could be a consumer-friendly way of determining appropriate defaults, however different providers may have alternative approaches that deliver a better consumer experience;
- An outcome-based approach – of shifting EV charging from on-peak to off-peak times – should be applied rather than setting a prescriptive default off-peak charging mode, as proposed in Government's recent consultation on smart charging standards. This has the added advantage of increasing diversity, and reducing secondary peak risks;
- Consumers must remain in control of their charging preferences, therefore it must be easy for them to change the settings and opt out of the default, for instance by overriding the default or choosing a 'charge now' function;
- The minimum technical requirements set out in the Work Package 3 report provide for a time programme that could be pre-set and also a panel to allow the consumer to modify this setting;
- Further consultation (whether formal or informal) with chargepoint operators, chargepoint manufacturers, energy suppliers and aggregators will be needed to determine detailed proposals. This should be coordinated with BSI's Energy Smart Appliance Publicly Available Standard work which is underway; and
- The proposal should be introduced as part of, and within the same timeframe as, Government's device-level smart charging standards, which are expected to be set out in 2020 and enforced from 2021.

Proposal 8
Require private EV chargepoints to charge smartly by default, thus making smart charging participation an opt-out function by 2021.

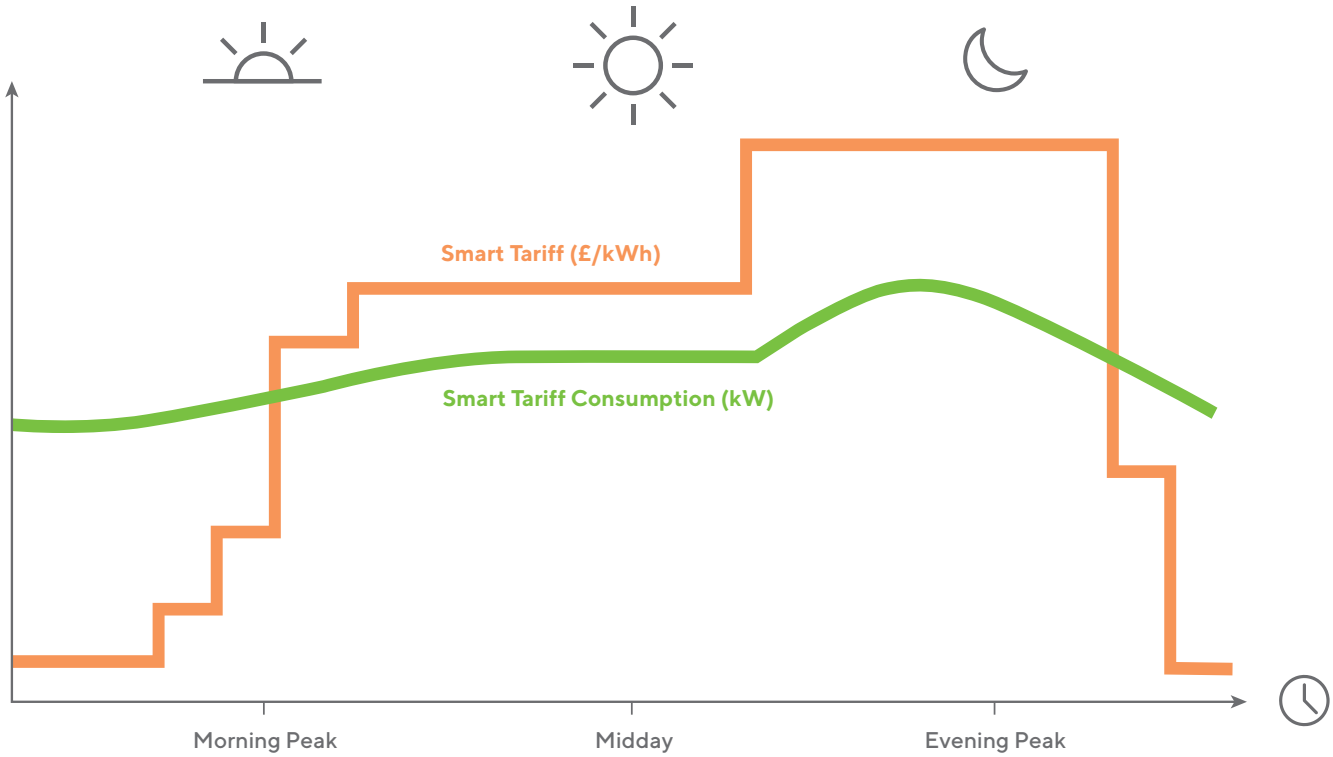
Without Smart Charging

EV charging exaggerates peak demand particularly in the evening.



With Smart Charging

In response to price signals, EV charging can reduce the variation in consumption, while saving EV drivers money.



Proposal 9 – Making the electricity market work for EV drivers

Government and Ofgem to deliver market mechanisms which reward EV drivers' actions.

The Government and Ofgem must ensure that the value of system services and the financial benefits of optimised network reinforcements and whole electricity system efficiencies, created by the actions of consumers, are reflected and accessible through market price mechanisms. EV chargepoints have the potential to support the operation and decarbonisation of the wider energy system in a number of ways. For the potential benefits to be fully realised it is vital that consumers are incentivised and rewarded for the system benefits arising from their actions. The benefit will be mutual allowing for improved propositions for the consumer and wider system payback. As part of its Targeted Charging Review, addressing residual network charges, and its Access and Forward-Looking Charges projects, Ofgem is reviewing price signals sent to users of distribution networks through the charging arrangements. Building on such activities, tariffs that better reflect true network costs and which more closely align retail price to wholesale variations (e.g. day-ahead dynamic tariffs) would further encourage demand flexibility. These propositions are designed to engage and bring about behavioural change, motivated in part by the carbon and environmental benefits but also through price and/or revenue incentives. This objective would be further supported through a regulatory framework which encourages innovation in whole-system and energy transition solutions.

Consideration should be given to the following points:

- Market mechanisms that encourage EV owners to provide energy services and/or avoid incurring additional energy system costs must be established;
- The overall market framework should allow a wide range of market participants and business models to compete on a level playing field;
- These market mechanisms must be coordinated to exploit potential synergies and avoid conflicting responses;
- This functionality should be delivered by BEIS/Ofgem comprehensively assessing the current markets and amending as appropriate; and
- Networks companies, generators, suppliers and aggregators should develop data driven market propositions.
- Building on existing work, networks companies, the automotive sector, suppliers and aggregators should further develop real world innovation trials at scale, working with consumers to understand the price signals needed to sufficiently reward people for providing flexibility and delivering wider system benefits.

Proposal 9
The Government and Ofgem must ensure that existing markets for flexibility are made accessible for EV drivers. They must also support the development of new co-ordinated and accessible markets for flexibility to compete with traditional networks and wider whole electricity system solutions by 2023 at the latest. Markets and price signals should maximise the opportunities for consumers to utilise their flexible resources, including EVs, and sufficiently reward them for offering demand flexibility services that support optimised network operations and investment, emission reductions and whole electricity system efficiency.

‘Smart electric vehicle charging must above all else deliver a good user experience. Consumers must be able to choose when to charge their electric vehicle and should be rewarded for offering flexibility to the energy system.’

Audrey Gallacher, Energy UK interim CEO

Proposal 10 – Getting value from smart meters

Government and Ofgem to encourage EV drivers to benefit from smart metering.

Smart meters are currently being rolled out across Great Britain, and as of August 2019, about 10 million out of approximately 32 million homes have a smart electricity meter installed. [31]. Furthermore, a number of consumers consider installing a smart meter as a low priority, causing difficulties in persuading uptake. [32]. Without a smart meter, consumers will be unable to access innovative tariffs and delivering some grid services may not be possible. Access to these can reduce the cost of their bills, improve the service propositions and provide wider system benefits. Smart meters can also provide visibility of charging patterns and usage for network operators, allowing them to more accurately assess network headroom and necessary reinforcements. The Government should look to encourage and maximise the number of homes with both smart meters and EV chargepoints.

While the Electric Vehicle Energy Taskforce believes that smart meters are an important enabler for smart charging and the EV rollout, it is not expressing a view on the desirability or viability of undertaking smart charging through the smart metering system, as examined under the Government's 'Phase Two' proposals of its smart charging consultation.

Consideration should be given to the following points:

- BEIS/Ofgem should establish a process which strongly encourages consumers who are going to install, or already operate, a chargepoint to have a smart meter installed;
- This process could be triggered by the installation of a chargepoint and include notifying the consumer's energy supplier; and
- This process should ensure that consumers understand the potential benefits that a smart meter could offer to the overall cost of operating their EV.

Proposal 10
The Government and Ofgem should ensure on an ongoing basis from 2020, possibly through a process triggered by a chargepoint installation, that the number of consumers who have a smart meter installed before or alongside the installation of a chargepoint is maximised, and that consumers have been properly informed of the potential benefits.

Theme 3 – Utilising and protecting data for better consumer outcomes

Introduction

The Electric Vehicle Energy Taskforce considers that two key principles should be applied in relation to EV data management. First, EV drivers should see value in allowing their data to be shared with third parties. Second, they must be assured that their data will be protected. EV drivers will expect easy access to comprehensive chargepoint data: location, availability and speed of charge. The Electric Vehicle Energy Taskforce proposes that chargepoint operators make this data available to meet this need.

A key theme underlying the work of the Electric Vehicle Energy Taskforce has been whole-system thinking. The parties developing the EV charging infrastructure will work closely with, in particular, the electricity industry and the national and local planning authorities. The Electric Vehicle Energy Taskforce supports the recommendations made by the Energy Data Taskforce and believes they can be applied in the EV sector. Industry, including EV manufacturers, should cooperate to put in place data acquisition and sharing mechanisms that facilitate efficient planning and operation of the EV charging infrastructure.

The Proposals

The Electric Vehicle Energy Taskforce has made three proposals under this theme. They are:

Proposal 11 – to establish industry-wide data sharing arrangements.

Proposal 12 – to facilitate the creation of public chargepoint information apps.

Proposal 13 – to introduce a data access and privacy framework for the EV sector.

‘A flexible grid, delivering smart charging to smart electric vehicles requires accessible data. Frameworks therefore need to be developed to facilitate the appropriate secure sharing of this data.’

Matt Evans, TechUK, Executive Director

Proposal 11 – Achieving system optimisation through shared intelligence

Industry to establish industry-wide data sharing arrangements.

Government, energy system infrastructure, vehicle (including state-of-charge) and energy market data should be made available at a local and national level, to allow innovation, planning, investment and operational decisions around EV load and infrastructure system optimisation by the appropriate parties. For example, for a DNO to better understand reinforcement and deployment of low voltage network monitoring, for installers to understand network capacity headroom and presence of smart charging schemes at a local level, or for the ESO to maintain system frequency and stability of the electricity system. Data access and rules must develop in a way that encourages ongoing innovation and opens up the market to new solutions - the recommendations from the EDTF [41] for data being presumed open, with a suitable triage process for access, should be implemented. Market participants should collect and share anonymised, statistical data on EV usage patterns, charging and energy consumption with relevant parties in order to allow the energy and transport systems to work effectively together and provide value to all market participants. There is significant uncertainty in the nature of the future transport system, particularly with respect to new business models such as Mobility-as-a-Service (MaaS), therefore data availability and access will enable electricity networks and others to deliver a reliable and efficient electricity system.

A full list of EV and associated energy infrastructure data is provided in the Work Package Four Report.

Consideration should be given to the following points:

- Digital integration must be inclusive to all market participants to maximise the uptake of electric vehicles and unlock whole energy system benefits;
- There needs to be clear guidance with regards to governance of data ownership, sharing and management among all market participants to create a level playing field;
- Digital integration is not bound by national boundaries and a global market view should be adopted for the UK;
- Customer choice, customer assurance and customer value will determine the pace of innovation and time to market for novel digital products and services; and
- The digital integration of electric vehicles from a whole-system perspective needs to consider wider and future focus areas such as cyber security, increasing levels of automation and artificial intelligence.

Proposal 11
Industry players should cooperate to develop comprehensive data sharing arrangements (including standardisation where appropriate) and open and interoperable exchange principles and mechanisms, in conjunction and alignment with implementation of the Energy Data Taskforce recommendations. They should also advise Government and relevant regulators if industry licences or codes need changing or if legislation is required to allow such sharing of data by 2021. Government and regulators to review progress and to act if necessary.

Proposal 12 – Making public chargepoints easily accessible for EV drivers

Making chargepoint data open and available for consumer and system benefits.

Currently, transport and energy datasets are fragmented and not in a format that enables them to be easily collated. EV drivers require better access to data to enable them to better understand and engage with their EV charging options, particularly with respect to public chargepoints. They need to understand where and when EV chargepoints are available, especially at peak times (e.g. holiday destinations during Bank Holidays, sporting events, festivals, etc).

Data access will maximise convenience for consumers and encourage the development of innovative applications that help users identify how they can best meet their charging requirements. A consistent registration strategy for all chargepoints (including private, public and workplace) will ensure optimum planning and operation of the electricity networks, further benefitting consumers.

Consideration should be given to the following points:

- EV owners will require consistent, easily accessible, accurate data to be openly available on public chargepoint location, type, status, capacity, price and availability to enable them to find (and possibly reserve) an available, working public chargepoint that is suitable for their immediate charging needs.
- The data will need to be updated at a frequency appropriate to its type; e.g. close to real time for availability. An asset registration strategy must include all fixed chargepoints (i.e. private, public, workplace, etc) and should include all relevant data to ensure optimum planning and operation of the electricity networks.
- Relevant datasets should be Presumed Open and subject to the Triage Process in keeping with the principles espoused by the Energy Data Taskforce.
- Relevant datasets should be included within the scope of the Data Catalogue recommended by the Energy Data Taskforce
- Chargepoint operators should be incentivised to provide data through an appropriate mechanism such as the Motor Fuels GHG Emission Reporting Regulations which complements the Renewables Transport Fuels Obligation.

Proposal 12
To facilitate the availability of open and accurate chargepoint data, public chargepoint operators, owners and market actors must make data on public chargepoint location, type, status, capacity, price and availability consistent and openly available for EV drivers by 2021. A single asset register, aligned with the Energy Data Taskforce Asset Registration Strategy, must include all fixed chargepoints (i.e. private, public, workplace, etc) and should include all relevant data to ensure optimum planning and operation of the electricity networks.

Proposal 13 – Giving consumers real control of their data

Government and Ofgem to introduce a data access and privacy framework for the EV sector.

Consumers need confidence on what data is being used for smart charging and EV services. There should be protections in place about how often industry can access this data and what for, and crucially, consumers should own data relating to their charging usage and transactions.

Consumers will need to be confident that any data they agree to release relating to their EV or chargepoint will be maintained according to an agreed framework of rules. General Data Protection Regulation (GDPR) sets out rules on the retention, deletion, processing and transfer of data. However, the Electric Vehicle Energy Taskforce has identified the need for further protections:

- To provide added reassurance and clarity to consumers on how data for smart charging and EV services can be used, what for and by whom;
- To clearly set out what data is owned by consumers and what is owned by other parties;
- To set out the rights and controls that consumers have over their data;
- To support industry in interpreting GDPR, for example on issues like data portability;

The Electric Vehicle Energy Taskforce proposes that a Data Access and Privacy Framework be set out by Government and Ofgem to deliver on the above. The framework must:

- Have provisions for removing historic data if a consumer moves away from the property;
- Ensure that consumers are clear about who has access to their data and whether it is being shared with other organisations (car manufacturers, EV retailers, CPOs, DNOs and energy suppliers) and if so, for what purposes;
- Incorporate learnings from relevant sources including the MiData project, Smart Metering Data Access and Privacy Framework and Ofgem's Half Hourly Settlement Code Review; and
- Take a global view, to ensure alignment with other jurisdictions where relevant.

Proposal 13
The Electric Vehicle Energy Taskforce proposes that Ofgem and Government introduce a Data Access and Privacy Framework for the EV sector to ensure that consumers have full control over their data by 2021. Consumers should be made aware of all data access issues at the point of sale of all EV products and services as well as their powers to control and delete this data.

Theme 4 – Winning consumers' trust and confidence

Introduction

There is an opportunity to make the transition to EVs a really positive consumer experience. The aim should be to make consumers want to drive an EV in the same way that they want to use a smart phone. However, committing to an EV is a significantly bigger decision than buying a smart phone. Winning consumers' trust and confidence in all aspects of the EV proposition is therefore essential.

The Electric Vehicle Energy Taskforce proposes that industry and Government should provide appropriate support, advice and protection starting at the point of sale. It is proposed that an independent body should promote the benefits of smart charging; Government should fund an independent advice service; and Ofgem and industry should ensure robust consumer protection and effective complaint handling.

The Proposals

The Electric Vehicle Energy Taskforce has made five proposals under this theme. They are:

Proposal 14 – to undertake a campaign to promote the benefits of smart charging to the public.

Proposal 15 – to provide an independent, tailored advice and information service on smart charging and EVs.

Proposal 16 – to adopt common, principle-based complaint handling standards across the EV sector.

Proposal 17 – to undertake a full review of consumer protections for all aspects of the EV customer journey.

Proposal 18 – to establish best practice standards for point of sale information relating to EVs

Proposal 14 – Promoting the benefits of smart charging

An independent body to campaign for the benefits of smart charging.

Proactively raising awareness of the benefits of smart charging will be important to secure consumer buy-in. While much of this will, and should, be undertaken as part of individual companies' marketing activity, there is merit in coordinated consumer-facing activity.

Consideration should be given to the following points:

- An independent body should be appointed to lead consumer-facing communications activity;
- The focus of this body should be on promoting the benefits of smart charging to consumers, myth and jargon busting and providing marketing tools that can be used and adapted by the private sector;
- The body should also undertake ongoing market research to ensure that messaging and content is aligned with users' motivations to participate in smart charging, rather than based on assumptions of what drives behaviour;
- The organisation(s) responsible for delivering advice on smart charging – as part of Proposal 15 – could also be tasked with promoting the benefits of smart charging. An alternative option is for the communications body to be separate and wholly or partly funded by interested private sector partners, such as the energy and automotive sectors;
- A new body could be created or the remit of an existing body or campaign (e.g. Go Ultra Low, Smart Energy GB, Citizens Advice, Energy Saving Trust) could be extended;
- Government should coordinate the implementation of the proposal, passing on responsibility for the campaign and research activities once the body is in place; and
- The Electric Vehicle Energy Taskforce proposes that the work be undertaken in parallel with the implementation of Proposal 15, meaning that an organisation should be appointed and an independent body set up by the end of 2021 / start of 2022. The launch of the campaign, however, should be in line with market availability of smart charging offerings and be kept open for review, to ensure that EV drivers are able to meaningfully act on the messaging.

Proposal 14
The Taskforce proposes that an ongoing and proactive campaign be undertaken to promote the benefits of smart charging to the public. An existing independent organisation could be given this task, or a new consumer-facing body established during 2022.

Proposal 15 – Providing a trusted source of impartial help and information

One of the first challenges to be addressed to build consumer confidence is to provide consumers with consistent information and advice about smart charging that they can trust.

There are a number of sources that play a role in providing information on EVs and smart charging. The private sector will be expected to provide consumers with information on specific smart charging products and services. However, there is no consistency in what information people receive and at what points; this can lead at best to misunderstanding and at worst to misinformation.

Access to an independent, expert and trusted advice service that represents consumer interests will be critical to build public confidence and help educate consumers on smart charging. It must be a key priority for Government.

Consideration should be given to the following points:

- An advice service with a remit of providing impartial and tailored advice to consumers on smart charging and EVs should be appointed by Government;
- To ensure that this advice service is seen as being independent and impartial, it must be delivered by an organisation that has no commercial interest. The advice service must therefore be Government funded rather than by industry;
- The provider must be a trusted and impartial body with the expertise to deliver comprehensive and accurate information and advice in one easy to find location - a so-called 'one stop shop';
- The advice service will complement the activity of the body for consumer facing communications – outlined under Proposal 14 – by providing advice and information able to be tailored to the consumer's individual circumstances. The body charged with delivering advice could also be tasked with providing the proactive consumer facing communications on smart charging if it had the relevant expertise;
- Government should procure the advice service through a competitive tendering process subject to the criteria above; and
- The Electric Vehicle Energy Taskforce proposes that scoping work and engagement with industry and potential suppliers begin in 2020, the tender process be launched in 2021 with a view of appointing a provider by the end of 2021 / start of 2022.

Proposal 15
The Taskforce proposes that Government fund the provision of an independent, tailored advice and information service on smart charging and EVs, to be established by the end of 2022.

Proposal 16 – Ensuring that market boundaries do not constrain effective complaint handling

Industry to adopt common complaint handling standards across the EV sector.

Trust and confidence can be won if consumers' complaints are dealt with swiftly and fairly. The bundling of home energy, public charging and vehicle services as well as the range of actors involved in the customer journey could create complex interdependencies within service provision. In such circumstances, users need to be confident that any problems will be resolved quickly and fairly, with clear boundaries for who is responsible and how the process will work.

Consumers must not be forced to navigate between different companies and agencies to resolve a problem. To prevent this, clear responsibilities for resolving consumer complaints must be defined and allocated between different market participants. Industry will need to agree to cooperate and work closely, jointly establishing processes to diagnose problems and assign them to relevant parties to create consumer confidence in fast, effective complaint resolution.

Consideration should be given to the following points:

- Complaint handling standards must be developed and implemented by all service providers involved in smart charging activities (including but not limited to energy suppliers, aggregators, chargepoint operators and installers, vehicle manufacturers);
- As the standards will cut across many different industries and organisation types, the standards should be principle-based, however access to an independent Alternative Dispute Resolution (ADR) is essential;
- The standards must be aimed at delivering a high level of service to the consumer;
- Establishing complaint handling standards should be industry-led in the first instance, to reflect the fast-changing nature of the EV sector; and
- Government must closely monitor implementation of the standards and if insufficient progress is made, keep open the option of intervening. The Electric Vehicle Energy Taskforce proposes the following timeline as a minimum:
- A set of standards must be agreed and published in 2020;
- The standards should be rolled out across industry over the course of 2021 with implementation by 2022.

Proposal 16
Industry must develop and adopt common, principle-based complaint handling standards by the end of 2021 to ensure that consumers are transferred seamlessly (between market boundaries if necessary) to resolve their problem(s), regardless of who they have initial contact with.

'Electric vehicles will impact how energy consumers buy, use and sell their electricity. As market offers become more complex and the number of intermediaries increase, access to independent advice and effective complaints handling will be crucial for consumers to get their problems solved.'

Gillian Guy, Citizens Advice CEO

Proposal 17 – Ensuring that consumer protections are fit for purpose

Government and Ofgem to take the lead on consumer protections for all aspects of the EV customer journey.

Consumer interactions with EVs and smart charging cuts across a range of sectors, from tightly regulated established sectors to new, largely unregulated ones. This means that many EV services are currently only covered by general consumer law, which brings a risk of consumer detriment as the roles and responsibilities in the sector evolve.

To understand exactly if and where further intervention is needed – both now and in the future – a thorough review of the consumer protections relating to smart charging and EV services must be undertaken.

Consideration should be given to the following points:

- The review should include a function mapping exercise, charting the roles and functions of each type of company involved in the EV customer journey, in order to identify whether consumers require further protection;
- The review will need to consider future roles that companies may play, alongside current ones;
- Particular consideration needs to be given to consumers in vulnerable circumstances;
- Existing work programmes that are looking at consumer protections (such as the Future Energy Retail Market Review which is looking at aspects of home charging) will need to be integrated; and
- The review should be launched in 2020 and be finalised by the end of 2021 at the latest, allowing enough time to undertake a detailed, in-depth review while ensuring that it is done in a timely manner.

Proposal 17
The Taskforce proposes that Government and/or Ofgem undertake a full review of protections for EV drivers by the end of 2021. This should build on and be coordinated with ongoing work (such as BEIS and Ofgem's Future Energy Retail Market Review).

Proposal 18 – Informing consumers about EVs and smart charging products and services

Industry to establish best practice standards for point of sale information.

As the electric vehicle market develops, the rapidly growing choice of products and services on the market may be confusing. Many organisations might play a role in informing and advising consumers about smart charging with the point of sale being a key opportunity to engage with them.

There is a risk that information given to consumers about EV smart charging could cut across different industries and organisations, causing confusion and providing an unpredictable consumer education. For example, you may learn about smart charging from a car manufacturer, a dealership, your energy supplier or a charge point operator. This could lead to inconsistencies in the quality of information and support given to consumers.

It will be important to promote best practice on information provision at the point of sale. This will help drive up knowledge within the supply chain and provide consumers with confidence that the person they are speaking to is knowledgeable and can support them in their purchasing decision.

Consideration should be given to the following points:

- Industry must develop and implement best practice standards for information provision at the point of sale;
- The standards must be backed up by an independent accreditation scheme to verify they are being applied consistently;
- This process should be industry-led in the first instance with Government keeping the situation under review, taking powers to intervene at a later date if necessary;
- The National Franchised Dealers Association's (NFDA) Electric Vehicle Approved (EVA) scheme can be used as a starting point. Other sector groups should seek to replicate and adapt the scheme to ensure that consumers are offered comprehensive and accurate information; and
- To give consumers added confidence, Government should endorse the standards, provided they are sufficiently ambitious.

Proposal 18
Industry to develop and implement best practice standards, backed up by an independent accreditation scheme, for information provision relating to smart charging and electric vehicle services at the point of sale by the end of 2021.

Theme 5 – Developing and maintaining the charging infrastructure consumers need

Introduction

Private sector investment must be unlocked in order to deliver a geographically sufficient charging infrastructure, providing equitable access for all. This requires sufficient confidence that the electricity system will facilitate and not constrain the growth of the charging infrastructure. Government and Ofgem must make certain, in part through the RIIO-2 price control process, that this precondition is met. They must ensure effective forward planning and coordination of the development of EV and electricity network infrastructure, nationally and locally. This will include the digital as well as physical integration of the EV charging infrastructure to deliver whole system benefits. OLEV must offer support to local authorities and other public bodies concerned with providing and maintaining EV charging infrastructure so that it quickly becomes a reliable, trusted national asset.

The Proposals

The Electric Vehicle Energy Taskforce has made three proposals under this theme. They are:

Proposal 19 – to ensure effective forward planning and coordination of the rollout of EV and electricity network infrastructure at a national and local level.

Proposal 20 – to ensure that Ofgem's RIIO-2 price control supports well-justified anticipatory network investment related to the development of EV charging infrastructure.

Proposal 21 – to provide support to local authorities, other public bodies and private organisations concerned with developing and procuring the delivery, operation and maintenance of public EV charging infrastructure.

Proposal 19 – Making the EV charging infrastructure a valuable part of the wider energy system

Effective planning and coordination of EV charging infrastructure, as part of the wider energy system, is needed to minimise costs, meet statutory obligations regarding air quality, ensure efficient network and charging investment and realise the system benefits of smart charging and grid services.

This can ensure that EV drivers have confidence in the development and accessibility of public EV charging infrastructure. In particular, that it will keep pace with potentially rapidly increasing EV take-up volumes irrespective of geographic location and type of journeys, and whether or not they have access to home-charging facilities. It can also ensure that electricity network development is undertaken in an efficient, coordinated and economic way at national, regional and local level, and that connections and supplies to individual EV chargepoints and charging hubs are provided in a timely and cost-effective manner.

To achieve the best outcomes, planning and coordination should be undertaken both strategically at a national level and in support of and complementary to planning at a more granular local level and with close alignment to wider transport and spatial planning.

‘Effective local and national coordination will be vital to help the most efficient delivery of the smart electric vehicle charging network that the public needs.’

David Smith, ENA Chief Executive

The Government should establish an integrated mechanism for the forward planning and coordination of the rollout of public EV charging and the supporting electricity network infrastructure. This will ensure better forward visibility of forecast EV uptake and chargepoint connections in different places. It will enable network operators to plan investment in required electricity infrastructure and industry to understand and be able to respond to changing public EV charging demands. The establishment and development of this mechanism should be considered in the wider context of the whole energy system and the Government's aspirations to achieve net zero energy systems by 2050. It should be supported by more accessible and open data across the energy system aligned to the recommendations of the Energy Data Taskforce to improve data visibility across the energy system [33].

Consideration should be given to the following points:

- The Government should facilitate national strategic planning to support the coordinated rollout of EV and electricity network infrastructure. This would focus on ensuring accessible EV charging along with the development of the electricity network to meet the growing demand of EVs. Initially this could comprise a cross government and industry forum or working group to review how planning and coordination is currently being undertaken, identify the critical gaps and inconsistencies and ensure the support needed at a local level is provided.
- The Government should provide support to local authorities in facilitating the planning of on-street, forecourt and destination charging facilities and forecasting future EV uptake as part of local energy, transport and emission reduction plans. National strategic planning outputs and guidance should inform Highways England, Transport Scotland, and the Welsh Government regarding provision of en route public charging over the Strategic Road Network and in local areas. Equally this should guide the development of robust evidence and plans related to the growth in EV use and public charging provision and how this informs the design and development of smart local energy systems. This should support an open dialogue between local authorities, network operators, Highways England and EV charging infrastructure providers, allowing EV charging to be considered as part of the wider whole energy system and enabling sufficient and timely investment. This needs to align to local transport and spatial planning, encompassing support and guidance to local authorities through Local Transport Notes [34] and to the national planning policy framework and its associated guidance [35].
- Ofgem should enable and encourage network operators to engage with local authorities in planning charging provision and forecasting future EV uptake in a structured and consistent way. This should be aligned to the latest RIIO-2 Business Plan Guidance [36] and wider whole-system local area energy, transport and emission reduction planning to engender stakeholder engagement and effective investment decisions.
- Ofgem should also consider how planning outputs could be most effectively utilised in informing well-justified anticipatory investment by network operators through the RIIO-2 price control (See Proposal 20) and in supporting whole-system approaches and minimising costs for all consumers.
- The Government should pursue the goal of developing a Digital Twin of energy system infrastructure that supports the efficient roll out of EV chargepoint infrastructure. This builds on recommendations put forward by the Centre for Digital Built Britain, Digital Framework Task Group and supported by the National Infrastructure Commission that a Digital Twin be implemented. This also aligns with the Energy Data Taskforce recommendation that energy system actors use existing data sets to build a map of current energy infrastructure and that third parties share other data to further inform its enhancement and evolution towards a full Digital Twin.

Proposal 19

The Government and Ofgem, as a matter of urgency, need to facilitate effective forward planning and coordination of the rollout of EV and electricity network infrastructure at a national and local level to meet consumer needs. This needs to be aligned nationally and to wider local area energy, transport and emission reduction plans and be implemented and used through RIIO-2 price control.

Proposal 20 – Facilitating efficient electricity network investment

The delivery of efficient and well-coordinated investment in electricity network infrastructure to support the connection of EV chargepoints is needed in order to ensure the electricity system supports the mass take-up of EVs and to minimise EV chargepoint connection costs and delays for the benefit of consumers. Effective management of the uncertainty associated with future EV charging demand is also needed to manage both the stranding risk and that of under-investment in network capacity.

Ofgem needs to ensure effective regulatory and market frameworks that encourage the development of an efficient, coordinated and economical electricity system able to support demand from EV charging. This includes supporting efficient, economical future-proofing and well-justified anticipatory (or highly anticipatory) electricity network investment that benefits consumers in the longer term. It should also serve the proposed EV charging infrastructure in combination with increasing decentralisation of generation and energy storage and support future wider decarbonisation policies such as Net Zero, and the potential electrification of heat. There is also the potential for efficiencies to be achieved when any anticipatory investment is aligned to asset replacement programmes. Selective investment in Low Voltage (LV) network monitoring to complement smart meter data is critical to enable accurate planning and operation of the LV networks, which in turn will reduce the costs associated with network reinforcement and operation for consumers.

Consideration should be given to the following points:

- Anticipatory investment is defined in this context as investment made in reasonable anticipation of future electricity demand due to EVs, driven by Government energy policy but in advance of firm (chargepoint) connection requests and maximum power requirement declarations.
- LV network monitoring, together with appropriate system modelling, is an essential component of an overall network information management capability (along with data from smart meters and potentially smart chargers). Such capability is essential to ensuring that network investment is optimised in terms of targeting and timing and should therefore be considered within the context of anticipatory investments subject to DNO business case justification.
- Insufficient allowances for anticipatory investment could result in reactionary and ad-hoc network investment, leading to potential connection delays and higher costs, as well as the failure to develop an efficient, coordinated and economic electricity transmission and distribution system.
- Appropriate 'uncertainty mechanisms' should be incorporated in recognition of the potentially large but uncertain timing of the impact of EV charging demand and the need for network investment.

Proposal 20
Ofgem should ensure RIIO-2 price control supports well-justified anticipatory network investment, including LV monitoring, that benefits consumers and enables efficient and co-ordinated deployment of the network infrastructure necessary for EV charging (with due consideration paid to other future additional loads including from the electrification of heat).

Developing and Maintaining the Charging Infrastructure Consumers Need

Proposal 21 – Delivering a high-quality public charging service for EV drivers

Ensuring that public EV charging infrastructure is effectively developed, operated and maintained is important to growing public confidence and trust in EVs. Poorly maintained and operated chargepoints create the risk of delivering a poor charging experience for EV drivers and adversely impacting public perception and uptake.

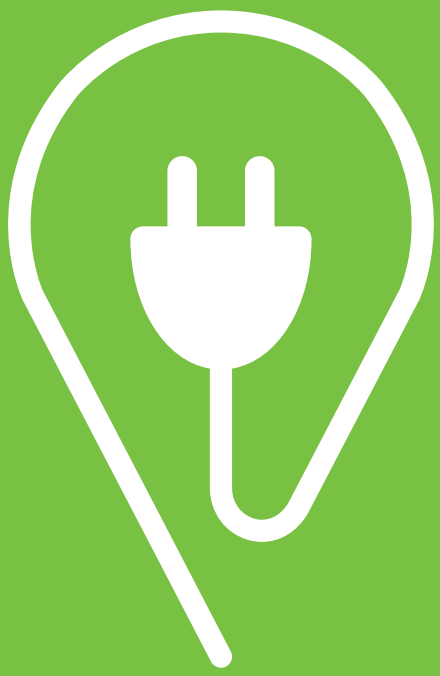
The Government should provide support to local authorities and all other organisations concerned with providing and maintaining public EV charging infrastructure. This should include both the sharing of best practice and provision of sufficient guidance on EV charging infrastructure development and its procurement and operation. This will ensure longer-term charging and electricity network infrastructure requirements are considered (aligned to Proposal 20) and that responsibilities for chargepoint maintenance and customer support are clearly defined with appropriate provisions to address contract termination, or in the event of a chargepoint operator failure. The type of EV charging infrastructure should suit the likely dwell time of drivers at different locations. It should also consider the management of parking to ensure chargepoints are effectively utilised.

A common approach to development, procurement, operation and maintenance of chargepoint infrastructure by local authorities and other public bodies will create efficiencies, enable industry to deliver, raise standards and minimise geographical disparities in user access and experience. Local authorities may also require ongoing support in applying the common approach to specifying and monitoring service standards for public EV charging.

Existing work, such as the 'general procurement guidance for electric vehicle charge points' produced by the UK EVSE to be considered for wider dissemination. Building on the data made available under Proposal 11, performance should be monitored and disseminated as appropriate.

Proposal 21
The Government should provide support to all public bodies and private organisations concerned with developing and procuring the delivery, operation and maintenance of public EV charging infrastructure. This should include the sharing of best practice and providing specific guidance on procurement of public charging solutions and requirements for effective delivery, ongoing operation and maintenance of public charging by the end of 2021.

4 Conclusion



Governance of the Electric Vehicle Sector

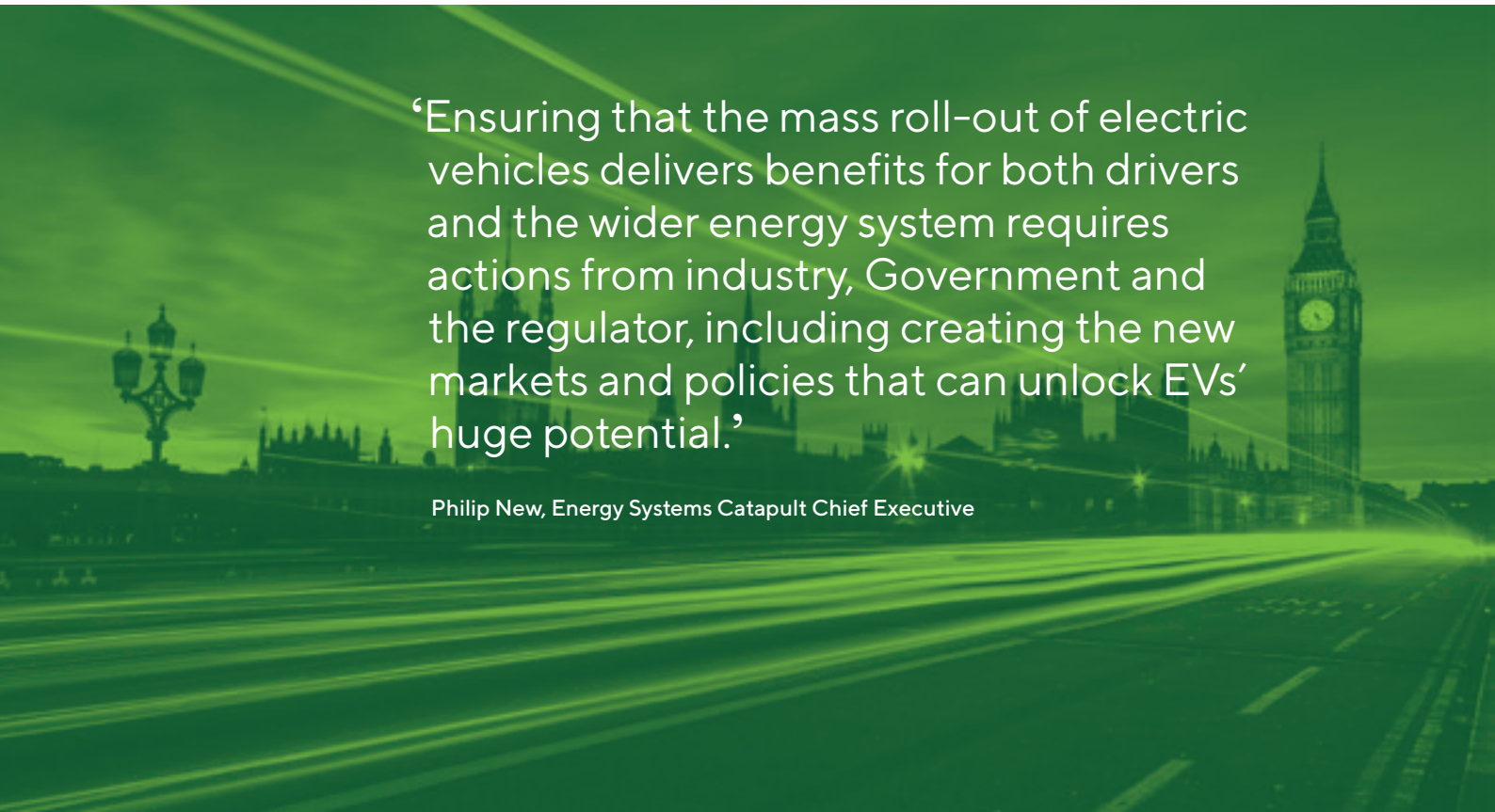
It is implicit in many of the proposals that their implementation will require some form of governance. This could be based on legislation, UK or international standards or simply codes of good practice overseen by Government, regulators or industry.

The consumer-facing proposals address point of sale information (Proposal 18), product labelling (Proposal 7), data access and privacy (Proposal 13), consumer protection (Proposal 17) and complaint handling (Proposal 16). They also propose making smart charging the default option (Proposal 8).

The EV charging and network infrastructure development proposals involve cross-sector activities to coordinate the planning of the charging infrastructure (Proposal 19) and to ensure its effective operation and maintenance (Proposal 21).

The detailed design of the charging infrastructure necessary to deliver interoperability will rely on agreement and adoption of UK and international standards (Proposal 1). UK specific agreements will need to be made in relation to data sharing (Proposal 11), system resilience (Proposal 2), emergency charging control (Proposal 6) and the coordination and prioritisation of smart charging control (Proposal 4).

The Electric Vehicle Energy Taskforce has not proposed who should be made accountable for these governance responsibilities. It is recognised that there is lively debate in relation to governance right now; for example, in the joint BEIS/Ofgem 'Energy Codes Review' consultation [37]. In taking the Electric Vehicle Energy Taskforce's proposals forward, all related initiatives should be taken into account including the work of the Energy Data Taskforce and the Future Power System Architecture programme. A strong commitment to whole-system principles and market-led solutions should be made to avoid duplication of governance mechanisms and to encourage innovation.



'Ensuring that the mass roll-out of electric vehicles delivers benefits for both drivers and the wider energy system requires actions from industry, Government and the regulator, including creating the new markets and policies that can unlock EVs' huge potential.'

Philip New, Energy Systems Catapult Chief Executive

Conclusion

The primary driver for the electrification of road transport is to help meet the UK's 'Net Zero' ambitions. However, the related benefits are significant and several of them engage directly with consumers. EVs are quieter, cleaner and can be refuelled at home. They give consumers the opportunity to be a part of the 'Net Zero' journey. They can also act as a catalyst for new technologies bringing growth opportunities to UK industry.

The EV transition will bring significant challenges but also opportunities. It requires two fundamental sectors of the economy – transport and electricity – to work together in a way that has never been necessary before. In particular, it requires the expansion of the electricity system so that it acts as an enabler for the growth of a charging infrastructure which meets consumers' needs and expectations. It offers perhaps the first real opportunity to apply a 'system of systems' approach on a grand scale.

The Electric Vehicle Energy Taskforce has also brought together the transport and electricity sectors for the first time. It has made proposals to help facilitate the growth of a smart, accessible, public and private charging infrastructure integrated with the whole electricity system. It has identified actions that can be mutually beneficial for consumers, EV drivers and the electricity system.

Three key priorities have emerged from the Electric Vehicle Energy Taskforce's work:

1. The delivery of smart charging capability, where appropriate, in ways that ensure the security and resilience of the electricity system. This should be supported by detailed analysis of its costs and benefits;

2. The development of standards and codes of practice to enable interoperability, and the sharing of data, across the EV and electricity sectors; and

3. The need for effective local and national planning to enable efficient investment, mediating the balance between future-proofing and asset stranding.

The Electric Vehicle Energy Taskforce has identified several significant issues that it has not been able to address:

- There are challenges relating to the decarbonisation of commercial vehicles that need detailed exploration;
- There is a risk that some consumers may enjoy a significantly better charging experience than others; off-street charging could be less costly and more convenient than public charging;
- Operating and maintaining the network of chargepoints presents very different challenges to the existing network of petrol stations; personal safety is amongst these; and
- Getting the right balance between competition and regulation so that EV drivers can be confident of a good charging experience wherever they are.

The Electric Vehicle Energy Taskforce [38] has for the first time bought together stakeholders across the EV and electricity sectors. Its formation has found the value and necessity in collaboration and to build momentum to support the EV transition. However, its proposals only offer a starting point. The Government is strongly recommended to maintain the momentum and cooperative working that has been achieved, through a joint industry forum that is properly resourced and sustainable into the future.

5 Annexes and References

Enabling the Electric Vehicle Transition – Detailed Proposal Timings

Annex 1 – Work Package Report Proposal Mapping

Introduction

The purpose of this annex is to show the origin of the proposals in this report. The proposals were synthesised from the detailed analysis of the four individual work packages of the Electric Vehicle Energy Taskforce. The final reports of the work packages are available from www.EVEnergyTaskforce.com.

Theme 1: Delivering Consumer Benefits Through Interoperability

Proposal 1

By no later than 2025 industry must have reached convergence on a preferred set of standards that meet interoperability requirements across the EV charging infrastructure. Government must intervene if this is not achieved. Government and industry should, as a matter of urgency, review, define and propose international standards for communications, data and security protocols in order to meet this goal. To support this work government should establish a body with industry to coordinate the involvement of industry stakeholders.

This proposal originates from:

- Work Package One: Recommendation 3
- Work package Three: Recommendations 1, 2, 3, 14 & 15
- Work package Four: Recommendations 1 & 2

Proposal 2

Government and industry must ensure system resilience by design. This includes ensuring that CPOs are aware of their responsibilities for ensuring the security of their systems. Government with industry should agree a common standard base for cyber security but not mandate a single solution, however, Government should provide support for the preferred set of standards, including device certification.

This proposal originates from:

- Work package Three: Recommendations 5 & 6
- Work package Four: Recommendation 1

Proposal 3

Industry should enable roaming services to deliver a seamless EV charging experience between public chargepoints by 2021.

This proposal originates from:

- Work Package One: Recommendation 3
- Work Package Two: Recommendation 5

Proposal 4

Government and Ofgem, through the electricity industry technical and market code governance frameworks, should ensure overall operational coordination of industry parties seeking to exploit EV flexibility through smart charging technologies and electricity market products by 2021. Clear visibility as to which market products are in play must be evident to both industry and users at any time, as well as which transactions have occurred over a settlement period. It must also ensure that the operation of smart charging does not present a risk to the stability of the electricity system.

This proposal originates from:

- the combined work of all the work packages in the process of synthesising the proposals, with further detailed input of Work Package 3.

Proposal 5

Industry should agree to extending the minimum technical requirements for smart chargers set out by OLEV to facilitate the management of electricity network capacity and energy availability. These requirements should be introduced in line with the powers set out in the Automated and Electric Vehicles Act by 2021.

This proposal originates from:

- Work Package Three: Recommendations 8, 9, 10, 11, 12 & 13

Proposal 6

If permitted, network and system operators must work with Ofgem, industry and consumer representatives to develop governance arrangements for the use of emergency charge limitation by a network company. Emergency charge limitation should only be used as a last resort to maintain the safety and security of the electricity system.

This proposal originates from:

- Work Package Two: Recommendation 8
- Work Package Three: Recommendation 9

Proposal 7

By 2021 industry must develop common labelling standards for EVSE, enforced by Government if necessary, so that consumers are aware of the forms of interoperability available from clear, comprehensible EVSE package labelling and other product material. There are a number of types of interoperability and it is proposed that generally, offering these is left as an option for EVSE providers.

This proposal originates from:

- Work Package Three: Recommendation 4

Theme 2: Rewarding Consumers For Charging Smartly

Proposal 8

Require private EV chargepoints to charge smartly by default, thus making smart charging participation an opt-out function by 2021.

This proposal originates from:

- Work Package Two: Recommendation 7

Proposal 9

The Government and Ofgem must ensure that existing markets for flexibility are made accessible for EV users. They must also support the development of new co-ordinated and accessible markets for flexibility to compete with traditional networks and wider whole electricity system solutions by 2023 at the latest. Markets and price signals should maximise the opportunities for consumers to utilise their flexible resources, including EVs, and sufficiently reward them for offering demand flexibility services that support optimised network operations and investment, emission reductions and whole electricity system efficiency.

This proposal originates from:

- Work Package One: Recommendation 2
- Work Package Four Recommendation 4

Proposal 10

The Government and Ofgem should ensure on an ongoing basis from 2020, possibly through a process triggered by a chargepoint installation, that the number of consumers who have a smart meter installed before or alongside the installation of a chargepoint is maximised, and that consumers have been properly informed of the potential benefits.

This proposal originates from the combined work of all the work packages in the process of synthesising the proposals.

Theme 3: Utilising And Protecting Data For Better Consumer Outcomes

Proposal 11

Industry players should cooperate to develop comprehensive data sharing arrangements (including standardisation where appropriate) and open and interoperable exchange principles and mechanisms, in conjunction and alignment with implementation of the Energy Data Taskforce recommendations. They should also advise Government and relevant regulators if industry licences or codes need changing or if legislation is required to allow such sharing of data by 2021. Government and regulators to review progress and to act if necessary.

This proposal originates from:

- Work Package One: Recommendation 1
- Work Package Two: Recommendation 4
- Work Package Four: Recommendation 2

Proposal 12

To facilitate the availability of open and accurate chargepoint data, public chargepoint operators, owners and market actors must make data on public chargepoint location, type, status, capacity, price and availability consistent and openly available for EV drivers by 2021. A single asset register, aligned with the Energy Data Taskforce Asset Registration Strategy, must include all fixed chargepoints (i.e. private, public, workplace, etc) and should include all relevant data to ensure optimum planning and operation of the electricity networks.

This proposal originates from:

- Work Package Two: Recommendation 4
- Work Package Four: Recommendation 3

Proposal 13

The Electric Vehicle Energy Taskforce proposes that Ofgem and Government introduce a Data Access and Privacy Framework for the EV sector to ensure that consumers have full control over their data by 2021. Consumers should be made aware of all data access issues at the point of sale of all EV products and services as well as their powers to control and delete this data.

This proposal originates from:

- Work Package Two: Recommendation 9

Theme 4: Winning Consumers' Trust And Confidence

Proposal 14

The Taskforce proposes that an ongoing and proactive campaign be undertaken to promote the benefits of smart charging to the public. An existing independent organisation could be given this task, or a new consumer-facing body established during 2022.

This proposal originates from:

- Work Package Two: Recommendation 1

Proposal 15

The Taskforce proposes that Government fund the provision of an independent, tailored advice and information service on smart charging and EVs, to be established by 2022.

This proposal originates from:

- Work Package Two: Recommendation 2

Proposal 16
Industry must develop and adopt common, principle-based complaint handling standards by the end of 2021 to ensure that consumers are transferred seamlessly (between market boundaries if necessary) to resolve their problem(s), regardless of who they have initial contact with.

This proposal originates from:
- Work Package One: Recommendation 1
- Work Package Two: Recommendation 10

Proposal 17
The Taskforce proposes that Government and/or Ofgem undertake a full review of protections for EV users by the end of 2021. This should build on and be coordinated with ongoing work (such as Ofgem's Future Energy Retail Market Review).

This proposal originates from:
- Work Package Two: Recommendation 11

Proposal 18
Industry to develop and implement best practice standards, backed up by an independent accreditation scheme, for the information provision for smart charging and electric vehicle services at the point of sale by 2021.

This proposal originates from:
- Work Package Two: Recommendation 3

Theme 5: Developing And Maintaining The Charging Infrastructure Consumers Need

Proposal 19
The Government and Ofgem, as a matter of urgency, need to facilitate effective forward planning and coordination of the rollout of EV and electricity network infrastructure at a national and local level to meet consumer needs. This needs to be aligned nationally and to wider local area energy, transport and emission reduction plans and be implemented and used through RIIO-2 price control.

This proposal originates from:
- Work Package One: Recommendation 1
- Work Package Four: Recommendation 1

Proposal 20
Ofgem should ensure RIIO-2 price control supports well-justified anticipatory network investment, including LV monitoring, that benefits consumers and enables efficient and co-ordinated deployment of the network infrastructure necessary for EV charging (with due consideration paid to other future additional loads including from the electrification of heat).

This proposal originates from:
- Work Package One: Recommendation 1
- Work Package Four: Recommendation 5

Proposal 21
The Government should provide support to all public bodies and private organisations concerned with developing and procuring the delivery, operation and maintenance of public EV charging infrastructure. This should include the sharing of best practice and providing specific guidance on procurement of public charging solutions and requirements for effective delivery, ongoing operation and maintenance of public charging by the end of 2021.

This proposal originates from:
- Work Package Two: Recommendation 6
- Work Package Four: Recommendation 1

Annex 2 - Key Terms

There are a number of terms used in this report that require explanation in order to enhance understanding. These are set out here.

Electric Vehicle (EV) – there are a number of types of EV. Hybrid EVs have both an electric motor and an internal combustion engine. Fuel cell EVs convert hydrogen into electricity to drive the electric motor. In this report, the term EV is used as shorthand for the plug-in Battery Electric Vehicle (BEV). This type of EV relies entirely on its own battery to drive its electric motor and will almost always be recharged by connecting it to the electricity system. However the conclusions of the Electric Vehicle Energy Taskforce would equally apply to Plug-in Hybrid Electric Vehicles as well.

Smart charging – shifting the time of day when an EV charges, or modulating the rate of charge at different times, in response to signals (e.g. electricity tariff information). Smart charging is most applicable when the time required to charge the vehicle is less than the dwell time available; most commonly, overnight at the EV owner's premises.

Interoperability – this term relates to the ability of different products or systems to work well together, without any intervention by the user. It embraces physical systems, for example plugs and sockets, and transactional systems that facilitate data transfers to deliver commercial and technical functionality. Effective interoperability for an EV will mean it can be plugged in to any public chargepoint and the electricity that it uses can be paid for in a way that is both transparent and fair for the consumer. There are other benefits too. Consumers can easily switch between service providers, avoiding lock-in situations and EV drivers and network operators can effectively engage with chargepoint operators and intermediaries, including aggregators.

Ad-hoc access and roaming – Ad-hoc access means that a public chargepoint is accessible without entering into a pre-existing contract, as defined in [28]. Ad-hoc access has been required for all public chargepoints since November 2018. The requirement can be met through contactless debit or credit card payment, or through an app or other means.

There is no agreed definition for roaming, often also referred to as "interoperability" when referring to public chargepoint networks. Here it is taken as meaning non-discriminatory access for customers with existing subscriptions with other public chargepoint network operators and allowing for consumers to roam using a single identification or payment method.

Whole-system – historically, our energy systems have operated without any significant degree of interaction. The essentially independent operation of the petroleum supply chain and the electricity supply chain offers a good example of this. However, there is a growing recognition that to most efficiently achieve net-zero greenhouse gas emissions it will be necessary to develop strategies that consider the energy system as a whole rather than in discrete silos. The growth of EVs highlights this need. The charging infrastructure for EVs will need to be fully integrated with the electricity system. This report also uses the term 'whole electricity system'. This is a concept developed by the Future Power System Architecture project [10]. It requires, amongst other things, that the devices in peoples' homes, including EV chargepoints, are considered to be part of the electricity system.

Annex 3 – UK and International Standards

The standards that currently apply to EVs and the equipment required to charge them are complex. This Annex is intended to provide some useful signposts for those who wish to explore this subject in more detail.

Standards Bodies

At international level, there are three primary bodies responsible for standards in this area. They are the International Organisation for Standardisation (ISO), the International Electrotechnical Commission (IEC) and the International Telecommunications Union. Each of these bodies has a European counterpart. They are The European Committee for Standardization (CEN), the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI). As a general rule, the UK engages with these bodies through the British Standards Institution (BSI).

EV Standards in Europe

In 2010, the European Commission issued mandate M/468. This required CEN, CENELEC and ETSI to review existing standards and to develop new standards relating to the charging of electric vehicles. In particular, they were required to consider: interoperability and connectivity issues between the EV and the electricity supply point; smart charging issues; safety risks; and electromagnetic compatibility. As a result of this mandate a portfolio of standards is now in place and work is continuing to respond to the development of the EV sector. In 2011, mandate M/490 was issued relating to the deployment of smart grids which is also relevant to EV charging.

Current EV Standards

It is not intended to provide a comprehensive summary of the standards here but instead to highlight those that are of particular relevance:

- IEC 61581 – addresses conductive charging systems for EVs;
- IEC 63110 – defines a protocol for the management of EV charging and discharging infrastructure; and
- ISO 15118 – relates to the communications between the EV and the charging equipment.

Also of interest is the work of CENELEC Technical Committee 205 WG 18 which is addressing

interoperability for demand side flexibility systems in homes and buildings. In the UK, BSI has its Energy Smart Appliances (ESA) programme which is preparing two Publicly Available Specifications (PAS 1878 and 1879) relating to the classification of smart appliances and a framework for demand side response, including EVs.

Cyber Security

The ISO, IEC and BSI are also addressing cyber security issues. Of particular relevance are:

- ISO/IEC 27034 is intended to help organisations integrate "security seamlessly throughout the life cycle of their applications"; and
- BS EN 62351-11:2017 which addresses information exchange in power system management applications.

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