FEVER

Future Electric Vehicle Energy networks supporting Renewables

Co-production workshop 1 report

Sheffield, June 2023

University of Southampton
University of Sheffield
University of Surrey
University of Portsmouth
UKRI Engineering and Physical Sciences Research Council

Aim

The aim of this workshop – held at the University of Sheffield (13/06/23) – was to bring the FEVER academic team together with non-academic stakeholders in EV charging in order to (a) discuss the technical, socio-political and socio-technical challenges facing the EV charging sector; and (b) openly consider the viability of the FEVER technology concept as a part solution to these challenges.

Learning from this workshop will help the FEVER team to explore the research and innovation challenges pertaining to the research, development and demonstration of the FEVER charging concept.

Delegates

The workshop was attended by ten representatives from the FEVER academic team and seven stakeholders from:

- **efaraday**
- **Affinity Electrical Services Ltd.**
- **Meadowhall - Property Services**
- **Sheffield City Council - Transport Services**
- **University of Sheffield – Estates and Facilities Managmenet**

Structure

09:00	**Arrival**
09:30–10:00	Introduction to the day, plus 2 x 'primer' presentations (technical & socio-political context)
10:00–11:00	Discussion 1 – Exploring the technical challenges (45 min discussion + 15 min feedback)
11:00-11:20	**Coffee Break 1**
11:20–12:15	Discussion 2 – Exploring the socio-political challenges (40 min discussion + 15 min feedback)
12:15-13:00	**Lunch**
13:00–13:30	Introduction to the FEVER technology concept
13:30–14:30	Discussion 3 – Exploring the technical and socio-political (and socio-technical) solutions (45 min discussion + 15 min feedback)
14:30-15:00	**Coffee Break 2**
15:00	**Close**

The following pages document the topics and themes discussed by delegates. The appendices include the slides associated with the presentations.

Technical Challenges

Following a short presentation from Prof. Andy Cruden about some of the technical challenges facing the EV charging sector, the delegates were split into three groups and invited to consider the following question:

"From your perspective or that or your organisation, what the biggest technical and infrastructural challenges associated with meeting rising demand for EV charging?"

The groups were prompted to consider (among other things): logistical and supply chain, location and siting, grid capacity, and technology readiness considerations.

Educational and knowledge challenges

There can be a lack of knowledge about EV chargers among (prospective) customers (e.g. how they work, the relative costs of charging at home vs. public chargers) or a low customer awareness of the benefits and uses of the technology. There needs to be more education on such matters. Work also needs to take place to educate those in customer sales, e.g. to promote products appropriately and avoid miss-selling products.

There are associated questions over the extent of charger utilisation and how responsibly they are used by end-users. This relates to issues of the accessibility and placement of the chargers (see *installation challenges*).

Standardisation challenges

Sometimes there can be problems with the affiliated 'kit' that is provided alongside smart chargers (e.g. support apps). These are required to make the chargers function but can be niche, specific to the product and/or not widely used elsewhere, which affects usability and can restrict flexibility and access/use of other systems. Perhaps there is need for more coordination of the support infrastructure around smart chargers, particularly as it is the infrastructure that makes an essentially 'dumb' charger, smart. There is also need for transparency and standardisation around charging costs.

Installation challenges

There can be issues identifying suitable locations for chargers. To some extent this is tied to poor practices from installers who do not do proper site visits but work off photographs, but also inadequate power ratings of nearby cables and substations.

Sometimes there can be issues with the qualifications that installers have (or have not). There is a need for tougher legislation to ensure that installers have correct qualifications (e.g. City and Guilds). There is a related need for installers to be government approved contractors and subject to a competent person scheme. Sometimes system breakdowns are a product of poor installation rather than technological issues.

Company incentivisation challenges

Historically, the domestic market has been challenging and has therefore been somewhat avoided by many businesses, particularly SMEs, who have suffered from payment delays (>30 days) on government grant initiatives and where there has been a requirement to complete complex documentation/portals (e.g. Electric Vehicle Homecharge Scheme or EVHS). This has moved these companies towards doing commercial rather than domestic work, which has

traditionally also been more lucrative. There is a need to make things simpler in order to attract people to the EV charger installation sector.

There is currently a problem obtaining grant funding for installations, this partly relates to complexities over determining one's eligibility for funding.

Big companies (e.g. multinational energy providers) install chargers for free but then take majority of profits. This reduces the revenue streams for others in the supply line (e.g. local authorities). There is a challenge to create better business models that allow for more revenue to be shared/retained by others in the supply line.

Local authority (LA) / Fleet operator incentivisation challenges

Internal financing has been cut and the cost of purchasing EVs (including buses) is very high which could put LAs off. Also, the purpose of some vehicles needs to be kept in mind, with EVs sometimes not having the same payload capacity as ICE vehicles, meaning more vehicles and drivers are needed to do the same job, which adds expense.

Grid-capacities at depots are already stretched (with EV penetration currently at 7%), the addition of further EVs to this, or the creation of super depots could take things beyond capacity unless thought is put into how the additional EVs will be charged. Part of the solution could be to increase the efficiency of the use of the existing fleet vehicles rather than add too many more vehicles to the feet. Another part of the solution could be to re-consider the creation of super depots in order to split the charging load across different sites.

The space required to park and charge fleet vehicles is also a big consideration for some fleet operators.

Consumer incentivisation challenges

Where EVs (including fleet) are taken home overnight, there are issues around how these EVs will be charged (e.g. at terraced houses or flats with no driveway).

There can be a lot of fuss and hassle with managing payments for installation and use of charging infrastructure, but using a service company (e.g. Mina) can help to reduce hassle, reduce personal liability for issues and promote engagement. To make owning and operating an EV charger more attractive, you need to de-risk installation and maintenance for end-users. The use of service companies is particularly attractive for fleet vehicle operators (e.g. parcel couriers that use EVs).

There are too many products on the market currently. As there are so many 'solutions', choosing between them becomes confusing for consumers, which is off-putting. Also identifying accredited (scrupulous) installers can perceptively be a challenge.

Making things simple for end-users is important and will promote engagement: simple charger designs (e.g. YESS), standardisation, flexibility to adapt the charger type as required, simple billing and maintenance programmes (e.g. Mina – a rebate systems for home charging that is popular with logistics companies and couriers).

Regulatory and governance challenges

As a relatively new sector, the industry suffers with a lack of regulation. The problem is that regulating the industry is potentially complicated and costly. There is a need for a low-cost solution. There are also questions around what should or should not be regulated.

OZEV set the rules and regulations for the sector but these are currently complex and difficult for SMEs to understand/follow. When approached for guidance the OZEV tend to create more questions than they answer and there can be difficulties and delays in obtaining answers.

There is conflict between targets of going Net Zero by 2050 and the practicality of delivering on this target. This is illustrative of something of a disjunction between the desires of policy and decision makers and those who are delivering on these policy objectives.

Data security challenges

There is a need for tight security around payment methods for charging infrastructure (e.g. the prospect of cloning of cards, confusion around what apps are needed, which could lead criminals to capitalise).

Maintenance and end of life challenges

There are questions over how EV chargers and associated infrastructures will be maintained after installation (e.g. how will this be managed, who is responsible?) There are related questions as to what happens at the end of life with regards to the infrastructure (and EV batteries). Also, what opportunity is there to upgrade or replace the infrastructure (e.g. with higher capacity) as technology develops.

Other technical challenges

Contending with: (1) the increased weight of EVs (particularly in multi-story car-parks which are not designed to contend with the load); (2) the increased chance of fire (fire safety) particularly in car parks; and (3) environmental impacts of the batteries?

There were also questions around what opportunity there might be to integrate wireless charging options into the EV charging ecosystem, and around issues of data-connectivity in rural areas that might make it difficult for people to book and pay for chargers.

Socio-political Challenges

Following a short presentation from Gareth Giles about some of the policy context around EV charging infrastructure, the delegates were split into three groups and invited to consider the following question:

"From your perspective or that or your organisation, what the biggest socio-political challenges associated with meeting rising demand for EV charging?"

The groups were prompted to consider (among other things): political and policy support, finance and business support, social acceptance (e.g. end-user expectations and behaviours). They were also invited to consider the socio-technical interface: how the technical challenges considered might interact with the socio-political challenges being explored.

Regulatory and governance challenges

There is a need for better control and regulation of the sector and a need for greater simplicity and clarity of guidelines, policies and strategies. There are too many relevant policies at present, which presents a confusing picture (c.f. Giles' talk).

While infrastructure is progressing in the right direction, there is need for strong governance (e.g. introduction of 'building codes' for the sector). Currently, it is not always the case that suppliers are capable and/or properly accredited and the technologies that are deployed are not always equivalent in quality and user-friendliness.

There are ambitious policy goals around Net Zero, but the guidelines and strategy around EV infrastructure is disjointed and this is slowing the rate of installation and/or is undermining the quality of infrastructure that is being deployed.

Part of the issue is the lack of approachability of the OZEV, with delays in their responses and ambiguity in their feedback to questions.

There were also questions as to what happens to the sector when the grant incentives dry up. Currently there are good grant schemes (e.g. for fleet purchases) that are encouraging investment in the sector, but these will eventually disappear and the question is whether the industry can then sustain itself.

There were related concerns about the differences that exist in funding and policy between different local authorities and between the home nations (i.e. perceived inequity in support for EV charging), as well as questions as to who controls the local resources associated with EV charging infrastructure and where the revenues from charging are spent (e.g. do they go into the maintenance of the chargers or do they get spent elsewhere).

There was a noted challenge of there being too much choice on the market currently, which fed into discussion about the need to homogenise and/or standardise user interfaces (both nationally and internationally). Reference was made to the benefits that devolution has afforded Scotland in this regard, as they have favoured more of a joined-up approach to installing infrastructure (leading to greater standardisation) vs. the English approach where there are many different options. Although, it was also noted that things in Scotland could now be changing as demand for EV infrastructure begins to outpace the abilities of the government to provide the infrastructure.

Consumer uptake challenges

Perceived complexity around product options is a barrier to uptake, as is the sheer number of product options and suppliers that are available. People might not be sure as to which technology option will eventually 'win out' (c.f. VHS vs. Betamax), which could be promoting apathy, disengagement and/or 'fence sitting' by consumers.

There were calls for greater transparency around consumer products and installation and maintenance services for EV chargers. Reference was made to a charger technology where the backplate is such that it can be updated easily as newer technologies arrive.

It is important not to consider every (prospective) consumer as being the same. There are different user groups (e.g. older people, lower socio-economic status, relative tech-savviness, rural vs. urban), it is important to recognise their different demands and expectations. There may be a need for people to be taught/educated how to use the technology. The ability to afford EVs is still a major perceived or actual barrier to entry for many prospective domestic users.

There is a related risk associated with the emergence of a growing digital divide or a lack of equity in access to the technology, particularly as we introduce and rely more on EVs (and a cash-less society). This could include inequalities introduced as a result of differences in the provision of infrastructure by different local authorities, differences in the costs of on-street and off-street charging, differences in the quality of infrastructure that can be afforded or accessed by different groups. This could be very pertinent when looking at infrastructure provision in urban vs. rural environments.

There is a fear that people might get left behind (c.f. smart phone technologies). Although there was an interesting follow-on discussion about whether it is okay to leave some people behind (or how many people it is okay to leave behind) as society inevitably progresses. Can we or should we expect to take everyone with us?

Alongside this, the risks associated with 'data sharing' were raised, particularly given the need for people to engage with EV infrastructures using myriad different apps (due to a lack of *standardisation* – see above). Another issue could relate to people who are in older houses, where the costs of retrofit of infrastructure are shouldered by homeowners vs. newer build where EV chargers are integrated and supplied for free.

There was some mention of changes to how people are using vehicles and whether this might shape the future need for infrastructure. With declining vehicle ownership in some quarters, and a rise in mobility as a service, might there be a reduction in some of the anticipated domestic charging issues – although the issues for EV fleets are likely to remain.

It was questioned whether there is a conflict between dissuading people from a reliance on personal transportation, versus the publicity that is occurring around EV expansion (and expansion of associated infrastructure). The placement of chargers could be important in this regard, e.g., placing them in park and ride carparks could continue to send people the right message.

Fleet uptake issues

The challenge of how to run a non-domestic/commercial fleet was raised. The need for homogenisation of EV interfaces and innovation in managing expenses (e.g. with a fuel card equivalent) was mentioned. The issue of transparency at point of purchase for fleet operators (like public consumers) was mentioned.

Reference was made to a fleet associated trial, where users of fleet vehicles are charging their vehicles from home and using Mina as a means to manage their expenses. This small trial is operating successfully and the participants are happy. It was mentioned that where the costs are reasonable and managed well then user experience (and acceptance) tend to be positive.

The cost of EVs relative to their standard equivalent is still a genuine barrier to fleet operators. This led to discussion about how costs might be reduced, with one option being to use a fleet of smaller (cheaper) EVs. However, this would reduce the capacity of the vehicles and would necessitate the employment of more people to drive them.

Maintenance issues

There was a clear focus on issues around the ongoing maintenance of EV chargers. There is not currently a requirement on installers to maintain their infrastructure, which could lead to breakdowns and health and safety issues, like fire. The issue of who would maintain and service the infrastructure was a key issue.

It was noted, however, that there could be a revenue stream (incl. jobs) in the maintenance and upgrading of the infrastructure.

Other issues

The environmental impacts of meeting demand for EVs were raised as a global issue (e.g. in creating batteries), leading to discussion about the relative advantages of EVs over ICES (particularly if you choose to drive your ICE for longer rather than trading in too soon – c.f. Rowan Atkinson blog).

The implications of the introduction of road taxes for EVs was noted as a potential consideration both for the domestic market and for commercial users.

Solutions

Following a short presentation from Ewan Fraser about the FEVER concept, the delegates were split into two groups and invited to consider the following question:

"Considering the morning's discussions, what for you or your organisation are the best ways of resolving the technical, socio-political and socio-technical challenges?"

The groups were prompted to consider (among other things): if there is such a thing as a 'one-size fits all' solution, the processes and timelines by which change can or should take place, who should or should not be involved in the discussions, and the role that FEVER could or should play in any EV transition.

Ensure the reliability of EV charging hardware and software

Bearing in mind the timescales of investment and replacement of infrastructure (circa. 7 years), there is a need to ensure that the EV charging hardware and software options are installed well (proper site surveys, etc.), are of good quality, and that they are maintained appropriately to ensure their operability and reliability for end-users. Part of this is ensuring that the energy requirements are met, but this is hard to forecast (particularly given seasonal variation), so additional work needs to be put into this. There is also a need for a reliable 'back-office' to cope with the complexity of charging requirement, particularly for fleet vehicles.

The need for education

The need to enhance 'EV literacy' among commercial and domestic users was outlined. This should include efforts to educate end-users about when vehicles need charging (e.g. does the battery need to be fully loaded when mileages covered are not necessarily high – tackling range anxiety), but also about charging infrastructure (e.g. how to use it, how to calculate how many chargers are needed for a fleet). There was an interesting on discussion about the need to change the behaviour of end-users (e.g. in terms of how they treat their vehicle) but the suggestion that this might just happen naturally as EVs become more commonplace.

Increasing attractiveness

The need for EV infrastructure to be associated with other 'attractions' was mentioned. This could include coffee shops, playgrounds and other things to promote greater interactivity at charge points to entertain people while they are charging their vehicles (e.g. a trial with an internet accessible portal highlighted people trying to access to Netflix).

Evolving wireless charging options and ensuring the charging infrastructure is fast was also mentioned as something that could increase the attractiveness of EV charging infrastructure as it would help to reduce the hassle associated with charging.

Security considerations

The need for security around charging infrastructure, particularly in more remote locations and for commercial users (notably haulage companies), was mentioned. The case of fleet operators buying up wasteland sites on major thoroughfares to create secure, gated, charging 'compounds' for their vehicles was outlined. These compounds could be prime locations for FEVER, plus there could be an option to create similar compounds for non-commercial users.

Other security issues were outlined. This included the need to create chargers that would reduce, avoid or deter vandalism and criminal behaviour (e.g. ensuring cables are not exposed to prevent theft).

Improving the Supply Chain and Decision making

A primary limitation for the installation of EV infrastructure is the supply of parts. There is a recognised need to plan ahead and to factor in supply lead times. The solutions we have for supplying EV charging infrastructure are only as good as the supply chains that feed them.

Regarding FEVER, there is a need to showcase a viable proof-of-concept to give the industry confidence to back the technology.

Another limitation to EV roll-out is the speed of decision-making. Often when time targets are set on expansion, the policies around meeting those targets are fuzzy, which can lead to last-minute rushed efforts to install infrastructure. Being more prepared and having the finance drivers in place to deliver on goals is important.

Increasing standardisation

There is a need to ensure the interoperability of different systems, which calls for increased standardisation or charging infrastructure. It will be important that FEVER conforms to this need to standardise or it can help to lead the way in standardisation.

Improved oversight and governance

A UK database for EV chargers should be created, showing where they are and how they are performing. These data should be made publicly available so there is accountability on the part of installers, plus an opportunity to use these data for academic research.

Recognise changing trends in vehicle use

There is a reduction in some parts of the country (particularly urban settings) in car ownership, as people turn to 'mobility as a service'. This might affect the need for and provision of EV charging infrastructure. Although, one must also recognise that some communities (e.g. rural communities) may continue to need and prefer the use of a private vehicle.

There is another interesting question – whether or not our attempts to design an EV charging environment that ostensibly 'recreates' the current petrol/diesel-based system is required. Should we try to map the infrastructure to existing vehicular habits (i.e. drive, quickly fill-up, drive) or do we change in how people relate to their vehicles, which could offer up a different type/array of charging options?

Specific considerations re: FEVER - a one-size fits all solution?

- **Geographical considerations**
  Rural locations might benefit from having space to put in solar and wind generation. This could make installation of FEVER easier. There is likely to be demand in rural environments due to weak grid connections. There is a need to consider any potential communication issues that might exist in rural areas (e.g. poor mobile phone signal).

  Urban locations are likely to have better grid connection opportunity but grid demand is likely to be very high. There are questions over where the generation and storage technology could be placed in an urban setting. Perhaps there is an opportunity to use solar carpark canopies. There would need to be suitable battery storage, though, to account for cloudy days.

Ensuring a small footprint or envelope for FEVER will be crucial, particularly in constrained urban environments. Having an eye on the aesthetics of the technology will also be important, to reduce opposition to the construction of facilities where they are considered to be an eye sore.

- **Fuel storage considerations**
  What option is there to use a wind powered Glycerine generator (c.f. Formula E). Glycerine is a waste product of biodiesel, so is low-carbon but there could be sourcing issues and policy-related restrictions.

- **End-goal considerations**
  Attention needs to be given to what the intended purpose of FEVER is, as it is this that will shape design considerations. For example, if the intention is to roll-out FEVER in different contexts and for different purposes then a scalable and modular design is necessary. Indeed, modularity (where parts can be easily changed) would enhance adaptability, customisation potential, and longevity, and is the key to future-proofing FEVER (as well as other EV charging options).

  A 'pop up' FEVER option could also allow the technology to respond reactively to where demand is, and could allow FEVER to be used for different purposes (e.g. disaster relief and humanitarian logistics).

  There question of whether FEVER could also provide heating and cooling solutions for vehicles, in addition to the electricity to power the motor, was raised.

Acknowledgement

This workshop was provisioned as part of the Future Electric Vehicle Energy networks supporting Renewables (FEVER) programme grant, an interdisciplinary project funded by the UK Engineering and Physical Sciences Research Council (EPSRC) (Grant Code: EP/W005883/1). This project unites a diverse team of academic scientists and engineers (mechanical, electronics and electrical, computer science) and social scientists (psychology, economics and management) across four research-led UK universities: Southampton, Sheffield, Surrey and Portsmouth. www.fever-ev.ac.uk

Appendices

FEVER | Future Electric Vehicle Energy networks supporting Renewables

The challenges facing electrification of transportation and the provision of EV infrastructure

Prof Andy Cruden, a.j.cruden@soton.ac.uk

13 June 2023

University of Southampton | University of Sheffield | University of Surrey | University of Portsmouth | UKRI Engineering and Physical Sciences Research Council

National Context

FEVER | Future Electric Vehicle Energy networks supporting Renewables

- FEVER proposes a novel solution to the current trilemma of achieving significant growth in EV charging infrastructure, facilitating continued development of on-shore renewable generation and mitigating electricity grid constraints.
- The UK transport sector became the largest contributor to the nation's carbon emissions back in 2016
- FEVER clearly supports the 'Ten Point Plan for a Green Industrial Revolution', Point 4 – Accelerating the Shift to Zero Emission Vehicles
- Also supports the National Infrastructure Strategy which will invest £1.3 billion in EV charging infrastructure

University of Southampton | University of Sheffield | University of Surrey | University of Portsmouth | UKRI Engineering and Physical Sciences Research Council

3

FEVER | Future Electric Vehicle Energy networks supporting Renewables

EV Charge Points:

- Latest statistics from May 2023 from ZapMap
- https://www.zap-map.com/ev-stats/how-many-charging-points

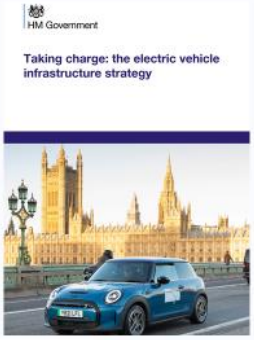
University of Southampton | University of Sheffield | University of Surrey | University of Portsmouth | UKRI Engineering and Physical Sciences Research Council

4

UK Government Strategy

- UK Government anticipates 300,000 public charging points by 2030 (minimum, if there is a high proportion of workplace chargepoints and consumer adopt efficient charging behaviour and lower mileage)
- However up to, potentially, 700,000 public charging points would be needed if there is higher proportion of on-street chargers, consumers drive more and have relatively inefficient charging behaviours.
- There are currently 43,626 charge points (ZapMap)
- (SMMT) expects that 1.7 million public chargepoints will be required by 2030 and 2.8 million by 2035 https://www.smmt.co.uk/2020/09/billions-invested-in-electric-vehicle-range-but-nearly-half-of-uk-buyers-still-think-2035-too-soon-to-switch/

https://www.gov.uk/government/publications/uk-electric-vehicle-infrastructure-strategy, March 2022



5

Grid constraints

- UK needs more renewables and growing EV charging capacity – need to avoid grid constraints

Grid constraints from SSEN, https://www.ssen.co.uk/GenerationAvailabilityMap/?mapareaid=1

- Vision - renewables powered EV charging station enabled using OVES

6

TopGear – 24 Hrs du M25 – EV charging and pricing

Assume BMW 520d @ 50mpg: and diesel at UK average of £1.456/l (RAC data*) – 1,208 miles = 109.7 l of diesel = £159.70 fuel cost

*https://www.rac.co.uk/drive/advice/fuel-watch/, 12/6/23

- https://www.topgear.com/car-news/big-reads/welcome-top-gears-24-heures-du-m25, 9th June 2023

7

Recent EV charging experience – Xmas return!

Video and pictures of a queue of 23 Tesla's waiting to use charging points at Tebay services, at the end of the Xmas break

- https://www.thesun.co.uk/motors/20935992/tesla-drivers-queue-hours-wait-electric-charging-station/, 4th Jan 2023

8

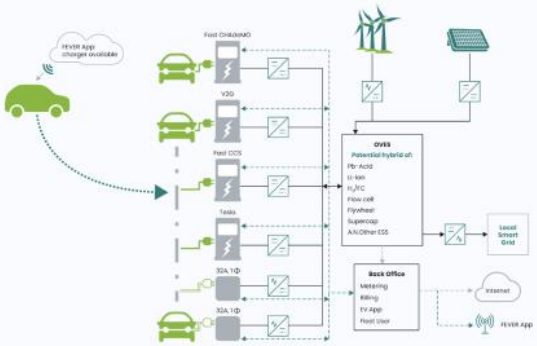
Why car parks are the hottest space in solar power

- https://www.bbc.co.uk/news/business-65626371
- BBC News item, 23rd May 2023

9

10

FEVER - Concept



University of Southampton | University of Sheffield | University of Surrey | University of Portsmouth | UKRI Engineering and Physical Sciences Research Council

11

Conclusion

- Significant pressure to increase rate of EV charge point installation and availability
- Restrictions evident on grid connections and capacity
- Charger availability and service is an issue
  - Potential concerns regarding EV charging cost and time
- FEVER offers route to decouple charger provision from national grid connections/capacity

University of Southampton | University of Sheffield | University of Surrey | University of Portsmouth | UKRI Engineering and Physical Sciences Research Council

12

FEVER | Future Electric Vehicle Energy networks supporting Renewables

UK Govt – EV Charging policy challenges summer 2023

Gareth **Giles**

13/06/2023

University of Southampton | University of Sheffield | University of Surrey | University of Portsmouth | UKRI Engineering and Physical Sciences Research Council

Areas of Research Interest

FEVER | Future Electric Vehicle Energy networks supporting Renewables

Department for Business, Energy & Industrial Strategy
Interim update 2020

- What are the challenges in getting households and electric vehicles to participate at scale in energy markets (barriers and solutions from a purely market entry perspective – not a social perspective
- How can we collect static and dynamic information of small-scale energy assets being deployed (e.g. EVs, domestic scale PV, storage etc) in order to use them meaningfully for system optimisation purposes?
- How can innovation initiatives can be utilised to help 'low income' consumers access a future market, removing barriers and increasing market accessibility?
- What are the challenges in getting households and electric vehicles to participate at scale in energy markets (barriers and solutions from a purely market entry perspective – not a social perspective)?
- What will future electric vehicle charging patterns look like as electric vehicle uptake increases? How will this be impacted by changing transport patterns (e.g. connected/autonomous vehicles and 'mobility as a service')? What charging patterns will have the lowest impact on the electricity network?
- How is electric vehicle charging likely to evolve in the future from a technology and retail perspective (e.g. wireless charging, vehicle-to-grid capability, bundled tariffs etc.) and what risks and opportunities may this bring for consumers, businesses and government
- What business models are helpful for smart charging of electric vehicles (e.g. bundling of products, rewards, etc) and what is the impact on consumer protection and uptake? • How important will Vehicle-to-Grid (V2G) technology be in the future and how do we exploit the UKs current position as one of the world leaders in V2G?
- What market enablers can be implemented to facilitate the flow of chargepoint installation and vehicle purchase data to relevant organisation to facilitate a better consumer experience and reduce costs?

University of Southampton | University of Sheffield | University of Surrey | University of Portsmouth | UKRI Engineering and Physical Sciences Research Council

2

Areas of Research Interest

FEVER | Future Electric Vehicle Energy networks supporting Renewables

Department for Transport

Corporate report
Areas of research interest 2023

- What are the strengths and limitations of advanced and emerging vehicle designs and technologies, from personal electric vehicles through to automated shuttles, and how can we enable their safe and secure use on roads?
- What future electric vehicle charging technology will be available? What are the advantages and disadvantages? And what groups of electric vehicle users will it mostly benefit?
- What does recent data tell us about possible long-term demand for private cars, electric vehicles, carpooling or public transport as a substitute and how might this impact decarbonisation?
- How will 'vehicle to grid' reverse charging impact on electric vehicle battery life?
- What is the best way(s) to solve the issue of electric vehicle charging for those without off-street provision?

University of Southampton | University of Sheffield | University of Surrey | University of Portsmouth | UKRI Engineering and Physical Sciences Research Council

4

Updates from OZEV

Focus on range anxiety/charging availability

21 February 2023 — News story
£56 million of public and industry funding electrifies chargepoint plans across the country
New LEVI capability funding also announced to help local authorities plan for new chargepoint infrastructure.

19 January 2023 — News story
Government charges ahead in car fleet transition to electric vehicles
Target reached to switch over a quarter of all government cars to ultra-low emission vehicles.

24 August 2022 — Press release
Drivers to benefit from £20 million EV chargepoint boost
Drivers will have access to more than 1,000 new electric vehicle chargepoints across the country.

6 July 2022 — Promotional material
Common misconceptions about electric vehicles
Leaflet addressing common misconceptions about electric vehicles.

14 June 2022 — News story
Plug-in grant for cars to end as focus moves to improving electric vehicle charging
Government to concentrate funding on expanding the public chargepoint network as well as electric taxis, vans, trucks, motorcycles and wheelchair accessible vehicles.

24 May 2022 — News story
Quick off the spark: electric vehicle sales continue to soar in green revolution
Sales of electric vehicles reach an all-time high while UK boasts one of the most extensive networks of rapid chargers in Europe.

1

Updates from OZEV

GOV.UK

Home > Transport > Driving and road transport > Road transport and the environment

News story

£56 million of public and industry funding electrifies chargepoint plans across the country

New LEVI capability funding also announced to help local authorities plan for new chargepoint infrastructure.

From: Office for Zero Emission Vehicles, Department for Transport, and The Rt Hon Jesse Norman MP
Published 21 February 2023

- £200,000 to Buckinghamshire
- £1.9 million to Cumbria
- £1 million to Hackney
- £2.3 million to Harborough
- £1.8 million to Hounslow
- £600,000 to Lancashire
- £1.6 million to Norfolk
- £1.6 million to Oxfordshire
- £1.6 million to Rotherham
- £800,000 to Sunderland
- £2.5 million to Waltham Forest
- £1 million to Warwickshire
- £8.5 million to West Midlands
- £2.9 million to West Sussex
- £3 million to West Yorkshire
- £1.9 million to York
- £7.4 million to Durham*
- £4.4 million to Barnet*
- £3.6 million to North Yorkshire*

*Denotes original pilot expansion.

Technology and Decarbonisation Transport Minister, Jesse Norman said:

Technology and Decarbonisation Transport Minister, Jesse Norman said:

" The government is giving local authorities across England additional help today to energise their chargepoint roll-out plans.

" Today's commitment will lead to thousands of new chargers being installed, and plans for tens of thousands extra in due course, so that more people than ever can make the transition to using EVs."

https://www.gov.uk/government/news/56-million-of-public-and-industry-funding-electrifies-chargepoint-plans-across-the-country

7

Updates from OZEV

GOV.UK

Home > Transport > Driving and road transport > Road transport and the environment > Low emission ar

Guidance

Apply for Local Electric Vehicle Infrastructure (LEVI) funding

What eligible local authorities need to do to apply for LEVI electric chargepoint infrastructure funding.

(Funding until 2024/25 currently)

The Local EV Infrastructure (LEVI) Fund supports local authorities in England to plan and deliver chargepoint infrastructure for residents without off-street parking.

The fund comprises of:

- capital funding to support chargepoint delivery
- capability funding to ensure that local authorities have the staff and capability to plan and deliver chargepoint infrastructure

Local authorities can now apply for LEVI capital and capability funding.

Fund objectives

The LEVI Fund has 2 main objectives:

- deliver a step-change in the deployment of local, primarily low power, on-street charging infrastructure across England
- accelerate the commercialisation of, and investment in, the local charging infrastructure sector

Published 21 February 2023
Last updated 30 March 2023 + show all updates

https://www.gov.uk/guidance/apply-for-local-ev-infrastructure-levi-funding#fund-objectives

8

Office for Zero Emission Vehicles

Policy paper

Automated and Electric Vehicles Act 2018 regulatory report 2022

Published 31 May 2022

The Automated and Electric Vehicle Act 2018 ('the act') supports the deployment of world class electric vehicle charging infrastructure right across in the UK. The powers laid out within the act allow government to regulate, if necessary, to:

•improve the consumer experience of charging infrastructure
•ensure provision at key strategic locations like motorway service areas (MSAs)
•require that chargepoints have 'smart' capability

https://www.gov.uk/government/publications/automated-and-electric-vehicles-act-2018-regulatory-report-2022/automated-and-electric-vehicles-act-2018-regulatory-report-2022

FEVER | Future Electric Vehicle Energy networks supporting Renewables

Part 2 - electric vehicles: charging

This part of the act provides government with new powers to improve the consumer charging experience, increase provision of electric vehicle charging infrastructure, and help that infrastructure benefit the energy system.

To ensure we retain our position as a global leader in the market for electric vehicles by taking powers to expand and improve our national charging infrastructure. The main benefits of this part are to ensure we have one of the best charging networks in the world, one with convenient infrastructure that is easy to access and ready to support the mass adoption of electric vehicles.

9

Office for Zero Emission Vehicles

Policy paper

Automated and Electric Vehicles Act 2018 regulatory report 2022

Published 31 May 2022

The Automated and Electric Vehicles Act 2018 gave the Secretary of State the power, through secondary legislation, to do the following:

- Improve driver experience of electric vehicle infrastructure, by ensuring interoperability between networks, consistent technical standards, and the provision of open data on infrastructure location and availability of public chargepoints.
- Prohibit the sale of chargepoints in the UK unless they meet certain requirements. This includes technical specifications to mandate 'smart charging', which helps enable consumers to charge their cars at different times of day, such as when renewable electricity generation is high or demand for electricity is low.

https://www.gov.uk/government/publications/automated-and-electric-vehicles-act-2018-regulatory-report-2022/automated-and-electric-vehicles-act-2018-regulatory-report-2022

FEVER | Future Electric Vehicle Energy networks supporting Renewables

These technical specifications are to:
•receive and process information
•react to this information, for example by adjusting the rate of charging or discharging
•transmit information
•monitor and record energy consumption
•comply with security regulations
•achieve energy efficiency
•to be accessed remotely

- Require the provision of electric vehicle infrastructure at motorway service areas and large fuel retailers and a duty to consider making regulations upon request by an elected mayor. This is to help overcome 'range anxiety' and allow longer journeys.
- Mandate that domestic and workplace chargepoints have 'smart functionality' and meet certain device-level requirements, to support the transition to a smart and flexible energy system by managing the additional electricity demand from EVs.

10

Office for Zero Emission Vehicles

Section 10: Public charging or refuelling points – access, standards and connection

In spring 2021 we consulted to improve the consumer experience at public chargepoints. We published the government response in March 2022 and aim to lay regulations in the coming months.

In the government response to the consumer experience at public chargepoints consultation, we set out the following policy decisions relating to section 10.

Making it easy to pay

Consumers should be able to charge their vehicle and pay with ease, as they would for any other service. We are mandating a payment method that is not specific to a brand and does not require a payee's mobile or internet signal. This should be made available at newly installed chargepoint sites (8kW and above) with retrofitting at existing rapid sites (50 kW and above).

Roaming

Consumers should be able to access and pay across multiple chargepoint networks with a single membership card or smartphone app. Fleet managers should be able to easily aggregate bills from EV charging. We are mandating industry-led payment roaming, with enforcement to come into effect from 24 months after the legislation comes into force. We are allowing a provision for government to designate approved providers if industry does not demonstrate sufficient progress in this timeframe. We will provide information as to how operators can meet these requirements in the consumer experience technical guidance that will support these regulations.

Ensuring a reliable charging network

EV consumers should feel confident that the UK charging infrastructure is reliable and easy to use. We are mandating a 99% reliable charging requirement across the rapid network, including the strategic road network (SRN), trunk roads and motorway service areas (MSAs). We will monitor the market for improvement of reliability over the next 24 months. We will then take powers to mandate a 99% reliable charging network across the entire public UK network if progress has not been made.

FEVER | Future Electric Vehicle Energy networks supporting Renewables

Section 11: Large fuel retailers etc – provision of public charging or refuelling points

Section 11 of the Automated and Electric Vehicles Act 2018 was commenced in May 2022. This allows government to begin the process of laying secondary legislation to mandate provision of chargepoints at motorway service areas and large fuel retailers.

In March 2020, we published a vision for the future of the rapid charging network in England, which included ambitions for the number of ultra-rapid (150kW+) chargepoints at motorway service areas. The government is supporting motorway service area (MSA) operators and the private sector to deliver ultra-rapid open access chargepoints in England. (Open access chargepoints can be used by any plug-in vehicle.) There are already more than 400 open access rapid and ultra-rapid chargepoints at motorway service areas across England.

We intend to consult on the secondary legislation to mandate provision of chargepoints at key sites at an appropriate point in the future.

Section 12: Duty to consider making regulations under section 11(1)(a) on request by elected mayor

Section 12 requires the Secretary of State to consider making regulations imposing requirements on large fuel retailers in relation to a relevant area if the mayor for that area makes a request and certain conditions are met. One such condition is that regulations have been made under section 11(3) in relation to the meaning of 'large fuel retailer'. At present, no such regulations have been made, therefore section 12 has not been commenced to date.

12

Office for Zero Emission Vehicles

Section 13: Information for users of public charging or refuelling points

The consumer experience at public chargepoints final policy decisions relating to section 13 are as follows.

Opening up chargepoint data

All drivers should be able to locate available and working chargepoints easily when they need to charge their vehicle. We are mandating the adoption of the Open Chargepoint Interface Protocol (OCPI), which is an independent, free to use protocol which provides a simplified and standardised way for chargepoint operators to communicate data. We are mandating that all static and some dynamic data is made openly available, as specified in technical guidance. We are progressing our open data workstream to understand how we should open this data and will specify this in technical guidance.

To improve reliability across the public charging network, we are mandating that all charging networks for all public EV chargepoints have a free 24-7-hour helpline when consumers experience an issue trying to charge their EV.

Section 14: Transmission of data relating to chargepoints

The consumer experience at chargepoints open data policy decision focuses on opening public EV chargepoint data to enable consumers to easily locate the chargepoint that suits their needs. We are mandating the data standard open chargepoint interface protocol (OCPI).

Government has also committed to progressing work on private chargepoint data. This work will seek to establish whether the powers under Section 14 could be used to require the sharing of private chargepoint data with specified parties, which could include distribution network operators and the electricity system operator.

FEVER | Future Electric Vehicle Energy networks supporting Renewables

Section 15: Smart chargepoints

EV smart charging involves shifting charging to a different time of day, such as overnight when there is lower demand on the electricity system, or to times of high renewable energy generation. This can help reduce the need for costly electricity network reinforcement to meet increased demand from EVs, and offers benefits to consumers too, including savings on their energy bills.

The electric vehicle smart charging consultation proposed introducing new requirements for all private (domestic and workplace) electric vehicle chargepoints sold in Great Britain to have smart functionality and comply with minimum device-level standards, using powers under Section 15 of the Automated and Electric Vehicles Act 2018.

In December 2021, the Electric Vehicles (Smart Charge Points) Regulations were made into law. These regulations came into force from 30 June 2022, except for new cybersecurity requirements which came into force on 30 December 2022.

Updated guidance to help chargepoint sellers to comply with the smart charging regulations was published in May. The Office for Product Safety and Standards (OPSS) are the regulatory body responsible for enforcing the requirements. The Department for Business, Energy and Industrial Strategy previously conducted a baseline survey to inform evaluation on the impact of the smart charging regulations on the smart capabilities of chargepoints and the smart charging behaviours of EV drivers.

14

Office for Zero Emission Vehicles

FEVER | Future Electric Vehicle Energy networks supporting Renewables

Next steps

Consumer experience

We published the government response to the consultation to improve the consumer experience at public chargepoints in March 2022, with parliamentary time allowing we intend to lay legislation in the coming months.

Smart charging

The Department for Energy Security and Net Zero will monitor and evaluate the impact of the Electric Vehicles (Smart Charge Points) regulations, and the market evolution. A process evaluation is currently underway, exploring the initial response from and impacts on industry and consumers. Interim impact evaluations findings are expected by 2025, and the final impact evaluation by 2027.

As set out in the government response to the smart charging consultation, a second phase of legislation will be necessary to fully mitigate the risks posed by smart charging.

These requirements go beyond the device-only powers included in the AEV Act and would be placed on entities that can control chargepoints, and other smart devices, called 'load controllers'.

Government also intends to broaden this work to encompass other smart devices and systems, beyond EV smart chargepoints alone.

As published in the government response to the consultation for the next phase of the requirements for smart charging, government will proceed with proposals to develop a competitive market for energy smart appliances and demand side response services.

16

FEVER | Future Electric Vehicle Energy networks supporting Renewables

WORKSHOP
The future of EV charging infrastructure in the UK – FEVER overview

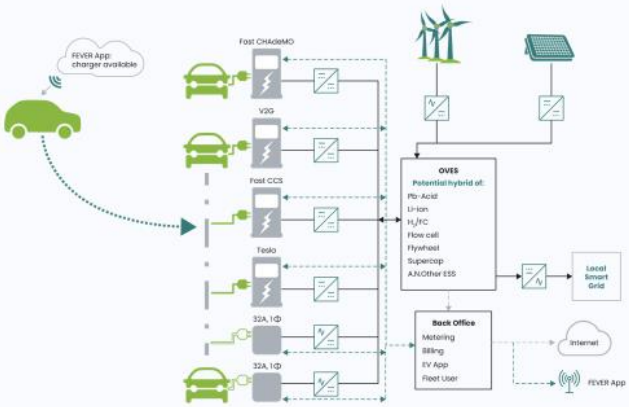
Dr Ewan Fraser, Senior Research Fellow
University of Southampton

13/06/2023

University of Southampton | University of Sheffield | University of Surrey | University of Portsmouth | Engineering and Physical Sciences Research Council

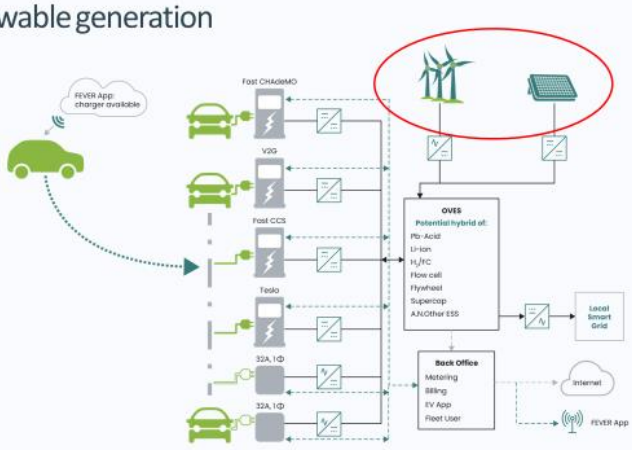
FEVER system

- FEVER will develop a fully grid-independent charging solution powered by renewables, facilitated by a novel off-vehicle energy store (OVES).
- FEVER will consider technical, economic and socio-political aspects



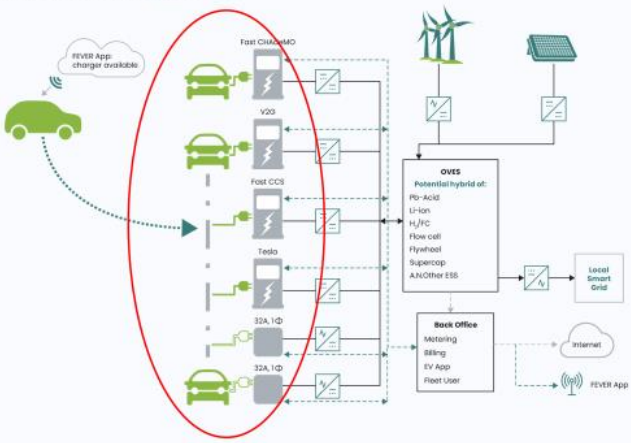
FEVER system – Renewable generation

- Type of renewables
  - Wind, solar
  - Dispatchable power
    - Hydrogen, biogas, glycerine generators?
- Rating of each technology
  - Oversizing



FEVER system – Demand and chargers

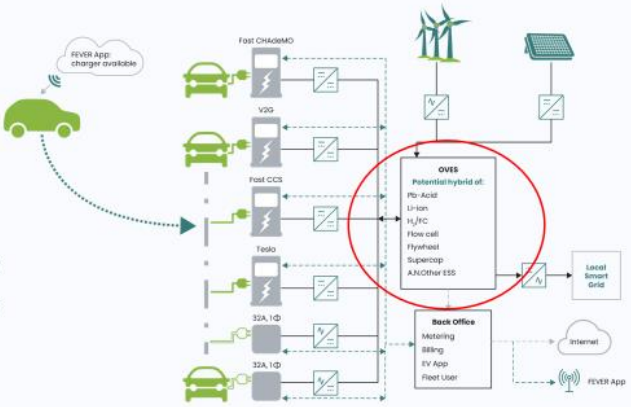
- EV charging demand
  - Time of day, duration, power
- Location of chargers
- Number of chargers
- Charging interface
- Fleets
  - Type, size
- Local smart grid
  - Other opportunities



4

FEVER system – OVES

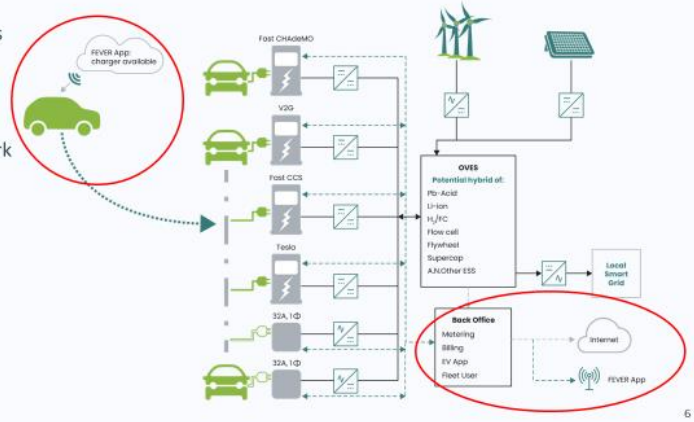
- Rating
  - Power (charge/discharge), capacity
- Type of storage
  - Li-ion, lead-acid, flow-battery etc.
    - Cost
    - Daily/weekly/seasonal
- Energy management system



5

FEVER system – Comms and Trading

- Smart charging algorithms
- User app
- Peer-to-peer trading
- Communication framework



6

FEVER | Future Electric Vehicle Energy networks supporting Renewables

Today's workshop

- **Consider the following socio-technical questions:**
  - What infrastructure will we need, where should it be placed, and how much should it cost users?
  - How do we support the national grid to cope with growing demand for electricity from EV users, or is it possible to come up with off-grid charging solutions?
  - How do we support fleet vehicles or people living in more rural communities to plug-in and charge, quickly and reliably?
  - What does the policy environment look like for EV charging infrastructure, and is it conducive with the growth in demand?
  - What will end-users expect and accept in terms of EV charging infrastructure?

7