

# The Future of **Energy**

## The sustainable transition to a low carbon road transport system

April 2019



# ► The sustainable transition to a low carbon road transport system

## Executive summary

**To meet our decarbonisation targets, the UK needs to achieve a significant reduction in transport emissions over the next decades.**

This mission has been given added urgency by the growing awareness of the impacts of air pollution, which are particularly acute in urban areas. Emissions from transport remain largely unchanged from 1990 levels, accounting for over a quarter of total UK greenhouse gas emissions, against an economy-wide cut in emissions of 42 per cent<sup>98</sup>.

By 2030, electric vehicles (EVs) will be a routine sight on UK roads, making up at least half of new vehicle sales<sup>99</sup>. Indeed, over one-third of the cars and vans on the road - numbering up to 10 million - will be electric<sup>100</sup>. This will deliver a major reduction in transport emissions, better air quality and significant economic opportunities for UK Plc.

In particular, zero emission vehicles (ZEVs), such as battery electric vehicles, offer a way forward, capitalising on progress made in power sector decarbonisation and achieving significant reductions in tailpipe pollutants against internal combustion engine (ICE) vehicles. This chapter focuses on decarbonising passenger vehicles, including cars and vans, and looking at what the system might look like in ten years' time. It outlines what needs to happen now to deliver it, and in particular how to deliver a smooth customer experience during the transition.

Implementing a modal shift in road transport requires cross-industry collaboration, in particular between the energy and automotive sectors. Further, the importance of a supportive policy framework from the Government cannot be overstated. In setting a 2040 target to phase out conventional vehicles, it has provided a clear direction of travel, giving certainty to industry and the public alike. It has played, and will continue to play, a leadership role in supporting the transition.

Building on the progress to date, this report section sets out an approach to ensure a smooth customer experience as part of the transition to EVs.

“By 2030, electric vehicles (EVs) will be a routine sight on UK roads, making up at least half of new vehicle sales.”

<sup>98</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/776085/2017\\_Final\\_emissions\\_statistics\\_-\\_report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/776085/2017_Final_emissions_statistics_-_report.pdf)

<sup>99</sup><https://www.gov.uk/government/publications/reducing-emissions-from-road-transport-road-to-zero-strategy>

<sup>100</sup><https://www.theccc.org.uk/publication/plugging-gap-assessment-future-demand-britains-electric-vehicle-public-charging-network/>

# Emerging thinking and potential solutions



No.	Opportunity	Forward direction	Potential solution
1	Demand for EVs creates an additional and potentially significant load on the energy system. If this occurs at peak times it would put a strain on the grid, requiring costly reinforcement or other solutions.	Smart charging standards, to be agreed by the end of 2019, should incorporate an opt-out requirement - making smart charging the default option for EV users.	Take forward smart charging standards by the end of 2019 that are performance-based and technology neutral. Set smart charging as an opt-out function, provided that there is a simple and straightforward override facility.
2	The majority of EV charging can be accommodated outside peak demand hours and within existing network capacity, provided that customers are appropriately incentivised to shift their charging and that the appropriate technical solutions/market frameworks are in place.	Contributions to the smooth operation of the energy system should be incentivised through smart charging tariffs and the creation of appropriate market frameworks for local flexibility.  Any action needed to protect networks that limits customer choice (such as DNO-managed charging) should be a last resort. Where it is most cost effective to do so, DNOs should invest in additional network capacity.	As a priority, DNOs need to share data and information regarding their networks so the impact of EVs is visible and opportunities for flexibility services can be identified.  The DNO regulatory regime must also allow for investment in advance of EV uptake, where it is clearly likely to facilitate adoption and prove value for money. This must be combined with a flexibility-first approach to network management.
3	EVs offer a route to decarbonisation and improved air quality, while opening up opportunities for engagement with the energy sector.	There are concerns about whether the power system will be able to manage the additional load on the system, and the flexibility requirements.	Provided the appropriate frameworks are in place, the energy industry will deliver the power required to enable all new cars and vans to be electric by 2035.
4	Provide long-term policy direction to businesses and domestic consumers.	Send a strong signal to UK drivers that everyone will be required to move away from ICE vehicles, and provide clarity on when subsidy will be removed.	Maintain public support for EVs and chargepoints while the sector remains in its infancy, and link subsidy removal to the market share of EVs.
5	There will be a variety of opportunities to charge an EV, and the market is well placed to deliver in most instances.	There must be consistent access to a well-maintained nationwide chargepoint network. There is a marginal business case for investment in some areas.	The Government will need to subsidise the grid connection cost of ultra-rapid chargers in strategic locations, to ensure a nationwide provision of charging infrastructure.

# Opportunities and challenges in low carbon transport



## Key points:

- **By 2030, over half of new cars and vans will be zero-emission, provided that industry and regulators work towards offering an excellent user experience.**
- **EVs offer a compelling customer proposition, and continued innovation in this marketplace is vital to identifying the most appealing solutions. This needs to be actively encouraged as part of the switch from internal combustion engine vehicles to EVs.**

The UK's ambitious carbon budgets are driving emissions reductions across the transport sector, which account for 27 per cent of total UK emissions<sup>101</sup>. The focus on improving air quality, particularly in urban areas, adds further impetus to ensuring these targets are met: it is estimated that 10,000 premature deaths per annum are attributable to road transport<sup>102</sup>. The healthcare costs to the NHS from air pollution alone are estimated at £6 billion per annum<sup>103</sup>.

## The EV revolution is here

Decarbonising transport as a whole is an area where technology is achieving significant success in reducing harmful emissions. EVs provide an attractive solution to this challenge because they produce zero emissions at the tailpipe. Battery range and other performance measures are rapidly improving, and costs are falling rapidly. Today, with an energy system increasingly powered by low carbon generation, EVs are already the cleanest choice to make<sup>104</sup>.

The early signs from the Government are positive: a supportive policy framework is in place and the release of the 'Road to Zero Strategy' has been coupled with the enactment of the Automated and Electric Vehicle Act. Further, the UK Government has proposed banning the sale of new conventional petrol and diesel cars and vans by 2040.

While Plug-in hybrid Vehicles (PHEVs) play an important role in the current EV market, by 2030 zero emission vehicles such as BEVs are likely to play a much more dominant role. This will be caused by improved vehicle ranges, increased charging speeds, continued cost reductions and the maturity of the UK's electricity grid infrastructure, in addition to the low consumer running costs of fully electric vehicles<sup>105</sup>.

Of course, managing a system with potentially 36 million EVs, by 2040<sup>106</sup> will present its own challenges and opportunities for the UK. The energy industry is committed to playing its part and ensuring that the UK can reap the driver, environmental and economy-wide benefits of decarbonising transport.

<sup>101</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/776085/2017\\_Final\\_emissions\\_statistics\\_-\\_report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/776085/2017_Final_emissions_statistics_-_report.pdf)

<sup>102</sup><https://www.cleanairday.org.uk/Handlers/Download.ashx?IDMF=7eb71636-7d06-49cf-bb3e-76f105e2c631>

<sup>103</sup>ibid

<sup>104</sup>[https://www.drax.com/press\\_release/emissions-electric-vehicles-fall-two-thirds-thanks-greener-electricity-generation/](https://www.drax.com/press_release/emissions-electric-vehicles-fall-two-thirds-thanks-greener-electricity-generation/)

<sup>105</sup>Although transport encompasses a wide range of modes and technologies, in line with Energy UK's expertise and remit this paper examines cars and vans only. The annex provided further thoughts on other technologies and modes of transport.

<sup>106</sup>Source: Future Energy Scenarios, National Grid, 2019

## The user experience

This report section sets to establish a vision of 2030 based on the existing direction of travel and the key challenges in the transition to a zero-emission transport sector. The user experience is critical, including meeting drivers' expectations and needs.

## The customer proposition

EVs already offer an attractive proposition for customers. The driving experience is one of quiet engines, responsive handling, smooth and fast acceleration, coupled with fewer maintenance requirements. For these reasons, many early adopters quickly become EV evangelists. But there will continue to be a financial element affecting customer uptake of EVs in the short term.

Of course, owning a EV will increase your electricity usage – adding around 2,000kWh a year<sup>108</sup> to the average household consumption of 3,800kWh<sup>109</sup> – but fuel savings more than make up for this. And if you use smart charging for your EV (discussed further below) the cost of driving drops further still. For example, ScottishPower estimates that off peak charging comes out at one-tenth of the cost per mile of fuelling a comparable petrol vehicle<sup>110</sup>. Combined with the falling upfront cost of a EV, which is expected to be on a par with comparable ICE vehicles by the mid-2020s, and EVs will soon be compelling on price as well as experience.



### Defining vehicle technology

A zero-emission vehicle (ZEV) has no greenhouse gas or air pollutant tailpipe emissions. This includes battery electric vehicles (BEVs) and fuel cell electric vehicles, with the former representing the most popular ZEV technology at present. The term electric vehicle (EV) encompasses a wider set of vehicle types, including a number of ZEV models but also a range of plug-in hybrid and hybrid electric vehicles.

To reach Government's ambition for all almost every car and van to be zero emission by 2050, Energy UK believes that the policy and regulatory framework should specifically focus on encouraging the uptake of ZEVs which offer the most significant emissions reduction potential. This is expanded on in the Annex.

<sup>108</sup><https://www.npower.com/business-solutions/blog/2018/06/21/a-new-way-of-meeting-future-ev-power-demand/>

<sup>109</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/729317/Energy\\_Consumption\\_in\\_the\\_UK\\_ECUK\\_2018.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/729317/Energy_Consumption_in_the_UK_ECUK_2018.pdf)

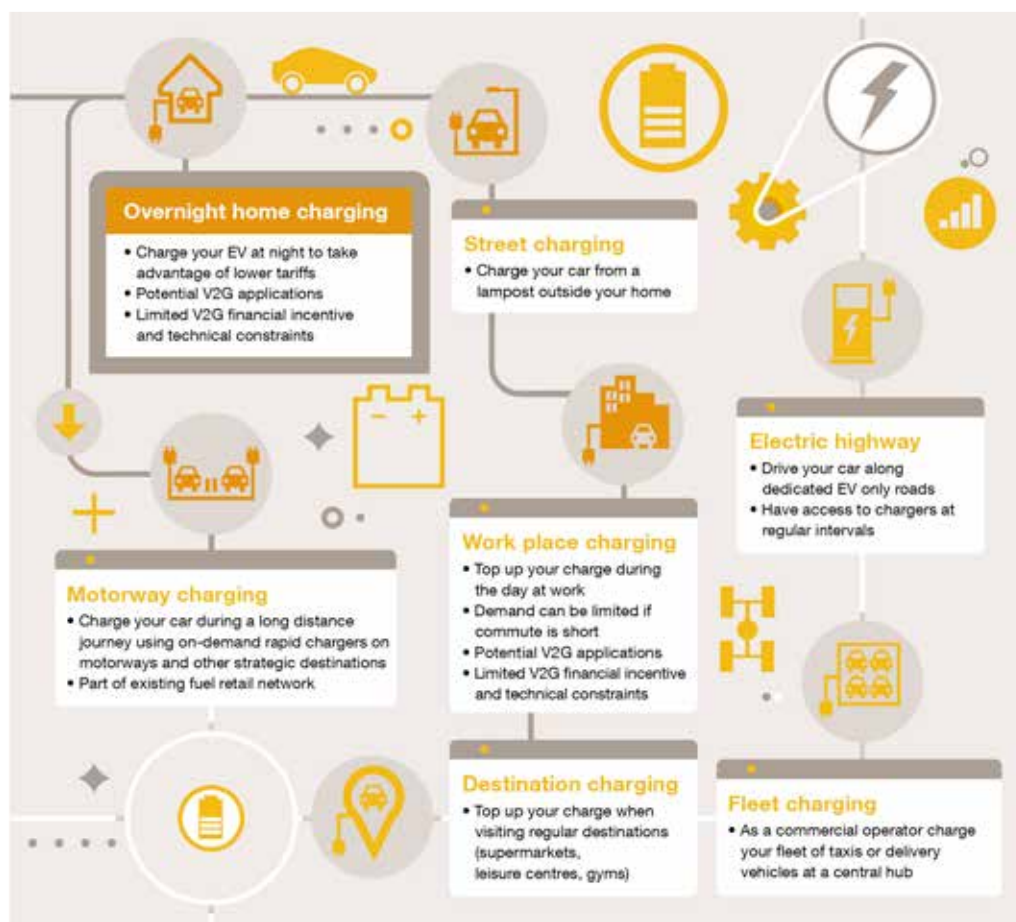
<sup>110</sup><https://quote.scottishpower.co.uk/#/electric-vehicles>

## An excellent user experience

By 2030 we expect there to be a comprehensive, accessible and well-maintained charging network across the UK, offering a range of charging solutions to meet users' needs, as illustrated in the figure below. Nervousness about longer trips will be a thing of the past, thanks to improved vehicle ranges and the more extensive charging network. Drivers will use EVs across the country with confidence, recharging primarily at home but also using chargers at work, at their destination or en route without the need for meticulous route planning or juggling chargepoint memberships.

To reach this more mature and settled state, a period of innovation is required as different providers trial new offerings. As explored by the Energy Systems Catapult, there are areas in which EVs fall short on a good user experience, such as journey planning, charging, payment methods and vehicle ownership. To encourage drivers to switch to EVs, the user experience across all these areas needs to equal or exceed the incumbent technology they know. A recent PwC and Energy UK report describes how providers can effectively overcome "experience anxiety" and deliver successful business models.

This process of innovation must be embraced as a vital part of identifying the most attractive customer propositions, while avoiding heavy-handed interventions that deter technical or business model innovations. Energy UK is currently collaborating with Gemserv and the Institute of Engineering and Technology (IET) to bring together existing customer protections, technical standards and best practice to help develop new business models that deliver on users' expectations. This work will seek to strike a balance between ensuring a fit for purpose regulatory regime that also promotes innovation.



Source: PwC Strategy& research

## Transport and energy bundled offerings

The integration of the energy and transport sectors is already seeing bundled transport and energy services emerge. Energy providers are collaborating with vehicle manufacturers and dealerships to offer greater customer choice and innovative products. These packages offer a variety of benefits to drivers including free memberships to public chargepoint networks; “free miles”; lower cost electricity at off-peak times and reduced cost home charging stations.

As this market grows, the number and type of offerings will multiply, with innovative packages to cater to users’ diverse preferences and requirements. Although we don’t yet know which offerings will be most appealing, they will need to offer seamless journeys and meet users’ expectations in the most convenient and user-friendly way.

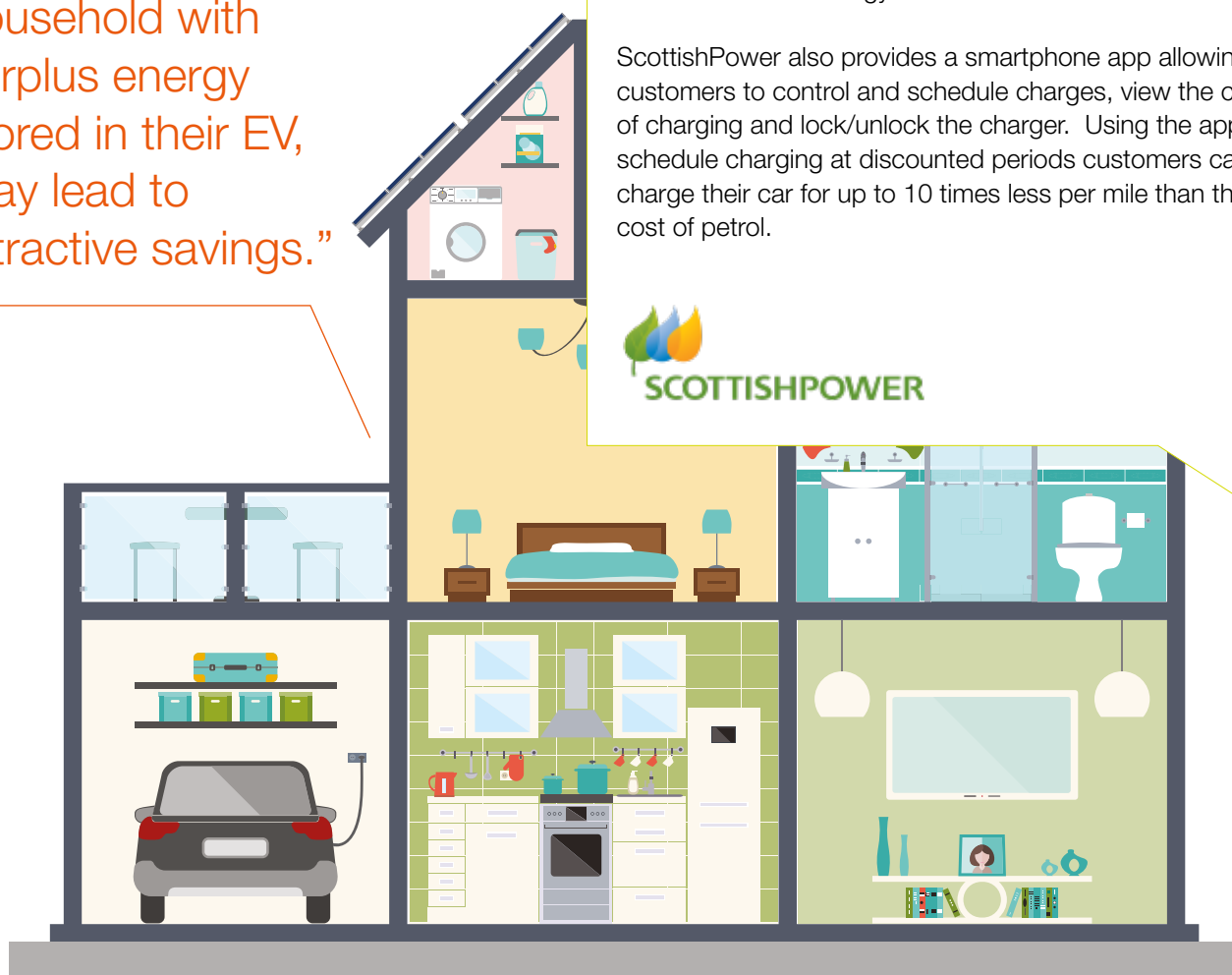
Energy providers fully appreciate the potential of mass EV uptake and are developing and delivering tailored products in response. Enabling vehicle batteries to store power from consumers’ rooftop solar panels, or to power their household with surplus energy stored in their EV, may lead to attractive savings. These products will be a catalyst in encouraging switching to EVs, and instrumental in ensuring that their mass uptake can be integrated into the energy system. We explore this in the next section.

“Enabling vehicle batteries to store power from consumers’ rooftop solar panels, or to power their household with surplus energy stored in their EV, may lead to attractive savings.”

### Case study

ScottishPower, in partnership with Arnold Clark, has launched a fully integrated EV proposition enabling customers to purchase an EV and a smart EV charger with a choice of Time of Use EV tariffs powered by 100% renewable energy.

ScottishPower also provides a smartphone app allowing customers to control and schedule charges, view the cost of charging and lock/unlock the charger. Using the app to schedule charging at discounted periods customers can charge their car for up to 10 times less per mile than the cost of petrol.



# Energy system benefits

## Smarter and more effective charging

The move from petrol and diesel as the primary transport fuel to electricity will have a profound impact on the system as a whole. But this is also an enormous opportunity, both in the flexibility and storage that EVs can provide to the grid, and the greater consumer engagement with energy that providing this flexibility could trigger.

By 2030 we envisage the majority of charging will take place outside of peak hours, with smart charging the norm<sup>111</sup> for nearly all EV drivers and charging events. This will be vital to ensure that energy system assets are used optimally. Vehicle owners will look to energy suppliers and other third parties to manage their cars' flexibility and realise the advantages on their behalf. This could lead to benefits for the wider energy system and all its customers.

While some drivers may not want to be actively involved in how and when their vehicle is charged, smart charging technology will take the hassle out of shifting energy consumption, offering a seamless experience. Customers will be able to choose how much – or conversely how little – they want to be involved in their vehicles' charging schedule.

Time of use, and other time-variant tariffs<sup>112</sup>, are an example of how this will unfold. As customers start to think about using the lowest cost or lowest carbon electricity to charge their car and plugging-in at times that are beneficial to the environment and the grid, many are likely to begin to include the rest of their energy consumption in the equation as well. These tariffs will increasingly use automated processes, and pull upon network and system price signals to ensure savings and convenience for consumers, and they are already showing success.

### Case study

WWF, National Grid and Environmental Defense Fund Europe have launched a new software ([www.carbonintensity.org.uk](http://www.carbonintensity.org.uk)) that forecasts the carbon intensity of electricity generation in the UK up to two days ahead, helping people to understand and control their energy use. The tool shows how green each region is in the UK and the generation sources, using machine learning to better predict the contribution of renewables.

The tool currently gets four million views a month and is in a format that allows technology companies to build innovative apps and software that could make a real difference to how and when people use energy in the home. This means that owners of electric vehicles can consult this tool to manage when they plug in. This helps relieve pressure on the energy system, reducing the need to use back-up fossil fuel plants, and potentially reducing bills for households.



“Vehicle owners will look to energy suppliers and other third parties to manage their cars' flexibility and realise the advantages on their behalf.”

<sup>111</sup>Smart charging means that charging is managed by a programmable device – a smart charger – that can react to a third party's signal to alter its pattern of power consumption.

<sup>112</sup>As advocated for by organisations like Environmental Defense Fund Europe.



Suppliers are beginning to offer innovative EV tariffs and give a glimpse of how the market may develop further. For example, initial findings from Octopus Energy's Agile Tariff suggest that time-of-use tariffs can act as a strong trigger for customers to shift their energy use, with some of the biggest reactions coming from EV drivers<sup>113</sup>. Over 95 per cent of those on the Agile Tariff paid less than they would have done on a fixed deal, with EV drivers saving an average of £132 per annum. This shows measurable benefits for the user and indicates the wider energy system benefits. This is echoed in the US, where one study found that between 78 and 85 per cent of charging happens outside of peak hours in response to appropriate price signals<sup>114</sup>.

Recent research from Citizens Advice has indicated that further work is needed to make sure that new EV-specific tariffs are easy to understand and compare<sup>115</sup>. Clarity will continue to be an important element of a smooth transition as the retail market evolves.

The prize of successfully encouraging drivers to charge smartly is significant. It will be critical to maximising existing electricity network capacity. Indeed, failing to do so could increase power system costs by £2 billion a year for the 2030–2050 period, adding up to £30 a year to customer bills<sup>116</sup>. Vivid Economics' research, undertaken for WWF, finds that smart charging will reduce energy system costs by £1.1 billion in 2030<sup>117</sup>.

Vehicles charged at off-peak times with smart charging will substantially reduce the need for further investments in generation capacity and network reinforcement. This maximises the use of excess low carbon generation, reducing the need for curtailment. Without smart charging, up to 36GW of additional generation capacity would be needed in 2050 to cope, with peak demand being nearly 20GW larger<sup>119</sup>.

Indeed, smart charging is so important, an opt-out system should be considered and chargers' default settings set to avoid charging at times of peak demand. There is a strong body of evidence from the social sciences highlighting the power of 'nudges', to overcome inertia or uncertainty. Current experience of applying opt-outs in diverse sectors such as health<sup>120</sup> and pensions<sup>121</sup> may provide useful learning.

But there is one important caveat. Drivers must be able to set their own charging schedule easily and conveniently, or to charge on demand if they choose.



<sup>113</sup><https://octopus.energy/static/consumer/documents/agile-report.pdf>

<sup>114</sup><https://www.sdge.com/sites/default/files/SDGE%20EV%20%20Pricing%20%26%20Tech%20Study.pdf>

<sup>115</sup><https://www.citizensadvice.org.uk/about-us/policy/policy-research-topics/energy-policy-research-and-consultation-responses/energy-policy-research/take-charge/>

<sup>116</sup>NIC page 57 [https://www.nic.org.uk/wp-content/uploads/CCS001\\_CCS0618917350-001\\_NIC-NIA\\_Accessible.pdf#page=53](https://www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350-001_NIC-NIA_Accessible.pdf#page=53)

<sup>117</sup><https://www.wwf.org.uk/sites/default/files/2018-06/Final%20WWF%20Accelerating%20the%20EV%20transition%20-%20part%202.pdf>

<sup>118</sup>Data downloaded from <http://carbonintensity.org.uk/> for October 2017, for instance, shows a marked difference between the carbon intensity during the evening peak compared to the early hours of the morning.

<sup>119</sup><https://www.nic.org.uk/wp-content/uploads/Power-sector-modelling-final-report-1-Aurora-Energy-Research.pdf>

<sup>120</sup><https://www.organdonation.nhs.uk/>

<sup>121</sup><https://www.pensionsadvisoryservice.org.uk/about-pensions/pensions-basics/automatic-enrolment>


## Flexibility provides opportunity

In 2030, the batteries in parked EVs will represent an enormous potential reserve of power and energy. Even under National Grid's 'Steady Progression' Future Energy Scenario, 2.5 million EVs would represent a considerable flexible power resource to be called on by the grid.

Typically, a car is parked for the vast majority of the time, resulting in the potential for EVs to earn all or part of their upkeep costs by providing energy services to the electricity system, through smart charging and vehicle to grid (V2G). V2G, which allows an EV to feed power back onto the system through bi-directional charging, goes above and beyond smart charging and unlocks a host of additional benefits to the EV user and the energy system.

V2G allows EVs to become fully integrated energy system assets, offering the potential to reduce curtailment of renewable generation, improve system flexibility, contribute to balancing the grid, and optimise the operation of local electricity networks. V2G further offers the opportunity for EV owners to become active consumers, or 'prosumers', and is another source of engagement with the energy sector.

Energy stored in EVs will allow some customers to meet their own demand, potentially powering their home for days from their battery. Their storage potential will be instrumental in supporting the UK's transition to low carbon, but typically less flexible, energy sources. Energy UK members are actively involved in V2G research pilots across the UK, representing a promising area of innovation for the UK economy.




**Case study**

**EDF & Nuvve**

EDF Energy and leading green tech firm Nuvve are partnering to install 1,500 Vehicle to Grid (V2G) chargers in the UK. The chargers will be offered to EDF Energy's business customers and installed on EDF Energy's own sites, this resource will be able to provide up to 15 megawatts of additional energy storage capacity.

As well as for charging electric vehicles, the V2G chargers can enable customers to access the stored electricity in their EV batteries. This will enable customers to use it to provide electricity on-site, to export power back to the grid, or to participate in energy markets, offering savings on energy costs and generating additional revenues.]



iStock.com/spyderskiddo

## Building around the consumer

Throughout this process, providing an excellent user experience must be a key priority. The onus is on the energy industry and the regulator to fashion a system that fits its customers; not vice versa.

This will be achieved through incentives and new product development. Low and medium-voltage monitoring of distribution networks must be rolled out, with the collected data shared widely and transparently wherever possible. This will ensure that the true impact of EVs is visible and will enable the value from flexibility services to be identified. Above all, we must avoid any technical solution that removes drivers' ability to charge when and how they want. But setting smart charging as an opt-out function for chargepoints should be considered.

No.	Opportunity	Forward direction	Potential solution
1	Demand for EVs creates an additional and potentially significant load on the energy system. If this occurs at peak times it would put a strain on the grid, requiring costly reinforcement or other solutions.	Smart charging standards, to be agreed by the end of 2019, should incorporate an opt-out requirement - making smart charging the default option for EV users.	Take forward smart charging standards by the end of 2019 that are performance-based and technology neutral. Set smart charging as an opt-out function, provided that there is a simple and straightforward override facility.
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“...providing an excellent user experience must be a key priority.”

# Building confidence and certainty in the transition



## Key points:

- **The energy industry will deliver the power required to enable all new cars and vans to be electric by 2035, provided the appropriate frameworks are in place to support investment in low carbon generation and smart charging.**
- **Support for electric vehicles and chargepoints must be maintained while the market matures. Subsidy removal should be linked to EV market share to ensure the sector is on a sustainable footing before removing support.**
- **Tackling concerns over vehicle range is vital in the short term, giving would-be EV drivers the confidence needed to transition. Government should fund the connection costs for a strategic network of ultra-rapid chargers, recognising their importance in building confidence.**

## Setting ambitious targets

Strong and ambitious commitments from the Government are needed to build confidence in the transition to zero emissions. Although Energy UK supports their commitment to phase out the sale of ICE vehicles by 2040, our industry believes that the UK can and should go further.

Indeed, we are confident that the power sector can be ready for an earlier rollout of EVs than currently projected by the Government. Provided the right investment frameworks are in place, including the Capacity Market and Contracts for Difference (CfD), and the move is to a smart charging system, we will be able to support and promote the target for all new cars and vans to be electric by 2035 – ahead of the Government’s own target. According to the Committee on Climate Change (CCC)<sup>122</sup>, the sale of ICE vehicles needs to end by 2035 to meet the Government’s target of having near-zero road transport emissions by 2050. This would allow roughly 15 years for the last stock of ICE cars and vans to run its course.

Beyond high-level targets, support is important in the short-term to encourage drivers to make the switch to EVs. Public subsidies for EVs and chargepoints continue to play a vital role and need to be maintained while the market matures. One option is to link reductions in subsidy to the market share of EVs. This has the advantage of providing certainty to industry and consumers and, if done effectively, prevents support being prematurely cut and damaging supply chains.

The trigger for subsidy to be reduced should be open for discussion. For example, it may be that the EV market is deemed to be mature once a given proportion of vehicle sales are EVs. Or, the trigger could be the point when there’s parity between the upfront cost of EVs and ICE vehicles. Whichever is used, support should remain in place to reflect the importance of reductions in carbon emissions and air pollution.

No.	Opportunity	Forward direction	Potential solution
3	EVs offer a route to decarbonisation and improved air quality, while opening up opportunities for engagement with the energy sector.	There are concerns about whether the power system will be able to manage the additional load on the system, and the flexibility requirements.	Provided the appropriate frameworks are in place, the energy industry will deliver the power required to enable all new cars and vans to be electric by 2035.
4	Provide long-term policy direction to businesses and domestic consumers.	Send a strong signal to UK drivers that everyone will be required to move away from ICE vehicles, and provide clarity on when subsidy will be removed.	Maintain public support for EVs and chargepoints while the sector remains in its infancy, and link subsidy removal to the market share of EVs.

<sup>122</sup><https://www.theccc.org.uk/wp-content/uploads/2018/10/Lord-Deben-to-Chris-Grayling-Greg-Clark-on-Road-to-Zero.pdf>

## Home is where the charge is

Just as we see now, most EV charging in the future is likely to take place at home using off-street parking<sup>123</sup>. It is assumed that 66 per cent of homes have off-street parking and a further 18 per cent have adequate on-street parking<sup>124</sup>. While charging at home is likely to be a cheaper and more convenient option for most, drivers remain anxious about out-of-pattern or longer journeys.

In a recent survey, two-thirds of motorists said they do not want an electric or hybrid vehicle as their next car, citing range anxiety, the lack of charging points around the country and upfront cost as the main reasons. Just over half - 52 per cent - expressed range anxiety and said worries about being unable to travel long distances was a “serious deterrent” to switching<sup>125</sup>.

## Tackling range anxiety: options for charging away from home

### A national public charging network

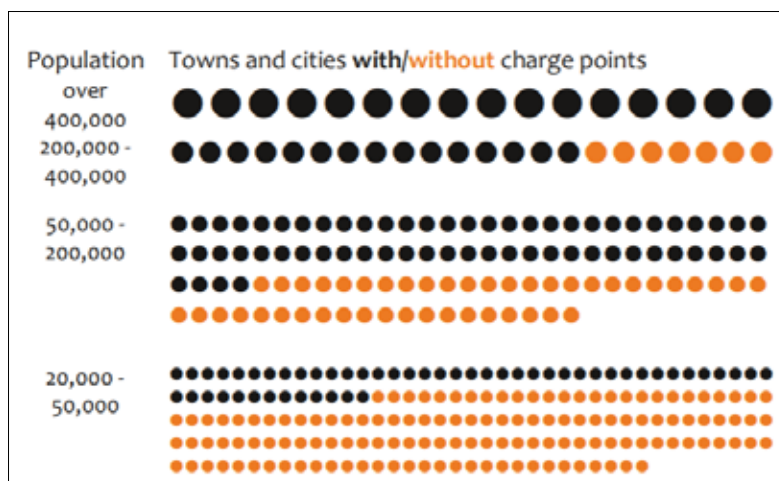
To maintain the momentum of EV uptake and ensure access to charging for all EV users, there is merit in providing central coordination to deliver a national charging infrastructure, while continuing to allow innovation and diversification of EV charging business models. This has been recommended by the National Infrastructure Commission (NIC)<sup>126</sup>, the BEIS Select Committee<sup>127</sup> and the Committee on Climate Change<sup>128</sup>.

There are wide disparities in the density of publicly available chargers across Great Britain. To date, nearly a quarter of all connectors have been installed in London, followed by Scotland (c. 15%) and the South East (c.14%). This compares to only 5% each in Yorkshire & Humber, the North East, and the West Midlands, dropping down to 4% in the East Midlands and only 3% in Wales<sup>129</sup>.

Differing levels of access to public rapid chargers is also starkly illustrated by the NIC’s 2018 assessment of sufficient access on a per population basis.

In many locations, it is clear from the continuous rise in public chargepoints that there is already a strong competitive market to provide them. However, this is not GB-wide and many locations have either marginal or negative business cases to have them installed.

These areas, where payback periods are too long and utilisation is low, are therefore likely to be under-served by a private market – and will suffer the effects of air pollution for longer than areas with significant charging infrastructure.



Proportion of built-up areas with at least one rapid charge point in June 2018 (by population)  
Source: National Infrastructure Commission<sup>130</sup>

<sup>123</sup>[https://www.delta-ee.com/index.php?option=com\\_edocman&view=document&id=1668](https://www.delta-ee.com/index.php?option=com_edocman&view=document&id=1668)

<sup>124</sup>2016 English Housing Survey – 2017 (38% have garages, 28% off street parking), 18% adequate on street parking local authority and housing association homes) [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/724359/Stock\\_condition.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/724359/Stock_condition.pdf)

<sup>125</sup><https://www.comparethemarket.com/media-centre/news/16-million-motorists-say-they-cant-afford-to-drive-electric-cars/>

<sup>126</sup><https://www.nic.org.uk/assessment/national-infrastructure-assessment/revolutionising-road-transport/>

<sup>127</sup><https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/383/383.pdf>

<sup>128</sup><https://www.theccc.org.uk/publication/reducing-uk-emissions-2018-progress-report-to-parliament/>

<sup>129</sup>Zap map – accessed 18 October 2018

<sup>130</sup><https://www.nic.org.uk/assessment/national-infrastructure-assessment/revolutionising-road-transport/>

National Grid has proposed that ultra-rapid chargers could be located along the strategic road network, with an initial 54 strategic locations ensuring that 99 per cent of drivers are always within 50 miles of an ultra-rapid charging station<sup>131</sup>.

But PwC and Energy UK<sup>132</sup> have found there are questions over the profitability of the rapid charging business model, due to a mix of high-cost regulatory complexity and low utilisation rates. These elements are particularly acute for ultra-rapid charging, where utilisation rates are likely to be lower still in the early years.

Compounding this is the issue that companies wanting to install chargepoints, especially rapid or ultra-rapid chargers, are often required to upgrade the grid connection. This is a lengthy, complex and expensive process, severely impacting the business case of rolling out chargepoints. And crucially, those who trigger the network upgrade bear all the risk and costs, at least in the short-term.

The NIC has proposed that the Government should ensure that every town with a population of over 20,000 has at least one rapid charger. While this proposal has its merits, the private sector is already filling this gap; providers are rapidly expanding coverage to meet growing demand. But it will remain important to continue monitoring if and where this gap is not being filled. Intervention may be necessary in the future, either from central or local government.

For most rural households with off-street parking, charging needs will largely be met by smart home charging. For out of pattern journeys and long-distance travel, particularly in the areas described above, the National Grid's proposals will remove range anxiety.

## Appropriate support

The UK Government has stated that it “[...] will not own or operate a chargepoint network now or in the future.”<sup>133</sup> Energy UK strongly agrees with this statement and is calling for financial support to be limited to helping cover the cost of the grid connection to avoid distorting the wider competitive market.

The private sector has a crucial role to play in rolling out charging solutions and developing attractive offerings that appeal to drivers. Significant progress to date and a number of announcements, by Ionity<sup>134</sup> and Pivot Power<sup>135</sup> among others, highlight private sector willingness to invest in innovative solutions to meet drivers' needs and overcome range anxiety.

Supporting the costs of installing chargepoints by funding the network connection would complement this activity, building on the existing progress and further unlocking investment across the UK. This would reduce the risk of installing chargepoints and provide a mechanism for network operators to recover costs in an equitable manner.

No.	Opportunity	Forward direction	Potential solution
5	There will be a variety of opportunities to charge an EV, and the market is well placed to deliver in most instances.	There must be consistent access to a well-maintained nationwide chargepoint network. There is a marginal business case for investment in some areas.	The Government will need to subsidise the grid connection cost of ultra-rapid chargers in strategic locations, to ensure a nationwide provision of charging infrastructure.

<sup>131</sup><https://www.nationalgrid.com/sites/default/files/documents/Electric%20Vehicle%20Charging%20-%20enabling%20the%20switch.pdf>

<sup>132</sup><https://www.pwc.co.uk/industries/power-utilities/insights/electric-vehicle-infrastructure-report.html>

<sup>133</sup>P16 [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/739460/road-to-zero.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739460/road-to-zero.pdf)

<sup>134</sup>[https://ionity.eu/Resources/Persistent/14e6304003e2cc95f78413bc9081b53309197b17/20180903\\_IONITY-PRICING\\_E.pdf](https://ionity.eu/Resources/Persistent/14e6304003e2cc95f78413bc9081b53309197b17/20180903_IONITY-PRICING_E.pdf)

<sup>135</sup><https://www.pivot-power.co.uk/pivot-power-work-national-grid-future-proof-energy-system-accelerate-electric-vehicle-revolution/>

## Charging your vehicle at work

Although most charging will happen at home, it is important to encourage and enable private businesses and public sector organisations to install chargepoints for staff to charge/top up at work. This will widen the appeal of EVs to those who need a car or van but don't have adequate on-street parking to guarantee access to a chargepoint. Slow workplace charging during the day also reduces the need to charge at home, cutting evening peak demand. This is something that should be actively encouraged.

The workplace charging grant has been important in encouraging businesses to install chargepoints. With many companies seeking to clean up their own fleets and encourage employees to make the switch to EVs, it is clear that incentives must target individuals, businesses and fleet operators alike.

Government support in the form of tax relief, subsidy, awareness-raising and innovation funding has been a key part of encouraging the uptake of EVs in the UK to date. As numbers continue to grow it is widely recognised that the level of public support should be gradually reduced and eventually removed. This must be done in a way that helps, rather than hinders, the uptake of EVs.

Although today access to EV charging is considered a workplace perk, by 2030 it will be the norm. The regulatory framework can and should be used to facilitate this: as support is phased out, requirements should be introduced for workplaces to provide chargepoints to their employees as standard, building on existing planning requirements.

### Case study

The world's biggest trial of commercial EVs - 'Optimise Prime' - will bring together leading power, technology, fleet and transport companies to test and implement the best approaches to the EV rollout.

Led by Hitachi Vantara and UK Power Networks, the trial will see up to 3,000 electric vehicles from Centrica, Uber and a large depot-based parcel carrier take to the road (supported by SSE, Hitachi Europe and Hitachi Capital Vehicle Solutions).

The trial aims to deliver an end-to-end overview of what the switch to EVs means for: the power networks that deliver our electricity; the businesses needing to invest in new infrastructure; and, the end users powering their vehicles. This wide-ranging trial will help develop solutions that cut the cost of owning and running EVs.

**centrica**



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# Financing the transition



## Key points:

- **If no action is taken, the Government risks a shortfall in revenue from vehicle excise duty and fuel duty as drivers migrate from the combustion engine to EVs.**
- **Various options for funding the transition have been proposed and a broad discussion about who pays, and how, needs to start now.**

The private sector has been, and will continue to be, pivotal to the decarbonisation of road transport. As Government support is reduced, so private investment will continue to grow as the market matures and develops. But today, the Government needs to address some thorny issues around the “who pays?” debate.

Motorists currently pay around £28 billion a year in fuel duty and £6 billion in vehicle excise duty (VED)<sup>136</sup>. EV drivers are currently exempt from these charges. Modifying the VED regime to allow for the uptake of EVs should not be difficult, provided it is done gradually and communicated ahead of time. Fuel duty, however, is more challenging. Transitioning from ICE vehicles to EVs will require a change in how and on whom fuel duty is levied.

Various alternative approaches have been proposed<sup>137</sup>, but each has a range of pros and cons, with no obvious solution to the problem. One thing is clear, however: fuel duty cannot simply be transferred to electricity bills as the new fuel source, as this would be applied to all electricity – rather than purely to power used to charge a vehicle.

It would disincentivise the switch to EVs and, indeed, the further uptake of electric heating, which is likely to have an important role to play in decarbonising heat in the UK. In addition, tackling fuel poverty and helping vulnerable customers remains a key priority for both the Government and the energy industry. Levying fuel duty onto electricity bills would be at odds with that goal, affecting all energy users irrespective of their ability to pay.

“...tackling fuel poverty and helping vulnerable customers remains a key priority for both the Government and the energy industry. Levying fuel duty onto electricity bills would be at odds with that goal, affecting all energy users irrespective of their ability to pay.”

<sup>136</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/720080/FOI2018-07265\\_-\\_Fuel\\_duty\\_VAT\\_and\\_VED\\_revenues.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/720080/FOI2018-07265_-_Fuel_duty_VAT_and_VED_revenues.pdf)

<sup>137</sup><https://www.theiet.org/impact-society/factfiles/transport/road-user-charging/>

<https://www.acenet.co.uk/media/1139/funding-roads-for-the-future.pdf>

<https://policyexchange.org.uk/wp-content/uploads/2017/07/Gergely-Raccuja-Miles-Better-Revised-Submission.pdf>

<https://policyexchange.org.uk/publication/driving-down-emissions-how-to-clean-up-road-transport/>



# Annex

## Alternative fuels and transport

We have focused here on passenger road transport, given the level of international certainty and the growing potential of this sector. But we have left out of scope other technologies and transport requirements (such as shipping, aviation and rail) due to their continuing levels of complexity.

Heavy Goods Vehicles (HGVs) remain a particular challenge with biofuels, hydrogen and biomethane leading demonstration projects. Since this area of decarbonising transport does not have a clear pathway at present<sup>138</sup>, our report does not examine freight in detail as a step-change in battery technology may lead to fully-electric HGVs becoming a viable option in the future. We will look again at this important area in subsequent work. In the meantime, the Government's efforts should focus on innovation funding for technologies and fuels that could aid this transition.

Opportunities to cut freight emissions in the short-term, such as by replacing diesel with lower-carbon gasses and liquid fuels, should be supported and encouraged as the longer-term decarbonisation roadmap is developed.

For light to medium vehicles - as well as segments of other transport modes including buses, BEVs and PHEVs are currently the most popular zero-emission capable vehicles. Plug-in vehicles represent a considerable opportunity to leverage the progress made in decarbonising the power sector, where emissions have been cut by 65 per cent since 1990<sup>139</sup>.

However, while PHEVs are an important part of the EV market at present, by 2030 we expect BEVs to play a much more dominant role. This will be driven by improving vehicle ranges, increasing charging speeds, continued cost reductions and the maturity of the existing electric grid infrastructure, in addition to low consumer running costs.

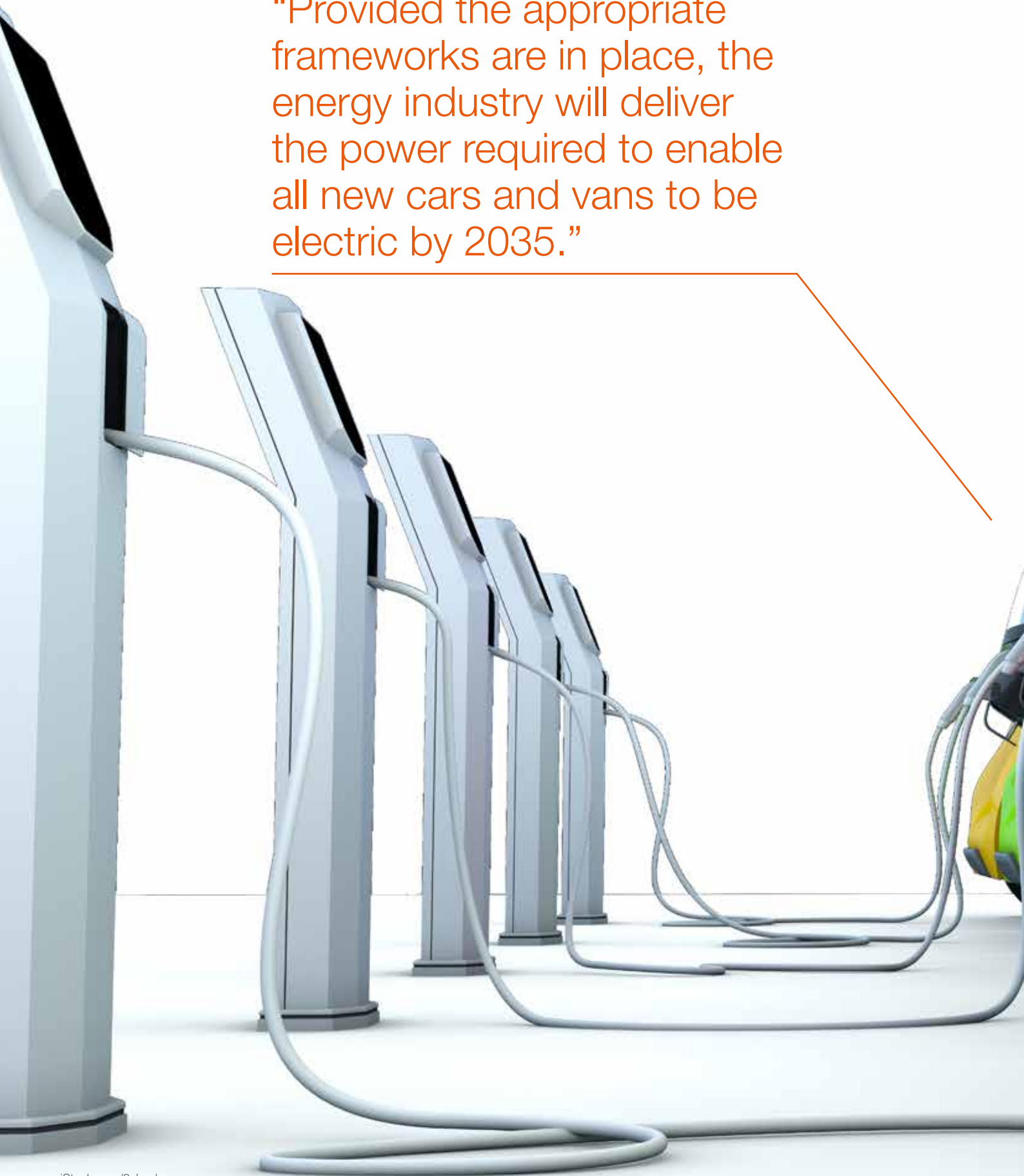
Fuel cell electric vehicles are not currently a major focus of development for car manufacturers due to the expense of hydrogen production and the cost of deploying new infrastructure. But beyond the 10-15-year timeframe of this report, hydrogen may become a viable option for a range of vehicles, dependent on developments in other sectors.



<sup>138</sup>[https://www.itf-oecd.org/sites/default/files/docs/towards-road-freight-decarbonisation\\_0.pdf](https://www.itf-oecd.org/sites/default/files/docs/towards-road-freight-decarbonisation_0.pdf)

<sup>139</sup><https://www.theccc.org.uk/wp-content/uploads/2018/06/CCC-2018-Progress-Report-to-Parliament.pdf>

“Provided the appropriate frameworks are in place, the energy industry will deliver the power required to enable all new cars and vans to be electric by 2035.”







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