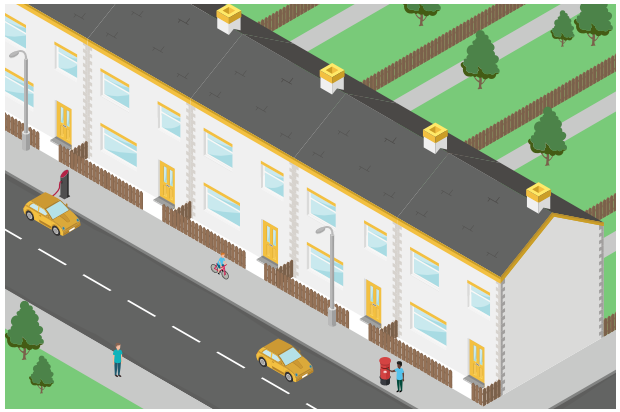
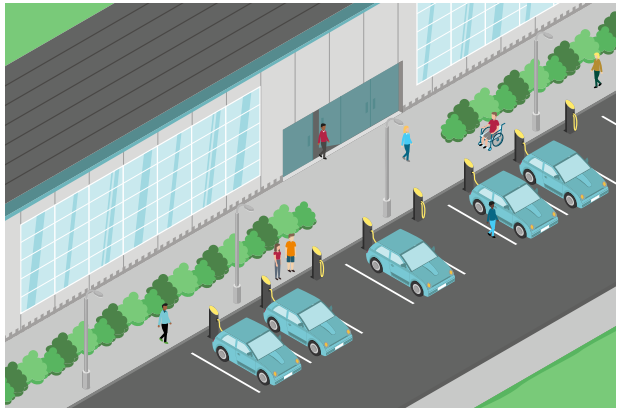
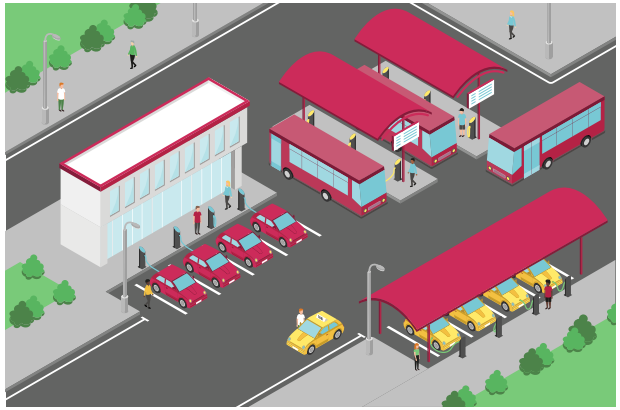
Llywodraeth Cymru
Welsh Government

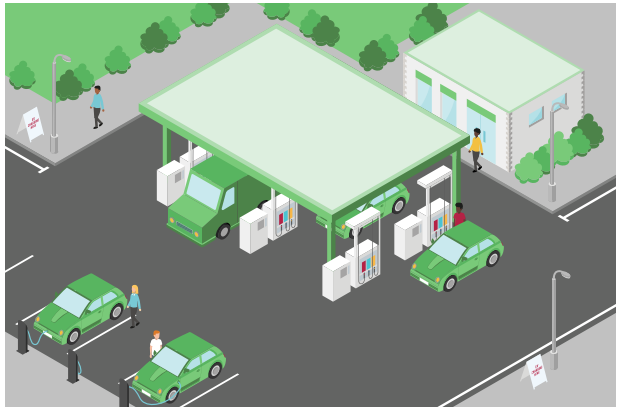
Electric Vehicle Charging Strategy for Wales

Facilitating the Transition to Net Zero









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From the Minister

Ken Skates MS

Minister for Economy,
Transport and North Wales

This strategy sets out our vision for electric vehicle charging in Wales. Thank you to everyone who has participated in shaping this strategy, through consultation on the draft. There has been widespread commitment to collaborative working to deliver our vision for charging across Wales. The vision, underpinned by the Well-being of Future Generations (Wales) Act 2015, 'reflects our commitment to inclusivity'.

A ban on the sales of new petrol and diesel only cars and vans will be introduced in 2030. This places greater emphasis on the urgency of the challenge for a transport revolution for Wales. It supports our aspiration to end Wales' contribution to climate change by 2050, and to improve the quality of the air that we breathe.

Llwybr Newydd: a new Wales Transport Strategy sets out my long term vision for an efficient transport system that makes a positive contribution to the economy, to social justice and to our health and well-being, in a way that reduces carbon emissions and the impact of transport on our environment. We want to increase the use of public transport in Wales and encourage more cycling and walking but we also recognise that electric vehicles will play an important part in the future of transport.

Electric vehicles will bring benefits to consumers, in lower running costs and the ability to charge at a variety of locations but we recognise that providing charging facilities to meet the needs of electric vehicle users will be a big challenge. There are clear commercial opportunities to meet this demand but we will also need to invest in order to deliver our vision of a network of electric vehicle charging that enables consumers to confidently switch from combustion to electric cars and vans. The strategy is intended to support the public, private and third sector, as well as individuals, providing a common framework for understanding and collaboration. The strategy will be supported by an action plan to track and manage delivery, which will be monitored and reviewed annually.

We look forward to continued collaboborative working to help shape the charging infrastructure system you need across Wales.

1. Executive Summary

We have declared a climate emergency and have committed to delivery of Wales' target of net zero by 2050. The transport sector, as one of the largest contributors to greenhouse gas emissions in Wales, has a significant role to play.

Welsh Government recognise that this strategy represents the first step for Wales to take targeted action to deliver a vision for electric vehicle charging that meets Wales' unique requirements. This strategy sets out where we are now in providing charging for cars and vans across Wales, our charging needs for the decade, and how these can be met.

It is based on the following vision:

A Vision for Charging in Wales

By 2025, all users of electric cars and vans in Wales are confident that they can access electric vehicle charging infrastructure when and where they need it.

Whilst Wales currently has one of the lower levels of electric vehicle ownership in the United Kingdom, this strategy aims to increase public confidence in the availability of charging infrastructure which will facilitate increased ownership. Engagement with existing and prospective electric vehicle users in Wales has shown that an overall lack of charging facilities and issues with the quality of the charging experience have been key concerns. We can work together to implement more charging and a better charging experience across the country, so that users are confident to make the switch to electric vehicles. This strategy includes the UK Government-led initiatives that apply in Wales, and where Wales can go further to meet our unique and localised needs.

Where users can charge cars and vans at home (with access to off-street parking), this offers the most convenient and cost-effective charging solution. Home charging presents great potential in Wales, where many homes have access to off-street parking. We will introduce requirements for new homes to be ready for charging through changes to Building Regulations as well as promoting the wider support available for those wanting to install charging at home.

In order to promote equitable access to charging we need to go further to support those who are unable to charge at home. Fast charging is installed at many different types of locations (workplaces, supermarkets, on-street, destinations etc.) and will be increasingly important for all users of electric cars and vans, particularly those unable to charge at home. Welsh socio-economic data has been used to predict that we need 30,000 to 55,000 fast chargers to be available in Wales by 2030. We plan to introduce measures that will provide high quality fast charging to meet this need, through partnerships and collaboration.

Rapid charging will also be important, especially for long distance journeys. We will need up to 4,000 rapid chargers to be installed by 2030. Welsh Government has started to work with Transport for Wales to bring forward rapid charging on the strategic trunk road network.

Based on policy context, existing and future charging needs and engagement with users and stakeholders, this strategy has identified the following key conclusions to be taken forward to action planning:

- The need for a substantial increase in the number of slow, fast and rapid/ultra-rapid chargers available in Wales. Meeting the need for up to 55,000 fast chargers in Wales, alongside home charging will be a key area of focus to promote equality of access to charging.
- The need for better quality charging, to improve the user experience for electric cars and vans.
- Sustainable, integrated and cross-sectoral planning will facilitate the decarbonisation of energy and transport, and create co-benefits. Welsh Government can create favourable conditions for economic and employment opportunities to be captured in Wales.
- The supply of power is the responsibility of electricity network owners and is regulated by UK Government and Ofgem. We will work within the current regulatory framework with these stakeholders to plan for the decarbonised grid network (including heat, renewable electricity generation and transport) so that the needs of charging will be met in a way that is efficient for network management incorporating smart technology. This will assist in being ready to capture the benefits of vehicle to grid.

The modelling for predicting charging needs set out in this document is based on the adoption of fully electric private vehicles from the 'Leading the Way' Future Energy Scenario, modified to account for the 2030 ban on the sale of petrol and diesel cars and vans announced by the UK Government. A further adjustment has been made to account for vehicle turnover in Wales compared to the UK average. This has resulted in higher predicted demand for charging than was published in the consultation draft of this strategy.

Section 8 provides the basis for an action plan which will be published in June 2021 to track and manage delivery. Welsh Government recognises its enabling role in delivering this charging infrastructure through the use of regulatory and planning levers, as well as land use planning guidance, use of public land and resources, funding, and targeted support programmes. Targeted action planning will be undertaken to meet the rapidly growing need for charging to ensure that a lack of electric vehicle charging infrastructure does not become a barrier to transitioning to electric cars and vans. Welsh Government can create favourable conditions for economic and employment opportunities to be captured in Wales. It is a key aspiration to develop a framework that captures as much economic activity as possible from the provision, operation and maintenance of these facilities within the Welsh and local economy.

Delivering the aims of this strategy will require significant levels of investment. There are clear commercial opportunities in electric vehicle charging but we recognise that targeted investment by government in areas where provision is not up to standard will be necessary. Technological change will influence the shape of electric vehicle charging infrastructure in the future, including improvements in battery technology, micro-mobility, autonomous vehicles and hydrogen. These aspects will be kept under review as part of ongoing action planning.

2. Vision and Scope

There is an immediate need for more charging and better charging infrastructure to facilitate consumer confidence in making the switch to electric vehicles.

The following vision will help stakeholders plan for charging infrastructure and their role in delivering or accessing it. Whilst charging infrastructure can be delivered by a variety of means, government has an enabling role. Setting the vision is the first step.

Vision

A Vision for Charging in Wales

By 2025, all users of electric cars and vans in Wales are confident that they can access electric vehicle charging infrastructure when and where they need it.

Scope

This strategy sets out current provision of charging in Wales, the number of chargers, types of chargers and standards of charging required. The future changes that should be considered are also outlined. The strategy covers the period until 2030, yet we recognise the urgency of taking action now to put us on the right path by setting the vision for 2025. This strategy focusses on cars and vans used by private individuals, businesses and taxis to meet predicted need of users with the most immediate and measurable need. As the ban on the sale of petrol and diesel cars and vans by 2030 applies to hybrid vehicles by 2035, this strategy focusses on supporting the charging needs of cars and vans that are entirely electric. In the short term, better charging provision will also enable hybrid vehicles to charge.

The future of electric charging will also need to consider the impact of market changes. These include the necessary transition of freight, public transport and more integrated multi-modal transport systems. Opportunities for sustainable modal shifts and integration will need to be quantified in the context of Llwybr Newydd: a new Wales transport strategy and will provide important context for ongoing action planning for electric vehicle charging.

Other technologies (such as hydrogen) will in future have a role to play alongside electrification. The longer term and bespoke charging needs of other vehicle types means that further planning will be required. Whilst these aspects are outside of the scope of this strategy, commentary is provided in Section 6 in order to provide context. Welsh Government is consulting more widely on planning for the decarbonisation of transport, and will continue to monitor additional implications that this may have on electric vehicle charging.

3. Background and Context

Wales legislation, policy and plans

Welsh Government has set out its legal commitment to achieve net zero emissions by 2050. We are passing regulations in 2021 to set interim targets for 2030, 2040 and 2050, against carbon budgets (2021-25 and 2025-2030). The transport sector, as one of the largest contributors to greenhouse gas emissions, has a significant part to play in achieving net zero.

Planning Policy Wales (2018) states that we should ensure our transportation infrastructure is adaptable to future advances in innovation (e.g. electric vehicles) and that we should ensure progress is made towards a shift to low or zero emission means of road transport.

In March 2019, the Welsh Government published "*Prosperity for All: A Low Carbon Wales*"[1] which sets out how Wales aims to meet its carbon targets. This includes proposals to address the adoption of electric vehicles and the required charging infrastructure.

The policies aim to:

- Increase the uptake of electric vehicles (including battery electric vehicles, hybrids and plug-in hybrid) and promote active travel.
- Reduce the carbon footprint of buses, taxis and private hire vehicle fleets to zero emissions by 2028.
- Explore the possibility for all new cars and light goods vehicles in the public sector fleet in Wales to be ultra-low emission by 2025. Where practicably possible, all new heavy goods vehicles are ultra-low emission by 2030.
- Invest in public charging infrastructure.

Llwybr Newydd: a new Wales transport strategy sets the framework for decarbonisation of the transport sector as a whole. This strategy has been created to sit within the context Llwybr Newydd as a specialist and priority topic area, where urgent action and cross-sectoral integration (across the energy and transport sectors in particular) is required.

Future Wales: The National Plan for 2040 sets a 20 year plan for shaping the growth and development of Wales and provides context for spatial planning in delivering electric vehicle charging. It notes that 'Planning Authorities should take a strategic approach to electric vehicle charging in their area and, where appropriate, develop policies in their development plan and specific local requirements.

[1]Welsh Government (2019). *"Prosperity for All: A Low Carbon Wales"*.

The provision of electric vehicle charging infrastructure should be planned as part of the overall design of a development'. These two key points will help guide action planning associated with this strategy.

Our vision for charging in Wales within this strategy is shaped by the context of the Well-being of Future Generations (Wales) Act 2015. The Act provides an important framework for how we go about meeting the charging needs of Wales and take a joined-up approach.

United Kingdom legislation, policy and plans

The Department for Transport is developing a Transport Decarbonisation Plan, which will set out actions for government, business and society to deliver the significant emissions reduction needed across transport. The need to support electrification, alongside other measures including demand reduction, is clear.

UK Government and the Department for Transport has started investing in electric vehicle charging infrastructure, across a number of planned programmes. The Department for Transport's 'Project Rapid' is planning to facilitate charging at Motorway Service Areas. The UK Office for Zero Emissions Vehicles administer grant funding schemes for home charging, workplace charging and on-street charging, as detailed in Section 4.

A public-private sector organisation, the Zemo was established in 2003, to accelerate the shift to low carbon vehicles. Their most recent review in 2020, identified three urgent priorities:

1. **"The urgency of developing standards and codes of practice to enable interoperability and the sharing of data within the electric vehicle sector and with the electricity system.**
2. **The need for effective local and national planning and coordination to enable efficient investment, mediating the balance between future-proofing and asset stranding.**
3. **The criticality of smart charging; underpinned by a resilient network and clear market signals, to reduce the cost of supplying millions of EVs".**

Emerging projects and plans are being led by the Department for Transport, alongside recommendations of the Zemo. They provide a framework for the public sector to take action on facilitating the provision of electric vehicle charging, largely applicable to England. The Automated and Electric Vehicles Act 2018 provides the UK Government powers to introduce further measures to regulate and shape future charging provision. Section 8 of this strategy adopts and expand upon the principles being established in order to promote coherence and a user experience that meets (and where appropriate exceeds) standards being set across the UK, as well as meeting the additional unique requirements for Wales.

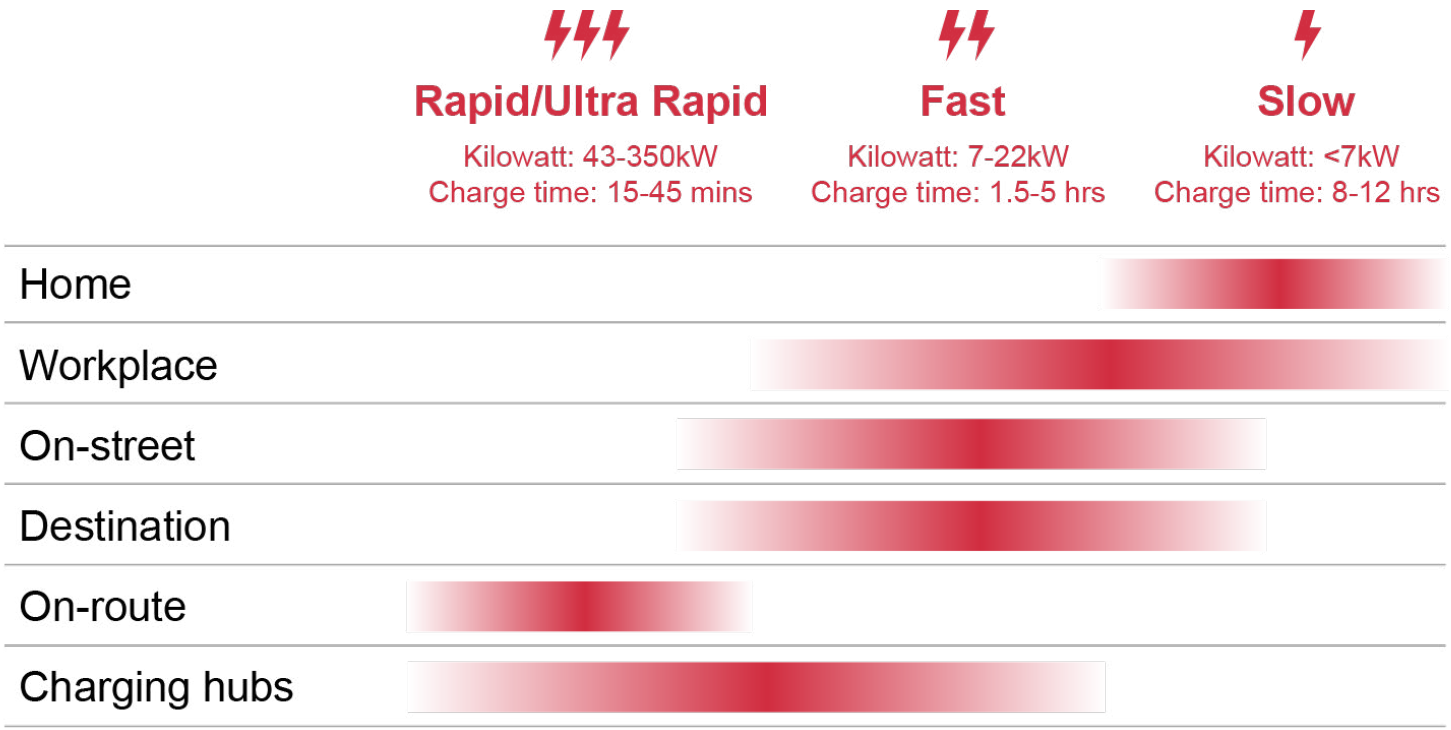
Charging infrastructure

Electric vehicle users have a range of options as to where, how and when to charge their cars. The patterns that users adopt (known as 'charging behaviours') vary according to personal circumstances and need. The key influencing factors on charging behaviours are the time it takes to charge, convenience and cost.

Charging at home, where available, is typically the cheapest and most convenient form of charging (known as 'slow' or 'trickle' charging). Not all users have access to charging at home, as this is difficult without a driveway. Most users will require charging away from home at some point, especially on long journeys.

Away from home, the type of charging most suitable depends on the length of time a user may stay at that location. The cost of charging is highly variable, depending on vehicle type, charging type, whether a user is fully charging or topping up, and payment arrangements (such as membership schemes or free charging bundled with other services). Rapid charging is usually most expensive for the user, on a pence per kilowatt hour basis. Higher powered charging provides a faster charging experience, and also places more demand on the electricity network, hence the higher cost.

Certain charging types are typically suited to certain locations, as illustrated below and further explained in the following sections.

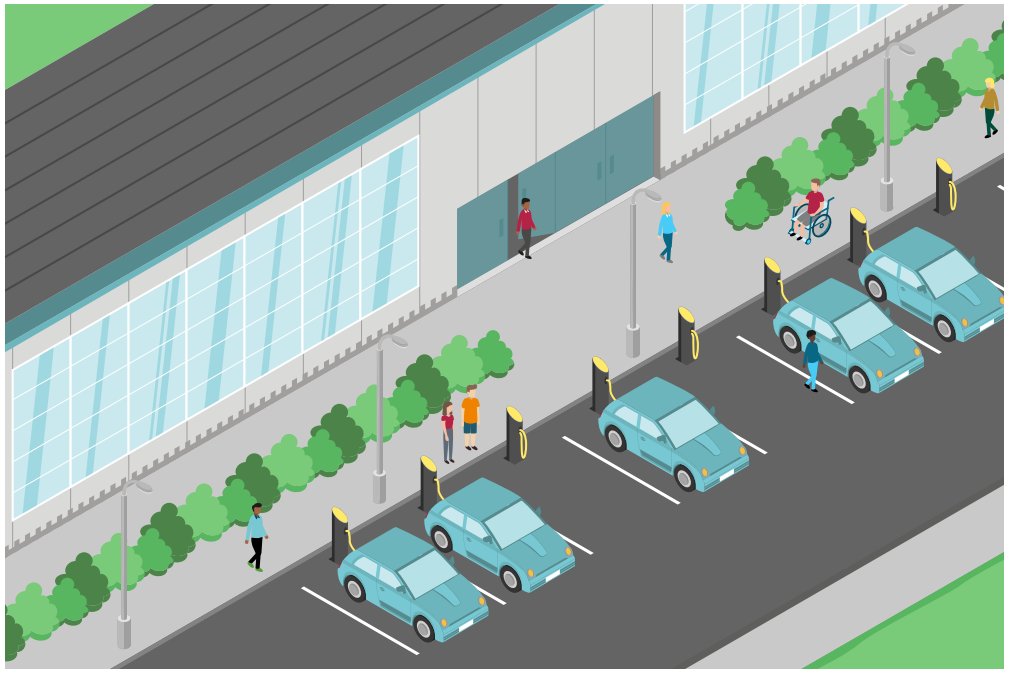


Home charging

Description: Home charging is the cheapest and most convenient form of charging, usually slow charging overnight.

Likely target users: Users with off-street parking.

Challenges: On existing properties, the onus is on the user to arrange installation. Grants are available via the Office for Zero Emission Vehicles Homecharge Scheme. Users can be better supported with clear and consistent information.

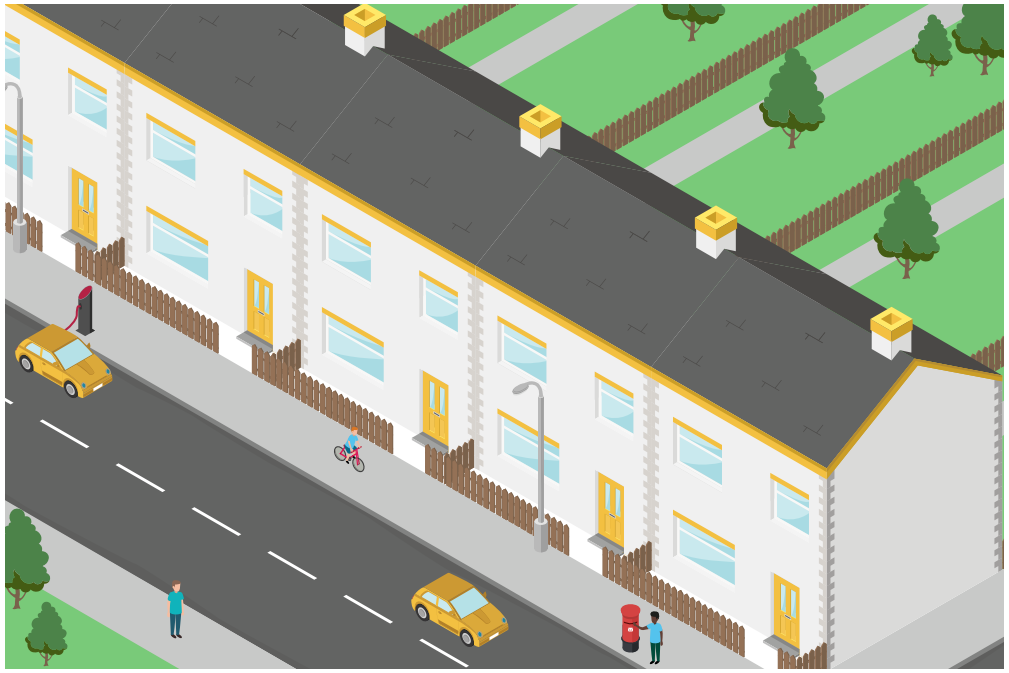


Workplace charging

Description: Workplace charging is typically provided in private car parks. Charging can be slow or fast and offers a convenient way to recharge an electric vehicle for employees and business fleet.

Likely target users: Employees, business fleet users.

Challenges: Parking space availability. May incentivise behaviours to use private vehicles rather than more sustainable transport modes, where possible. Grant support is available via the Office for Zero Emission Vehicles Workplace Charging Scheme.



On-street charging

Description: Stand-alone pillars, typically 'fast' chargers provide on-street charging. Dedicated kerbside charging points have been developed that avoid cables trailing across footways.

Likely target users: Users with no off-street parking, such as terraced housing. Visitors to destinations where on-street parking is available.

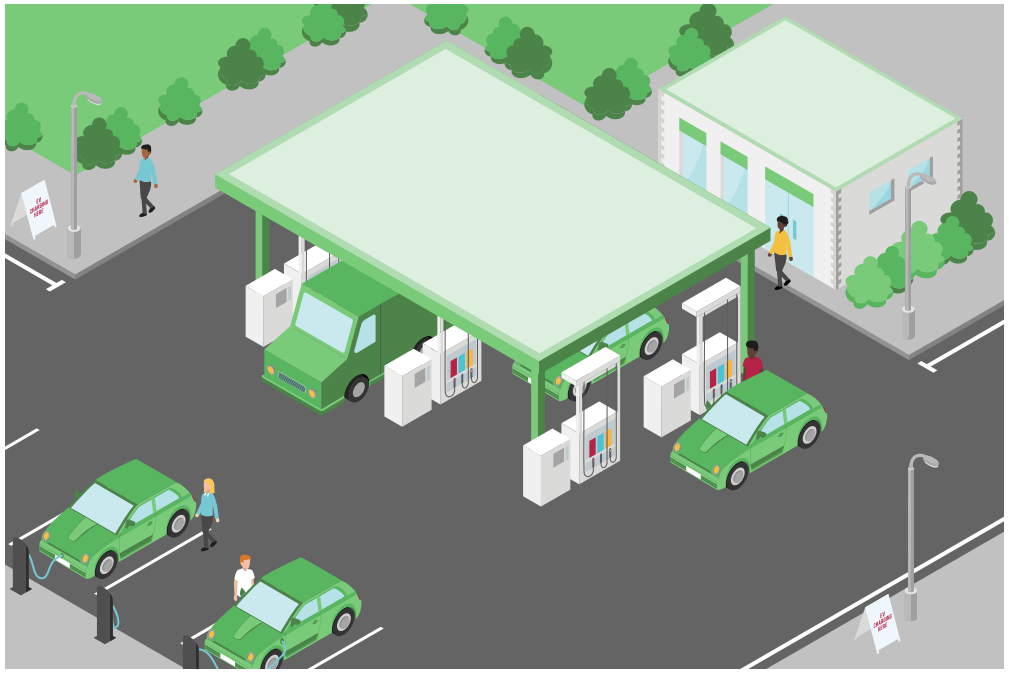
Challenges: Managing parking to ensure that users have access when they need it, and others don't block spaces when not charging. Funding and arranging installation can be time consuming, especially where grid is constrained.

Destination charging

Description: Fast charging is provided at destinations where the user may park for a number of hours, e.g. gym, cinema or shopping centres. Hotel chains may take advantage of the overnight charging, and use slow charging as it is more cost-effective.

Likely target users: Destination visitors.

Challenges: Not strategically planned or managed – based on individual investment decisions at destination.

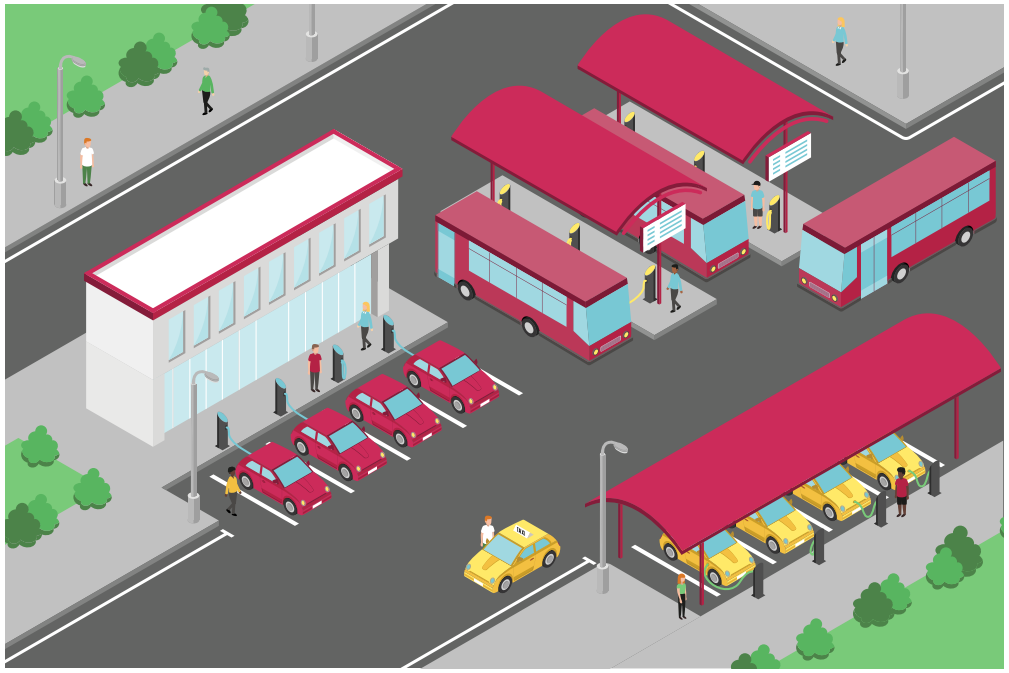


On-route charging

Description: On-route charging is used to top up midway through a journey, for example at motorway service areas.

Likely target users: Business travel users, private leisure users, freight and logistics.

Challenges: Market segmentation, resulting in incompatibility across charging equipment and supporting payment and data infrastructure. Lack of strategic planning. Sufficient grid capacity must be available to accommodate high powered charging.



Hub charging

Description: Hub-based charging can be at centralised or out-of-town locations. Hubs can include different types of users, as part of a multi-modal transport strategy. A mix of charging types would be required to service different user needs. There is the potential for synergies to offer greater value.

Likely target users: Taxis, buses, business fleet, park and ride/multi-modal transport users, car rental companies, freight and logistics.

Challenges: Land availability. Grid capacity and cross-sector integration. New delivery models are required to deliver multi-modal transport services.

4. Current Charging

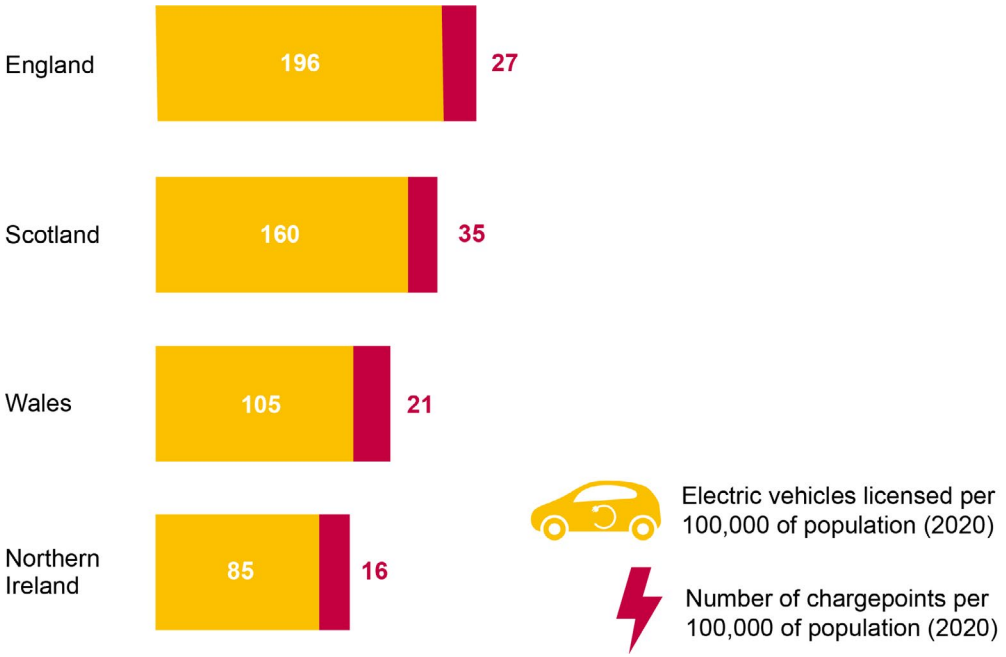
The following provides an outline of where Wales is in the context of the rollout of electric vehicle charging infrastructure. It sets out how the market is developing across different charging types. We know that we must improve the provision of electric charging across Wales, so that users are confident to make the switch to electric vehicles.

Total number of charge points in Wales

Wales currently has one of the lower levels of electric vehicle ownership in the UK. This strategy aims to increase public confidence in charging, which will facilitate increased ownership.

Wales is currently behind England and Scotland in terms of the number of chargers available and electric vehicle ownership. The relationship between the number of chargers available and electric vehicle ownership is positive (i.e. more charging supports increased electric vehicle ownership), but slightly different for each part of the UK. Other factors such as geography, demographics, prosperity, policy and institutional frameworks are influential, emphasising the need for this strategy to consider circumstances specific to Wales.

Public charge points and electric vehicles licensed per 100,000 of population by UK regions[2,3]



[2]Department for Transport (2020). Battery Electric Vehicles or BEV (subset of ULEV) licensed at the end of the quarter by upper and lower tier local authority
[3]Department for Transport (11 August 2020). Electric vehicle charging device statistics July 2020

Electric Vehicle Market Penetration[4]

determined by number of electrical vehicles compared to the number of total vehicles.

WALES

0.17%

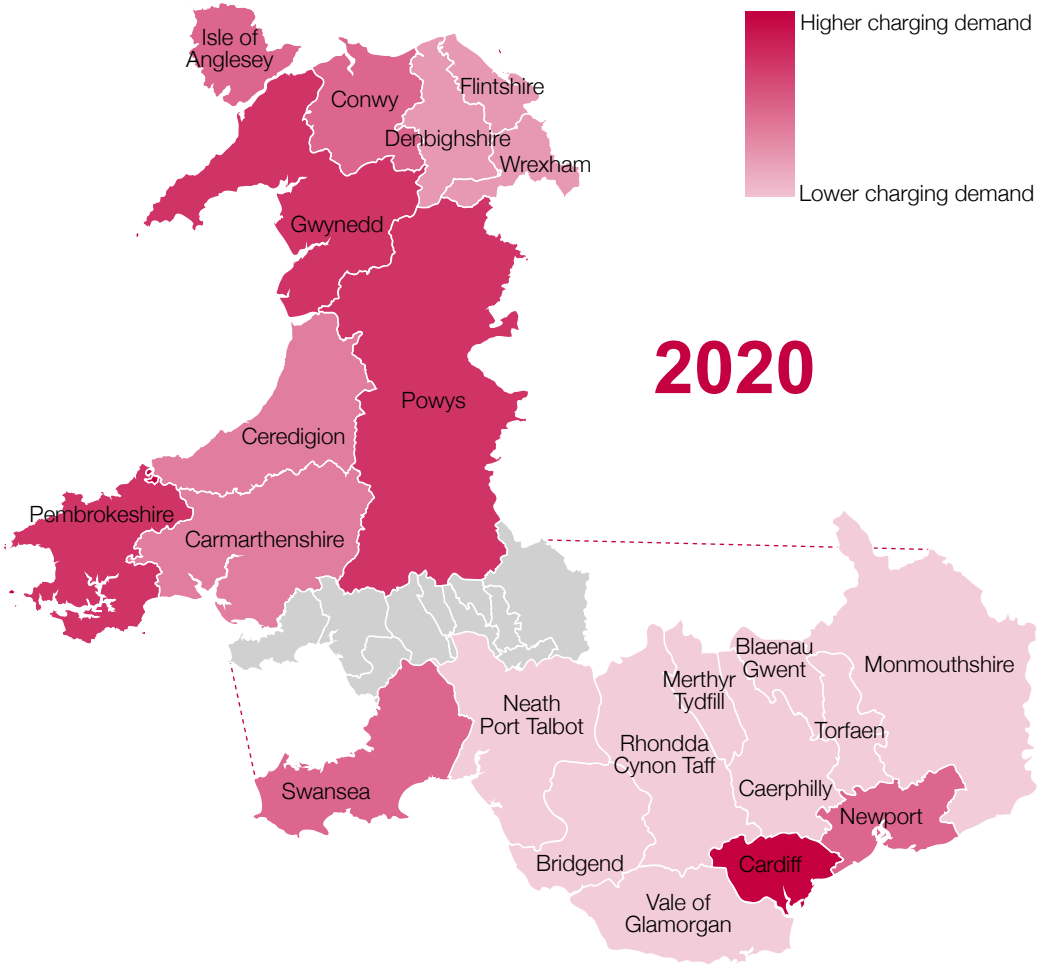
UK

0.32%

The unique geography and demographics of Wales frame the challenges that we face in providing better charging. Rural areas and economically disadvantaged areas of Wales are particularly underserved, with large 'gaps' in the rapid charging network for long distance travel. The following graphic also indicates very low numbers of charge points in local authority areas around the South Wales valleys, and localised differences between local authority areas. These factors are important when defining unique actions for Wales in Section 8.

[4]Department for Transport (2019), Vehicle Licensing Statistics. Available at: **www.gov.uk/government/collections/vehicles-statistics**

Number and location of chargers in Wales in 2020[5]



Local Authority	Rapid	Fast	Slow	Total
Cardiff	21	28	14	63
Pembrokeshire	5	28	0	33
Isle of Anglesey	3	20	0	23
Newport	16	5	0	21
Denbighshire	14	6	0	20
Conwy	8	10	0	18
Swansea	8	8	0	16
Gwynedd	9	4	2	15
Wrexham	5	8	0	13
Vale of Glamorgan	6	6	0	12
Blaenau Gwent	2	7	2	11
Flintshire	7	1	0	8
Ceredigion	5	2	0	7
Monmouthshire	4	3	0	7
Merthyr Tydfil	2	3	2	7
Powys	2	4	0	6
Caerphilly	4	2	0	6
Neath Port Talbot	3	1	1	5
Bridgend	4	0	0	4
Torfaen	2	1	0	3
Carmarthenshire	2	0	0	2
Rhondda, Cynon, Taff	0	2	0	2

[5]Data extract from Chargepoint Registry July 2020

Types of charging in Wales

Home charging

Adoption in Wales: As the cheapest and most convenient form of charging, where users have access to off-street parking they will predominantly charge at home. Users are responsible for installing their own charge point at existing properties. There are currently a few thousand charge points installed at homes in Wales[6]. Charging at home in Wales offers huge potential, a large proportion of houses in Wales (varying across local authority areas) have off-street parking that can be used for this purpose, although it is hugely variable across different parts of Wales. Urban areas in Wales tend to have more houses with off-street parking than major UK cities such as London. Over 50% of homes in Cardiff, for example, have access to off-street parking.

Delivery in Wales: Residents wishing to install a charge point can apply to The Electric Vehicle Homecharge Scheme (EVHS) which provides grants of up to £350 per charge point.

Direction of travel: The Energy Performance Buildings Directive, to be transposed into Welsh Building Codes (see Section 8), signal the requirement for all new homes with associated parking be ready for electric vehicle charging. The same obligation is placed on any refurbishment scheme covered by the Code.

A number of energy providers are offering combined electric vehicle charging and home energy tariffs. These 'smart tariffs' incentivise users to charge overnight, when electricity can be cheaper and more efficient for managing the grid network. The Office for Zero Emissions Vehicles has recommended that this be mandated.

As more people install home charging, there will be more pressure on local grid capacity. Smart charging seeks to alleviate pressure through efficient use of the grid network mitigating peaks and troughs in load where possible. Welsh Government will work with District Network Operators (DNO), National Grid and Ofgem to promote a regulatory framework. The framework will allow the electricity industry to cost effectively deliver the changes to enable networks to provide the power needed to deliver net zero across Wales.

Workplace charging

Adoption in Wales: There are approximately 320 workplace chargers installed in Wales[7].

Delivery in Wales: Employers are primarily responsible for installing charging at workplaces, although in rented commercial properties tenants may need to make arrangements with landlords. The Workplace ChargePoint Scheme run by the Office for Zero Emission Vehicles provides access to a grant of up to £350 per charge point, up to a maximum of 40 charge points at each location.

Direction of travel: There is an ambition in Wales for public sector to switch fleet vehicles from combustion to electric as soon as possible. To enable this to happen we might expect much more charging at workplaces to be installed. Many larger businesses are seeking to adopt charging as part of corporate commitments to net zero.

[6]3,500 domestic charge points in Wales received grants from the Electric Vehicle Homecharge scheme as of October 2020.
[7]Based on the number of charging sockets in Wales supported by the Workplace Charging scheme as of October 2020.

On-street charging

Adoption in Wales: There are at least 145 on-street chargers in Wales[8]

Delivery in Wales: Local authorities are leading the roll-out of on-street charging. The On-Street Residential ChargePoint Scheme from the Office for Zero Emission Vehicles helps local authorities to part fund the capital costs of installation (up to £7500 per charge point). The Welsh Government Local Transport Fund is also a source of funding accessible to local authorities.

Direction of travel: The Office for Zero Emissions Vehicles is considering what further incentives may be provided in support of on-street charging.

Destination charging

Adoption in Wales: There are approximately 300 destination chargers, at approximately 150 locations across Wales[9].

Delivery in Wales: Partnerships are increasingly being used to deliver electric vehicle charging. In this model, organisations that provide goods and services partner with a charge point operator to provide charging across a number of sites. Some supermarkets, for example have announced plans to do this.

Direction of travel: Partnerships between automotive organisations are emerging in order to consolidate services for both the physical infrastructure and soft infrastructure (such as payment and customer support). Alternative models of localised charging include Welsh community partnerships, such as TrydaNi. Community partnerships consolidate a number of community interest and community energy companies to provide charging infrastructure to areas in need. It is expected that business will continue to lead the uptake, but that in order to gain coverage that includes hard-to-reach communities, further investment will be required in community-based solutions.

On-route charging

Adoption in Wales: There are approximately 130 rapid chargers providing on-route charging at approximately 70 locations across Wales[10]. There are however significant 'gaps' in the network, particularly for journeys up and down the country north to south/ south to north. Whilst in England rapid charging is widely available at a distance of at least every 20 miles, the provision in Wales is much more sparsely distributed.

Delivery in Wales: Delivery has been led primarily by the market to date. Rapid charging typically carries a cost premium, which has resulted in investment from the automotive and energy sectors. Sites are most profitable at locations with highest traffic volumes and to date a market-led approach means that there has been little strategic planning to meet the needs of users. Transport for Wales has been tasked by the Welsh Government to lead a project to install rapid charging at a handful of strategic locations. The Transport for Wales project consists of £2 million funding and proposed concession agreements to facilitate the installation of rapid charging and key points in Wales' transport network. The project is a first step in seeking to address gaps in the network to increase user confidence in the availability of charging facilities on long distance journeys.

[8]145 charge points in Wales supported by the On-Street Residential Chargepoint Scheme funding as of October 2020.
[9]Refers to connection points identified in the National Chargepoint Registry (2020)
[10]Refers to connection points identified in the National Chargepoint Registry (2020)

Direction of travel: The UK government has signalled that it expects the industry to start to support roaming, which gives users the ability to pay on multiple charge points with a single card. The industry will be required to support the integration of driver services including payment platforms. This includes a common digital language or 'protocol'.

Hub charging

Adoption in Wales: To date, there are no charging hubs in Wales.

Delivery in Wales: Partnerships and collaboration across the public and private sector will be the most effective way to maximise the co-benefits of different charging types and charging facilities at one location. The model would be specific to the location and services provided, and would see hubs being integrated with renewable energy generation schemes and energy storage facilities. This approach could provide a means of providing charging hubs in rural areas together with other shared and sustainable transport modes. Such models could provide mechanisms to return benefits to communities.

Direction of travel: Charging hubs offer opportunity to support Welsh Government aspirations for integrated decarbonised travel as outlined in the Llwybr Newydd: a new Wales transport strategy.

Case Study: TrydaNi

TrydaNi-Chargeplace Wales Cyf. is dedicated to addressing the electric vehicle charging needs of residential communities, organisations and visitors across Wales. TrydaNi has a network of active member groups in Carmarthenshire, Gwynedd, Monmouthshire, Neath Port Talbot, Powys and Cardiff.

TrydaNi is a charge point operator – installing, operating and maintaining a growing number of fast chargers and providing bilingual customer services. As a community benefit society, it aims to retain charging revenues in the Welsh economy by facilitating community ownership of charge points. The society's profits can be reinvested to improve the TrydaNi network to help further decarbonise transport in Wales.

It seeks to support local businesses as installation and maintenance contractors and associated ventures such as car-sharing clubs.

5. Future Charging Needs of Wales

In order to predict the number and type of charging requirements for Wales, so that charging does not become a barrier to the adoption of electric vehicles, the strategy has estimated the scale of need for charging electric cars and vans over the next decade.

Wales' charging needs are considered in the context of the Llwybr Newydd: a new Wales transport strategy, and the shift towards decarbonised and integrated mobility. Meeting our predicted need for charging will contribute to successful outcomes and actions for the decarbonisation of transport as a whole, as further detailed in Section 7 and 8.

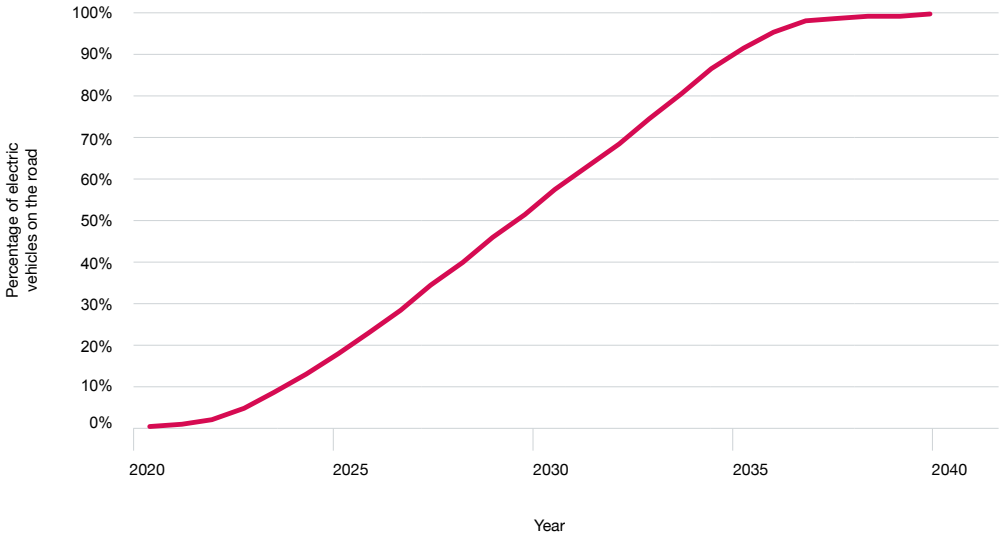
Charging needs to 2030

Demand for electric vehicle charging is a function of the number of electric vehicles on the road and charging behaviours. Charging behaviours have been modelled based on a number of assumptions about where and how people will use the charging network, which results in a credible range of outcomes.

Number of electric vehicles on the road

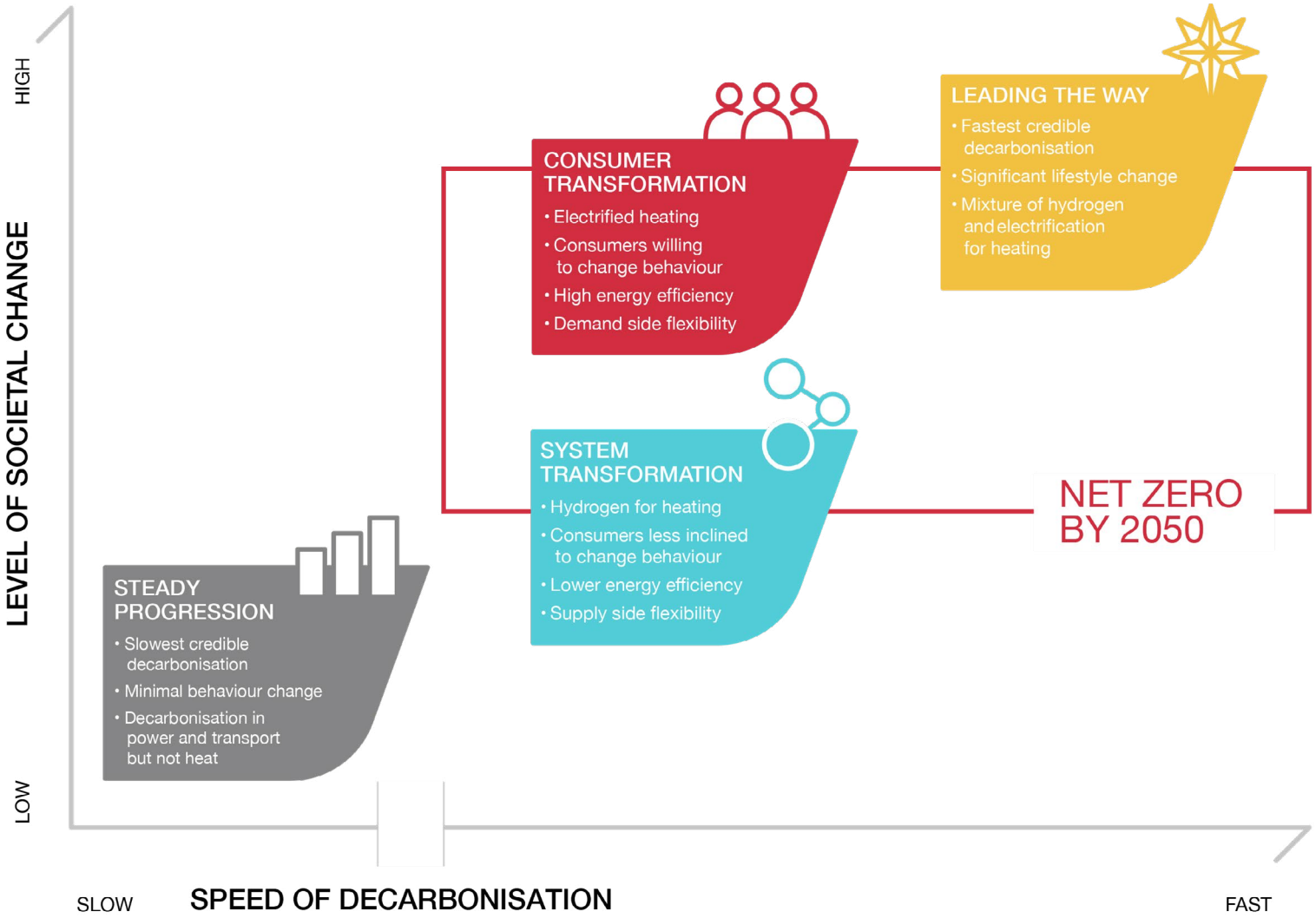
As drivers transition from internal combustion vehicles to electric cars and vans, it is predicted that the increase in number of electric vehicles on the road will follow an 's-curve' of accelerated uptake over time, as illustrated. The acceleration of uptake is dependent on charging provision, technology maturity, incentives, regulatory change and behavioural trends. This strategy is based on forecasts for the number of electric vehicles on the road produced by National Grid under their Future Energy Scenarios. The implications of the 2030 ban announced by UK Government in November 2020 have been added. The Leading the Way scenario has been adopted to model an approach in this strategy where the transition from combustion to electric vehicles happens most effectively, supported by adequate charging. As the Leading the Way scenario was based on a 2032 ban, adoption has been accelerated two years to account for the updated regulatory context. A further adjustment has been made to account for vehicle turnover in Wales compared to the UK average.

Electric vehicle uptake curve based on 'Leading the Way' Future Energy Scenario 2020 and adapted for the 2030 ban



National Grid Future Energy Scenario – Leading the Way

The National Grid Future Energy Scenarios 2020 establish four credible pathways for the future of energy over the next 30 years.

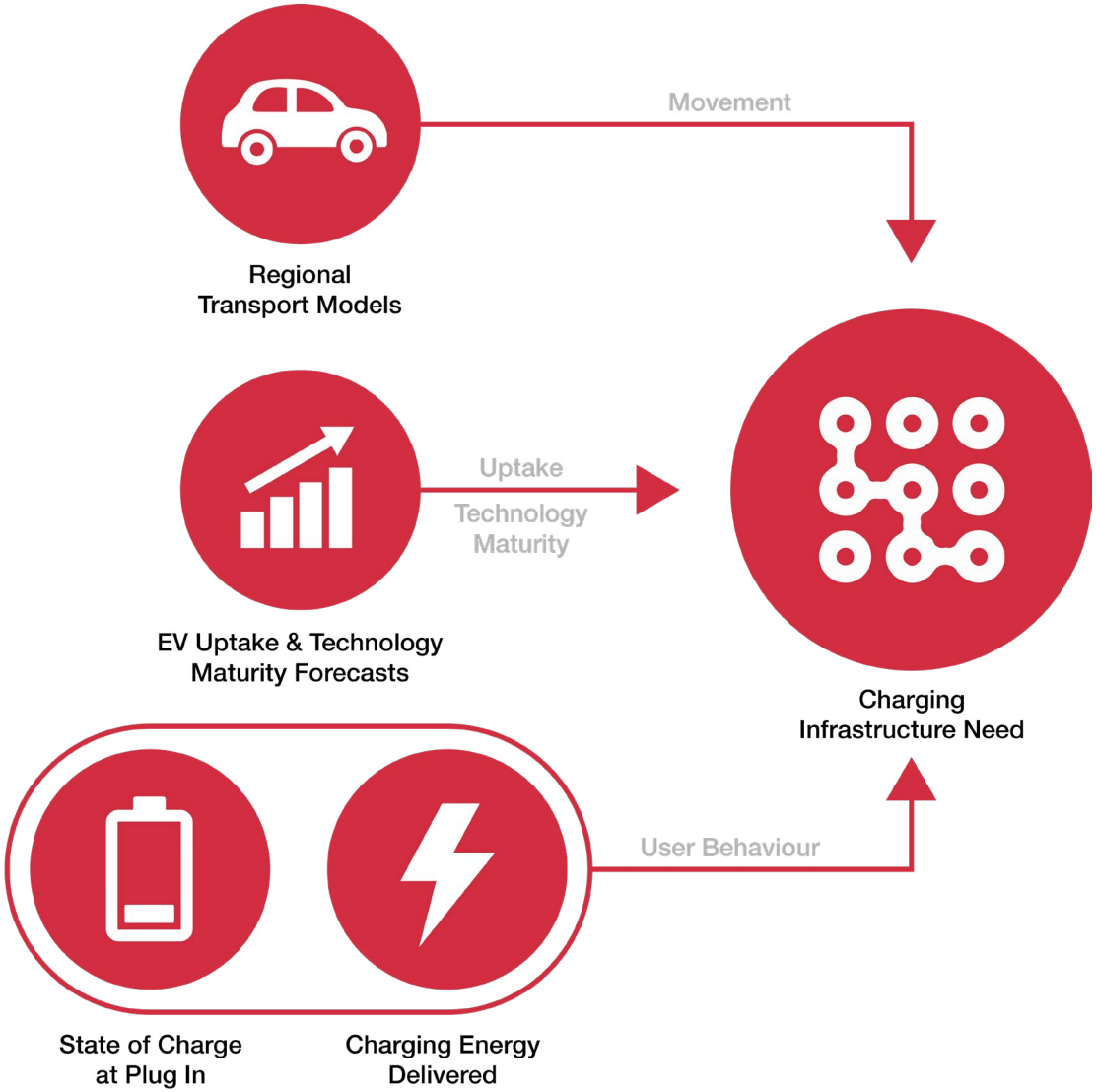


National Grid published a range of scenarios and their implications on energy demand and ability to meet net zero by 2050. The scenarios look at the whole energy system, including transport and the role of electric vehicles.

The electric vehicle charging market is rapidly changing, and therefore any estimate of the scale of future demand is based on a number of assumptions that will inevitably change over time. A high electric vehicle uptake scenario (Leading the Way) underpins the estimates that follow as it represents a scenario where charging infrastructure is not a barrier to electric vehicle uptake. From 2032 onwards, the scenario expects that the purchase of internal combustion cars and vans will cease. On 18th November 2020 the UK Government announced that the cessation will be brought forward to 2030. The implications of the 2030 ban announced by UK Government in November 2020 have been added, and estimated rate of adoption accelerated by two years since publication of the draft Electric Vehicle Charging Strategy for Wales.

Charging scenarios

Welsh transport data as well as socio-economic data and observations of electric vehicle charging behaviour have been used to provide bespoke, holistic, data driven scenarios for Wales. The method considers the ability to charge at home, the most popular locations for different types of journey and usage patterns for different charger types (Section 4 provides the context for this in Wales). It is based on industry standard traffic modelling and assumptions about the distances drivers of electric vehicles will be able to cover as battery technology improves.



Predicting the need for charging

As set out in Section 4, publicly available charging infrastructure can be broadly divided into fast and rapid/ultra-rapid charging speeds. The relative balance of these charging types will depend on a number of factors including user behaviour and preference, infrastructure costs and pricing. To account for the large number of variables, two bespoke scenarios have been developed: one weighted towards the widespread use of fast charging and the other towards the widespread use of rapid chargers. Each scenario includes all types of charging and the relative balance is based on a series of credible assumptions detailed below. Home charging is represented by slow charging on the basis that if users can charge at home they will – and therefore remains the same in both scenarios.

Fast charging dominant

This scenario is based on the widespread use of fast charging at destinations, on-street, hubs and/or workplaces (during stays of several hours or more). This scenario places less demand on the electrical grid network, and therefore can be more cost effective. The scenario relies less on vehicle and battery performance improvements, where cheaper or second-hand cars and vans are more accessible.

Rapid charging dominant

This scenario is based on the widespread use of rapid chargers where users quickly recharge batteries at charging hubs and other locations. This scenario assumes that car batteries continue to improve in size and battery performance and that the grid network will meet the additional electrical requirements.

Predicting charging needs

The number of chargers that could be needed, and the types of chargers needed has been predicted for each local authority across Wales, based on the following. As with any quantitative modelling, some simplifications and exclusions have been appropriately made.

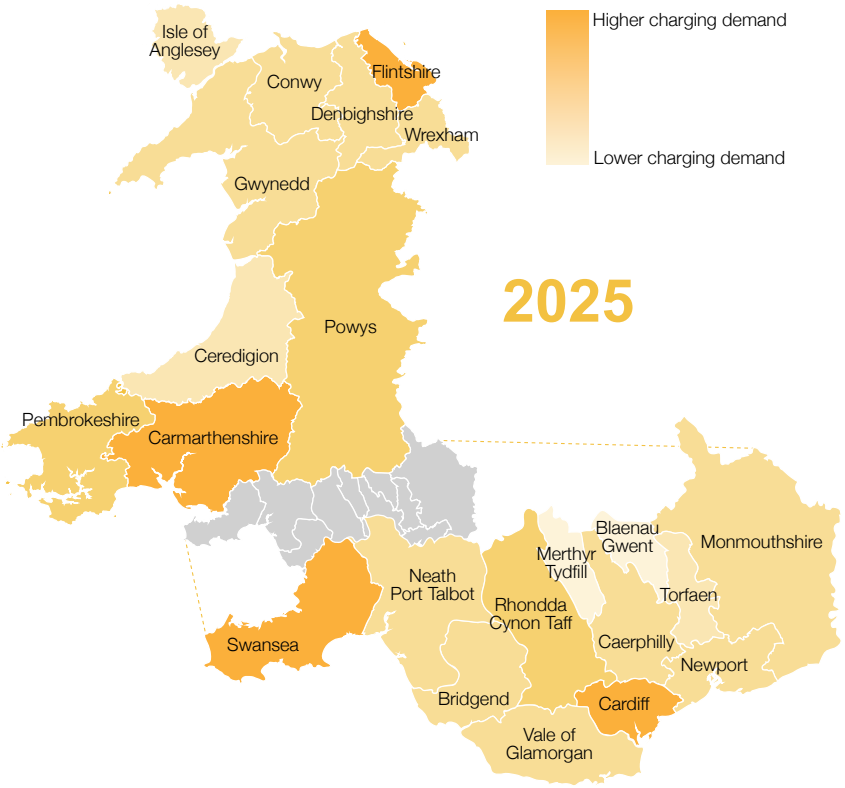
Inclusions:

- Rapid uptake in the adoption of fully electric private vehicles based on Future Energy Scenarios. Ban on the sale of diesel and petrol cars and van (and hybrids) as anticipated in the 'Leading the Way' scenario, and updated to account for the 2030 ban.
- An adjustment has been made to account for vehicle turnover in Wales compared to the UK average.
- Rapid uptake in electric taxis and private hire vehicles, based on the requirement in Wales for all taxis and private hire vehicles to be ultra-low emission by 2028.
- The bespoke higher intervention and lower intervention scenarios relating to how fast and rapid chargers are used and how much energy is delivered per charging event.
- Traffic forecasts where the total number of vehicles is increasing, balanced by a reduction in the miles travelled by each vehicle. The reduction in miles per vehicle is not as strong in Wales compared to England based on the rural travel requirements in many parts of Wales.
- Regional Transport Models, informing the quantity of vehicles moving from origin to destination on different types of journey, including trips originating from outside Wales.
- The ability of electric vehicle users to charge at home, informed by Census data on housing type.
- Seasonal variation in charging demand at high volume tourist locations.

Exclusions:

- Impact of COVID19 on traffic forecasts. Whilst an economic slowdown is likely to result in a contraction of the market for combustion vehicles, the International Energy Agency predicts that sale of electric cars and vans will be impacted to a lesser extent.
- The 2030 ban, given the proximity of this date may have implications on user behaviors that could not have been foreseen when the Future Energy Scenarios were developed. The original assumptions on which the Future Energy Scenarios were developed have not been reviewed or revised by National Grid. The predictions should be kept under review as part of on-going action planning as the market matures and implications of the 2030 ban are better understood.
- Unnecessary occupation of chargers (plugged in but not charging) and the impact on the required number of chargers. It is assumed that chargers are used efficiently.
- Charging needs of heavy goods vehicles, buses and micro-mobility.
- Wider measures for the decarbonisation of transport outlined in the Llwybr Newydd: a new Wales transport strategy.
- Impacts associated with the Well-Being of Future Generations Act, which will influence better access to more sustainable modes of travel over time.

Predicted requirement for chargers in Wales in 2025



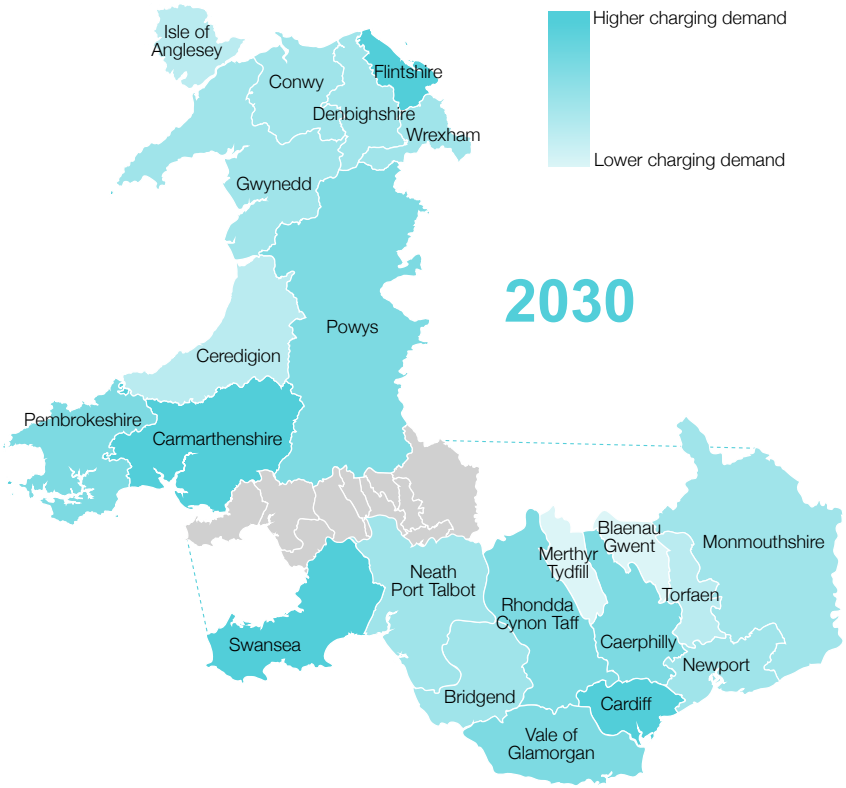
FAST CHARGING DOMINANT

Local Authority	Rapid	Fast	Slow	Total
Cardiff	150	4290	17020	21460
Carmarthenshire	75	1680	18060	19815
Swansea	80	2190	17030	19300
Flintshire	60	1190	16210	17460
Powys	60	1320	14430	15810
Rhondda, Cynon, Taff	75	1780	11780	13635
Pembrokeshire	45	1380	11630	13055
Wrexham	45	1210	11580	12835
Caerphilly	45	1200	11550	12795
Bridgend	55	1200	10680	11935
Conwy	60	1630	10130	11820
Neath Port Talbot	50	960	10470	11480
Vale of Glamorgan	40	1120	9910	11070
Monmouthshire	50	1210	9650	10910
Gwynedd	60	1730	9090	10880
Newport	80	1740	8830	10650
Denbighshire	35	940	9110	10085
Ceredigion	30	810	7420	8260
Isle of Anglesey	25	610	6810	7445
Torfaen	25	850	5080	5955
Blaenau Gwent	15	450	2860	3325
Merthyr Tydfil	15	520	2650	3185

RAPID CHARGING DOMINANT

Local Authority	Rapid	Fast	Slow	Total
Cardiff	285	2620	17020	19925
Carmarthenshire	130	1000	18060	19190
Swansea	150	1320	17030	18500
Flintshire	100	750	16210	17060
Powys	100	790	14430	15320
Rhondda, Cynon, Taff	135	1150	11780	13065
Pembrokeshire	90	770	11630	12490
Caerphilly	85	780	11550	12415
Wrexham	85	720	11580	12385
Bridgend	95	790	10680	11565
Neath Port Talbot	80	610	10470	11160
Conwy	110	870	10130	11110
Vale of Glamorgan	75	710	9910	10695
Monmouthshire	95	760	9650	10505
Gwynedd	115	940	9090	10145
Newport	135	1120	8830	10085
Denbighshire	65	550	9110	9725
Ceredigion	55	460	7420	7935
Isle of Anglesey	45	350	6810	7205
Torfaen	55	550	5080	5685
Blaenau Gwent	30	290	2860	3180
Merthyr Tydfil	35	330	2650	3015

Predicted requirement for chargers in Wales in 2030



FAST CHARGING DOMINANT

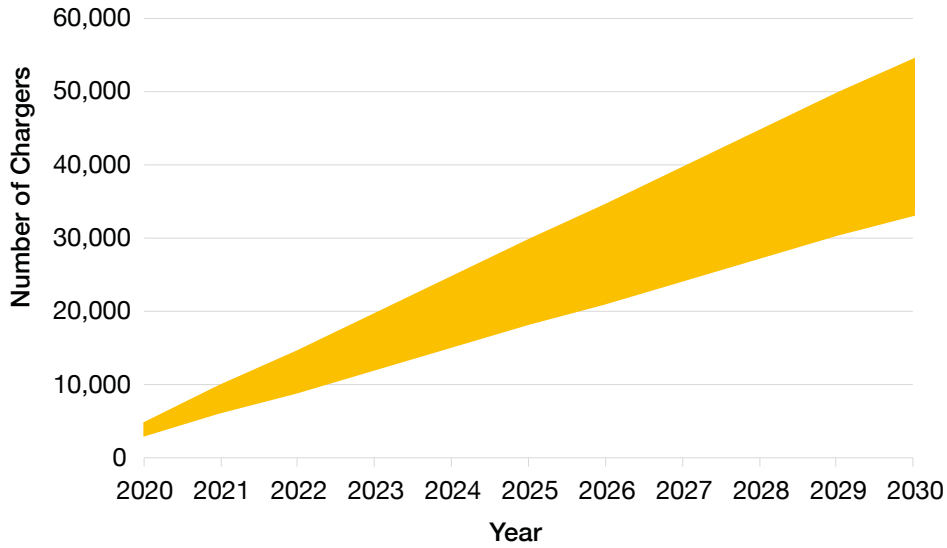
Local Authority	Rapid	Fast	Slow	Total
Cardiff	280	7860	52960	61100
Carmarthenshire	140	3080	56170	59390
Swansea	145	4020	52980	57145
Flintshire	110	2180	50440	52730
Powys	105	2410	44900	47415
Rhondda, Cynon, Taff	140	3260	36650	40050
Pembrokeshire	85	2520	36170	38775
Wrexham	85	2220	36020	38325
Caerphilly	85	2200	35940	38225
Bridgend	100	2200	33210	35510
Conwy	105	2980	31510	34595
Neath Port Talbot	90	1760	32560	34410
Vale of Glamorgan	75	2050	30830	32955
Monmouthshire	95	2220	30030	32345
Gwynedd	115	3170	28270	31555
Newport	145	3180	27470	30795
Denbighshire	65	1720	28340	30125
Ceredigion	55	1490	23070	24615
Isle of Anglesey	45	1120	21190	22355
Torfaen	50	1560	15820	17430
Blaenau Gwent	30	830	8890	9750
Merthyr Tydfil	30	960	8250	9240

RAPID CHARGING DOMINANT

Local Authority	Rapid	Fast	Slow	Total
Cardiff	525	4800	52960	58285
Carmarthenshire	240	1830	56170	58240
Swansea	275	2430	52980	55685
Flintshire	180	1380	50440	52000
Powys	190	1440	44900	46530
Rhondda, Cynon, Taff	245	2100	36650	38995
Pembrokeshire	165	1420	36170	37755
Caerphilly	150	1430	35940	37520
Wrexham	155	1330	36020	37505
Bridgend	170	1440	33210	34820
Neath Port Talbot	145	1120	32560	33825
Conwy	200	1590	31510	33300
Vale of Glamorgan	140	1300	30830	32270
Monmouthshire	170	1400	30030	31600
Gwynedd	210	1720	28270	30200
Newport	250	2060	27470	29780
Denbighshire	120	1010	28340	29470
Ceredigion	105	840	23070	24015
Isle of Anglesey	80	630	21190	21900
Torfaen	100	1010	15820	16930
Blaenau Gwent	60	540	8890	9490
Merthyr Tydfil	60	610	8250	8920

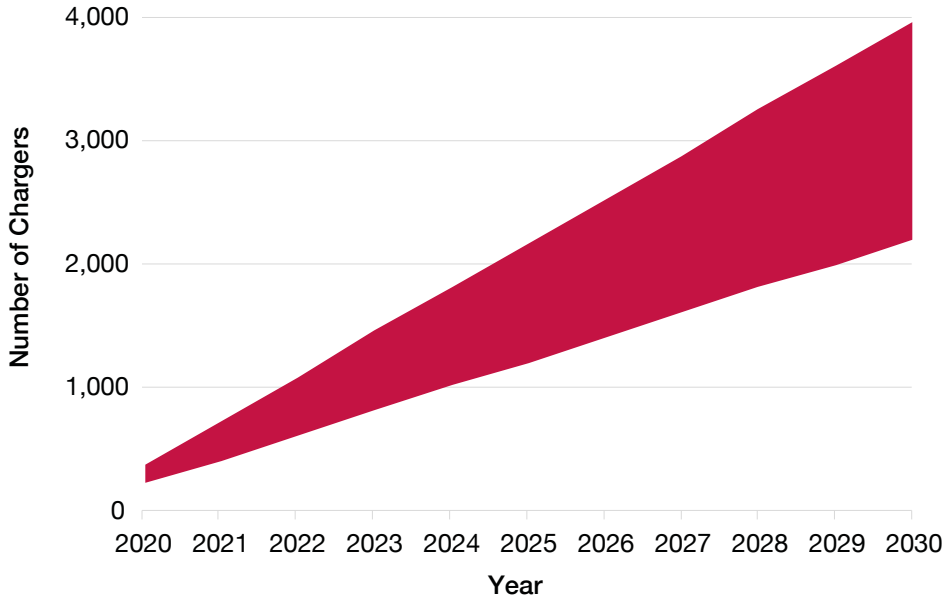
The predicted need for charging cars and vans across Wales provides an indication of the scale of need. Whilst the total predicted need for charging is highest in urban areas such as Cardiff and Swansea, some more rural local authority areas such as Carmarthenshire and Powys will also require comparatively high numbers of charging units to be deployed. Some localised factors have contributed to the predicted charging need. These include the proportion of homes in Wales which currently have access to off-street parking, and travel patterns based on current trends, projected for anticipated growth. It is important to note from an equality and sustainability perspective that the above figures do not represent an idealised outcome for electric charging in Wales, particularly at the lower end of the table where the numbers may be influenced by existing socio-economic trends. Further, the implications of modal shift have not yet been sufficiently quantified across the sector to factor into these predictions, but will be kept under review as part of on-going action planning.

Substantial planning, resources and investment will be required across the public and private sector to deliver the charging needs identified. In every local authority area, careful planning will be required to meet localised need. The above can be considered a guide for the scale of localised action planning set out in Section 8 to be viewed in the context of integrated pathways to net zero.



Predicted need for fast chargers in Wales until 2030

The number of fast chargers needed across Wales increases to 30,000 to 55,000 by 2030. We currently have less than 1% of this total installed. Successful action will rely on public and private sector collaboration. Mechanisms to facilitate this collaborative delivery model will be set out in the action plan.



Predicted need for rapid chargers in Wales until 2030

The number of rapid chargers needed across Wales increases to up to 4,000 over the next ten years. We currently have less than 3% of this total installed. Successful action will rely on public and private sector collaboration. Mechanisms to facilitate this collaborative delivery model will be set out in the action plan.

User requirements

Charge point locations must meet standards for safety, accessibility and security, particularly for the most vulnerable users and those with accessibility needs.

Section 8 sets out recommendations that build upon the UK Government vision for charge points, providing an integrated, accessible and collaborative approach to electric vehicle charging throughout the UK. Welsh Government seek to expand on these standards to ensure electric vehicle user needs are central to the development of electric vehicle charging infrastructure in Wales.

In this emerging market, there is very little published research on the needs and experiences of consumers.

Engagement in understanding of prospective and existing Welsh electric vehicle consumer experiences has been used to inform the development of this strategy.

The key issues identified were dependent on personal circumstances and often influenced by early purchasing decisions. Those that had the most positive experience of charging in Wales were those that purchased a package of personal e-mobility services when purchasing an electric vehicle. This meant that the availability and cost of charging was part of the service that they expected from the outset. This approach currently carries a significant cost premium and is unlikely to be accessible for many. Those with the most negative experiences were more likely to purchase an electric car as a 'product', and charging was not discussed with the dealership at the point of sale.

The following themes were noticeable across the majority of users:

- General lack of charging locations, or lack of availability if other users are either charging or blocking the space.
- Unreliability of charging infrastructure, often out of service.
- Incompatibility of charging cables.
- A disproportionate amount of time and energy spent by users planning for their journey and charging needs.

- Issues at payment including different payment platforms, membership schemes, lack of internet connection, and poor customer support services.
- Users feeling vulnerable where trying to access payment and support services, for example when alone or in a poorly lit environment.

Consultation on the draft Electric Vehicle Charging Strategy for Wales added further context and highlighted the need for:

- The ability to pay using contactless payment methods.
- Standard and clear pricing.
- Appetite for new homes to have charging installed.
- Charge points in safe, secure locations with amenities.
- Charging that is accessible and user friendly for all.
- The confidence to travel around Wales with sufficient and reliable charge points available.

Consultation further highlighted that much of the charging infrastructure installed to date has not been designed with the needs of disabled users in mind. Specific issues include heavy cables and difficult connectors presenting problems for those with mobility and dexterity impairments. High kerbs or no dropped kerbs around the charge point can create a dangerous built environment for disabled drivers. Several participants also highlighted that inclusive design must be prioritised. One in five people in the UK have a disability[11] and there are indications that electric vehicle uptake amongst disabled customers has been limited to date.[12] Further details regarding feedback from consultation can be found in the accompanying Consultation Report.

Unlocking the grid

The transport and energy sectors will be required to work together to deliver electric vehicle charging in the context of decarbonisation. The availability of capacity on the grid network is a constraint in a number of areas of Wales. The grid is designed for current rather than future demand. Considering how to manage and fund the transformation of the grid to meet a future with much more electric transport and heat is a major undertaking. Changes in the way the energy system is regulated and funded will be required. As indicated earlier, Welsh Government will work with the DNO, National Grid and Ofgem to promote a regulatory framework. The framework will allow the industry to effectively deliver the changes to enable networks to provide the power needed to deliver net zero across Wales. The needs of users and the grid network must be carefully balanced.

There are two electricity DNOs in Wales - Scottish Power Energy Networks and Western Power Distribution. DNOs manage the supply of power to end users, drawing this power from the National Grid's transmission system. Both Welsh DNOs are taking steps to address the needs of electric vehicle charging in relation to their networks. Scottish Power Energy Networks has launched Project Charge to provide insight about where charging may be required within their network area, and the likely impact on the network. Western Power Distribution has launched a strategy setting out solutions and a roadmap for meeting various consumer needs.

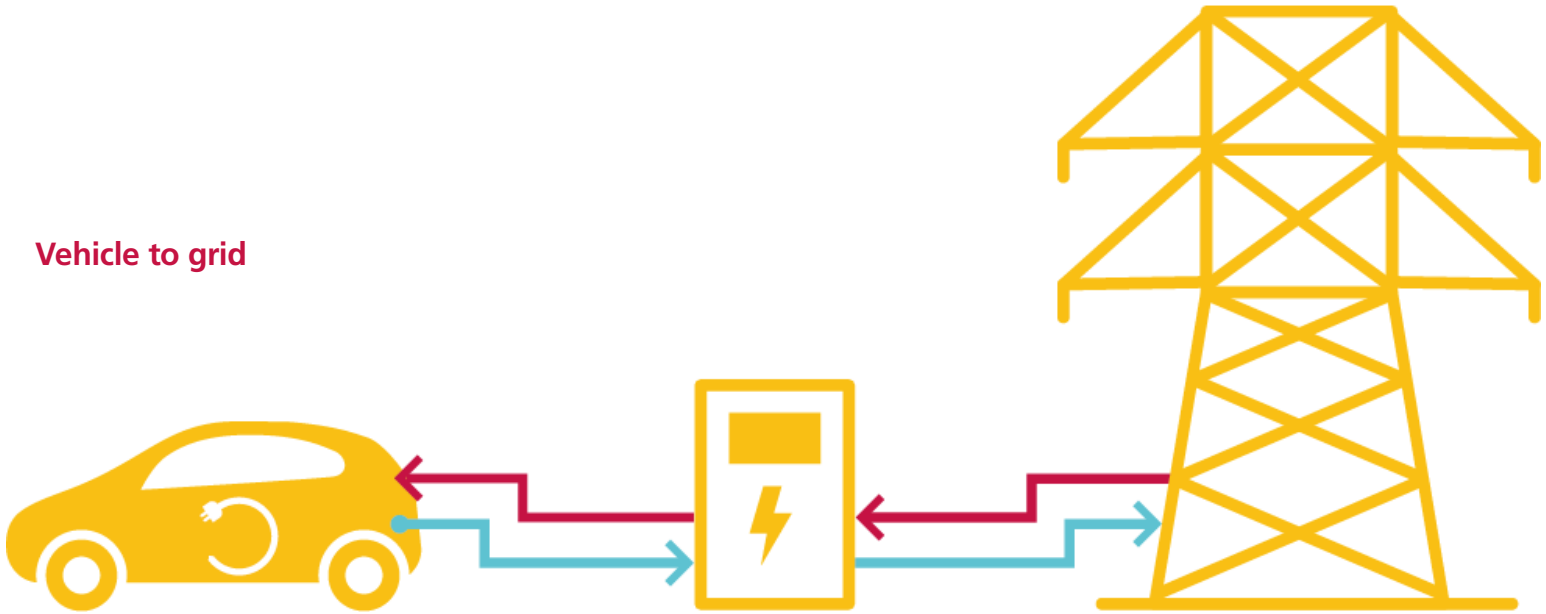
Future investment in the grid network is governed by submissions from the network operators to Ofgem, the regulator. Investment may be targeted at flexible and 'smart' network management solutions and include wider network reinforcement. Network reinforcement can take a variety of forms including new substations and connecting cables overhead or underground.

[11]https://www.gov.uk/government/statistics/family-resources-survey-financial-year-201819
[12]https://www.motability.org.uk/about/news/electric-vehicle-charge-points-lack-accessibility

National Grid's Future Energy Scenarios forecast that electric vehicle charging will have a key role in facilitating the transition to a decarbonised energy system, using vehicle batteries as storage ('vehicle to grid' technology) to help balance overall supply and demand. The principle applies at different scales – for example within a residential setting for a single car and household system up to large scale where numerous vehicles plugged into the grid can be aggregated within and across a number of car parks managed as a large battery.

This requires the markets to evolve to incentivise investment in grid flexibility, with vehicle to grid technology, and 'smarter' charging at home playing an essential role. As we go forward, the development of Regional Energy Plans in Wales will assist in Local Authority led planning for public charging infrastructure. Alignment will be facilitated through the action plan.

Vehicle to grid



6. Drivers of Change

This section outlines technological drivers that could influence the electric vehicle charging infrastructure of the future. These aspects are out of scope for the current strategy (the immediate need to charge cars and vans) but provide context as to how charging may change in the future, beyond 2030. The following will be kept under review as part of ongoing action planning so that further specific plans can be developed at the appropriate time.

Multi-modal decarbonised mobility

Llwybr Newydd: a new Wales transport strategy provides the context for systems-wide, multi-modal shifts in our approach to transport. The shift from combustion to electric cars and vans is an important part of this, to be viewed in the context of broader system wide changes. In future, the charging delivered by this strategy will support the electrification of further modes of transport. There will be additional work required to identify the additional and bespoke needs of other transport modes. Actions that meet the immediate charging needs for cars and vans will begin enabling the shift to decarbonised multi-modal journeys when mobility is viewed as an integrated service. Charging hubs in particular can create value from co-locating charging facilities for different modes of transport. The Wales transport strategy provides the framework for integration across the sector, where further co-benefits can be realised.

Improvements in battery technology

Research, development and manufacturing in battery technology is continuing at pace. The cost of batteries has fallen by almost a factor of ten over the last decade, and as the mass market expands will continue to fall further. As battery performance improves, the widespread availability of cars with ranges in excess of 400 miles could be expected within the next ten years. Electric buses will become increasingly commercialised over the next decade as battery technology improves.

Electric bus operation in Wales is increasing as in the rest of the UK with 21 areas in the UK having incorporated electric buses either entirely or partly into their services.[13]

[13]Low Carbon Vehicle Partnership

Bus Charging in Sheffield, South Yorkshire Passenger Transport Executive

The South Yorkshire Passenger Transport Executive (SYPTE) toolkit demonstrates the viability of piloting buses in Sheffield and Doncaster. It identifies which bus routes could accommodate electric buses and has been based on data considering operational patterns, topography and charging strategies. The toolkit enables selection of buses, specific areas and comparison against various options, and measures potential air quality improvements.

The outcomes have led to two major operators within the area expressing interest in trialling electric buses.

Micro-mobility

Micro-mobility refers to a range of small, lightweight, often electrically powered vehicles used to transport people or goods. The term covers vehicles that are either owned or hired by users, such as e-bikes, shared bicycles, electric scooters or small vehicles used for 'last mile' deliveries.

The micro-mobility industry is rapidly expanding and changing, with an increasing array of devices available for sale in the UK. Micro-mobility has the potential to enable improved accessibility to services and employment and to make transport more inclusive. For example, electric bikes can increase the range of journeys and make cycling viable to a wider audience.

Charging infrastructure requirements for micro-mobility are much less demanding than for cars. Given their size, privately owned micro-mobility vehicles can typically be charged easily from home or the workplace. In addition, many micro-mobility vehicles have removable batteries which increase the range of locations the battery can be charged. There are many different charging models for shared micro-mobility schemes. Shared electric bikes and e-scooters can be charged at docking stations, or by the operator at warehouse facilities.

Whilst the infrastructure demands for micro-mobility charging is not significant now, further growth of these mobility solutions is expected. Modal shift away from private vehicles may warrant consideration of dedicated charging facilities. These facilities could include improved provisions at workplaces or shared charging facilities at mobility hubs.

Autonomous vehicles

Whilst the future of, and timescales for, autonomous vehicles is uncertain, they could also help us move away from individual car ownership in the years to come. Manufacturers could gain significantly more by operating them over their lifetime as a fleet, as opposed to selling vehicles to the individual consumer. Autonomous vehicles will have multiple expensive sensors requiring regular maintenance (alignment, cleaning, software updates, etc.) making the fleet ownership model a more likely scenario than personal ownership. Charging of vehicles under a shared ownership in future could require different charging infrastructure than the current distributed model associated with personal car ownership.

Hydrogen

Hydrogen is being increasingly recognised as a means by which energy can be effectively stored, moved and used as part of a decarbonised, integrated energy and transport system. Hydrogen and electric mobility are complementary in supporting the transition to net zero. Hydrogen production, transport and use can take many forms. Creating hydrogen involves using electrolysers to convert energy from renewable energy generation or small modular reactors, or via gas reformation and carbon sequestration. Wales is currently investing in demonstrator projects such as the Anglesey Energy Island and Milford Haven Energy Kingdom, to test the system-wide integration of hydrogen. Large scale commercialisation of hydrogen as the primary source of energy for vehicle transport (including the necessary supply chain) is not yet advanced enough to model the implications for electric vehicle charging. Welsh Government has commissioned a baseline study and hydrogen pathway for Wales that will feed through into regional energy planning and the low carbon plan 2021-2025, to map out hydrogen's role in the transition to net zero. Hydrogen may start to take the lead as the most effective way to decarbonise heavy duty vehicles after 2030. Hydrogen may, in future, offer a viable alternative to electrification of bus travel, particularly for longer distance routes. Although electric buses are expected to represent 60% of the global municipal bus market by 2030 and 80% by 2040[14]

[14]Salim Morsy, Long Term Electric Vehicle Outlook, BNEF, 2018

7. Summary and Key Conclusions

The strategy has set out the rapid need to decarbonise our transport systems in order to help tackle the climate emergency. Planning for decarbonisation across the UK and Wales has identified that more needs to be done to support the transition to electric vehicles. Welsh Government recognise that this strategy represents the first step for Wales to take targeted action to deliver a vision for electric vehicle charging that meets Wales' unique requirements.

User engagement has identified issues including lack of charging locations, availability, reliability and compatibility issues, which has undermined confidence in charging. Responses to consultation also highlighted inclusivity and accessibility concerns.

Modelling has predicted that a rapid increase in charging across Wales is needed. This is based on Welsh transport data, charging behaviours, and the electric vehicle uptake required to decarbonise.

As the market develops there will be technological changes such as battery technology, autonomous vehicles and the role of hydrogen that will influence the long-term shape of integrated and decarbonised travel. Yet it is clear that we must take action to provide better charging to support the electrification of cars and vans now.

A Vision for Charging in Wales

By 2025, all users of electric cars and vans in Wales are confident that they can access electric vehicle charging infrastructure when and where they need it.

Policy, existing and future charging needs, together with user engagement and public consultation has identified the following key conclusions to be taken forward to action planning:

- The need for a substantial increase in the number of slow, fast and rapid/ultra-rapid chargers available in Wales. The total need for fast charging, alongside home charging will be a key area of focus to promote equality of access to charging.
- The need for better quality charging, to improve the user experience for electric cars and vans, including better accessibility and inclusivity.
- Sustainable, integrated and cross-sectoral planning will facilitate the decarbonisation of energy and transport, and create co-benefits. Welsh Government can create favourable conditions for economic and employment opportunities to be captured in Wales.
- The need for better networks will be kept under review by Welsh Government in the context of other measures that are needed to deliver net zero across Wales (for example better broadband connectivity and the electrification of home heating).

8. Action Planning

The analysis contained within this strategy identifies the following key outcomes for future charging in Wales. These will be developed into an action plan and will be monitored and updated annually to reflect progress.

i. Total charging provision

Slow charging

We know that charging at home, using slow charging where feasible, offers consumers the most convenient and cost-effective charging option. The following outcomes will drive better provision:

- All new homes with an associated car parking space will be ready to have electric vehicle charging installed.
- Homeowners and occupiers with off-street parking in Wales will be supported to charge at home.
- Home charging will be 'smart enabled' for value and efficiency.

The above will be delivered through support and incentives, alongside changes to building codes and regulation. This will be supported by education and awareness raising, and cross industry collaboration to ensure coherence and consistency.

Fast charging

This strategy has shown that we will need to have between 30,000 and 55,000 fast chargers available for use by 2030, and that we currently have less than 1% of this installed.

We plan to introduce measures that will provide high quality fast charging to meet this need, through partnerships and collaboration:[15]

- New non-residential buildings with more than 10 parking spaces will have a charge point provided by 2025.
- Business provides charging facilities at places of work for the use of staff and visitors.
- Destinations provide charging facilities for the use of customers which may act as a means of improving customer experience.
- On-street charging and in car parks will be encouraged in villages, towns and cities throughout Wales; with a view to installing on average one charge point for one in every three electric vehicles that cannot charge at home.
- Charging hubs, including out of town park and ride, and supporting active travel will feature in enabling decarbonised multi-modal journeys across Wales.[16]

[15]The outcomes below would be appropriate to fast charging in most circumstances, although in some cases be slow or rapid/ultra-rapid to meet location specific needs.
[16]Taxis and private hire vehicles will require access to rapid charging within operational hours, but would also benefit from other types of charging and outcomes highlighted elsewhere.

Welsh Government/Transport for Wales will work with local authorities to determine the best ways to support and enable them to deliver the above for on-street charging and publicly owned parking. Potential measures to be outlined in the action plan include providing a framework for public sector procurement, use of public land, sharing best practice and support to building the capabilities required. Welsh Government will provide support to ensure that business sectors, for example taxis and private hire can take advantage of improved charging infrastructure that supports their needs. There will be a framework for enhanced collaboration across stakeholders with a diverse range of requirements.

Rapid/ultra-rapid charging

It is predicted that up to 4,000 rapid/ultra-rapid chargers will be needed in Wales over the next ten years, and that we have less than 3% of this installed.

A comprehensive network of rapid charging infrastructure across Wales provide essential charging to visitors, tourists and everyone wishing to undertake long distance travel. The following actions have been identified:

- By 2025, a rapid charging network will be provided across the strategic trunk road network of Wales, providing charging at a distance of approximately 20 miles.
- In urban centres taxis and private hire vehicles will have extensive access to charging facilities by 2025[17].

Transport for Wales will take the lead in delivering rapid charging on the strategic trunk road network. The Welsh Government's Ultra Low Emission Vehicle Transformation Fund will be used to support the transition for taxis and private hire. Delivery measures will be outlined within the action plan.

[17]Charging hubs will feature fast charging, but may also offer slow and rapid/ultra-rapid charging options depending on user type.

ii. Quality outcomes

Consumer engagement identified issues including lack of charging locations, availability, reliability and compatibility, leaving users unconfident in their ability to charge.

Expanding on the UK Government's vision, we expect that in order to support user confidence, charging must provide a user experience of sufficient quality.

The following outcomes are desirable:

- Payment for electric vehicle charging will be possible by contactless debit or credit card and an associated app based system.
- Consistent information about charging on main roads (the strategic trunk road network) will be openly available, helping drivers choose when, where and how they charge.
- Charging infrastructure will be reliable with a high level of availability. Users will be able to charge when they require.
- Drivers will be supported by 24/7 customer care to handle any technical issues. This will be available in Welsh and English.
- Users will be able to park and pay for charging in a safe, well-lit environment.
- Charging facilities will be available to everyone, including those with accessibility needs.
- Payment platforms will be simple, accessible and easy to use with clear pricing information available.
- Digital and data platforms will be open-access, creating new opportunities for Welsh businesses and supporting e-mobility services.

The creation of a national standard for charging facilities that reflects the above requirements could be a reliable mechanism to drive an improvement in industry standards. Further delivery measures will be outlined within the action plan.

iii. Sustainable outcomes

The strategy has highlighted the importance of integrated cross sectoral planning for a sustainable energy and transport system in the context of decarbonisation. To achieve this the following outcomes have been identified:

- Ensuring that where possible the charging network makes full use of renewable energy generation.
- We will work with the electricity industry within the current regulatory framework to plan for the decarbonised grid network (including heat, renewable electricity generation and transport). The needs of charging will be met in a way that is efficient for network management incorporating smart technology. The opportunities and benefits associated with vehicle to grid will be captured.
- Electrical installations in new build and refurbished residential and non-residential buildings will be required to plan for electric vehicle charging facilities. Consideration will be given to allowing sufficient additional spare capacity and cableways to meet anticipated need for electric vehicle charging.
- Sufficient market signals are in place to promote sustainable charging behaviours, incentivising off-peak charging to support decarbonisation of the electricity grid.
- Where possible, electric vehicle charging is installed at locations that complement other modes of sustainable transport, including the use of public transport, walking, and cycling.
- The full life cycle of charging infrastructure (including supply chain, decommissioning and recycling/reuse of equipment) adopts circular economy principles. Supply chains work towards becoming transparent, carbon accounted and sustainability accredited. Synergies are captured with emerging sustainable and circular supply chains for electric vehicle battery technology.
- Electric vehicle charging in installed in a way that seeks to supports wider environment, health and well-being objectives. Support includes facilitating local air quality improvements, active travel and wider strategies for decarbonisation.
- Support for electric vehicle charging at home is considered as part of any wider support programmes for sustainable, energy efficient and healthy home environments.

Welsh Government will enable the above through integrated planning for energy and transport (including the Low Carbon Delivery Plan, and on-going Regional Energy Planning), and improved regulatory standards (including amendments to building codes regulations). The creation of a national quality standard for charging that reflects both quality and sustainable outcomes could be a reliable mechanism to drive an improvement in industry standards.

iv. Localised benefit

Ensuring the infrastructure is in the right place for users will boost confidence and create wider economic opportunity for businesses and people in Wales. The following outcomes will assist in maximising the co-benefits that can be achieved:

- The location of charging infrastructure supports local business opportunities and services for local benefit. There are opportunities for local businesses to expand their services into charging (where appropriate) or servicing the needs of users whilst charging.
- Charging is provided at multi-modal transport nodes, for example at train stations.
- Local skills and training are provided in Wales to support servicing, maintenance and digital jobs in the sector.
- A local supply chain is developed for manufacturing equipment. Wales' industrial clusters and regional development plans identify opportunities to support battery manufacturing and other supply chain needs.
- Community-led and not-for-profit initiatives are supported. Collaboration with renewable energy providers delivers local benefit and contributes to decarbonisation. This offers the opportunity to utilise energy generated in Wales, retaining local value in line with the Welsh Government Local Ownership of Energy Generation policy statement.
- Partnerships and collaboration between organisations, across the public and private sector and communities in Wales. These partnerships and collaborations seek to deliver solutions that are effective, create co-benefits and are resilient to climate change.

Welsh Government can create favourable conditions for economic and employment opportunities to be captured in Wales. The creation of a national procurement framework could support the above outcomes through encouraging solutions that deliver the most advantageous outcomes for Wales.

Delivering successful outcomes

Successful action will rely on public and private sector collaboration, alongside strong delivery mechanisms being in place. Sufficient resources, capabilities and skills will be required throughout the sector to underpin delivery, and to maximise the benefits and opportunities for Wales. It is a key aspiration to develop a framework that captures as much economic activity as possible within the Welsh and local economy. Activity is driven through from the provision, operation and maintenance of these facilities.

Delivering the aims of this strategy will require significant levels of investment. There are clear commercial opportunities in electric vehicle charging. However, we recognise that targeted investment by government in areas where provision is not up to standard will be necessary. Spending will be kept under review as part of action planning. Welsh Government is developing an action plan to track and manage delivery, which will be monitored and reviewed annually. Welsh Government will, with Transport for Wales and based on the feedback from consultation, develop the governance and delivery arrangements. Embedding the Five Ways of Working of the Well-being of Future Generations Act will be a key part of delivery.