Are we nearly there yet?

Better metrics to measure the delivery of public EV infrastructure

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Acknowledgements

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All data is accurate as of 1st August 2024 unless stated otherwise. All data sources are not currently available for Northern Ireland, so analysis is for Great Britain (GB) only.

Foreword

"Are we nearly there yet?" It's a phrase that those of us with children dread and everyone else jokes about.

But we've all thought it at one time or other on a long journey. Thankfully, answering your impatient passengers is usually easy.

But how do we answer this question when it comes to one of the greatest journeys of our time – electrification of transport?

Today, there are three customer concerns that make that journey look challenging: price, vehicle range and accessibility of charge points.

Vauxhall is playing its part to solve two of these. Our new Frontera SUV will be the first car on sale in the UK that offers list price parity between its BEV & ICE versions, whilst New Grandland offers all-electric range of up to 435 miles!

However, as a manufacturer we can't fix the infrastructure problem alone. We need a coordinated cross industry approach to assist the 40% of UK households without access to off street parking. But first we all need to know where we are headed.
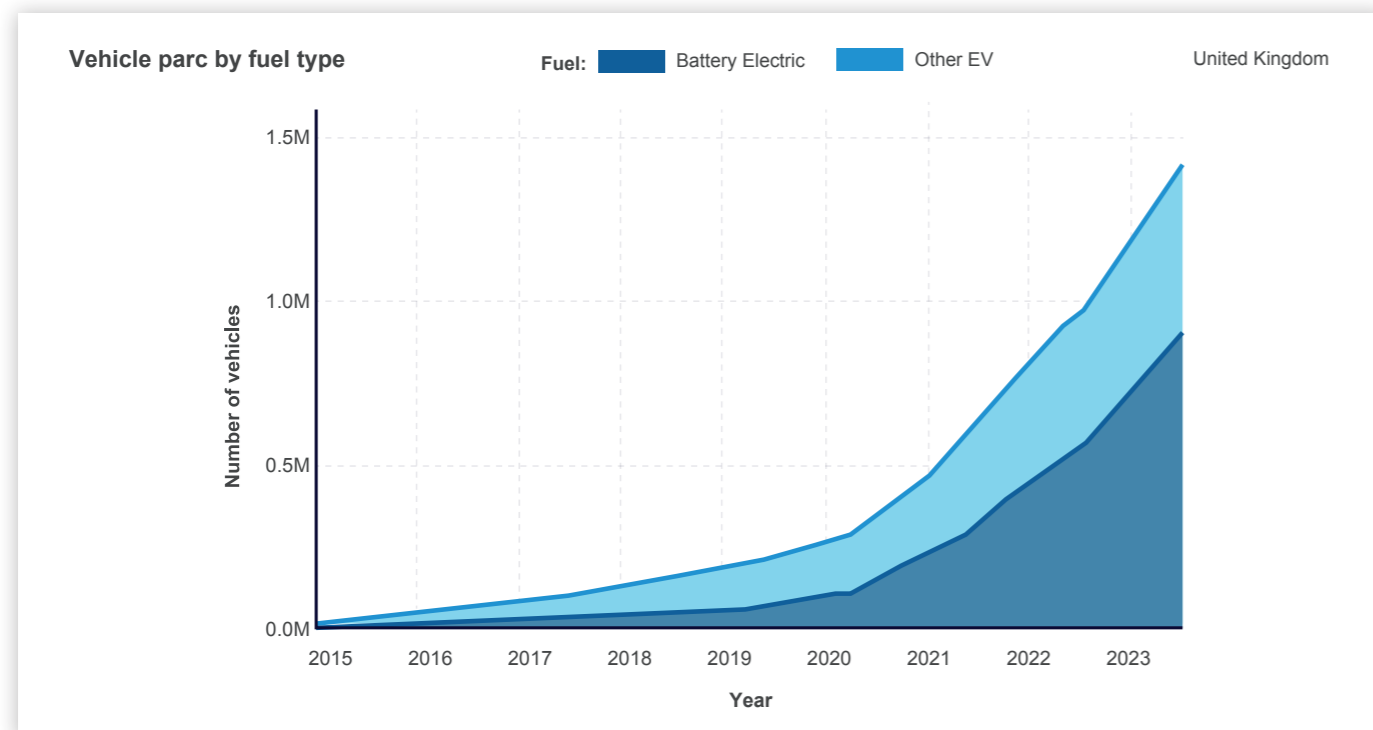
How many charge points do we need? Where should they be? What power output is required?

Without answers to these questions, we won't be clear on how close we are to the mass adoption of electric vehicles. Without this clarity none of us can tell if "we are nearly there".

We are delighted to support this effort with Cenex to give everyone a clear picture on where we are and what more needs to be done.

James Taylor, Vauxhall Managing Director

Introduction

Vehicle parc by fuel type — United Kingdom
Fuel: Battery Electric / Other EV

UK milestone: 60k EV charge points
April 2024
zapmap INSIGHTS

Source: Charge devices on Zapmap database, April 2024.

The good

Cleaner cars and vans are coming onto the roads in increasing numbers (left-hand chart). These are predominantly Battery Electric Vehicles (BEVs) and Plug-in Hybrid Vehicles (PHEVs), collectively referred-to as Electric Vehicles (EVs). Whilst EVs do still create emissions during manufacture and in the electricity they use, they do not cause the same issues as their petrol or diesel equivalents.

Furthermore, the rate of deployment of public EV Infrastructure (EVI) to support these electric cars and vans is accelerating. It took just two years to get from 30k to 60k public chargers, the same length of time as it took to get from 10k to 20k (right-hand chart).
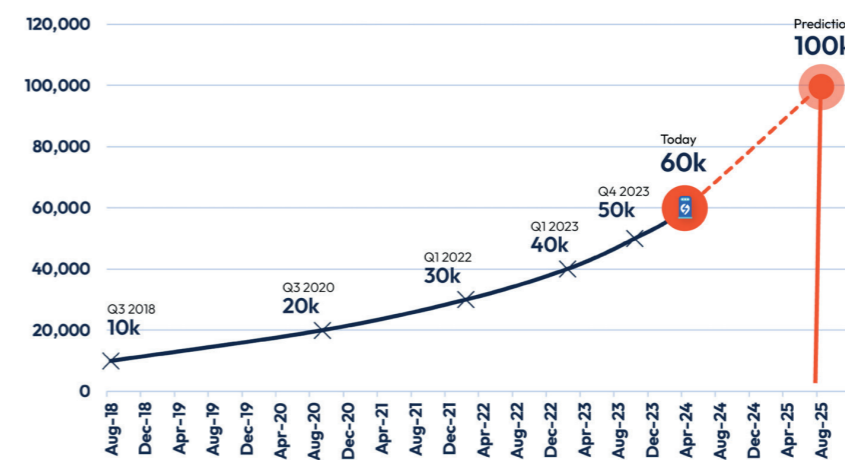
The bad

Although these stats can be tracked nationally, it is not currently possible to know whether this provision is enough for residents and businesses around the country.

Taking Charge, the UK's EVI Strategy, sets an expectation that a minimum of 300,000 public chargepoints may be needed, but this value is a blunt instrument against which to measure progress.

Surface transport stubbornly remains the worst sector from an environmental perspective (CCC, 2024). Cars and vans contribute around one-quarter of these carbon dioxide (CO_2) emissions, as well as reducing air quality and making our streets noisier.

Enabling anyone to make the switch to an EV will depend on not just a significant expansion of infrastructure but installing the right chargepoints in the right locations.

The ugly

Despite progress being made, 'charging anxiety' is still a real worry for drivers. Consumer and business surveys repeatedly highlight that the accessibility, reliability and affordability of public EVI is not enough to give confidence for the switch to electric.

This perception is compounded by the metrics we currently use.

Official UK statistics report the number of chargepoints, chargepoints per 100,000 population, or EVs per chargepoint in an attempt to measure progress.

The public and the media appear to easily understand them – surely more chargers per person or fewer EVs per chargepoint must represent progress?!

But the simplicity of these metrics is their downfall and these statistics are rarely quoted with context. For instance:

▸ Are we actually measuring what matters to drivers?

▸ Is it clear what 'good' is for each measure?

▸ Can we compare these figures across the country?

The solution?

This report comes from a belief that we can do better. And that we should do better, given that the next five years will see the largest influx of public and private investment into EVI to-date.

Getting the right chargepoint of the right power into the right place at the right price will be essential to deliver cleaner and greener transport in the most sustainable, effective and efficient manner.

To be able to measure 'are we nearly there yet?' along the way, we need to measure more precisely, measure what actually matters and publish this data.

Current metrics

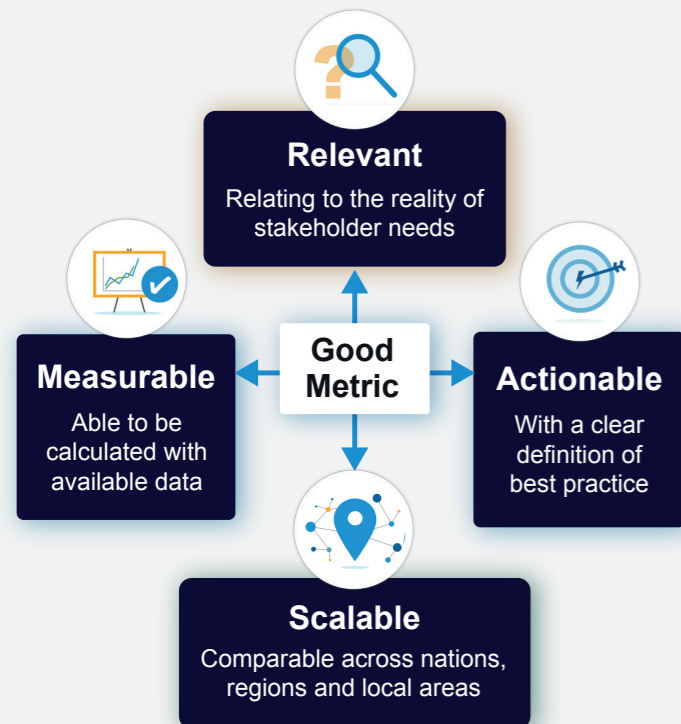## Assessing current ways of measuring progress

Cenex conducted research to understand:

1 What are the strengths and weaknesses of existing metrics in use at the moment?

2 What are the potential strengths and weaknesses of the metrics we might use to measure progress?

Desk-based research was completed into international and national best practice, 86 responses were received to an online survey and 9 interviews were conducted with experts to explore themes and ideas in detail.

Four dimensions of a good metric

91% of respondents agreed or strongly agreed that a good metric should be:

Relevant
Relating to the reality of stakeholder needs

Measurable
Able to be calculated with available data

Good Metric

Actionable
With a clear definition of best practice

Scalable
Comparable across nations, regions and local areas

No respondents disagreed or strongly disagreed with this.

✓ Strengths

A good range of current metrics were recognised by respondents, who noted that they are simple and easy to measure.

These can be tracked over time and some level of comparison can be made between different countries, regions or areas.

Furthermore, the current metrics which were rated the most favourably were those which show overall progress towards electrification of cars and vans: % vehicle sales that are EV, total number of EVs on the road and % of vehicle parc which is EV.

Weaknesses

However, the most recognised current metrics were not viewed favourably against the definition of a good metric. Three examples are given:

Metric	Relevant	Actionable	Scalable	Measurable
Number of chargepoints	No	No	No	Yes
Number of chargepoints per 100,000 people	No	No	Partially	Yes
Number of EVs per public chargepoint	No	No	Yes	Yes

The **number of chargepoints** implies that more chargepoints are better. This is not always the case, so this is not actionable nor scalable. The required energy to charge EVs in an area can be met in different ways: a few high-powered chargepoints or a lot of lower-powered chargepoints.

The ratio of chargepoints per 100,000 people improves on this because it takes into account a level of demand due to population size. That said, it assumes that vehicle ownership is equal across the country, which means it is only partially scalable. In reality, an area with greater EV adoption will need more charging capacity than an area with lower uptake.

The ratio of EVs per chargepoint is perhaps the most widely reported metric. This improves on the previous two because it now accounts for vehicle ownership, making it **scalable**. However, this still assumes that reliance on public charging is uniform across the country. Furthermore, there is no agreed ratio against which to benchmark performance, so this is still **not actionable**.

On top of this, the respondents felt that these three metrics were **not relevant** because they do not capture the needs of users. There is not information on where the chargepoints are in relation to those that want to charge.

Conclusion

None of the most recognised metrics in-use today meet the definition of a good metric. Each has key weaknesses which undermine their effectiveness.
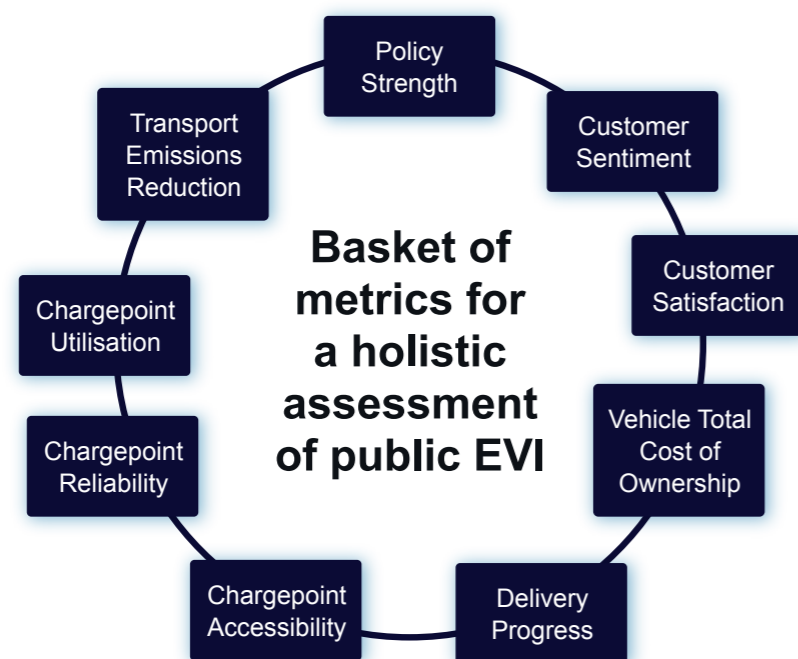
Designing better metrics

As well as critiquing current ways of measuring progress, survey respondents and interviewees were invited to make suggestions about how best to overcome these weaknesses. From these, two key themes emerged.

1 Different audiences want different metrics

The survey demonstrated that whether a particular metric is viewed as actionable or not, depends on who wants to use it and how.

For example, many chargepoint operators placed a high emphasis on utilisation as a measure of EVI progress. Public sector officials tended to prefer simple targets such as number of chargepoints. User groups prioritised metrics which tackled perceived barriers to EV adoption, such as the difference in cost of charging between those with off-street parking and those without.
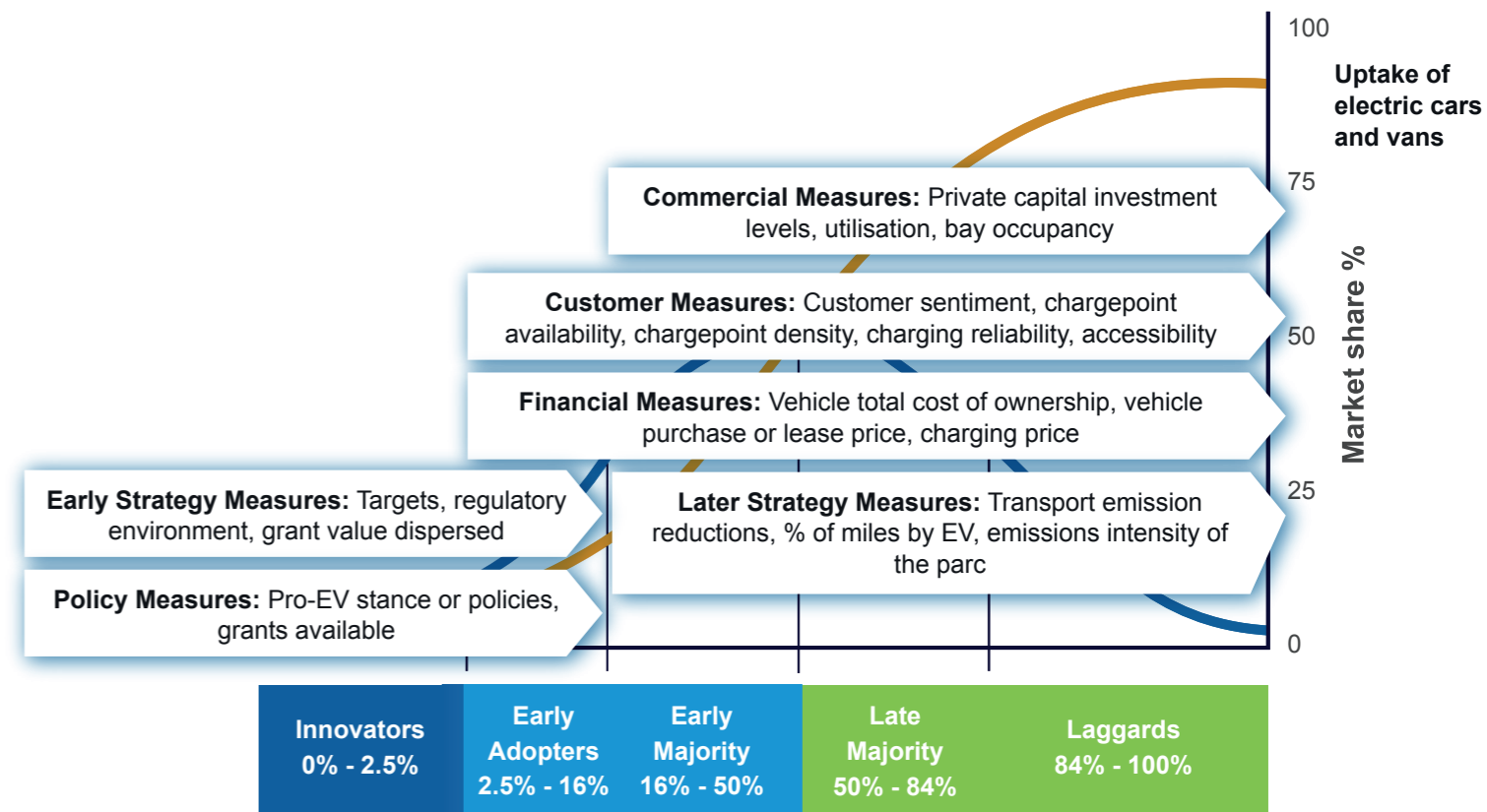
This means that the ideal metric will vary according to who you ask. This points towards a need for a basket of metrics.

Basket of metrics for a holistic assessment of public EVI

- Policy Strength
- Customer Sentiment
- Customer Satisfaction
- Vehicle Total Cost of Ownership
- Delivery Progress
- Chargepoint Accessibility
- Chargepoint Reliability
- Chargepoint Utilisation
- Transport Emissions Reduction

2 What is "best" varies over time

Many interviewees commented that the relative strengths or weaknesses of different metrics depended on what stage the market is in. Different metrics are useful at different points in time, especially as different organisations or market forces come into play. Cenex distilled these views into the chart (top-right).

Note that currently just under 4% of all cars and vans on the roads today are EVs, meaning that the market is currently in the Early Adopter phase.

Uptake of electric cars and vans

Market share %

100
75
50
25
0

- **Commercial Measures:** Private capital investment levels, utilisation, bay occupancy
- **Customer Measures:** Customer sentiment, chargepoint availability, chargepoint density, charging reliability, accessibility
- **Financial Measures:** Vehicle total cost of ownership, vehicle purchase or lease price, charging price
- **Early Strategy Measures:** Targets, regulatory environment, grant value dispersed
- **Later Strategy Measures:** Transport emission reductions, % of miles by EV, emissions intensity of the parc
- **Policy Measures:** Pro-EV stance or policies, grants available

Innovators 0% - 2.5%	Early Adopters 2.5% - 16%	Early Majority 16% - 50%	Late Majority 50% - 84%	Laggards 84% - 100%

At the beginning of the transition, the role of Government policy is crucial to establish a facilitating environment where the pace of EVI deployment can be supported and accelerated for Innovators. This is the stage that many non-Western countries are currently at.

Towards the middle of the transition, Early Adopters start to switch to EVs and other factors come into play to measure progress and health in the sustainable transport transition. The leading role of the Government fades away, and financial, customer and ultimately commercial metrics are likely to be more helpful to encourage the Early Majority to make the switch.

Finally, the long-term goals are to achieve an overall reduction of emissions in transport, which can be demonstrated through % of miles driven by EV or the emissions intensity of the vehicle parc. This is the end-goal of all the activity and a highly relevant, actionable, scalable and measurable metric.

Conclusion

Effective tracking of progress will require measurement of a range of metrics, which takes into account different stakeholders' interests.

Some of these are not yet measurable, but improvements can be made on how to track Delivery Progress, compared to currently used metrics.

Better metrics by use case

Relevance is key

When it comes to measuring delivery progress, almost all respondents agreed that a single metric is not sufficient and cannot encompass the needs of different audiences over time. For example, capturing the distinctive needs of private users vs fleets, those charging overnight vs en-route, and users vs providers cannot be done effectively within one number or ratio.

The research also highlighted that decision-makers need a suite of relevant metrics.

Charging use cases determine what is relevant

Vehicles are broadly divided by their use case: private travel and commercial or business-related travel. Furthermore, they are segmented by body type (motorcycle, car, van etc).

These vehicles may have diverse charging needs, but driver travel habits such as where they park and for how long will shape these requirements.

Since drivers might have the opportunity to charge EVs whenever they park, the locations of where vehicles dwell can be used to create use cases: near-home (sometimes called residential), commercial, destination and journey.

Near home		Public	Residential dwellings with on street or off-street parking (car parks).
		Private	Residential dwellings with off-street parking (driveways).
		Communal	Residential dwellings with parking accessed by a limited group of users.
Commercial		Back to Base	Depots where fleets return to park at the end of each shift.
		Multiple Depot	Depots where the vehicle may park at multiple locations during its operations.
Destination		Long Stay	Locations where vehicles park for > 4 hours and might be charged at the same time (including tourist destinations, airports, workplace, park & ride, and train stations).
		Short Stay	Locations where vehicles park for < 4 hours and might be charged at the same time (including workplace, shopping / leisure centres).
Journey		Short Stay	Bespoke charging locations where multiple vehicles park for < 4 hours.

Near home charging

The near home use case covers any vehicles at or near residential dwellings. This includes private cars as well as commercial vehicles which are taken home and car sharing schemes.

In the long-run, it is expected that almost all homes with off-street parking will install private residential chargers, so the main focus for public near home charging is on those who do not have this provision.

Commercial charging

This covers scenarios where commercial vehicles use back-to-base or multi-depot models to complete their business. This charging provision is the responsibility of individual businesses to ensure their fleets have sufficient access to charging, so is not considered further in this report.

Destination charging

Destinations are defined as locations which people visit for business or leisure reasons and a charging service is also available. This includes workplaces. They are typically sub-categorised as long-stay (4+ hours) or short-stay (under 4 hours).

Journey charging

This use case is the closest equivalent to today's petrol stations as they are dedicated locations for high-powered EV charging. They are often equipped with renewable energy solutions and have other facilities such as shopping amenities or food courts.

Conclusion

Our key finding on how to improve the metrics we use to track the progress of EVI delivery is that they must be more relevant. This means measuring progress by charging use case: Near Home, Destination and Journey.

Near home charging

For the near home use case, the concepts of supply, demand and distribution can be used to create a better metric:
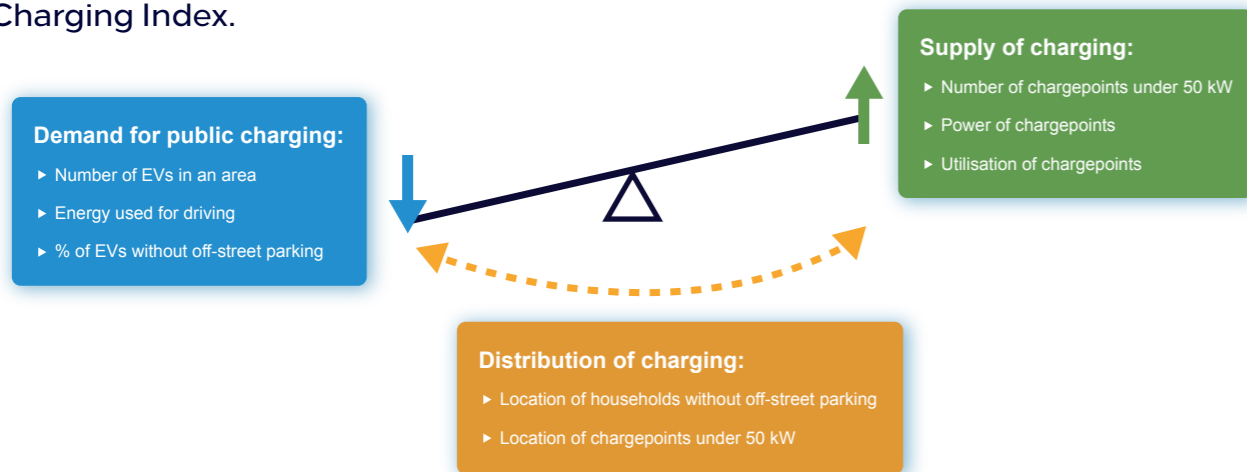
Supply: the maximum available charging capacity from all chargepoints across a given area at the current time.

Demand: the energy needed for public charging for the EVs in that area at a particular point in time.

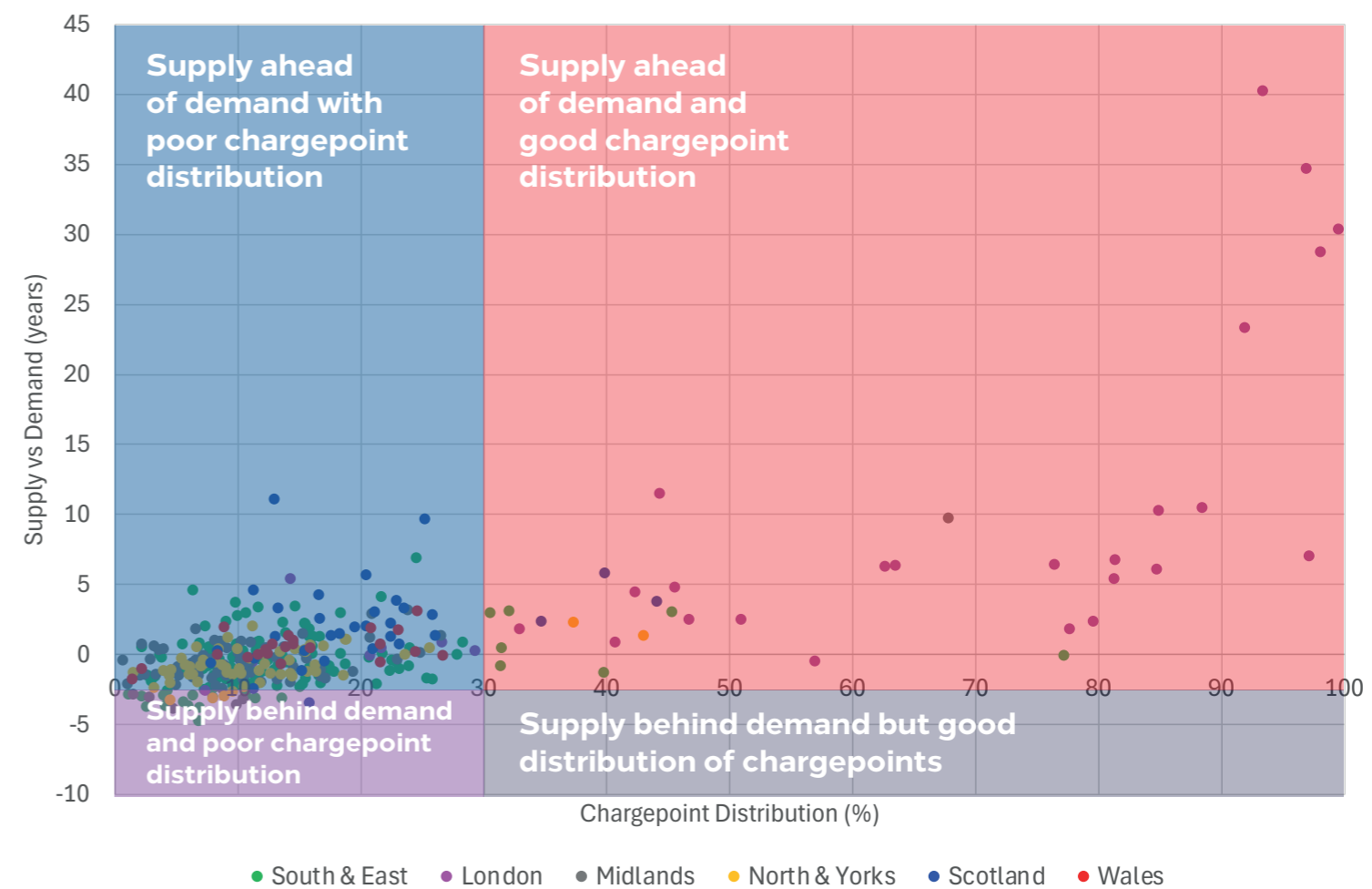**Distribution:** the number of households that cannot access private charging which are within a 4-minute walk of chargepoints.

The act of balancing supply and demand in relation to distribution gives what we call the Near Home Charging Index.

Demand for public charging:
- Number of EVs in an area
- Energy used for driving
- % of EVs without off-street parking

Supply of charging:
- Number of chargepoints under 50 kW
- Power of chargepoints
- Utilisation of chargepoints

Distribution of charging:
- Location of households without off-street parking
- Location of chargepoints under 50 kW

Using a unique combination of Cenex and partner datasets within the NEVIS service, the Near Home Charging Index was calculated for every household in Great Britain (GB), and summarised by local authority area (top-right).

This fulfils the four definitions of a good metric:

- **Relevant** – users want sufficient charging capacity, close to where they live.
- **Actionable** – a balance of supply vs demand is better; more households served by chargepoints is better.
- **Scalable** – this can be compared locally, regionally and/or nationally.
- **Measurable** – all the data is available to calculate this.

Chart axes: Supply vs Demand (years) vs Chargepoint Distribution (%)

Quadrant labels:
- Supply ahead of demand with poor chargepoint distribution
- Supply ahead of demand and good chargepoint distribution
- Supply behind demand and poor chargepoint distribution
- Supply behind demand but good distribution of chargepoints

Legend: South & East, London, Midlands, North & Yorks, Scotland, Wales

Conclusion

- Supply of near home chargepoints is ahead of demand by approximately two months across Great Britain.
- On average, 19% of all GB households who need it are close to a public chargepoint.
- Scotland and Wales are ahead of England in supply vs demand; England is ahead of Scotland and Wales in EVI distribution.
- Supply in 25% of LAs is over one year ahead of demand.
- Supply approximately meets demand in 41% of local authority areas.
- Camden has nearly the capacity that they need for 2040 and 93% of households within a four-minute walk of a public chargepoint.
- Na h-Eileanan Siar, Coventry and Blaenau Gwent are the leading Scottish, English and Welsh LAs outside the capital.
- Outside London, households reliant on public charging in Brighton and Hove have the best chance of being near a chargepoint.

View the interactive maps and dashboards at **nevis.cenex.co.uk/metrics**
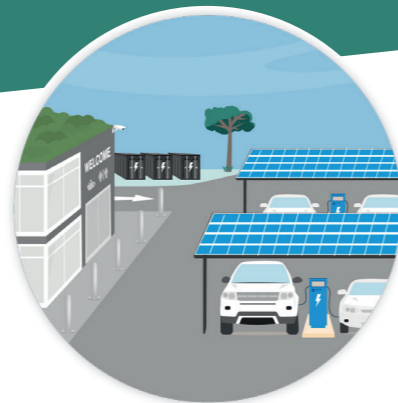
Journey charging

Although near home charging is likely to be the foundation for delivering the electrification of cars and vans, journey charging is a much more visible and tangible demonstration of that progress.

This is partly because it is closer to the traditional petrol station model but also because it addresses the 'charging anxiety' experienced by those who want to journey further than the range of their vehicle.
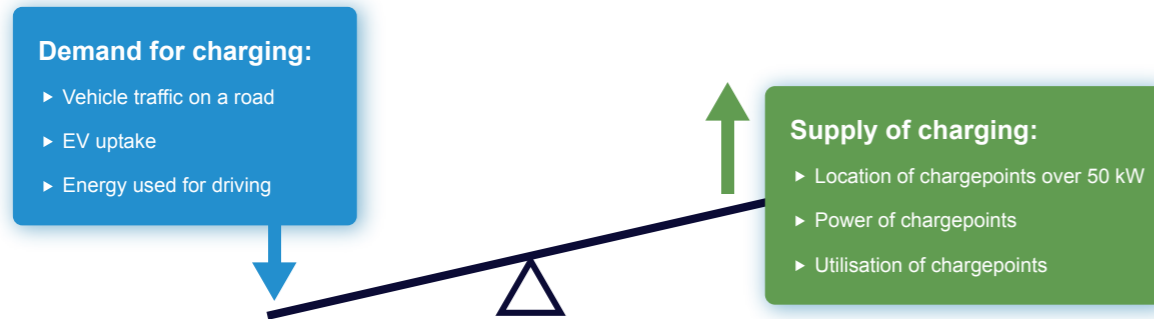
Better metrics for these users must establish if the right chargepoints of the right power are in the right place to meet the needs of drivers needing a convenient and quick charge to continue their journey. The concepts of supply and demand can again be used to form a better metric:

Supply: the maximum available charging capacity from all chargepoints on or near a particular road at the current time.

Demand: the energy needed for public charging for the EVs on that road at a particular point in time.

The act of balancing supply and demand for each road gives what we call the Journey Charging Index.

Demand for charging:
▸ Vehicle traffic on a road
▸ EV uptake
▸ Energy used for driving

Supply of charging:
▸ Location of chargepoints over 50 kW
▸ Power of chargepoints
▸ Utilisation of chargepoints

Using a combination of Cenex and public datasets within the NEVIS service, the Journey Charging Index was calculated for every road in the country.

This fulfils the four definitions of a good metric:

▸ **Relevant** – users want charging to be available when they need it.

▸ **Actionable** – a balance of supply vs demand is better.

▸ **Scalable** – this can be compared between roads locally, regionally and/or nationally.

▸ **Measurable** – all the data is available to calculate this.

Conclusion

▸ Overall, the supply of journey charging for GB's major roads is ahead of demand.

▸ Around two-thirds of the miles driven on major roads have access to sufficient charging.

▸ The major road with best provision is M2 (Gillingham-Canterbury).

▸ The motorway with the worst provision is M27 (Southampton bypass).

▸ Supply is nearly four years ahead of demand in England, three years ahead in Wales and just under three years ahead in Scotland.
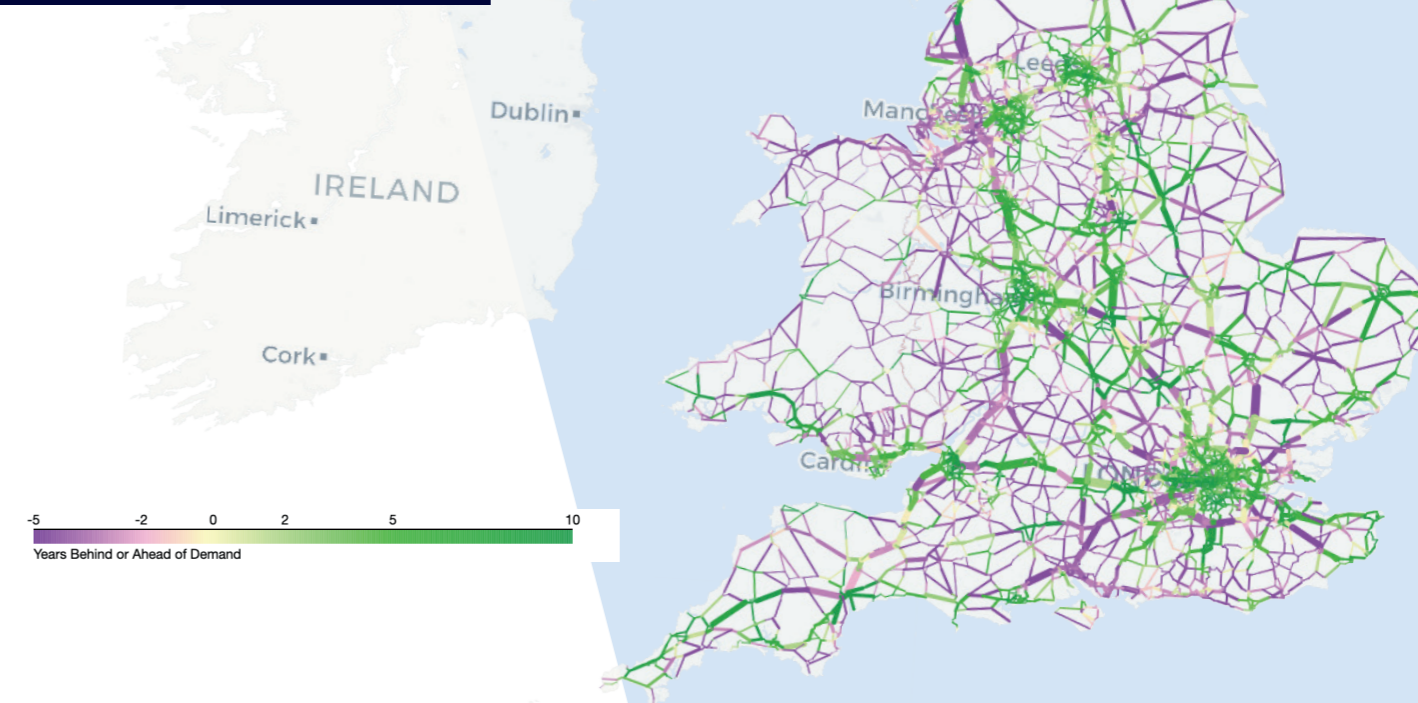
View the interactive maps and dashboards at **nevis.cenex.co.uk/metrics**

-5   -2   0   2   5   10
Years Behind or Ahead of Demand

Destination charging

Whilst vehicles visit near home or journey charging sites specifically for the purpose of charging, destination charging is more defined by the destination than the charging – chargepoints are often just an incidental add-on or an opportunity to bring additional business to the site.

Variables specific to the site and its visitors can be used to create a better metric:

Uptake: Proportion of all visiting vehicles which are EVs at a particular point in time.

Users: The proportion of short-stay (<4 hours) and long-stay (>4 hours) visitors.

Usage: How highly utilised the parking bays are over a given period.

Need: The likelihood that visitors will want to charge.

By combining these for any given site, a Destination Charging Ratio can be produced to guide individual destinations about the ideal number and power of chargepoints which are needed. This is calculated as follows:

Uptake x Users x Usage x Need

This mostly fulfils the definition of a good metric:

- ▶ **Relevant** – users want charging available whenever they park.

- ▶ **Actionable** – the ratio gives a good guide to what is needed and when.

- ▶ **Scalable** – this can be compared between car parks in similar or different localities.

- ▶ **Measurable** – the data is not available nationally, but usually available to site owners and operator to calculate this.

Note that the eventual number of charging sockets should be rounded-up, once the car park size has been taken into account.

The destination charging ratio was calculated for a range of generic settings:

Setting	Uptake	Users	Usage	Need	Ratio
Workplace	5% EV uptake	10% short-stay 90% long-stay	0.75 visitors per bay	Low – 20%	0.075 rapids per 100 bays 0.675 standards per 100 bays
Airport	4% EV uptake	100% long-stay	1 visitor per bay	High – 80%	3.2 standards per 100 bays
Tourist Destination	4% EV uptake	75% short-stay 25% long-stay	2 visitors per bay	High – 80%	4.8 rapids per 100 bays 1.6 standards per 100 bays
Rural town car park	2% EV uptake	50% short-stay 50% long-stay	0.5 visitors per bay	Medium – 50%	0.25 rapids per 100 bays 0.25 standards per 100 bays

Conclusions

This metric gives a good rule of thumb which can be easily applied.

Note that other factors may need to be considered at individual sites, including:

- ▶ Increasing EV uptake over time;

- ▶ Proportion of local households reliant on public charging;

- ▶ Opening hours;

- ▶ Seasonality;

- ▶ Charging provision in disabled bays; and/or

- ▶ Commercial viability.

See more examples and get more detailed results for individual sites at **nevis.cenex.co.uk/metrics**

Conclusions

Reducing the significant environmental impact of cars and vans is a core part of helping our country to reach its net zero destination.

Getting the right chargepoint of the right power into the right place at the right price will be essential to deliver cleaner and greener transport in the most sustainable, effective and efficient manner.

Our research concludes that current metrics to measure progress on the EVI deployment are blunt instruments which do not fulfil all four definitions of a good metric:

- ▶ **Relevant to the reality of stakeholder needs.**
- ▶ **Actionable for decision-makers.**
- ▶ **Scalable across areas.**
- ▶ **Measurable with available data.**

Our key finding on how to improve the metrics we use to track the progress of EVI delivery is that they must be more relevant. This means measuring progress by charging use case: Near Home, Destination and Journey.

Using a unique combination of Cenex and partner datasets, we have created and analysed three new and improved EVI metrics for Great Britain:

1. Near home charging index: supply is a few months ahead of demand nationally, but distribution suffers from significant regional disparities.

2. Journey charging index: supply is three years ahead of demand, but gaps remain on some major roads.

3. Destination charging ratio: Car park operators can apply a simple equation to determine what EVI they need for their situation.

Interactive maps and dashboards to explore these metrics and results for your area can be found at: **nevis.cenex.co.uk/metrics**
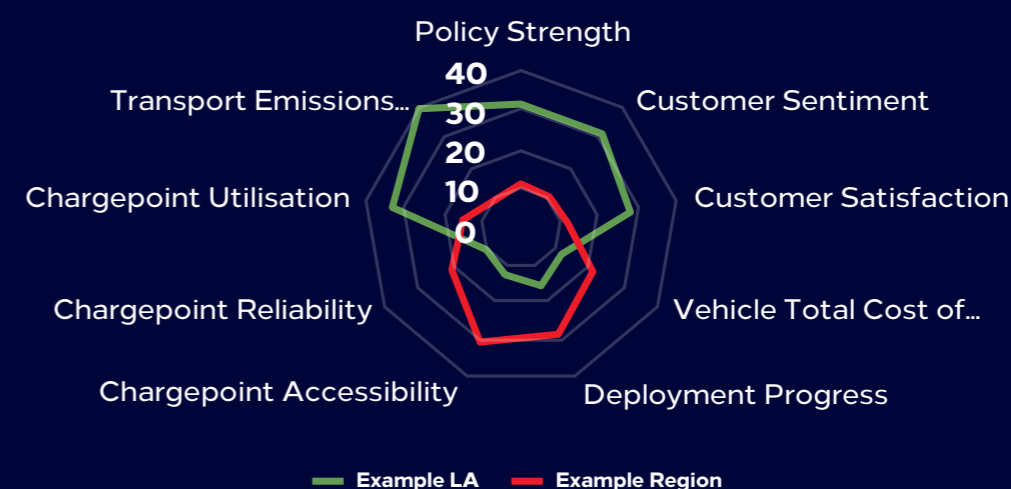
These new metrics offer relevant, actionable, scalable and measurable metrics by which to judge progress more closely aligned with user needs.

Policy makers will need to set these metrics into a charging hierarchy, which describes the relative priorities of near home, destination and journey charging.

The metrics themselves could be further improved through open access to important data sources, which the UK Government and Devolved Administrations could facilitate:

- ▶ **Keepership records** – these will give a more nuanced picture of vehicle location and mileage around the country, refining the demand side of the Near Home Charging Index.

- ▶ **Chargepoints at homes and workplaces** – this data is held by Distribution Network Operators and will help to better quantify the supply side of the Near Home Charging Index.

- ▶ **EVI in car parks** – addition of relevant information on chargepoints to the National Parking Platform will allow a more robust assessment of the provision of destination charging in relation to the Destination Charging Ratio.

- ▶ **Population movement** – better public data on the start, end and routes of journeys in cars and vans will enhance the Journey Charging Index.

Different audiences are likely to need different metrics, the importance of which will vary over time. This means that a basket of metrics in addition to the three new ones will eventually be needed to best answer those who ask 'are we nearly there yet?'

Radar chart axes: Policy Strength, Customer Sentiment, Customer Satisfaction, Vehicle Total Cost of..., Deployment Progress, Chargepoint Accessibility, Chargepoint Reliability, Chargepoint Utilisation, Transport Emissions... — scale 0, 10, 20, 30, 40

— Example LA   — Example Region

About Vauxhall

Vauxhall Motors started making vehicles in the UK in 1903. Today, as the oldest and most familiar of Britain's automotive manufacturers, its philosophy is to build vehicles that are relevant to all. Vauxhall is one of few mainstream automotive brands to produce vans in Britain at its manufacturing plants in Luton, and Ellesmere Port, the UK's first EV-only manufacturing plant.

Vauxhall is one of the first manufacturers to offer fully electric versions of all of its vans and by the end of 2024 will offer a fully electric version of every car and van model in its line-up.

Vauxhall launched Electric Streets of Britain in 2023 to help accelerate the UK's on-street charging infrastructure.

Vauxhall launched a UK database where motorists can register their local on-street charging requirements - www.electricstreets.co.uk. Information from the Electric Streets of Britain database is shared with councils across the country to help develop charging strategies and accelerate the installation of on-street charging provision across the country.

About Cenex

Cenex was established as the UK's Centre of Excellence for Low Carbon and Fuel Cell technologies in 2005.

Today, Cenex lowers emissions through innovation in transport & associated energy infrastructure and operates as an independent, not-for-profit research and technology organisation (RTO) and consultancy, specialising in the project delivery, innovation support and market development.

Employing over 40 people, the Cenex head office is in Loughborough, with an additional base in Belfast, Northern Ireland, as well as a sister non-profit company Cenex Nederland, based in Amsterdam.

We also organise Cenex Expo (formerly Cenex-LCV), the UK's premier transport decarbonisation and Connected and Automated Mobility event comprising three exhibition halls and a two-day seminar programme demonstrating the latest technology and innovation.

Cenex's independence ensures impartial, trustworthy advice, and as a not-for-profit we are driven by the outcomes that are right for you, your industry and your environment, not by the work which pays the most or favours one technology.