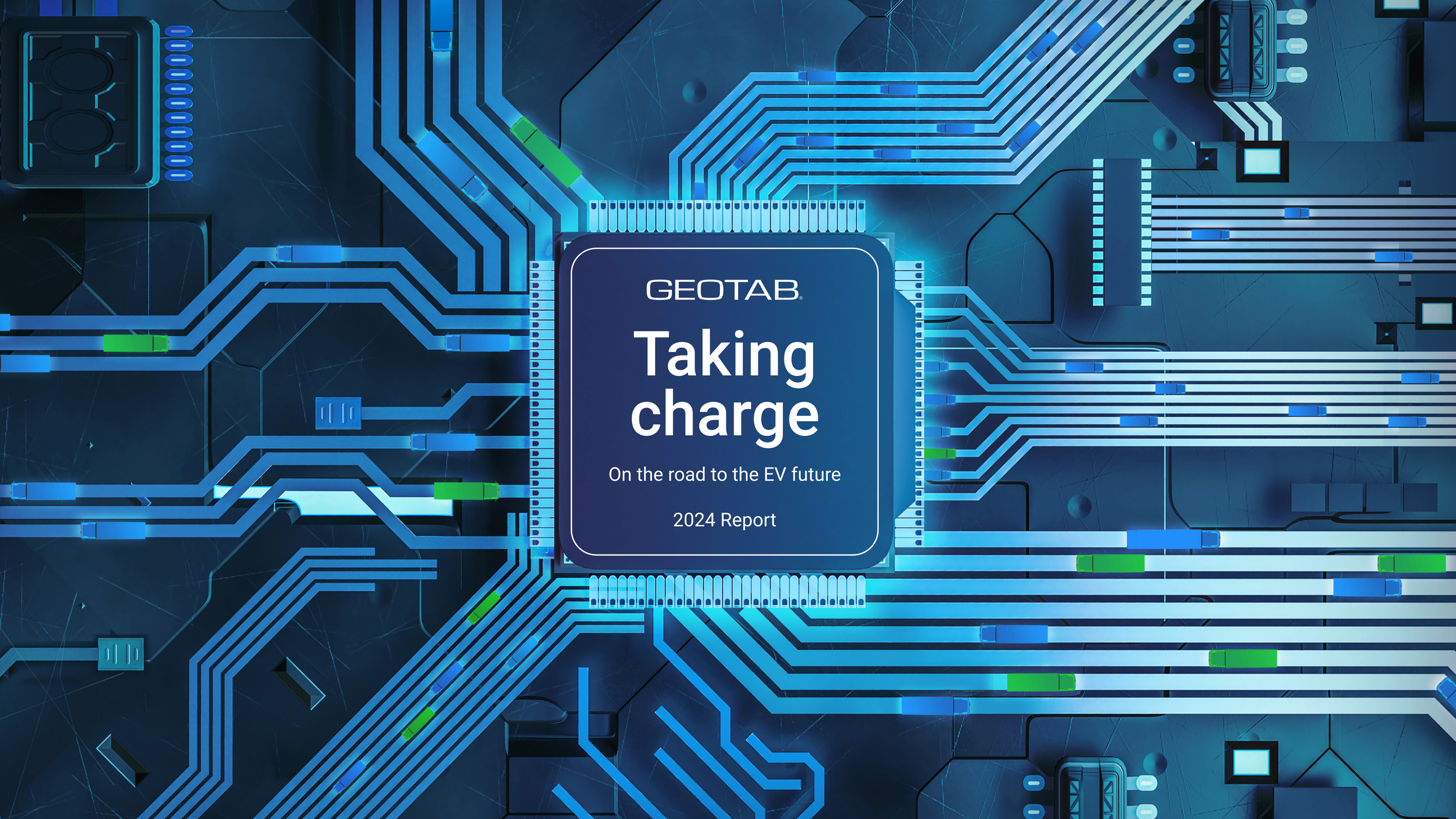

GEOTAB
Taking charge
On the road to the EV future
2024 Report

Executive summary

We're entering an exciting time for fleet electrification. The opportunities are growing for fleets to electrify, and in doing so, they can reduce their total cost of ownership (TCO) while meeting their carbon reduction goals. This study highlights how EVs can transform today's fleets, using real-world data insights from over 1.3M vehicles across seven countries: The United States, Canada, the United Kingdom, France, Germany, Italy and Spain. It also analyses data from over 5,200 early adopter fleet EVs to understand the decisions fleets make once they adopt these vehicles and how these can influence asset utilisation and resulting TCO.

Study highlights

Light-duty EV Suitability Assessment

75%

of the analysed light-duty vehicles could be replaced with a range-capable battery electric vehicle today.

41%

of these vehicles were economically viable and could save fleets money over their lifespan.

8.3B

litres

of fuel would be saved over the next seven years.

19M

metric tonnes of CO_2

emissions would be avoided during that time.

Early adopter fleet behaviors

45%

European

charge sessions occur before the battery drops to half, representing a missed opportunity to fully utilize the EVs and improve ROI.

Some markets are more developed, while others may take some additional time. But by digging deeper into region-specific driving and charging data, we can see that EVs are both operationally and economically viable for a large number of fleet applications today.

Introduction

With a growing number of emissions targets and regulations, fleet managers from across the globe are taking a closer look at fleet electrification.

Most fleet managers now recognise that adding EVs to their fleet will help reduce their CO_2 emissions and play an important role in their organisation's future. However, some questions remain on how much they will cost and whether the current models are up to the task.

This report shows that not only are EVs suitable for many fleet applications, but they may also represent an opportunity for significant cost savings over the lifespan of the vehicle.

Using data intelligence to assess light-duty fleet electrification potential

This study delves deep into real-world telematics data to understand the feasibility of transitioning from internal combustion engine (ICE) vehicles to electric vehicles (EVs) within light-duty fleets. Spanning a year, from 1 June, 2022 to 31 May, 2023, we analysed the daily vehicle usage patterns of approximately 750,000 commercial vehicles across seven countries: The United States, Canada, Spain, Italy, Germany, France and the UK.

By analysing the data using Geotab's EV Suitability Assessment (EVSA), this research provides insights into the number of vehicles that can feasibly be replaced by currently available EVs. The analysis also quantifies the economic and environmental benefits of such a transition. Detailed assessments were conducted at a regional and country level, offering a comprehensive view of the electrification potential across these regions.

EV charging behaviours and what we can learn from early adopters

The report takes an in-depth look at the charging behaviours of over 5,200 fleet-operated EVs across North America and Europe, from 1 June, 2022 to 31 May, 2023. By examining where and how these fleet EVs are charged, we illuminate the intricacies of current EV deployments, offering insights into their true utilisation and charging requirements, as well as the potential for improved performance and ROI. Our analysis reveals trends such as the typical number of charging stations an EV visits, the prominence of AC charging and the average battery levels fleet operators are allowing their vehicles to get to before charging.

Key findings from this report

Light-duty EV Suitability Assessment

- 41% of vehicles were suitable for electrification
- On average, fleets could save around £13,000 GBP (€15,400) per vehicle
- EV suitability varies greatly across Europe, from 20% of assessed vehicles in France, to 66% in the UK

Charging behaviour analysis

- More than 50% of European fleet vehicles charge in just 1-2 locations
- Most charging occurs outside of the core business hours
- 45% of European charge sessions occur before the battery drops to half, showing the potential for greater utilisation and reduced TCO

SECTION 1

Potential fleet electrification for light-duty vehicles

Of all the different classes, light-duty vehicles currently provide the greatest opportunity to go electric.

This is due to the light-duty market being more established, resulting in more vehicle options, as well as the vehicles generally having less demanding duty cycles than the other vehicle classes.

In order to highlight the overall potential of fleet electrification in the light-duty space, this macro analysis leveraged Geotab's Electric Vehicle Suitability Assessment (EVSA) tool to look at a number of factors, including:

- What percentage of vehicles could be replaced with a range capable battery electric vehicle (BEV)?
- Would a fleet save money by replacing an existing vehicle with an equivalent electric model?
- What would the financial savings be over the lifespan of the vehicle?
- How much fuel could be saved and what is the potential amount of tailpipe emissions that could be avoided?

Additionally, we will dive deeper into factors that influence EV suitability such as daily driving distances, the impact of incentives and whether or not daytime charging is used.

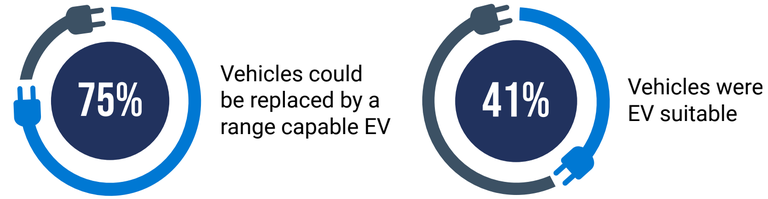
What is an EV Suitability Assessment (EVSA)?

Geotab's EVSA tool uses telematics data to understand a fleet's specific needs to make a tailored EV adoption recommendation. It maps the fleet's driving patterns against real-world EV performance metrics to pinpoint which vehicles in the fleet can be replaced with an EV available in the local market. The tool also provides a forecast of the financial savings and environmental benefits of making the switch.

Refer to the **methodology** section for details on all assumptions and definitions leveraged in this study.

Close to half of fleet vehicles could save money by going electric

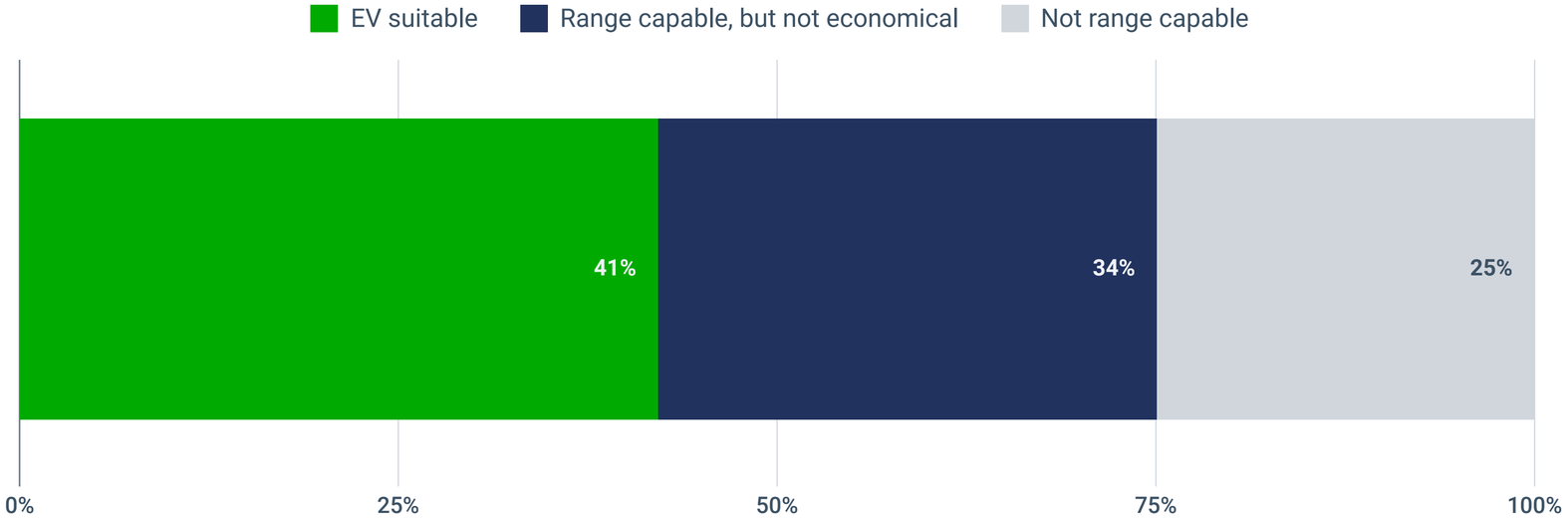
In total, we analysed a year's worth of telematics data for roughly 750,000 ICE vehicles from across the United States, Canada, Spain, Italy, Germany, France and the UK. Of these vehicles, 75% would have a range capable EV replacement, while 41% were EV suitable and could be economically replaced with a range capable EV.



Topline results over a seven-year lifespan

- Potential savings: £4.1B GBP (€4.7B) or an average of around £13,240 GBP (€15,300) per EV suitable vehicle
- Fuel savings: 8.3B litres across all EV suitable vehicles
- Avoided tailpipe emissions: At least 19M metric tonnes of CO_2 across all EV suitable vehicles

Vehicles with suitable EV recommendations



Defining EV suitability and range capability

When evaluating the suitability of replacing an ICE vehicle with an EV, we look at two essential factors: Is there a range capable electric model that can meet the existing daily driving requirements and does it make economic sense to make the switch?

For a replacement to be considered range capable, it needed to be able to drive 98% of the days that year on a single charge. This 2% margin was allowed for outlier days to exclude abnormal driving distance days outside of standard usage.

In order for it to be considered suitable, the EV would have to be both range capable and economical – it has a total cost of ownership (TCO) that is lesser or equal to a new replacement ICE model. The TCO included the acquisition cost along with fuel and maintenance costs over a 7-year lifespan. This calculation does not include any rebates and assumes zero residual value for both ICE vehicles and EVs.

Fleet electrification plays a major role in carbon reduction initiatives

In an effort to combat climate change, many governments and organisations around the world are taking steps to reduce carbon emissions. By electrifying the EV suitable vehicles in this study, fleets could avoid producing over 19M metric tonnes of tailpipe emissions, while making a significant impact on their scope 1 direct GHG emissions (occurring from sources controlled by the organisation). According to the EPA, this is equivalent to the amount of **CO2 sequestered** over the course of a year by a forested area of 95,500 km^2. This is larger than the country of Hungary (95,025 km^2)

Fleet driving patterns influence electrification potential

Driving patterns have a major impact on fleet electrification potential as they determine whether a suitable replacement vehicle is available that satisfies the vehicle's range needs while saving the fleet money. In this part of the analysis, we will look at how far vehicles drive, how much they are utilised during their week and what role vocational driving profiles play in EV suitability.

Around half of European vehicles never travelled further than the range capabilities of the more common models

Understanding driving behaviour is a critical component when considering EVs for fleet applications. You need to look at the maximum daily driving distances and make sure that the vehicle has the range capability to meet those requirements.

An important insight that we observed was that although the maximum daily distance is reaching the range limits of some EVs, around half of the vehicles never travelled further than the range capabilities of the more common models.

A fifth of vehicles drove three days per week or fewer, leaving room for improvement by increasing utilisation

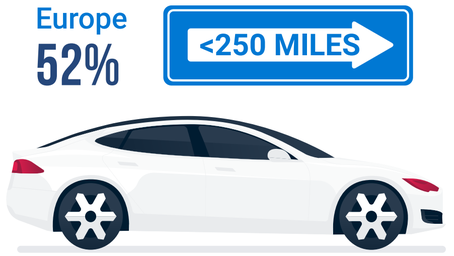
While daily driving distance is a limiting factor for range capability, having a lower TCO plays a significant role when deciding to go electric. The factor that contributes most to an EV's TCO is its utilisation and the majority of the potential savings are the result of lower electricity costs compared to fuel prices. Simply put, the more an EV is driven, the greater the fuel savings.

We observed that 17% of European vehicles were driven for three days or fewer over a seven-day period. This may indicate underutilised assets, suggesting that some fleets could combine the duties of these vehicles. The vast majority of these would have an EV replacement that is range capable but not economically viable. Rightsizing the overall fleet and retiring underutilised assets could likely improve the economics of electrification, provided the daily distance driven remains within the EV's range.

In addition, it is likely that some of the vehicles already identified as EV suitable are not being utilised to their full potential.

In Europe, a vehicle driven on average for two days or fewer per week has a less than 26% chance of being suitable. In comparison, a vehicle driven four days or more has a 60% chance of being EV suitable.

By increasing these vehicles' utilisation, fleets could further increase the ROI of going electric and reduce their number of underutilised vehicles.



- 52% of vehicles never exceed 250 miles in a single day
- Average daily distance: 68 miles
- Average max. daily distance: 293 miles

TIP: Optimise your operations prior to transitioning to EVs, or you risk incurring unnecessary costs. By implementing sustainable strategies, such as rightsizing and route optimisation, you can make sure you are getting the most out of your assets.

Vocations with shorter or more predictable routes have the highest potential for EV suitability

For classification purposes, fleet vehicles will sometimes be grouped by industry. However, this can pose challenges when evaluating the potential for EVs. Vehicles within the same industry may drive and charge in a very different manner. For example, a pizza delivery vehicle and a catering van are both in the food industry but have very different behaviours.

A different way to classify them is by the job they do. This is also known as a vocation, which better reflects how they generally behave.

Geotab breaks down vocation into five categories: Door-to-Door, Hub-and-Spoke, Local, Regional and Long Distance. For the previous examples, the pizza delivery vehicle would be classified as Hub-and-Spoke since they make multiple round trips from a central location. Given the typical driving distances, the catering van would be classified as Local.

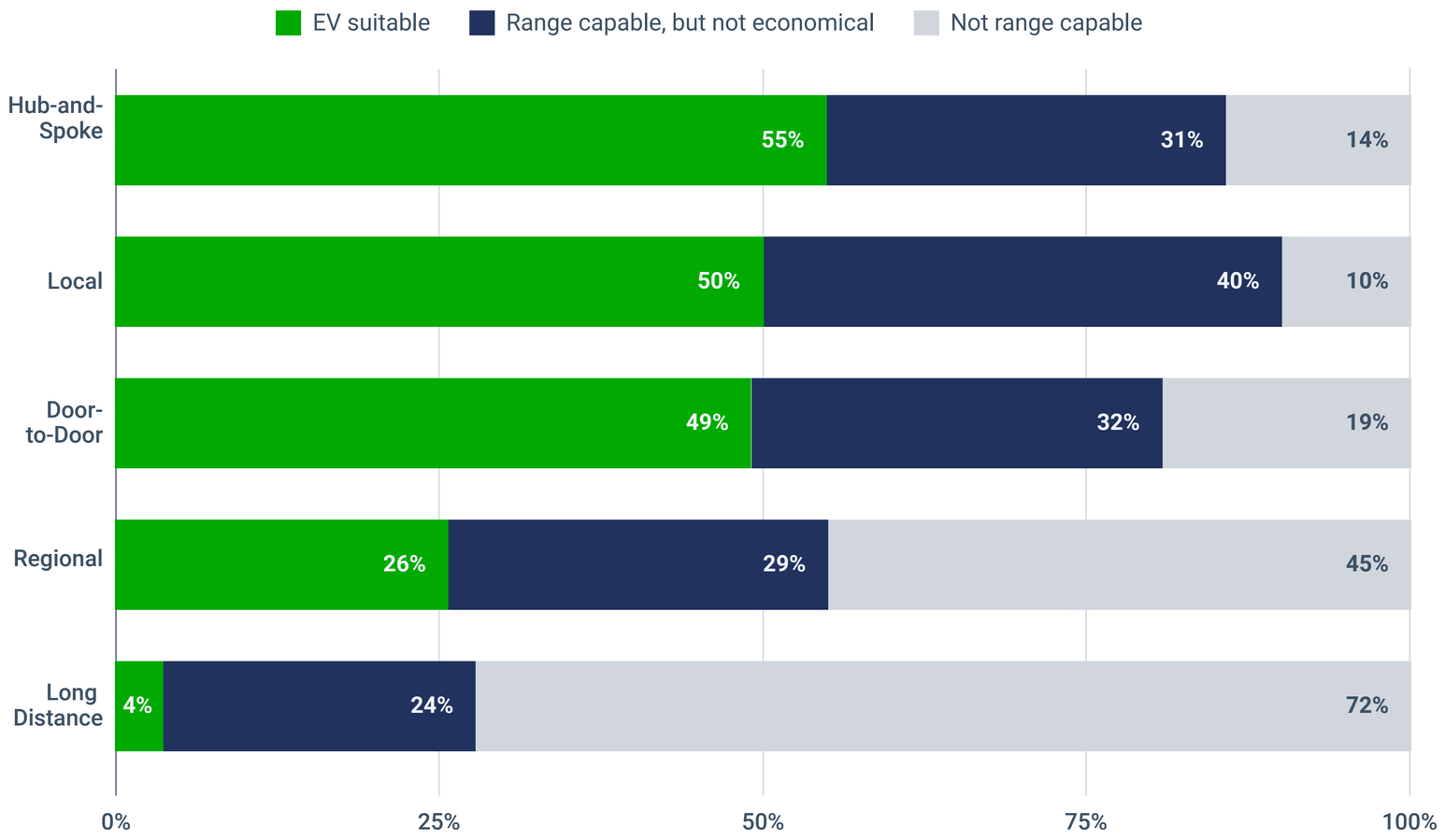
Vocation	Daily driving behavior
Door-to-Door	• Makes significantly more stops than most and tends to spend very little time per stop.
Hub-and-Spoke	• Makes multiple round trips from a singular location or centralised hub.
Local	• Remains within an area of 150 miles. • The vehicle is also neither Door-to-Door nor Hub-and-Spoke.
Regional	• Drives beyond an area of 150 miles and tends to rest in the same location often. • The vehicle is also neither Door-to-Door nor Hub-and-Spoke.
Long Distance	• Large range of activity and typically does not rest in the same location. • The vehicle is also neither Door-to-Door nor Hub-and-Spoke.

When reviewing the data for these analysed vehicles, a clear, but unsurprising pattern emerges – EVs are more suitable for vocations that stay within a smaller geographic area and have more predictable routes. Vehicles that were classified as Door-to-Door, Hub-and-Spoke and Local were therefore more suitable for electrification.

As seen in the below chart, a very low portion of vehicles categorised as long-distance would be suitable to electrify, whereas, for fleet vehicles in hub-and-spoke, door-to-door or local vocations, around half could save money if they went electric.

EV technology continues to improve and we will continue to see new models with greater capabilities. However, even once there are EVs with greater range capabilities available, they will still have to deal with some hurdles, such as the fact that the vehicles classified as Long Distance don't typically rest in the same location – making charging more difficult. Also, range capability is largely dependent on a vehicle's battery capacity. Since the battery is the most expensive component of an EV, it would mean that these longer-range models would be more expensive.

EV suitability by vocation



Other ways to influence electrification potential

There are other changes fleet managers can make to influence electrification potential. To highlight the impact of each tactic, we showcased them independently. However, all of these could be implemented at the same time, further improving the results.

Even a modest rebate can make a significant difference in electrification

The TCO calculations presented above exclude rebates or financial incentives. Factoring in incentives can notably enhance the economic viability of EVs, reducing the overall total cost of ownership.

By applying a £4,100 GBP (€3,800) rebate, the number of vehicles that could economically go electric in Europe increases by 6 percentage points, from 49% to 55%.

A different way to approach this is to consider the cost of becoming more sustainable. Fleets around the world are becoming more accountable for their carbon footprint and many will need to meet specified emission reduction targets.

In our analysis, any increase in the TCO for a range capable EV compared with an equivalent ICE would classify it as not economical. However, 21,600 vehicles (or 3%) of those not economical vehicles were within £1,250 GBP (€1,400) of breaking even. This cost, when spread out over the lifespan of the vehicle, may be deemed insignificant for fleets looking to accelerate their transition.

Extending vehicle replacement cycles improves EV suitability

During this analysis, it was assumed that all vehicles would have a lifespan of seven years, although replacement cycles can vary between different fleets. However, since EVs have fewer moving parts, it is conceivable that they could have a longer usable lifespan than their ICE counterparts. As most of the cost savings for EVs are a result of saving on fuel and maintenance, extending the lifespan of the vehicles increases the likelihood that they will be suitable for electrification.

To highlight the impact of a vehicle's lifespan on suitability, we ran a few different scenarios. By increasing the lifespan to 10 years, the number of vehicles considered EV suitable in Europe increased by 6 percentage points. Alternatively, by reducing the lifespan to five years, suitability dropped by 9 percentage points.

Region		5-year lifespan	7-year lifespan	10-year lifespan
Europe	• EV suitability	• 40%	• 49%	• 55%
	• Avg. lifetime savings	• £11,200 GBP (€12,900)	• £15,300 GBP (€17,700)	• £22,700 GBP (€26,200)

One consequence of extending the lifespan of the EV is some loss in range through battery degradation. Geotab has observed a loss of 1.8% battery capacity per year on average, which may impact range capability for longer routes over time.

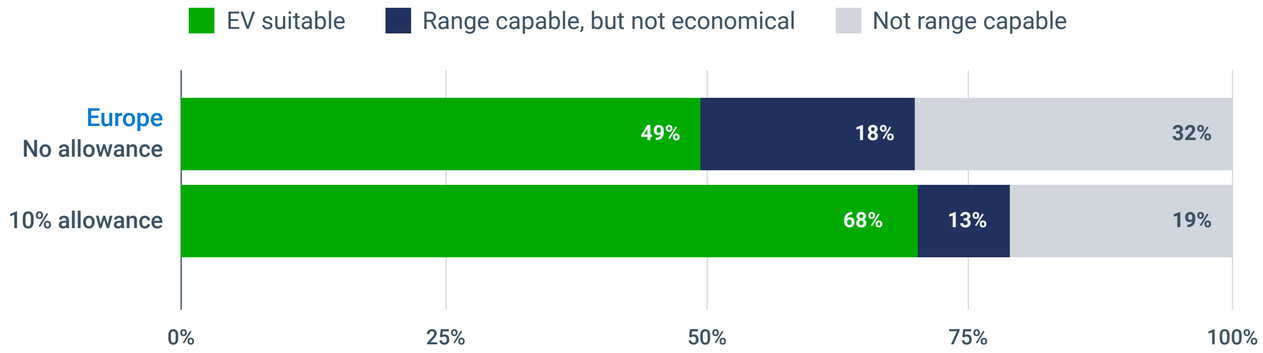
More vehicles will have a range capable replacement if you allow occasional daytime charging

As previously mentioned, for our analysis to consider an EV replacement as range capable, it needs to be able to complete its daily driving requirements on a single charge. However, this is not necessarily a requirement for all fleets. Some might be able to charge during the day, whether it is a planned stop at an owned depot or opportunity charging at a public station and customer sites.

If vehicles are allowed to be occasionally charged during the day, the number of vehicles deemed range capable increases. To showcase this, we adjusted the analysis to allow additional charging on 10% of days when the vehicles are being driven. This greatly increased the number of vehicles that would be EV suitable, particularly within North America, which leaps from 76% to an astonishing 95% range capability, with 65% being economical.

Two insights can be gleaned from this data. Firstly, there was most likely a number of long-range EVs that were deemed range-suitable replacements, but that came at a high price tag. By allowing some daytime charging, it unlocked a set of less expensive, shorter-range models or trims that could now do the job while also saving money. Secondly, the jump in range capability indicates that many of these vehicles, while occasionally travelling long distance days, for the most part, are well within EV range. These outlier trips might be workable either with daytime charging or by reallocating vehicles and routes.

Allowing daytime charging in Europe



As the market changes, EVs will become more economical

The majority of potential savings for an EV are a result of lower electricity costs compared to fuel costs. As fuel prices increase, so do the potential cost savings and with many countries implementing sustainability initiatives like carbon taxes, we are likely to see further increases in the future. Electricity prices will inevitably rise as well, but there is generally less volatility. At the same time, as battery technology becomes cheaper and new models enter the market, EVs should move towards parity compared to ICE vehicles. These factors make going electric even more favourable.

Reviewing EV potential by country

This next section analyses EV potential at a country level. Note that the values have been adjusted to reflect local currencies and units of measurement. We have remained consistent with our assumptions from our methodology unless stated otherwise. Where we reflect suitability based on incentives, we reflected the available incentives in the local markets as of the time of writing. It should be noted that the incentives may not apply to all vehicle classes and applications, so fleets should review how incentives apply to their specific vehicles.

France

Driving profile

Average daily driving distance:

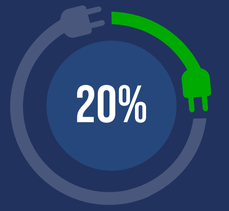
- 127 km

Maximum distance daily:

- 581 km

% of vehicles never exceeded 350 km in a day

- 33%



of vehicles are EV suitable (no incentive)

Lifetime savings per EV suitable vehicle

Potential savings

€17,300

Fuel saved

21,600L

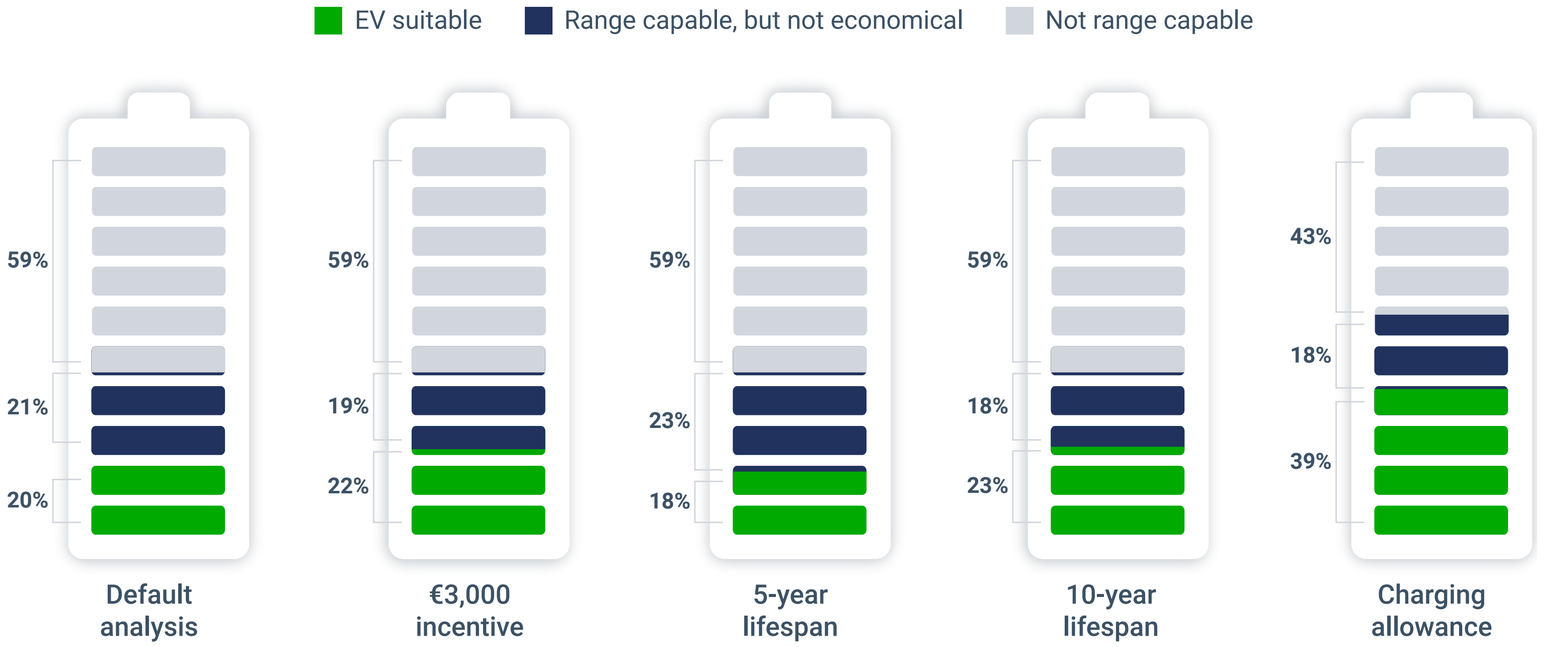
Avoided tailpipe emissions

49 TONNES OF CO_2

Influencing electrification potential

Fleet managers can influence the number of vehicles that could be electrified through a number of levers.

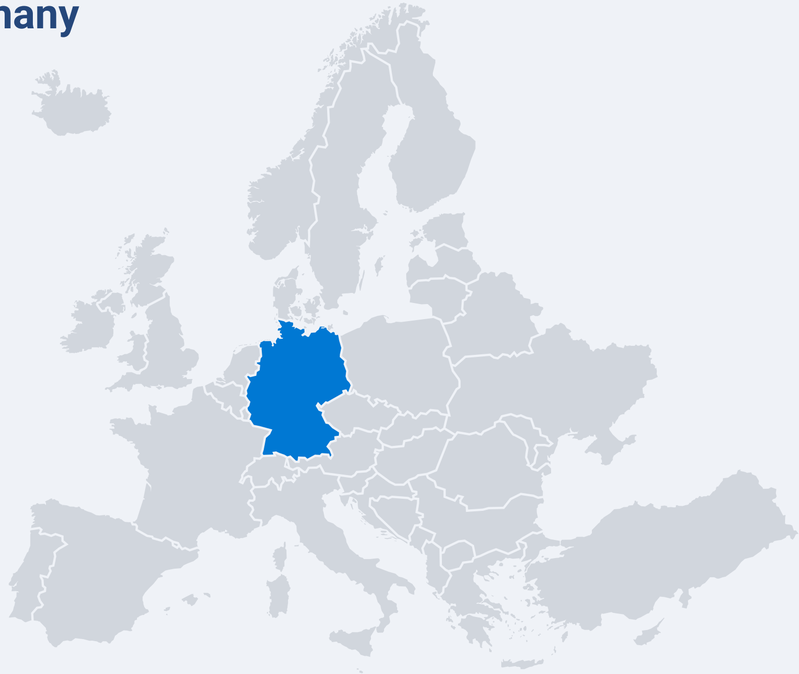
By leveraging incentives, allowing daytime charging or increasing the replacement cycle, increases EV suitability.
A charging allowance additionally will increase range capability.



> By allowing daytime charging, France's EV suitability almost doubles. Daytime charging does not need to take time away from the vehicle's job by having it charge fully - it could occur whenever the vehicle is naturally stopped, such as loading or for customer visits.

Charlotte Argue
Senior Manager, Sustainable Mobility, Geotab

Germany



Driving profile

Average daily driving distance:

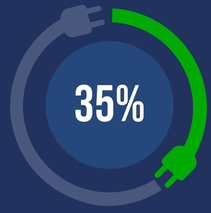
- 131 km

Maximum distance daily:

- 432 km

% of vehicles never exceeded 350 km in a day

- 56%



of vehicles are EV suitable (no incentive)

Lifetime savings per EV suitable vehicle

Potential savings

€12,200

Fuel saved

20,000L

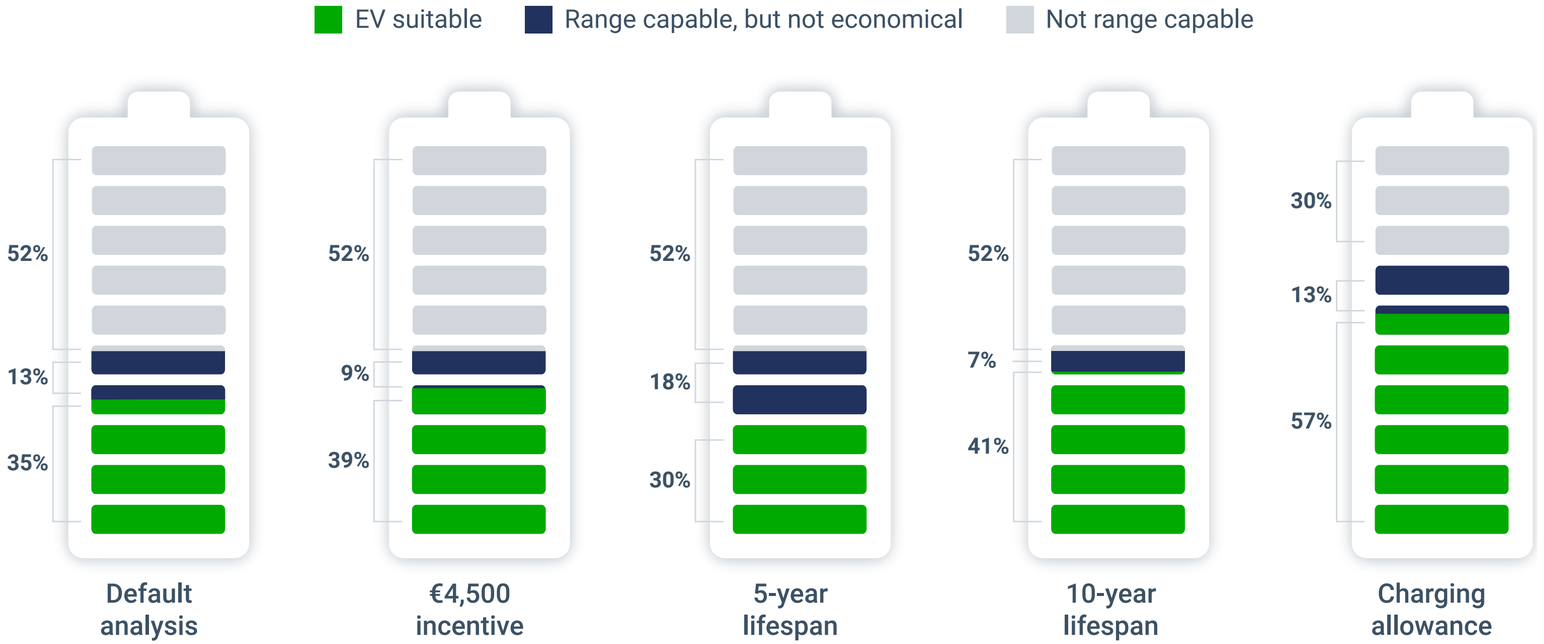
Avoided tailpipe emissions

46 TONNES OF CO_2

Influencing electrification potential

Fleet managers can influence the number of vehicles that could be electrified through a number of levers.

By leveraging incentives, having a 10% charging allowance in place or increasing the replacement cycle, EV suitability increases. Additionally, a charging allowance will increase range capability.



Italy

Driving profile

Average daily driving distance:

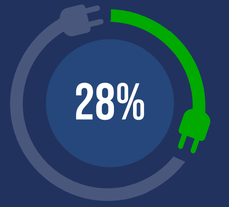
- 121 km

Maximum distance daily:

- 448 km

% of vehicles never exceeded 350 km in a day

- 51%



of vehicles are EV suitable (no incentive)

Lifetime savings per EV suitable vehicle

Potential savings

€20,300

Fuel saved

15,900L

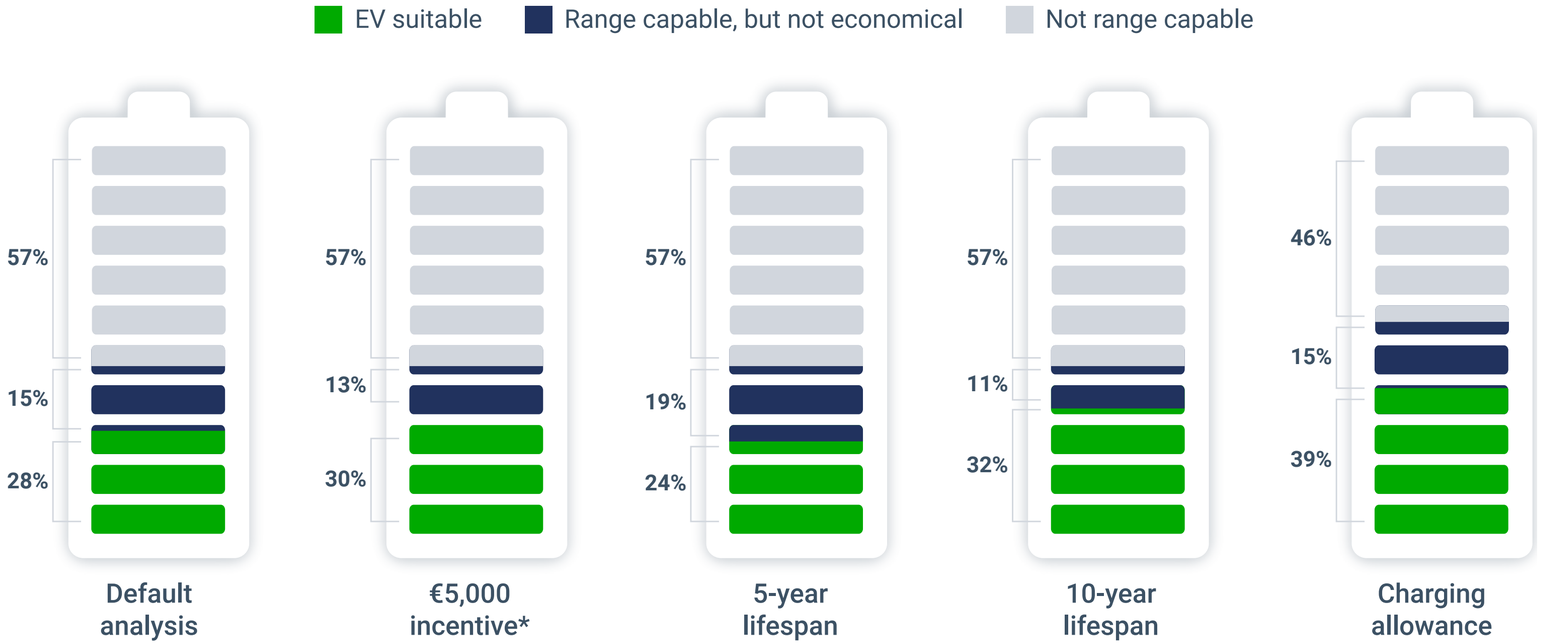
Avoided tailpipe emissions

36 TONNES OF CO_2

Influencing electrification potential

Fleet managers can influence the number of vehicles that could be electrified through a number of levers.

By leveraging incentives, having a 10% charging allowance in place or increasing the replacement cycle, EV suitability increases. Additionally, a charging allowance will increase range capability.



Including scrappage

> In some European countries like Italy and Germany, the business case for EVs today is high, making additional levers like vehicle incentives and vehicle lifespan less impactful.

Charlotte Argue
Senior Manager, Sustainable Mobility, Geotab

Spain

Driving profile

Average daily driving distance:

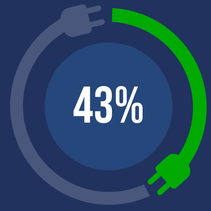
- 123 km

Maximum distance daily:

- 427 km

% of vehicles never exceeded 350 km in a day

- 53%



of vehicles are EV suitable (no incentive)

Lifetime savings per EV suitable vehicle

Potential savings

€12,100

Fuel saved

18,800L

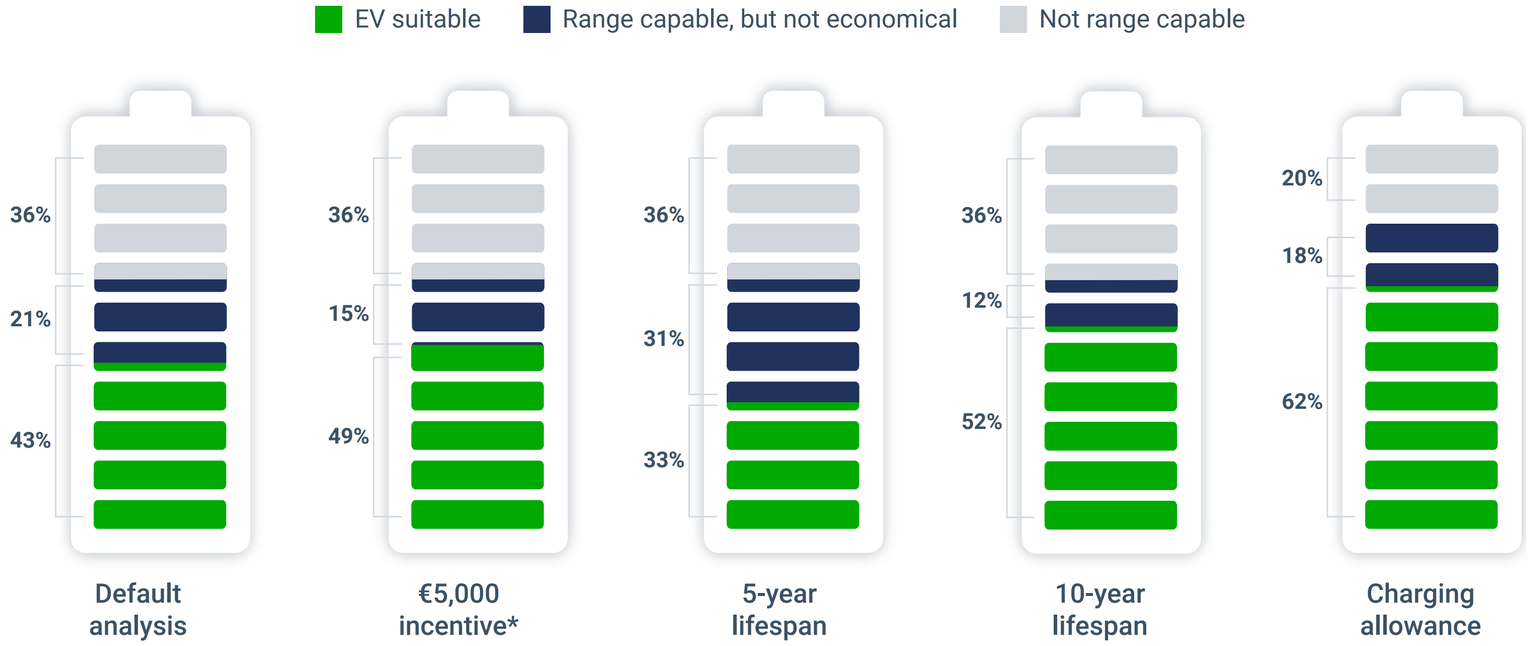
Avoided tailpipe emissions

43 TONNES OF CO_2

Influencing electrification potential

Fleet managers can influence the number of vehicles that could be electrified through a number of levers.

By leveraging incentives, having a 10% charging allowance in place or increasing the replacement cycle, EV suitability increases. Additionally, a charging allowance will increase range capability.



**Fleets of up to 500 vehicles may receive a maximum benefit of €2.5m, equivalent to €5,000 per vehicle*

United Kingdom

Driving profile

Average daily driving distance:

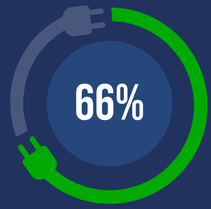
- 58 miles

Maximum distance daily:

- 287 miles

% of vehicles never exceeded 250 miles in a day

- 49%



of vehicles are EV suitable (no incentive)

Lifetime savings per EV suitable vehicle

Potential savings

£7,300

Fuel saved

17,100L

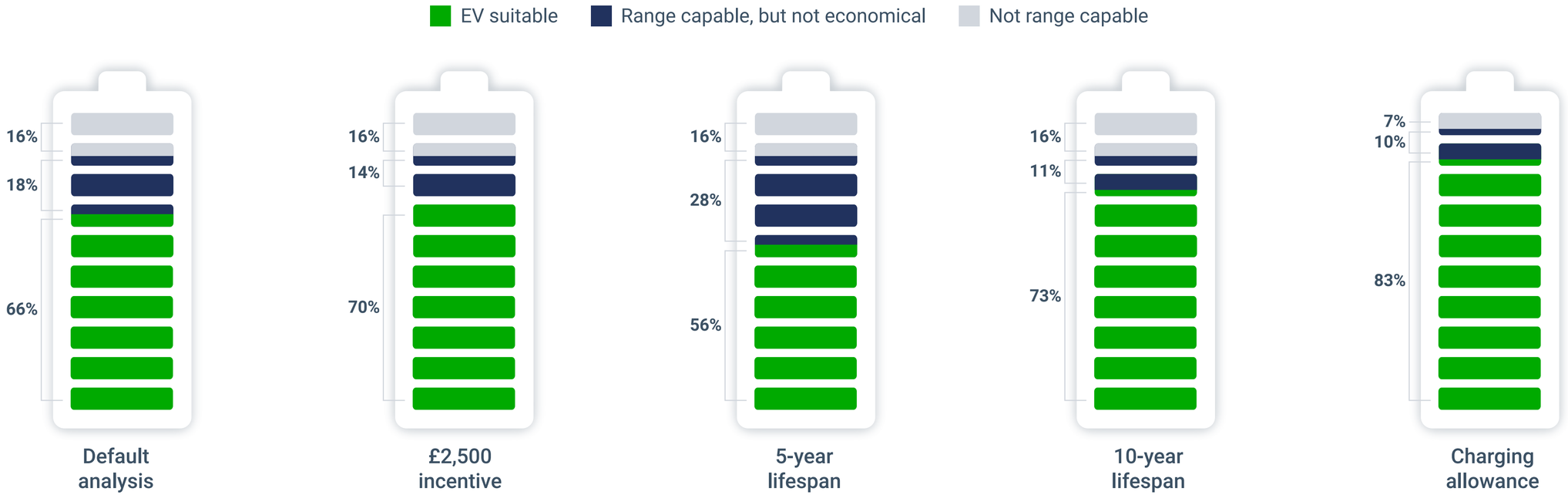
Avoided tailpipe emissions

39 TONNES OF CO_2

Influencing electrification potential

Fleet managers can influence the number of vehicles that could be electrified through a number of levers.

By leveraging incentives, having a 10% charging allowance in place or increasing the replacement cycle, EV suitability increases. Additionally, a charging allowance will increase range capability.



TIP: Try our interactive country dashboard

Explore how each country ranks for EV suitability, cost savings and avoided emissions in our interactive experience. You will be able to adjust the analysis to include how factors like government incentives, extending the lifespan or adding a charging allowance impact those ranks. Visit geotab.com/taking-charge today.

SECTION 2

Charging behaviour of early adopter fleets

We've proposed that EVs are well suited for many fleet applications, but how are EVs actually being used and charged in fleets today?

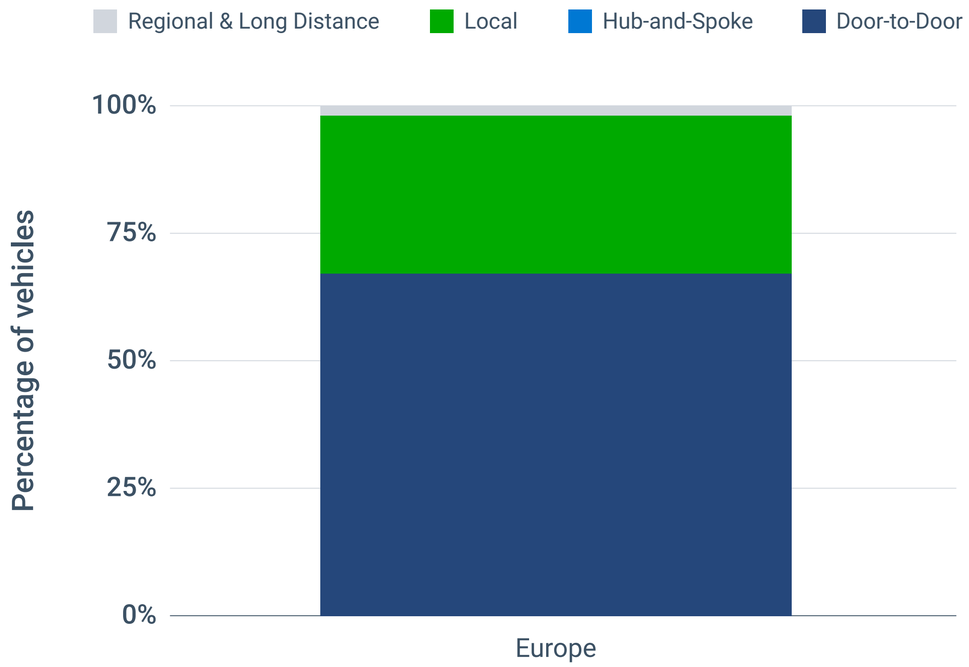
Charging behaviours of fleet EVs can unveil significant insights for both fleet managers and policy makers. Analysing aspects such as frequency of usage of charging locations, charging times, and state-of-charge at the time of charging can illuminate patterns and preferences that are crucial for optimising charging infrastructure deployment, enhancing grid management, and improving the overall efficiency of fleet operations.

This section of the report will take a more in-depth look at the charging behaviour of more than 5,200 EVs in early adopter fleets across North America and Europe over the course of a year. Refer to our methodology section for more information. The analysis predominantly included passenger and light-duty commercial vehicles, with larger EV lorries and buses making up only roughly 4% of the analysis.

Vocational makeup

When sorting fleet vehicles by their job (or vocation), the majority of the analysed vehicles in Europe are classified as door-to-door. This may influence the overall results when reviewing the data at a regional level.

Vocational breakdown of the vehicles analysed in Europe



Note: In adherence with Geotab's data privacy policies and sample size requirements, the vehicles in the Regional & Long Distance vocations have been combined into a single group and the European Hub-and-Spoke vehicles have been removed.

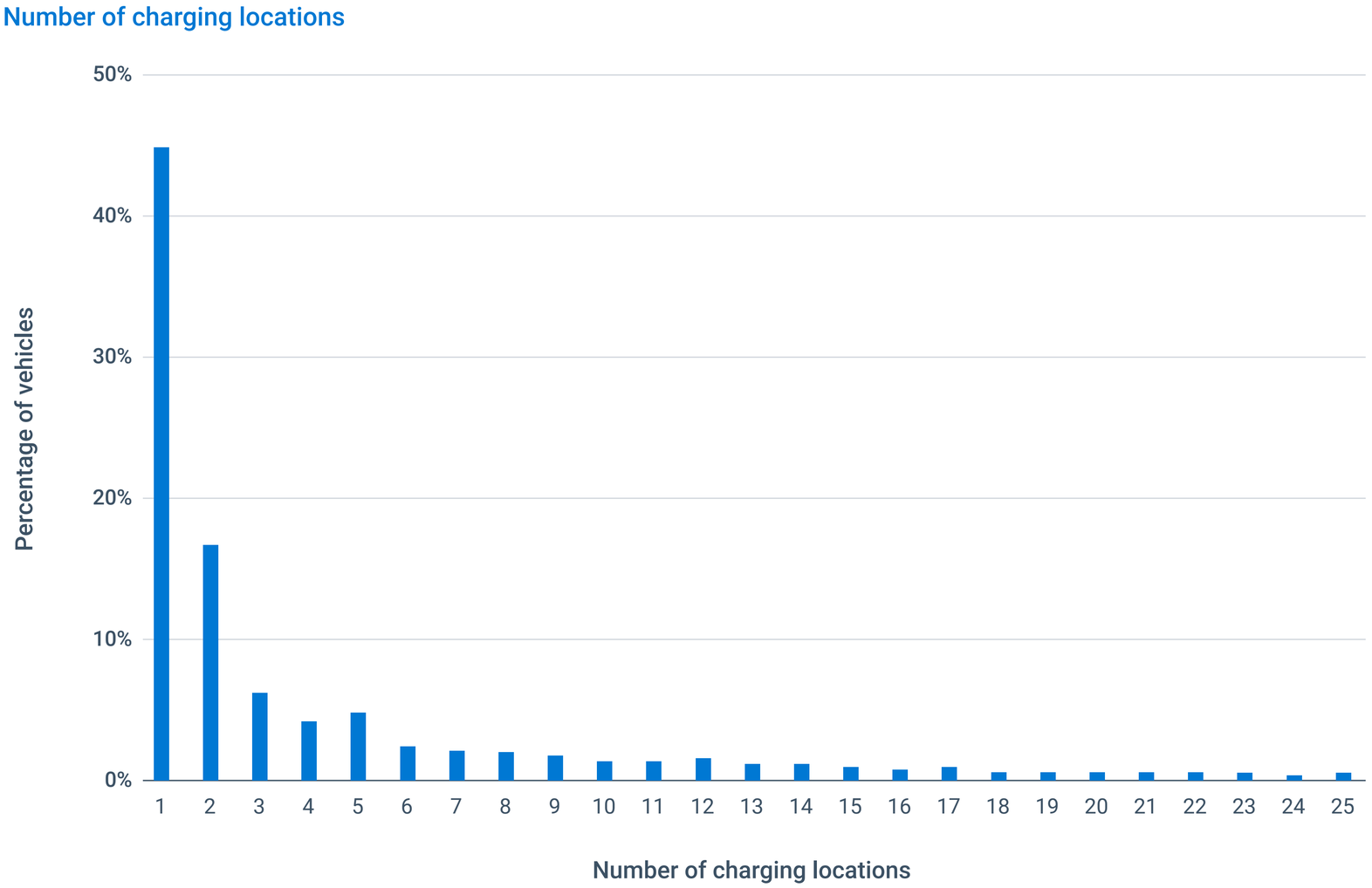
Vocation	Daily driving behaviour
Door-to-Door	• Makes significantly more stops than most and tends to spend very little time per stop.
Hub-and-Spoke	• Makes multiple round trips from a singular location or centralised hub.
Local	• Remains within an area of 150 miles. • The vehicle is also neither Door-to-Door nor Hub-and-Spoke.
Regional	• Drives beyond an area of 150 miles and tends to rest in the same location often. • The vehicle is also neither Door-to-Door nor Hub-and-Spoke.
Long Distance	• Large range of activity and typically does not rest in the same location. • The vehicle is also neither Door-to-Door nor Hub-and-Spoke.

Most fleet vehicles only charge at a few locations

When reviewing charging behaviour, we found that a significant proportion (more than 50%) of fleet EVs in Europe only ever charge at one or two locations; the percentage of vehicles that used additional locations drops off rapidly from there.

This charging behaviour should not be overly surprising. The EVs currently on the road today are most likely the ones that were the "easiest" to deploy – vehicles with predictable routes, that return to the same domiciles each day and have the ability to charge on-site at the fleet's facility or the driver's home, if it is a take-home vehicle.

This aligns with the overall makeup of the vehicles in this analysis. In the future, as fleets begin adopting EVs in "tougher-to-electrify" vocations, and as charging infrastructure expands, we may see a change in this overall pattern.



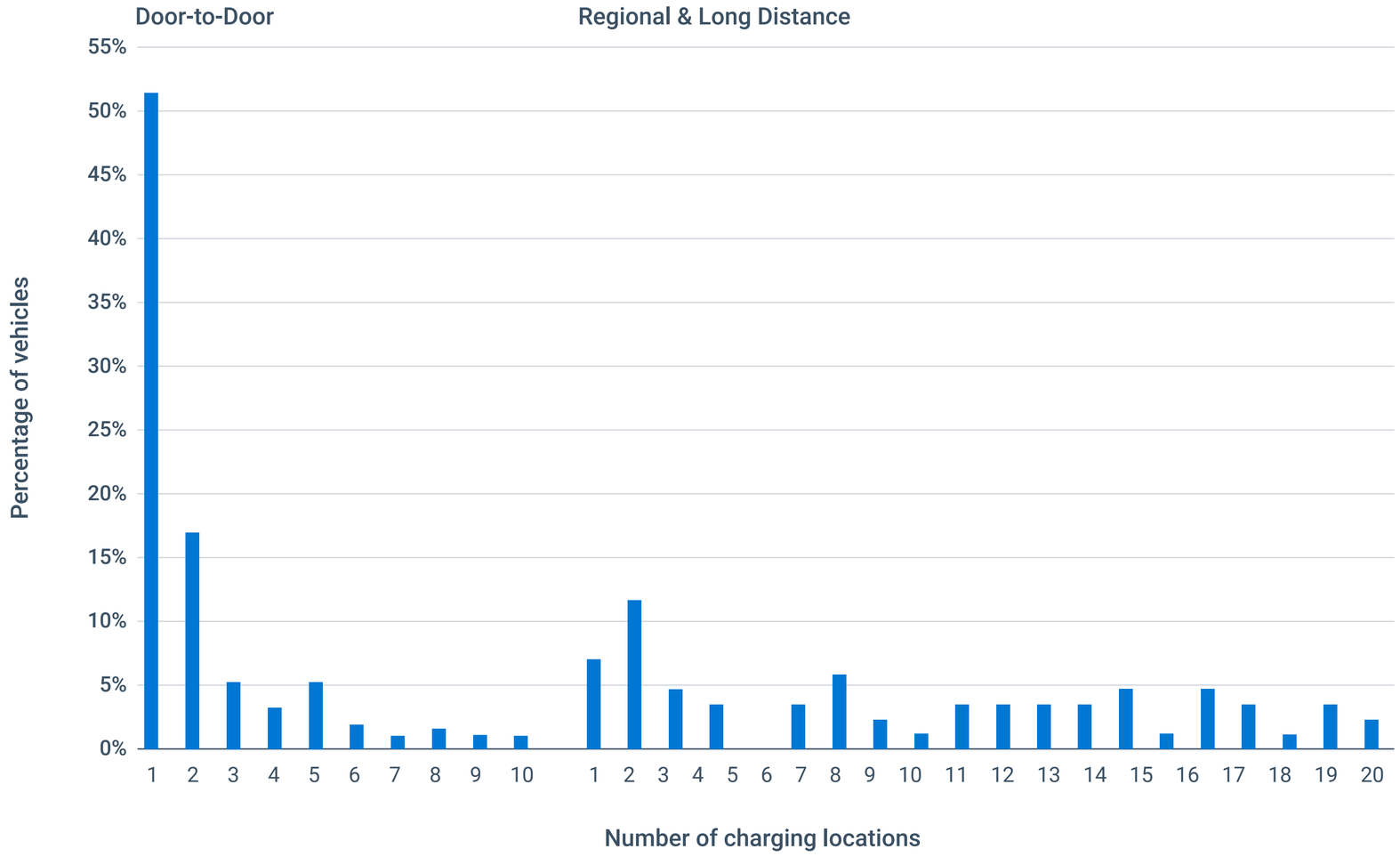
Grouping vehicles by vocation unveils some patterns: Door-to-Door, as well as the Hub-and-Spoke and Local vehicles, are vocations that drive within a 150 mile area, and therefore are staying close to a “home base”. These vocations relied on far fewer charge locations than Regional & Long Distance vehicles, which are driving further afield and seem to rely on multiple charging locations rather than one dedicated spot. In Europe, EVs in Regional & Long Distance vocations are able to utilise many charging locations due to its robust charging network.

This provides many options to charge along their routes or potentially at customer sites. This aligns with our findings that 25% of the Regional & Long Distance vehicles in Europe used 21 or more unique charging locations over the course of the year.

Insight

In July 2023, the **European Union** passed a law to dramatically increase the number of publicly available chargers. By the end of 2025, there will be a system of fast chargers every 37 miles along the Trans-European Transport Network system of highways.

Number of charging locations by vocation



Fleets are conservative with when and how they charge their EVs

Understanding where charging happens is only part of the story – the other questions are when and how. In our analysis, we looked at both what time of day EVs were charging as well as what charger type they used. While both of these factors have their own independent impact, they also influence each other.

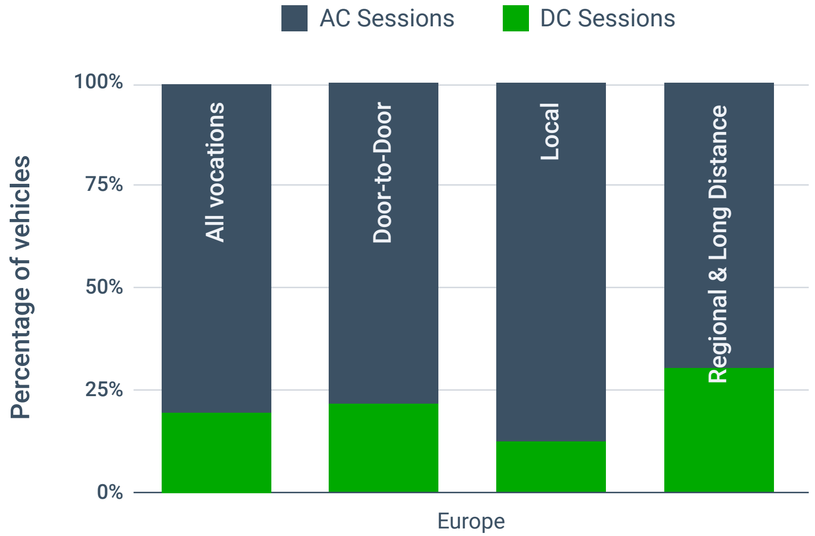
There is more than one way to charge an EV and the terminology is different depending on your location. To simplify this, the charging has been grouped into either AC charging or DC charging.

Light-duty fleet EVs are relying on AC charging

Overall, AC charging accounted for the majority of all charging across all vocations. DC charging accounts for 20% of total charge sessions in Europe. Widespread EV adoption across Europe results in a robust network of publicly available DC chargers – allowing for opportunity charging. Additionally, with the more mature market, fleets are increasingly willing to invest in this more expensive infrastructure at their own depots. In fact, some OEM-sold DC fast charger offerings provide extremely competitive rates to encourage fleets to use them.

Looking at the vocational breakdowns, Regional & Long Distance vehicles used DC charging the most. This finding also coincides with the previous insight that these vehicles are most likely to use multiple charging locations throughout the year.

Proportion of charging sessions by type and vocation

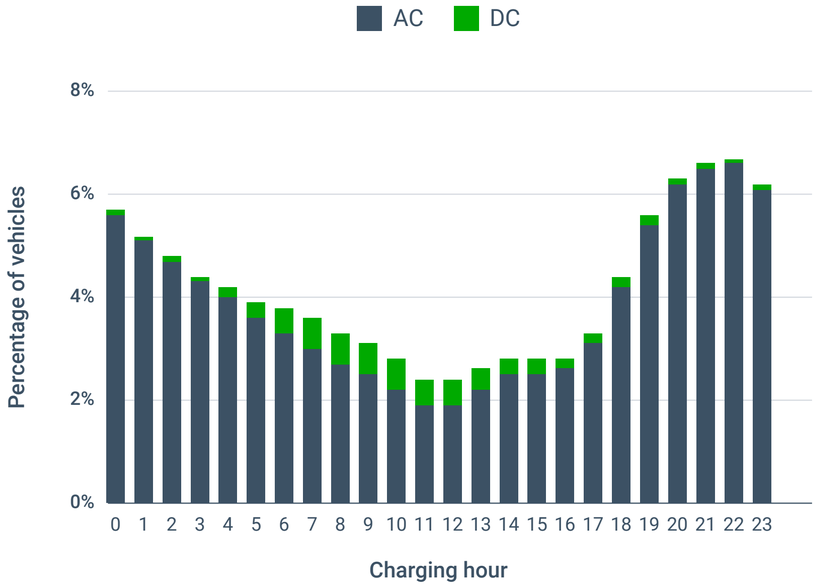


Fleets make sure they're ready for the next day by largely charging outside of 'core' work hours

In the charts below, we have broken out the percentage of charging sessions by hour of day for the entire year. It should be noted that we observed that not all vehicles were charged every day that they drive.

The dip in the middle of the day indicates fewer sessions are occurring during typical "work hours" (between 9 a.m. and 5 p.m.) while charging peaks in the evening. In Europe, a notable increase in DC charging occurs during daytime hours, indicating that these fleets are taking advantage of opportunity charging during the day.

Proportion of charging sessions at different times



*This graph represents the proportion of total charging sessions that occur at some point during that hour, irrespective of the length of the sessions. For more details, refer to the **methodology section**.*

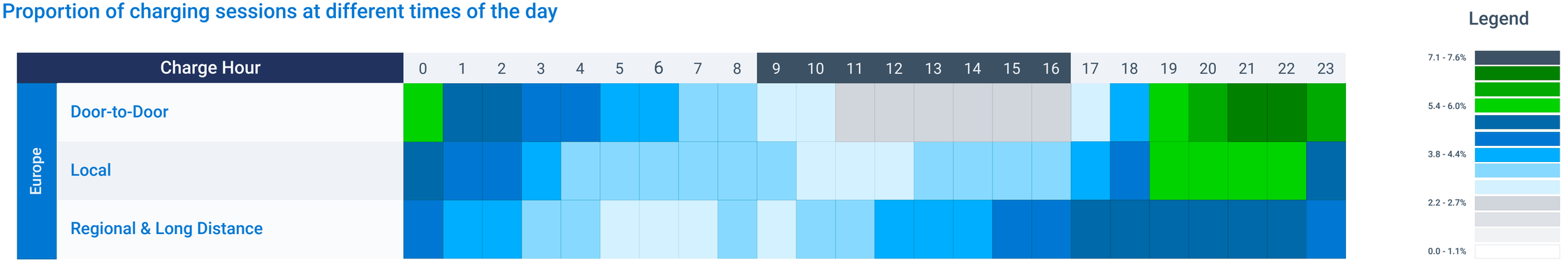
> **Fleet operators have access to a powerful toolkit for a successful EV transition: connected vehicle data. Insights from EV data can reveal whether the vehicles are maximised and charging is optimised, ensuring investments pay off.**

Charlotte Argue

Senior Manager, Sustainable Mobility, Geotab

While charging is generally more concentrated outside the core work hours, for the Regional & Long Distance vocations, the charging is more evenly distributed throughout the day. This could be due to these vocations covering further distances or more diverse routes – which in turn require more frequent charging.

Proportion of charging sessions at different times of the day



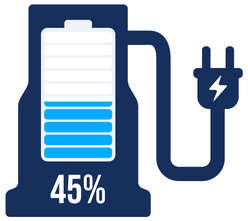
Fleets charge more often than they need to

An EV's state-of-charge (SOC) is a representation of how much energy is left in the battery – essentially the EV equivalent of a fuel gauge.

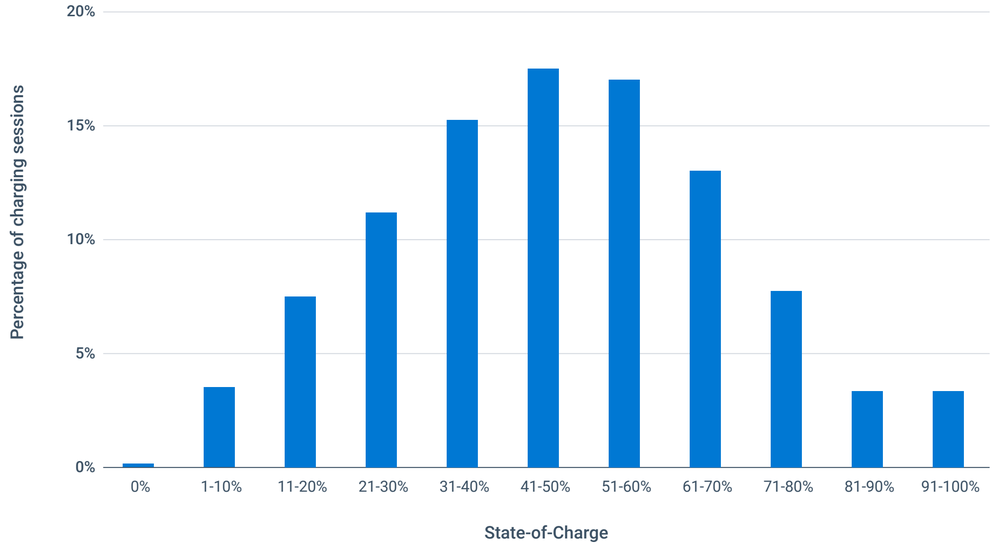
Most fleet vehicles observed were charged conservatively and never depleted their batteries. In fact, 45% of European charge sessions happen before the battery drops to half. This is a missed opportunity to utilise an EV to its full potential, since many EVs can go well over 100 miles at 50% SOC.

Familiarity with EVs, combined with a robust public charging network breeds confidence in an EV's range and a comfort with waiting until SOC is lower before initiating a charge session.

% of charge sessions that happen before battery drops to half



Charge session by their starting state-of-charge

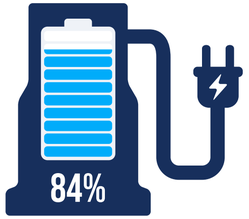


When fleets charge, they charge to full

We were also interested in whether EVs were being charged fully. For this study, we considered any charge session that ended when the SOC was 91% or greater to be fully charged.

Regardless of vocation, the majority of charging sessions ended when the vehicle was fully charged. 84% of European charging sessions result in a fully charged battery. It's possible this high proportion of vehicles charging to full may be because many EVs used in Europe are early generation models that do not have the capability to stop charging automatically at a predetermined SOC – a feature most newer EVs offer to help prolong the battery life.

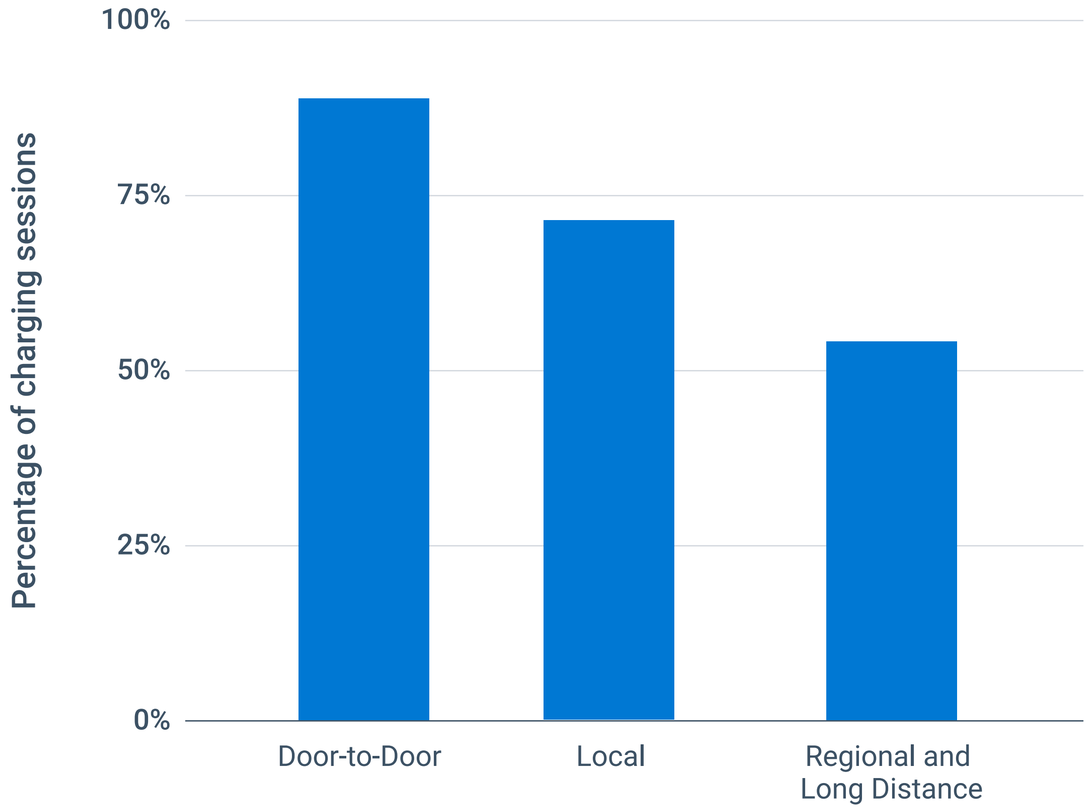
% of charge sessions resulting in fully charged battery



These findings, in combination with the fact that most fleets tended not to let their vehicles go below a 45% SOC, highlight that fleets are:

- Overly conservative with how they use their vehicles and what routes they send them on
- Opting to charge their vehicle more often and for longer than they need to, or
- Using an oversized battery for the application and could have fulfilled their duty cycle with a shorter range EV

Charging sessions that end with a fully-charged battery



Early adopter fleet experiences provide learnings for the next generation of EV adopters

Fleet electrification has a learning curve. Running pilot deployments at a smaller scale can be a helpful tool for fleets to test the waters, allowing them to become more comfortable with an EV's capability. Early adopter fleets are paving the way, highlighting that the more time they spend with EVs, the more comfortable they seem to become. Findings from aggregated data like this study highlight the importance of data to identify performance improvements in their fleets.

For their existing fleet EVs this could entail:

Maximise utilisation

1. Monitor EV usage and measure how much battery capacity is being used, with a goal to increase EV utilisation in the fleet

Rightsize

1. Deploy those EVs with larger batteries in more strenuous or longer duty cycles
2. As ICE vehicles come to their end of life, evaluate if an existing EV could already do the job by increasing its utilisation in lieu of purchasing another vehicle

Optimise charging

1. Manage charging to ensure the vehicle is ready for its next deployment
2. Delay or limit charging if it's not needed
3. Take advantage of favourable electricity rates ("off-peak"), in regions where the rate changes depending on the time of use

Note: As the fleet considers expanding its EV operations, leveraging insights from early deployments and conducting an EV Suitability Assessment can help you make more informed decisions.

We’re entering an exciting time for fleet electrification

Armed with real-world data from over 1.3M fleet vehicles across 7 countries, the story our study tells is clear.

Fleet electrification is no longer a pipe dream or a solution solely for organisations intent on reducing their carbon emissions. Instead, across all regions studied, our data shows that there are even greater opportunities for fleets to electrify, reduce their TCO and meet their carbon reduction goals.

EVs can satisfy a large portion of daily range needs for light-duty fleet vehicles, and by incorporating some day-time charging, an even greater opportunity is unlocked. What’s more, they can provide significant savings opportunities while also supporting the company’s emission reduction objectives.

Fleets looking to make the move to electric have a number of levers they can use to prepare their fleet for the transition - through rightsizing, increasing utilisation and route optimisation. Leveraging incentives, identifying daytime charging opportunities and adjusting the service life of the vehicle are ways in which fleets can better incorporate EVs and result in positive ROI. Macroeconomics, like fuel and electricity costs as well as available government support, vary between countries and even at a regional level. Data-informed decision-making starts by understanding the regulatory and economic variables for fleet electrification and pairing those with your own fleet data to create the most accurate electrification blueprint.

> **We’re in the middle of a transformative shift for the industry. The technology is accelerating by leaps and bounds, meaning EVs can do the job in more applications each year. There’s also global collaboration to accelerate the shift to zero-emissions. The road to an EV future is only getting started and I am excited for what lies ahead.**

Charlotte Argue

Senior Manager, Sustainable Mobility, Geotab

Once fleets adopt EVs, their operating behaviours provide an early glimpse into the opportunities and challenges that fleets face in practicality. Charging behaviours, in particular with regards to the number of locations and the time of charging, are largely aligning with those fleet vocations that are more suitable for electrification today. How often and how much they charge their vehicles point to fleets being more conservative in their EV deployment, leaving potential to increase EV utilisation and improve ROI. Fleet operators can likely do more with their current EVs and should look to use good fleet practices to maximise their operations. Route and vehicle optimisation, asset utilisation and rightsizing help match their existing vehicle's capability with the need of the job at hand, while also helping inform future procurement decisions.

With data on your side, and the learnings of early adopters to make your journey more certain, there's really nothing stopping you from moving your fleet towards an electric future.

To begin your EV adoption journey, Geotab has a number of resources available to you. Visit our **Fleet Electrification Knowledge Center** for a curation of research, real-world fleet success stories and educational resources in one convenient location. From there, download our related **ebook**, a step-by-step guide covering the full fleet electrification journey.

If you're ready to take the next step in your sustainability journey, discover how Geotab can help you take the complexity out of electrifying your fleet by visiting **geotab.com/uk/ev**

Methodology

The studies analysed de-identified, aggregated data from Geotab's connected vehicle platform between the dates of 1 June, 2022 - 31 May, 2023 in accordance with Geotab's privacy policies.

Section 1: Potential fleet electrification for light-duty vehicles

This section analysed the driving patterns of light-duty ICE vehicles driven in North America and Europe over a one-year period, in order to identify vehicles that could be replaced with a battery electric vehicle. The study did not consider plug-in hybrid electric vehicles (PHEVs). The study assumed that vehicles were in service for seven years, unless stated otherwise, and were purchased, not leased. A vehicle was assigned a vocational profile by analysing the most common driving pattern over the time period. Any currency conversions used an exchange rate average from 1 May, 2022 - 30 April, 2023.

EVs were considered range capable if they could meet the vehicle's daily driving distance on a single charge each driving day over the one-year period, and had at least 15 miles of range left at the end of the day. We discounted 2% of trips that would represent outliers outside of the standard usage.

For an EV to be considered EV suitable, it needed to be considered range capable and have a total cost of ownership that was equal to or lower than that of a comparable new ICE vehicle replacement. Total cost of ownership includes the local cost of procurement and maintenance as well as the local fuel and energy costs as at July 2023, but excluded resale value. Capital cost of infrastructure was not included.

Estimated avoided emissions are solely tailpipe emissions and do not account for emissions generated through energy production or vehicle manufacturing. Emissions calculations are based on the emissions factor of 2.29 kg of CO_2 per litre of petrol. The **U.S. EPA Greenhouse Gas Equivalencies** online calculator was used to compare the aggregate reduction of CO_2 across all EV suitable vehicles to the amount of carbon sequestered by a forested area.

Section 2: Charging behaviour of early adopter fleets

Focusing on battery electric vehicles, this section examined driving and charging data from passenger cars through to light-, medium- and heavy-duty vehicles (classes 1-8) in North America and Europe, excluding rental vehicles. All times are based on the vehicle's local time. The study defined a charging location as those areas where a charge session occurred. In order to distinguish charging locations from one another, we utilised Geohash 5, equivalent to a 9 square mile area, meaning that any session occurring in that area would be considered to be part of a single charging location.

Charging sessions were identified by AC, which groups Level 1 and Level 2 together, or DC charging using Geotab's onboard telematics devices. A charge session would be counted if it lasted longer than 1 minute. Charging hours were based on whether a charging session, either AC or DC, occurred at any point during that hour. As a result, a charge session may be counted towards several charging hours depending on when the charge session began and ended. A vehicle was assigned a vocational profile by analysing the most common driving pattern over the time period.

Vocation details

Geotab has a patented machine-learning algorithm which is used to determine the purpose or job (vocations) of the vehicles from which we collect data. Vocations are classified as follows:

Vocation	Description	Examples
Door-to-Door	• The vehicle makes significantly more stops than most per work day but also tends to spend very little time per stop.	• Last-mile delivery • Waste collection
Hub-and-Spoke	• The vehicle spends many of its work days making multiple round trips from a singular location (a centralised hub). • Typically the vehicle would average over one round trip per working day, with round trips accounting for the majority of its total mileage.	• On-demand services or delivery • Suppliers
Local	• The vehicle's range of activity is below 150-air-miles thus qualifies for the short-haul exemption under Hours of Service Regulations. • In addition, the vehicle does not exhibit behaviour in line with other vocations such as Door-to-Door or Hub-and-Spoke.	• HVAC • Beverage distribution
Regional	• The vehicle has a wide range of activity, over the 150-mile threshold for short-haul exemption, but tends to rest in the same location often. • The vehicle is also neither Door-to-Door nor Hub-and-Spoke.	• Building supplies • Fuel carrier
Long Distance	• The vehicle has a very large range of activity and typically does not rest in the same location. • The vehicle is also neither Door-to-Door nor Hub-and-Spoke.	• Freight trucking • Rental or company vehicles

About Geotab

Geotab is a global leader in connected transportation solutions. We provide telematics — vehicle and asset tracking — solutions to over 50,000 customers in 160 countries. For more than 20 years, we have invested in ground-breaking data research and innovation to enable partners and customers, including Fortune 500 and public sector organisations, to transform their fleets and operations. With over 4 million subscriptions and processing more than 75 billion data points a day, we help customers make better decisions, increase productivity, have safer fleets, and achieve their sustainability goals. Geotab's open platform and Marketplace, offers hundreds of third-party solution options. Backed by a team of industry leading data scientists and AI experts, Geotab is unlocking the power of data to understand real-time and predictive analytics — solving for today's challenges and tomorrow's world.

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