World Electric Vehicle Journal

Article

The Potential of Light Electric Vehicles to Substitute Car Trips in Commercial Transport in Germany

Robert Seiffert [1,*], Mascha Brost [2] and Laura Gebhardt [1]

[1] Institute of Transport Research, German Aerospace Center (DLR), Rudower Chaussee 7, 12489 Berlin, Germany
[2] Institute of Vehicle Concepts, German Aerospace Center (DLR), Pfaffenwaldring 38-40, 70569 Stuttgart, Germany
* Correspondence: robert.seiffert@dlr.de

Abstract

Achieving climate protection goals in the transport sector requires the adoption of innovative mobility solutions and new vehicle concepts. In Germany, commercial transport accounts for one-quarter of the total car mileage. Many of these trips are comparatively short, often involve a single passenger, and require the transport of only small or lightweight goods—yet they are typically carried out by car. Substituting cars with small and light electric vehicles (LEVs) wherever feasible could make commercial transport more efficient and environmentally friendly. LEVs combine a favorable weight-to-payload ratio with the high efficiency of electric drivetrains. This study estimates the share of car trips in commercial transport in Germany that could theoretically be substituted by LEVs. The analysis is based on a comparison of trip characteristics from a national travel survey with the technical capabilities of selected LEV categories. Our results indicate that up to 73% of commercial car trips and 44% of mileage could theoretically be covered by LEVs, with particularly high potential for trips in commercial passenger transport. Although limitations in range and payload restrict the universal applicability of LEVs, the findings reveal substantial opportunities to make commercial transport cleaner and more sustainable. These insights highlight the relevance of LEVs for sustainable commercial transport and offer a data-driven basis for further discussion of their potential and for guiding targeted policy and planning.

Keywords: LEV; micro-mobility; commercial transport; car trip substitution; potential analysis

Academic Editor: Michael Fowler

Received: 11 July 2025
Revised: 29 August 2025
Accepted: 6 September 2025
Published: 23 September 2025

Citation: Seiffert, R.; Brost, M.; Gebhardt, L. The Potential of Light Electric Vehicles to Substitute Car Trips in Commercial Transport in Germany. *World Electr. Veh. J.* **2025**, *16*, 547. https://doi.org/10.3390/wevj16100547

1. Introduction

Approximately one-fifth of the emissions in Germany originate from the transport sector, with road transport accounting for more than 90% [1]. Although private transport dominates road traffic, commercial transport also makes a significant contribution, accounting for around 27% of the total mileage driven [2], and it must therefore be considered in efforts to effectively reduce greenhouse gas emissions from road transport. Commercial transport in Germany is predominantly conducted using cars and light commercial vehicles [2]. It includes not only freight transport but also (to an even larger extent) commercial passenger transport [3,4]. That is, all trips made in the course of a profession (e.g., craftsmen, doctors, nursing staff, lawyers, and salespeople), including longer business trips. Many trips in commercial transport are rather short, shorter on average than those in passenger transport [2], and often involve only a single passenger and the transport of a few and relatively small goods [5,6]. However, these trips are typically made using cars: cars account for approximately 60% of all commercial trips, while light trucks with a payload of up to 3.5 tons account for a further 26%. Heavy-duty trucks account for only approximately 7% of commercial trips [2]. Regarding mileage, cars represent around 62% and light trucks around 17% of the total distance traveled in commercial transport, while heavy-duty trucks account for around 18% of the traveled kilometers.

Against this background, and in light of increasing urbanization and the associated traffic and environmental challenges, the question arises as to what extent commercial trips could also be covered by smaller and more efficient vehicles, such as light electric vehicles (LEVs). This consideration is particularly relevant for cars and light commercial vehicles, whereas heavy-duty vehicles are excluded due to the limited transport capacities of LEVs.

LEVs are a relatively new category of vehicles that are gaining increasing importance. These vehicles are characterized by a favorable ratio of vehicle weight to payload and are electrically powered, making them a more efficient and environmentally friendly option than conventional cars [7]. For this study, LEVs are defined as vehicles that are electrically powered, have a low vehicle weight, and can be used for the transport of goods and/or people. This includes electric (cargo) bikes, small electric transporters, and electric micro-cars. All vehicles considered in this study belong to class L in accordance with EU Regulation 168/2013 or are classified as bicycles and are therefore positioned lower than the passenger car or van classes regarding size and weight, for example. These vehicles offer an efficient and environmentally friendly alternative to conventional cars and light trucks. Particularly compared with internal combustion engine vehicles but also compared with conventional electric vehicles, they offer several advantages due to their compact and lightweight design, electric drive with low energy consumption, small batteries, and low production-related emissions.

Against this background, this study aims to estimate the number of car trips in commercial transport in Germany that could theoretically be conducted by LEVs. By quantifying the application potential of LEVs, this study aims to enhance the understanding of LEVs' potential contribution to a cleaner and more efficient commercial transport and provide a basis for further discussion. Focusing on a rather technical potential, the analysis is based on a comparison of vehicle characteristics—such as range, transport capacity, and speed—with trip data from commercial transport to assess the suitability of LEVs. The analysis draws on representative data on car usage in commercial transport in Germany from the KiD 2010 survey (Kraftfahrzeugverkehr in Deutschland).

The following section provides a short overview of the state of research (Section 2). Section 3 introduces the general approach for the estimation of the substitution potential, the data basis KiD 2010, and data preparation, as well as the selection of LEV categories and trip substitution criteria considered in this study. The results of the analyses are presented in Section 4 and discussed with regard to their realization (Section 5). The article concludes with a summary (Section 6).

2. State of Research

Previous studies and projects have demonstrated that LEVs can be successfully employed in commercial transport. For example, cargo bikes are already used in various business sectors, particularly in logistics, but also in crafts and service businesses. Gruber et al. [8] provide an overview of various application fields with several examples and a strong focus on Germany. They categorize existing cargo bike applications into four groups: logistics (e.g., professional couriers, express and parcel service providers (CEPs), and micro, regional, and self-employed logistics), services (such as traditional crafts, other service sectors, and community services), company-internal transport, and other applications.

For micro-cars and micro-vans, no comprehensive overview exists to date. However, numerous examples of companies testing their application can be found, for instance, as delivery vehicles [9–13], for municipal services [14–17], for nursing services [18–20], and for other services [21–25]. These real-world examples demonstrate that LEVs can be a practical alternative to conventional cars and light commercial vehicles in certain use cases.

Several studies have explored the application potential of LEVs in Germany. An overview of related regulatory and technical aspects, as well as market insights and possible use cases, was provided by Brost et al. [26]. A study by Eisenmann et al. [27] used the German National Travel Survey MiD 2017 (Mobilität in Deutschland) to estimate the general application potential of LEVs for daily trips in Germany. The authors divided the results into personal and commercial transport and estimated the general potential for LEV use on 34–56% of trips and roughly 10% of all traveled kilometers in commercial transport. Although the study applied a similar approach—comparing trip characteristics with the capabilities of various LEV models—its results are not directly comparable, as it focused on the general application potential rather than car substitution.

Following the approach of Eisenmann et al. [27], further studies were conducted to estimate the substitution potential of e-scooters [28] and LEVs in general [7,29] for private passenger car trips in Germany. The latter also included an estimation of potential emission savings [30]. The results showed that up to 50% of car mileage could be covered by LEVs, and emissions could be reduced by about 44%. Both studies used the MiD 2017 dataset but placed a strong focus on private individual mobility, while commercial transport was not covered comprehensively.

The substitution potential of LEVs for cars in commercial transport in Germany has hardly been studied so far. Gruber and Rudolph [31] estimated the substitution potentials of cargo bikes for cars in commercial transport. They assessed various scenarios, resulting in a substitution potential ranging from 8 to 22% for trips and 0.8 to 3.6% for mileage. Although their analysis used the same dataset as this study (KiD 2010), the results are not directly comparable, as they focused only on a subset of trips. Additionally, their approach considered single trips in isolation, without accounting for dependencies between trips in the context of trip chains. Furthermore, the transport weight limits for cargo bikes in their study reflect the state of technology at the time (maximum 50 kg). Modern cargo bikes, however, can carry significantly more. For instance, models such as the ONO heavy cargo bike and Radkutsche Musketier can transport 150 kg or more and are even capable of carrying standard Euro-pallets [32,33].

In contrast to previous studies on the application potential of LEVs in Germany, our study specifically focuses on the substitutability of car trips in commercial transport, while taking into account current technical capabilities of various LEV categories—from e-pedelecs and cargo bikes to micro-cars and micro-vans. By assessing substitutability at the level of round trips, the analysis ensures that a critical factor—the range of LEVs compared with conventional cars—is appropriately addressed.

3. Methodological Approach and Data Basis

To estimate how many car trips in commercial transport in Germany could be covered by LEVs, the characteristics of real trip data were compared with the capabilities of selected LEV categories. Trip data were obtained from KiD 2010 (Kraftfahrzeugverkehr in Deutschland)—specifically, trips made by cars, light trucks, and motorcycles in commercial transport. Heavy-duty vehicles were not considered due to the limited transport capacities of LEVs.

For this analysis, cars, light trucks, and motorcycles are collectively referred to as “cars”. Since car trips are typically not undertaken in isolation but rather as part of trip chains, trips were assigned to trip chains in advance. This approach ensured that constraints, such as vehicle range, were adequately considered. If any single trip within a trip chain could not be substituted by an LEV, all trips in that trip chain were classified as non-substitutable.

The methodological framework is further explained step by step in the following sections. Section 3.1 describes the trip data and data preparation, Section 3.2 introduces the selected LEV categories, Section 3.3 outlines the substitution criteria, and Section 3.4 demonstrates the substitution process with an illustrative example.

3.1. Trip Data Basis and Data Preparation

Germany has a comprehensive national travel survey focused on commercial transport: the KiD (Kraftfahrzeugverkehr in Deutschland). Conducted in 2002 and 2010, the KiD aims to provide a representative assessment of mobility behavior in Germany, with a strong emphasis on commercial transport [2]. The survey delivers key figures at both national and regional levels, serving as an important resource for policymaking, planning, and research. For this study, the KiD 2010 was used as the database. The survey focused on a nationwide study of motor vehicle owners, specifically examining the use of their vehicles, with particular emphasis on cars owned by commercial entities and trucks with a payload of up to 3.5 tons [2]. In total, the resulting dataset contains information on 117,377 trips conducted by 70,249 vehicles [2]. The dataset also includes extrapolation factors that are used to project a total annual car traffic volume of 41.98 billion trips and an annual traffic performance of 587.2 billion vehicle kilometers in 2010 (Table 1). Commercial transport accounts for approximately 35% of all trips and 27% of total vehicle kilometers. About 85% of these commercial trips and 79% of commercial vehicle kilometers are conducted by cars, trucks up to a 3.5 t payload, and motorcycles—which is the target population for this study.

Table 1. Description of the KiD 2010 dataset and target population (own calculations and [2]).

Population	Surveyed Trips	Annual Trips (in Million)	Annual Mileage (in Million km)
Total	117,377	41,510	587,220
Commercial transport	85,624	14,493	158,223
Cars, light trucks, and motorcycles	69,385	12,373	124,829
After allocation to commercial round trips	76,038	13,229	143,530

The KiD 2010 dataset consists of individual car trips. Since car trips are rarely made independently of each other in practice, but almost always as part of trip chains (e.g., a trip from home to work and back constitutes a trip chain with two trips), the trips were allocated to trip chains. Most of these trip chains start and end at the same location (e.g., at the company or at home), which is why we refer to them as round trips. These round trips serve as the base for the analysis, i.e., if any single trip within a round trip cannot be substituted, all other trips within that specific round trip are also considered non-substitutable. This approach takes into account that, for a realistic potential estimation, the technical requirements for LEVs have to be met by all trips of the given round trip. For instance, an LEV has to be able to cover the whole range of a round trip to substitute a car in this specific situation. Or if there are two persons transported on a single trip within a round trip, an LEV has to have two seats minimum to substitute the whole round trip.

When analyzing trip data at the round-trip level in the KiD 2010 dataset, one issue arose: round trips often consist not only of commercial trips or private trips but of a mix of both purposes. In many cases of commercial round trips, trips to and from work were classified as private, even though these trips were made before or after commercial trips and with the same (company) car. Therefore, it was necessary to determine how to handle these types of trips. Since the same vehicle was used for all trips in these cases, excluding single trips from the analysis would prevent an accurate assessment of the range an LEV would need to cover to substitute a car on the associated round trip. Therefore, trips to and from work that precede or follow commercial trips and were conducted with the same car were considered part of the commercial round trip. For example, this applies if a person drives to work or to the first job site of the day using a company car and drives home with it after work or uses a private car for commercial purposes.

In total, about 7500 trips labeled as private (about 10% of the commercial trip data) were used as part of commercial round trips and included in the analysis. The resulting dataset contained 76,038 surveyed trips, which were representative of 13.3 billion annual trips and 144 billion vehicle kilometers in Germany (see Table 1).

3.2. Vehicle Dataset of Exemplary LEVs

For this study, 10 LEV categories formed the basis for estimating the potential of LEVs to substitute cars, covering a range from very small vehicles, such as EPACs, up to comparably large LEVs, such as micro-vans. Table 2 shows the chosen categories with relevant parameters.

Table 2. Characteristics of the considered LEVs.

Category	Model	Manufacturer	Max. Speed of Model in km/h	Technical Electr. Range (nomin.) in km	Comment	Payload Capacity—Weight in kg	Payload Capacity—Volume in L
EPAC	Nuride Hybrid Pro 750 Allroad	Cube (GER)	25	70–180	Battery swappable	25 on pannier rack	-
Speed Bike	X Alpha 45	Klever (GER)	45	45–300	Battery swappable	25 on pannier rack	-
Moped	NOVI delivery D 1500	Emco (GER)	45	130	Battery swappable	70	155
Cargo Bike S	eBullitt EP8	Larry vs. Harry (DK)	25	110	Battery swappable, in eco mode	100	160
Cargo Bike XL	ONO	ONOMOTION (GER)	25	60	2 batteries, swappable	200	2000
Cargo Trike	DXP	Kyburz (CH)	45	30–100	-	Front: 30 Rear: 90	> 300
Micro-Van 45	E-Truck	Aixam (FRA)	45	130	-	327	2800
Micro-Van 80	Ari 458 Pickup L with Box	Ari (GER)	80	120–495	Long range with LiFePO$_4$ battery	531–648	2050
Micro-Car 45	Zeromax 45	Tazzari (IT)	45	216	Big batt., WMTC	n.a.	240/400
Micro-Car 90	Microlino	Micro Mobility Systems (CH)	90	93/177/228	Various battery config.	n.a.	230

Data source: Manufacturer information [32,34–47].

For each category, the technical parameters of an exemplary LEV series model were used as a basis to derive trip substitution criteria (see Table 3). The exemplary models were selected by conducting a market analysis, in which different LEV categories, such as electrically power-assisted cycles (EPACs), cargo bikes, and micro-vans, were examined. The analysis was limited to series models, ensuring realistic, currently available vehicle properties for the analysis. The technical characteristics of the selected models were compared within each vehicle category, and differences as well as overlaps between the categories were also analyzed. The goal of these analyses was to (a) cover a broad range of characteristics and capabilities, thereby addressing various use cases to identify maximum trip substitution potential; (b) capture the heterogeneity in LEV categories and models; (c) limit the number of modeled categories and, thus, the modeling effort; and (d) select models with low expected CO_{2eq} emissions, for example, models with a battery capacity sufficient for a required range, but not much higher.

Table 3. Trip substitution criteria. Maximum values for trip substitution.

Category	Round-Trip Length * (in km)	Single-Trip Length (in km)	Number of Passengers	Transport Capacity: Weight (in kg)	Transport Capacity: Category of Goods	Street Category
EPAC	100 **	15	1	5	“Other goods”	Excl. highway
Speed Bike	120 **	25	1	5	“Other goods”	Excl. highway
Moped	120 **	30	1	20	“Other goods”	Excl. highway
Cargo Bike S	80 **	15	1	50	“Other goods”	Excl. highway
Cargo Bike XL	60 **	15	1	150	All, excl. bulked goods, containers, and vehicles	Excl. highway
Cargo Trike	70	30	1	120	“Other goods”	Excl. highway
Micro-Van 45	70	30	2	240	All, excl. bulked goods, containers, and vehicles	Excl. highway
Micro-Van 80	200	100	2	500	All, excl. bulked goods, containers, and vehicles	All
Micro-Car 45	120	30	2	50	“Other goods”	Excl. highway
Micro-Car 90	140	70	2	50	“Other goods”	All

* The round-trip length describes a distance that is considered well rideable using a respective LEV, based on the literature and expert assessments. It is shorter than the technical electric range provided by the installed battery, or **, if required, considers battery swapping.

To model trip substitution potential, each category was represented by an exemplary vehicle; see Table 2. Regarding the electric range, it should be noted that the specified range depends on many conditions and that manufacturers handle the method of determining the range differently. Factors influencing the range are, for example, the speed profile, support level for bike-like vehicles (e.g., Eco, Tour, or Max), topography, payload, and battery characteristics (e.g., temperature or age). For the analyses of the trip substitution potential, we used reduced ranges instead of the nominal technical range to take into account these uncertainties, as well as a plausible use of vehicles; see columns “Technical electr. Range” in Table 2 and “Round-Trip Length” in Table 3. If available, we considered the option of battery swapping for some vehicles.

3.3. Substitution Criteria

Table 3 presents the substitution criteria and corresponding parameters for each LEV category, as derived from Table 3. The criteria are explained in detail below, providing a comprehensive overview of the substitution process.

Range: Round-trip length and Single-trip length

Considering the substitution potential of LEVs for cars, their range is an important criterion regarding technical feasibility. Therefore, round-trip length was considered in the potential analysis. Note that since the analysis considered the substitution of car trips rather than cars, the daily mileage was not considered in this analysis. Given that vehicle range depends on various factors and that manufacturers' specifications are based on differing boundary conditions, we selected conservative range estimates—below those stated by the manufacturers—as criteria for the analysis. Where technically feasible, battery swapping was also considered as an option for the respective vehicle. We also considered a plausible use of vehicles. For example, EPACs usually have ranges of over 100 km, but we did not assume that such a distance would be covered by EPACs in commercial transport, as, for example, their speed does not allow for time-efficient transportation.

The trip length of single trips within a round trip was also considered as relevant, since, especially for (cargo) bikes, a certain technical range does not mean that this distance can be driven realistically at once. Therefore, limits for plausible single-trip lengths were set and used for the analysis.

Number of seats: Passengers and trip purpose

The special feature of LEVs is that they are smaller than cars. Therefore, seats for passengers are limited. Most of the categories considered here provided only space for one or two people. To consider this, another criterion was the number of passengers transported on a car round trip. Additionally, the trip purpose "passenger transport" was also excluded for LEV categories with just one seat.

Transport Capacity: Weight and Volume

Transport capacity plays an important role in comparing LEVs and cars, as LEVs are generally smaller and have a lower payload. Therefore, both the weight and volume of transported goods were considered in the estimation. The KiD 2010 dataset includes information on the weight of transported goods for each individual trip. However, since exact volume data were not available, the category of goods was used as a proxy for volume, as it is available for each trip.

Eight categories of goods were available: bulk goods, containers, vehicles, pallets, bundled goods, and general cargo. All other goods were classified under the "other goods" category, presumably smaller and loose goods without a specific cargo form [5]. Since most of the LEV categories considered have a rather low transport capacity, only goods of the "other goods" category were allowed for all LEV categories except for micro-vans and cargo bike XLs. As both LEV categories have a significantly higher transport capacity (see Table 2), pallets, general cargo, and bundled goods were also allowed for these vehicles.

Despite providing comprehensive and detailed information about car trips in Germany, there is a partly specific lack of information for transport weight and category of goods in the dataset: 7% of the considered commercial trips were without any information about transported weight, and 4% were without any information about the category of transported goods, the latter being almost exclusively a subset of the former.

Due to the approach used, missing information can lead to car trips not being excluded from substitution and, therefore, the overall potential being distorted upwards. To evaluate the impact of trips without transport weight information, an additional scenario was calculated in which all such trips were deemed non-substitutable. The results indicate only a minor effect, showing that in total 1.5–5% of substitutable round trips result from trips without weight/goods category information, or 2.5–5% of substitutable trips and 0.5–3% of the substitutable vehicle mileage. These findings were also included and described in more detail in the Section 4.

Street category: Highway trips

Driving on highways is not allowed with most LEV categories. Therefore, such trips were also excluded for most LEV categories (e.g., cargo bikes). Highway trips could be avoided by taking detours, but this could lead to significantly longer round trips, which would contradict the consideration of round-trip length and range.

Since the road category used for a single trip was not available in the dataset, it was anticipated by using the average speed on the single trips belonging to a round trip; i.e., if the average speed on a trip exceeded 80 km/h, it was considered as a highway trip, and substitution by certain LEV categories was therefore not possible.

3.4. Determining the Substitution Potential

The car trip data from KiD 2010 were taken and analyzed by comparing the described characteristics of individual trips with the technical capabilities of the selected LEV categories (Table 3). The procedure is illustrated in Table 4, using the cargo bike S category as an example. In this case, all trip characteristics could be met except for transport weight, which exceeded the cargo bike's capacity. Consequently, this trip was classified as non-substitutable by a cargo bike S. The same procedure was applied to each LEV category.

Table 4. Exemplary comparison of trip characteristics with LEV capabilities, illustrated for the cargo bike S category.

Criteria	Exemplary Trip	LEV Category: Cargo Bike S	Check
Round trip length (in km)	20	Max. 80	√
Single trip length (in km)	10	Max. 15	√
Number of passengers	1	Max. 1	√
Transport capacity: Weight (in kg)	100	Max. 50	X
Transport capacity: Category of goods	"Other goods"	"Other goods"	√
Street category	No highway use	Excl. highway	√

Since car trips are typically not undertaken in isolation but rather as part of trip chains, a consistent approach was applied. If any single trip within a round trip did not meet the criteria, all trips in that round trip were considered non-substitutable.

Finally, the trips deemed substitutable by LEVs were aggregated to determine the substitution potential of each LEV category, as well as the overall potential for round trips, trips, and mileage that could be covered by any LEV category.

4. Results

4.1. Distribution of Round-Trip Lengths

Round trips are trip chains that start and end at the same location (e.g., the company location or home). The approximately 13.3 billion commercial trips made by cars can be allocated to a total of around 1.7 billion round trips. A round trip, therefore, consists of seven trips on average. Figure 1 illustrates the length distribution of the round trips. Approximately one-third of all car round trips are no longer than 20 km. Half of all round trips do not exceed 40 km, and roughly three-quarters are within 100 km.

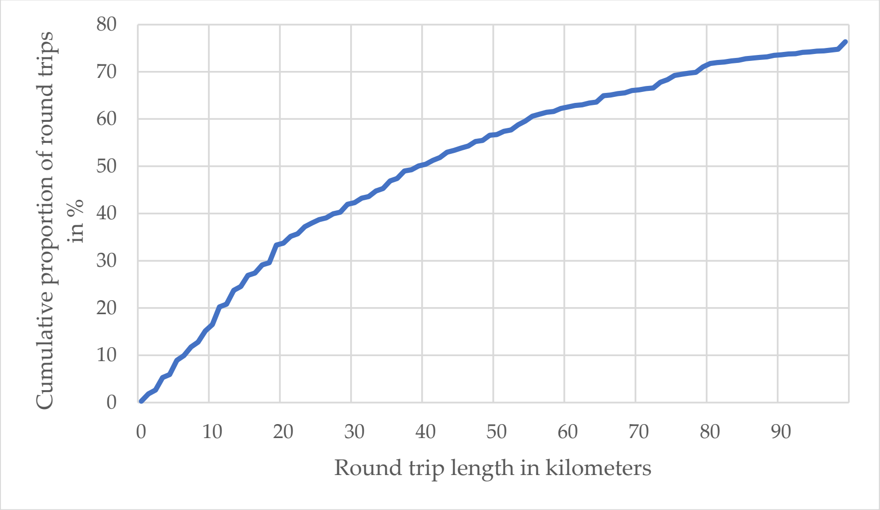

Figure 1. Distribution of car round-trip lengths up to 100 km.

Since the range of electric vehicles is often regarded as an important factor in comparison with internal combustion cars, it is noteworthy that a large proportion of commercial round trips do not require vehicles with a particularly high range. Consequently, it can be concluded that, regarding range, LEVs appear to be a feasible option for substituting a significant number of commercial car trips.

4.2. Substitution Potentials

Based on the depicted methodological approach, the following substitution potentials of LEVs for passenger cars in commercial transport in Germany are presented, as illustrated in Figure 2. The substitution potentials are shown as follows:

- The proportion of substitutable round trips, because it forms the basis of the calculations;
- The proportion of substitutable trips, because the traffic volume (trips) is a central parameter in transport research and planning;
- The proportion of substitutable mileage, because traffic performance is also a key parameter that is crucial for estimating, for example, emission reduction potential.

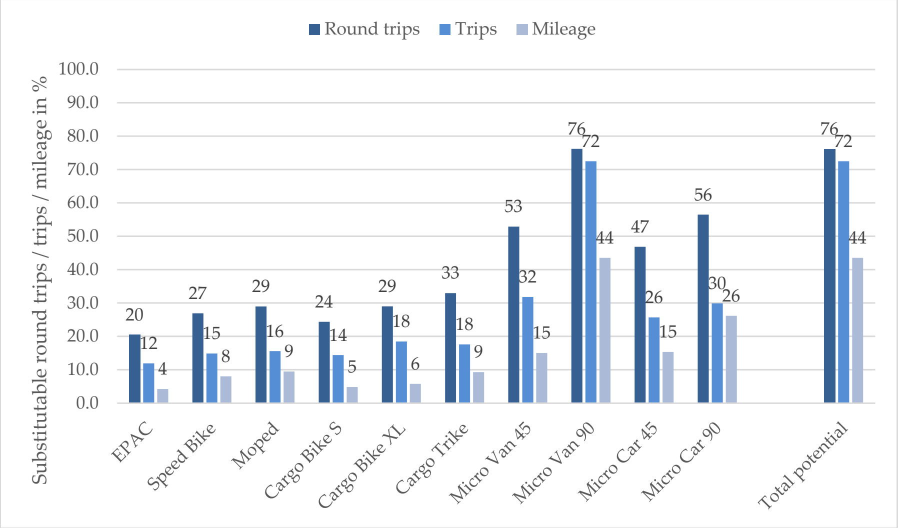

Figure 2. Proportion of substitutable car round trips, trips, and mileage.

Round trips

Out of approximately 1.7 billion round trips, around 76% can potentially be substituted by LEVs, as shown in Figure 2. This potential is primarily driven by the Micro-Van-90, which alone could substitute 76% of these trips. Additionally, other micro-cars and micro-vans provide a significant potential of roughly half of all round trips. Even two-wheelers and cargo bikes/trikes can substitute roughly 20–33% of all round trips.

As mentioned in Section 3.3, an additional scenario was calculated to evaluate the impact of trips without transport weight/goods category information. The results show that for two-wheelers and cargo bikes/trikes, 1.5–3% of substitutable round trips lack transport weight data. For micro-vans, the proportion is 4–5%, while the overall potential is affected by 5%.

Trips

Regarding single trips and traffic volume, a similar picture emerges. Out of approximately 13.3 billion annual car trips, 72% can potentially be substituted by LEVs, as shown in Figure 2. The Micro-Van-90 demonstrates a particularly strong influence, capable of substituting 72% of all car trips, while other micro-cars and micro-vans can substitute between 26 and 32% of trips. Although the potential for two-wheelers and cargo bikes/trikes to substitute traffic volume is smaller, they still offer a significant substitution of car trips, ranging from 12 to 18%.

Of the substitutable car trips, 2.5–3% are trips without transport weight information for two-wheelers and cargo bikes/trikes. For micro-cars and micro-vans, this proportion is 4–5%, while the overall potential is impacted by 5%.

Mileage

Due to the limited range of LEVs compared with cars, the total substitution potential regarding traffic performance is lower. In total, 44% of all car mileage could be covered by LEVs (Figure 2). As with round trips and trips, this potential is largely driven by the Micro-Van-90. That said, the Micro-Car-90 could also substitute cars on 26% of all driven kilometers. In general, micro-cars and micro-vans have a potential of at least 15%, while two-wheelers and cargo bikes/trikes could substitute between 4 and 10% of all kilometers.

Of the substitutable car mileage, 0.5–1.5% is attributed to trips without transport weight information for two-wheelers and cargo bikes/trikes. For micro-vans, this proportion rises to 2–3%, while the overall potential is impacted by 3%.

4.3. Substitution Potential by Trip Purpose

As mentioned in Section 1, a significant portion of commercial transport in Germany consists of commercial passenger transport. This particularly applies to cars and light trucks used in commercial transport. Figure 3 illustrates the distribution of mileage for cars and light trucks used in commercial transport across various purposes (blue bar), along with the corresponding mileage that can be substituted by LEVs (light-blue bar).

Only 16% of all trips are dedicated to the pure transport of goods, and 9% are used for passenger transport—trips that, due to their characteristics (e.g., high transport weights or transport of multiple passengers), are challenging for LEVs. However, more than half are commercial passenger transport trips (i.e., trips for the provision of professional services), while the remainder consists of other trips associated with business activities and outward/return trips.

About half of the commercial passenger transport and other business trips can potentially be substituted by LEVs. In contrast, the share is significantly lower for goods transport trips and passenger transport trips. Consequently, the majority of the substitution potential comes from commercial passenger transport and other business trips. In this subcategory of commercial transport, there is significant potential to substitute car trips with LEVs.

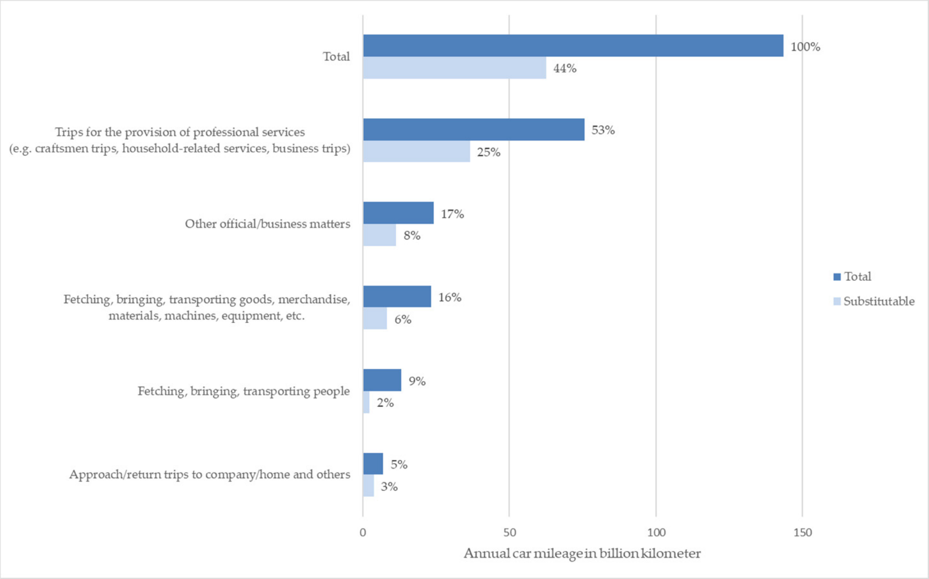

Figure 3. Distribution of mileage for cars and light trucks used in commercial transport across purposes and corresponding substitutable mileage.

5. Discussion

The starting point of this study was the observation that many trips in commercial transport are relatively short—on average, even shorter than those in passenger transport [2]. At the same time, recent studies have demonstrated the substitution potential of LEVs for car trips. In 2022, this was shown for passenger transport [7]. Therefore, this study explored the question of how great the potential of LEVs is to substitute cars on commercial transport trips in Germany. The results clearly indicate that there is indeed significant potential. Approximately 76% of all car round trips in commercial transport could alternatively be made by an LEV instead. Regarding transport volume, this corresponds to about 72% of all car trips and around 44% of car mileage driven for commercial purposes. Since the range of LEVs is limited compared with cars, substitution is primarily feasible for short round trips. However, the maximum substitution potential can only be achieved by the category Micro-Van-90, which is already quite similar to a common car. Nevertheless, even two-wheelers, cargo bikes, and cargo trikes can cover up to around 9% of car mileage, while micro-cars can cover up to 26%.

It is also noteworthy that while the substitution potential of different LEV categories might be comparable regarding the share of substitutable trips, each LEV category could suit different types of trips better. For example, a cargo bike XL has a higher load capacity, while a cargo trike is able to cover longer distances. According to our results, both categories can substitute a similar number of trips, but these would be trips of a different kind. As a result, the cargo trike has higher potential regarding substitutable mileage.

The results are not surprising regarding the distribution of round-trip lengths of cars in commercial transport in Germany, as shown in Figure 1. To a large extent, cars in commercial transport are used for rather short (round) trips. Additionally, these car trips are often conducted with a low occupancy rate and without transporting any goods [5]. It is also noteworthy that commercial transport consists, to a greater extent, of commercial passenger transport than of pure goods transport [3,4]. This is particularly true in the case of cars and light trucks, which were considered in this study (see also Section 4.3).

Comparing these theoretical potentials with practical numbers is hardly feasible, as concrete data on the number of LEVs used for business purposes in Germany and the extent of traveled mileage are not available. At least for cargo bikes, sales data have been available for several years, indicating a continuous increase, with more than 200,000 cargo bikes sold in 2022 [8,48]; however, these figures include both private and commercial use. According to an estimate by the Radlogistikverband Deutschland e.V., approximately 100,000 cargo bikes were in use for business purposes in 2023 [49]. However, as real-world examples in Section 2 show, cargo bikes and micro-cars/micro-vans are already used in various businesses. This study is a first attempt to quantify the theoretical potential of LEVs in commercial transport in Germany and may provide a foundation for discussion on where cars could potentially be substituted by LEVs.

Even if only part of this substitution potential was realized by covering internal combustion engine and conventional electric car mileage with lighter, more efficient vehicles, it could still make a significant contribution to cleaner and more efficient commercial transport. Beyond this broader perspective, the usage of LEVs instead of cars could particularly bring advantages for urban areas, where commercial transport is often regarded as a major contributor to the negative impacts of road transport [6,50]. According to various studies, commercial transport accounts for up to 30% of urban trips in European cities [51,52]. LEVs could contribute not only to improved air quality (reduction of GHG and other emissions) and reduced noise, but also, due to their comparatively small size, to a more efficient use of space, which is notoriously scarce in urban areas [53–55]. Land scarcity and conflicts over land use are increasingly pressing issues, which are expected to intensify further with ongoing urbanization.

For LEVs to be widely adopted and move beyond their current niche, both push and pull measures are needed. On the one hand, LEVs must be designed to meet users' needs. For commercial purposes, factors such as range, transport capacity, and technical reliability are particularly important for making LEVs a possible alternative to combustion engine vehicles in daily operations. However, aspects such as weather protection and the practical ease of everyday use for drivers also need to be taken into account. On the other hand, the existing transport system, which is still primarily geared toward car usage, including direct and indirect subsidies, must be adapted accordingly. Many cities around the world have introduced more car-restrictive policies in recent years, and further planning is still underway (e.g., limited traffic zones, altered traffic routing and one-way streets, reduction in parking spaces, and speed limits). Where car access to urban areas will be more restricted, costly, or even prohibited, LEVs could serve as an alternative for commercial transport trips. Vice versa, cities and communities could promote the adoption and dissemination of LEVs as an alternative to conventional cars through appropriate policies. Beyond the car-restrictive measures mentioned, dedicated infrastructure could improve operating conditions and make the use of LEVs safer, easier, and more attractive [29]. For instance, developing and expanding high-quality bicycle infrastructure, including dedicated parking areas, fosters not only private cycling but also the adoption of e-bikes and cargo bikes for commercial transport. Moreover, charging LEVs usually only requires a household socket and low charging power, which should be considered when developing new public charging infrastructure. Given their smaller size, differentiated parking fees or the provision of dedicated parking spaces should also be discussed [53,55]. At a broader policy level, targeted subsidy schemes can help offset the currently comparatively high costs of these innovative vehicles for companies and create incentives for their trial and adoption. In Germany, for instance, nationwide funding schemes supporting the acquisition of cargo bikes for commercial use have already been implemented in the past.

The limitations of this study emerge primarily from the dataset. Despite its unique scope and level of detail, the data source (KiD 2010) also has certain limitations.

The first limitation is its actuality: the data are representative of the year 2010, which dates back more than a decade. Structural changes in commercial transport since then are to be expected due to changes in fleet compositions and developments across different economic sectors. For instance, the rapid growth of e-commerce—a trend further accelerated by the COVID-19 pandemic—is likely to have reshaped trip patterns and increased the overall share of delivery traffic. These developments could imply even greater potential for LEVs, as they are associated with an increase in short last-mile deliveries. The already observable integration of cargo bikes and micro-cars/micro-vans in delivery fleets by professional logistic companies, as mentioned in Section 2, might support this assumption. Nevertheless, despite being collected in 2010, the KiD remains the most comprehensive and latest available dataset on commercial transport in Germany and continues to serve as a key source for analysis by authorities and researchers (see, for example, ref. [56]).

Second, even this comprehensive database lacks some information about important features used in this study. For around 7% of the analyzed trips, no information on transported weight is available; the same applies to 4% of trips regarding the category of transported goods. Nevertheless, the sensitivity analysis showed that the impact of these trips on the potential of the individual categories and the total potential is comparably small, and the results of the analysis are still robust. However, more studies that quantify the application potentials of LEVs in commercial transport would be helpful to obtain a more robust picture of their overall potential in this sector.

Considering the results of our analysis, it is important to note that these substitution potentials are rather theoretical in nature. The analysis conducted by using the described criteria (see Section 3.4) takes into account the technical feasibility of substituting cars with suitable LEVs regarding range, transport capability, and seating. However, this technical potential does not indicate the extent to which LEVs will actually be used in practice. Whether potential users choose to adopt LEVs instead of cars depends on additional, and often more decisive, factors, such as suitable application scenarios, economic considerations, technical reliability of vehicles, available infrastructure, convenience of use, and individual user acceptance. More research on these topics has to be conducted to identify promising application scenarios regarding different LEV categories as well as drivers and obstacles of implementation into daily commercial transport. Several studies on these aspects for cargo bikes already exist (see, for instance, refs. [8,31,50,57–59]), but research on other LEV categories beyond cargo bikes remains scarce.

In addition, data on LEV sales and their use in commercial transport—along with systematic overviews of current real-world applications (as already available to some extent for cargo bikes)—would help to contrast theoretical potentials with evidence from actual practice.

Building on the analysis presented in this article, future work could also explore which specific kind of car trips could be best substituted by which LEV models and assess the spatial distribution of substitution potentials. This would provide a deeper understanding of which specific trip patterns and regions offer the highest potential for substituting cars with LEVs. Moreover, a scenario could be explored in which the smallest suitable LEV is assigned to each substitutable car trip, followed by a calculation of corresponding emission savings.

6. Conclusions

Approximately one-fifth of the emissions in Germany originate from the transport sector, with road transport accounting for more than 90% [1]. Reducing these emissions requires not only technological advancements but also fundamental changes in both mobility behavior and vehicle concepts—this applies to passenger and commercial transport alike. While innovations such as more efficient drive systems contribute to relative emission reductions, they have not yet led to the necessary absolute reductions in Germany, as overall mileage continues to rise. Progress in vehicle efficiency alone will not be sufficient to meet climate protection targets unless the overall transport system is restructured. Key elements of this transformation include increasing transport efficiency, reducing transport demand, and shifting to more sustainable transport modes. LEVs, alongside other environmentally friendly alternatives, could play an important role in this shift.

This study demonstrates that based on technical parameters such as range, seating capacity, and payload, LEVs have significant potential to substitute current car trips in commercial transport. By substituting conventional cars, LEVs could contribute to making commercial transport more efficient and environmentally friendly.

However, the presented findings represent the theoretical potential for substituting cars with LEVs, derived from empirical car usage data. Whether and to what extent this potential can be realized in practice remains uncertain and depends on additional factors, such as suitable application scenarios, economic considerations, technical reliability of vehicles, available infrastructure, convenience of use, and individual user acceptance. Future research should focus on these factors and identify the necessary push and pull measures to successfully integrate LEVs into the transport sector and move them beyond their current niche.

Author Contributions: Conceptualization, R.S., L.G. and M.B.; methodology, R.S. and M.B.; formal analysis, R.S.; writing—original draft preparation, R.S. and L.G.; writing—review and editing, R.S., L.G. and M.B.; visualization, R.S.; supervision, L.G.; project administration, M.B.; funding acquisition, M.B. and L.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding, and the APC was funded by Deutsches Zentrum für Luft- und Raumfahrt (DLR).

Data Availability Statement: The data used in this study are available as Public Use Files (PUFs) from the German Federal Motor Transport Authority at https://www.kba.de/DE/Statistik/Forschungsdatenzentrum/Datenangebot/Kraftfahrzeugverkehr_in_Deutschland/kraftfahrzeugverkehr_in_deutschland_node.html (accessed on 29 August 2025). Scientific Use Files (SUFs) are available on request.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

LEV	light electric vehicle
CEP	Courier, Express, and Parcel Service Provider
EPAC	electrically power-assisted cycle

References

1. Bundesministerium für Wirtschaft und Klimaschutz (BMWK). *Klimaschutz in Zahlen: Aktuelle Emissionstrends und Klimaschutzmaßnahmen in Deutschland*, 2022 ed.; BMWK: Berlin, Germany, 2022. Available online: https://www.bmwk.de/Redaktion/DE/Publikationen/Klimaschutz/klimaschutz-in-zahlen.pdf?__blob=publicationFile&v=8 (accessed on 16 January 2023).
2. Wermuth, M.; Neef, C.; Wirth, R.; Hanitz, I.; Löhner, H.; Hautzinger, H.; Stock, W.; Pfeiffer, M.; Fuchs, M.; Lenz, B.; et al. *Kraftfahrzeugverkehr in Deutschland 2010 (KiD 2010): Ergebnisse im Überblick*; Ergebnisse der Bundesweiten Verkehrsbefragung: Braunschweig, Germany, 2012. Available online: https://www.kba.de/DE/Statistik/Forschungsdatenzentrum/Datenangebot/Kraftfahrzeugverkehr_in_Deutschland/downloads/download_kid_2010_ueberblicksbericht.pdf?__blob=publicationFile&v=2 (accessed on 5 September 2025).

3. Flämig, H. Wirtschaftsverkehr. In *Handwörterbuch der Stadt- und Raumentwicklung*, 2018 ed.; ARL Akademie für Raumforschung und Landesplanung, Ed.; Akademie für Raumforschung und Landesplanung: Hannover, Germany, 2018; pp. 2889–2899, ISBN 978-3-88838-559-9.
4. Wermuth, M. Personenwirtschaftsverkehr: Die empirische Analyse eines unterschätzten Teils des Straßenverkehrs. In *Handbuch Verkehrspolitik*; Schwedes, O., Canzler, W., Knie, A., Eds.; Springer Fachmedien Wiesbaden: Wiesbaden, Germany, 2016; pp. 295–322, ISBN 978-3-658-04692-7.
5. Wermuth, M.; Neef, C.; Wirth, R.; Hanitz, I.; Löhner, H.; Hautzinger, H.; Stock, W.; Pfeiffer, M.; Fuchs, M.; Lenz, B.; et al. Kraftfahrzeugverkehr in Deutschland 2010 (KiD 2010): Schlussbericht. 2012. Available online: https://www.kba.de/downloads/KiD2010-Schlussbericht.pdf (accessed on 5 September 2025).
6. Menge, J.; Horn, B. Fahrradnutzung im Wirtschaftsverkehr. In *HKV—Handbuch der Kommunalen Verkehrsplanung: Loseblattsammlung*; Becker, T., Blees, V., Deuster, J., Francke, A., Mietzsch, O., Nobis, C., Saary, K., Schwedes, O., Eds.; Wichmann Verlag: Berlin, Germany; Offenbach, Germany, 2014; p. 2.4.6.2, ISBN 978-3-87907-400-6.
7. Brost, M.; Gebhardt, L.; Ehrenberger, S.; Dasgupta, I.; Hahn, R. *The Potential of Light Electric Vehicles for Climate Protection through Substitution for Passenger Car Trips: Germany as a Case Study*; Final Report; German Aerospace Center: Berlin, Germany; Stuttgart, Germany, 2022. Available online: https://elib.dlr.de/186036/1/2022-03-15_LEV4Climate_DLR_report_1.1.pdf (accessed on 5 September 2025).
8. Gruber, J.; Plener, M.; Rudolph, C.; Seiffert, R. Gewerblicher Einsatz von Lastenrädern—Vielfalt der Nutzungsmöglichkeiten. In *Radlogistik*; Assmann, T., Bürklen, A., Gruber, J., Knese, D., Mayregger, P., Rudolph, C., Eds.; Springer Fachmedien Wiesbaden: Wiesbaden, Germany, 2024; pp. 67–88, ISBN 978-3-658-44448-8.
9. Goupil Deutschland. Goupil G4 Bringt in Spezialversion Lebensmittel an die Haustür. Available online: https://goupil.de/goupil-g4-bringt-in-spezialversion-lebensmittel-an-die-haustuer/ (accessed on 3 January 2025).
10. Reichel, J. Pin AG und Urban Cargo Liefern per Paxster Leicht und Elektrisch. Available online: https://logistra.de/news/nfz-fuhrpark-lagerlogistik-intralogistik-pin-ag-und-urban-cargo-liefern-paxster-leicht-und-elektrisch-72467.html (accessed on 3 January 2025).
11. I Love Sushi GmbH. Nachhaltigkeit—Unsere Elektroflotte. Available online: https://i-love-sushi.de/page/nachhaltigkeit (accessed on 3 January 2025).
12. ARI Motors GmbH. Fahrzeugkatalog und Informationen zur Förderung. Available online: https://www.begeca.de/assets/userfiles/pdf/ARI_Motors_Produktkatalog.pdf (accessed on 3 January 2025).
13. Metropolenjournal. Wie Betriebe in Baden-Württemberg von der Lieferung mit Elektro-Leichtfahrzeugen Profitieren: E-Mobilität im Liefergeschäft Kommt an. Available online: https://www.metropoljournal.com/lokales/baden-wuerttemberg2/19187-wie-betriebe-in-baden-w%C3%BCrttemberg-von-der-lieferung-mit-elektro-leichtfahrzeugen-profitieren (accessed on 3 January 2025).
14. Lang, P. Elektroauto mit Staubsauger zur Straßenreinigung: Renault Twizy Sammelt Hundekot ein. Available online: https://www.auto-motor-und-sport.de/ (accessed on 3 January 2025).
15. LOGISTRA. Fotostrecke: 22 Goupil G6 im Einsatz: Stadtreinigung Freiburg Fährt Elektrisch. Available online: https://logistra.de/galerien/fotostrecke-22-goupil-g6-im-einsatz-stadtreinigung-freiburg-faehrt-elektrisch-369144.html?galerie=0#galerie-anchor (accessed on 3 January 2025).
16. Stadt + Werk. Schnell, Spritzig, Sauber. Available online: https://www.stadt-und-werk.de/k21-meldungen/schnell-spritzig-sauber/ (accessed on 18 February 2025).
17. Steglitz-Zehlendorfer Zeitung. Grünflächenamt Steglitz Zehlendorf Fährt Künftig Elektromobil. Available online: https://www.steglitz-zehlendorf-zeitung.de/gruenflaechenamt-steglitz-zehlendorf-faehrt-kuenftig-elektromobil/ (accessed on 18 February 2025).
18. Osthessen-news.de. Erster Elektrifizierter Pflegedienst: R + R Nimmt Viertes E-Mobil in Die Flotte Auf. Available online: https://osthessen-news.de/n11493304/erster-elektrifizierter-pflegedienst-r-r-nimmt-viertes-e-mobil-in-die-flotte-auf.html (accessed on 17 January 2025).
19. ARI Motors GmbH. ARI 458 Pritsche als Erstes Elektroauto im Fuhrpark der Klinik Hohe Mark. Available online: https://www.ari-motors.com/magazin/referenzen/ari-458-pritsche-als-erstes-elektroauto-im-fuhrpark-der-klinik-hohe-mark (accessed on 17 January 2025).
20. Pflegedienst Bethel Bad Oyenhausen. Pflegedienst Nutzt E-Mobil. Available online: https://bethelnet.de/wp-content/uploads/2021/07/Pflegedienst_nutzt_E-Mobil_WB_29.04.2016.pdf (accessed on 17 January 2025).
21. ARI Motors GmbH. ARI 458 Pritsche L Mit Laubgitter Beim Haus der Bestattung in 19370 Parchim. Available online: https://www.ari-motors.com/magazin/referenzen/ari-458-pritsche-l-mit-laubgitter-beim-haus-der-bestattung-in-19370-parchim (accessed on 17 January 2025).
22. ARI Motors GmbH. Vier ARI 458 mit Individualaufbau im Van der Valk-Resort in 18292 Linstow. Available online: https://www.ari-motors.com/magazin/referenzen/vier-ari-458-mit-individualaufbau-im-van-der-valk-resort-in-18292-linstow (accessed on 17 January 2025).

23. ARI Motors GmbH. ARI 458 Kofferaufbau im Einsatz bei der Bayer AG in Frankfurt am Main. Available online: https://www.ari-motors.com/magazin/referenzen/ari-458-kofferaufbau-im-einnsatz-bei-bayer-ag (accessed on 17 January 2025).
24. Swiss International Airlines. Huge in the Air, Tiny on the Ground: SWISS Opts for Microlinos. Available online: https://www.swiss.com/magazine/en/inside-swiss/sustainability/microlino (accessed on 17 January 2025).
25. ARI Motors GmbH. ARI 458 Koffer als "Charmeur" im Einsatz bei Schornsteinfeger Mörs-Sauskojus in Oberhausen. Available online: https://www.ari-motors.com/magazin/referenzen/ari-458-koffer-als-charmeur-im-einsatz-bei-schornsteinfeger-moers-sauskojus-in-oberhausen (accessed on 17 January 2025).
26. Brost, M.; Ewert, A.; Schmid, S.; Eisenmann, C.; Gruber, J.; Klauenberg, J.; Stieler, S. *Elektrische Klein- und Leichtfahrzeuge: Chancen und Potenziale für Baden-Württemberg*; Landesagentur für neue Mobilitätslösungen und Automotive Baden-Württemberg: Stuttgart, Germany, 2019; Available online: https://www.e-mobilbw.de/fileadmin/media/e-mobilbw/Publikationen/Studien/LEV_e-mobil_BW_Leichtfahrzeug_Studie.pdf (accessed on 17 January 2025).
27. Eisenmann, C.; Gruber, J.; Brost, M.; Ewert, A.; Stieler, S.; Gicklhorn, K. Fields of Applications and Transport-Related Potentials of Small Electric Vehicles in Germany. In *Small Electric Vehicles*; Ewert, A., Schmid, S., Brost, M., Davies, H., Vinckx, L., Eds.; Springer International Publishing: Cham, Switzerland, 2021; pp. 127–140, ISBN 978-3-030-65842-7.
28. Gebhardt, L.; Wolf, C.; Seiffert, R. "I'll Take the E-Scooter Instead of My Car"—The Potential of E-Scooters as a Substitute for Car Trips in Germany. *Sustainability* **2021**, *13*, 7361. [CrossRef]
29. Gebhardt, L.; Brost, M.; Seiffert, R. What Potential Do Light Electric Vehicles Have to Reduce Car Trips? *Future Transp.* **2023**, *3*, 918–930. [CrossRef]
30. Ehrenberger, S.; Dasgupta, I.; Brost, M.; Gebhardt, L.; Seiffert, R. Potentials of Light Electric Vehicles for Climate Protection by Substituting Passenger Car Trips. *World Electr. Veh. J.* **2022**, *13*, 183. [CrossRef]
31. Gruber, J.; Rudolph, C. Untersuchung des Einsatzes von Fahrrädern im Wirtschaftsverkehr (WIV-RAD). 2016. Available online: https://elib.dlr.de/104273/ (accessed on 12 June 2023).
32. ONOMOTION GmbH. Die E-Cargo Bike Revolution. Available online: https://onomotion.com/wp-content/uploads/2021/05/2022-11-01_broschuere-komplett_DE.pdf (accessed on 12 June 2023).
33. Deutsches Zentrum für Luft- und Raumfahrt e.V. Ich Entlaste Städte 2: Radkutsche Musketier Muskebox. Available online: https://www.lastenradtest.de/testraeder/radkutsche-musketier-muskebox/ (accessed on 31 January 2025).
34. fahrrad.de. Cube Nuride Hybrid Pro 750Allroad. Available online: https://www.fahrrad-xxl.de/cube-nuride-hybrid-pro-750-allroad-m000080501 (accessed on 5 September 2025).
35. Klever Mobility Europe GmbH. Website Klever Mobility. Available online: https://klever-mobility.com/en/x-series/x-alpha-45 (accessed on 5 June 2024).
36. Emco Electroroller GmbH. Website Emco. Available online: https://www.emco-e-scooter.com/lieferroller-fuer-bringdienste (accessed on 5 June 2024).
37. Deutsches Zentrum für Luft- und Raumfahrt e.V. Ich Entlaste Städte 1: Larry vs Harry E-Bullitt. Available online: https://www.lastenradtest.de/testraeder/larry-vs-harry-steps-e-bullitt/ (accessed on 7 January 2025).
38. Deutsches Zentrum für Luft- und Raumfahrt e.V. Ich Entlaste Städte 2: Larry vs Harry E-Bullitt & Convoy Box L/2XL. Available online: https://www.lastenradtest.de/testraeder/larry-vs-harry-ebullit-convoy-l-2xl/ (accessed on 7 January 2025).
39. Kyburz Switzerland AG. DXP/DXC. Available online: https://kyburz-switzerland.ch/library/2020_Broschuere_Kyburz_DXP_DXC_JAG_da47.pdf (accessed on 7 January 2025).
40. Kyburz Switzerland AG. Objekt der Woche: Cabriobox. Available online: https://kyburz-switzerland.ch/de/hauszeitung/objekt-der-woche-cabriobox (accessed on 7 January 2025).
41. Aixam.de. Entdecken sie den E-Truck Van. Available online: https://aixam.de/fahrzeuge/aixam-pro/e-truck-van/ (accessed on 7 January 2025).
42. ARI Motors GmbH. Produktblatt ARI 458 Koffer. Available online: https://ari-motors-v2-uploads.s3.eu-central-1.amazonaws.com/ARI_458_Koffer_DE_produktblatt_430ed8f175.pdf (accessed on 7 January 2025).
43. Tazzari GL S.p.A. Konfigurator ZEROMAX. Available online: https://configurator.tazzari-zero.com/de/konfigurator/configure/34170/ (accessed on 18 December 2024).
44. Astara Mobility Deutschland GmbH. Microlino Entdecken. Available online: https://microlino-car.com/de-de/microlino (accessed on 7 January 2025).
45. ONOMOTION GmbH. Next Step of the (R)Evolution. Available online: https://onomotion.com/produkte/ (accessed on 7 January 2025).
46. Larry vs Harry. eBullitt. Available online: https://larryvsharry.com/products/ebullitt (accessed on 5 September 2025).
47. Deutsches Zentrum für Luft- und Raumfahrt e.V. Forschungsprojekt Ich Entlaste Städte 2: Internetauftritt. Available online: https://www.lastenradtest.de/ (accessed on 17 January 2025).

48. ZIV. Marktdaten Fahrräder und E-Bikes 2022: Mit Zahlen und Analysen zum Jahr 2022. 2023. Available online: https://www.ziv-zweirad.de/wp-content/uploads/2023/09/ZIV_Marktdatenpraesentation_2023_fuer_GJ_2022.pdf (accessed on 29 August 2025).
49. Manager Magazin. Warum der Cargobike-Boom Bald Enden Könnte. Available online: https://www.manager-magazin.de/unternehmen/industrie/lastenfahrraeder-der-boom-die-zuschuesse-die-zukunft-a-dd11b974-3e53-45c1-b0a6-ab097329dfe1 (accessed on 22 August 2025).
50. Wrighton, S.; Reiter, K. CycleLogistics—Moving Europe Forward! *Transp. Res. Procedia* **2016**, *12*, 950–958. [CrossRef]
51. Reiter, K.; Wrighton, S. Potential to Shift Goods Transport from Cars to Bicycles in European Cities: D7.1 A Set of Updated IEE Common Performance Indicators Including Their Baseline and Assumptions for Extrapolation. 2013. Available online: https://www.cargobike.jetzt/wp-content/uploads/2021/03/2013_cyclelogistics_baseline_study.pdf (accessed on 28 February 2025).
52. Müller, M.; Görnert, S.; Volkamer, A. *Güterverkehr in der Stadt. Ein Unterschätztes Problem*; Verkehrsclub Deutschland eV: Berlin, Germany, 2006. Available online: https://www.vcd.org/fileadmin/user_upload/Redaktion/Themen/Gueterverkehr/Lkw-Maut/VCD_Kurzbroschuere_Gueterverkehr_in_der_Stadt_2006.pdf (accessed on 15 July 2025).
53. Ewert, A.; Brost, M.K.; Schmid, S.A. Framework Conditions and Potential Measures for Small Electric Vehicles on a Municipal Level. *World Electr. Veh. J.* **2019**, *11*, 1. [CrossRef]
54. Ewert, A.; Brost, M.; Schmid, S. Small Electric Vehicles—Benefits and Drawbacks for Sustainable Urban Development. In *Small Electric Vehicles*; Ewert, A., Schmid, S., Brost, M., Davies, H., Vinckx, L., Eds.; Springer International Publishing: Cham, Switzerland, 2021; pp. 3–15, ISBN 978-3-030-65842-7.
55. Ewert, A.; Brost, M.; Eisenmann, C.; Stieler, S. Small and Light Electric Vehicles: An Analysis of Feasible Transport Impacts and Opportunities for Improved Urban Land Use. *Sustainability* **2020**, *12*, 8098. [CrossRef]
56. Hensel, L.; Grajewski, V.; Matteis, T.; Liedtke, G. Quantification and forecasting of regional commercial traffic volumes based on aggregated national data. *Transp. Res. Procedia* **2024**, *78*, 264–272. [CrossRef]
57. Thoma, L.; Gruber, J. Drivers and barriers for the adoption of cargo cycles: An exploratory factor analysis. *Transp. Res. Procedia* **2020**, *46*, 197–203. [CrossRef]
58. Gruber, J.; Bachmann, R. Treiber und Hemmnisse der Radlogistik. In *Radlogistik*; Assmann, T., Bürklen, A., Gruber, J., Knese, D., Mayregger, P., Rudolph, C., Eds.; Springer Fachmedien Wiesbaden: Wiesbaden, Germany, 2024; pp. 355–374, ISBN 978-3-658-44448-8.
59. Gruber, J. Results and learnings from Europe's largest cargo bike testing program for companies and public institutions. *Transp. Res. Procedia* **2024**, *79*, 146–153. [CrossRef]