CARBON TRUST

Green bond impact assessment report

Final report

March 2020

The Carbon Trust's mission is to accelerate the move to a sustainable, low carbon economy. It is a world leading expert on carbon reduction and clean technology. As a not-for-dividend group, it advises governments and leading companies around the world, reinvesting profits into its low carbon mission.

LeasePlan is one of the world's leading vehicle leasing companies, with over 55 years' experience and 1.9 million vehicles under management in over 30 countries. Across these countries, LeasePlan purchases, funds and manages vehicles for its customers, providing a complete end-to-end service through two core businesses, its 'Car as a Service' business and CarNext.com, a fast-growing digital pan-European marketplace for high-quality used cars.

Abbreviations

BEV(s)	Battery electric vehicle(s). Only BEVs are included within the scope of LeasePlan's Green Bond Framework.
CO_2(e)	Carbon dioxide (equivalent)
CT	Carbon Trust
EV(s)	Electric vehicle(s). EVs include BEVs and Plug-in Hybrids (PHEVs).
kg or tCO_2(e)	Kilogram or tonne of CO_2 (equivalent)
HEV(s)	Hybrid Electric Vehicle(s)
ICE	Internal Combustion Engine
LCV(s)	Light Commercial Vehicle(s)
LP	LeasePlan
OEM	Original Equipment Manufacturer
PHEV(s)	Plug-in hybrid electric vehicle(s)

Contents

Executive Summary

Context

LeasePlan (LP), a global fleet management company, has established a Green Bond Framework ('Framework')[1] dated February 2019, under which it can issue Green Bonds to finance and/or refinance 'Eligible Projects' within the 'Eligible Category' of Clean Transportation[2]. Eligible Projects are defined as eligible vehicles meaning battery electric vehicles (BEVs). The issuance of Green Bonds is aligned with LP's ambition to achieve net-zero carbon emissions from its total funded fleet by 2030, as outlined in the LP Sustainability Strategy. In accordance with the Framework, LeasePlan has committed to report, based on the availability of suitable data, on metrics regarding the Eligible Projects' environmental impact. LP commissioned the Carbon Trust (CT) to produce the environmental impact metrics calculation. The CT has provided technical advisory support to:

1) Develop a methodology to calculate the estimated avoided emissions originated from LP's BEV funded fleet, considering both Direct and Indirect emissions; and

2) Understand the average carbon intensity of LP's passenger car funded fleet.

Definitions: fleets, avoided emissions, baseline, and carbon intensity

Throughout the report, three ***fleets*** within LP's funded fleet are distinguished:

- ***Total funded fleet:*** refers to all powertrains (e.g. ICE, EVs, HEVs, etc.) and vehicle types (e.g. passenger cars, LCVs, trucks, etc.) in LP's funded fleet;
- ***BEV funded fleet:*** refers to BEVs only in LP's total funded fleet. If not specified, it refers to all vehicle types within the BEV powertrain (e.g. passenger cars and LCVs);
- ***Passenger car funded fleet:*** refers to passenger cars only in LP's total funded fleet. If not specified, it refers to all powertrains (e.g. ICE, EVs, HEVs, etc.).

Avoided emissions refer to the incremental difference in emissions that internal combustion engine or ICE vehicles (e.g. petrol, diesel, etc.) would have generated when driving a given distance (i.e. "the baseline" see definition below), compared with

[1] LeasePlan's Green Bond Framework (LeasePlan, 2019).
[2] The LeasePlan Green Bond Framework 2019 is structured in alignment with the ICMA Green Bond Principles 2018

the carbon emissions associated with generating electricity to charge BEVs to drive the same given distance. Figure 1 below illustrates this concept.

Avoided emissions refer to the difference between Direct or "tailpipe" emissions of ICE vehicles and the Indirect emissions from generating electricity to charge BEVs. These are defined as follows:

- ***Direct emissions:*** Direct emissions occur from ICE vehicles during the combustion of fuel, often referred to as "tailpipe" emissions. BEVs have zero tailpipe emissions.
- ***Indirect emissions***: Indirect emissions originate from the production of electricity required to charge BEVs.

Both Direct and Indirect emissions originate from the use phase of the vehicle and do not include upstream (e.g. well-to-wheel emissions, battery manufacturing, etc.) or downstream (e.g. end of life treatment) emissions.

The ***baseline*** can be considered as a hypothetical scenario in which BEVs in the LP total funded fleet were replaced with ICE vehicles. In other words, the baseline refers to what would have happened if LP had not, in recent years, increased the share of BEVs in its total funded fleet and had leased ICE vehicles in their place. The baseline represents the emissions that would have occurred if the current budgeted mileage of BEVs was driven by ICE vehicles instead, using an emission factor derived from the carbon intensity of ICE vehicles in LP's total funded fleet.

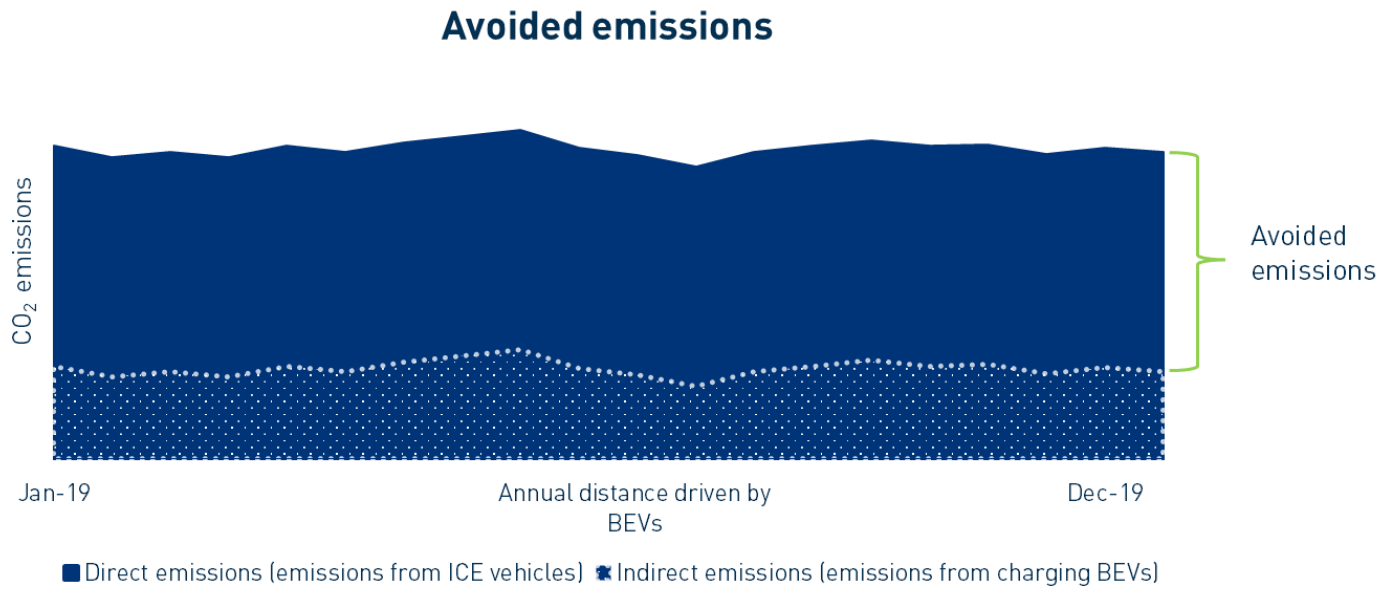


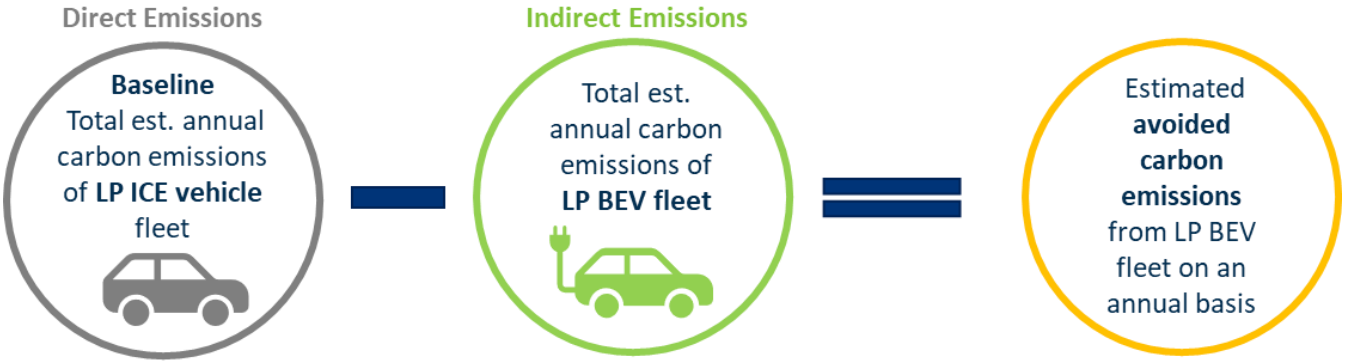
Figure 1. Visual representation of avoided emissions, or Direct emissions minus Indirect emissions (demonstration purposes only).

Carbon intensity refers to the weighted average of the emission factors of LP's passenger car funded fleet[3] (including BEVs) based on the number of passenger cars

[3] In this report, only the carbon intensity of LP passenger cars funded fleet (rather than the total funded fleet) was considered. Please see section 2.4 below for more information.

in each country, and is measured in carbon emissions per kilometre travelled (gCO_2/km).

Avoided Emissions Calculation



The diagram above provides an insight into how avoided emissions were calculated. The full report provides extensive detail on the methodology used in the calculations. The estimated annual carbon emissions resulted from the LP's BEV funded fleet were calculated using both the EU average emissions factor for charging BEVs **and** the relevant country emission factor for charging BEVs.

Results

The estimated annual avoided emissions from LP's BEV funded fleet and average carbon intensity of LP's passenger car funded fleet was calculated for the period January 2019-December 2019. The analysis considered all vehicles in LP's total funded fleet as of December 2019. See below a summary of all results, split by emission factor source, which are further discussed in the full report.

Table 1. Avoided emissions from BEVs in LP's Eligible Project Portfolio using an EU grid emission factor.

Description	Units	Result (EU electricity grid emission factor)
Total distance travelled by LP BEV funded fleet	Million km/year	703.18
Direct emissions (from ICE vehicles in LP total funded fleet, otherwise known as Baseline emissions)	tCO_2e	84,512
Indirect emissions (from electricity used to charge LP BEV funded fleet)	tCO_2e	(–) 50,498 [4]
Estimated avoided emissions from LP BEV fleet (annual)	**tCO_2e**	**34,015**

[4] Please note that charging BEVs does generate emissions and that this is being presented as a negative for demonstration purposes only – to show that Indirect emissions are being subtracted from Direct emissions to calculate avoided emissions.

Table 2. Avoided emissions from BEVs in LP's Eligible Project Portfolio using a country-specific emission factor.

Description	Units	Result (country-specific electricity grid emission factor)
Total distance travelled by LP BEV funded fleet	Million km/year	703.18
Direct emissions (from ICE vehicles in LP total funded fleet, otherwise known as Baseline emissions)	tCO_2e	84,512
Indirect emissions (from electricity used to charge LP BEV funded fleet)	tCO_2e	(–) 52,589 [5]
Estimated avoided emissions from LP BEV funded fleet (annual)	**tCO_2e**	**31,923**

Carbon intensity [6]

A weighted average of LP passenger car funded fleet's emission factors by country was provided by LP. This was evaluated against each country's average emissions factor of newly sold passenger cars in 2017 or 2018 sourced from publicly available databases. Both carbon intensity figures included zero-carbon emitting vehicles (e.g. BEVs) as a way to illustrate how LP compares against a 'best-in-class' scenario (i.e., the European market of newly sold cars) with regards to mobility decarbonisation trends.

Across all countries, the average carbon intensity of LP's passenger car funded fleet was 6.48 gCO_2e/km lower than the EU country averages sourced. This suggest that, if LP's passenger car funded fleet was representative of one country, it would be less carbon intensive than the European market average of newly sold cars. At a country level, LP's emission factors were lower in 15 out of the 21 countries analysed, while the EU country average was lower in 6 countries. See section 3.2 for more information.

[5] Please note that charging BEVs does generate emissions and that this is being presented as a negative for demonstration purposes only – to show that Indirect emissions are being subtracted from Direct emissions to calculate avoided emissions.

[6] In this report, only the carbon intensity of LP passenger car funded fleet (rather than the total funded fleet) was considered. Please see section 2.4 below for more information.

1. Introduction

1.1 From LeasePlan [7]

As one of the world's leading 'Car as a Service' (CaaS) companies LeasePlan has committed to taking a leadership role in the transition from Internal Combustion Engine (ICE) vehicles to Alternative Powertrains such as Battery Electric Vehicles (BEVs). LeasePlan has set the ambitious goal of working towards net zero emissions from the funded fleet by 2030, supporting the effective implementation of the Paris Agreement and climate-related UN Sustainable Development Goals.

The company's aim is to help create healthier environments in towns and cities by promoting cleaner, low-emission vehicles and the infrastructure required to make these cars a viable option for customers.

Sustainability is therefore at the heart of LeasePlan's business and is viewed as a vital enabler of the overall strategy towards all stakeholder groups. In 2017, the company developed a sustainability strategy with three key focus areas: shaping the future of low-emission mobility; strengthening their contribution to societal wellbeing; and reducing their own environmental impact.

Sustainability is also of growing importance in the Car-as-a-Service industry as customers look to access cleaner, low-emission vehicles. Through its innovative 'full package electric vehicle (EV) solution', which includes both home and office charging solutions, as well as educational initiatives, LeasePlan is aiding its customers to make the switch to EVs. As a result, LeasePlan is enabling a positive environmental impact via the avoidance of carbon dioxide emissions by encouraging increased uptake of EVs by its customers.

LeasePlan is also committed to using its scale, expertise and broad geographic presence to be at the heart of the discussion on the transition to low-emission mobility. LeasePlan's global advocacy programmes and initiatives include the EV100, World Economic Forum (WEF), World Business Council for Sustainable Development and WEF's Global Battery Alliance.

In line with its ambition of providing low-carbon mobility solutions, LeasePlan established its Green Bond Framework under which it can issue Green Bonds to finance and/or refinance assets within the 'Eligible Category' of Clean Transportation. Under the Framework, LeasePlan committed to reporting the weighted average fleet carbon intensity[8] and the estimated CO_2 emissions avoided as a result of increasing the proportion of BEVs in the funded fleet.

[7] Please note – this introduction was authored by LeasePlan and was included for context purposes. CT did not write this part of the report.

[8] Based on vehicle manufacturers' data concerning engine carbon emissions per kilometre travelled.

LeasePlan has engaged The Carbon Trust to provide an independent assessment of the environmental impact of increasing the proportion of BEVs in its fleet and to gain insight on the carbon intensity of the funded fleet in light of this increase in BEVs.

1.2 From Carbon Trust

To underpin and achieve the aims of its sustainability strategy, LP has established a Green Bond Framework ('Framework') under which LP can issue green bonds to finance and/or refinance a portfolio ('Eligible Project Portfolio') of Eligible Projects (defined as eligible vehicles meaning battery electric vehicles, or BEVs) that contribute to the development of clean transportation and the transition to a low-carbon future (LeasePlan, 2019)[9].

In February 2019, LP issued its EUR 500 Million inaugural green bond. Under the Framework, LP committed to reporting on:

1. The estimated CO_2e emissions avoided as a result of increasing the proportion of BEVs in LP's total funded fleet;
2. The carbon intensity of LP's passenger car funded fleet measured after increasing the proportion of BEVs[10].

This report therefore outlines the methodology used to 1) estimate the annual avoided emissions of the BEVs included in the Eligible Project Portfolio that substituted ICE and other types of carbon-emitting vehicles, and 2) showcase the carbon intensity of LP's passenger car funded fleet after increasing the proportion of BEVs.

The report presents and discusses the results of the annual avoided emissions calculation for the Eligible Project Portfolio and of LP's passenger car funded fleet carbon intensity for the period January 2019 - December 2019.

[9] LeasePlan (2019) - LeasePlan's Green Bond Framework.
[10] Based on vehicle manufacturer's data concerning engine carbon emissions per kilometre travelled.

2. Methodology

This methodology explains how 1) the estimated annual avoided emissions originating from LP's Eligible Project Portfolio were calculated; and 2) the carbon intensity of LP's passenger car funded fleet was measured.

Definition - avoided emissions: avoided emissions refer to the incremental difference in emissions that internal combustion engine or ICE vehicles (e.g. petrol, diesel, etc.) would have generated when driving a given distance (i.e. "the baseline" or Direct emissions – see section 2.2 below for full definition), compared with the carbon emissions associated with generating electricity to charge BEVs to drive the same given distance (Indirect emissions). In other words, the estimated annual emissions avoided as a result of driving a fully electrical vehicle instead of a vehicle with an internal combustion engine (ICE) over a given distance.

Definition - carbon intensity: the weighted average of the emission factors of LP's passenger car funded fleet[11] (including BEVs) based on the number of vehicles in each country, measured in carbon emissions per kilometre travelled (gCO_2/km).

2.1 Scope

2.1.1 Carbon emissions assessed

As more BEVs are sold and circulate on the road, they replace conventional petrol and diesel cars, therefore reducing CO_2e emissions that would have otherwise been emitted following the combustion of these fuels. BEVs do not produce any Direct ("tailpipe") emissions but they cause Indirect emissions through the charging of their batteries.

In calculating the avoided emissions of the eligible vehicles, this study has considered two types of emissions, categorized as follows:

- Direct emissions, or ICE emissions: Tailpipe CO_2e emissions from fossil fuels combustion when driving ICE vehicles;
- Indirect emissions, or BEVs emissions: CO_2e emissions from generating electricity used to charge BEVs.

To standardise the emission comparison between Direct and Indirect emissions (between emissions originating from ICE vehicles when driving and BEVs when charging), an emission factor (expressed in gCO_2e/km driven) for both vehicle categories was developed (see section 2.3.3 and 2.3.4 below). These ratios are

[11] In this report, only the carbon intensity of LP passenger car funded fleet (rather than the total funded fleet) was considered. Please see section 2.4 below for more information.

subsequently used in CT's impact assessment model to calculate the CO_2e emissions avoided as a result of LP replacing ICE vehicles with BEVs.

Both Direct and Indirect emissions originate from the use phase of the vehicle and do not include upstream (e.g. well-to-wheel emissions, battery manufacturing, etc.) or downstream (e.g. end of life treatment) emissions.

2.1.2 Eligible Projects (BEVs)

Eligible Projects are BEVs[12], meeting the criteria of 'Green' under the Climate Bonds Standard and Certification (traffic light) scheme[13] and in accordance with the ICMA Green Bond Principles[14]. The Eligible Project Portfolio refers to the total number of Eligible Projects, or BEVs, that can be financed or re-financed by LP's green bonds. See section 2.3.1 for more information.

2.1.3 Time period

The avoided emissions are calculated for an annual period[15]. All the data provided by LP for this current reporting cycle is as at December 2019. Given the ongoing flow of acquisition and turnover of LP's total funded fleet composition, this period was considered to be an accurate representation for the whole year of 2019.

The timeframe provides a boundary for which eligible vehicles are included in the analysis, which also guides the following boundary decisions:

- The analysis considers all BEVs circulating on the road at the end of 2019;
- The analysis considers the estimated annual avoided emissions of a given BEV vehicle, regardless of when it was included in LP's total funded fleet during 2019 and of how much of its annual budgeted mileage the BEV has driven;
- The reporting period is from January 2019 to December 2019.

More detail, discussion and rationale for all the inputs used in the analysis can be found in the inputs section (section 2.3).

2.1.4 Geography

The impact calculation considers only European countries[16] in which BEVs represent a proportion of LP's total funded fleet equal or greater than 0.1%. This includes the

[12] For the avoidance of doubt, vehicles with the following powertrains are excluded: ICE, Hybrid electric including PHEV, Liquefied Petroleum Gas (LPG), Compressed Natural Gas (CNG), Ethanol, Biofuels.
[13] CBI (2017).
[14] LeasePlan (2019) - LeasePlan's Green Bond Framework.
[15] LeasePlan will report annually, throughout the life of its green bonds.
[16] Where the greatest proportion of LeasePlan's BEV funded fleet is operational.

following 21 countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, and the UK.

2.2 Baseline to calculate the avoided emissions

The baseline can be considered as a hypothetical scenario in which BEVs in the LP total funded fleet (Eligible Project Portfolio) were replaced with ICE vehicles. In other words, the baseline refers to what would have happened if LP had not, in recent years, increased the share of BEVs in its total funded fleet and had leased ICE vehicles in their place. It calculates the emissions that would have occurred if the current budgeted mileage of BEVs was driven by ICE vehicles instead, using an emission factor derived from the carbon intensity of ICE vehicles in LP's total funded fleet.

One main baseline was developed to calculate the avoided emissions originating from increasing the proportion of EVs in LP's total funded fleet (a baseline was not needed for the carbon intensity output – see section 2.4):

- **Baseline – LeasePlan total funded fleet**: Calculating the Direct Emissions based on the composition of all ICE vehicles in LP's total funded fleet and the distance driven by LP's Eligible Project Portfolio in 2019.

Table 3 summarises the input data used in the baseline. The 'Inputs' section that follows gives further details on the datasets used in the calculations.

Table 3. Summary of input data for the baseline considered.

Baseline	Number of ICE vehicles	Distance driven	ICE emission factor
LeasePlan total funded fleet	LP's Eligible Project Portfolio	Based on LP's Eligible Project Portfolio	Based on LP total funded fleet (excluding BEVs)

2.3 Inputs to calculate the avoided emissions

The inputs required to calculate the avoided emissions include the:

- number of BEVs in the Eligible Project Portfolio;
- distance travelled by BEVs;
- emission factor of ICE vehicles; and
- emission factor related to charging BEVs.

Table 4 summarises the main inputs of the model and Table 5 provides an example for one of the countries analysed. The subsequent sections provide further information on each individual input.

Table 4. Summary of inputs used to calculate avoided emissions.

Input	Unit	Description	Source	Section
Number of BEVs in the Eligible Project Portfolio	#	Number of BEVs included in the Eligible Project Portfolio	Provided by LP	2.3.1
Distance driven in 2019	km/year	Budgeted and expected annual mileage driven for each leased BEV	Provided by LP	2.3.2
Emission factor of ICE vehicles	(k)gCO_2e/km	Weighted average of LP ICE vehicles' emission factors	Provided by LP	2.3.3
Emission factor of BEVs – EU average	(k)gCO_2e/km	Emission factor for charging BEVs based on an EU average grid emission factor	Carbon Trust analysis based on BEIS and DEFRA (2019) and IEA (2019) data	2.3.4
Emission factor of BEVs – country specific	(k)gCO_2e/km	Emission factor for charging BEVs based on country-specific grid emission factors	Carbon Trust analysis based on BEIS and DEFRA (2019) and IEA (2019) data	2.3.4

Table 5. Example of inputs used for one selected country

Number of BEVs in the Eligible Project Portfolio	BEV cars	332	#
	BEV LCVs	33	#
Distance	Average annual budgeted mileage (LP)	19,069	Km
ICE emission factor	ICE vehicle emission factor (LP country avg)	0.129	kgCO_2e/km
Electricity	Grid emission factor (example country)	0.1480	kgCO_2e/kWh
	Grid emission factor (EU avg)	0.2942	kgCO_2e/kWh
BEV emission factor	BEV car emission factor (example country specific grid)	0.0360	kgCO_2e/km
	BEV LCV emission factor (example country specific grid)	0.037587	kgCO_2e/km
	BEV car emission factor (EU avg grid)	0.07157	kgCO_2e/km
	BEV LCV emission factor (EU avg grid)	0.07472	kgCO_2e/km

2.3.1 Number of BEVs in the Eligible Project Portfolio

'Number of BEVs' refers to the quantity of battery electrical vehicles included in the LP's Eligible Project Portfolio as of December 2019. This only includes vehicles that were already circulating on the road at the end of 2019.

Within the Eligible Project Portfolio, LP leases different types of vehicles, primarily: passenger cars, LCVs and micro-mobility vehicles[17]. Despite the majority of BEVs being passenger cars, different emission factors were used to calculate the emissions related to charging a passenger car and an LCV (see Section 2.3.4). It is important to make this distinction for two reasons:

1) The efficiency of passenger cars is higher than LCVs, therefore a car would normally drive further per every unit of electricity used for charging compared to an LCV; and

2) LP projects the share of LCVs to increase in the next few years in line with the overall fleet mix percentage[18], making this distinction necessary for future reporting purposes.

2.3.2 Distance driven

The distance driven considered each country's average budgeted annual mileage for BEVs included in the Eligible Project Portfolio during the reference period considered (2019).

2.3.3 Emission factors for Direct emissions (ICE vehicles)

To calculate the Direct emissions originating from ICE vehicles, the impact assessment model used an emission factor expressed in $kgCO_2e$ per kilometre driven ($kgCO_2e/km$). The ICE emission factor for every country was provided by LP and it represents a weighted average of all vehicles generating Direct emissions (therefore excluding BEVs included in the Eligible Project Portfolio) in each country's respective fleet as of December 2019. The ICE emission factor includes all vehicle types in LP's total funded fleet, including passenger cars, vans, LCV, trucks, and others.

2.3.4 Emission factors for Indirect emissions (BEVs)

To calculate the Indirect emissions originating from charging BEVs, an emission factor expressed in $kgCO_2e$ per kilometre driven was used. The UK's emission factor of an average sized fully electric passenger car and LCV were sourced from BEIS and DEFRA (2019). Subsequently, an EU average and each country's grid emission factor

[17] Despite having a significant share in France and Italy, a separate emission factor for micro-mobility vehicles was not calculated; instead, they were grouped under, and were considered to have, the same emission factor as passenger cars. This is because, over time, the share of micro-mobility vehicles will become insignificant as the number of BEVs (passenger cars) will grow materially.

[18] Funded Fleet Mix as at December 2019, 76% Passenger vehicles, 22% Light commercial vehicles, 2% Others.

for electricity were sourced from IEA (2019). Through a proportionality calculation, the electricity emission factors were used to obtain the charging emissions factors for both BEV passenger cars and LCVs for all countries in the study.

An EU average grid emission factor for electricity generation was used because:

1) Europe's electricity network is interconnected and therefore allows for frequent energy trading within countries;

2) As a result of 1), it is not technically feasible for the electricity generated in a country to be fully and solely used within that same country throughout one given year.

The formula below illustrates the calculation performed for both BEVs and LCVs and Table 6 illustrates an example for one of the countries.

$$EF_{BEV}^{x} = \frac{\left(EF_{grid}^{x} \times EF_{BEV}^{UK}\right)}{EF_{grid}^{UK}} \quad (1)$$

Where:

- EF_{BEV}^{x}, is the BEV emission factor of country *x*;
- EF_{grid}^{x}, is the grid emission factor of country *x* (this was substituted with the EU average grid emission factor);
- EF_{BEV}^{UK}, is the UK's BEV emission factor;
- EF_{grid}^{UK}, is the UK's grid emission factor.

Table 6. Example of calculation process for a select country's BEV passenger car emission factor

UK grid emission factor	$kgCO_2e/kWh$	0.2470
UK BEV charging emission factor	$kgCO_2e/km$	0.0555
Country *x*'s grid emission factor	$kgCO_2e/kWh$	0.0694
Country *x*'s BEV charging emission factor	$kgCO_2e/km$	0.0156

2.4 Inputs for carbon intensity calculation

Carbon intensity refers to the weighted average of the emission factors of LP's passenger car funded fleet (including BEVs) based on the number of vehicles in each country. To measure the carbon intensity of LP's passenger car funded fleet it was not necessary to develop a baseline. Rather than a calculation, a comparison analysis was performed between the carbon intensity of LP's passenger car funded fleet versus each country's average emissions factor of newly sold passenger cars in 2017 or 2018[19] sourced from publicly available databases (namely EEA, 2018; ICCT 2019; EEA, 2018a; SFOE, 2019; Odyssee-Mure, 2018).

Both measurements included zero-carbon vehicles, which have no Direct ("tailpipe") emissions. This comparison was included to:

1) assess the impact of BEVs in the Eligible Project Portfolio on the overall carbon density of LP's passenger car funded fleet versus the carbon density of each country's newly sold passenger cars; and

2) to assess LP's passenger car funded fleet against a 'best-in-class' scenario (or the market of newly sold cars in Europe).

Only Direct ("tailpipe") emissions of passenger cars were considered because:

1) the emission factor of a given vehicle as per its manufacturer's data refers to Direct emissions from fuel combustion when driving;

2) The emission data sourced at the EU level was for passenger cars only and therefore to ensure a fair comparison other vehicle types present in LP's total funded fleet (e.g. trucks, LCVs, vans, etc.) were excluded.

2.5 Outputs

2.5.1 Total distance driven

To calculate the total distance travelled by LP's eligible vehicles, the total number of BEVs in each country was multiplied by the average distance driven in said country. Subsequently, each of the respective 21 country's distance travelled was summed to obtain the cumulative distance travelled, as per the below two formulas:

$$D_{tot}^{x} = D_{avg}^{x} \times BEV_{n}^{x} \quad (2)$$

$$\sum_{i=1}^{21} D_i = D_{tot}^{1} + D_{tot}^{2} + \cdots + D_{tot}^{21} \quad (3)$$

[19] Based on data availability.

Where,

- D_{tot}^{x} , is the total distance driven in country *x*;
- D_{avg}^{x} , is the average distance travelled in country *x*;
- BEV_{n}^{x} , is the number of BEVs in country *x*.

2.5.2 Total Direct emissions (emissions from ICE vehicles)

To obtain the total Direct emissions (emissions from ICE vehicles) that ICE vehicles would have generated by driving the considered total distance, each country's average ICE emission factor was multiplied by the total distance travelled in said country. Subsequently, each of the respective 21 country's emissions from ICE vehicles were summed to obtain the cumulative Direct emissions, as per the below two formulas:

$$E_{tot\ (ICE)}^{x} = D_{tot}^{x} \times EF_{ICE}^{x} \quad (4)$$

$$\sum_{i=1}^{21} E(ICE)_i = E_{tot\ (ICE)}^{1} + E_{tot\ (ICE)}^{2} + \cdots + E_{tot\ (ICE)}^{21} \quad (5)$$

Where,

- $E_{tot\ (ICE)}^{x}$, are the total Direct emissions in country *x*;
- D_{tot}^{x} , is the total distance driven in country *x;*
- EF_{ICE}^{x} , is the ICE emission factor in country *x*;
- $E(ICE)$, are the cumulative Direct emissions (emissions from ICE vehicles) from all countries.

2.5.3 Total Indirect emissions (emissions from BEVs)

While the same emission factor was used for all ICE vehicles, two distinct emission factors were used to calculate the Indirect emissions related to charging BEVs: one for electric passenger cars and one for electric LCVs. As such, an additional step was included to calculate the total emissions originating from charging BEVs. The total number of vehicles in each BEV category was multiplied by each country's average distance driven, and subsequently multiplied by the emission factor of the respective BEV category. The total Indirect emissions from both BEV categories were summed to obtain the cumulative Indirect emissions from charging BEVs sufficiently to drive the given total distance. The same calculation process was performed using both an EU average and country-specific grid emission factors to account for the carbon-intensity

of the electricity used to charge the BEVs. These steps are summarised in the following two formulas:

$$E^{x}_{tot\ (BEV)} = \left(D^{x}_{avg} \times EF^{x}_{BEV\ car}\right) + \left(D^{x}_{avg} \times EF^{x}_{BEV\ LCV}\right) \quad (6)$$

$$\sum_{i=1}^{21} E(BEV)_i = E^{1}_{tot\ (BEV)} + E^{2}_{tot\ (BEV)} + \cdots + E^{21}_{tot\ (BEV)} \quad (7)$$

Where:

- $E^{x}_{tot\ (BEV)}$, are the total Indirect emissions from charging BEVs in country *x*;
- D^{x}_{avg}, is the average distance travelled in country *x*;
- $EF^{x}_{BEV\ car}$, is the emission factor for an electric passenger car in country *x*;
- $EF^{x}_{BEV\ LCV}$, is the emission factor for an electric LCV in country *x*.
- $E(BEV)$, are the cumulative Indirect emissions from charging BEVs in all countries.

2.5.4 Avoided emissions

Once the total Direct emissions from ICE vehicles and Indirect emissions from BEVs were obtained as per formula (5) and (7) above, the avoided emissions were calculated by subtracting Indirect emissions from Direct emissions, as per the below formula:

$$E_{tot\ (avoided)} = E(ICE) - E(BEV) \quad (8)$$

The above calculation was performed with both an EU average and a country-specific grid emission factor for electricity.

Additionally, to show the avoided emissions per Eligible Project (BEV), the total avoided emissions were divided by the total number of BEVs:

$$E_{(per\ BEV)} = E_{tot\ (avoided)} \div BEV_{tot} \quad (9)$$

Where,

- $E_{(per\ BEV)}$, are the avoided emissions per Eligible Project (BEV);
- $E_{tot\ (avoided)}$, are the total avoided emissions;
- BEV_{tot}, are the total number of Eligible Projects (BEVs).

3. Results

3.1 Avoided emissions

This impact report calculated the total avoided emissions as a result of increasing the proportion of BEVs in LP's total funded fleet. The avoided emissions originate from BEVs replacing ICE vehicles in driving a given distance. In other words, avoided emissions are the total Direct emissions minus the total Indirect emissions[20]. The tables below summarise the total distance driven by BEVs, the total Direct emissions (from ICE vehicles) and Indirect emissions (from charging BEVs) from driving that distance, as well as the avoided emissions for the considered baseline. The results are shown using the EU grid emission factor and the country emissions factor separately.

Table 6. Avoided emissions from BEVs in LP's Eligible Project Portfolio using an EU grid emission factor.

Description	Units	Result (EU grid electricity emission factor)
Total distance travelled by LP BEV funded fleet	Million km/year	703.18
Direct emissions (from ICE vehicles in LP total funded fleet, otherwise known as Baseline emissions)	tCO_2e	84,512
Indirect emissions (from electricity used to charge LP BEV funded fleet)	tCO_2e	(–) 50,498 [21]
Estimated avoided emissions from LP BEV funded fleet (annual)	**tCO_2e**	**34,015**

[20] Considering avoided emissions as the difference between Direct and Indirect emissions is normally advised and is CT's preferred approach when developing green bond impact reporting. However, there are other approaches that consider Direct emissions as the avoided emissions, thus not considering the Indirect emissions related to charging BEVs.

[21] Please note that charging BEVs does generate emissions and that this is being presented as a negative for demonstration purposes only – to show that Indirect emissions are being subtracted from Direct emissions to calculate avoided emissions.

Table 7. Avoided emissions from BEVs in LP's Eligible Project Portfolio using a country-specific emission factor.

Description	Units	Result (country-specific electricity grid emission factor)
Total distance travelled by LP BEV funded fleet	Million km/year	703.18
Direct emissions (from ICE vehicles in LP total funded fleet, otherwise known as Baseline emissions)	tCO_2e	84,512 [22]
Indirect emissions (from electricity used to charge LP BEV funded fleet)	tCO_2e	(–) 52,589
Estimated avoided emissions from LP BEV funded fleet (annual)	**tCO_2e**	**31,923**

It is noticeable that emissions originating from charging BEVs are not insignificant. This is especially true when using country-specific grid emission factors, due to some countries relying on carbon intensive energy sources for their electricity generation (e.g. Poland, Greece, and the Netherlands). When using an EU average grid emission factor for electricity, avoided emissions are greater. This is partially due to the Netherlands having the largest BEV fleet (and therefore the longest cumulative distance driven) and a relatively carbon-intensive grid, significantly higher than the EU average figure. Figures 2-5 showcase the Direct emissions from ICE vehicles, Indirect emissions from charging BEVs and the associated avoided emissions.

[22] Please note that charging BEVs does generate emissions and that this is being presented as a negative for demonstration purposes only – to show that Indirect emissions are being subtracted from Direct emissions to calculate avoided emissions.

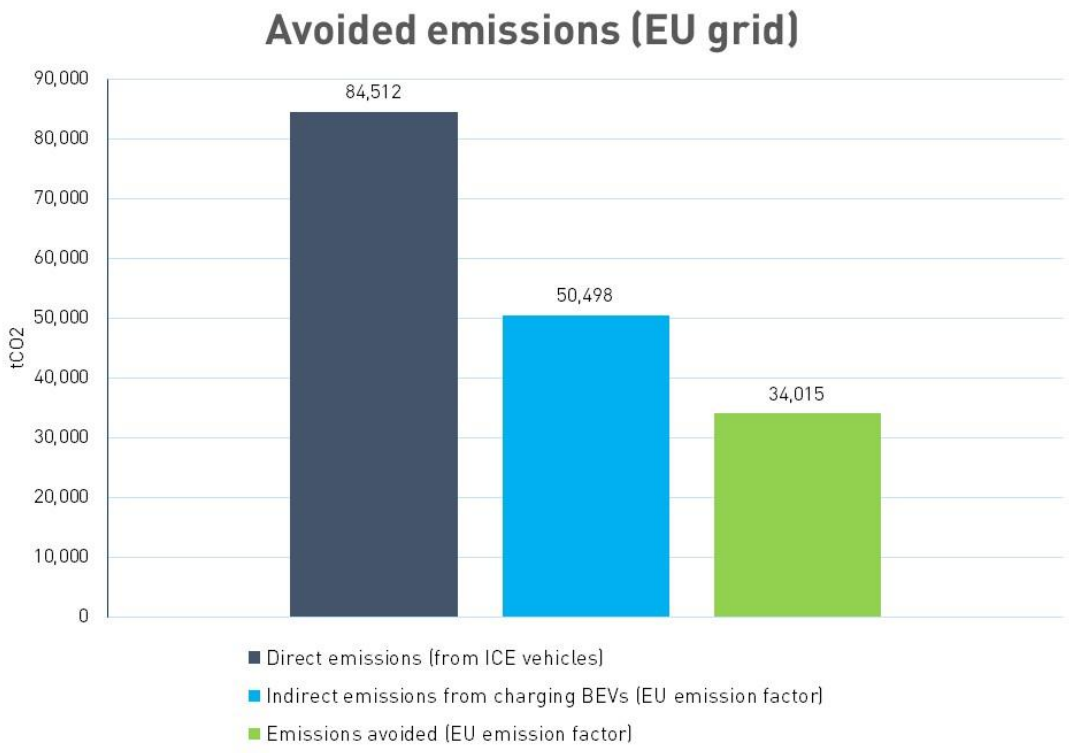


Figure 2. Avoided emissions using an EU grid emission factor.

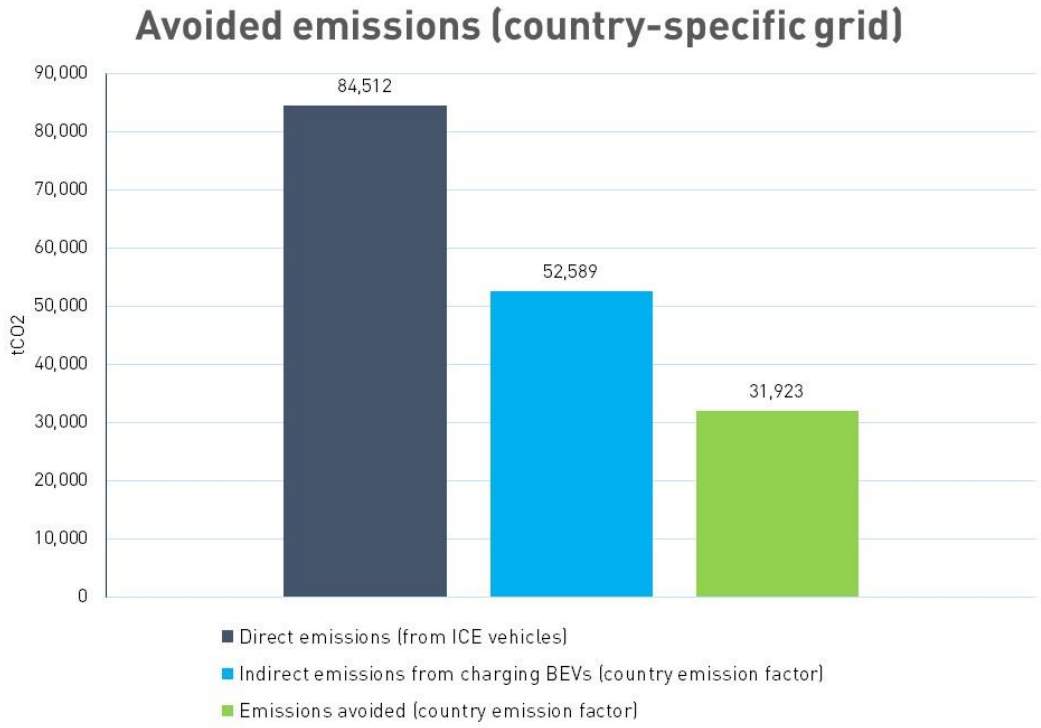


Figure 3. Avoided emissions using a country-specific grid emission factor

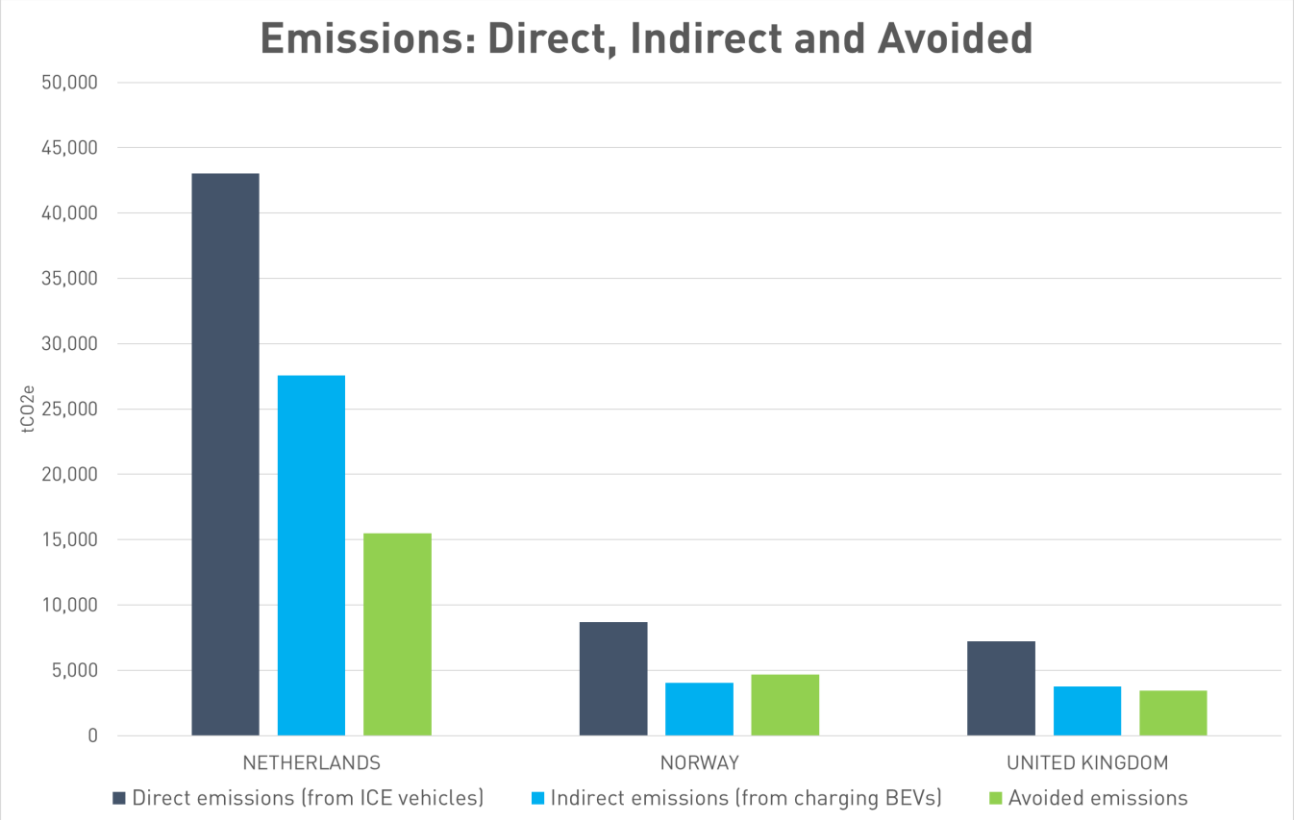


Figure 4. Direct, Indirect and avoided emissions in the Netherlands, Norway and the UK.

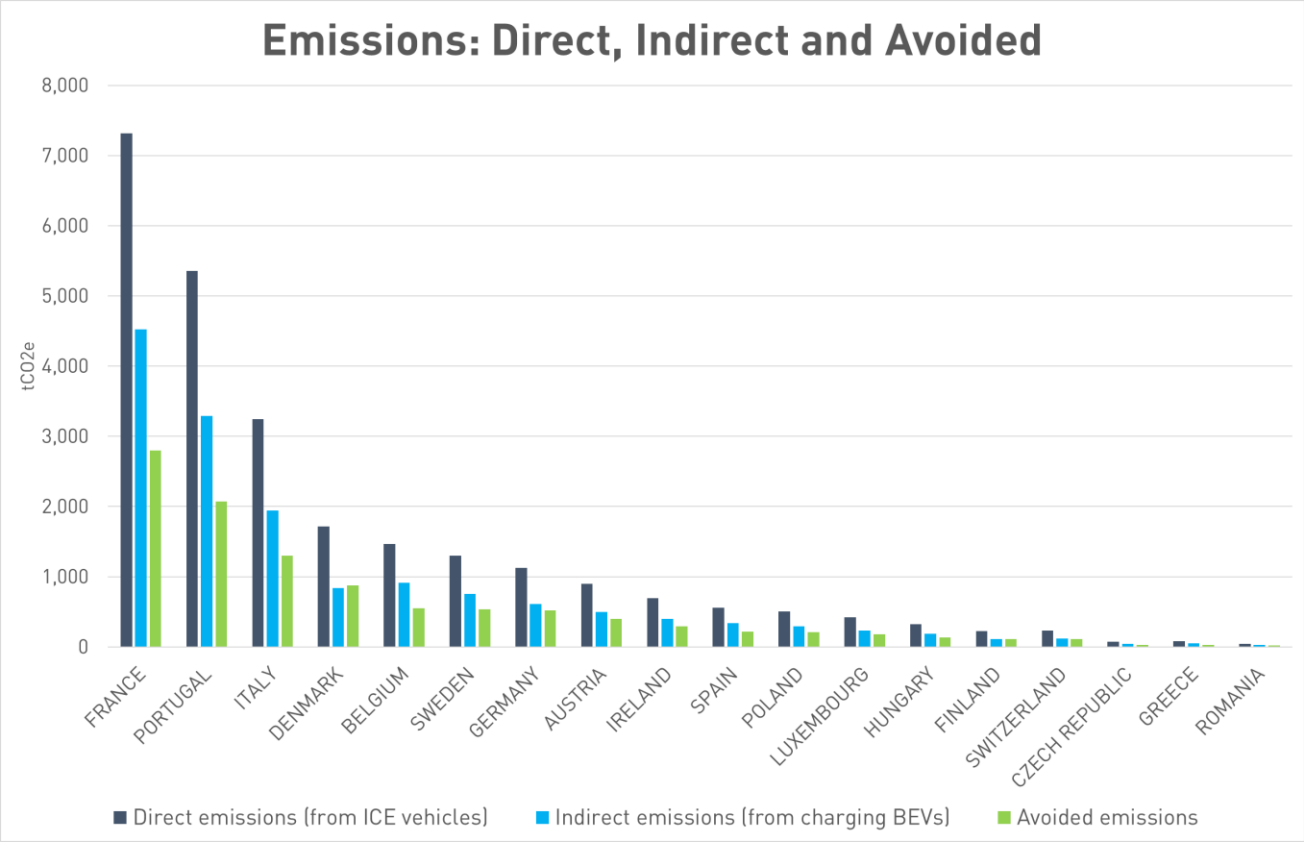


Figure 5. Direct, Indirect and avoided emissions in the other countries.

3.1.1 Avoided emissions by country

When breaking down the avoided emissions by country, the Netherlands is the highest contributor (45.55% of the total avoided emissions) primarily due to having the largest number of Eligible Projects (BEVs). Norway (13.77%) and the UK (10.14%) are the next highest. The following two figures display the percentage breakdown of avoided emissions by country. For demonstration purposes, the top three contributing countries were graphed separately to the rest.

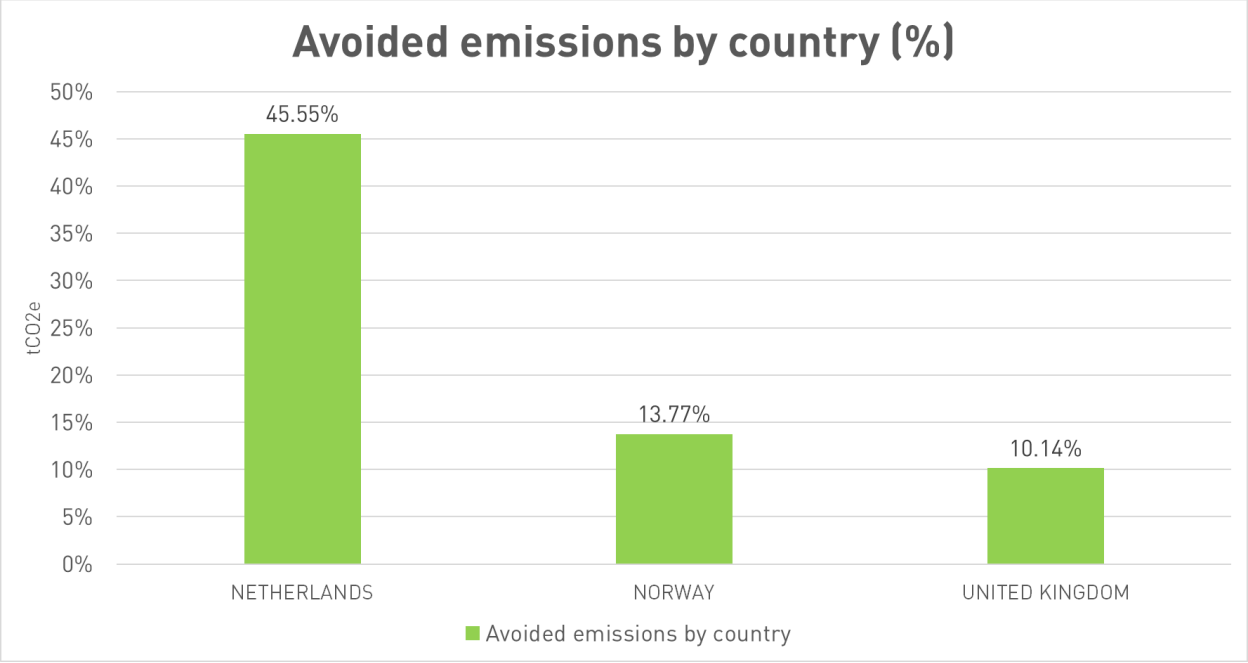


Figure 6. Avoided emissions by country, expressed in percentage of total (top three contributing countries).

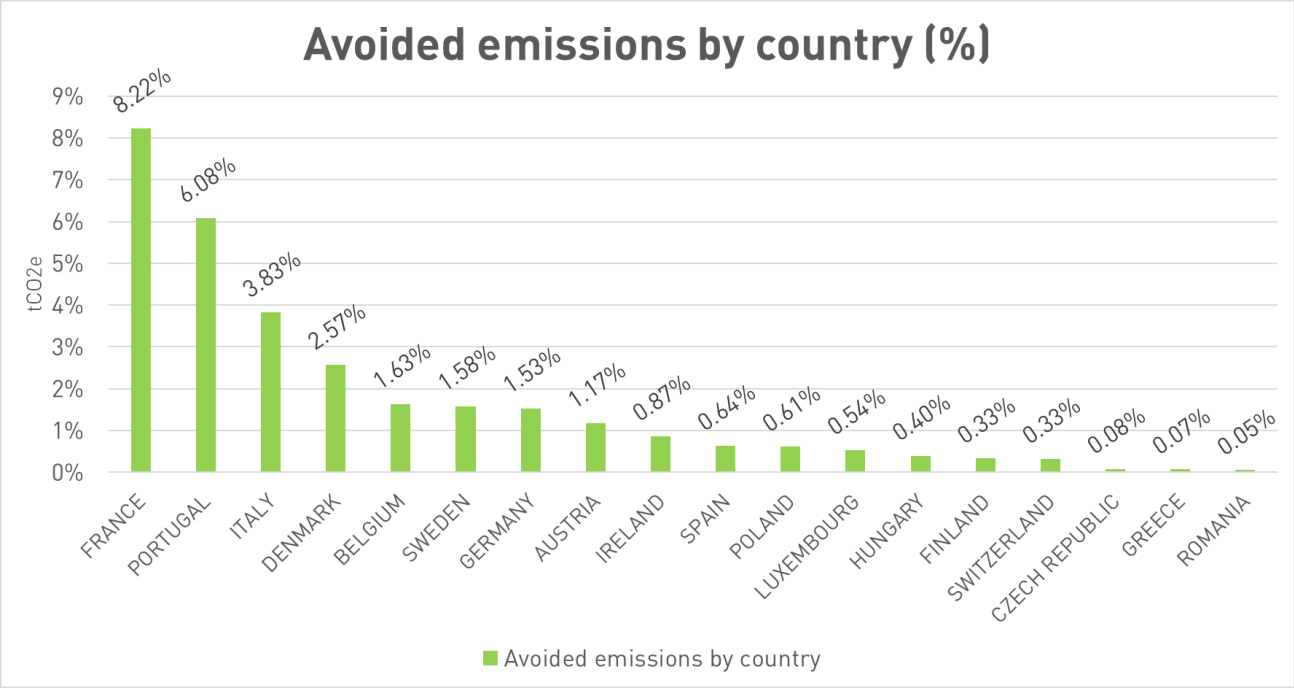


Figure 7. Avoided emissions by country, expressed in percentage of total (other countries).

3.1.2 Avoided emissions per Eligible Project

The annual avoided emissions per Eligible Project amounted to 1.090 tCO_2e per BEV, considering 31,194 BEVs in the Eligible Project Portfolio and 34,105 tCO_2e as the total avoided emissions (using an EU average grid emission factor).

Table 8. Avoided emissions per Eligible Project versus baseline.

	Avoided emissions	Number of Eligible Projects	Avoided emissions per Eligible Project
Baseline – LeasePlan total funded fleet	34,015 (tCO_2e)	31,194	1.090 (tCO_2e/vehicle)

3.2 Carbon intensity

A weighted average of LP passenger car funded fleet's emission factors by country was provided by LP. This was evaluated against each country's average emissions factor of newly sold passenger cars in 2017 or 2018 sourced from publicly available databases. Both carbon intensity figures included zero-carbon emitting vehicles (e.g. BEVs) as a way to illustrate how LP compares against a 'best-in-class' scenario (i.e. the European market of newly sold cars) with regards to mobility decarbonisation trends.

The average carbon intensity of LP's passenger car funded fleet was 110.25 gCO_2e/km, 6.48 gCO_2e/km lower than the EU country averages sourced. This suggest that, if LP's passenger car funded fleet was representative of one country, it would be less carbon intensive than the European market average of newly sold cars. At a country level, LP's emission factors were lower in 15 out of the 21 countries analysed, while the EU country average was lower in 6 countries.

These findings suggest that when compared against a 'best-in-class' scenario such as the European market of newly sold passenger cars, LP's passenger car funded fleet performs strongly in that its decarbonisation efforts reach beyond the European market average. In other words, LP is overall increasing its proportion of BEVs at a greater rate than the European passenger car market.

The findings are summarised in Table 9 and Figure 8.

Table 9. Comparison of carbon intensity between LP's passenger car funded fleet and the analysed EU countries' newly sold passenger car fleets (gCO_2e/km).

	LeasePlan (gCO_2e/km)	EU countries (gCO_2e/km)
Passenger car fleet average	110.25	116.73 [23]

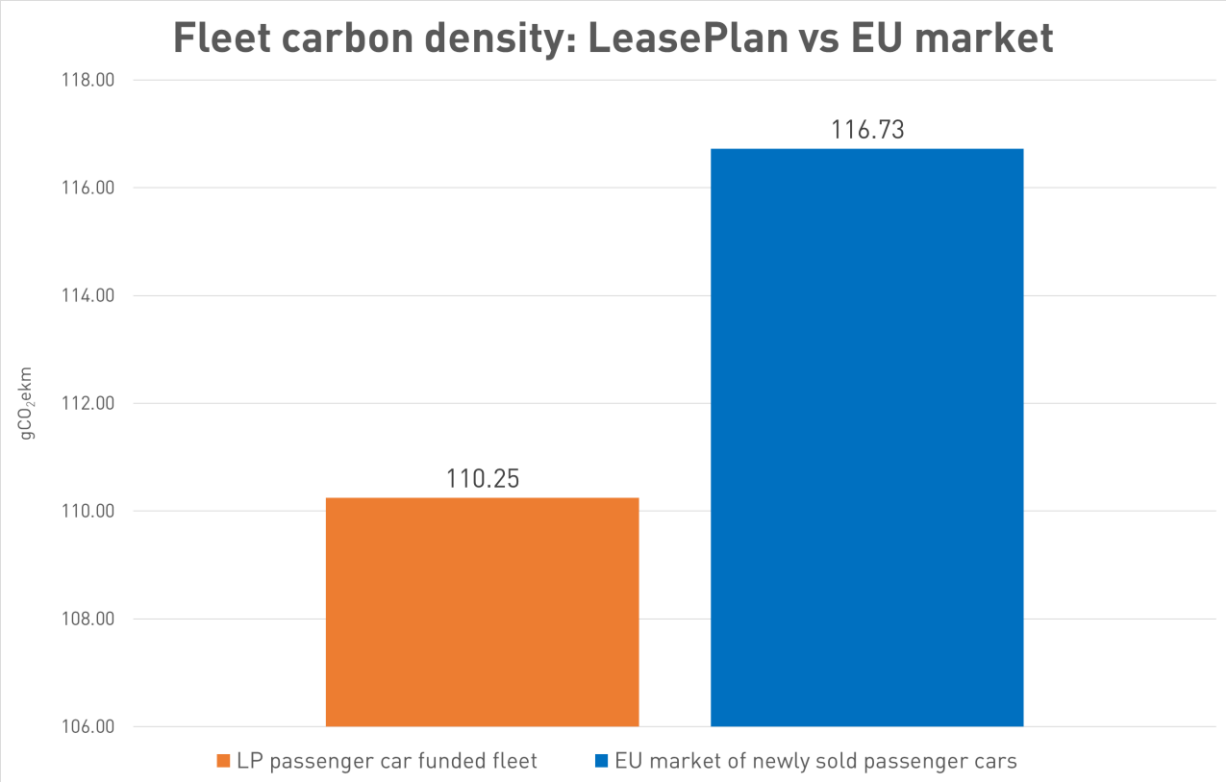


Figure 8. Visual comparison of carbon intensity between LP's passenger car funded fleet and the analysed EU countries' newly sold passenger car fleets (gCO_2e/km).

[23] Average of all 21 EU countries analysed.

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+44 (0) 20 7170 7000

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