REPORT

Santander Consumer Bank electric vehicles portfolio

CLIENT

Santander Consumer Bank AS

SUBJECT

Impact assessment

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1 Introduction

On assignment from Santander Consumer Bank, Multiconsult has assessed the impact of electric vehicles in Norway on climate gas emissions. The bank's portfolio is assessed regarding direct emissions (Scope 1) and indirect emissions related to electric power production (Scope 2). A baseline is established as the emission of the average car of the total new cars introduced to the marked, EV's excluded.

2 Loan Portfolio Analysis Santander Consumer Bank

The Green loan portfolio of Santander Consumer Bank consists of electric vehicles that meet the eligibility criteria as formulated below.

2.1 Eligible assets

The eligibility criteria is formulated in line with Climate Bonds Initiative (CBI) criteria[1] and proposed criteria in the EU Taxonomy[2].

The vehicles in the examined portfolio are relevant for CBI's Low Carbon Land Transport eligibility criteria, Criterion 1.

Eligibility criterion:
Vehicles propelled by fully electric engines. Automatically eligible Light Duty and Heavy Goods Vehicles: electric and fuel cell vehicles

2.2 Portfolio data

The bank has provided essential data on number of electric vehicles in the portfolio and portfolio volume including type of engine, fuel and vehicle category. All vehicles are registered in Norway. Multiconsult has investigated Santander Consumer Bank's portfolio and can confirm that it in July 2019 includes 25,787 electric cars.

[1] https://www.climatebonds.net/standard/transport
[2] The financing and / or refinancing of electric powertrain vehicles loans is contemplated by the EU Technical Expert Group's June 2019 Taxonomy Technical Report. https://ec.europa.eu/info/files/190618-sustainable-finance-teg-report-taxonomy_en

3 Electric Vehicles – general description

Personal mobility in Norway is high, among the highest in Europe, with privately owned passenger cars taking the lion share of the passenger transportation work. Figure 1 show the nature of passenger transport in Norway compared to other selected countries.

Historical figures of how far the average private car is driven annually, shows a falling slope from 2007, when the personal car peaked and was on average driven 13,916 km. In 2018 the average personal car was driven 12,140 km[3].

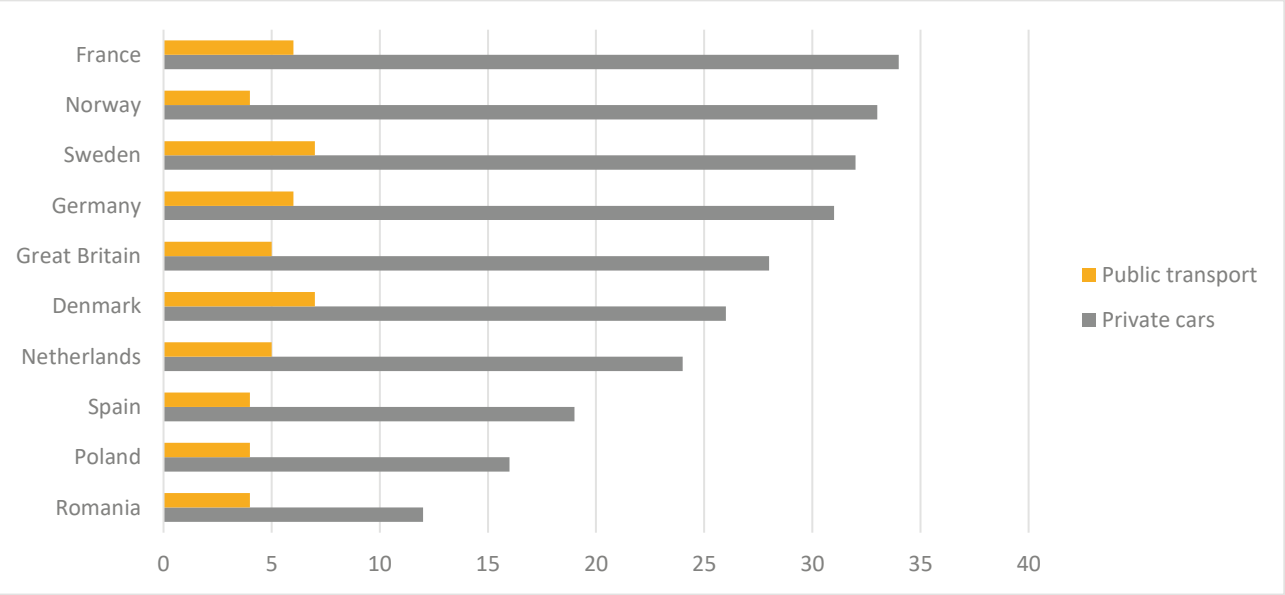

Figure 1 Passenger transport in selected countries [passenger kilometre per person per day] (Source Statistics Norway[4]/Eurostat,2014)

In 2018 the average age of private cars scrapped for refund was 18 years old[5]. The history of modern EV's is short and there is yet no evidence for the lifetime of EV's being different from other cars. In this analysis we assume the same lifetime independent of fuel and that it will stay 18 years.

3.1 EV policy in Norway

The number of EVs on Norwegian roads rose in 2019 above 200 000. In July 2019, 44, 3 %[6] of all new registered personal cars were zero emission cars (including a small number of fuel cell vehicles).

A broad consensus around gradually expanding the Norwegian EV-politics has been sustained in parliament. The Norwegian EV policy, one of the world's most ambitious EV policies have been made effective by the tax exemption on VAT and tax exemption on the high registration tax, in addition to a series of benefits like free fares on the many toll roads, car ferries, free parking and free charging in cities.

[3] SSB 12578: Kjørelengder , eter kjøreøyype, drivstoffype, alder, staisikkvariabel og år, 2019
[4] https://www.ssb.no/transport-og-reiseliv/artikler-og-publikasjoner/koyrer-nest-mest-i-europa
[5] https://www.ssb.no/en/statbank/table/05522
[6] CO2-utslippet, OFV, 2019

The tax exemption has been prolonged to 2021 in the current government platform[7], so far without a new policy in place. Many of the other benefits have been reduced and EVs are currently paying up to a maximum, by law, of 50 % for parking, toll roads and ferries.

The Norwegian Parliament have unanimously adopted a target of 100 % EV-sales from 2025.

3.2 Biofuel policy

Norway has an ambitious biofuel policy in order to reduce CO_2-emissions. Regulation[8] was introduced in 2008 to oblige all petrol retailers to sell a volume of at least 2 % biofuels of their total sales of ordinary petroleum products. For 2019 the regulation states a total of 12 % biofuels, escalating to 20 % in 2020. Advanced biofuels counts double against this target and 4 % of the biofuels is set to be advanced biofuels in 2020. The government platform points in the unambiguous direction of an increasing share of advanced biofuels.

3.3 Climate policy

Norway recently passed a bill to join the EU's mechanisms for climate emission reduction in non- ETS sectors, and has in the government platform[9], Europe's most ambitious targets of reducing climate emissions in non-ETS-sectors by 45% by 2030 compared to 2005 levels.

4 Climate gas emissions (Scope 1 and 2)

Categorizing the emissions we have chosen to use the CBI guidelines for the Scope 1, Scope 2 and Scope 3 emission calculations. CBI's Low Carbon Transport Background Paper to Eligibility Criteria[10] underlines the focus on tailpipe emissions because of their dominance, the need to send strong signals to vehicle purchasers and the need to promote technologies and infrastructure that have the potential to radically shift emissions trajectories and avoid fossil fuel lock-in. We do however include indirect emissions related to power production.

4.1 Indicators

In this analysis we a using two relevant climate gas emission indicators for vehicles:

- Emissions per kilometre [gCO_2/km]
- Emissions per passenger kilometre [gCO_2/pkm]

The car fleet composition and emissions from the types of cars is used to calculate the emissions per kilometre.

A passenger-kilometre, abbreviated as pkm, is the unit of measurement representing the transport of one passenger over one kilometre. Passenger kilometers are found by multiplying the number of passengers by the corresponding number of kilometers traveled.

Statistics Norway's method for calculating indicators for emissions per passenger kilometre utilizes a vehicle occupancy of 1.7 persons in private cars[11]. The same factor is adopted in this analysis.

[7] Granavolden-plattformen, 2019
[8] Produktforskriften kapittel 3: Omsetningskrav for biodrivsoff og børekrafskrierier for biodrivsoff og flytende biobrensel, Lovdata, 2019
[9] Granavolden-plattformen, 2019
[10] https://www.climatebonds.net/files/files/Low%20Carbon%20Transport%20Background%20Paper%20Feb%202017.pdf page 10
[11] https://www.ssb.no/transport-og-reiseliv/artikler-og-publikasjoner/mindre-utslipp-per-kjorte-kilometer

4.2 Direct emissions (tailpipe)- Scope 1

Under scope 1 of the "Low Carbon Land Transport and the Climate Bonds Standard (Version 1.0)" we calculate the "Direct tailpipe CO_2 emissions from fossil fuels combustion" avoided.

The estimation of the baseline is performed through 4 steps:

1. Estimating the gross CO_2-emission per km (c) from the average car that is being substituted by the zero emission car.
2. Multiplied by the number of km (d) the car is estimated to travel.
3. Multiplied by the number (n) of cars substituting fossil cars in the portfolio.

This can be described in the following equation:

$$E_{baseline} = c_{weighted\ average} * d_y * n_{total} = E_{avoided} \qquad (1)$$

All EVs and fuel cell vehicles are considered eligible with zero tailpipe emissions. So for scope 1 calculations, the emissions from these vehicles are set to zero, and the baseline will amount to the total avoided emissions.

Emission data are retrieved from recognized test methods and not actual registrations of emissions in Norwegian climate. Test methods have lately been improved to better reflect actual emissions but are still likely to underestimate the emissions[12].

Biofuels are already to some degree mixed with fossil fuels in Norway, and in the lifetime of the vehicles the influence of biofuel will increase. This will result in some adjustment to the direct emissions. There are however major uncertainties related to the future share of advanced biofuels that do not replace feedstock and the related CO_2-emissions. In these calculations the effect of biofuels on direct emissions are not included.

To estimate the annual emissions avoided by the eligible assets, projections are made for direct tailpipe CO_2 emissions from fossil fuels combustion in the national car fleet. These projections are linear, and since the average lifetime of private cars is 18 years, the baseline emission is set at the year 2027, half way into new cars lifetime (the bank's portfolio include cars from 2017 to 2019).

We chose 9 years from year 0 as the best approximation year and set 2018 as the best approximation for year 0 based on the portfolio.

1. To estimate the weighted average of emissions per fossil car ($c_{weighed\ average}$) we use the average annual emission from new car models from 2017, 2018, 2019[13]. To reflect the age dispersion of the cars in the portfolio, a weighted average is calculated based on the number and age of zero emission cars in the portfolio.

   $c_{wheigted\ average}$ = 101 g CO_2/km

[12] https://www.vegvesen.no/fag/fokusomrader/miljo+og+omgivelser/klima
[13] https://ofv.no/CO2-utslippet/co2-utslippet

2. To estimate the distance traveled by the average car (d_{2027}) we assume that EVs in 2027 will travel as far as the average car. Figure 2 illustrates the distance traveled yearly by relatively new vehicles dependent on type of car.

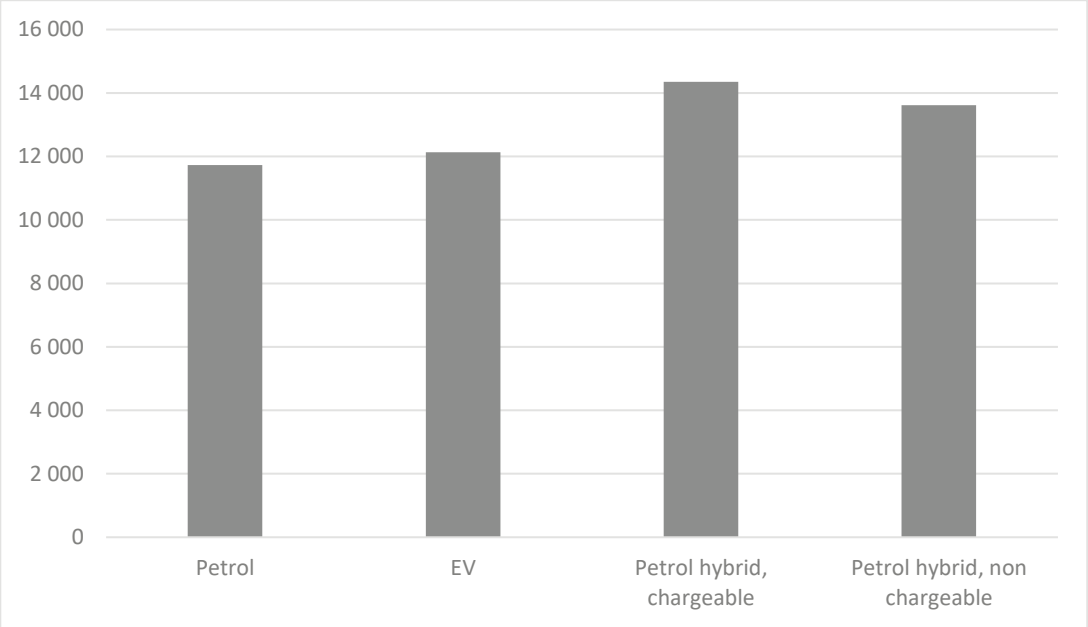

Figure 2 Average road traffic volumes per vehicle age 0-4 years old in 2018 [km] (Source: Statistics Norway[14])

Traffic volumes per car is declining and we use linear regression on publicly available dataset (d_{2005}-d_{2018}) and extrapolate until 2027.

We estimate the distance traveled by the average car to: d_{2027} = 10,975 km/yr

Based on calculated gross tailpipe CO_2-emissions for the average car, fossil fuel content in petrol/diesel pumped in 2027 and the traveled distance for the average car the same year, table 1 present the calculated emission factors and CO_2-emissions in a year for the same car.

	Direct emissions fossil car-Baseline 2027	**Direct emissions EV**
Emissions per passenger km	60 gCO_2/pkm	0 gCO_2/pkm
Emissions per km	101 gCO_2/km	0 gCO_2/km
Emissions per car and year	1108 $kgCO_2$	0 $kgCO_2$

Table 1 Greenhouse gas emission factors (CO_2- equivalents), direct emissions in the year 2027[15]

[14] https://www.ssb.no/en/statbank/table/12575/
[15] Calculations have been rounded

4.3 Indirect emissions (Power consumption only)- Scope 2

4.3.1 Electricity production mix

In 2018, the Norwegian power production was 98 % renewable (NVE[16]). As shown in figure 3, the Norwegian production mix in 2018 (95 % hydropower) results in emissions of 11 gCO_2/kWh. The production mix is also included in the figure for other selected European states for illustration.

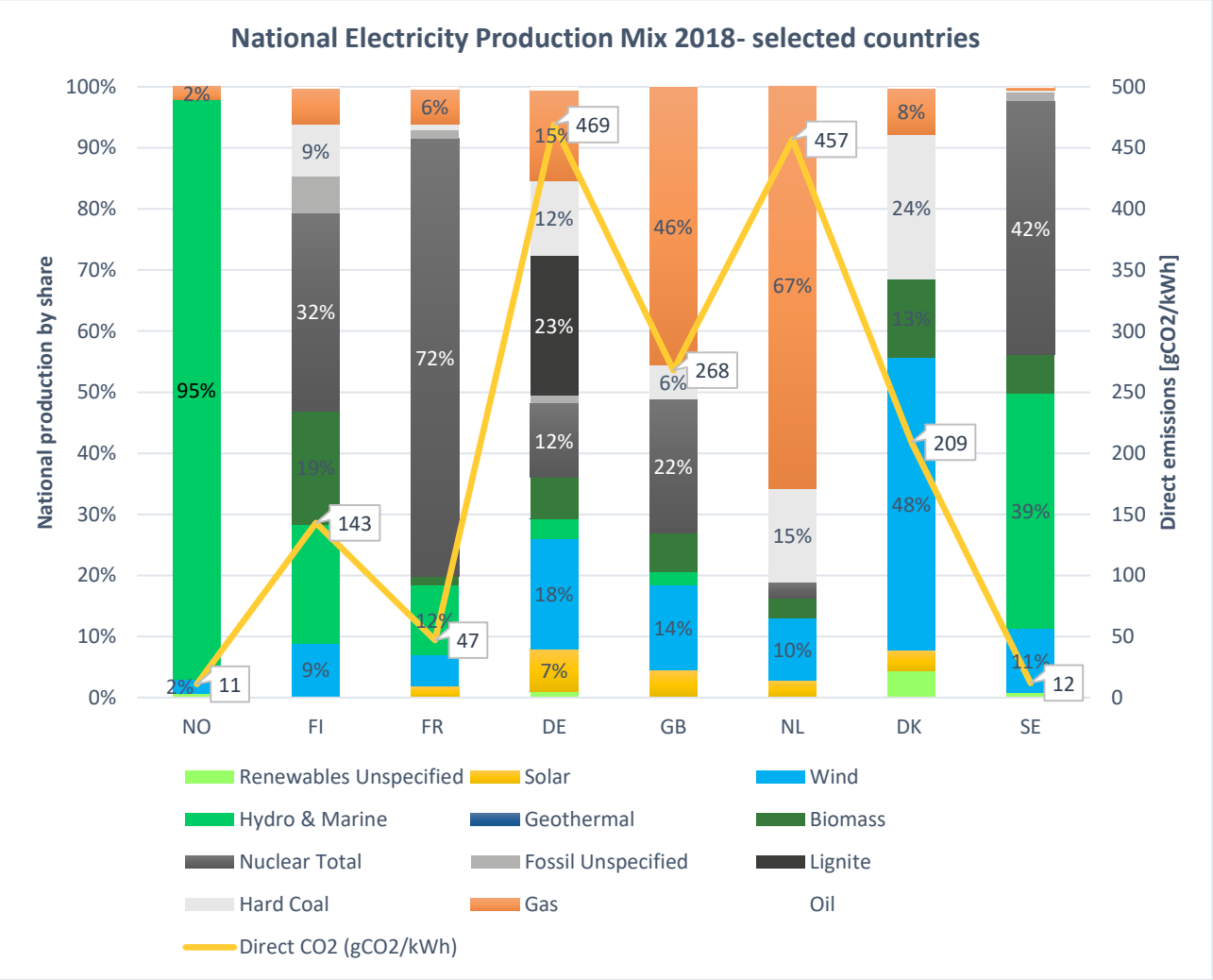

Figure 3 National electricity production mix in some relevant countries (European Residual Mixes 2018, Association of Issuing Bodies[17])

[16] https://www.nve.no/reguleringsmyndigheten-for-energi-rme-marked-og-monopol/varedeklarasjon/nasjonal-varedeklarasjon-2017/
[17] https://www.aib-net.org/facts/european-residual-mix

4.3.2 CO_2- emissions related to electricity demand

Power is traded internationally in an ever more interconnected European electricity grid. For impact calculations of all power consumption, and even electrification of transportation, the regional or European production mix is more relevant than national production.

Figure 4 illustrates the emission trajectory used as basis for scope 2 emission calculations for EV's. The direct emissions in power production in Europe (EU28+Norway) is expected to be dramatically reduced the coming decades. Due to urgency the trajectory takes into consideration the 1.5 °C scenario and a substantial reduction of emissions in the power sector that will have close to zero emissions in 2040. This is in line with the EU's ambitious decarbonisation of the power sector[12].

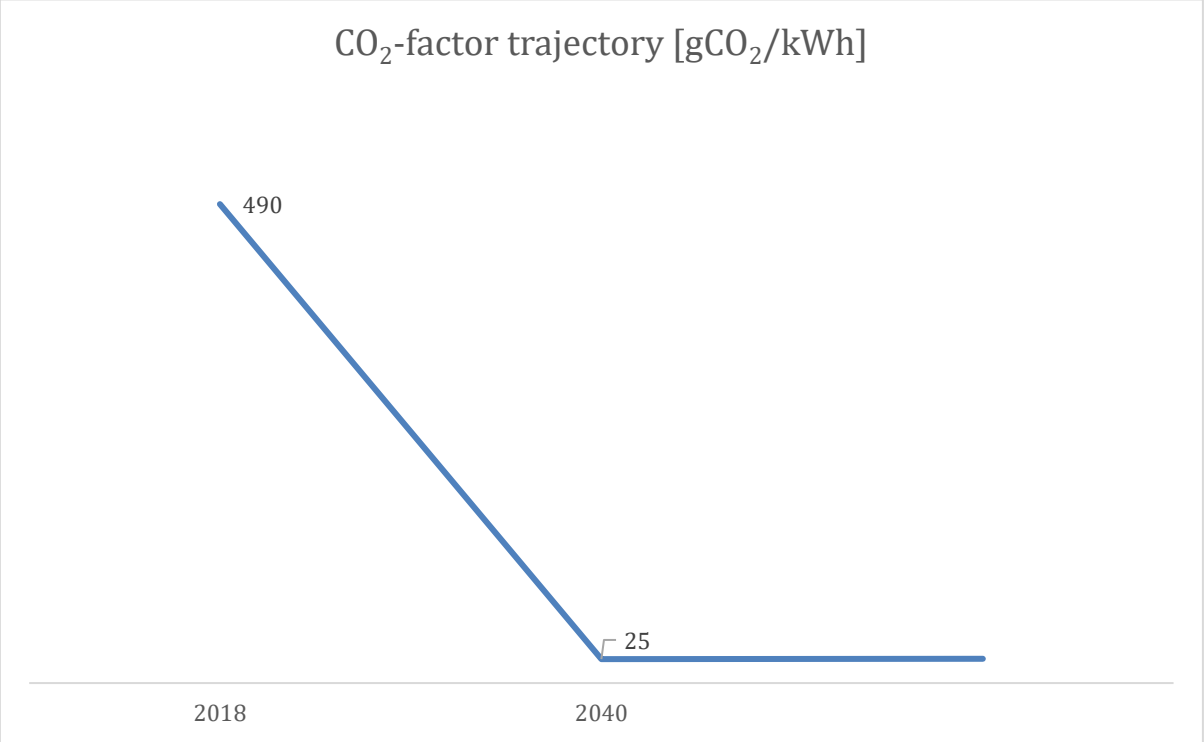

Figure 4 Direct GWP in European electricity production mix, trajectory from 2018 to a zero target in 2040 (EU[18], Multiconsult, European Residual Mixes 2018, Association of Issuing Bodies[19])

Private cars have a life expectancy of 18 years in Norway. This is based on the average age of cars delivered to destruction[20]. The bank's portfolio includes new cars from 2017, 2018 and 2019 with rather even distribution, and the average car is here assumed to end its life in 2036.

The GHG emission intensity baseline for power production may be calculated with different system boundaries. The table below illustrates the CO_2 – factor for both the European production mix and the Norwegian production mix.

[18] http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/631047/IPOL_BRI(2019)631047_EN.pdf
[19] https://www.aib-net.org/facts/european-residual-mix
[20] https://www.ssb.no/en/statbank/table/05522/

Scenario	CO_2- factor (g/kWh)
European (EU28+ Norway) production mix (year 2027)	275
Norwegian consumption mix	11

Table 2 Electricity consumption greenhouse gas factors (CO_2- equivalents) for two scenarios

The following calculations apply the European mix in table 2. This is in line with Nordic Public Sector Issuers: Position Paper on Green Bonds Impact Reporting (January 2019)[21]. 275 gCO_2/kWh constitute the GHG emission intensity baseline for power production in the life time of a 2018 model private car.

The energy consumption of EV's is very much dependent on size and outdoor temperature. There is not sufficient available data to ensure an accurate estimation of energy consumption for the average EV. In these calculations we are using the average for all currently available EV models in Electrical Vehicle Database[22], 17.5 kWh/100km. In table 3 emission factors are presented in both emissions per kilometre and per passenger kilometre.

	Indirect emissions fossil car*	Indirect emissions EV-2027
Emissions per passenger km, indirect emissions from power production	0 gCO_2/pkm	28 gCO_2/pkm
Emissions per km, indirect emissions from power production	0 gCO_2/km	48 gCO_2/km

Table 3 Electricity consumption greenhouse gas factors (CO_2- equivalents)

*Note that there are indirect emissions related fossil fuel as well but that are scope 3 emissions and not included in this analysis.

[21] https://www.kommunalbanken.no/media/545579/npsi_position_paper_2019_final.pdf
[22] https://ev-database.org/cheatsheet/energy-consumption-electric-car

5 Portfolio analysis and impact assessment

5.1 Santander Consumer Bank's criterion – All electric vehicles

The 25,787 eligible vehicles in Santander Consumer Bank's portfolio is estimated to drive 283 million kilometres in a year. The available data from the bank include:

- Current number of contracts and related portfolio volume
- Historic number of contracts and related portfolio volume

	Number of vehicles	Sum km/yr	Sum person km/yr
Eligible passenger vehicles plants in portfolio	25,787	283 mill.	167 mill.

Table 4 Number of eligible passenger vehicles and expected yearly mileage

The table below summarises, in rounded numbers, the reduced CO_2-emissions compared to baseline for the eligible assets in the portfolio in an average year in the lifetime of the vehicles in the portfolio, presented as reductions in direct emissions and indirect emissions. Note that indirect emissions only is calculated for EV's and not fossil fuelled cars.

Direct emissions in table 5 are calculated by multiplying distant travelled by the 25,787 cars in the portfolio in a year, 283 mill. km, by the specific emission factor [CO_2/km] in table 1.

Indirect emissions are calculated by multiplying distant travelled by the 25,787 cars in the portfolio in a year by the specific emission factor [CO_2/km] in table 3.

Eligible passenger vehicles plants in portfolio	Reduced CO_2-emissions compared to baseline
Direct emissions only (Scope 1)	**28,600 tons CO_2/year**
Indirect emissions EV's only (Scope 2)	- 13,600 tons CO_2/year
Direct and indirect emissions in total	15,000 tons CO_2/year

Table 5 The portfolio's estimated impact on GHG-emissions in rounded numbers

The reduction in direct emissions correspond to 12 million litre gasoline saved per year.