REPORT

SpareBank 1 Østlandet electric vehicles portfolio

CLIENT

SpareBank 1 Østlandet

SUBJECT

Impact assessment Norwegian EV portfolio

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1 Introduction

On assignment from SpareBank 1 Østlandet, Multiconsult has assessed the impact of electric vehicles in Norway on climate gas emissions. In this document we briefly describe SpareBank 1 Østlandet's qualification criteria for Green Financing Instruments, the evidence for the criteria and the result of an analysis of the loan portfolio of SpareBank 1 Østlandet. For more information related to the eligibility criteria we refer to SpareBank 1 Østlandet's website [1].

The eligibility criteria are formulated in line with Climate Bonds Initiative (CBI) criteria[2]. The eligible EVs/ zero tailpipe emissions vehicles in the portfolio are also automatically eligible according to the wording in the EU Technical Expert Group's March 2020 Taxonomy Technical Report[3].

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 vehicles of the total new vehicles introduced to the marked, EV's excluded.

2 Electric vehicles - Eligibility criteria

Related to clean transportation the SpareBank 1 Østlandet Sustainable Product Framework has a comprehensive number of relevant eligibility criteria for Green Financing Instruments. This report, however, investigate the electric vehicle portfolio and the relevant criterion:

- Development, manufacture, purchase or financing of electric, hybrid or hydrogen passenger vehicles or fleets

The portfolio examined includes solely electric vehicles financed by the bank.

3 Electric Vehicles – general description

Personal mobility in Norway is high, among the highest in Europe, with privately owned passenger vehicles 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 passenger vehicle is driven annually in Norway, show a falling slope from 2008 and 2009, when the passenger vehicles peaked and was on average driven 13,835 km. This has declined ever since, and in 2019 the average passenger vehicle travelled 11,883 km[4]. For light duty vehicles the travelled distance was 13,994 km and an average bus travelled a distance of 32,983 km in 2019.

[1] https://www.sparebank1.no/en/ostlandet/about-us/investor.html
[2] https://www.climatebonds.net/standard/transport
[3] The financing and / or refinancing of electric powertrain vehicles loans is contemplated by the EU Technical Expert Group's March 2020 Taxonomy Technical Report. https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy-annexes_en.pdf
[4] SSB 12578: Kjørelengder , etter kjøretøytype, drivstoffype, alder, staisikkvariabel og år, 2019

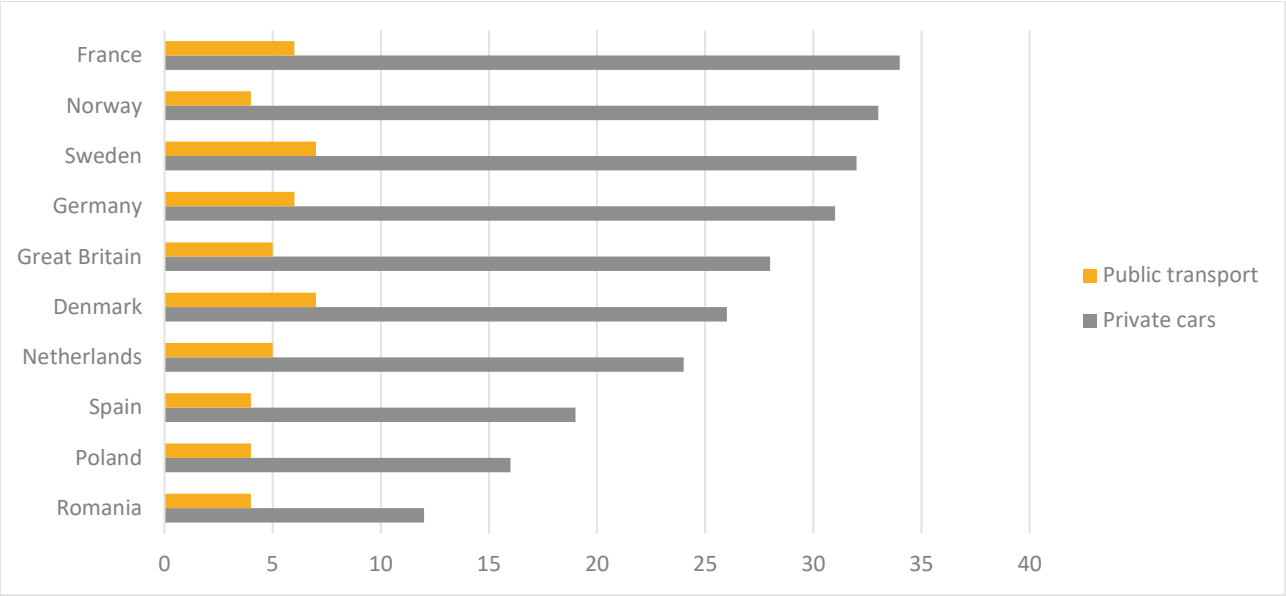

Figure 1 Passenger transport in selected countries [passenger kilometre per person per day] (Source Statistics Norway[5]/Eurostat,2014)

In 2019 the average age of passenger vehicles scrapped for refund in Norway was 18 years old[6]. The history of modern EV's is short and there is yet no evidence for the lifetime of EV's being different from other vehicles. Due to big uncertainties related to the expected lifetime of new vehicles sold between 2011 and 2020, the average lifetime for both passenger vehicles and light duty vehicles are set to 18 years in this analysis independent of fuel type. According to Statistics Norway the average lifetime for a bus in Norway is about 9 years[7], and this has been used in the analysis.

3.1 EV policy in Norway

The number of zero emission passenger vehicles (dominated by EVs but including a small number of fuel cell vehicles) on Norwegian roads rose in March 2020 above 270 000, which is 10% of the passenger vehicle stock[8].

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, ferries, free parking and free charging in cities.

The tax exemption has been prolonged to 2021 in the current government platform[9], 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 % of sales of zero emission light duty and passenger vehicles from 2025.

[5] https://www.ssb.no/transport-og-reiseliv/artikler-og-publikasjoner/kjorer-nest-mest-i-europa
[6] https://www.ssb.no/en/statbank/table/05522
[7] https://www.ssb.no/184994/gjennomsnittlig-%C3%B8konomisk-levetid-antall-%C3%A5r
[8] https://ofv.no/kjoretoybestanden/kj%C3%B8ret%C3%B8ybestanden-1-3-2020
[9] Granavolden-plattformen, 2019

3.2 Biofuel policy in Norway

Norway has an ambitious biofuel policy to reduce CO_2-emissions. A regulation[10] 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. This obligation was increased to 20 % in 2020, whereof a share of minimum 9% should be advanced biofuel. As the goal was achieved by 2019, the goal was later boosted[11]. It has been emphasised that increased use of biofuel should not increase deforestation[12]. The current government platform points in the unambiguous direction of an increasing share of advanced biofuels. A new ambition is 40% biofuel (including double counting) in the fuel mix by 2030[13] [14]. Road tax exempts are still in place for biofuels, however, have been somewhat reduced[15]. It has been estimated that biofuel used in Norway in 2018 reduced specific emissions by 72 % in a life cycle perspective compared to regular fuels[16].

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[17] 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 are using two relevant climate gas emission indicators for vehicles:

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

The passenger vehicle fleet composition and emissions from the types of passenger vehicles 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 travelled.

Statistics Norway's method for calculating indicators for emissions per passenger kilometre utilizes a vehicle occupancy of 1.7 persons in passenger vehicles and 1.5 persons in a light duty vehicle, and these factors have been adopted in this analysis[18].

[10] Produktforskriften kapittel 3: Omsetningskrav for biodrivsoff og børekrafskrierier for biodrivsoff og flytende biobrensel, Lovdata, 2019
[11] https://lovdata.no/dokument/LTI/forskrift/2020-06-17-1221
[12] https://www.regjeringen.no/no/dokumenter/politisk-plattform/id2626036/
[13] https://www.regjeringen.no/no/dokumenter/politisk-plattform/id2626036/
[14] https://www.ssb.no/energi-og-industri/artikler-og-publikasjoner/stadig-mer-alternativt-drivstoff-i-transport
[15] https://www.regjeringen.no/no/tema/okonomi-og-budsjett/skatter-og-avgifter/veibruksavgift-pa-drivstoff/id2603482/
[16] https://www.miljodirektoratet.no/aktuelt/nyheter/2019/mai-2019/salget-av-avansert-biodrivstoff-okte-i-fjor/
[17] https://www.climatebonds.net/files/files/Low%20Carbon%20Transport%20Background%20Paper%20Feb%202017.pdf page 10
[18] 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 we calculate the "Direct tailpipe CO_2 emissions from fossil fuels combustion" avoided.

The estimation of the baseline is performed through 3 steps:

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

This can be described in the following equation:

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

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

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 passenger vehicle fleet.

For the substituted fossil fuelled vehicles, emission data are retrieved from recognized test methods and not actual registrations of emissions in a Nordic climate. Test methods have lately been improved to better reflect actual emissions but are still likely to underestimate the emissions[19].

Biofuels are to some degree mixed with fossil fuels, and the reduced emissions due to these contributions are considered in the emissions from the vehicle that would have been bought as an alternative for the electric vehicle in this portfolio, in effect reducing the climate impact of zero emission vehicles. As Norway is aiming at substantially reducing emissions from fossil fuelled vehicles through use of biofuel in the fuel sold before 2030, the marginal emission reduction possibly obtained through these political goals between 2020-2030 have been accounted for in the analysis. It is assumed that the biofuel share in the fuel mix will remain constant between 2030 and 2038.

To estimate the weighted average of emissions per fossil passenger vehicle ($c_{weighed\ average}$) we use the average annual emission from new passenger vehicle models from 2011-2021[20].

To estimate the distance travelled by the average passenger vehicle we assume that EVs drive as much as an average Norwegian passenger vehicle each of the 18 years it is in use. Existing EVs younger than 9 years have yearly milage somewhere between petrol and diesel passenger vehicles[21].

[19] https://www.vegvesen.no/fag/fokusomrader/miljo+og+omgivelser/klima
[20] https://ofv.no/CO2-utslippet/co2-utslippet
[21] https://www.ssb.no/statbank/table/12578/

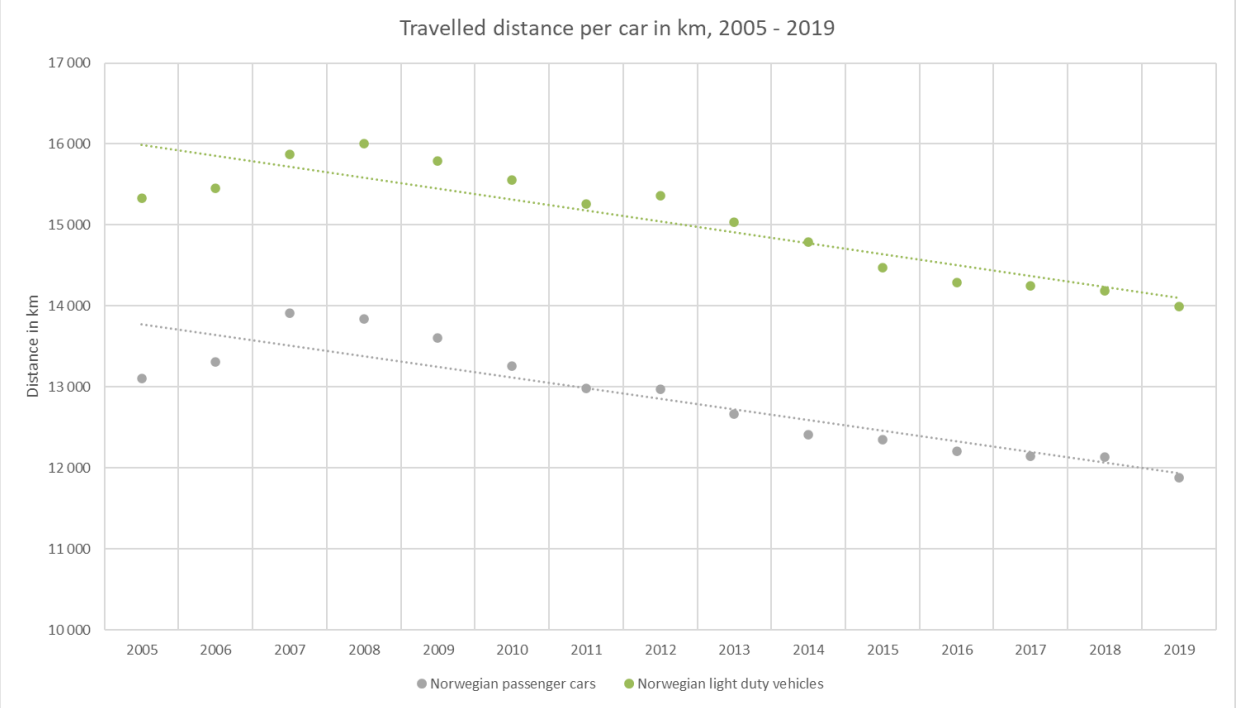

Figure 2 Average travelled distance per passenger vehicles 2005-2019 [km] (Source: Statistics Norway [22])

Traffic volumes per passenger vehicle and light duty vehicle has shown a historic decline and we use linear regression on publicly available dataset (d_{2005}-d_{2019}) and extrapolate until 2038. This is a conservative approach as it is likely, at some point, to see a flattening.

For busses we do not expect this declining trend. The distance travelled by busses is assumed at about 32,000 km/year, which is the average from the 10 last years[23].

Table 1 through Table 3 present the calculated emission factors and CO_2-emissions in a year for the relevant vehicle categories. This is based on emissions statistics between 2011-2019, calculated gross tailpipe CO_2-emissions for the average vehicle produced in each of the years 2011-2021, anticipated biofuel- and fossil fuel content in petrol/diesel pumped each year between 2020-2038. Emissions per vehicle and year is further based on the travelled annual distance for the average vehicle produced in each year between 2011-2021.

	Direct emissions substituted fossil passenger vehicles – Average	**Direct emissions EV**
Emissions per passenger km	57 gCO_2/pkm	0 gCO_2/pkm
Emissions per km	97 gCO_2/km	0 gCO_2/km
Emissions per passenger vehicle and year	1,071 $kgCO_2$/vehicle/year	0 $kgCO_2$

*Table 1 **Passenger vehicles**: Greenhouse gas emission factors (CO_2- equivalents), average direct emissions*

[22] https://www.ssb.no/en/statbank/table/12575/
[23] SSB 12578: Kjørelengder , eter kjøreøyype, drivstoffype, alder, staisikkvariabel og år, 2019

	Direct emissions substituted fossil light duty vehicles – Average	**Direct emissions EV**
Emissions per passenger km	101 gCO_2/pkm	0 gCO_2/pkm
Emissions per km	152 gCO_2/km	0 gCO_2/km
Emissions per passenger vehicle and year	1,978 $kgCO_2$/vehicle/year	0 $kgCO_2$

Table 2 ***Light Duty Vehicles****: Greenhouse gas emission factors (CO_2- equivalents), average direct emissions*

	Direct emissions substituted fossil buses – Average	**Direct emissions EV**
Emissions per km	841 gCO_2/km	0 gCO_2/km
Emissions per bus and year	27,024 $kgCO_2$/vehicle/year	0 $kgCO_2$

Table 3 ***Buses and trucks****: Greenhouse gas emission factors (CO_2- equivalents), average direct emissions*

4.3 Indirect emissions (Power consumption only)- Scope 2

4.3.1 Electricity production mix

In 2019, the Norwegian power production was 98 % renewable (NVE[24]). As shown in Figure 3, the Norwegian production mix in 2019 (93% hydropower and 4% wind) resulted in emission of 11 gCO_2/kWh. In the figure, the production mix is included for other selected European states for illustration.

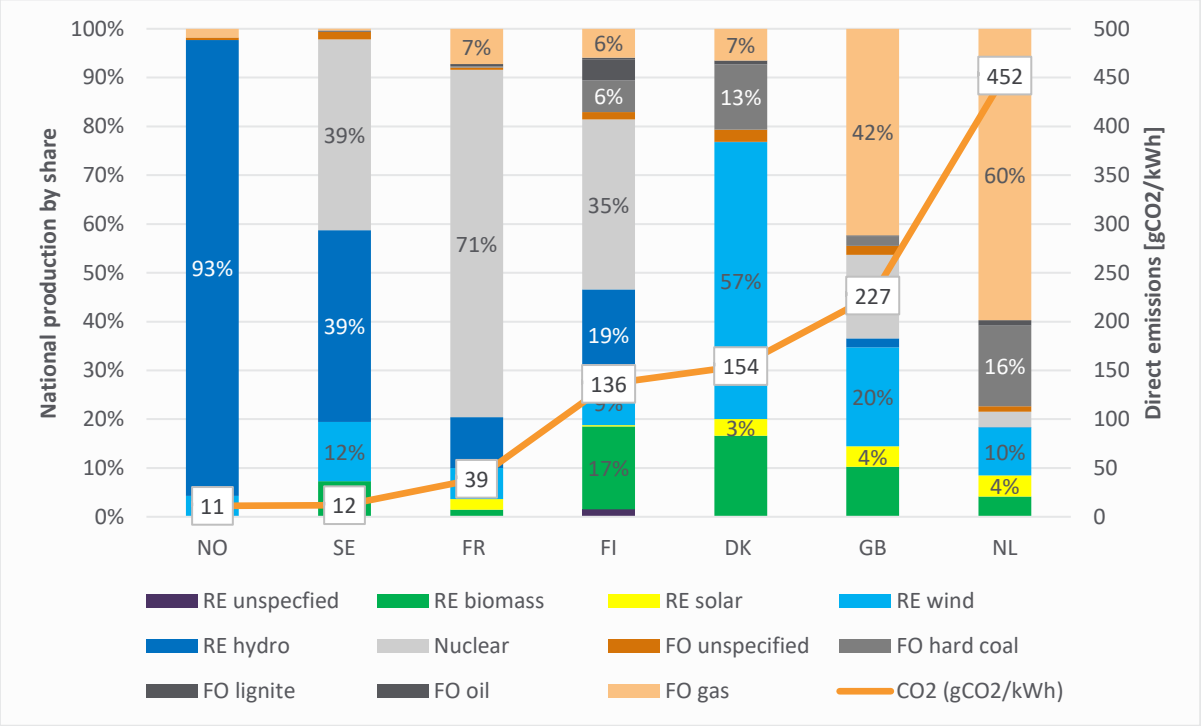

Figure 3 National electricity production mix in some relevant countries (European Residual Mixes 2019, Association of Issuing Bodies[25])

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 the national power production mix and is the basis for the main analysis. We have, however, also included calculations of indirect emissions from power production setting the system boundary at national borders.

The direct emissions in power production in Europe (EU28+Norway) is expected to be dramatically reduced the coming decades. Figure 4 illustrates the emission trajectory used as basis for scope 2 emission calculations for EV's. 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[26].

[24] https://www.nve.no/nytt-fra-nve/nyheter-energi/varedeklarasjon-for-stromleverandorer-2019/
[25] https://www.aib-net.org/facts/european-residual-mix
[26] http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/631047/IPOL_BRI(2019)631047_EN.pdf

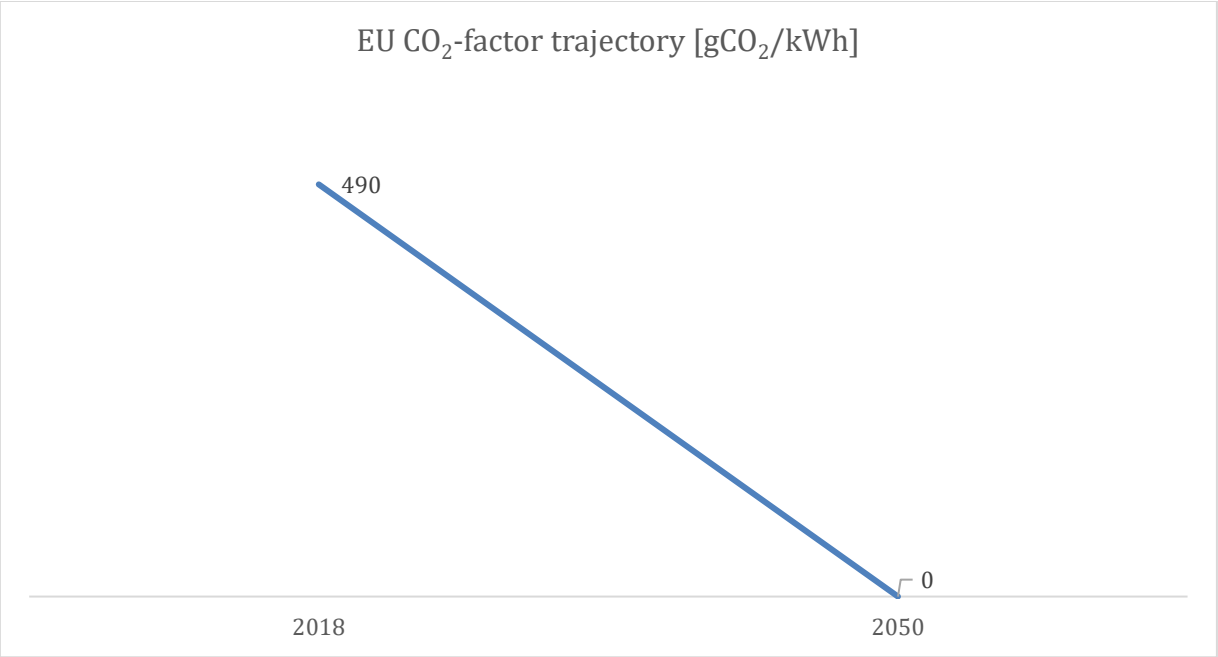

Figure 4 Direct GWP in European electricity production mix, trajectory from 2018 to a zero target in 2050 (EU, Multiconsult, Association of Issuing Bodies[27])

The national power production mix is also likely to change somewhat in the period. Figure 5 illustrates an assumed linear projection of the emission factor used in the following calculations.

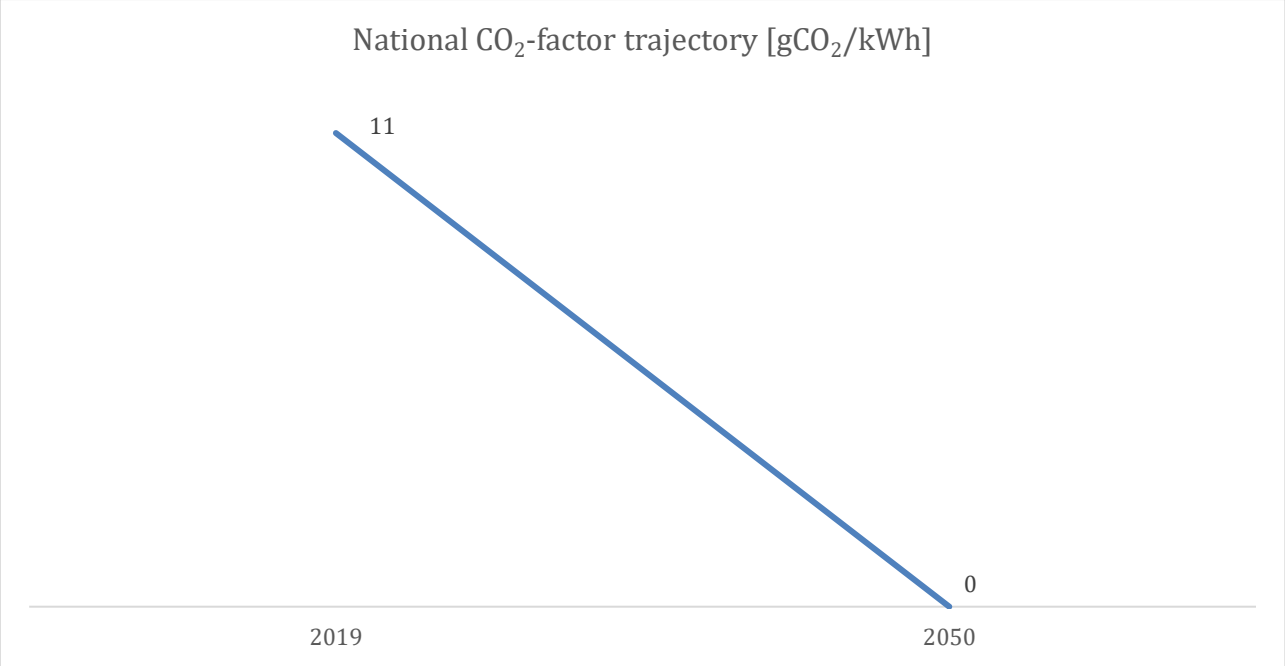

Figure 5 Direct GWP in Norwegian electricity production mix, trajectory from 2019 to a zero target in 2050 (Multiconsult, Association of Issuing Bodies)

[27] https://www.aib-net.org/facts/european-residual-mix

Passenger vehicles in Norway have a life expectancy of 18 years. The production mix is based on the assumed emissions from 2027, which is the weighted average of the lifetime for the vehicles in the portfolio.

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

Scenario	**CO_2- factor (g/kWh)**
European (EU27 + UK + Norway) production mix in (2018) / 2027	(490) / 352
Norwegian production mix in (2019) / 2027	(11) / 8

Table 4 Electricity consumption greenhouse gas factors (CO_2- equivalents)

Using a European production mix is in line with Nordic Public Sector Issuers: Position Paper on Green Bonds Impact Reporting (February 2020)[28]. 352 gCO_2/kWh constitute the GHG emission intensity baseline for power production in the lifetime of passenger vehicles produced between 2011 and 2021. The following calculations apply the European mix in Table 4.

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[29], which is 20 kWh/100 km. Energy consumption by light duty vehicles is estimated to be 21 kWh/100km and the energy consumption by buses is estimated as 90 kWh/100 km, based on the Swedish Transport Administration's handbook on air pollution from road traffic[30]. In Table 5 emission factors are presented in both emissions per kilometre and per passenger kilometre.

	Indirect emissions electric passenger vehicle - annual average	**Indirect emissions electric light duty vehicle - annual average**	**Indirect emissions electric bus - annual average**
Emissions per passenger km, indirect emissions from power production	41 gCO_2/pkm	49 gCO_2/pkm	-
Emissions per km, indirect emissions from power production	70 gCO_2/km	74 gCO_2/km	317 gCO_2/km

Table 5 Electricity consumption greenhouse gas factors (CO_2- equivalents) electric vehicles- based on EU power production mix

[28] https://www.kbn.com/globalassets/dokumenter/npsi_position_paper_2020_final_ii.pdf
[29] https://ev-database.org/cheatsheet/energy-consumption-electric-car
[30] Handbok för vägtrafikens luftföroreningar, chapter 6, Trafikverket, 2019

	Indirect emissions fossil vehicle*	**Indirect emissions fossil light duty vehicle***	**Indirect emissions fossil bus***
Emissions per passenger km, indirect emissions from power production	0 gCO_2/pkm	0 gCO_2/pkm	-
Emissions per km, indirect emissions from power production	0 gCO_2/km	0 gCO_2/km	0 gCO_2/km

Table 6 Electricity consumption greenhouse gas factors (CO_2- equivalents) fossil fuelled alternatives

*Note that there are indirect emissions related to fossil fuel as well but that are scope 3 emissions and not included in this analysis. Scope 3 emissions differ between fossil and electric vehicles mostly due to the batteries where there is rapid technology development.

5 Portfolio analysis and impact assessment - avoided emissions EVs

The 3,114 eligible vehicles in SpareBank 1 Østlandet's portfolio are estimated to drive 34 million km a year. The available data from the bank include the current number of contracts and related portfolio volume and asset values.

	Number of vehicles	Sum km/yr	Sum person km/yr
Passenger vehicles	3,049	33.5 mill.	57.0 mill.
Light Duty Vehicles	61	0.8 mill.	1.2 mill.
Buses (including 3 trucks > 16 tons)	4	0.1 mill.	-
Sum portfolio	**4,114**	**34.5 mill.**	**58.2 mill. (ex. Busses)**

Table 7 Number of eligible passenger vehicles and expected yearly mileage

The table below summarises, in rounded numbers, the lower 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 the indirect emissions are only calculated for EV's and not fossil fuelled vehicles.

Direct emissions in the following tables are calculated by multiplying distance travelled by the vehicles in the portfolio in a year, 34.5 mill. km, by the specific emission factor [CO_2/km] in Table 1 through Table 3. Indirect emissions are calculated by multiplying distance travelled by the vehicles in the portfolio in a year by the specific emission factors [CO_2/km] in Table 5 and Table 6.

	CO_2-emissions compared to baseline – scaled to reflect the banks engagement
Direct emissions only (Scope 1)	**- 3,320 tons CO_2/year**
Indirect emissions EV's only (Scope 2)	**2,337 tons CO_2/year**
Direct and indirect	**- 983 tons CO_2/year**

Table 8 The portfolio's estimated impact on GHG-emissions, indirect emissions based on European power production mix

The reduction in direct emissions correspond to 1,4 million litre gasoline saved per year.