REPORT

SR-Bank Green Portfolio Impact Assessment

CLIENT

SpareBank 1 SR-Bank ASA

SUBJECT

Impact assessment- energy efficient residential and commercial buildings, electric vehicles and renewable energy

DATE: / REVISION: June 1, 2021 / 00

DOCUMENT CODE: 10226251-1-TVF-RAP-001

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In summary, impact assessed for all examined asset classes in the SR-Bank portfolio qualifying according to SR-Bank's Green Bond Framework is dominated by renewable energy but with significant contributions from all asset classes. This table sums up the impact in rounded numbers:

Energy efficient residential buildings		*25,500 ton CO_2e/year*
Energy efficient commercial buildings		*5,700 ton CO_2e/year*
Electric vehicles	*Scope 2: -500 ton CO_2e/year*	*Scope 3: 1,000 ton CO_2e/year*
Renewable energy		*104,000 ton CO_2e/year*
Total		*136,200 ton CO_2e/year*

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1 Introduction

Assignment

On assignment from SR-Bank, Multiconsult has assessed the impact of the part of SR-Bank's loan portfolio eligible for green bonds according to SR-Bank's Green Bonds Framework.

In this document we briefly describe SR-Bank's green bond qualification criteria, the evidence for the criteria and the result of an analysis of the loan portfolio of SR-Bank. More detailed documentation on baseline, methodologies and eligibility criteria is made available on SR-Bank's website [1].

1.1 CO_2- emission factors related to electricity demand and production

The eligible assets are either producing renewable energy and delivering into the existing power system or using electricity from the same system. The energy consumption of Norwegian buildings is also predominantly electricity, with some district heating and bioenergy. The share of fossil fuel is very low and declining.

As shown in figure 1, 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.

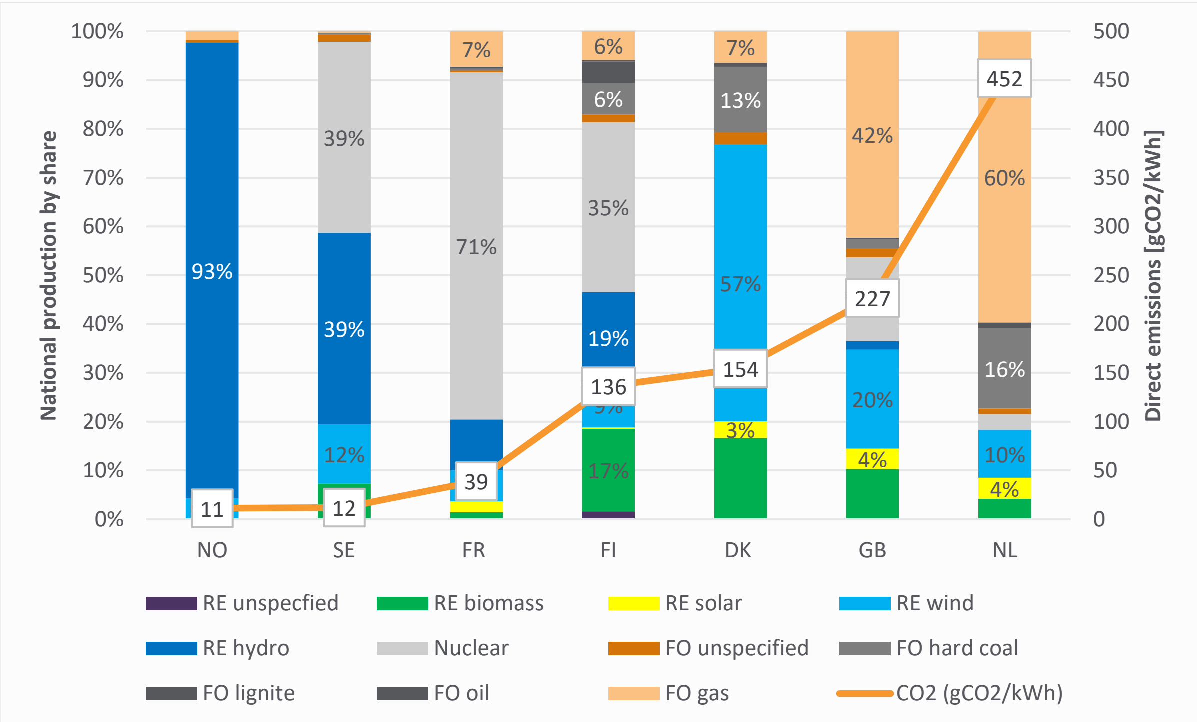

Figure 1 National electricity production mix in some relevant countries (European Residual Mixes 2019, Association of Issuing Bodies[2])

Power is traded internationally in an ever more interconnected European electricity grid. For impact calculations, the regional or European production mix is more relevant than national production. Using a life-cycle analysis, the Norwegian Standard NS 3720:2018 "Method for greenhouse gas calculations

[1] https://www.sparebank1.no/en/sr-bank/about-us/investor/financial-info/debt-investors.html
[2] https://www.aib-net.org/facts/european-residual-mix

for buildings" takes into account international electricity trade and that the consumption is not necessarily equal to domestic production. The grid factor, as average in the lifetime of an asset, is based on a trajectory from the current grid factor to a close to zero emission factor in 2050 and steady until the end of the lifetime.

The mentioned standard calculates, on a life-cycle basis, the average CO_2- factor for the next 60 years, a lifetime relevant for buildings and renewable energy assets, according to two scenarios as described in table 1.

Scenario	**CO_2- factor (g/kWh)**
European (EU28+ Norway) consumption mix	136
Norwegian consumption mix	18

Table 1 Electricity production greenhouse gas factors (CO_2- equivalents) for two scenarios (source: NS 3020:2018, Table A.1)

The impact calculations in this report apply the European mix in table 1. This is in line with Nordic Public Sector Issuers: Position Paper on Green Bonds Impact Reporting (February 2020)[3].

Applying the factor based on EU28 + Norway energy production mix, the resulting CO_2- factor for Norwegian residential buildings[4] is on average 124 gCO_2/kWh due to the influx of bioenergy and district heating in the energy mix.

The average emission factor relevant for electric vehicles is calculated correspondingly, however, with a shorter life expectancy of the vehicles of 18 years. The relevant emission factor is, as presented in more detail in section 3, calculated for this asset class to be 352 gCO_2/kWh

[3] https://www.kbn.com/globalassets/dokumenter/npsi_position_paper_2020_final_ii.pdf
[4] Multiconsult. Based on building code assignments for DiBK

2 Energy efficient buildings

2.1 Residential buildings

2.1.1 Eligibility criteria

The SR-Bank eligibility criteria for residential buildings are divided in three, one based on building code, one based on Energy Performance Certifications, and at last an upgrade criterion.

Building code criterion

i. New or existing Norwegian apartments that comply with the Norwegian building codes of 2010 (TEK10) or 2017 (TEK17). Hence, built in 2012 and later.

ii. New or existing Norwegian other residential dwellings that comply with the Norwegian building codes of 2007 (TEK07), 2010 (TEK10) or 2017 (TEK17). Hence, built in 2009 and later.

Over the last several decades, the changes in the building code have pushed for more energy efficient buildings. Combining the information on the calculated energy demand related to building code and information on the residential building stock, the calculated average specific energy demand on the Norwegian residential building stock is 252 kWh/m^2. Building code TEK07(small residential buildings), TEK10 and TEK17 gives an average specific energy demand for existing houses and apartments, weighted for actual stock, of 118 kWh/m^2.

Hence, compared to the average residential building stock;

- the building code TEK07(small residential buildings), TEK10 and TEK17 gives a calculated specific energy demand reduction of 53 %

EPC criterion

Existing Norwegian residential buildings built using older building codes than TEK10 for apartments and TEK07 for other residential dwellings with EPC-labels A, B and C.

As only half of all dwellings have a registered EPC, the available data have been extrapolated assuming the registered dwellings are representative for their age group regarding energy label. Then the EPC data indicates that 15 % of the current residential buildings in Norway will have a C or better. The average energy performance of a dwelling, according to the EPC system, relates to an energy label E.

The system boundary in the Norwegian EPC system differs from the one used in the building code (EPC uses delivered energy and not gross energy demand). For impact assessments the building code baseline is hence based on the EPC statistics where the average dwelling gets an E. For buildings qualifying according to this criterion, the improved energy efficiency is calculated by factors presented in the table below. All energy labels cover a span and in these calculations the average values are assumed for all dwellings, except for dwellings with energy label A, where the limit value is expected as a conservative approach.

	Apartments	Small residential buildings
Difference between average efficiency to energy label A	93 kWh/m²	121 kWh/m²
Difference between average efficiency to energy label B	85 kWh/m²	106 kWh/m²
Difference between average efficiency to energy label C	66 kWh/m²	76 kWh/m²

Table 2 Difference in energy efficiency between qualifying dwellings and the national average

Refurbishment criterion

Refurbished Residential buildings in Norway with an improved energy efficiency of 30%

Refurbished buildings with an improved energy efficiency of at least 30 % or more are eligible for Green Bonds.

As the tables below illustrate, when under this criterion only qualifying buildings with energy label D, the calculated improved efficiency depends on age of the building and building category.

Building year:	after 2018	2012-2018	2009-2018	1999-2008	1989-1998	1971-19887	1951-1970	before 1951
Building code:	TEK17	TEK10	TEK07	TEK97	TEK87	TEK69	TEK49	OLDER
Calculated delivered energy [kWh/m²,year]:	106,9	126	126	168,2	204,2	245,6	261	388,5
Improvement (average)								
A	6 %	21 %	21 %	41 %	51 %	59 %	62 %	74 %
B		9 %	9 %	32 %	44 %	53 %	56 %	70 %
C				14 %	29 %	41 %	44 %	63 %
D					12 %	26 %	31 %	54 %
E						10 %	15 %	43 %
F								30 %

Table 3 Eligible small residential buildings

Building year:	after 2018	2012-2018	2009-2018	1999-2008	1989-1998	1971-19887	1951-1970	before 1951
Building code:	TEK17	TEK10	TEK07	TEK97	TEK87	TEK69	TEK49	OLDER
Calculated delivered energy [kWh/m²,year]:	91,7	110,1	110,1	155,4	177,2	228,3	252,7	312,7
Improvement (average)								
A		14 %	14 %	39 %	47 %	59 %	63 %	70 %
B				34 %	42 %	55 %	60 %	67 %
C				22 %	31 %	47 %	52 %	61 %
D					15 %	34 %	40 %	52 %
E						18 %	26 %	40 %
F								25 %

Table 4 Eligible apartments

This criterion has so far not been used to identify eligible buildings in the portfolio.

2.1.2 Impact assessment - Residential buildings

The eligible residential buildings in SR-Bank's portfolio is estimated to amount to 1.6 million square meters. The available data include reliable area for most objects. For object where this data is not available, the Area per dwelling is calculated on the basis of average area derived from national statistics (Statistics Norway[5]). The area is calculated based on the assumption that the residents in the portfolio are equivalent to the average Norwegian residential building stock. The values in the column [area per unit] in the table below are calculated from these statistics.

	Number of units	Area qualifying buildings in portfolio [m^2]
Apartments	4 202	302 544
Small residential buildings	8 087	1 328 174
Sum	12 289	1 630 718

Table 5 Eligible objects and calculated building areas

Based on the calculated figures in table 5, the energy efficiency of this part of the portfolio is estimated. All these residential buildings are not included in one single bond issuance.

To calculate the impact on climate gas emissions the trajectory is applied to all electricity consumption in all buildings. Electricity is the dominant energy carrier to Norwegian buildings but the energy mix includes also bio energy and district heating, resulting in a total specific factor of 124 g CO_2eq/kWh. A proportional relationship is expected between energy consumption and emissions.

Table 6 indicates how much more energy efficient the eligible part of the portfolio is compared to the average residential Norwegian building stock. It also presents how much the calculated reduction in energy demand constitutes in CO_2-emissions.

	Area	Reduced energy compared to baseline	Reduced CO_2-emissions compared to baseline
Buildings eligible under the building code criterion	1 404 140 m^2	187 GWh/year	23 300 tons CO_2/year
Buildings eligible under the EPC criterion	226 578 m^2	17 GWh/year	2 200 tons CO_2/year
Eligible buildings in portfolio- total	1 630 718 m^2	204 GWh/year	25 500 tons CO_2/year

Table 6 Performance of eligible objects compared to average residential building stock

[5] Table 06513: Dwellings, by type of building and utility floor space

2.2 Commercial buildings

2.2.1 Eligibility criteria

The SR-Bank eligibility criteria for commercial buildings are divided in three, one based on building code, one based on certifications as BREEAM, and at last an upgrade criterion.

Building code criterion

New or existing commercial buildings belonging to top 15% low carbon buildings in Norway:

i. New or existing Norwegian hotel and restaurant buildings that comply with the Norwegian building code TEK07, TEK10, TEK17 and later building codes. Hence, built after 2011.

ii. New or existing Norwegian office, retail and industrial buildings and warehouses that comply with the Norwegian building TEK07, TEK10, TEK17 and later building codes. Hence, built after 2010.

Combining the information on the calculated specific energy demand related to building code and information on the commercial building stock, the calculated average specific energy demand on the part of the Norwegian building stock examined is presented in the table below. The table also presents the average specific energy demand for the younger and qualifying part of the building stock and the relative reduction in energy demand.

	Average total stock [kWh/m^2]	Average TEK07, TEK10 and TEK17 [kWh/m^2]	Reduction [kWh/m^2]
Office buildings	250	149	40 %
Commercial buildings	321	212	34 %
Hotel buildings	330	222	33 %
Small industry and warehouses	294	172	41 %

Table 7 Average specific energy demand for the building stock; whole stock, part eligible according to criteria and reduction

A reduction of energy demand from the average of the total commercial building stock to the average for eligible building codes is multiplied to the emission factor and area of eligible assets to calculate impact.

Certification criteria: BREEAM, LEED and Nordic Swan Ecolabel

New, existing or refurbished commercial buildings which received at least one or more of the following classifications:

i. LEED "Gold", BREEAM or BREEAM-NOR "Excellent", or equivalent or higher level of certification

ii. Nordic Swan Ecolabel

BREEAM-NOR is the most often used certification scheme for commercial buildings in Norway, and the bank has identified a number of buildings in the portfolio that qualify, six "Excellent" and one "Outstanding".

Information on energy demand or the design of specific buildings is not available but the impact may be calculated based on minimum requirements in the certification system. “Excellent” requires a net energy demand 25% lower than the limit value for a grade C in the EPC system. To get “Outstanding” the net energy demand must be 38% lower than the limit value for a grade C in the EPC system.

Refurbishment criterion

Refurbished Commercial buildings in Norway with an improved energy efficiency of 30%

Refurbished buildings with an improved energy efficiency of at least 30 % or more are eligible for Green Bonds.

This criterion has so far not been used to identify eligible buildings in the portfolio.

2.2.2 Impact assessment - Commercial buildings

The eligible buildings in SR-Bank’s portfolio is estimated to amount to 307,886 square meters. All qualify due to the building code criteria, and 75,100 square meters of office buildings in addition qualify due to BREEAM certificate Excellent (5) or Outstanding (1). The available data include reliable area per object.

	Average area per building [m^2]	Area qualifying buildings in portfolio [m^2]
Office buildings	4 157	116 408
Commercial buildings	1 371	31 535
Hotel buildings	7 000	7 000
Small industry and warehouses	3 557	152 943
Sum		307 886

Table 8 Eligible objects and calculated building areas

To calculate the impact on climate gas emissions the trajectory is applied to all electricity consumption in all buildings. Electricity is the dominant energy carrier to Norwegian buildings but the energy mix includes also bio energy and district heating, resulting in a total specific factor of 124 g CO_2eq/kWh. A proportional relationship is expected between energy consumption and emissions.

Table 9 indicates how much more energy efficient the eligible part of the portfolio is compared to the average residential Norwegian building stock. It also presents how much the calculated reduction in energy demand constitutes in CO_2-emissions.

	Area	Reduced energy compared to baseline	Reduced CO_2-emissions compared to baseline
Buildings eligible under the building code criterion	307,886 m^2	35 GWh/year	4,300 tons CO_2/year
Buildings eligible under the BREEAM criterion	75,100 m^2	11 GWh/year	1,400 tons CO_2/year
Eligible buildings in portfolio- total	382,986 m^2	46 GWh/year	5,700 tons CO_2/year

Table 9 Performance of eligible objects compared to average building stock

3 Electric vehicles

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 SR-Bank's portfolio and can confirm that it in May 2020 includes 275 electric vehicles.

The impact of electric vehicles in Norway on climate gas emissions is assessed in the following. 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 vehicle of the total new vehicle introduced to the marked, EV's excluded.

3.1 Loan Portfolio Analysis SR- Bank

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

Eligibility criterion:
Low carbon vehicles. Automatically eligible passenger vehicles, Light Duty and Heavy Goods Vehicles: electric and fuel cell vehicles

The eligibility criterion is formulated in line with Climate Bonds Initiative (CBI) criteria[6] and proposed criteria in the final TEG Report on EU Taxonomy[7].

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

3.2 General description

Personal mobility in Norway is high, among the highest in Europe, with privately owned passenger vehicles taking the lion's share of the passenger transportation work. Figure 2 shows 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[8]. For light duty vehicles the travelled distance was 13,994 km and an average bus travelled a distance of 32,983 km in 2019.

[6] https://www.climatebonds.net/standard/transport
[7] https://ec.europa.eu/info/publications/sustainable-finance-teg-taxonomy_en
[8] SSB 12578: Kjørelengder , etter kjøretøytype, drivstoffype, alder, staisikkvariabel og år, 2019

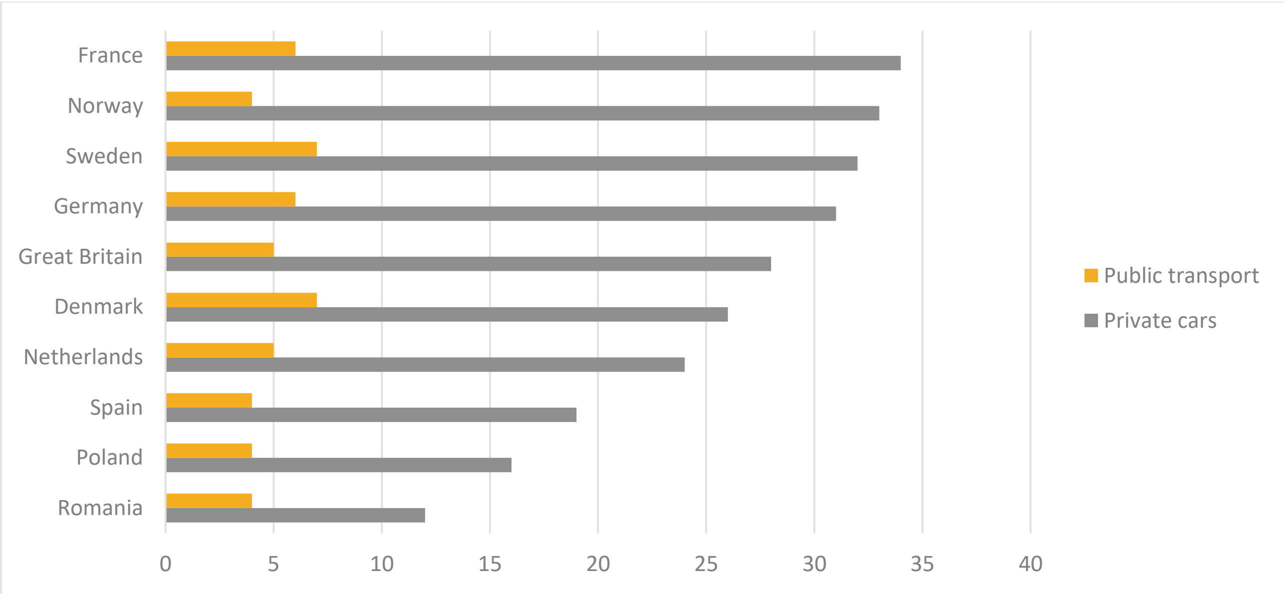

Figure 2 Passenger transport in selected countries [passenger kilometre per person per day] (Source Statistics Norway[9]/Eurostat,2014)

In 2019 the average age of passenger vehicles scrapped for refund in Norway was 18 years old[10]. 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[11], and this has been used in the analysis.

3.2.1 *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[12].

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[13], 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.

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

3.2.2 Biofuel policy

Norway has an ambitious biofuel policy to reduce CO_2-emissions. A regulation[14] 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[15]. It has been emphasised that increased use of biofuel should not increase deforestation[16]. 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[17] [18]. Road tax exempts are still in place for biofuels, however, have been somewhat reduced[19]. 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[20].

3.3 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[21] 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.

3.3.1 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[22].

3.3.2 Direct emissions (tailpipe)- Scope 1

Under scope 1 we calculate the "Direct tailpipe CO_2 emissions from fossil fuels combustion" avoided.

[14] Produktforskriften kapittel 3: Omsetningskrav for biodrivsoff og børekrafskrierier for biodrivsoff og flytende biobrensel, Lovdata, 2019
[15] https://lovdata.no/dokument/LTI/forskrift/2020-06-17-1221
[16] https://www.regjeringen.no/no/dokumenter/politisk-plattform/id2626036/
[17] https://www.regjeringen.no/no/dokumenter/politisk-plattform/id2626036/
[18] https://www.ssb.no/energi-og-industri/artikler-og-publikasjoner/stadig-mer-alternativt-drivstoff-i-transport
[19] https://www.regjeringen.no/no/tema/okonomi-og-budsjett/skatter-og-avgifter/veibruksavgift-pa-drivstoff/id2603482/
[20] https://www.miljodirektoratet.no/aktuelt/nyheter/2019/mai-2019/salget-av-avansert-biodrivstoff-okte-i-fjor/
[21] https://www.climatebonds.net/files/files/Low%20Carbon%20Transport%20Background%20Paper%20Feb%202017.pdf page 10
[22] https://www.ssb.no/transport-og-reiseliv/artikler-og-publikasjoner/mindre-utslipp-per-kjorte-kilometer

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[23].

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[24].

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[25].

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

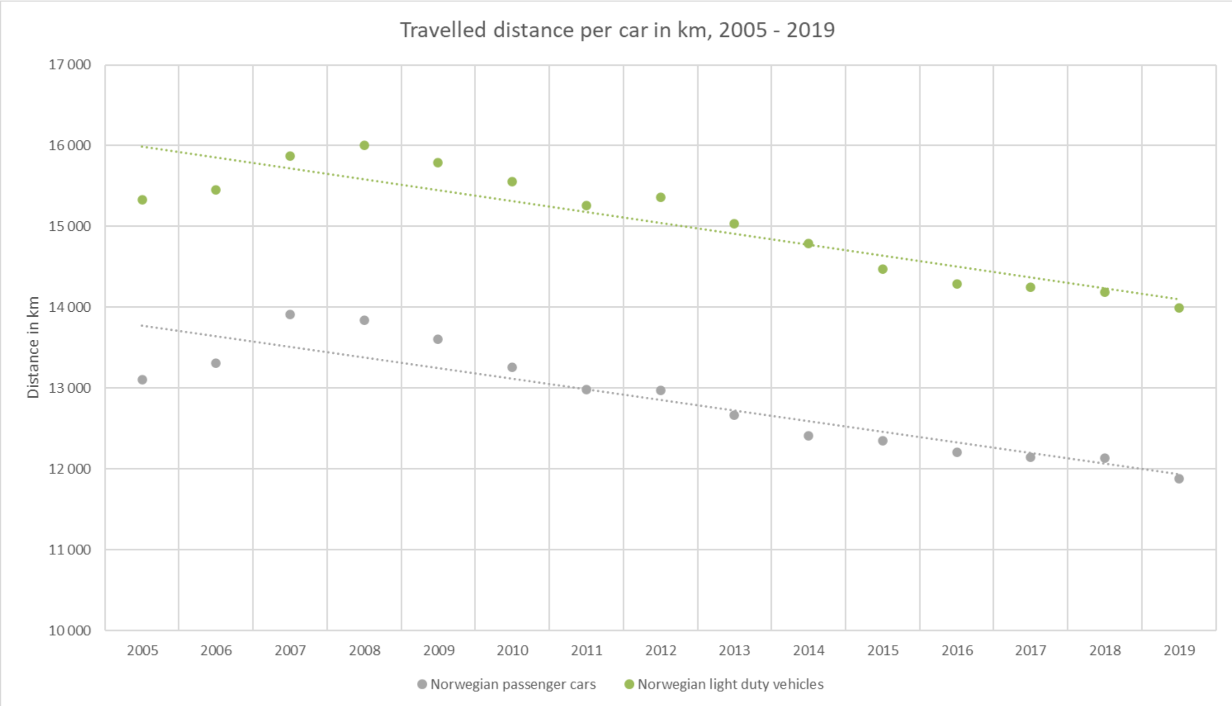

Figure 3 Average travelled distance per passenger vehicles 2005-2019 [km] (Source: Statistics Norway [26])

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[27].

Table 10 through Table 12 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 fueled 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 10 **Passenger vehicles**: Greenhouse gas emission factors (CO_2- equivalents), average direct emissions*

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

	Direct emissions substituted fossil fueled 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 11 ***Light Duty Vehicles****: Greenhouse gas emission factors (CO_2- equivalents), average direct emissions*

	Direct emissions substituted fossil fueled 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 12 ***Buses and trucks****: Greenhouse gas emission factors (CO_2- equivalents), average direct emissions*

3.3.3 Indirect emissions (Power consumption only)- Scope 2

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[28].

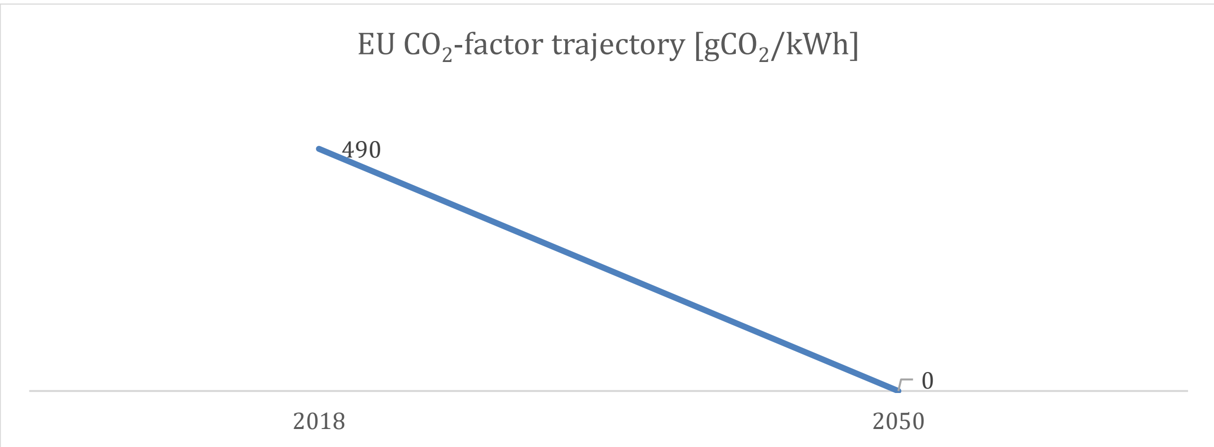

Figure 4 Direct GWP in European electricity production mix, trajectory from 2018 to a zero target in 2050 (EU, Multiconsult, Association of Issuing Bodies[29])

[28] http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/631047/IPOL_BRI(2019)631047_EN.pdf
[29] 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 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 13 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)[30]. 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 13.

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[31], 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[32]. In Table 14 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 14 Electricity consumption greenhouse gas factors (CO_2- equivalents) electric vehicles- based on EU power production mix

Indirect emissions related to fossil fuelled vehicles are zero for scope 2. Scope 3 emissions are not included in this analysis.

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

3.4 Impact assessment: Avoided emissions – Electric vehicles

The 428 eligible vehicles in SR- Bank's portfolio are estimated to drive 5.14 million kilometres in a year. The available data from the bank include current number of contracts and related portfolio volume. Passenger vehicles is the major vehicle category in the portfolio accounting for 81% of the vehicles eligible for inclusion in a green bond issuance.

	Number of vehicles	Sum km/yr.
Eligible passenger vehicles in portfolio	345	3.72 mill.
Eligible light duty vehicles in portfolio	65	0.84 mill.
Eligible buses and lorries in portfolio	18	0.58 mill.
Sum eligible vehicles	428	5.14 mill.

Table 15 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 is only calculated for EV's and not fossil fuelled vehicles.

Direct emissions in table 17 are calculated by multiplying distance travelled by the vehicles in the portfolio in a year by the specific emission factor [CO_2/km] in tables 10 through 12.

Indirect emissions are calculated by multiplying distance travelled by the number of vehicles in the portfolio in a year by the specific emission factor [CO_2/km] in table 14.

Eligible vehicles plants in portfolio	Reduced CO_2-emissions compared to baseline
Total **Direct emissions only** (Scope 1)	**977 tons CO_2/year**
Total Indirect emissions EV's only (Scope 2)	-508 tons CO_2/year
Total Avoided emissions	469 tons CO_2/year

Table 16 The portfolio's estimated impact on direct, indirect and avoided GHG-emission in rounded numbers

The reduction in direct emissions correspond to 0.4 million litre gasoline saved per year.

4 Renewable energy

Hydropower is the clearly dominant power production solution in Norway and has been for 100 years since the beginning of the industrialisation. Hydropower accounts for about 95 % of the national power production. On-shore wind power is developed at speed in Norway and production in 2019 accounted for 4 % of the national power production.

Power production development in Norway is strictly regulated and subject to licencing and is overseen by Norwegian Water Resources and Energy Directorate (NVE), a directorate under the Ministry of Petroleum and Energy. Licenses grant rights to build and run power production installations under explicit conditions and rules of operation. NVE puts particular emphasis on preserving the environment. The Norwegian part of the NVE homepage gives detailed information about different requirements on different kind of projects[33].

[33] https://www.nve.no/konsesjonssaker/konsesjonsbehandling-av-vannkraft/

Data about the assets are available from Norwegian Water Resources and Energy Directorate (NVE) as all assets are subject to licencing.

4.1 Eligibility

The eligibility criteria are formulated in line with CBI criteria[34] and the threshold is in line with the emissions threshold of 100 gCO_2e/kWh proposed for hydro power in the latest Delegated act of the EU Taxonomy[35].

Eligibility criteria:
All renewable energy plants with emission intensity below 100 gCO_2e/kWh are eligible for green bonds.
All wind power plants are eligible for green bonds.

Hydropower plants with power density > 5 W/m^2 are exempt from the most detailed investigations. More on the power density, general background for the criteria and portfolio eligibility, please consult Multiconsult report "SR-Bank Green Hydropower portfolio"[36].

For Norwegian hydropower assets, these criteria are easily fulfilled and most assets overperform radically.

- All run-of-river power stations have no or negligible negative impact on GHG emissions
- Due to the cold climate, Norwegian reservoirs are not exposed to cyclic revegetation of impoundment and hence the negative impacts on GHG emissions from these reservoirs are very small
- Hydropower stations with high hydraulic head and/or relatively small impounded area have high power density

The adaptation and resilience component in Climate Bonds Initiative (CBI) hydropower eligibility criteria and the EU Taxonomy's "Do no significant harm", addressing ESG, is in the Norwegian context covered by the rigid relevant requirements in the Norwegian regulation of energy plants. Hence, all Norwegian wind and hydropower assets conform to very high standards regarding environmental and social impact.

4.2 Eligible assets in portfolio

Multiconsult has investigated a sample of SR-Bank's portfolio and can confirm that the assets, both planned and in operation have low to negligible GHG-emissions related to construction and operation.

Wind power accounts for 5% of the renewable energy production in the portfolio.

[34] https://www.climatebonds.net/standard/hydropower
[35] https://ec.europa.eu/info/publications/sustainable-finance-teg-taxonomy_en
[36] https://www.sparebank1.no/en/sr-bank/about-us/investor/financial-info/debt-investors.html

About 52% of power produced by renewable energy power stations in the portfolio are in hydropower stations with capacities in the range of 0.1- 25 MW. These are to a very large extent run-of-river plants with no or very small reservoirs and hence very high power density of several thousand W/m^2 (ratio between capacity and impounded area).

The remaining 42 % of power produced by renewable energy power stations in the portfolio is related to medium sized existing run-of–river power stations (total 59 MW) in an existing waterway that has been in operation for more than 60 years and a station with power density over 60 W/m^2 and a smaller power station in an area with very little revegetation due to cold climate.

4.3 Impact assessment- Renewable energy

4.3.1 CO_2-emissions from renewable energy power production

All power production facilities have a negative impact on GHG emissions. Instead of calculating the impact on GHG emissions for all, and most of them rather small facilities in the SR-Bank portfolio, we refer to The Association of Issuing Bodies (AIB). AIB is responsible for developing and promoting the European Energy Certificate System – "EECS".

The Association of Issuing Bodies (AIB), referred to by NVE[37], uses an emission factor of 6 gCO_2/kWh for all European hydropower and 20 gCO_2/kWh for wind power in their calculations of the European residual mix. The value is based on a life-cycle analysis where all upstream and downstream effects in the whole value chain for power production are included.

In subsequent assessments we are using the AIB emission factors for all assets, even though they are higher than factors in other credible sources. E.g. has the average GHG emission intensity in Norwegian hydropower (all categories) been calculated, using LCA, to 2.39 gCO_2e/kWh. (Østfoldforskning, 2015[38])

For the type of assets in the portfolio, with many run-of-river and small hydropower assets, the AIB emission factor is regarded as conservative in an impact assessment setting. The positive impact of the hydropower assets is 130 gCO_2/kWh compared to the baseline of 136 gCO_2/kWh. For wind power the impact is 116 gCO_2/kWh.

4.3.2 Power production estimates

The renewable energy power plants in SR-Bank's portfolio are quite varied in age. And a large portion of younger plants add uncertainty to the future power production. Actual or planned power production has been attained by the bank, covering 99% of the portfolio.

For small hydropower it is important to understand that stated power production given in the concession documents do not necessarily represent what can realistically be expected from the plant over time. For one the hydrology is uncertain, and unfortunately often overestimated in early project phases for small hydropower. There is, however, also the fact that the production figures normally do not account for planned and unplanned production stops, due to accidents, maintenance etc. Research on small hydropower has shown that actual production often is more than 20 % lower than the concession/pre-construction figures. There is no equivalent evidence to claim the same mismatch for large hydropower.

[37] https://www.nve.no/norwegian-energy-regulatory-authority/retail-market/electricity-disclosure-2018/
[38] https://www.ostfoldforskning.no/media/1056/734-1.pdf

4.3.3 SR-Bank's criterion – New or existing Norwegian renewable energy plants

The eligible plants in SR-Bank's portfolio is estimated to have the capacity to produce about 808 GWh per year. The available data from the bank and in open sources include:

- Type of plant (wind/solar/hydropower, run-of-river/reservoir)
- Installed capacity
- Production estimated/recorded
- Age

	Capacity [MW]	Estimated production [GWh/yr]	Expected production [GWh/yr]
Small run- of – river	0.1 – 25	562	450
Medium sized HPP	90	311	311
Wind		48	48
Sum		921	808

Table 17 Capacity and production of eligible hydropower plants (HPP), estimated and expected production (reduced for common errors)

Table 18 summarises the expected renewable energy produced by the eligible assets in the portfolio in an average year, and the resulting avoided CO_2-emissions the energy production results in.

	Produced power compared to baseline	Reduced CO_2-emissions compared to baseline
Eligible wind and hydropower plants in portfolio	**808 GWh/year**	**104,000 tons CO_2/year**

Table 18 Power production and estimated positive impact on GHG-emissions