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

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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		*22,700 ton CO_2e/year*
Energy efficient commercial buildings		*7,000 ton CO_2e/year*
Clean transportation	*Scope 2: -900 ton CO_2e/year*	*Scope 1: 2,000 ton CO_2e/year*
Renewable energy		*105,800 ton CO_2e/year*
Total		*137,500 ton CO_2e/year*

Note that the impact in the table above is not scaled by the bank's engagement. The scaled values for the green residential buildings portfolio are presented later in the report.

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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 2021 (91% hydropower and 8% wind) results in emissions of 4 gCO_2/kWh. The production mix is also included in the figure for other selected European states for illustration.

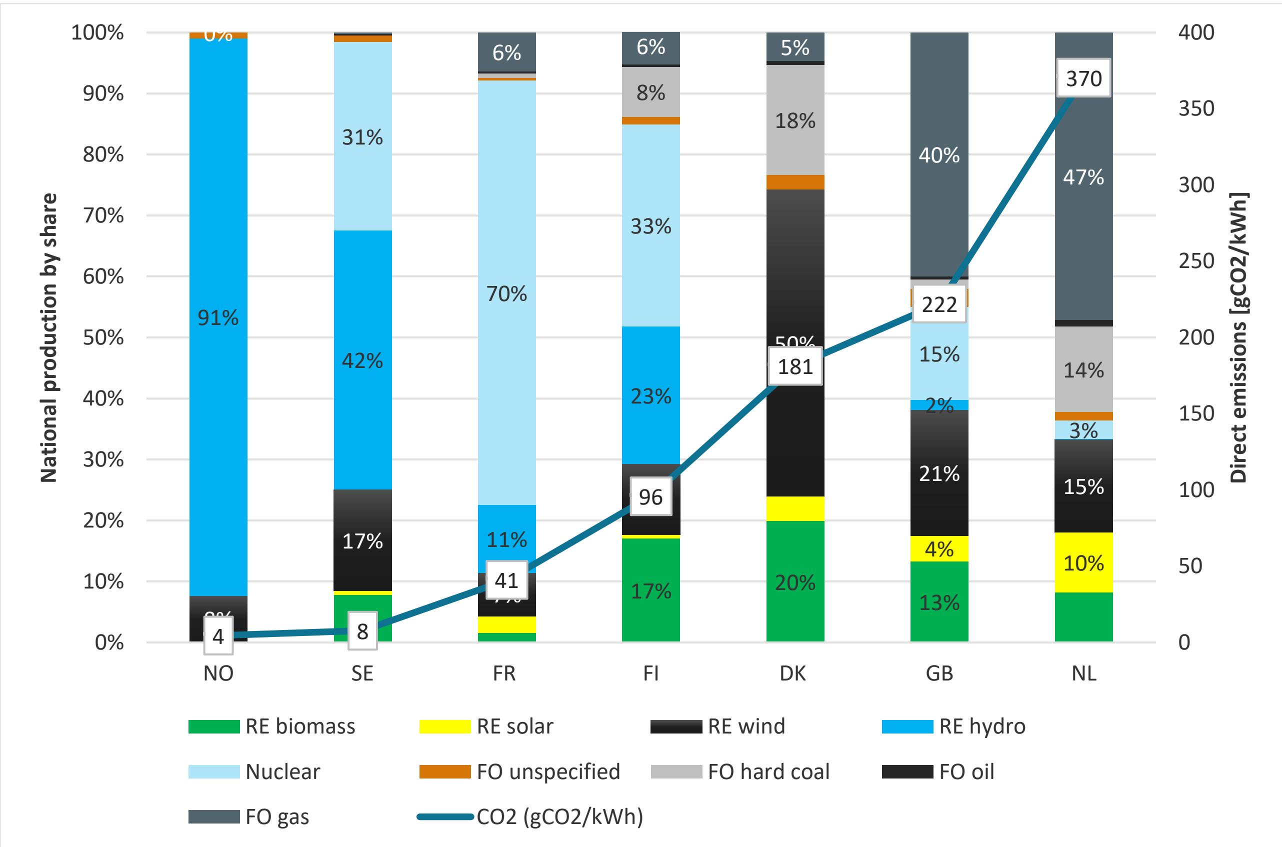

Figure 1 National electricity production mix in some selected countries (European Residual Mixes 2021, Association of Issuing Bodies[2])

[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

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 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 (EU27+ UK+ Norway) electricity mix	136
Norwegian electricity 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 EU27+ UK + Norway energy production mix, the resulting CO_2- factor for Norwegian residential buildings, including the influence of bioenergy and district heating in the energy mix, is on average 111 gCO_2/kWh due to. This factor is used in impact calculations in section 2.

The average emission factor relevant for electric vehicles is calculated, not based on this Norwegian standard for greenhouse gas calculations for buildings , but based on the last three year average for the Europeean production mix. This is described in more detail in chapter 0.

[3] https://www.kbn.com/globalassets/dokumenter/npsi_position_paper_2020_final_ii.pdf

2 Energy efficient buildings

2.1 Residential buildings

2.1.1 Eligibility criteria

The SR-Bank eligibility criteria for residential buildings are based on building code and on Energy Performance Certifications.

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 251 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 117 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 %

Given the dynamic nature of the top 15% of the building stock, the bank has decided to tighten the eligible criteria to respect the top 15% threshold. Hence, the bank is no longer including TEK07 small residential buildings in the portfolio in the green pool that were originated post 31/12/2021. Loans originated before this date are grandfathered.

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 and B.

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 7.5 % of the current residential buildings in Norway will have a B 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.

Given the dynamic nature of the top 15% of the building stock, the bank has decided to tighten the eligible criteria to respect the top 15% threshold. Hence, the bank is no longer including EPC C label buildings in the portfolio in the green pool that were originated post 31/12/2020. Loans originated before this date are grandfathered.

Combination of criteria

The two criteria are based on different statistics. It is however interesting to view them in combination. Table 2 illustrates how the criteria, independently and in combination, make up cumulative %'s.

Interpretation: TEK10 and newer in isolation represents 11.3%; TEK10 and newer in combination with A+B labels represents 12.6%; TEK10 and newer in combination with A+B+C labels represents 17.1%

	TEK10+TEK17	TEK07 small resi.	EPC A+B	EPC A+B+C
TEK10+TEK17	11,3 %		12,6 %	17,1 %
TEK07 small resi.		13,5 %	14,7 %	18,7 %
EPC A+B			7,5 %	
EPC A+B+C				15,9 %

Table 2 Matrix of Cumulative %'s for criteria combinations (FY21), relative to the total residential building stock in Norway

2.1.2 *Impact assessment - Residential buildings*

The eligible residential buildings in SR-Bank's portfolio is estimated to amount to 1.7 million square meters. The area is calculated based on the assumption that the residents in the portfolio are equivalent to the average Norwegian residential building stock (Statistics Norway[4]). 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]
Both building code and EPC criteria	Apartments	3,712	267,264
	Small residential buildings	6,073	991,150
Grandfathered Both criteria	Apartments	429	30,888
	Small residential buildings	2,333	383,152
	Total	12,547	1,672,454

Table 3 Eligible objects and calculated building areas

Based on the calculated figures in table 3, 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 111 g CO_2eq/kWh. A proportional relationship is expected between energy consumption and emissions.

Table 4 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.

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

	Avoided energy compared to baseline [GWh/yr]	Avoided CO_2-emissions compared to baseline [ton CO_2/yr]
Buildings eligible under the building code criterion	165	18,217
Grandfathered under the building code criterion	38	4,234
Buildings eligible under the EPC criterion	3	280
Grandfathered under the EPC criterion	9	1,031
Total impact eligible buildings	**206**	**22,731**
Impact scaled by bank's engagement	**136**	**14,985**

Table 4 Performance of eligible objects compared to average residential building stock (Based on public statistics, SSB, Energimerking.no, Multiconsult)

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 2010.

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 2009.

Since the criteria was established, the building stock has grown, and the new buildings are entering the top 15%. For the sub-categories office, retail, hotel and restaurant buildings combined the buildings complying with TEK07 and later codes are currently 10% of the total. Small industry and warehouses, however, where the newbuild rate has been very high the last years, are now past 15%. This indicates the need to move the criterion for this sub-category.

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 5 Average specific energy demand for the building stock; whole stock, part eligible according to criteria and reduction (Source: SSB, historic cuilding codes, Multiconsult)

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 compared to before refurbishment 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 available data include building year, reliable area per object, building category and certificate information. In SR-Bank's portfolio, 55,500 square meters of office buildings qualify due to BREEAM certificate Excellent (2) or Outstanding (1). Another 479,000 square meters qualify due to the building code criteria, as indicated in the table below.

	Average area per building [m^2]	Area qualifying buildings in portfolio [m^2]
Office buildings	3,010	87,291
Commercial buildings	4,046	165,870
Hotel buildings	4,725	9,450
Small industry and warehouses	4,010	216,524
Sum		479,135

Table 6 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 111 g CO_2eq/kWh. A proportional relationship is expected between energy consumption and emissions.

Table 7 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. The impact related to buildings completed since January 1st 2021 account for 1.6 % of the total.

	Area	Reduced energy compared to baseline	Reduced CO_2-emissions compared to baseline
Buildings eligible under the building code criterion	479,135 m^2	54 GWh/year	6,028 tons CO_2/year
Buildings eligible under the BREEAM criterion	55,500 m^2	9 GWh/year	948 tons CO_2/year
Eligible buildings in portfolio- total	534,135 m^2	63 GWh/year	6,976 tons CO_2/year

Table 7 Performance of eligible objects compared to average building stock

3 Clean transportation- Electric vehicles and ferries

The impact of electric vehicles in Norway on climate gas emissions is assessed in the following. The bank's portfolio in June 2022, consisting of 943 electric vehicles and one full electric ferry, 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, EVs 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 criteria:
Fully electrified, hybrid (with direct emissions ≤50 gCO2e/pkm) or hydrogen passenger vehicles such as cars
Fully electrified or hydrogen freight vehicles such as ferries or vessels

The identified eligible vehicles in the portfolio all align with the technical eligibility criteria formulated by Climate Bonds Initiative (CBI)[5] and in the June 2021 EU Taxonomy Annex I to the Commission Delegated Regulation[6].

3.2 General description EVs

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.

Historical figures of how far the average passenger vehicle is driven annually in Norway, show a falling slope from 2007 and 2008, when the passenger vehicles peaked and was on average driven about 13,900 km. This has declined ever since, and in 2020 the average passenger vehicle travelled 11,152 km[7]. The sudden reduction from 11,883 km driven in 2019 might, however, be a COVID-19 effect, that early tendencies show, will not last.

In 2020 the average age of passenger vehicles scrapped for refund in Norway was 18 years old[8]. The history of modern EVs is short and there is yet no evidence for the lifetime of EVs being different from other vehicles. Due to big uncertainties related to the expected lifetime of new vehicles sold between 2011 and 2021, the average lifetime for both passenger vehicles and light duty vehicles are set to 18 years in this analysis independent of fuel type.

The Norwegian government have over time, with different administrations, had high ambitions both regarding electric vehicles and biofuel to reduce CO_2-emissions. By the end of 2020 there were about 340,000 electric passenger vehicles on Norwegian roads, which is 12% of the total passenger vehicle

[5] https://www.climatebonds.net/standard/transport
[6] https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800-annex-1_en.pdf
[7] SSB 12578: Kjørelengder , etter kjøretøytype, drivstoffype, alder, staisikkvariabel og år, 2019
[8] https://www.ssb.no/en/statbank/table/05522

stock[9]. The Norwegian Parliament have unanimously adopted a target of 100 % of sales of zero emission light duty and passenger vehicles from 2025.[10] Petrol retailers are obliged to sell biofuels as a defined percentage 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. The new government has in their government platform (Hurdalsplattformen) established that the requirements for the share of second-generation biofuels in the fuels sold will be tightened[11].

3.3 Climate gas emissions (Scope 1 and 2)

Categorising 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[12] 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 for information.

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 are 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 kilometres are calculated by multiplying the number of passengers by the corresponding number of kilometres travelled.

Statistics Norway's method for calculating indicators for emissions per passenger kilometre utilises 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[13].

3.3.2 Direct emissions (tailpipe)- Scope 1

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

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.

[9] https://www.ssb.no/transport-og-reiseliv/landtransport/statistikk/bilparken
[10] https://www.regjeringen.no/no/tema/transport-og-kommunikasjon/veg_og_vegtrafikk/faktaartikler-vei-og-ts/norge-er-elektrisk/id2677481/
[11] https://res.cloudinary.com/arbeiderpartiet/image/upload/v1/ievv_filestore/43b0da86f86a4e4bb1a8619f13de9da9afe348b29bf24fc8a319ed9b02dd284e
[12] https://www.climatebonds.net/files/files/Low%20Carbon%20Transport%20Background%20Paper%20Feb%202017.pdf page 10
[13] https://www.ssb.no/transport-og-reiseliv/artikler-og-publikasjoner/mindre-utslipp-per-kjorte-kilometer

For the substituted fossil fuelled vehicles, emission data are retrieved from recognised 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[14].

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[15].

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 a yearly milage somewhere between petrol and diesel passenger vehicles[16].

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[17].

Table 8 and Table 9 present the calculated emission factors for the relevant vehicle categories. The calculations are 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, and anticipated biofuel- and fossil fuel content in petrol/diesel pumped each year between 2020-2038.

	Direct emissions substituted fossil passenger vehicles – Average	Direct emissions EV
Emissions per passenger km	53 gCO_2/pkm	0 gCO_2/pkm
Emissions per km	90 gCO_2/km	0 gCO_2/km
Emissions per passenger vehicle and year	957 $kgCO_2$/vehicle/year	0 $kgCO_2$

Table 8 ***Passenger vehicles****: Greenhouse gas emission factors (CO_2- equivalents), average direct emissions*

[14] https://www.vegvesen.no/fag/fokusomrader/miljo+og+omgivelser/klima
[15] https://ofv.no/CO2-utslippet/co2-utslippet
[16] https://www.ssb.no/statbank/table/12578/
[17] 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	102 gCO_2/pkm	0 gCO_2/pkm
Emissions per km	153 gCO_2/km	0 gCO_2/km
Emissions per passenger vehicle and year	1,932 $kgCO_2$/vehicle/year	0 $kgCO_2$

Table 9 ***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 10 ***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 analysis. The direct emissions in power production in Europe is expected to be dramatically reduced in the coming decades. Due to urgency, a 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 2050. This is in line with the EU's ambitious decarbonisation of the power sector.

Passenger vehicles in Norway have a life expectancy of 18 years. The production mix is based on the assumed emissions in 2028, 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. For this section a three year average emission factor for power in Europe is applied. Yearly power production and related CO_2-emissions presented by the Association of Issuing Bodies[18] are included for all Europeean countries except Iceland, Cyprus, Ukraine, Russia and Moldova. From a factor of 245 gCO_2/kWh, the reduction in the vehicles lifetime gives the applied average factor of 169 gCO_2/kWh.

Using a European production mix is in line with Nordic Public Sector Issuers: Position Paper on Green Bonds Impact Reporting (February 2020)[19].

The energy consumption of EVs 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 the Electrical

[18] https://www.aib-net.org/facts/european-residual-mix
[19] https://www.kbn.com/globalassets/dokumenter/npsi_position_paper_2020_final_ii.pdf

Vehicle Database[20], 19.5 kWh/100km, which is close to the factor presented in the Swedish "Handbok för vägtrafikens luftföroreningar"[21]. The same handbook presents an energy consumption for light-duty vehicles of 21 kWh/100km. These factors (19,5 kWh/100km and 21 kWh/100km) have been used in the analysis. In Table 11, 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	19 gCO_2/pkm	24 gCO_2/pkm	-
Emissions per km, indirect emissions from power production	33 gCO_2/km	35 gCO_2/km	152 gCO_2/km

Table 11 Electricity consumption greenhouse gas factors (CO_2- equivalents) electric vehicles- based on EU power production mix

*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. Indirect emissions related to fossil fuelled vehicles are zero for scope 2.

3.4 Impact assessment: Avoided emissions – Clean transportation

The 943 eligible vehicles in SR- Bank's portfolio are estimated to drive 9.37 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 76% of the vehicles eligible for inclusion in a green bond issuance.

	Number of vehicles	Sum km/yr.
Eligible passenger vehicles in portfolio	718	6.31 mill.
Eligible light duty vehicles in portfolio	213	2.67 mill.
Eligible buses in portfolio	12	0.39 mill.
Sum eligible vehicles	943	9.37 mill.

Table 12 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 are only calculated for EVs, and not fossil fuelled vehicles.

[20] https://ev-database.org/cheatsheet/energy-consumption-electric-car
[21] Handbok för vägtrafikens luftföroreningar, chapter 6, Trafikverket, 2019

Direct emissions in table 13 are calculated by multiplying the distance travelled by the vehicles in the portfolio in a year by the specific emission factor [CO_2/km] in tables 8 through 10.

Indirect emissions are calculated by multiplying the distance travelled by the number of vehicles in the portfolio in a year by the specific emission factor [CO_2/km] in table 11.

Eligible passenger and light-duty vehicles and busses	Reduced CO_2-emissions compared to baseline
Total Direct emissions only (Scope 1)	**1,292 tons CO_2/year**
Total Indirect emissions EVs only (Scope 2)	-362 tons CO_2/year
Total Avoided emissions	930 tons CO_2/year

Table 13 The EV portfolio's estimated impact on direct, indirect and avoided GHG-emission in rounded numbers

The reduction in direct emissions from passenger and light-duty vehicles and busses corresponds to 0.5 million litres of gasoline saved per year.

The one fully electric ferry in the portfolio is by multiple publicly available sources said to reduce the use of 270,000 liter diesel per year compared to a diesel alternative.

Eligible ferries in portfolio	Reduced CO_2-emissions compared to baseline
Direct emissions only (Scope 1)	**718 tons CO_2/year**
Indirect emissions EVs only (Scope 2)	-488 tons CO_2/year
Avoided emissions	230 tons CO_2/year

Table 14 The financed ferry estimated impact on direct, indirect and avoided GHG-emission

Table 15 describes the reduction of direct emissions from the passenger and light-duty vehicles, busses and fully electric ferry in the portfolio and the indirect emissions related to electricity provided to the vehicles.

Eligible vehicles in portfolio	Reduced CO_2-emissions compared to baseline
Total Direct emissions only (Scope 1)	**2,010 tons CO_2/year**
Total Indirect emissions EVs only (Scope 2)	-850 tons CO_2/year
Total Avoided emissions	1,160 tons CO_2/year

Table 15 The clean transportation portfolio's estimated impact on direct, indirect and avoided GHG-emission

The reduction in direct emissions corresponds to 0.8 million litres of 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 92 % of the national power production. Onshore wind power is developed at speed in Norway and production in 2020 accounted for 6 % 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 for different kind of projects[22].

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[23] and the threshold is in line with the emissions threshold of 100 gCO_2e/kWh in the June 2021 EU Taxonomy Annex I to the Commission Delegated Regulation[24].

Eligibility criteria:
All renewable energy plants with emission intensity below 100 gCO_2e/kWh are eligible for green bonds.
All wind and solar 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"[25].

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

[22] https://www.nve.no/konsesjonssaker/konsesjonsbehandling-av-vannkraft/
[23] https://www.climatebonds.net/standard/hydropower
[24] https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800-annex-1_en.pdf
[25] https://www.sparebank1.no/en/sr-bank/about-us/investor/financial-info/debt-investors.html

The adaptation and resilience component in Climate Bonds Initiative (CBI) hydropower eligibility criteria and the EU Taxonomy's "Do no significant harm", addressing environmental and social issues, is in the Norwegian context to a large degree 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. Portfolio alignment with DNSH requirements has not been assessed in detail.

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.

About 68% 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 32 % of power produced by renewable energy power stations in the portfolio is related to medium sized existing run-of–river power stations.

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 SpareBank 1 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[26], uses an emission factor of 6 gCO_2/kWh for all European hydropower 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 Østfoldforskning[27] calculated the life-cycle emissions of Norwegian hydropower (all categories) to 3.33 gCO_2e/kWh. 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.

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 future power production. Actual or planned power production has been attained by the bank, covering 99% of the portfolio and supplemented by information from NVE.

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

[26] https://www.nve.no/norwegian-energy-regulatory-authority/retail-market/electricity-disclosure-2018/
[27] https://norsus.no/wp-content/uploads/AR-01.19-The-inventory-and-life-cycle-data-for-Norwegian-hydroelectricity.pdf

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.

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 814 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	636	509
Medium sized HPP	90	305	305
Sum		941	814

Table 16 Capacity and production of eligible hydropower plants (HPP), estimated and expected production (reduced for common errors)

Table 17 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 hydropower plants in portfolio	**814 GWh/year**	**105,800 tons CO_2/year**

Table 17 Power production and estimated positive impact on GHG-emissions