REPORT

Green Portfolio Impact Assessment 2023

CLIENT

SpareBank 1 SMN

SUBJECT

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

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Report

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SUBJECT	Impact assessment- energy efficient residential and commercial buildings, electric vehicles and renewable energy	ACCESSIBILITY	Open
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In summary, the impact for the examined asset classes in the SpareBank 1 SMN portfolio qualifying according to green bond criteria is dominated by energy efficient residential buildings but with significant contributions from all asset classes. This table sums up the impact in rounded numbers:

Energy efficient residential buildings	*19,400 ton CO_2-eq/year*
Energy efficient commercial buildings	*3,300 ton CO_2-eq/year*
Clean transportation	*4,100 ton CO_2-eq/year*
Renewable energy	*5,100 ton CO_2-eq/year*
Total	***31,900 ton CO_2-eq/year***

Note that the impact in the table above is not scaled by the bank's engagement.

Note also that for electric vehicles, the scaled impact above is the sum of 6,800 tons CO_2-eq/year Scope 1 emissions, and -2,700 CO_2-eq/year in Scope 2 emissions based on European power mix.

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1 Introduction

Assignment

On assignment from SpareBank 1 SMN (SMN), Multiconsult has assessed the impact of the part of SMN's loan portfolio eligible for green bonds according to SMN's Green Bonds Framework.

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

1.1 Electricity demand and production

The eligible assets are either producing renewable energy and delivering it 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.

In 2023, renewables accounted for 98 percent of the total (154 TWh) Norwegian electricity production, the final two percent being thermal power production from natural gas, biomass, and waste heat[2]. Figure 1-1, which is based on numbers from the Association of Issuing Bodies, shows that the Norwegian production mix in 2023 resulted in emissions of 0 gCO_2/kWh. In the figure, the production mix is included for other selected European states for comparison.

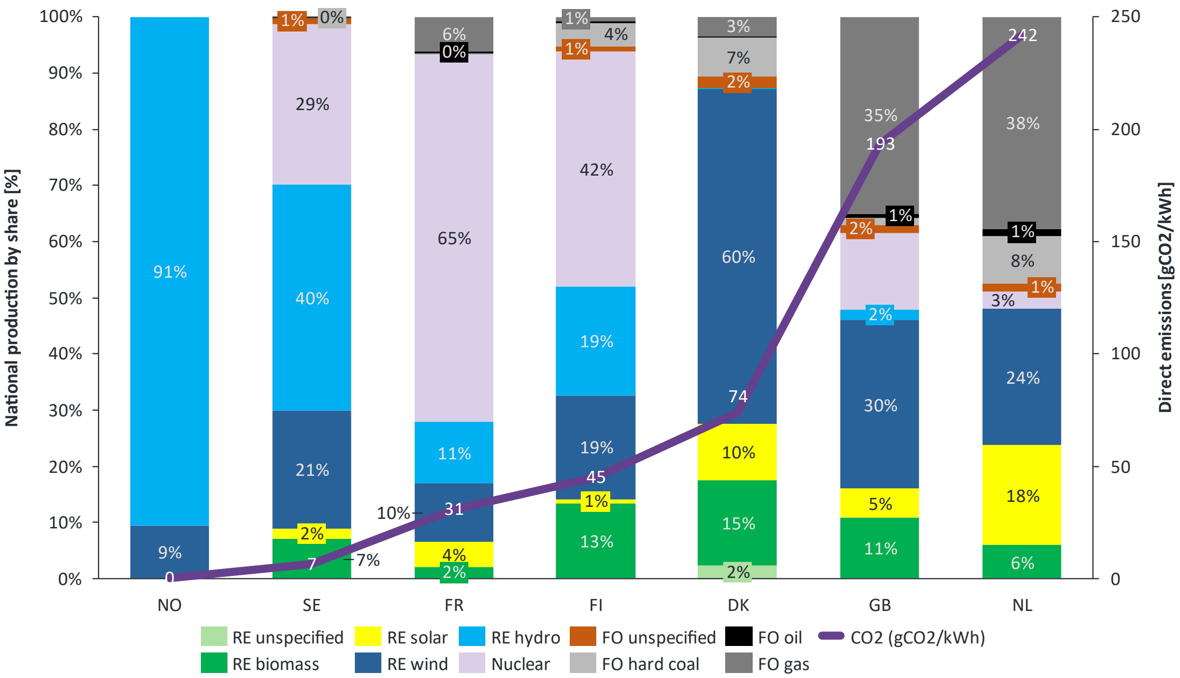

Figure 1-1 National electricity production mix in some selected countries (Source: European Residual Mixes 2023, Association of Issuing Bodies[3]).

[1] https://www.sparebank1.no/nb/smn/om-oss/barekraft/rammeverk-for-gronne-obligasjoner.html
[2] Statistics Norway Table 08307: Production, imports, exports and consumption of electric energy (GWh) 1950 - 2023, 2024
[3] https://www.aib-net.org/facts/european-residual-mix, 2024

As Figure 1-1 shows, emissions from power production varies between countries. Due to the interconnection of the power grid, the placement of the system boundary for power production heavily influences the greenhouse gas (GHG) emission factor associated with said production. To demonstrate how the choice of system boundary between Norway only or Europe as a whole and type of emission factor influence the results, the impact assessments are here presented based on several emission factors.

1.2 Emission factors for energy efficient buildings

The CO_2-emissions resulting from energy demand in residential buildings depends to a large degree on the age of the building. This again is due to two factors: the differences in energy efficiency requirements in the building code, and development in the predominant solutions and energy sources for heating in new buildings. Examples of the latter are direct electric heating, several types of heat pumps, bioenergy, and district heating. The share of fossil fuel is very low and declining.

Since the Norwegian buildings are predominantly heated by electricity, the placement of the system boundary for power production heavily influences the emission factor. Since the financed qualifying objects in the portfolio are rather new, and expected to have a 60-year life, the impact is considered best illustrated by the yearly average CO_2-emissions in their lifetime. The main grid factor used in this green portfolio impact assessment reflects an average in the buildings lifetime, assuming a decarbonisation in the European energy system.

Finans Norge released a guidance document for calculation of financed GHG emissions in 2023, including recommendations for grid factors to be used[4]. To demonstrate how emissions vary depending on grid factor, the two recommended grid factors from The Norwegian Water Resources and Energy Directorate (NVE) are included. That is, the most recent Norwegian physically delivered electricity for 2023[5] and the Norwegian residual mix for 2023[6]. The Norwegian residual mix is calculated by the Association of Issuing Bodies, which is the organization responsible for developing and promoting the European Energy Certificate System (EECS)[7].

The grid factors are summarized in Table 1-1 below and described in more detail in the following sub-sections.

To calculate the impact on climate gas emissions, the grid factors are applied to all electricity consumption in the residential buildings in the portfolio eligible for green bonds. Electricity is, as mentioned, the dominant energy carrier to Norwegian residential buildings, but the energy mix also includes other energy carriers such as bio energy and district heating. The influx of other energy sources for heating purposes is applied to all electricity emission factors resulting in the "Emission factor considering other heating sources", found in the rightmost column in Table 1-1.

[4] https://www.finansnorge.no/dokumenter/maler-og-veiledere/veileder-for-beregning-av-finansierte-klimagassutslipp/, 2024
[5] https://www.nve.no/energi/energisystem/kraftproduksjon/hvor-kommer-stroemmen-fra/, 2024
[6] https://www.aib-net.org/facts/european-residual-mix/2023, 2024
[7] https://www.aib-net.org/, 2024

Table 1-1 Electricity production GHG factors (CO_2-eq) with and without influx of other heating sources for buildings in three scenarios. (Source: NS 3720:2018, Table A. 1, NVE[5], AIB[6])

Scenario	Description	Emission factor electricity [gCO_2/kWh]	Emission factor incl. other heating sources [gCO_2/kWh][8]
European (EU27+ UK+ Norway) NS 3720:2018 electricity mix	Location-based electricity mix with wide system boundary including EU countries, UK and Norway, average emissions over building's 60-year lifetime	136	115
Norwegian NVE physically delivered electricity 2023	Location-based production mix with narrow system boundary of Norway only but including net export/ import only to neighbouring countries and average annual emission factors	15	15
Norwegian NVE residual mix 2023	Market-based residual mix for Norway with a European marketplace	599	495

1.2.1 European (EU27+ UK+ Norway) and Norwegian electricity mix over building's lifetime

Using a life-cycle analysis (LCA), the Norwegian Standard NS 3720:2018 "Method for greenhouse gas calculations for buildings" considers international trade of electricity and the fact that consumption and grid factor does not necessarily mirror domestic production. The grid factor, as average in the lifetime of an asset, is based on a linear trajectory from the current grid factor to a close to zero emission factor in 2050 and steady until the end of the lifetime. This factor is location-based.

The mentioned standard calculates, on a life-cycle basis, the average CO_2- factor for the next 60 years according to a European (EU27+ UK+ Norway) system boundary, as described in Table 1-1.

Norway is part of a larger, integrated European power grid, and import and export of electricity throughout the year means not all electricity consumed in Norway is produced here. The standard also calculates the equivalent Norway only emission factor. Using the European mix instead of the Norway only mix, is then a more conservative approach.

The European electricity factor is 136 gCO_2-eq/kWh, which constitutes the GHG emission intensity baseline for energy use in buildings with a life span of 50-60 years and assuming that the CO_2 emission factor of the European power production mix is close to zero in 2050. This value is comparable to the equivalent determined in Nordic Public Sector Issuers: Position Paper on Green Bonds Impact Reporting (January 2020).

1.2.2 Norwegian physically delivered electricity 2023

NVE calculates a climate declaration for physically delivered electricity for the previous year[9]. This factor represents electricity consumed in Norway, accounting for emissions from net import and export of electricity from neighbouring countries and these countries' average

[8] Multiconsult. Based on building code assignments for DiBK, 2015.

annual emission factors. The most recent grid factor is 15 gCO_2-eq/kWh for 2023[9]. This is also a location-based grid factor.

1.2.3 Norwegian residual mix 2023

Certificates of origin, direct power purchase agreements or other documentation of which power has been purchased for the buildings in the portfolio is not available to the bank. There is also no basis for making assumptions on the share of the energy consumed by the buildings in the portfolio that has been purchased with Guarantees of Origin. An alternative market-based grid factor for Norway is then the electricity disclosure published by NVE[10] and Association of Issuing Bodies[11]. This is the electricity residual mix of the country, which shows the sources of the electricity supply that is not covered with Guarantees of Origin, considering a European marketplace for electricity. Guarantees of Origin are not very widespread in the Norwegian electricity end-user market, resulting in a high emission factor of 599 gCO_2-eq/kWh for 2023[11].

1.3 Emission factors for zero-emission vehicles

The GHG emission intensity baseline for power consumption may be calculated with different system boundaries. For electric vehicles (EVs), a three-year average emission factor for power production in Europe is applied. Yearly power production mix and related CO_2-emissions as calculated by the Association of Issuing Bodies[11] are included for all European countries excluding Iceland, Cyprus, Ukraine, Russia and Moldova.

Similarly to the European NS 3720:2018 electricity mixes for buildings, the average emission factor relevant for electric vehicles is also calculated based on a trajectory from the current grid factor to a close to zero emission factor in 2050. But while a life-cycle based factor is used for buildings, a factor based on European (EU27+UK+Norway) electricity production mixes for recent years is applied to represent the location-based production mix with wide system boundaries.

Considering the emission trajectory and lifetime of the vehicles this gives the electricity factor 159 gCO_2-eq/kWh for passenger vehicles. In addition, the Norwegian NVE physically delivered electricity and residual mixes for 2023 presented in the previous subsection are applied. Relevant indirect emission factors per distance [gCO_2/km] are calculated based on these and used in the EV analysis. See more detail in subsection 3.3.

1.4 Emission factors for renewable energy production

For renewable energy, the impact calculations compare the emissions from hydropower to the emissions of grid electricity. The difference between the two is considered the avoided emissions per produced unit of electricity. The electricity emission factors from Table 1-1 are used as baseline for the calculations. The location-based mix for Europe have been used in previous analyses, and the location-based and market-based mixes for Norway are introduced for comparison. The resulting factors are described more in subsection 4.3.1.

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[9] https://www.nve.no/energi/energisystem/kraftproduksjon/hvor-kommer-stroemmen-fra/, 2024
[10] https://www.nve.no/energy-supply/electricity-disclosure/?ref=mainmenu, 2024
[11] https://www.aib-net.org/facts/european-residual-mix/2023, 2024

2 Energy efficient buildings

2.1 Residential buildings

2.1.1 Eligibility criteria

Eligibility is in this impact assessment for residential buildings in the SpareBank 1 SMN portfolio identified against a nearly zero-energy buildings (NZEB) criterion for new buildings. Existing buildings from before 2021 are identified against a building code criterion and an Energy Performance Certificate (EPC) based criterion, which combined covers the top 15 percent most energy efficient buildings, as formulated below.

Eligibility criteria for residential buildings in Norway:

- Buildings built ≥ 2021: NZEB-10 percent
  - Buildings complying with the relevant NZEB-10 percent threshold
- Buildings built <2021: EPC A label or within the top 15 percent low carbon buildings in Norway

Buildings built ≥ 2021: NZEB-10 percent

New or existing buildings complying with the relevant NZEB-10 percent threshold.

In January 2023, a national definition of NZEB was published with a correction issued in January 2024[12]. Even if the definition is not directly linked to the EPC system, detailed EPC data may assist the bank identifying qualifying buildings in their portfolio. A comparison of the definition and the EPC system indicate that buildings built according to the current building code, TEK17, and an energy label A, qualify. The best performing B-labelled buildings will qualify, but only as long as the specific primary energy demand is below the calculated threshold.

Data on specific primary energy demand was not available for this impact assessment, but loans for buildings built later than 2021 with EPC A originated post 31/01/2023 are considered eligible under the NZEB-10 percent criterion.

Previously eligible TEK17 buildings in the portfolio with loans originated before 31/01/2023 are grandfathered. The grandfathered loans continue to be included in the portfolio for impact calculations, but no new loans for TEK17 buildings are eligible under the new buildings' criterion.

Buildings built < 2021: EPC A label or within the top 15 percent low carbon buildings in Norway

Building code criterion: Existing Norwegian apartments and other residential dwellings that comply with the Norwegian building codes of 2010 (TEK10) or 2017 (TEK17). Hence, built in 2012 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 249 kWh/m^2. Compared to the

[12] https://www.regjeringen.no/contentassets/296636deecef419590fe6b5668fe196f/23-12-korrigert-veiledning-om-beregning-av-primarenergibehov-og-nesten-nullenergibygg.pdf, 2024

average building stock, the building codes TEK10 and TEK17 give a calculated specific energy demand reduction of 55 percent.

Previously, TEK07 small residential buildings were included in the top 15 percent and thus the green bond eligibility criteria of the bank. Given the dynamic nature of the top 15 percent of the building stock, the bank has decided to tighten the eligible criteria to respect the top 15 percent threshold. Hence, the bank is no longer including TEK07 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 with EPC-labels A and B.

Around half on Norwegian dwellings have a registered EPC. The available data have therefore been extrapolated assuming the registered dwellings are representative for their age group regarding energy label. Then the EPC data indicates that 9.3 percent of the current residential buildings in Norway will have an EPC B or better, and are eligible under this criteria.

Previously, buildings with EPC C were included in the top 15 percent and thus the green bond eligibility criteria of the bank. Given the dynamic nature of the top 15 percent of the building stock, the bank has decided to tighten the eligible criteria to respect the top 15 percent 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 for existing buildings are based on different statistics. It is, however, interesting to view them in combination. Table 2-1 illustrates how the criteria, independently and in combination, make up cumulative percentages of the building stock.

Interpretation: TEK10 and newer in isolation represents 13.3 percent; TEK10 and newer in combination with A+B labels represent 14.8 percent; TEK07 and newer in combination with A+B+C labels represent 21.4 percent of the total Norwegian residential building stock.

Table 2-1 Matrix of cumulative percentages for criteria combinations (FY23), relative to the total residential building stock in Norway.

	TEK10+TEK17	TEK07 small resi.+TEK10+TEK17	EPC A+B	EPC A+B+C
TEK10+TEK17	13.3 percent		14.8 percent	19.2 percent
TEK07 small resi. +TEK10+TEK17		15.5 percent	17 percent	21.4 percent
EPC A+B			9.3 percent	
EPC A+B+C				16.8 percent

2.1.2 Impact assessment – Residential buildings

The eligible residential buildings in SpareBank 1 SMN's portfolio are estimated to amount to 1.3 million square meters. The available data include reliable area for most objects. For objects where this data is not available, the area per dwelling is calculated based on the average area derived from national statistics[13].

[13] Statistics Norway Table 06513: Dwellings, by type of building and utility floor space, 2024

As Table 2-2 shows, in total 10,135 buildings are eligible for green bonds. 14 percent of these are identified by the NZEB criterion for new buildings, of which 94 percent are grandfathered with TEK17.

76 percent of the eligible buildings are existing buildings identified by the building code criterion, of which 22 percent have building code TEK17 and 78 percent have TEK10. The rest of the building code eligible buildings are grandfathered small residential buildings with TEK07.

The final 10 percent of eligible buildings qualify for the EPC criterion, of which 20 percent have energy grade A and 47 percent have energy grade B. The rest have EPC C and are grandfathered.

Table 2-2 Eligible objects and calculated building areas.

	Building type	No. of units	Area qualifying buildings in portfolio [m^2]
New buildings eligible under the NZEB criterion	Apartments	67	4,742
	Small residential buildings	7	1,335
Existing buildings eligible under both building code and EPC criteria	Apartments	4,108	319,585
	Small residential buildings	3,986	748,184
Existing buildings grandfathered under both criteria	Apartments	894	65,756
	Small residential buildings	1,073	195,622
	Total	**10,135**	**1,335,224**

Based on the calculated figures in Table 2-2, the energy efficiency of the residential portfolio is estimated. Not all residential buildings are necessarily included in one single bond issuance.

Eligibility is first checked against the NZEB-10 percent criterion for new buildings. For existing buildings, the buildings are first checked against EPC A, then the building code criterion, and lastly against the EPC B criterion so no double counting of objects will occur.

For buildings qualifying under the NZEB-10 percent criteria, impact is calculated by taking the difference between the calculated specific energy usage of EPC A dwellings and the limit for a corresponding NZEB unit of the same area and building type. The reduction in energy demand is multiplied with the area of the eligible asset and the emission factors from Table 1-1 and summed up for all the units.

As mentioned in the previous section, the calculated average specific energy demand on the Norwegian residential building stock is 249 kWh/m^2. Separated on apartments and small residential buildings, the averages are 202 kWh/m^2 and 257 kWh/m^2, respectively. Building codes TEK10 and TEK17 give an average specific energy demand for existing buildings, weighted for actual stock, of 102 kWh/m^2 for apartments and 119 kWh/m^2 for houses. The difference between the total building stock and TEK10/TEK17 buildings in average specific energy demand is used in impact calculations.

As only half of all dwellings have a registered EPC, the average specific energy demand of the Norwegian residential building stock as described above is also used as baseline for the buildings qualifying according to the EPC criterion. For the impact calculations, the specific energy demand reduction between the energy demand for the achieved energy label, based on the energy grade scale[14], and the average energy demand for each of the apartment and small residential building stocks is used.

Table 2-3 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 avoided CO_2-emissions. The avoided emissions are calculated using the three emission factors described in section 1.2: European NS 3720:2018 electricity mix, and NVE's grid factors for Norway only, representing physically delivered electricity and the residual mix for 2023. A proportional relationship is expected between energy consumption and emissions.

Table 2-3 Performance of eligible objects compared to baseline of average residential building stock. (Sources: public statistics, Statistics Norway, enova.no/energimerking, Multiconsult)

	Avoided energy compared to baseline [GWh/year]	Avoided CO_2-emissions compared to baseline [tons CO_2-eq/year]		
		European lifetime mix	Norwegian physically delivered el. 2023	Norwegian residual mix 2023
New buildings eligible under NZEB criterion	0,03	4	1	16
New buildings grandfathered under NZEB criterion	19	2,138	288	9,212
Buildings eligible on building code criterion	120	13,765	1,855	59,297
Grandfathered under building code criterion	9	1,056	142	4,549
Buildings eligible on EPC criterion	17	1,917	258	8,257
Grandfathered under the EPC criterion	5	548	74	2,360
Total impact eligible buildings	169	19,427	2,618	83,691

[14] https://www.enova.no/energimerking/om-energimerkeordningen/om-energiattesten/karakterskalaen/, 2024

2.2 Commercial buildings

2.2.1 Eligibility criteria

This impact assessment is based on the following SpareBank 1 SMN eligibility criteria for commercial buildings.

Buildings built ≥ 2021: NZEB-10 percent

Buildings complying with the relevant NZEB-10 percent threshold.

Sufficient data has not been available for an examination of this criterion.

Buildings built < 2021: EPC A label or within the top 15 percent low carbon buildings in Norway

Hotel-, restaurant-, office- and retail buildings complying with TEK10 and TEK17 building codes (hotel and restaurant buildings built ≥ 2013 and office, retail buildings built ≥ 2012) and industrial buildings complying with TEK17 (built ≥ 2019).

Buildings with EPC labels reflecting the top 15 percent buildings.

Buildings which received at least one or more of the following classifications

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

Sufficient data has not been available for an examination of this criterion.

Building code

The buildings' EPC data has not been available for this assessment; hence the identification of energy efficient buildings rely on the building code (building year).

Since the bank established its first green criteria, the building stock has grown, and the new buildings are entering the top 15 percent most energy efficient buildings. For the sub-categories' office, retail, hotel and restaurant buildings combined the buildings complying with TEK10 and later codes are currently 8.5 percent of the total building stock. For small industry and warehouses, however, the newbuild rate has been very high the last years, and TEK10 and TEK17 buildings combined are now past 15 percent. This indicates the need to move the criterion for this sub-category to encompass only TEK17 buildings.

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.

Table 2-4 Average specific energy demand for the building stock; whole stock and part eligible according to criteria and reduction. (Source: SSB, historic building codes, Multiconsult)

	Average total stock [kWh/m^2]	Average TEK10 and TEK17 [kWh/m^2]	Reduction
Office buildings	245	138	44 percent
Commercial buildings	316	199	37 percent
Hotel buildings	322	202	37 percent
Small industry and warehouses	281	158	44 percent

Previously, TEK07 buildings were included in the top 15 percent and thus the green bond eligibility criteria of the bank. The bank has decided to tighten the eligible criteria and is no longer including loans for TEK07 buildings that were originated post 31/12/2022 in the green pool. Loans originated before this date are grandfathered.

2.2.2 Impact assessment - Commercial buildings

The green commercial buildings portfolio amount to 246,606 square meters. It is to be noted that the business portfolio of SpareBank 1 SMN includes some residential buildings as well. The impact related to these residential buildings are presented here, and not in the previous section to avoid mixing impact related to covered bonds (residential buildings) senior bond issuances.

The bank has specific data on assets, including area and building category. Where a building falls into several categories, the total area is distributed between the categories. Table 2-5 indicates the area of each building category providing a basis for the following impact assessments.

Table 2-5 Eligible commercial buildings and calculated building areas.

	Area qualifying buildings in portfolio [m^2]
Office buildings	70,332
Commercial buildings	42,350
Hotel buildings	19,577
Small industry and warehouses	113,904
Residential buildings	444
Sum	246,606

Similarly to impact calculations for residential buildings, impact for the commercial buildings qualifying on building code is calculated by first estimating the reduction in energy demand from the average of the total commercial building stock to the average for eligible building codes. This difference is then multiplied to the emission factors from Table 1-1 and area of eligible assets to calculate impact. A proportional relationship is expected between energy consumption and emissions.

Table 2-6 indicates how much more energy efficient the eligible part of the portfolio is compared to the average commercial Norwegian building stock. It also presents how much the calculated reduction in energy demand constitutes in CO_2 emissions.

Table 2-6 Avoided energy demand and emissions (CO_2-eq) of eligible objects in the portfolio compared to average commercial building stock using three emission factors. (Source: public statistics, Statistics Norway, Multiconsult)

	Avoided energy demand compared to baseline [GWh/year]	Avoided emissions compared to baseline [tons CO_2-eq/year]		
		European lifetime mix	Norwegian physically delivered el. 2023	Norwegian residual mix 2023
Buildings eligible and grandfathered on building code criterion	28.9	3,323	433	14,301

3 Clean transportation

The impact of electric vehicles (EVs) in Norway on climate gas emissions is assessed in the following. SpareBank 1 SMN's portfolio at the end of 2023, consisting of 9,662 electric vehicles, 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 market, EVs excluded. The bank has provided data on the number of electric passenger vehicles in the portfolio.

3.1 Eligibility criteria

The green loan portfolio of SpareBank 1 SMN consists of electric vehicles that meet the eligibility criteria as formulated below.

Low carbon vehicles: Fully electric, hydrogen or otherwise zero emissions vehicles for the transportation of passengers or freight

The identified eligible vehicles in the portfolio all align with the technical eligibility criteria formulated by Climate Bonds Initiative (CBI) [15] and in the June 2021 EU Taxonomy Annex I to the Commission Delegated Regulation[16].

3.2 General description electric vehicles

Personal mobility in Norway is high, among the highest in Europe, with privately owned passenger vehicles accounting for most 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 were on average driven about 14,000 km. In 2023, the average passenger vehicle travelled about 11,300 km in Norway[17]. In this analysis, the expected yearly travelled distance for the vehicles in the portfolio is estimated based on an expectation of a continuing trend of reduced yearly travelled distance, and as an average in the vehicles' lifetime.

In 2023 the average age of passenger vehicles scrapped for refund in Norway was 18 years old[18]. The history of modern EVs is short and there is yet no evidence for the lifetime of EVs being different from other vehicles. There are uncertainties related to the expected lifetime of new vehicles sold between 2011 and 2023, so the average lifetime for passenger vehicles is set to 18 in this analysis, independent of fuel type.

3.2.1 EV policy in Norway

The Norwegian government have over time, with different administrations, had high ambitions both regarding electric vehicles and biofuel to reduce CO_2-emissions. 690,000 electric passenger vehicles were registered in Norwegian by the end of 2023, up from 600,000 by 2023 and now accounting for 24 percent of the total passenger vehicle stock[19]. The Norwegian

[15] https://www.climatebonds.net/standard/transport
[16] https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800-annex-1_en.pdf
[17] Statistics Norway 12578: Kjørelengder, etter kjøretøytype, drivstofftype, alder, statistikkvariabel og år, 2024
[18] Statistics Norway 05522: Vehicles scrapped for refund, by contents and year, 2024
[19] Statistics Norway 07849: Registered vehicles, by type of transport and type of fuel (M) 2008 - 2023, 2024

Parliament have unanimously agreed that all new light-duty and passenger vehicles sold should be zero-emission from 2025[20].

Petrol retailers are obliged to sell biofuels as a defined percentage of their total sales of ordinary petroleum products. As of 2023, the percentage of advanced biofuel of the overall quota obligation (24.5 percent) is set at 12.5 percent[21]. The current government platform ("Hurdalsplattformen") strengthens the obligations to utilize second-generation biofuels in the fuels sold[22].

3.3 Climate gas emissions (Scope 1 and 2)

Categorising the emissions, we have used the CBI guidelines for the Scope 1, Scope 2 and Scope 3 emission calculations. CBI's *Low Carbon Transport Background Paper*[23] 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 information on indirect emissions related to power production.

In this analysis, we are using two relevant GHG 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 each type of 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 this factor have been adopted in this analysis[24].

3.3.1 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 three steps:

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

[20] https://www.regjeringen.no/no/tema/transport-og-kommunikasjon/veg_og_vegtrafikk/faktaartikler-vei-og-ts/norge-er-elektrisk/id2677481/, 2023
[21] https://lovdata.no/dokument/LTI/forskrift/2023-12-20-2305, 2023
[22] https://www.regjeringen.no/no/dokumenter/hurdalsplattformen/id2877252/, 2023
[23] https://www.climatebonds.net/files/files/Low%20Carbon%20Transport%20Background%20Paper%20Feb%202017.pdf page 10
[24] https://www.ssb.no/transport-og-reiseliv/artikler-og-publikasjoner/mindre-utslipp-per-kjorte-kilometer, 2023

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 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[25].

Biofuels are to a varying degree mixed with fossil fuels. The abated emissions due to these contributions are reflected in the emissions from the vehicle that would otherwise have been bought as an alternative to the electric vehicle in this portfolio, in effect reducing the climate impact of zero emission vehicles. As Norway is aiming at substantially lowering 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 2023 and 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 2040.

To estimate the weighted average of emissions per fossil passenger vehicle, we use the average annual emission from new passenger vehicle models from 2011-2023[26].

To estimate the distance travelled by the average passenger vehicle we assume that the EVs drive as much as an average Norwegian passenger vehicle in each of the 18 years it is in use. Statistics of annual driven distance by electric, diesel and gasoline cars younger than 10 years support this assumption[27].

Traffic volumes per passenger vehicle has shown a historic decline. We use linear regression on publicly available dataset from the years 2005 to 2023 and extrapolate until 2040. This is a conservative approach as it is likely, at some point, to see a flattening.

Table 3-1 below presents the calculated emission factors for the relevant vehicle categories. The calculations are based on calculated gross tailpipe CO_2-emissions for the average vehicle produced in each of the years between 2011-2023, biofuel- and fossil fuel content in petrol/diesel pumped in each year between 2023-2040, as well as the travelled annual distance for the average vehicle.

Table 3-1 Passenger vehicles: Greenhouse gas emission factors (CO_2-eq) for substituted fossil vehicles and EVs, average direct emissions.

	Direct emissions per passenger-km [gCO_2/pkm]	Direct emissions per km [gCO_2/km]	Direct emissions per vehicle per year [$kgCO_2/vehicle/year$]
Substituted fossil passenger vehicles – average	45	77	703
Electric passenger vehicles	0	0	0

[25] https://www.vegvesen.no/fag/fokusomrader/miljo+og+omgivelser/klima, 2021
[26] https://ofv.no/CO2-utslippet/co2-utslippet, 2024
[27] Statistics Norway Table 12578: Road traffic volumes, by main type of vehicle, type of fuel and age of vehicle 2005 - 2023, 2024

3.3.2 Indirect emissions (Power consumption only) - Scope 2

Power is traded internationally in an 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 following 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 (EU27 + UK + Norway) is expected to be dramatically reduced the coming decades. An emission trajectory is applied that takes into consideration the 1.5 °C scenario and a substantial reduction of emissions from the power sector towards zero emissions in 2050. This aligns with the EU's ambitious goal of decarbonizing the power sector[28].

Passenger vehicles in Norway have a life expectancy of 18 years. The production mix is based on the assumed emissions in 2031, which is the weighted average of the lifetime for the vehicles in the portfolio.

As mentioned in section 1.2, the GHG emission intensity baseline for power consumption depends on system boundaries. The table below illustrates the emission factor for the European production mix as an average of the three last years with available data. The factor is calculated by Association of Issuing Bodies[29], and includes the EU countries, UK, and Norway. The value will vary from year to year.

To demonstrate how emissions vary depending on grid factor and for clarity if comparing avoided emissions from other segments, two more grid factors introduced in section 1.2 are included: Norwegian physically delivered electricity 2023 and the Norwegian residual mix for 2023. The mentioned grid factors are included in

Table 3-2 below.

Table 3-2 Electricity consumption greenhouse gas factors (CO_2-eq). (Sources: Association of Issuing Bodies[29], NVE[30], Multiconsult)

Scenario	Description	Emission factor [gCO_2/kWh]
European (EU27+UK+Norway) production mix average 2021-2023	Location-based production mix with wide system boundary of EU countries, UK, and Norway	231
Norwegian physically delivered electricity 2023	Location-based production mix with narrow system boundary including net export/ import only to neighbouring countries and average annual emission factors	15
Norwegian residual mix 2023	Market-based residual mix with a European marketplace, represents electricity not covered by Guarantees of Origin	599

For the European production mix, the following calculations use the emission factor as an average from the 2023-baseline in

[28] http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/631047/IPOL_BRI(2019)631047_EN.pdf, 2019
[29] https://www.aib-net.org/facts/european-residual-mix, 2024
[30] https://www.nve.no/energi/energisystem/kraftproduksjon/hvor-kommer-stroemmen-fra/, 2024

Table 3-2 over the expected lifetime for each type of vehicle, following the assumed trajectory of the European production mix toward zero. For instance, for passenger vehicles with an expected lifetime of 18 years, the emission factor will then be an average over the period 2023-2040. From a factor of 231 gCO_2/kWh, the reduction during the vehicle's lifetime gives the applied average factor of 159 gCO_2/kWh. The same method is not used to estimate the CO_2- factor based on the Norwegian-only mixes.

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 Vehicle Database[31], 0.195 kWh/km, which is close to the factor presented in the Swedish "Handbok för vägtrafikens luftföroreningar"[32].

In Table 3-3, indirect emission factors are presented in both emissions per kilometre and per passenger-kilometre, used to calculate indirect emissions for the portfolio based on European (incl. UK and Norway) production mix and the Norway only mixes. The factors are used in corresponding calculations of impact.

Table 3-3 Annual average GHG emission factors (CO_2-eq) per distance for electric passenger vehicles - based on three different power mixes.

	Indirect emissions per passenger-km [gCO_2/pkm]	Indirect emissions per km [gCO_2/km]
European production mix 2021-2023	18.2	31
Norwegian physically delivered el. 2023	1.7	2.9
Norwegian residual mix 2023	68.7	116.8

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 passenger vehicles are zero for scope 2.

3.4 Impact assessment – Clean transportation

The 9,662 eligible electric passenger vehicles in SMN's portfolio are estimated to drive 88 million kilometres in a year. The available data from the bank include the current number of contracts and related portfolio volume. Table 3-4 shows the number of eligible EVs in the portfolio with calculated average yearly driven distances.

Table 3-4 Number of eligible passenger vehicles and expected yearly mileage.

	No. of vehicles	Sum distance [km/year]	Sum distance [pkm/year]
Eligible passenger vehicles	9,662	87,977,669	149,562,038

Table 3-5 below summarise 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

[31] https://ev-database.org/cheatsheet/energy-consumption-electric-car, 2024
[32] "Handbok för vägtrafikens luftföroreningar", ch. 6, Trafikverket, 2021

as reductions in direct emissions and indirect emissions. Note that the indirect emissions are only calculated for EVs and not fossil fuelled vehicles.

Direct emissions in the following Table 3-5 are calculated by multiplying distance travelled by the vehicles in the portfolio in a year, by the specific emission factor [gCO_2/kWh] in

Table 3-1. Indirect emissions are calculated by multiplying distance travelled by the vehicles in the portfolio in a year by the specific emission factors [gCO2/km] in Table 3-3. Indirect emissions are calculated for all three grid factors mentioned in

Table 3-2.

Table 3-5 The EV portfolio's estimated impact on Scope 1 and Scope 2 GHG-emissions and sum of avoided emissions (CO_2-eq).

	Avoided emissions compared to baseline [tons CO_2-eq/year]		
	European production mix 2021-2023	Norwegian physically delivered el. 2023	Norwegian residual mix 2023
Direct emissions only (Scope 1)	6,794	6,794	6,794
Indirect emissions EVs only (Scope 2)	2,728	257	10,276
Sum avoided direct and indirect emissions	4,066	6,537	-3,482

Note that the high residual mix for Norway lead to net negative avoided emissions.

The reduction in direct emissions from passenger vehicles corresponds to 2.8 million litres of gasoline saved per year.

4 Renewable energy

Hydropower has been the dominant power production technology in Norway since the beginning of the industrialisation. Today, hydropower remains a crucial component of the national energy mix, accounting for 89 percent of the national electricity production in 2023.

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 webpages gives detailed information about different requirements for different kind of projects[33].

Data about Norwegian assets are available from NVE as all assets are subject to licencing.

4.1 Eligibility

SpareBank 1 SMN's eligibility criteria are formulated in line with CBI criteria[34] , and the hydropower threshold is in line with the emissions threshold of 100 gCO_2-eq/kWh in the June 2021 EU Taxonomy Annex I to the Commission Delegated Regulation[35].

Loans, credit and investments to finance or refinance equipment, development, manufacturing, construction, operation, distribution and maintenance of the following renewable energy generation sources are eligible for green bonds:

- Solar Energy: Photovoltaics (PV), concentrated solar power (CSP) and solar thermal facilities
- Wind Energy: Onshore and offshore wind energy generation facilities and other emerging technologies, such as wind tunnels and cubes
- Hydropower in Norway (boreal regions):
  - the electricity generation facility is a run of river plant and does not have an artificial reservoir
  - the power density of the electricity generation facility is above 5 W/m^2
  - the lifecycle emissions from the generation of the electricity from hydropower are lower than 100 gCO_2-eq/kW

4.1.1 Hydropower

Hydropower plants with power density > 5 W/m^2 are exempt from the most detailed investigations.

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

- All run-of-river power stations have no or negligible negative impact on GHG emissions

[33] https://www.nve.no/konsesjonssaker/konsesjonsbehandling-av-vannkraft/
[34] https://www.climatebonds.net/standard/hydropower
[35] https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800-annex-1_en.pdf

- 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 CBI hydropower eligibility criteria and the EU Taxonomy's "Do no significant harm" (DNSH) criteria, 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. All Norwegian 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 the portfolio

Multiconsult has investigated a sample of SpareBank 1 SMN's portfolio and can confirm that the assets have low to negligible GHG emissions related to construction and operation.

The power produced by the renewable energy power stations in the portfolio is from hydropower stations with capacities in the range of 0.1-2.9 MW. These are all run-of-river plants with no or very small reservoirs and hence a very high power density of several thousand W/m^2 (ratio between capacity and impounded area).

4.3 Emission factors and production estimates

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 individual impact on GHG emissions for the facilities in the portfolio, we refer to Association of Issuing Bodies (AIB)[36]. AIB, as referred to by NVE[37], has used 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 hydropower assets, even though the factors are reported higher than in other credible sources in Norwegian context. For instance, Østfoldforskning[38] calculated the life-cycle emissions of Norwegian hydropower across all categories to 3.33 gCO_2-eq/kWh.

For the 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 from Table 1-1.

Given the Norwegian electricity mix for physically delivered electricity of 15 gCO_2/kWh from Table 1-1, the positive impact for hydropower will be 9 gCO_2/kWh compared to the baseline.

[36] https://www.aib-net.org/, 2024
[37] https://www.nve.no/norwegian-energy-regulatory-authority/retail-market/electricity-disclosure-2018/, 2019
[38] https://norsus.no/wp-content/uploads/AR-01.19-The-inventory-and-life-cycle-data-for-Norwegian-hydroelectricity.pdf

Similarly, the positive impact for the Norwegian residual mix of 599 gCO_2/kWh from Table 1-1, will be 593 gCO_2/kWh.

4.3.2 Power production estimates

The renewable energy power plants in SMN's portfolio are quite varied in age. A large portion of younger plants add uncertainty to future power production. Actual or planned power production has been attained by the bank and supplemented by information from NVE[39].

It is important to note that indicated power production capacity in the licensing documents do not necessarily represent what can realistically be expected from the plant over time. For hydropower, the hydrology is uncertain, and unfortunately often overestimated in early project phases. Also, 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 may be more than 20 percent lower than the licensing/pre-construction figures.

4.4 Impact assessment- Renewable energy

The eligible plants in SpareBank 1 SMN's portfolio have a planned capacity stated in licensing documents to produce about 48.7 GWh per year. This has in the impact assessment been adjusted to an expected 39.0 GWh based on research mentioned in the previous section. The available data from the bank and open sources include:

- Type of plant
- Installed capacity [MW]
- Planned annual production [GWh]

Table 4-1 shows the capacity, number of plants, estimated and expected production for the assets in SMN's portfolio.

Table 4-1 Capacity and production of eligible hydropower plants, estimated and expected production (reduced for common errors).

	Capacity [MW]	No. of plants	Estimated production [GWh/year]	Expected production [GWh/year]
Small hydropower	0.1 – 2.9	10	48.7	39.0

Table 4-2 summarises the expected renewable energy produced by the eligible assets in the portfolio in an average year and the resulting avoided CO_2 emissions from the energy production. Avoided emissions are presented based on all three emission factors from Table 1-1.

Table 4-2 Power production and estimated positive impact on GHG-emissions (CO_2-eq).

	Expected production [GWh/year]	Avoided emissions compared to baseline [tons CO_2-eq/year]		
		European lifetime mix	Norwegian physically delivered el. 2023	Norwegian residual mix 2023
Eligible hydropower plants in the portfolio	39.0	5,065	351	23,103

[39] https://www.nve.no/energiforsyning/kraftproduksjon/vannkraft/vannkraftdatabase/, 2024