REPORT

SpareBank 1 Østlandet
Green Portfolio Impact Assessment 2023

CLIENT

SpareBank 1 Østlandet

SUBJECT

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

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REPORT

PROJECT	**SpareBank 1 Østlandet Green Portfolio Impact Assessment 2023**	DOCUMENT CODE	10249156-1-TVF-RAP-001
SUBJECT	Impact assessment - energy efficient residential and commercial buildings, electric vehicles, and renewable energy	ACCESSIBILITY	Open
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In summary, the assessed impact is significant for all examined asset classes in the SpareBank 1 Østlandet portfolio qualifying according to the bank's green bond criteria.

The total impact of the assets in the portfolio is close to 0.7 mill. tones CO_2e/year:

Energy efficient residential buildings		*11,020 ton CO_2e/year*
Energy efficient commercial buildings		*4,504 ton CO_2e/year*
Electric vehicles	*Scope 2: -1,577 ton CO_2e/year*	*Scope 1: 3,668 ton CO_2e/year*
Renewable energy		*70,512 ton CO_2e/year*
Sustainable forestry		*582,761 ton CO_2e/year*
Total		*670,888 ton CO_2e/year*

When scaled by the banks share of financing, the impact is estimated to 0.2 mill. tones CO_2e/year:

Energy efficient residential buildings		*5,499 ton CO_2e/year*
Energy efficient commercial buildings		*2,046 ton CO_2e/year*
Electric vehicles	*Scope 2: -1,451 ton CO_2e/year*	*Scope 1: 3,375 ton CO_2e/year*
Renewable energy		*18,385 ton CO_2e/year*
Sustainable forestry		*177,354 ton CO_2e/year*
Total		*205,208 ton CO_2e/year*

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1 Introduction

Assignment

On assignment from SpareBank 1 Østlandet, Multiconsult has assessed the impact of the part of SpareBank 1 Østlandet's loan portfolio eligible for green bonds.

In this document we briefly describe SpareBank 1 Østlandet's green bond qualification criteria, the evidence for the criteria and the result of an analysis of the loan portfolio of SpareBank 1 Østlandet. More detailed documentation on baseline, methodologies and eligibility criteria is made available on SpareBank 1 Østlandet'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_2e/kWh. The production mix is also included in the figure for other selected European states for illustration.

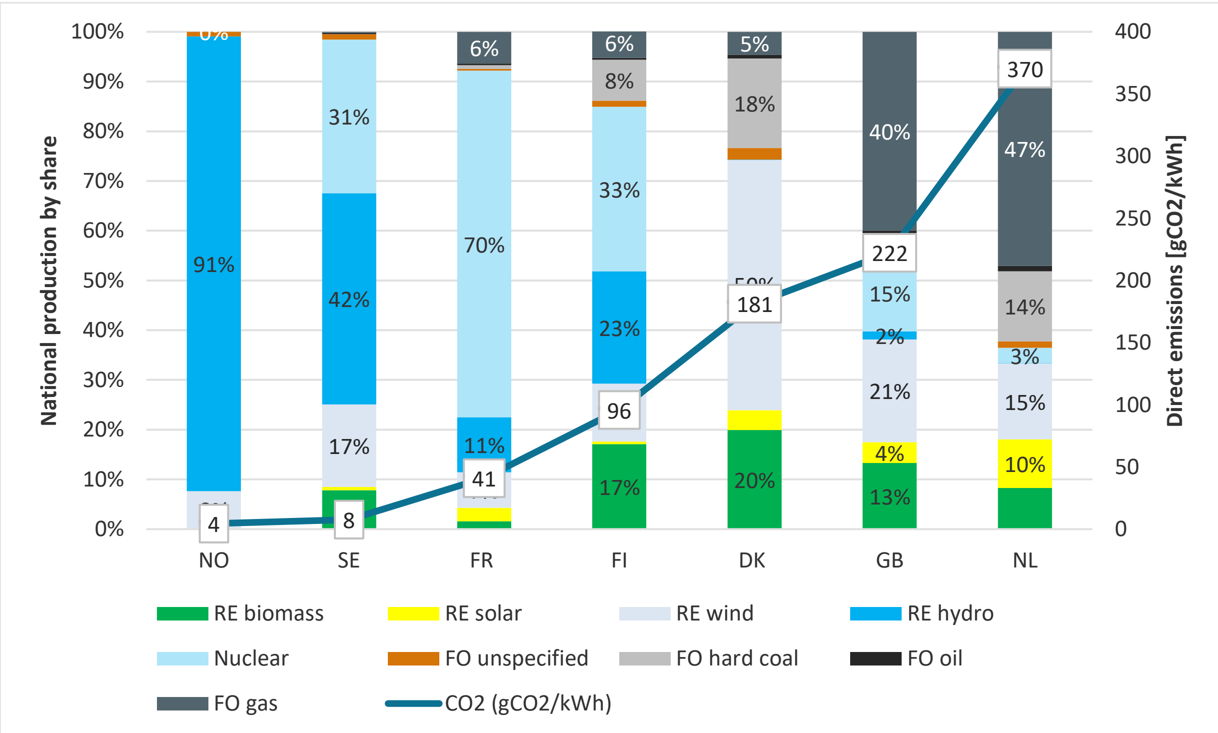

Figure 1 National electricity production mix in some selected countries (European Residual Mixes 2021, Association of Issuing Bodies[2])

[1] https://www.sparebank1.no/en/ostlandet/about-us/investor.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" considers 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.

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

Scenario	CO_2-factor (g/kWh)
European (EU27 + UK + Norway) consumption mix	136
Norwegian consumption mix	18

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[4] is on average 111 gCO_2e/kWh due to the influx of bioenergy and district heating in the energy mix. This factor is used in impact calculations in section 2.

The average emission factor relevant for electric vehicles is calculated correspondingly, however, with a shorter life expectancy of the vehicles of 18 years. The relevant emission factor is, as presented in more detail in section 3, calculated for this asset class to be 337 gCO_2e/kWh.

1.2 Emission factors in green portfolio assessments vs. annual total portfolio assessments

In addition to reporting on impact of the green portfolio used as basis for emissions of green bonds, as presented in this report, the bank reports on an annual basis the greenhouse gas emissions in CO_2-equivalents for the whole portfolio. Where this green portfolio reporting considers the energy related emissions in the life-cycle of the eligible objects assuming a decarbonisation of the power system in line with EU policy in this life span, the CO_2-factor used in the total portfolio reporting is reflecting the current energy mix in the power system. The latter is in line with PCAF and gives the bank annual feedback on how the total portfolio is performing. For investors in green bonds, however, we present annual impact of the eligible objects using a lower emission factor resulting in more conservative impact.

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

2 Energy efficient buildings

2.1 Residential buildings

2.1.1 Eligibility criteria

Eligibility in this impact assessment for residential buildings in the SpareBank 1 Østlandet portfolio is identified against a building code criterion and an EPC criterion as formulated below. These criteria are in line or stricter than the equivalent CBI's proxy criterion for Norwegian residential buildings.

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

i. **New or existing Norwegian residential buildings that comply with the Norwegian building code of 2010 (TEK10) and later codes are eligible for green bonds as all these buildings have significantly better energy standards and account for less than 15% of the residential building stock (10% in 2021). A two-year lag between implementation of a new building code and the buildings built under that code must be taken into account.**

ii. **Existing Norwegian residential buildings with EPC-labels A or B.**

iii. **Refurbished Norwegian commercial and residential buildings with at least a 30% improvement in energy efficiency measured in specific energy, kWh/m^2, compared to the calculated label based on building code in the year of construction. (Residential buildings qualify for this criterion if they are built in 1971 or earlier and have energy grade D or better, or built in 1991 or earlier and have energy grade C.)**

iv. **Buildings built from the 1st January 2021 should be at least a 20% more energy efficient than regulation at time of construction.**

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 TEK10 and TEK17 gives an average specific energy demand for existing houses and apartments, weighted for actual stock, of 116 kWh/m^2.

Hence, the building codes TEK10 and TEK17 give a calculated specific energy demand 54% lower than the average residential building stock.

2.1.2 Impact assessment - Residential buildings

A reduction of energy demand from the average 251 kWh/m^2 of the total residential building stock to 121 kWh/m^2 (TEK10) or 102 kWh/m^2 (TEK17) dependent on building code, is multiplied to the emission factor and the area of eligible assets to calculate impact for buildings qualifying to the building code criterion. For the buildings qualifying according to the EPC-criterion only, the difference between energy demand for achieved energy label and weighted average in the EPC database is used. For the buildings qualifying according to the refurbishment criterion only, the calculations are based on the difference between energy demand for achieved energy label and the energy label based on building year.

The eligible residential buildings in SpareBank 1 Østlandet's portfolio is estimated to amount to 728,443 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 average area derived from national statistics (Statistics Norway[5]).

Eligibility is first checked against the building code criterion. The ones left are checked against the EPC-criterion, and last against the refurbishment criterion so no double counting of objects will occur. The eligible residential buildings in SpareBank 1 Østlandet's portfolio is estimated to amount to 0.73 million square meters, whereas the major part, 5,196 objects, is eligible through the building code criterion. Of the 362 objects qualifying according to the EPC-criterion, 6% are A's and the rest have energy label B. 1,252 objects qualify according to the refurbishment criteria, of which 71% have energy label D and were built before 1971.

Note that data is not available to check whether or not the buildings built in 2021 are performing 20% better than the energy efficiency standards in the TEK17 code. Hence the number of units and area are presented separately in the tables below for information. In the impact assessment, the units are included, however, as performing no better than the TEK17 standard.

Table 2 Eligible residential objects

	Number of units qualifying buildings in portfolio						
	TEK10	TEK17	TEK17 2021+	EPC A	EPC B	EPC C <1991	EPC D <1971
Small residential buildings	1,507	476	572	7	189	78	124
Apartments	1,405	587	649	16	150	281	769
Sum	**2,912**	**1,063**	**1,221**	**23**	**339**	**359**	**893**

Table 3 Calculated area of qualifying buildings

	Area qualifying buildings in portfolio [m2]							
	TEK10	TEK17	TEK17 2021+	EPC A	EPC B	EPC C <1991	EPC D <1971	Sum
Small residential buildings	228,304	73,857	87,652	1,495	35,020	13,774	21,377	**461,479**
Apartments	102,031	39,178	44,778	1,122	10,040	19,328	50,487	**266,964**
Sum	**330,335**	**113,035**	**132,430**	**2,617**	**45,060**	**33,102**	**71,864**	**728,443**

Based on the calculated figures in Table 2 and 3, the energy efficiency of this part of the portfolio is estimated based on calculated energy demand dependent on building code. All these residential buildings are not necessarily 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 also includes bioenergy and district heating, resulting in a total specific emission factor of 111 gCO_2e/kWh. A proportional relationship is expected between energy consumption and emissions.

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

Table 4 below 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.

Table 4 Performance of eligible residential objects compared to average building stock

	Avoided energy demand compared to baseline	Avoided CO_2-emissions compared to baseline
Eligible buildings in portfolio	**100 GWh/year**	**11,020 tons CO2e/year**
Scaled by engagement	**53 GWh/year**	**5,499 tons CO2e/year**

2.2 Commercial buildings

2.2.1 Eligibility criteria

Unique criteria have been established for the four subcategories: office buildings, retail, hotel and restaurant buildings and industry/warehouses. The criteria identify no more than the top 15% most energy efficient commercial buildings countrywide based on building code.

Eligible Commercial Green Buildings for SpareBank 1 Østlandet must meet the following eligibility criterion: New or existing Norwegian office and retail buildings, industrial buildings and warehouses, hotel and restaurant buildings that comply with the Norwegian building code of 2010 (TEK10) and later codes are eligible for green bonds as all these buildings have significantly better energy standards and account for less than 15% of the building stock.

For hotel and restaurant buildings a three-year lag between implementation of a new building code and the buildings built under that code must be taken into account. Hence all buildings finished in 2013 or later qualify.

For office buildings, retail buildings, industrial buildings and warehouses a two-year lag between implementation of a new building code and the buildings built under that code must be considered. Hence all buildings finished in 2012 or later qualify.

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

Table 5 Average specific energy demand for the building stock; whole stock, part eligible according to criteria and reduction

	Average total stock [kWh/m^2]	Average TEK10 and TEK17 [kWh/m^2]	Reduction [%]
Office buildings	251	147	42%
Retail buildings	323	206	36%
Hotel and restaurant buildings	309	184	41%
Small industry and warehouses	297	169	43%

Furthermore, new or existing Norwegian office and retail buildings, industrial buildings and warehouses, hotel and restaurant buildings are eligible for green bonds if having energy label A or B.

Lastly, new or existing Norwegian office and retail buildings, hotels and restaurants, industrial buildings and warehouses are also eligible if they have been refurbished, leading to an improved energy efficiency of 30%. Office and retail buildings, industrial buildings and warehouses qualify for this criterion if they are built in 1971 or earlier and have energy grade D or better, or built in 1991 or earlier and have energy grade C. Hotels and restaurants qualify according to this criterion if they are built in 1970 or earlier and have energy grade D, or built in 1990 or earlier and have energy grade C.

2.2.2 Impact assessment - Commercial buildings

The eligible buildings in SpareBank 1 Østlandet’s commercial portfolio is estimated to amount to 360,000 square meters. 50 objects are found eligible according to a building code criterion. Two of the 10 buildings identified as eligible according to an EPC-criterion only, have the energy label A. An additional 19 building are found eligible according to a refurbishment criterion, which 58% have energy label C and were built before 1991. The buildings qualifying according to two or more criteria are only counted once.

The difference between average specific energy demand for each sub-category in the building stock and the average for qualifying buildings is multiplied by the emission factor and area of eligible assets to calculate impact for buildings qualifying to the building code criterion. For the buildings qualifying according to the EPC-criterion only, the calculations are based on the difference between achieved energy label and weighted average in the EPC database. For the buildings qualifying according to the refurbishment criterion only, the calculations are based on the difference between energy demand for achieved energy label and the energy label based on building year.

Table 6 Calculated building areas for eligible commercial objects

	Area qualifying buildings in portfolio [m^2]						
	TEK10	TEK17	EPC A	EPC B	Energy upgrade to EPC C	Energy upgrade to EPC D	Total
Office buildings	29,588	10,761	5,024	35,737	59,387	17,298	157,795
Retail/commercial buildings	71,248	8,285		5,487	11,509	7,035	103,564
Hotel and restaurant buildings	8,980		15,000	21,441	1,800	5,700	52,921
Industry and small warehouse buildings	34,982	1,200		7,439	2,405		46,026
Sum	**144,798**	**20,246**	**20,024**	**70,104**	**75,101**	**30,033**	**360,306**

Based on the calculated figures in tables 4 and 5, the energy efficiency of this part of the portfolio is estimated. All these commercial buildings are not included in one single bond issuance.

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

Table 7 Performance of commercial eligible objects compared to average building stock

	Avoided energy demand compared to baseline	Avoided CO_2-emissions compared to baseline
Eligible buildings in portfolio	**41 GWh/year**	**4,504 tons CO_2e/year**
Scaled by engagement	**18 GWh/year**	**2,046 tons CO_2e/year**

3 Electric vehicles

Multiconsult has assessed the direct and indirect impact of electric vehicles. The bank has provided essential data on number of electric vehicles in their portfolio and portfolio volume including type of engine, fuel and vehicle category - all registered in Norway. SpareBank 1 Østlandet's vehicle portfolio contains 5,094 electric vehicles.

The eligibility criteria are framed in agreement with the Climate Bonds Initiative (CBI) criteria[6]. The eligible EVs/ zero tailpipe emission vehicles in the portfolio are also automatically aligned to the wording in the June 2021 EU Taxonomy Annex I to the Commission Delegated Regulation[7].

The bank's portfolio is assessed regarding direct emissions (Scope 1) and indirect emissions related to electric power production (Scope 2). The emission of the average vehicles compared to the total new vehicles introduced to the marked (EVs excluded) constitutes the baseline used in this analysis.

3.1 Loan Portfolio Analysis

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

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

The portfolio in question includes solely electric vehicles financed by the bank.

3.2 General description

Personal mobility in Norway is high, among the highest in Europe, with privately owned passenger vehicles accounting for the vast majority 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 2021 the average passenger vehicle travelled about 11,290 km[8] in Norway. 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 2020 the average age of passenger vehicles scrapped for refund in Norway was 18 years old[9]. 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.

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

3.1 EV policy in Norway

There were over 460,700 electric passenger vehicles on Norwegian roads by the end of 2021, which accounts for 16% of the total passenger vehicle stock[10]. The Norwegian Parliament have unanimously agreed that all new light-duty and passenger vehicles sold should be zero-emission from 2025[11].

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

In 2023, the Norwegian government adjusted the previous VAT exemption to only be applicable up to 500,000 NOK of the purchase price. Additionally, EV vehicles now need to pay a registration fee, to the same degree as fossil fuel vehicles. Many of the other benefits have been reduced and EVs are currently paying up to a maximum, by law, of 70% for toll roads, and 50% for parking and ferries.

3.2 Biofuel policy in Norway

Norway has an ambitious biofuel policy, with a 50% reduction in GHG emissions from fossil fuel from 2018[12]. In 2018, legislation was put in place to require all petrol retailers to sell fuel containing biofuels, with a benchmark of 2% of their annual sold volume of ordinary petroleum products. This requirement was extended to a minimum of 24.5% in 2021, whereof 9% was advanced biofuel[13]. The goal has since been advanced, with a special emphasis on avoiding the usage of biofuels with a high risk of increasing deforestation[14]. As of 2023, the percentage of advanced biofuel of the overall quota obligation (24.5%) is set at 12.5%. To incentivise the use of advanced biofuels, one litre of advanced biofuels is counted as two litres of conventional biofuel. Subsequently, the overall use of advanced biofuel has increased year after year. In 2021, advanced biofuels accounted for 75% of the overall biofuel usage, thus reducing the usage of conventional biofuels[15]. As a result, the overall volume of biofuel has declined the past years, even though the percentage of biofuels has increased. The current government platform (Hurdalsplattformen) strengthens the obligations to utilize second-generation biofuels in the fuels sold[16].

In 2020, a road tax (veibruksavgift) for all biofuel was introduced. The taxation of bioethanol is significantly lower compared to standard gasoline, but the road tax for biodiesel is equal to conventional diesel[17]. Previous estimates from 2018 concluded that biofuel used in Norway resulted in 72% lower greenhouse gas (GHG) emissions in a life cycle perspective compared to regular fuels[18]. The same year, legislation was passed, stipulating that biofuels shall have a minimum of 50% lower life cycle GHG emissions than fossil fuels[19].

[10] https://www.ssb.no/transport-og-reiseliv/landtransport/statistikk/bilparken/artikler/to-av-tre-nye-personbiler-er-elbiler
[11] https://www.regjeringen.no/no/tema/transport-og-kommunikasjon/veg_og_vegtrafikk/faktaartikler-vei-og-ts/norge-er-elektrisk/id2677481/
[12] Produktforskriften kapittel 3: Omsetningskrav for biodrivsoff og bærekrafskrierier for biodrivsoff og flytende biobrensel, Lovdata, 2019
[13] https://www.ssb.no/transport-og-reiseliv/landtransport/artikler/utfordringer-med-fornybart-drivstoff
[14] https://www.regjeringen.no/no/dokumenter/politisk-plattform/id2626036/
[15] https://www.miljodirektoratet.no/aktuelt/nyheter/2022/juni-2022/avansert-biodrivstoff-oker-pa-norske-veier/
[16] https://res.cloudinary.com/arbeiderpartiet/image/upload/v1/ievv_filestore/43b0da86f86a4e4bb1a8619f13de9da9afe348b29bf24fc8a319ed9b02dd284e
[17] https://www.skatteetaten.no/satser/veibruksavgift/?year=2023#rateShowYear
[18] https://www.miljodirektoratet.no/aktuelt/nyheter/2019/mai-2019/salget-av-avansert-biodrivstoff-okte-i-fjor/
[19] https://lovdata.no/dokument/LTI/forskrift/2022-12-20-2356

In 2021, 75% of the advanced biofuel utilized in the Norwegian transportation sector stemmed from waste and residue, with only 1% of the raw materials being produced in Norway[20]. The raw materials utilized in domestic biofuels were principally imported from North America and Europe. Biofuels accounted for 14% of all fuels consumed by domestic road traffic in 2021 - a positive incremental change since 2020. In 2021, there were no sales of biofuels containing soy or palm oil in Norway, aligning with the target to reduce the usage of raw materials with a high risk for deforestation.

3.3 Climate gas emissions (Scope 1 and 2)

Categorizing the emissions, we have chosen to use the CBI guidelines for the emission calculations. CBI's *Land Transport Background Paper*[21] underlines the focus on tailpipe emissions because of their dominance, the need to send strong signals to vehicle purchasers and the need to promote technologies and infrastructure that have the potential to radically shift emissions trajectories and avoid fossil fuel lock-in. We do however include indirect emissions related to power production.

3.3.1 Indicators

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

- Emissions per kilometre [gCO_2e/km]
- Emissions per passenger kilometre [gCO_2e/pkm]

The passenger vehicle fleet composition and emissions from each type of passenger vehicle is used to calculate the emissions per kilometre.

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

Statistics Norway's method for calculating indicators for emissions per passenger kilometre utilizes a vehicle occupancy of 1.7 persons in passenger vehicles and 1.5 persons in a light duty vehicle, and these factors have been adopted in this analysis[22].

3.3.2 Direct emissions (tailpipe) - Scope 1

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

The estimation of the baseline is performed through 3 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.miljodirektoratet.no/aktuelt/nyheter/2022/juni-2022/avansert-biodrivstoff-oker-pa-norske-veier/
[21] https://www.climatebonds.net/files/files/CBI_Background%20Doc_Transport_Jan2020%20.pdf page 25
[22] https://www.ssb.no/transport-og-reiseliv/artikler-og-publikasjoner/mindre-utslipp-per-kjorte-kilometer

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

To estimate the annual emissions avoided by the eligible assets, projections are made for direct tailpipe CO_2-emissions from fossil fuels combustion in the national passenger vehicle fleet.

For the substituted fossil fuelled vehicles, emission data are retrieved from recognized test methods and not actual registrations of emissions in a Nordic climate. Test methods have lately been improved to better reflect actual emissions but are still likely to underestimate the emissions[23].

Biofuels are to some degree mixed with fossil fuels, and the reduced emissions due to these contributions are considered in the emissions from the vehicle that would have been bought as an alternative for the electric vehicle in this portfolio, in effect reducing the climate impact of zero emission vehicles. As Norway is aiming at substantially reducing emissions from fossil fuelled vehicles through use of biofuel in the fuel sold before 2030, the marginal emission reduction possibly obtained through these political goals between 2022-2030 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, we use the average annual emission from new passenger vehicle models from 2011-2022[24].

To estimate the distance travelled by the average passenger vehicle we assume that 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[25].

Traffic volumes per passenger vehicle and light duty vehicle has shown a historic decline. We use linear regression on publicly available dataset from the years 2005 to 2021 and extrapolate until 2040. 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.

Table 8 and

Table 9 present the calculated emission factors for the relevant vehicle categories. The calculations are based on calculated gross tailpipe CO2-emissions for the average vehicle produced in each of the years between 2011-2022, biofuel- and fossil fuel content in petrol/diesel pumped in each year between 2022-2040, as well as the travelled annual distance for the average vehicle.

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

	Direct emissions substituted fossil passenger vehicles – average	**Direct emissions EV**
Emissions per passenger km	46 gCO_2e/pkm	0 gCO_2e/pkm
Emissions per km	79 gCO_2e/km	0 gCO_2e/km
Emissions per passenger vehicle and year	690 $kgCO_2e$/vehicle/year	0 $kgCO_2e$

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

Table 9 ***Light Duty Vehicles****: Greenhouse gas emission factors (CO_2 equivalents), average direct emissions*

	Direct emissions substituted fossil light duty vehicles – average	**Direct emissions EV**
Emissions per passenger km	101 gCO_2e/pkm	0 gCO_2e/pkm
Emissions per km	152 gCO_2e/km	0 gCO_2e/km
Emissions per passenger vehicle and year	1,707 $kgCO_2e$/vehicle/year	0 $kgCO_2e$

3.3.3 Indirect emissions (power consumption only) - Scope 2

Norway trades power internationally through 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 main analysis in this report. Nonetheless, calculations of indirect emissions from power production setting the system boundary at national borders is included for comparison.

The direct emissions in power production in Europe (EU27 + UK + Norway) is expected to be dramatically reduced the coming decades. The emission trajectory takes into consideration the 1.5 °C scenario and a substantial reduction of emissions from the power sector towards zero emissions in 2040. This aligns with the EU's ambitious goal of decarbonizing the power sector[26].

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 depends on system boundaries. The table below illustrates the CO_2-factor for the European production mix and Norwegian production mix as an average of the three last years with available data.

Table 10 Electricity production greenhouse gas factors (CO_2 equivalents)

Scenario	**CO_2-factor (g/kWh)**
European (EU27 + UK + Norway) production mix average 2019-2021	245
Norwegian production mix average 2019-2021	7.8

Using a European production mix is in line with Nordic Public Sector Issuers: Position Paper on Green Bonds Impact Reporting (February 2020)[27]. The following calculations use the CO_2-factor as an average from the baseline presented in Table 10 and the expected lifetime for each type of vehicle, following the emission trajectory of the European production mix. For passenger vehicles, with an expected lifetime of 18 years, the CO_2-factor will then be an average of the CO_2-factor in the period from 2021-2038. The same method is used to estimate the CO_2-factor based on the Norwegian power production

[26] http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/631047/IPOL_BRI(2019)631047_EN.pdf
[27] https://www.kbn.com/globalassets/dokumenter/npsi_position_paper_2020_final_ii.pdf

mix. The projected declining CO_2 emission trajectories reported for power production for EU and Norway, from 2021 and onward, will impact the indirect emissions and avoided emissions from the vehicle portfolio.

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[28], 0.2 kWh/100km.

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

	Indirect emissions electric passenger vehicle - annual average	**Indirect emissions electric light duty vehicle - annual average**
Emissions per passenger km, indirect emissions from power production	20 gCO_2e/pkm	30 gCO_2e/pkm
Emissions per km, indirect emissions from power production	35 gCO_2e/km	46 gCO_2e/km

Table 12 Electricity consumption greenhouse gas factors (CO_2 equivalents) electric vehicles - based on Norwegian power production mix

	Indirect emissions electric passenger vehicle - annual average	**Indirect emissions electric light duty vehicle - annual average**
Emissions per passenger km, indirect emissions from power production	0.6 gCO_2e/pkm	1.0 gCO_2e/pkm
Emissions per km, indirect emissions from power production	1.0 gCO_2e/km	1.5 gCO_2e/km

Table 13 Electricity consumption greenhouse gas factors (CO_2 equivalents) fossil fuelled alternatives

	Indirect emissions fossil vehicle*	**Indirect emissions fossil light duty vehicle***
Emissions per passenger km, indirect emissions from power production	0 gCO_2e/pkm	0 gCO_2e/pkm
Emissions per km, indirect emissions from power production	0 gCO_2e/km	0 gCO_2e/km

*Note that there are indirect emissions related to fossil fuel as well but those 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.

[28] https://ev-database.org/cheatsheet/energy-consumption-electric-car

3.4 Impact assessment: Avoided emissions – Electric vehicles

The 5,094 eligible vehicles in SpareBank 1 Østlandet's portfolio are estimated to drive 45 million km per annum. The available data from the bank include the current number of contracts and related portfolio volume and asset values.

Table 14 Number of eligible passenger vehicles and expected yearly mileage

	Number of vehicles	Sum km/yr	Sum person km/yr
Passenger vehicles	4,941	43.3 mill.	73.6 mill.
Light Duty Vehicles	153	1.7 mill.	2.6 mill.
Sum portfolio	**5,094**	**45 mill.**	**76.2 mill.**

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

Direct emissions in the following tables are calculated by multiplying distance travelled by the vehicles in the portfolio in a year by the specific emission factor [CO_2e/km] in Table 8 and

Table 9. Indirect emissions are calculated by multiplying distance travelled by the vehicles in the portfolio in a year by the specific emission factors [CO_2e/km] in Table 11 through Table 13. The values in Table 15 and 15 reflect the banks share of financing being 92% of the total value of the vehicle portfolio.

Table 15 The portfolio's estimated impact on GHG-emissions, indirect emissions based on the European power production mix

	CO_2-emissions compared to baseline – scaled to reflect the banks engagement
Direct emissions only (Scope 1)	**- 3,375 tons CO_2e/year**
Indirect emissions EVs only (Scope 2)	**1,451 tons CO_2e/year**
Direct and indirect	**- 1,924 tons CO_2e/year**

Table 16 The portfolio's estimated impact on GHG-emissions, indirect emissions based on the Norwegian power production mix

	CO_2-emissions compared to baseline – scaled to reflect the banks engagement
Direct emissions only (Scope 1)	**- 3,375 tons CO_2e/year**
Indirect emissions EVs only (Scope 2)	**42 tons CO_2e/year**
Direct and indirect	**- 3,332 tons CO_2e/year**

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

4 Renewable energy

Hydropower has played a significant role in Norway's power production since the industrial revolution. Today, hydropower remains a crucial component of the national energy mix, accounting for 88% of the national electricity production in 2022[29]. The same year, onshore wind accounted for 10% of the national power production.

Power production development in Norway is strictly regulated and subject to licencing and is overseen by Norwegian Water Resources and Energy Directorate (NVE), a directorate under the Ministry of Petroleum and Energy. Licenses grant rights to build and run power production installations under explicit conditions and rules of operation. NVE puts particular emphasis on preserving the environment. The Norwegian part of the NVE homepage gives detailed information about different requirements on different kind of projects[30].

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 main eligibility criteria are in line with the CBI criteria and the EU Taxonomy. For Norwegian hydropower 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 and high power density of Norwegian hydropower, Norwegian reservoirs are not exposed to significant cyclic revegetation of impoundment and hence the negative impacts on GHG emissions from these reservoirs are very small.

Hydropower plants in the bank's portfolio qualify for green bonds if they are small-scale hydropower projects (less than 25 MW) and large-scale projects (more than 25 MW) with either:

i. life cycle emissions of less than 100 gCO2e/kWh, or
ii. power density greater than 5 W/m2.

Climate Bonds Initiative (CBI) have published hydropower eligibility criteria[31]. These criteria have a mitigation component and an adaptation and resilience component.

The mitigation component for existing plants requires power density > 5 W/m^2 or emission intensity < 100 gCO_2e/kWh. (For new/under construction the thresholds are 10 W/m^2 and 50 gCO_2e/kWh).

The adaptation and resilience component, addressing ESG, is in the Norwegian context covered by the rigid relevant requirements in the Norwegian regulation of hydropower.

The eligibility criteria mentioned above are central also in the EU taxonomy. Most *do no significant harm* (DNSH) requirements are covered by current national regulation of hydropower, however, with exemptions. Portfolio alignment with DNSH requirements has not been assessed.

[29] https://www.ssb.no/energi-og-industri/energi/statistikk/elektrisitet/artikler/betydelig-nedgang-i-stromforbruket-i-2022
[30] https://www.nve.no/konsesjonssaker/konsesjonsbehandling-av-vannkraft/
[31] https://www.climatebonds.net/files/files/Hydropower-Criteria-doc-March-2021-release3.pdf

4.2 Eligible assets in portfolio

Sparebank 1 Østlandet's eligble assets have low to negligible GHG emission related to construction and operation of the renewable power plants, something Multiconsult can verify.

All power produced by renewable energy power stations in SpareBank 1 Østlandet's portfolio is from hydropower stations with capacities in the range of 0.1-10 MW. These are run-of-river plants or hydropower plants with small reservoirs and hence have higher power density of several thousand W/m^2 (ratio between capacity and impounded area).

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 across the SpareBank 1 Østlandet portfolio, with most of the facilities being in rather small scale, 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[32], uses an emission factor of 6 gCO2e/kWh for all European hydropower in their calculations of the European residual mix. The value is based on a life cycle analysis (LCA) 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 the factors are reported higher than in other credible sources. For instance, Østfoldforskning calculated the average GHG emission intensity of Norwegian hydropower, across all categories using LCA, to be 3.33 gCO_2e/kWh[33].

SpareBank 1 Østlandet portfolio contains many run-of-river and small hydropower assets, and the AIB emission factor is therefore regarded as conservative in an impact assessment setting. The positive impact of the hydropower assets is 130 gCO_2e/kWh, compared to the baseline of 136 gCO_2e/kWh.

4.3.2 Power production estimates

Actual and planned power production has been provided by the bank and verified by Multiconsult using the NVE's hydropower database.

It is important to note that indicated power production capacity in the concession documents do not necessarily represent what can realistically be expected from the plant over time. For one the hydrology is uncertain, and unfortunately often overestimated in early project phases. 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 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.

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

4.3.3 *Portfolio analysis - New or existing Norwegian renewable energy plants*

The eligible plants in SpareBank 1 Østlandet's portfolio is expected to have the capacity to produce about 141 GWh per year, scaled to the banks engagement. The available data from the bank and open sources include:

- Type of plant (run-of-river/reservoir)
- Installed capacity
- Estimated or recorded production
- Age

To cross-check the data, the planned power production for the assets has been attained from the Norwegian Water Resources and Energy Directorate's hydropower database[34] or licencing documents. Table 17 describes the hydropower plants identified in the mentioned database. The production volume is scaled by the banks share of financing, ranging from 5 to 100%.

Due to the often overestimated annual production in small hydropower, the impact is conservatively calculated for estimated production reduced by 20%.

Table 17 Capacity and annual production of eligible hydropower plants, estimated and expected production

	Capacity [MW]	# of plants	Total capacity [MW]	Estimated production [GWh/yr]	Expected production [GWh/yr]
Small run-of-river	0.04 – 9.9	53	192.8	105.8	84.6
Small reservoir HPP	2.2 – 10	6	21.6	71.0	56.8
Sum		**59**	**214**	**177**	**141**

Table 17 below summarises the scaled renewable energy produced by the eligible assets in the portfolio in an average year, and the avoided CO_2-emissions the energy production results in.

Table 18 Annual power production and estimated positive impact on GHG-emissions

	Expected produced power	Reduced CO_2-emissions compared to baseline
Identified eligible renewable energy plants in portfolio scaled by bank's share of financing	**141 GWh/year**	**18,385 tons gCO_2e/year**

[34] https://www.nve.no/energiforsyning/kraftproduksjon/vannkraft/vannkraftdatabase/

5 Sustainable Forestry

Forests make up about 14 million hectares (140,000 km^2), or 44% of the land area in Norway. Of this, approximately 8.6 million hectares are productive forest area, and the most important and economically important tree species are spruce, pine and birch[35].

The standing forest in Norway is an important factor in the Norwegian climate gas accounting that is reported on an annual basis to the United Nations as required by the UN Framework Convention on Climatic Change and the Kyoto Protocol. In 2020, the total annual carbon sequestration (storage) by the forest amounted to 24.5[36] million tonnes CO_2 equivalents. While taking into account CO_2 emissions caused by forest- and peat land conversion, the net sequestration was estimated at 20.3 million tonnes. This represents 40% of the total Norwegian CO_2 emissions.

Both CO_2 sequestration and carbon stored in the forest biomass has been steadily increasing since the 1920s, because of active forest management since 1945 and especially in the period 1955 – 1992. Trees planted in this period have been, and still partly are, in healthy growth, while logging has remained relatively stable with some increases in quantity over the last years. In the future, the CO_2 sequestration is expected to drop towards 2050 and then stabilize, for again to increase towards 2100. That is due to the combined effect of logging and replanting and the fact that climate change and increased temperatures will lead to an increased growth rate for the forest.

Norwegian obligations through international agreements related to sustainable forestry have been included in Norwegian regulation, including criteria for sustainable forestry negotiated in the European forest cooperation. The purpose of the Norwegian Forestry Act is to promote sustainable management of forest resources and to ensure biodiversity, consideration for the landscape, outdoor life, and cultural values. The Forestry Act applies to all forests. The Biodiversity Act in Norway contains provisions on the protection of forests and special provisions on priority species and selected habitat types to ensure important environmental values, including in forests.

5.1 Eligibility

Close to all commercially manged forests in Norway are certified according to ISO 14001, where compliance with the Norwegian PEFC Forest Standard (Living Forest Standard) is one of the main qualification criteria. This makes it highly likely that all forests in the bank's forest-based portfolio are PEFC certified. Nothing has come to the Consultant's attention whilst assessing the forestry portfolio that would suggest otherwise.

It is reasonable to assume that the bank's forestry-based assets will fall into the category Existing Forest Management in the EU Taxonomy. According to the statement in the Technical Annex, that FSC and PEFC certified forestry operations are likely to meet the Sustainable Forest Management requirement, the bank's forestry-based assets are probably in compliance with criterion 1. Considering also that the large majority of forest properties in Norway, and consequently also the bank's forestry-based assets, have forest manage plans in place, makes it likely that criterion 2 and 3 will be fulfilled. This is because the information provided in the forestry management plans normally will allow for

[35] https://www.skogbruk.nibio.no/skogen-i-norge
[36] https://miljostatus.miljodirektoratet.no/tema/klima/norske-utslipp-av-klimagasser/utslipp-og-opptak-fra-skog-og-arealbruk/

establishment of a verified GHG balance baseline and a demonstration of consistency and steady progress with respect to carbon storage.

With regards to fulfilling the requirements of the Forestry Criteria of the Climate Bonds Initiative, it is equally likely that the forest-based loan assets fulfil the requirements of PEFC certification. Uncertainty remains regarding compliance with the climate adaptation and resilience checklist of the Climate Bonds Initiative's Forestry Criteria, which requires a mandatory climate change risks assessment and a plan to mitigate any identified risk.

5.2 Impact Assessment

An actively and well managed forested area may bring benefits in the form of carbon sequestration, recreational space, and wildlife preservation. The focus in this high-level evaluation of the forest green loan assets is the mitigation of climate change impacts that these assets potentially represent.

According to figures from the climate gas accounts for forests prepared by NIBIO[37] , lowland forests in Norway amounted to a total area of 14 988 000 hectares (ha) and a carbon stock of 452 million tonnes of CO_2. This equals 30.2 tonnes of CO_2 storage per hectare of forest. The table below presents the calculated carbon storage the green loan assets represent.

Table 19 Present carbon storage in CO2 equivalents by SpareBank 1 Østlandet's green loan portfolio

Type of forest	Area - ha	CO_2 Storage - tonnes per ha	Total CO_2 Storage of Forest Assets - tonnes
Spruce	79,115	30.2	2,385,907
Pine	40,303	30.2	1,215,445
Total	**119,418**	**30.2**	**3,601,353**

As can be read from Table 19, the present carbon storage of the green loan portfolio of SpareBank 1 Østlandet is estimated at 3.6 million tonnes CO_2 equivalents. This amounts to 41% of the estimated 8.7 million tonnes of CO_2 equivalents from road traffic and the transport sector in Norway in 2021[38].

In a publication from Bioforsk [39] (now NIBIO), the average carbon sequestration capacity is estimated to be 1.33 tonnes of carbon per ha per year which corresponds to 4.88 tonnes of CO_2 per ha. In Table 20, the annual carbon sequestration capacity of the green loan portfolio has been estimated using this figure. The banks engagement has been calculated at 30.4%

Table 20 Estimated annual carbon sequestration by the green loan portfolio assets of SpareBank 1 Østlandet

Type of forest	Area - ha	Annual CO_2 sequestration - tonnes per ha	Estimated annual increase in CO_2 storage - tonnes	Estimated annual increase in CO_2 storage relative to engagement - tonnes
Spruce	79,115	4.88	386,081	117,498
Pine	40,303	4.88	196,680	59,857
Total	**119,418**	**4.88**	**582,761**	**177,354**

[37] https://www.skogbruk.nibio.no/klimagassregnskapet-for-norske-skoger
[38] https://www.ssb.no/natur-og-miljo/statistikker/klimagassn/
[39] A. Grønlund,. K. Bjørkelo, G. Hylen and S. Tomter (2010). CO_2-opptak i jord og vegetasjon i Norge. Lagring, opptak og utslipp av CO_2 og andre klimagasser.