REPORT

Residential building portfolio- carbon and energy footprint

CLIENT

Eika Boligkreditt AS

SUBJECT

Norwegian Energy Efficient residential Buildings

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TABLE OF CONTENTS

Contents

1 Introduction

On assignment from Eika, Multiconsult has studied the Eika residential loan portfolio and compared its energy efficiency and CO_2-emissions related to energy demand in use to the Norwegian building stock. In this report the methodology is presented and substantiated based on energy requirements in the national building code.

In addition, Multiconsult has applied available criteria and methodology to identify the most energy efficient residential buildings in Norway, to be used with respect to a potential green bond issuance. In this document we describe identification criteria, the evidence for the criteria and the result of an analysis of the loan portfolio of Eika. The criteria to select the buildings are based on credible standards in Norway such as the Norwegian building regulation and Energy Performance Certificates, and the criteria are in line with international accepted standards.

2 The Norwegian building stock

The Norwegian building stock consist of approximately 2.6 million dwellings in apartment buildings and small residential buildings. Figure 1 illustrates the building stock according to the latest available statistics.

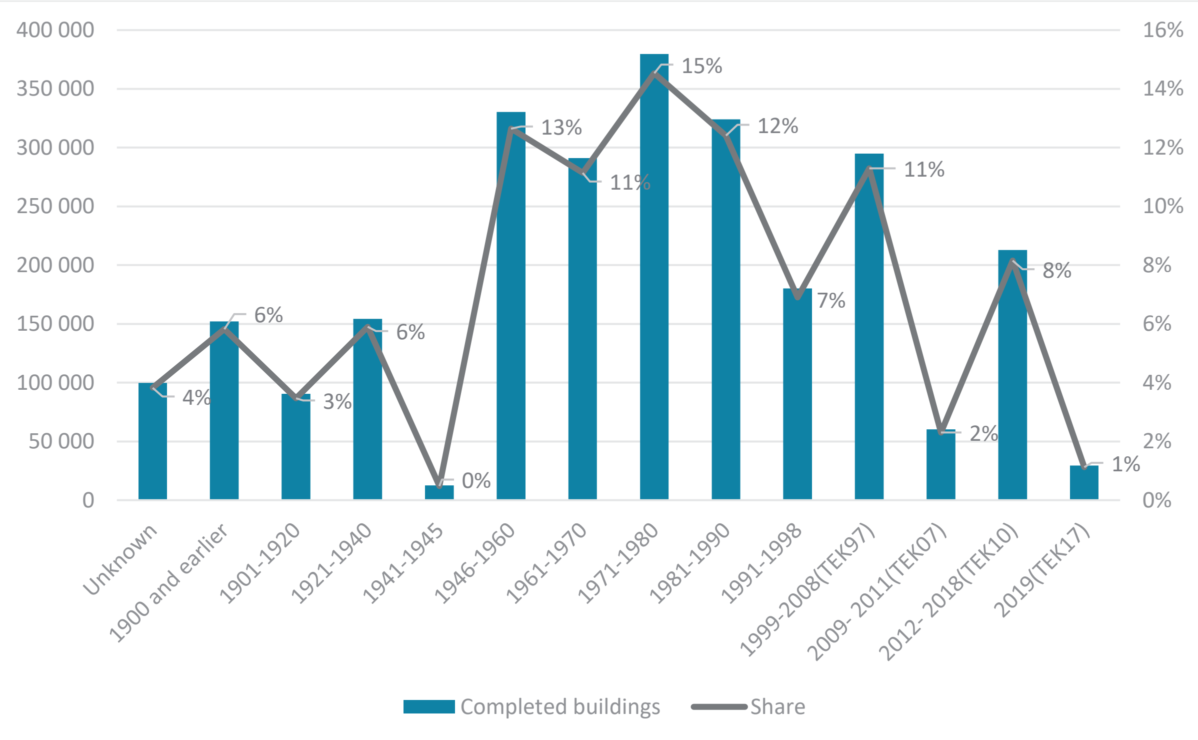


Figure 1 Age and building code distribution of dwellings (Statistics Norway[1] and Multiconsult, January 2021)

Of the total stock, apartments constitute 30%, and small residential buildings the remaining 70%. However, the share of apartments is increasing and has been over the last couple of decades.

[1] Boligstatistikken, Tabell: 06266: Boliger, etter bygningstype og byggeår (K). Adjusted to match the development of building code.

Energy

The energy consumption of Norwegian buildings is predominantly electricity, with some district heating and bioenergy. The share of fossil fuel is very low and declining.

In 2013, Statistics Norway assessed energy use in Norwegian households. They found demand was covered by electricity (79%), fossil oil and gas (4%) and bioenergy etc. (16%). Already in 2007, the building code was in clear disfavour of fossil energy, and the use of fossil energy in buildings has declined since. From 2020, fossil oil is banned from use in buildings. The fuel mix in Norwegian district heating production in 2019 included only 5% from fossil fuels (oil and gas) (Fjernkontrollen[2]). In 2019, the Norwegian power production was 98 % renewable (NVE[3]).

As shown in figure 2, the Norwegian production mix in 2019 gives resulting emissions of 11 gCO_2/kWh. Using a life-cycle analysis, the Norwegian Standard NS 3720:2018 "Method for greenhouse gas calculations for buildings" take into account international trade of electricity and the fact that consumption and grid factor not necessarily mirrors domestic production. The mentioned standard calculates the average CO_2- factor for the lifetime of a building to 136 g CO_2/kWh for EU27+UK + Norway and 18 g CO_2/kWh for Norwegian production mix only. Applying the factor based on EU27+UK + Norway energy production mix and the influx of other energy sources for heating purposes, the resulting CO_2- factor for Norwegian residential buildings[4] is on average 124 g CO_2/kWh.

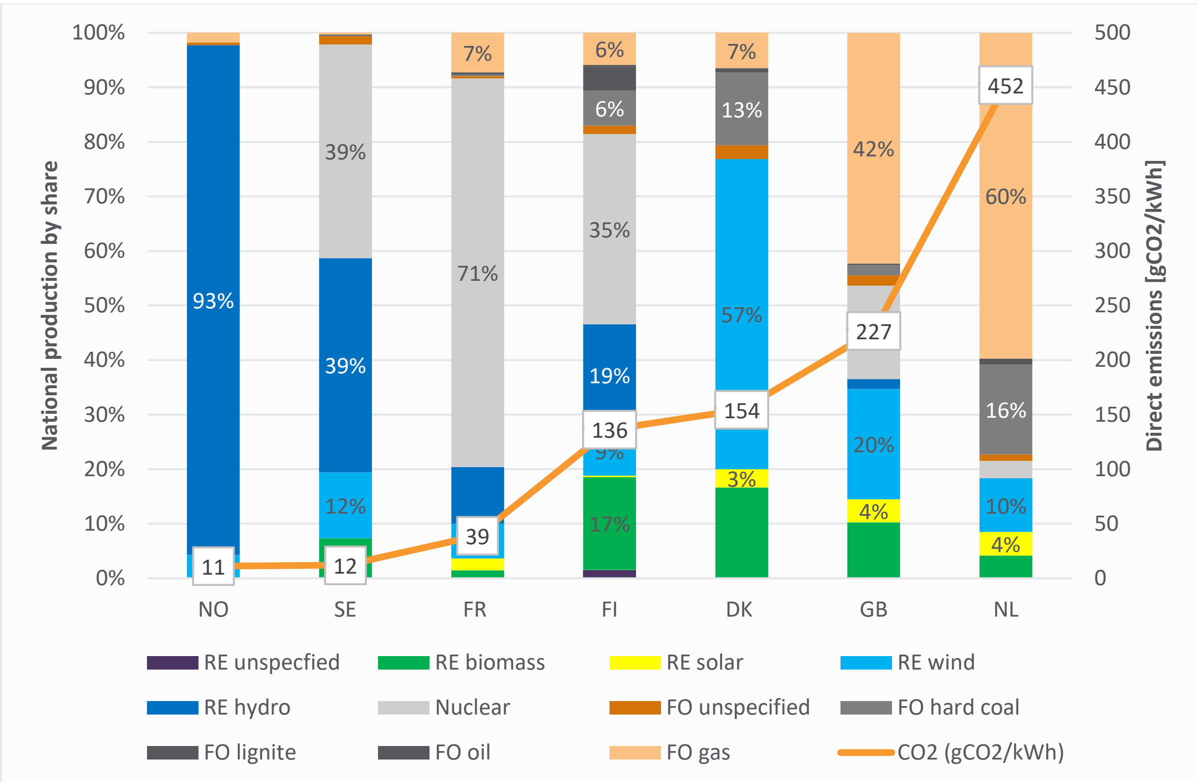


Figure 2 National electricity production mix in some relevant countries (European Residual Mixes 2019, Association of Issuing Bodies[5])

[2] http://fjernkontrollen.no/
[3] https://www.nve.no/energy-supply/electricity-disclosure/?ref=mainmenu
[4] Multiconsult. Based on building code assignments for DiBK
[5] https://www.aib-net.org/facts/european-residual-mix

3 Energy efficiency in the building stock

The actual energy performance of individual buildings is not publicly available, and the bank cannot request energy data from their clients and expect sufficient data of reliable quality. Two options for describing buildings' energy performance are presented in the following chapters. The two are historic energy requirements in the national building code and the Energy Performance Certificate system (EPC). The two have different qualities and for the purpose of describing a full portfolio, the building code approach stands out as the most reliable.

3.1 National building code

Changes in the Norwegian building code have consistently over several decades resulted in more energy efficient buildings. The calculated specific energy demand (kWh/m^2) dependent on building code, presented in Figure 3, illustrates how the energy demand declines with decreasing age of the buildings.

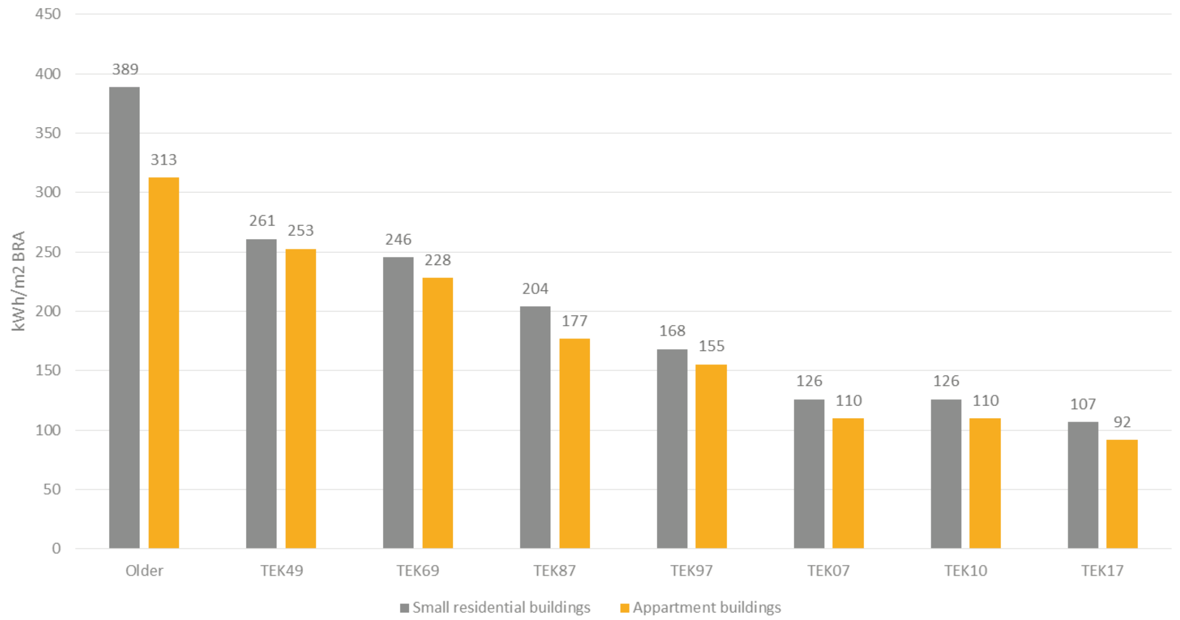


Figure 3 Development in calculated specific net energy demand based on building code and building tradition, (Multiconsult, simulated in SIMIEN)

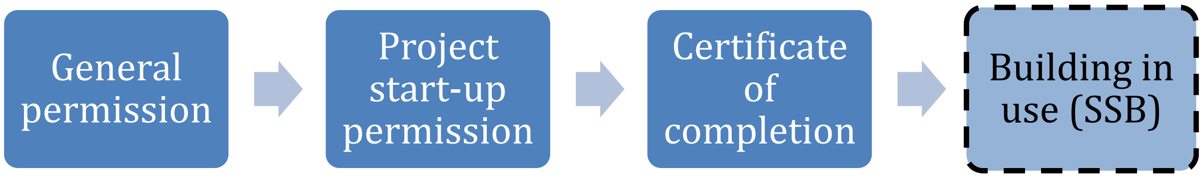
From TEK07 to TEK17 the reduction is about 15% and the former shift from TEK97 to TEK07 was no less than 25%. Note that, for residential buildings, there was no change between TEK07 and TEK10 with respect to energy efficiency requirements.

The figure gives theoretical values for representative models of an apartment and a small residential building, calculated in the computer programme SIMIEN and in accordance with Norwegian Standard NS 3031:2014 *Calculation of energy performance of buildings. Method and data*, and not based on measured energy use. In addition to the guiding assumption in Norwegian Standard NS3031:2014, experience with building tradition is included. Net energy demand is calculated for model buildings used for defining the building code. For older buildings, the calculated values tend to be higher than the actual measured demand, mostly because the calculated ventilation air flow volume in older buildings is assumed as high as in newer buildings, but without heat recovery. Indoor air quality is hence assumed not to be dependent on building year. This is the same methodology as used in the EPC-system (Energy Performance Certificate).

The building codes have a significant effect on energy efficiency. An investigation of the energy performance of buildings registered in the EPC database younger than 1997, shows a clear improvement in the calculated energy level for buildings finished after 2008/2009 when the building code of 2007 came into force. The same observation on improvement is evident when the building code of 1997 came into force. In the period between 1997 and 2007, a period when there was no change in the building code, it is difficult to see any clear changes, however a small reduction of energy use might have taken place in the latest years coming up to 2007. This might be due to an increased use of heat pumps in new buildings, and to a certain degree, better windows.

3.1.1 Time lag between building permit and building period

After the implementation of new a building code there is some time lag before we see new buildings completed according to this new code. The lag between the date of general permission received (no; rammetillatelse), which decides which code is to be used, and the date at which the building is completed and taken into use, varies a lot depending on such things as the complexity of the site and project, financing and the housing market.



The time from granted general permission to granted project start-up permission is often spent on design, sales and contracting. Based on Multiconsult's experience, six months to a year is a reasonable timespan for residential buildings in this phase. The figure below, based on statistics from Statistics Norway (SSB), indicates that approximately six months to a year construction period is standard for residential buildings.

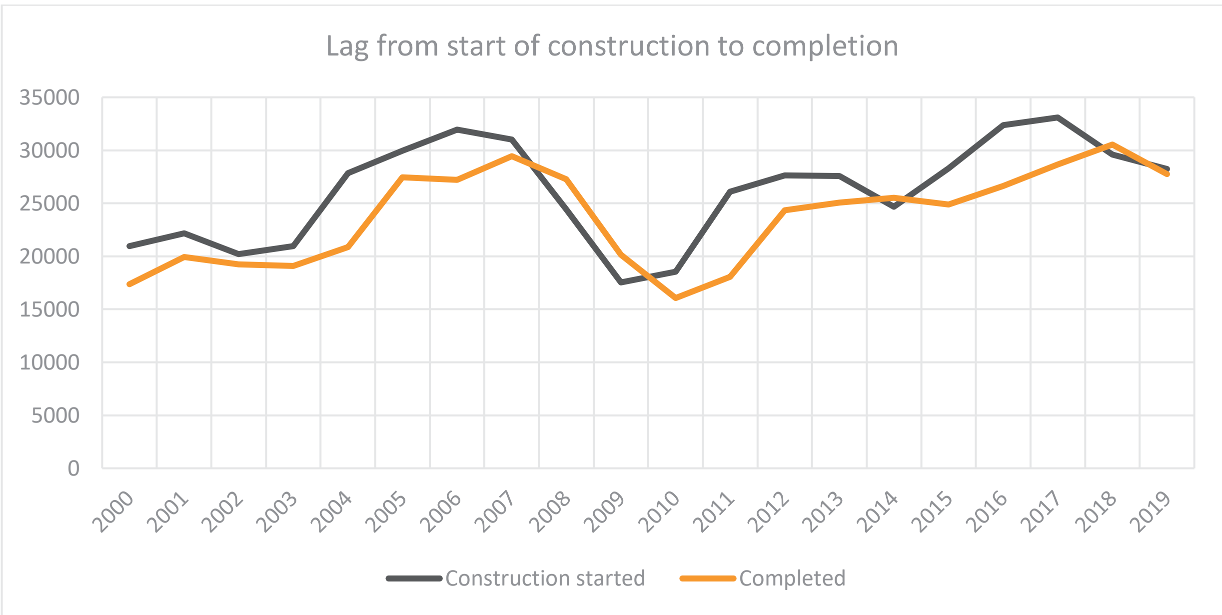


Figure 4 Project start-up and completion (Statistics Norway, bygningsarealstatistikken)

Based on the discussions on time for design and construction, we regard a time-lag of two years, in most cases, between code implementation and completion of buildings based on this code to be a robust and conservative assumption. Some deviations may however occur, but the methodology must account for the building year information (completed construction) only is available to the bank on a yearly basis. E.g. the 2010 building code (TEK10) was implemented July 1st, 2010. Since the energy requirements were unchanged from TEK07 to TEK10 it is a very robust assumption that all buildings finished in 2012 have used energy requirements according to TEK10. There are likely buildings finished in 2011 built under the 2010 code as well, but equally, the year 2012 may also contain projects built based on TEK07. All buildings finished in 2009- 2011 are assumed to have used TEK07. There are likely buildings finished in 2008 built under that code as well, but equally, the year 2009 may also contain some delayed projects built later based on TEK97.

3.1.2 The suitability of building codes to demonstrate energy performance in large portfolios

The registered efficiency improvements substantiate that Norwegian buildings comply with the building code in force.

The bank may obtain sufficient information about the financed objects to estimate the energy performance of the buildings in a bank's loan portfolio. For objects with available information on building year and building category, the energy performance may be calculated based on specific energy demand illustrated in Figure 3. Living area can be used when available, or an average for each building category may be utilized for large portfolios.

For buildings without recorded building year, the category *Older* in Figure 3 (buildings from 1951 and earlier) may be applied in a conservative approach.

3.2 Energy Performance Certificate

The Energy Performance Certificate system became operative in 2010. It was made obligatory for all new residences finished after the 1st of July 2010, and all older residences, sold or rented out, were to have an Energy Performance Certificate. Enova, entity owned by the Norwegian Ministry of Climate and Environment, is now responsible for operation and development of the Energy Performance Certificate system (EPC). The system is under revision and public consultation of new regulations is expected in 2021. Changes may include new limit values and calculation methods.

The whole database is available for statistical purposes and an investigation shows that, comparing the number of certificates with actual buildings in the building stock from Statistics Norway, coverage of individual dwellings is less than 50%. This is based on raw data, even before the database has been cleaned of double entries and test entries. Low coverage influences the basis for establishing a base line and eligibility criteria. Low coverage reduces the pool volume of which a bank may identify objects in their portfolio.

Eika has linked the individual residences to the EPC database, and included the energy certificate results for individual assets, based on some key information.

3.2.1 EPC labels to demonstrate energy efficiency in residential buildings

The figure below shows how the complete stock of residences in Norway is distributed by building code, and their certificate label.

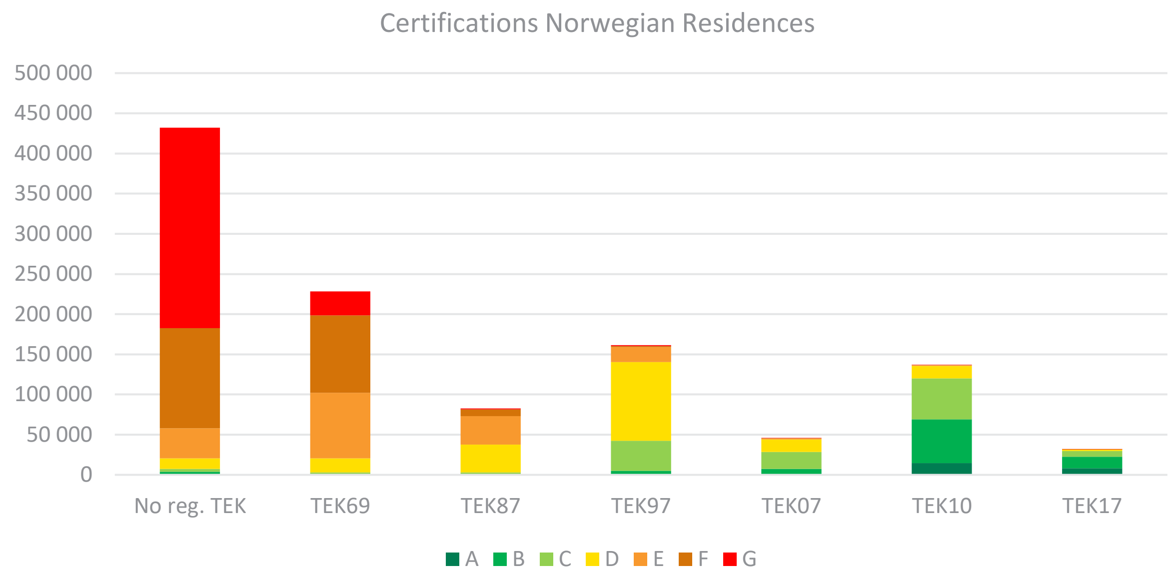


Figure 5 Registered EPC Certificates Norwegian residences distributed per building code and Energy Performance Certificate.(Source: EPC database, www.energimerking.no, February 2020).

The registered properties in the EPC database are considered to be representative for the buildings built under the same building code, however not representative for the total stock as younger buildings are highly overrepresented in the database. There is currently a coverage ratio of EPC labels relative to the total residential building stock equal to 44%. Extracting only buildings built before 2009, 5% of the total stock is expected to get a C or better. These are buildings that have initially been built, or through refurbishment, attained higher energy efficiency standards than the original building year (and respective building code) would imply.

3.2.2 EPC grading statistics

Short facts about the Norwegian EPC

The energy label in the EPC system is based on calculated delivered energy, including the efficiencies of the building's energy system (power, heat pump, district energy, solar energy etc.). The building codes are defined by net calculated energy, not including the building's energy system.

The EPC consist currently of an energy label (A-G) and a heating label (defined as colour). The heating label is seldom used, on its way out, and not considered relevant in the context of this work.

Registration of certificates is performed in two ways. Professionals must be involved when certifying all new buildings and non-residential buildings. Non-professional building-owners that are selling their house or apartment can however do the certification themselves in a simplified registration system. This latter system is based on simplified assumptions and conservative values, and the results are therefore less precise and might give a lower energy label than a registration for the same building performed by professionals.

The energy label is a result of calculated energy delivered to the residential building in "normal" use. The calculation method is described in the Norwegian Standard NS 3031. The table below shows the relationship between calculated energy delivered per square meters and energy labels for small residential buildings and apartments. This is the current grade scale:

Delivered energy per m² heated space (kWh/m²)							
	A	**B**	**C**	**D**	**E**	**F**	**G**
Houses	95	120	145	175	205	250	above F
Sq. m adjustment	+800/A	+1600/A	+2500/A	+4100/A	+5800/A	+8000/A	
Flats/Apartments	85	95	110	135	160	200	above F
Sq. m adjustment	+600/A	+1000/A	+1500/A	+2200/A	+3000/A	+4000/A	

Table 1 Delivered energy EPC energy labels (Source: www.energimerking.no)
A = heated floor area of the dwelling
Example: a 150 sq. m *small residential building* would have a C qualification limit of 145+2500/150 = 161.67 kWh/m²

The grading system and C-label

The C grade is defined for residences so that a building built after the building codes of TEK2007 and TEK2010 in most cases should get a C.

The limit value for reaching a C is calculated based on a representative model of a small residential building and an apartment, built according to the building codes of 07/10, with an assumed moderate system efficiency for the building's energy system. Residences built after the building code of 2007, will hence mostly get a C or better, but might also get a D.

The Norwegian EPC system require every apartment to be certified separately. Particularly for apartments, the defined limit value in the grading system is set for an average apartment. An apartment in the top or bottom floors or at a corner of an apartment building will have a higher heat loss and may very well get a lower grade than other apartments in the same building. Hence, a TEK10 building may have apartments with energy labels C and D, and in some rare cases even an energy label E. But these apartments are still more energy efficient than apartments with similar locations in older apartment buildings.

Since most certifications for residential buildings are done in simplified registration mode, and not by professionals, a larger share of existing TEK10-buildings does get a D, and in some rare cases even an E. This is in many cases due to the more conservative calculation methods used in this simplified registration mode. Another reason why some existing houses and apartments built after the code of 10 get a D, is that the grade scale has been revised and tightened three times between 2011 and 2015. E.g. a small residential building that had a C when it was new in 2012, could have a D in its EPC if given a new EPC in 2015.

Therefore, most of the poorer grades D (and E) for TEK07/10-buildings are due to either one or a combination of these factors; the conservative method of calculation in the simplified registration system, unfavourable location of an apartment in apartment buildings, a geometrically unconventional building form with higher energy losses than the representative model, and/or the revised and tightened grading scale. So, the building itself is not necessarily less energy efficient.

Figure 6 shows the energy grades in the already granted certificates to Norwegian residential buildings.

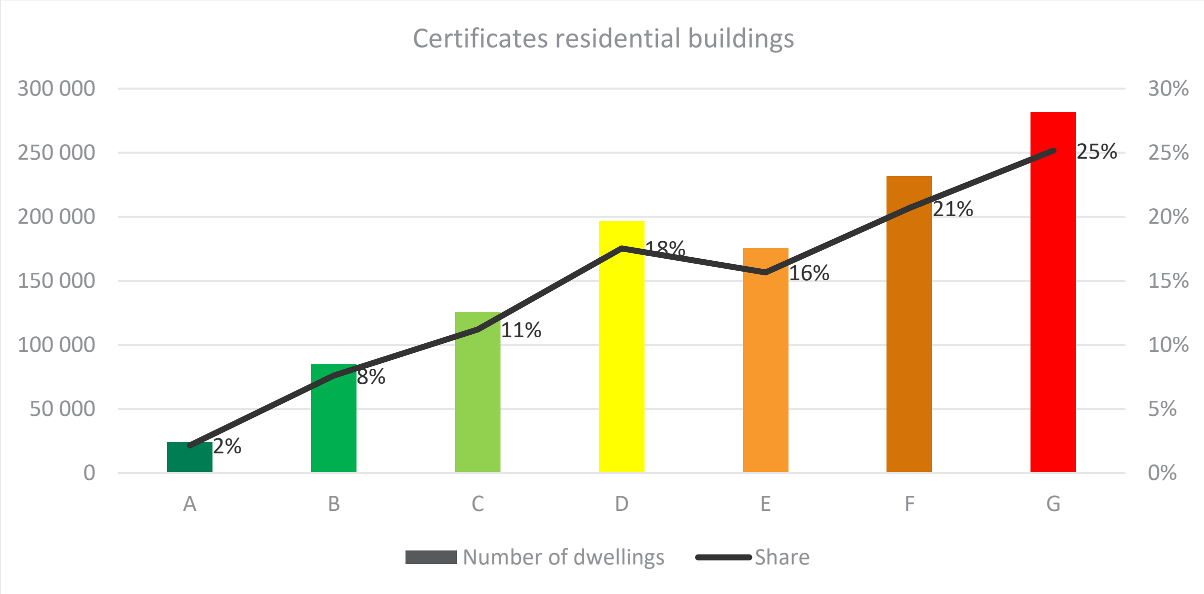


Figure 6 Energy Performance Certificates by grade- residential buildings only, representative only of buildings with EPCs (Source: energimerking.no, January 2021)

The EPC coverage is, however not equally distributed over the building stock. Figure 7 shows the age of the buildings with EPCs and total number of buildings in the building stock, age distribution in brackets of applicable building code, and how much of the building stock is represented in the EPC database (building stock data is not yet released including 2020 data). This illustrates how younger buildings are overrepresented in the EPC database. Note that EPC data is regularly updated and the data behind the figure include almost all new registrations in 2020. Building stock data is, however, only updated on a yearly basis and the figure only include building finished before the end of 2019, hence the misleading coverage ratio for TEK2017 buildings.

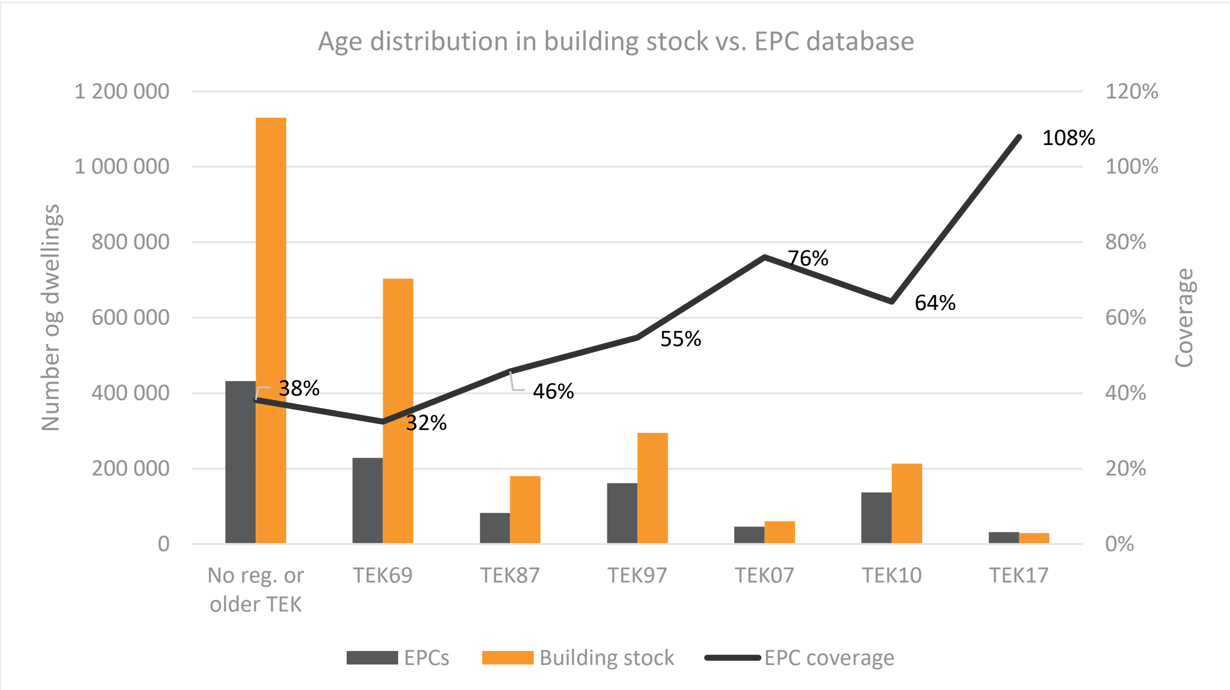


Figure 7 Age distribution in Energy Performance Certificates vs. actual residential building stock and EPC coverage by building year (Source: energimerking.no and Statistics Norway, January 2021)

Assuming registered EPCs for each time period are representative for the building stock, we are able to indicate what the label distribution would be if all residential buildings were given a certificate. Figure 8 illustrates how EPCs would be distributed based on this assumption.

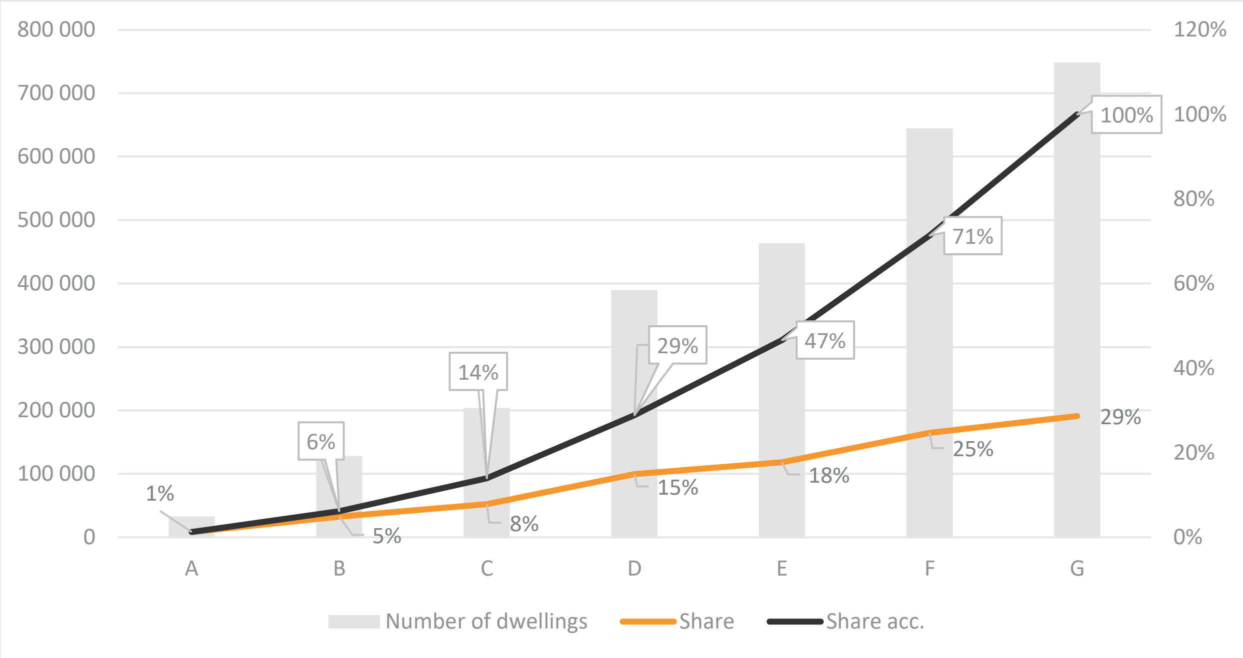


Figure 8 EPCs extrapolated to include the whole residential building stock (Source: energimerking.no and Statistics Norway, Multiconsult, January 2021)

3.2.3 The suitability of the EPC system to demonstrate energy performance in large portfolios

Energy Performance Certificates have the potential to take into account building specific data and illustrate a buildings energy efficiency performance. The bank may obtain relevant information about the financed objects in the EPC database, however this is today limited to energy label and does not include specific energy demand. To calculate the energy demand in buildings, average values derived from table 1 may be utilized in combination with living area. Living area is to a large degree available information to the bank, but an alternative is to apply an average for each building category.

The EPC coverage of about 50% is however very limiting for the bank as half of the dwellings are not to be found in the database. Coming changes in the EPC system may also obscure the picture as existing buildings may have certificates based on either the existing or the coming system. A consistent update of the portfolio's performance will be challenging. For identifying the most energy efficient buildings, however, the changes in the system will not be problematic.

3.3 Building code vs. EPC

The bank’s portfolio is dynamic and objects with variable degree of available EPCs will go in and out of the portfolio. Combining EPCs and building code is not recommended as the two solutions have different system boundaries. It is possible to estimate the effect of the different system boundaries, however, these estimates would have to be based on multiple assumptions as detailed information about the individual dwellings is not available.

The EPC coverage is on average about 44% for residential buildings in Norway. The coverage for older buildings, constituting a major part of any bank’s portfolio, is even down in the 30’s and 40’s. This is an evident weakness in using the available EPCs to shed light on the energy efficiency in a large portfolio.

The building code approach is based on consistently updated statistics on building stock and standardized calculations of energy performance dependent on building code and age of the buildings. This is found to be a robust and consistent approach to monitor a complete portfolio over time and illustrate the energy use related carbon footprint of the buildings in use. This approach has been employed in the following analysis of the complete Eika residential loan portfolio.

4 Eika Loan Portfolio - Energy Efficiency Analysis

4.1 Portfolio information

The portfolio analysis is based on the cut-off January 2021. Of the Eika residential loan portfolio, 55,022 dwellings, 42,069 small residential buildings and 12,953 apartments, have been analysed. From the loan portfolio, holiday homes, building registered in the portfolio as second mortgages (no; tilleggssikkerhet) and shared debt in cooperative housing have been excluded from the analysis. These dwellings are excluded due to miscellaneous reasons; as no energy requirements in the building code (holiday homes), missing living area data (cooperative housing) and to avoid double counting as same assets may be included in other portfolios (second mortgages). Figure 9 shows how the remaining assets in the portfolio is distributed by age, indicated by building code, taken into consideration the time lag from time of implementation of a code to most finished buildings adhere to the new code. For objects without building year information, the building is conservatively assumed to fall into the "older" category. For dwellings without living area information, the category average in the national statistics is assumed.

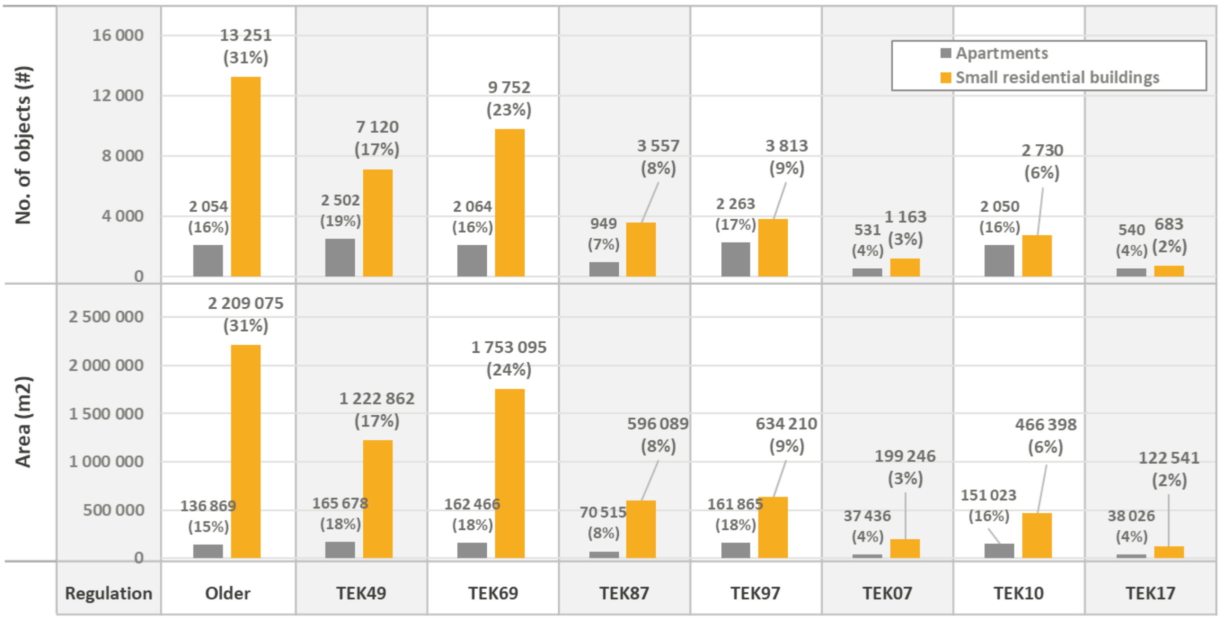


Figure 9 Eika residential loan portfolio, January 2021 (Source: Eika Boligkreditt, Multiconsult)

4.2 Calculated energy demand

Combining the age distribution of the living area in the portfolio with calculated energy demand in the building stock dependent on building code, we can illustrate the energy demand in the whole portfolio. Over the years, the energy footprint of this dynamic portfolio will develop, and the bank will be able to monitor the energy efficiency of their portfolio.

Figure 10 illustrates energy demand in buildings in the current portfolio applying information in Figure 3 and Figure 9. Figure 11 illustrated the energy demand in the same buildings, however, scaled down to reflect the bank's engagement. The scaling simply reflects the engagement's share of the object value.

Buildings in the current portfolio, as of January 2021, represents yearly energy demand of 2,118 GWh. Adjusted to only reflect the bank's engagement relative share of property value, the portfolio represents yearly energy demand of 929 GWh.

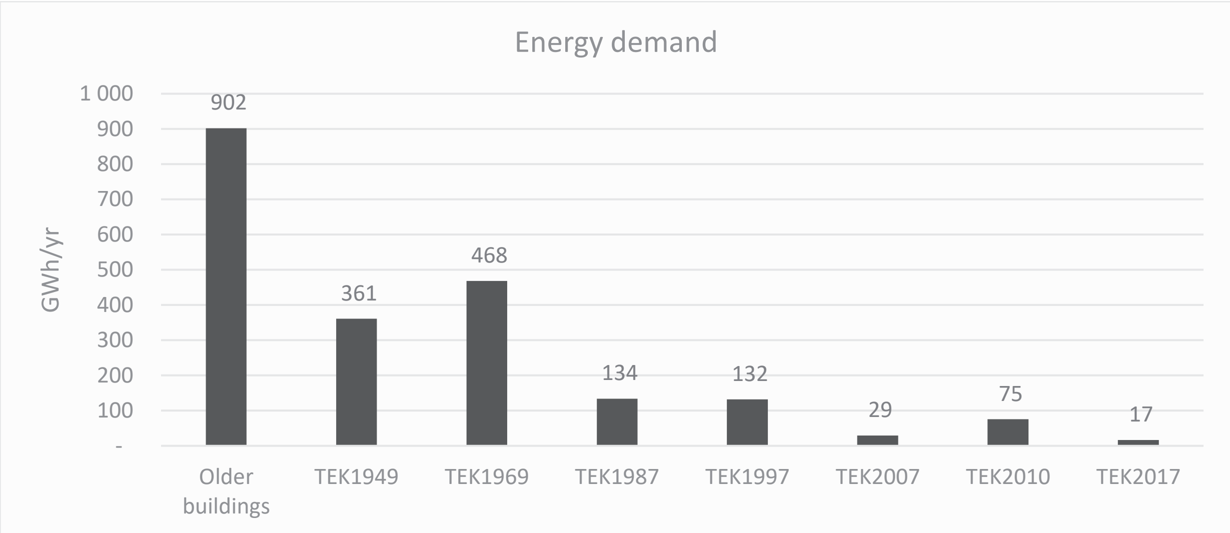


Figure 10 In-use energy demand distributed by age of buildings in the portfolio (Source: Eika, Multiconsult).

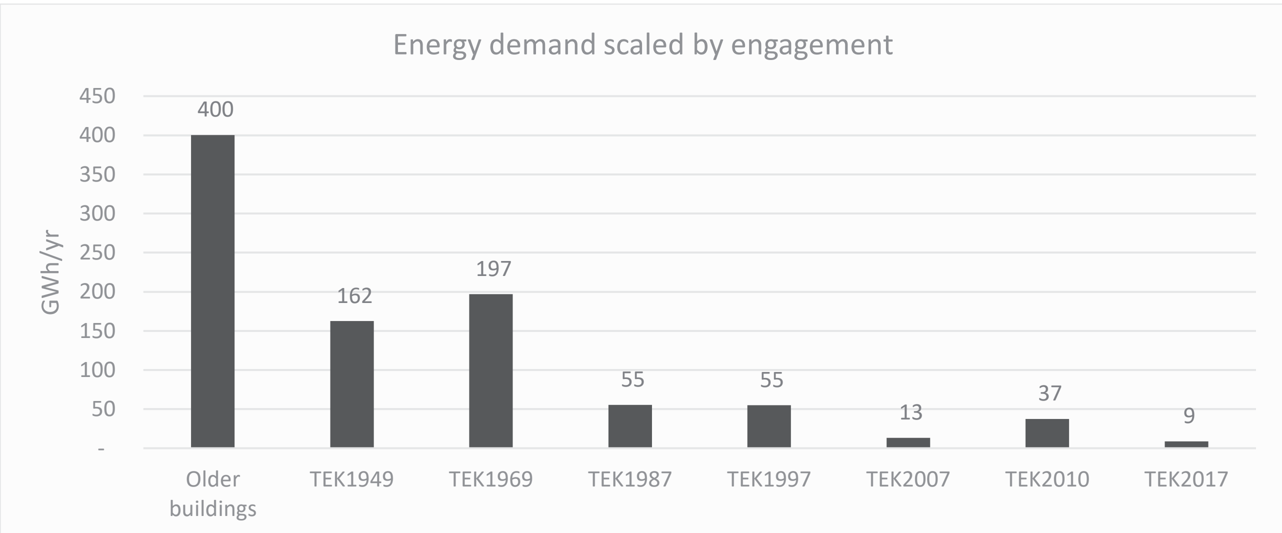


Figure 11 Portfolio in-use energy demand scaled by engagements share of property value distributed by age of buildings (Source: Eika, Multiconsult).

4.3 Calculated CO_2-emissions related to in use energy demand

The CO_2-emissions resulting from in use 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, various types of heat pumps, bio energy and district heating. Figure 12 illustrates the specific CO_2-emissions in the Norwegian residential building stock.

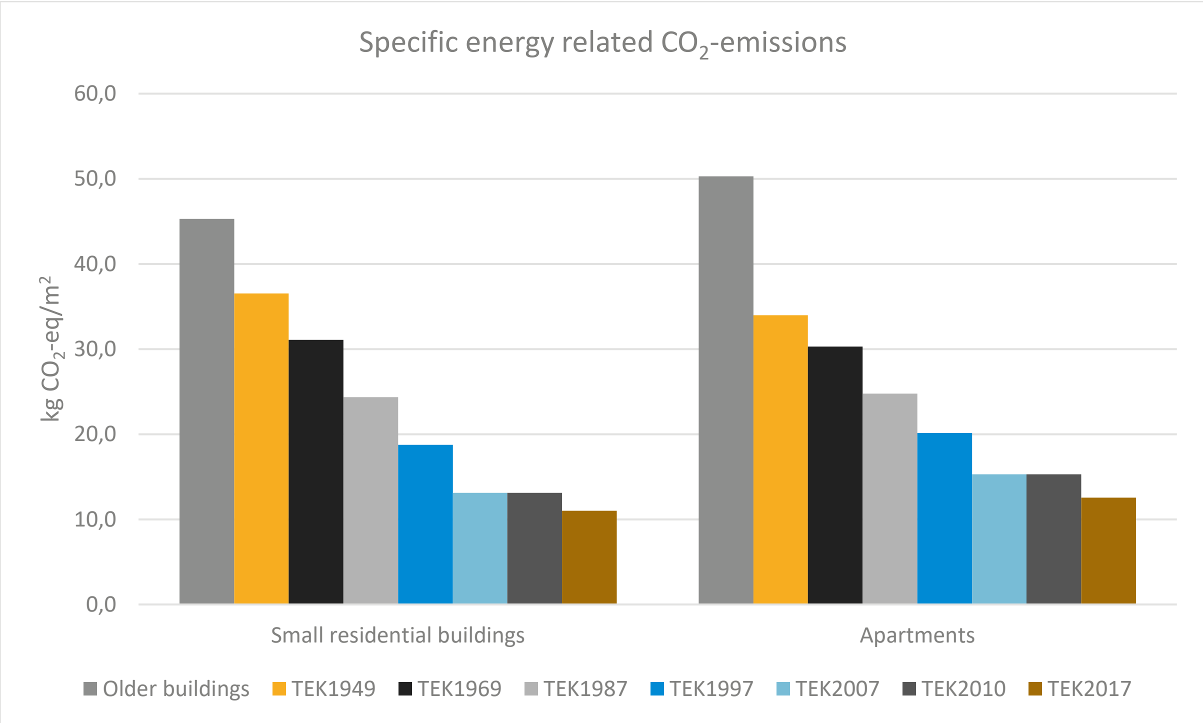


Figure 12 Total Norwegian residential building stock specific CO_2-emissions ($kgCO_2$-eq/m^2) dependent on building category and age of buildings (Source: Multiconsult, DiBK)

The calculated energy demand distributed by age of the buildings in the portfolio and the estimated specific emissions in Figure 12, give basis to estimate the CO_2-emissions the total Eika residential buildings portfolio. Figure 13 illustrates the CO_2-emissions related to in-use energy demand in the buildings in the current portfolio. Figure 14 also illustrated the CO_2-emissions, however, scaled down to reflect the bank's engagement.

Buildings in the current portfolio, as of January 2021, represent yearly emissions of 261,504 tons CO_2eq. Adjusted to only reflect the bank's engagement relative share of property value, the portfolio represents yearly emissions of 114,603 tons CO_2eq.

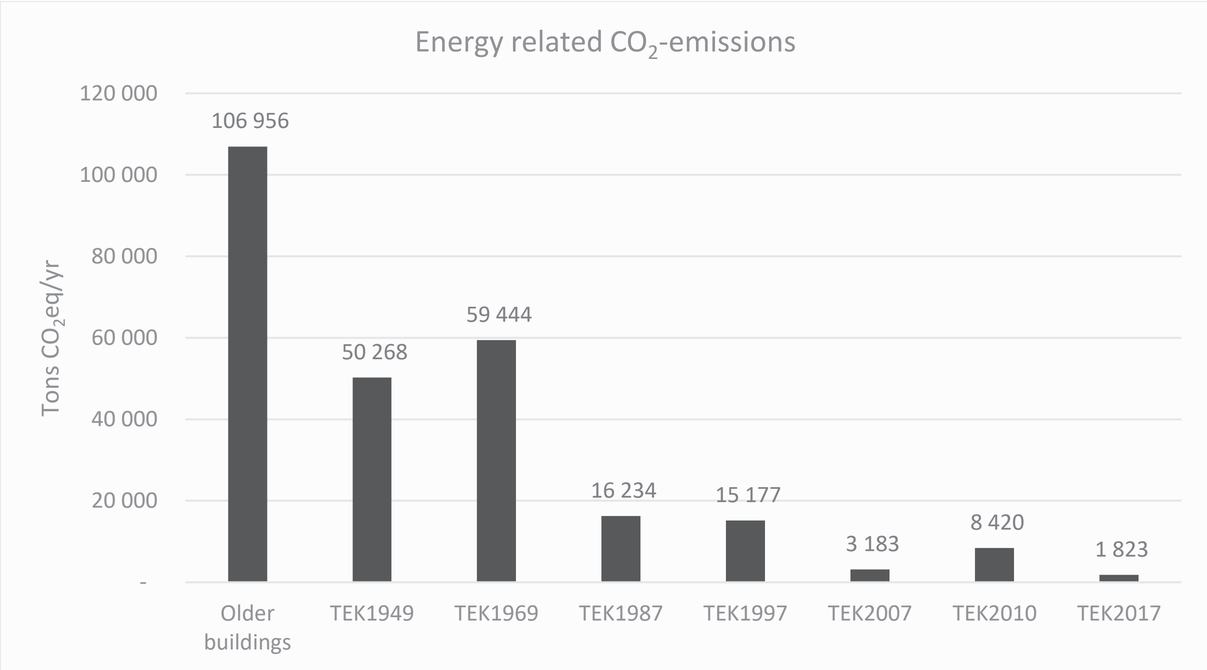


Figure 13 CO_2-emissions related to yearly in use energy demand distributed by age of building in portfolio (Source: Eika, Multiconsult)

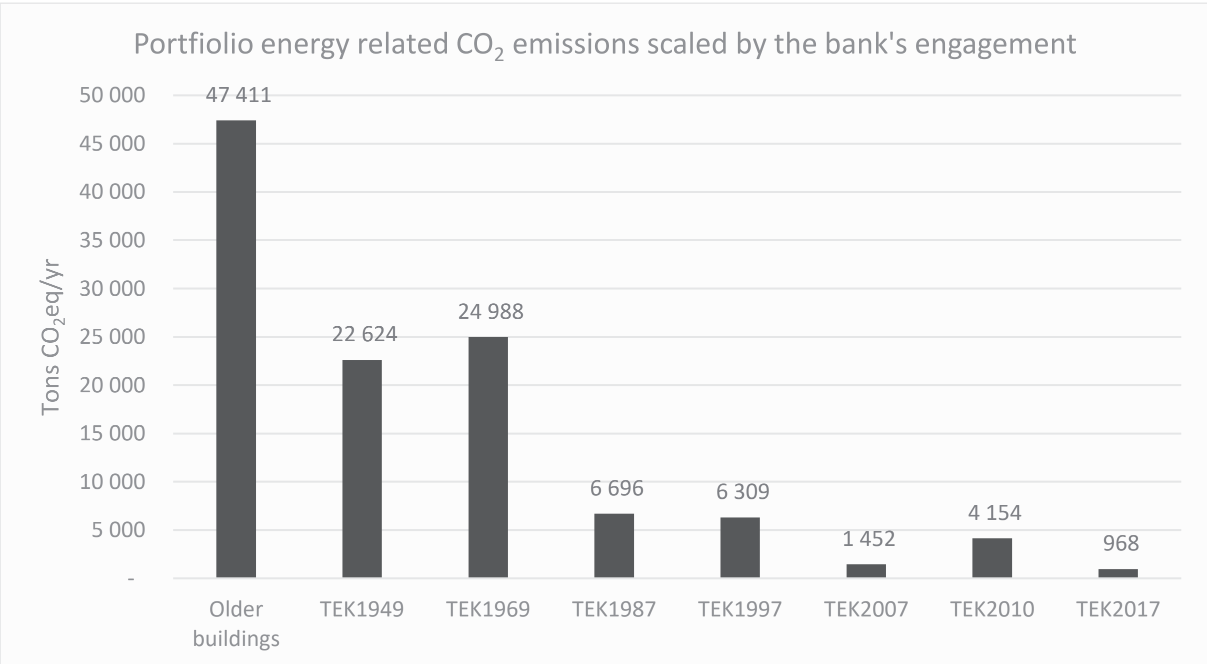


Figure 14 Portfolio CO_2-emissions related to yearly in-use energy demand, scaled by engagements share of property value (Source: Eika, Multiconsult)

5 Green bonds eligibility criteria- Residential buildings

Multiconsult has studied the Norwegian residential building stock and identified three solid eligibility criteria for Green Bonds on energy efficient buildings. Criterion 1 and 2 have been aligned with the Climate Bonds Initiative (CBI) and is published as a CBI baseline for Norwegian residential buildings. Criterion 1 identifies the top 10% most energy efficient residential buildings countrywide. The CBI baseline methodology also includes criteria using data from Energy Performance Certificates, and according to CBI taxonomy, residential buildings may also qualify after being refurbished to a standard resulting in at least a 30% reduction in energy demand[6].

Eligible Residential Green Buildings for Eika must meet the following eligibility criteria:

1. New or existing Norwegian residential buildings that comply with the Norwegian building code of 2007 (TEK07) and later codes for small residential buildings [7]and code of 2010 (TEK10) and later codes for apartments are eligible for green bonds as all these buildings have significantly better energy standards and account for no more than 15% of the residential building stock. A two year lag between implementation of a new building code and the buildings built under that code must be taken into account.

2. Existing Norwegian residential buildings with EPC-labels A, B or C. These buildings may be identified in data from the Energy Performance Certificate (EPC) database.

3. Refurbished Norwegian residential buildings with EPC-labels which corresponds to at least a 30 % improvement in energy efficiency. These buildings may in time be identified using the EPC database.

5.1 Criterion 1: New or existing Norwegian residential buildings that comply with the Norwegian building code of 2007 (TEK07) or later codes for small residential buildings, and code of 2010 (TEK10) and later codes for apartments: 11%

Changes in the Norwegian building code have consistently over several decades resulted in more energy efficient buildings. As of 2020, 11% of Norwegian residential buildings are eligible according to the Eika criterion.

The methodology is based on Climate Bonds Initiative (CBI) taxonomy, where the top 15 % most energy efficient buildings are considered eligible. Eika's baseline and criterion are somewhat stricter than the CBI baseline methodology for energy efficient residential buildings for Norwegian conditions published in spring 2018.

Net energy demand is calculated for model buildings used for defining the building code. The result presented in figure 3 illustrates how the calculated energy demand declines with decreasing age of the buildings. From TEK07 to TEK17 the reduction is about 15% and the former shift from TEK97 to TEK07

[6] https://www.climatebonds.net/standard/buildings/upgrade
[7] Include residential buildings from single family houses, detached, undetached and semi-detached dwellings, and buildings with up to four apartments.

was no less than 25%. Note that, for small residential buildings, there was no change between TEK07 and TEK10 with respect to energy efficiency requirements.

Building code	Specific energy demand apartment buildings (model homes)	Specific energy demand small residential buildings (model homes)
TEK 07/ TEK 10	110 kWh/m^2	126 kWh/m^2
TEK 17	92 kWh/m^2	107 kWh/m^2

Table 2 Specific energy demand calculated for model buildings

Table 2 includes the specific energy demand calculated by using the standard model buildings for the building codes relevant for identifying the top 10% most energy efficient residential buildings in Norway.

As discussed in section 3.1.1, a two-year lag between code implementation and buildings based on this code to be a robust and conservative assumption.

5.1.1 Building age statistics

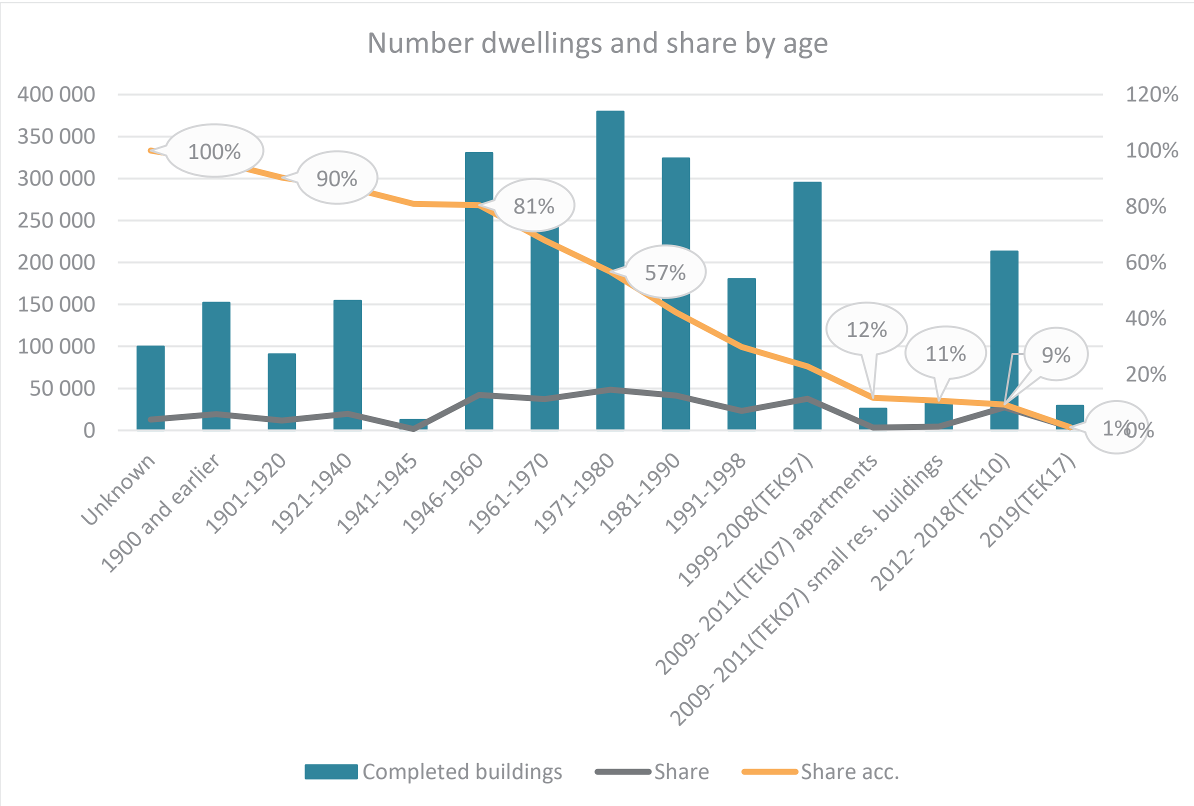


Figure 15 Age and building code distribution of dwellings (Statistics Norway[8] and Multiconsult)

[8] Boligstatistikken, Tabell: 06266: Boliger, etter bygningstype og byggeår (K). Adjusted to match the development of building code.

Figure 15 above shows how the Norwegian residential building stock is distributed by age. The same statistics are adjusted by new intervals available by using statistics on building area (Bygningsarealstatistikken). The figure shows how buildings finished in 2012 and later (and built according to TEK10 and TEK17) amount to 9% of the total stock. Adding the small residential buildings built under the TEK07 code, 1%, the total qualifying dwellings accounts for 11% of the total stock. Based on theoretical energy demand in the same building stock, the same 11 % of the stock makes up for only 4% of the energy demand in residential buildings and 3.7% of the related CO_2- emissions. The difference between energy demand and CO_2-emissions are due to the slightly less CO_2-intensive heating solutions in newer buildings.

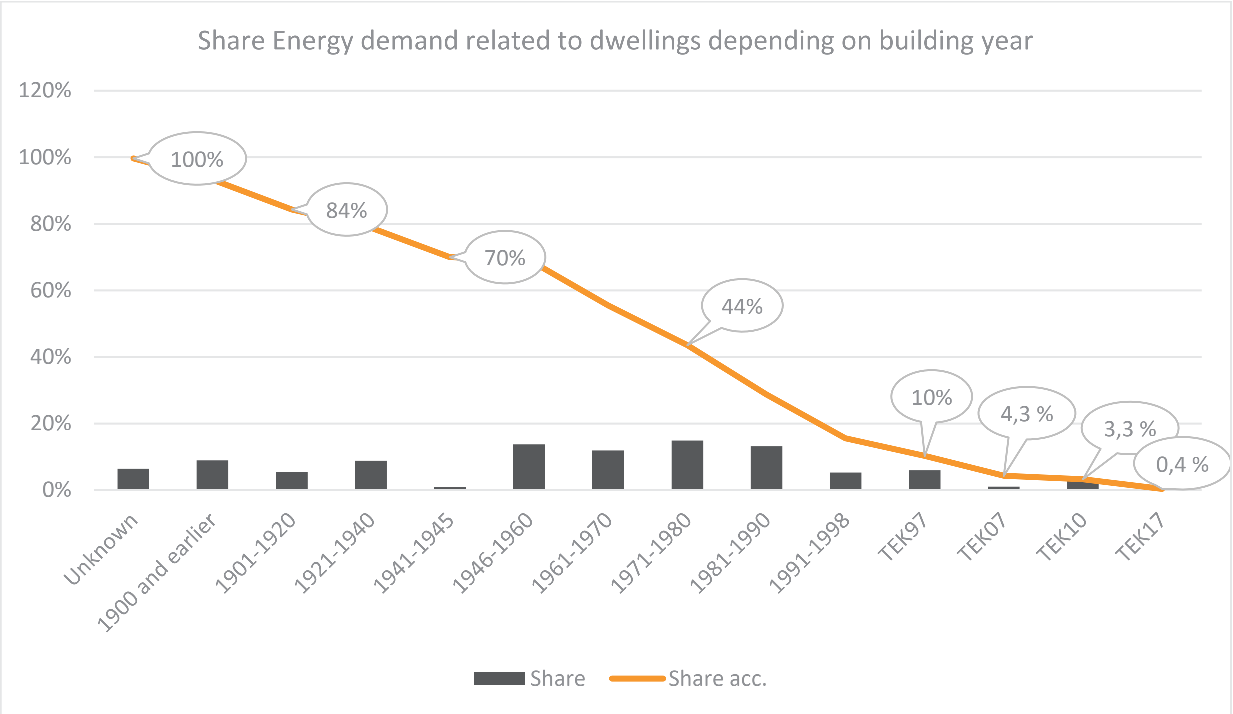


Figure 16 The building stock's relative share of energy demand dependent on building year and code (Statistics Norway and Multiconsult)

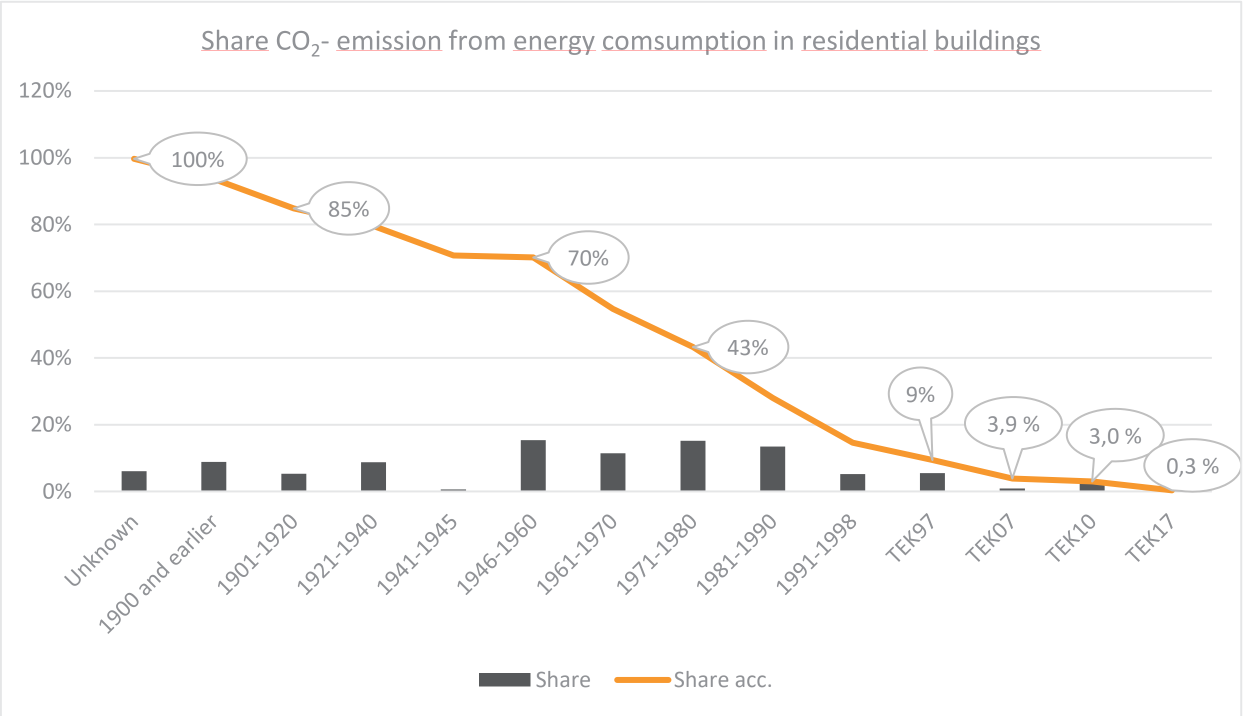


Figure 17 The building stock's relative share of CO_2 –emissions related to energy demand dependent on building year and code (Statistics Norway and Multiconsult)

5.1.2 Eligibility under criterion 1

Over the last several decades, the changes in the building code have pushed for more energy efficient buildings. The building stock data indicates that 11% of the current residential buildings in Norway were constructed using the code of 2007 (TEK07) and later codes for small residential buildings and code of 2010 (TEK10) and later codes for apartments.

Combining the information on the calculated energy demand related to building code in Figure 3 and information on the residential building stock in Figure 15, the calculated average specific energy demand on the Norwegian residential building stock is 253 kWh/m^2. Building codes TEK07(small residential buildings), TEK10 and TEK17 give an average specific energy demand for existing houses and apartments, weighted for actual stock, of 120 kWh/m^2.

Hence, compared to the average residential building stock;

- building codes TEK07(small residential buildings), TEK10 and TEK17 give a calculated specific energy demand reduction of 52%

New or existing Norwegian residential buildings that comply with the Norwegian building code of 2007 (TEK07) and later codes for small residential buildings and code of 2010 (TEK10) and later codes for apartments 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. A two-year lag between implementation of a new building code and the buildings built under that code must be taken into account.

5.2 Criterion 2: Norwegian residential buildings with EPC-labels A, B or C

5.2.1 EPC labels to identify energy efficient residential buildings

The energy label in the EPC system is based on calculated delivered energy, including the efficiencies of the building's energy system, while the building codes are defined by net calculated energy, not including the building's energy system. The criteria are hence based on two different system boundaries and must be regarded as two separate criteria describing and classifying the buildings level energy efficiency differently.

The EPC system currently consists of an energy label (A-G) and a heating label (defined as colour). The heating label is seldom used, and not considered relevant in the context of the criteria.

The C grade was in 2010 defined so that a building built after the building codes of TEK2007 in most cases should get a C. Residences built after the building code of 2007 will hence mostly get a C or better.

80% of all certification for residential buildings are registered in a simplified registration system. This system is based on simplified assumptions and conservative values, and the results are less precise and might give a lower energy label than the optional more detailed approach.

The EPC coverage is not equally distributed over the building stock. There is currently a coverage ratio of EPC labels relative to the total building stock of no more than 44%, where younger buildings are overrepresented in the EPC database, as illustrated in Figure 7. Assuming registered EPCs for each time period are representative for the building stock, we are able to indicate what the label distribution would be if all residents were given a certificate. Figure 18 illustrates how EPCs would be distributed based on this assumption. 14 % of the residents would have a C or better.

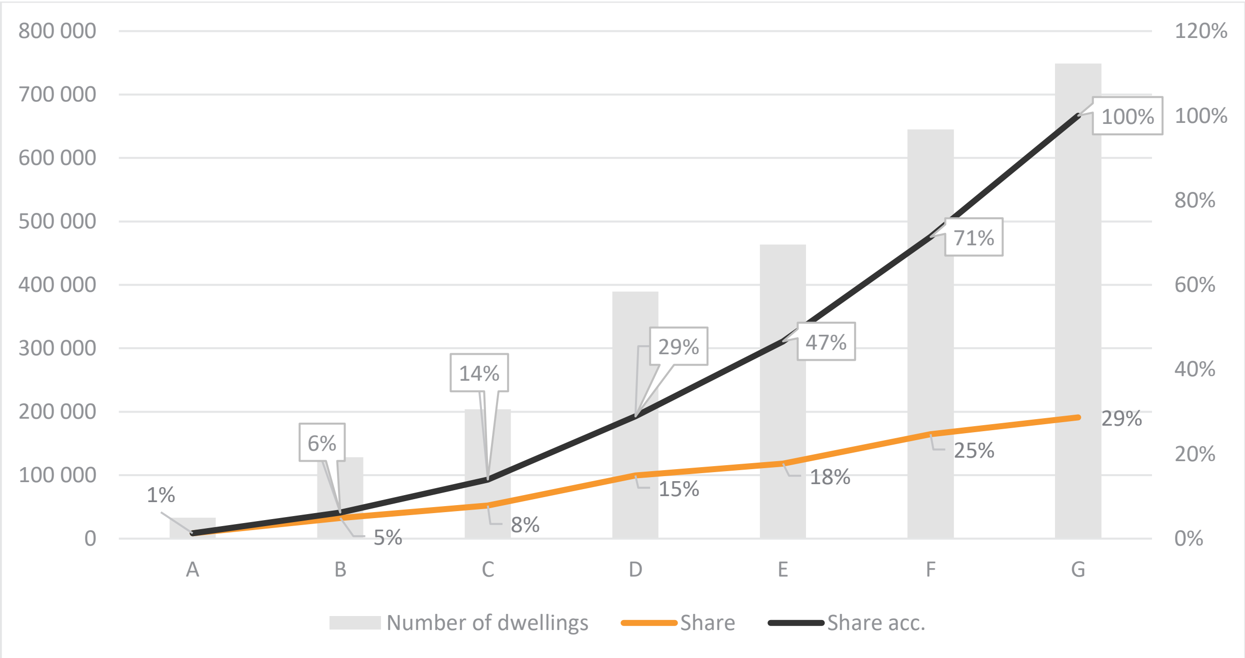


Figure 18 EPCs extrapolated to include the whole residential building stock (Source: energimerking.no and Statistics Norway, Multiconsult, January 2021)

5.2.2 Eligibility under criterion 2

An Energy Performance Certificate is mandatory for new buildings and existing residential buildings that are sold or rented. The EPC data indicates that 14% of the current residential buildings in Norway will have a C or better.

5.3 Criterion 3: Refurbished residential buildings with substantial CO_2 emissions reduction targets

Refurbished buildings with substantial CO_2 emission reduction targets qualify for green bonds against this criterion. This is in line with CBI's refurbishment criterion in their Property Upgrade Climate Bonds Certification methodology where the carbon reduction targets can be derived using a linear equation between a 30-year bond and a 5-year bond.

The CO_2- emissions related to operation of residential buildings is dominated by direct and indirect emissions related energy use. Energy supply differs to some degree between buildings but in a heavily electrified heating market in Norway, the grid factor dominates the calculations and energy efficiency will most likely qualify most buildings according to this criterion rather than fuel switch. If historic EPC-labels are made available, the EPC database may be a source to identify eligible objects.

5.3.1 Eligibility under criterion 3

Refurbished residential buildings with substantial CO_2 emissions reduction targets qualify. The minimum target value is determined by the term of the bond (e.g. 5-year bond > 30%). A lower threshold is set at an achieved energy label D.

6 Portfolio analysis – Eligible assets for green bond issuance

The Green loan portfolio of Eika consist of residential buildings that meet the criteria as formulated.

6.1 Eligible buildings

Multiconsult has investigated Eika's portfolio and can confirm that the reviewed buildings have been identified as eligible for green bonds according to Eika's eligibility criteria related to building code and EPC-label for residential buildings. Criterion 3 on refurbishment has not been applied.

Holiday homes, second mortgages and shared debt in cooperative housing have been excluded from the analysis, due to data availability and to avoid double counting of assets. The eligible 8,087 buildings/apartments in Eika's portfolio is estimated to amount to 565,072 square meters, scaled down by the engagement's share of building values. Living area per object is available in intervals for most objects. The average value for the intervals is used in the calculation. For the smallest apartments and largest houses, where intervals are not available, the area is calculated based on national statistics (Statistics Norway[9]). Where object specific living area data is missing, the area per dwelling is calculated based on average area in the rest of the portfolio. The area is calculated based on the assumption that the residents in the portfolio are equivalent to the average Norwegian residential building stock.

The portfolio is first matched against criterion 1 (building code/year). The objects eligible under criterion 1 are supplemented with a number of objects qualifying due to energy performance certificate, criterion 2. There is no double-counting of objects that qualify pursuant to more than one criterion.

In total 15% of the objects in the total portfolio qualifies. The eligible objects are presented in somewhat more detail in table 3.

Criterion	Type of dwelling	Number of objects	Area total [m^2]
Criterion 1 and 2	Apartments	2,944	101,308
	Small residential buildings	5,143	463,766
Total criterion 1 and 2		8,087	565,074

Table 3 Eligible objects and estimated building areas scaled to reflect engagement share of building value

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

7 Impact assessment

Impact is calculated for the criteria in the earlier sections.

The grid factor on electricity consumption, as average in the buildings' lifetime, is based on a linear trajectory from the current grid factor to an assumed grid factor at the end of the buildings' lifetime. According to *Norwegian Standard NS 3720 "Method for greenhouse gas calculations for buildings"* greenhouse gas is to be calculated on a life-cycle basis according to two scenarios:

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

Table 4 Electricity production greenhouse gas factors (CO_2- equivalents) for two scenarios (source: NS 3020:2018, Table A.1)

Calculations in this report is based on the European (EU27+ UK+ Norway) factor of 136 gCO_2/kWh, which constitute the GHG emission intensity baseline for energy use in buildings with a life span of 50-60 years and assuming that the CO_2-factor of the European 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)[10].

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

A reduction of energy demand from the average 253 kWh/m^2 of the total residential building stock to 122 kWh/m^2 (TEK07/TEK10) or 102 kWh/m^2 (TEK17) dependent on building code can then be multiplied to the emission factor and area of eligible assets to calculate impact.

7.1 Eligible buildings in Eika's portfolio and related impact

The calculated average specific energy demand for national eligible assets is 120 kWh/m^2. This is 52% lower than the calculated average of the total residential building stock.

Table 5 below indicates how much more energy efficient the eligible part of the portfolio is compared to the average residential Norwegian building stock, and how much less CO_2-emissions, directly and mostly indirectly, this avoided energy demand results in. All values are scaled down to reflect Eika's engagement relative to the objects' deemed market value.

	Area	Avoided energy compared to baseline	Avoided CO_2-emissions compared to baseline
Eligible buildings in portfolio (criterion 1 and 2)	565,074 m^2	**75 GWh/year**	**9,300 tons CO_2/year**

Table 5 Performance of eligible objects compared to average building stock in rounded numbers

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