REPORT

BN Bank Green Buildings Portfolio

CLIENT

BN Bank

SUBJECT

Norwegian Energy Efficient Buildings- Green residential and commercial buildings

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REPORT

PROJECT	**BN Bank Green Buildings Portfolio**	DOCUMENT CODE	10229086-01-TVF-RAP-001
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BN Bank’s eligibility criteria for green energy efficient residential and commercial buildings are in line with international criteria and criteria used in a number of green bond issuances including Norwegian buildings. The evidence for the criteria and the result of an impact analysis of the eligible part of BN Bank’s loan portfolio is presented in this report. The criteria to select the buildings are based on credible standards in Norway such as the national building regulation and the Energy Performance Certificates scheme.

In summary, impact assessed for residential and commercial buildings in the BN-Bank portfolio qualifying according to BN-Bank’s Green Bond Framework is somewhat dominated by residential buildings but with significant contribution from commercial buildings. This table sums up the impact in rounded numbers, both for the total number of buildings qualifying and impact scaled by the bank’s engagement compared to asset value:

Residential buildings	*(1,450 ton CO_2e/year, scaled)*	*2,695 ton CO_2e/year*
Commercial buildings	*(548 ton CO_2e/year, scaled)*	*1,040 ton CO_2e/year*
Total	*(1,998 ton CO_2e/year, scaled)*	*3,735 ton CO_2e/year*

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1 Introduction

Assignment

On assignment from BN Bank Multiconsult is presenting criteria and methodology to identify the most energy efficient residential and commercial buildings in Norway to be used with respect to a potential green bond issuance. In this document we describe BN Bank's identification criteria, the evidence for the criteria and the result of an analysis of the loan portfolio of BN Bank. The criteria to select the buildings are based on credible standards in Norway such as the Norwegian building regulation and Energy Performance Certificates.

Buildings included in this analysis

The analysis of the commercial building stock includes office buildings, commercial/retail buildings (shops and stores), hotels and restaurants and small industrial buildings and warehouses. These categories cover the most relevant commercial buildings in BN Bank's portfolio.

All categories of residential buildings are included in the analysis.

Energy

Apart from these criteria, we also want to stress that both residential and commercial buildings in Norway are mostly heated with renewable energy. The energy consumption of Norwegian buildings is predominantly electricity, supplemented by some district heating and bioenergy. The share of fossil fuel in heating is very low and declining.

Statistics Norway published statistics in 2013 on energy use in Norwegian households. According to this, the 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 all buildings. The fuel mix in Norwegian district heating production in 2020 included only 3 % from fossil fuels (oil and gas) (Fjernkontrollen[1]).

In 2020, the Norwegian power production was 98 % renewable (SSB[2]). As shown in Figure 1, the Norwegian production mix in 2020 (92% hydropower and 6% wind) resulted in emission of 8 gCO_2/kWh. In the figure, the production mix is included for other selected European states for illustration.

Using a life-cycle analysis, the Norwegian Standard NS 3720:2018 "Method for greenhouse gas calculations for buildings" takes into account international electricity trade and considers that the consumption is not necessarily equal to 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

[1] http://fjernkontrollen.no/
[2] https://www.ssb.no/statbank/table/12824

production mix, the resulting CO_2- factor for Norwegian residential buildings[3] is on average 124 g CO_2/kWh.

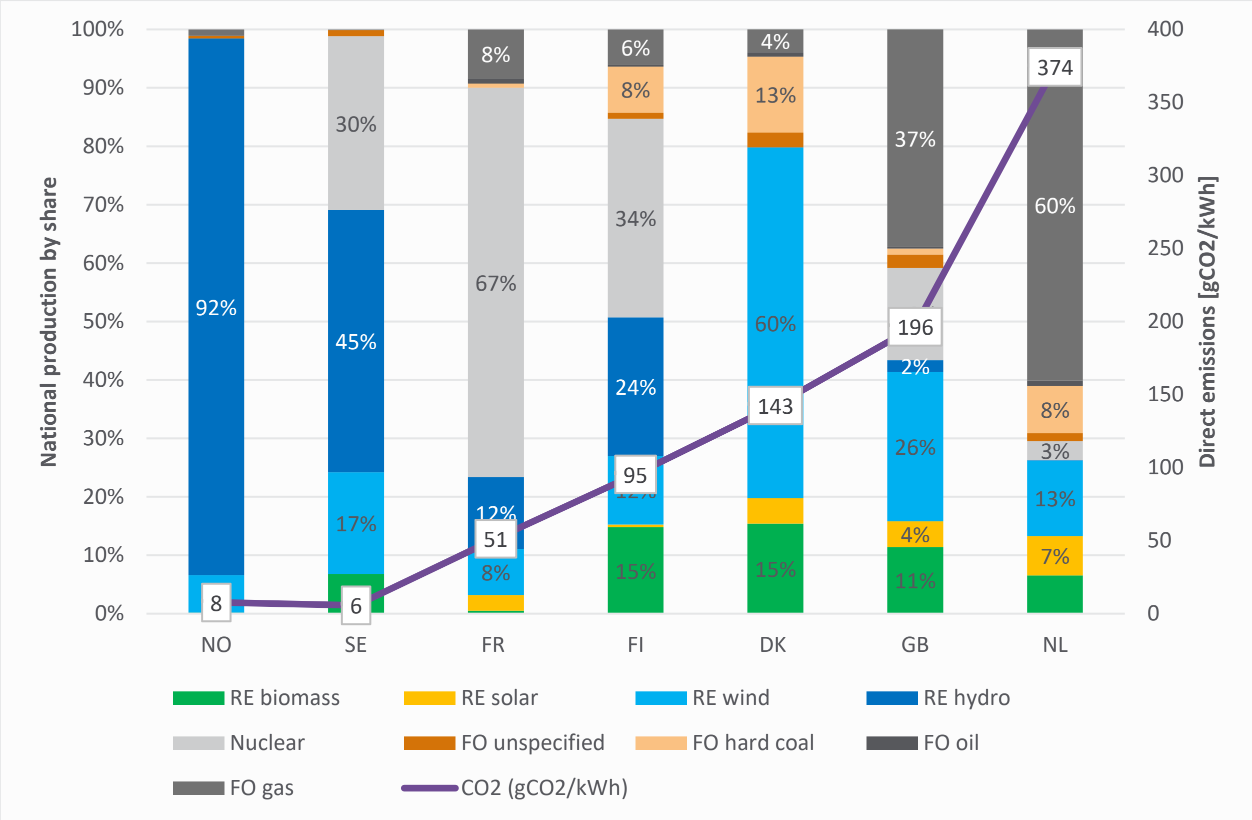


Figure 1 National electricity production mix in some selected countries (European Residual Mixes 2020, Association of Issuing Bodies[4])

[3] Multiconsult. Based on building code assignments for DiBK
[4] https://www.aib-net.org/facts/european-residual-mix

2 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. The criteria have been aligned with the Climate Bonds Initiative (CBI) and are published as a CBI baseline for Norwegian residential buildings. The criteria used to derive the baseline are similar to the CBI methodology used in similar markets. 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 the CBI taxonomy, residential buildings may also qualify after being refurbished to a standard resulting in at least a 30% reduction in energy demand[5].

Eligible Residential Green Buildings for BN Bank must meet one of the following eligibility criteria:

1. 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. 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 or B. These buildings may be identified by using data from the Energy Performance Certificate (EPC) database.
3. Renovated Norwegian residential buildings which have achieved an improvement in energy-efficiency of at least 30%. (This criterion is not examined further in this report.)

2.1 New or existing Norwegian residential buildings that comply with a building code no older than TEK10: 10%

Changes in the Norwegian building code have consistently over several decades resulted in increasingly energy efficient buildings. As of 2020, 10% of Norwegian residential buildings are built following TEK10 or a later building code, thus being eligible according to the BN Bank criterion.

The methodology is based on the Climate Bonds Initiative (CBI) taxonomy, where the top 15% most energy efficient buildings are considered eligible. The baseline and criterion are in line with, or stricter than, the CBI baseline methodology for energy efficient residential buildings for Norwegian conditions published in spring 2018. The threshold of top 15% is in line with the relevant building acquisition and ownership of buildings criteria in the EU Taxonomy Delegated Acts[6]

[5] https://www.climatebonds.net/standard/buildings/upgrade
[6] https://ec.europa.eu/info/law/sustainable-finance-taxonomy-regulation-eu-2020-852/amending-and-supplementary-acts/implementing-and-delegated-acts_en

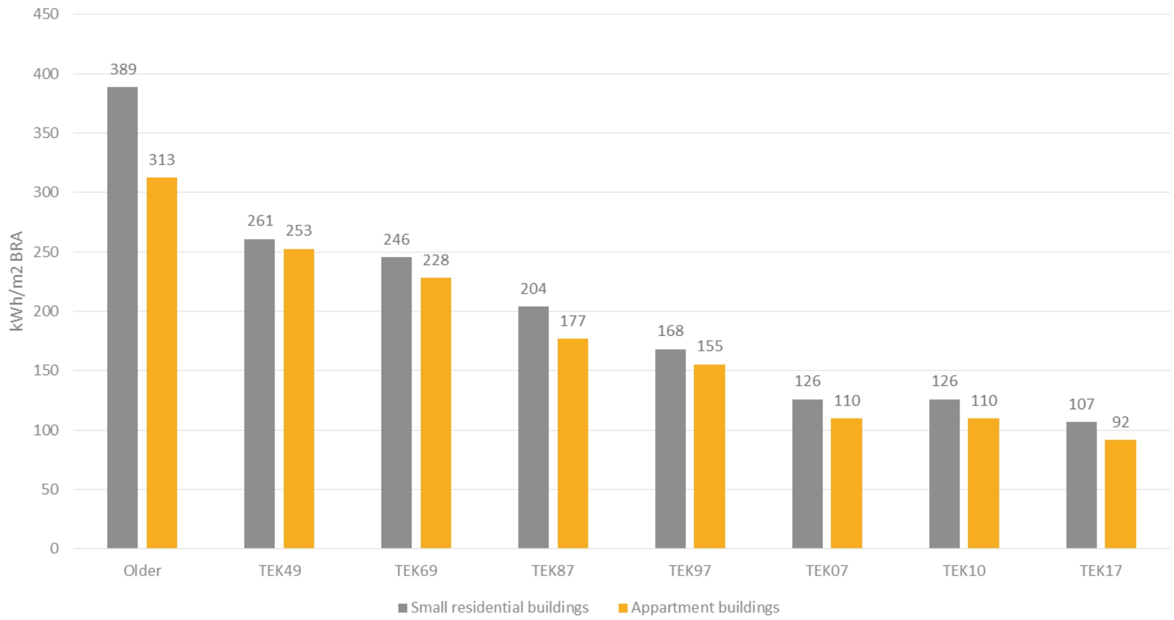


Figure 2 Development in calculated specific net energy demand based on building code and building tradition, (Multiconsult, simulated in SIMIEN)

Net energy demand is calculated using model buildings identical to the models used for defining the building code (TEK10/TEK17). The result presented in Figure 2 illustrates how the calculated energy demand declines with decreasing age of the buildings. From TEK10 to TEK17 the reduction is about 15%, and the former shift from TEK97 to TEK10 was no less than 25%. It should be noted 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 integrated in the Norwegian Standard NS3031:2014, building tradition has been considered. For older buildings, the calculated values tend to be higher than the actual measured use, mostly because the ventilation air flow volume is assumed as high as in newer buildings, but no heat recovery. Indoor air quality is assumed not to be dependent on building year. This is the same methodology as used in the EPC-system.

Building code	**Specific energy demand apartment buildings (model homes)**	**Specific energy demand small residential buildings (model homes)**
TEK10	110 kWh/m^2	126 kWh/m^2
TEK17	92 kWh/m^2	107 kWh/m^2

Table 1 Specific energy demand calculated for model buildings

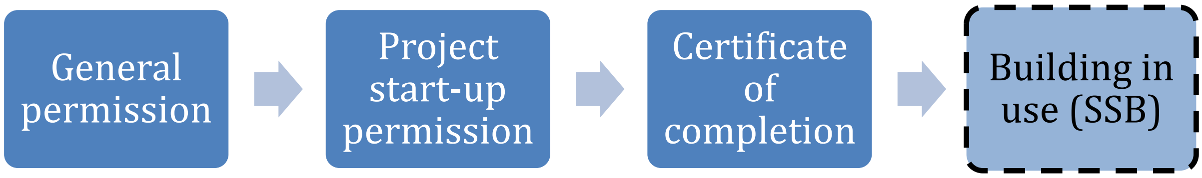
Table 1 includes the specific energy demand calculated by using the standard model buildings, for the building codes relevant for identifying the top 10% most energy efficient residential buildings in Norway.

The building codes are having a significant effect on energy efficiency. An investigation of the energy performance of buildings registered in the EPC database built after 1997 show 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 can be done from 1997 to 1998 when the building code of 1997 came into force.

In the period between 1998 and 2009, a period when there was no change in the building code, it is difficult to see any clear changes, however a small reduction in energy use might have taken place in the latest years. This might be due to an increased use of heat pumps in new buildings, and to a certain degree, better windows.

2.1.1 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 in accordance with 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 factors like 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, a reasonable timespan for residential buildings in this phase is six months to a year. The figure below, based on statistics from Statistics Norway (SSB), indicates that a standard construction period for residential buildings lasts approximately six months to a year.

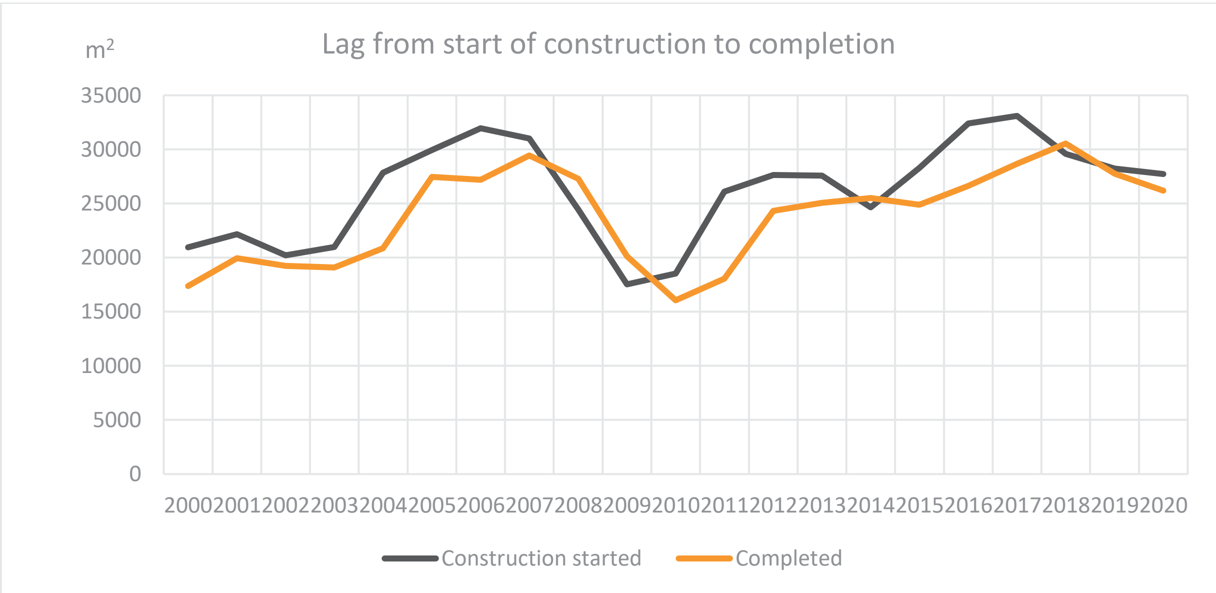


Figure 3 Project start-up and completion (Statistics Norway, bygningsarealstatistikken)

The 2010 building code was implemented on July 1st, 2010. Based on the discussions on time period for design and construction, we regard a time-lag of two years between code implementation and buildings being constructed based on this code, to be a robust and conservative assumption in most cases. The data available on completed construction is only available to the issuer on a yearly basis. 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.

2.1.2 Building age statistics

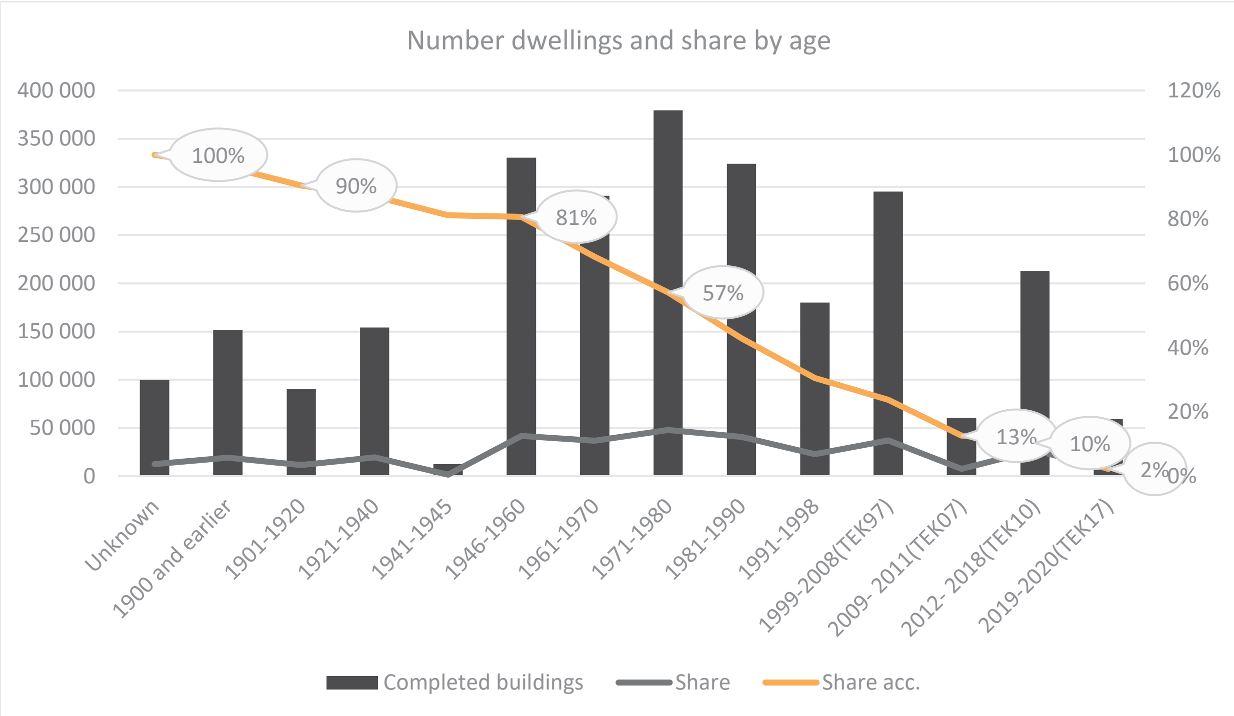


Figure 4 Age and building code distribution of dwellings (Statistics Norway and Multiconsult)

Figure 4 above shows how the Norwegian residential building stock is distributed by age. The same statistics are adjusted by new intervals using statistics on building area (Bygningsarealstatistikken). The figure shows how buildings finished in 2012 and later (and built according to TEK10 or TEK17) amount to 10% of the total stock. Based on theoretical energy demand in the same building stock, the same 10% of the stock makes up for only 4% of the energy demand in residential buildings (Figure 5) and 3.6% of the related CO_2- emissions (Figure 6). The difference between energy demand and CO_2-emissions can be explained by heating solutions in newer buildings being slightly less CO_2-intensive.

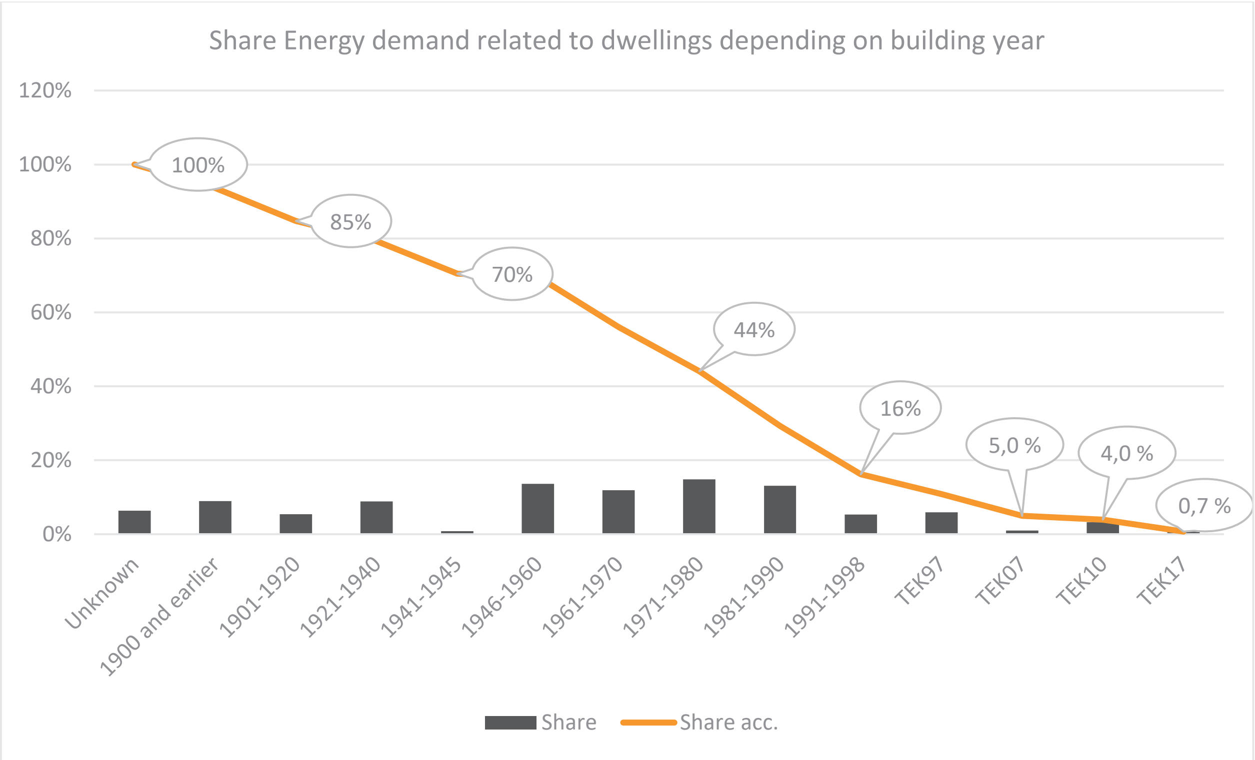


Figure 5 The building stock's relative share of energy demand (Statistics Norway and Multiconsult)

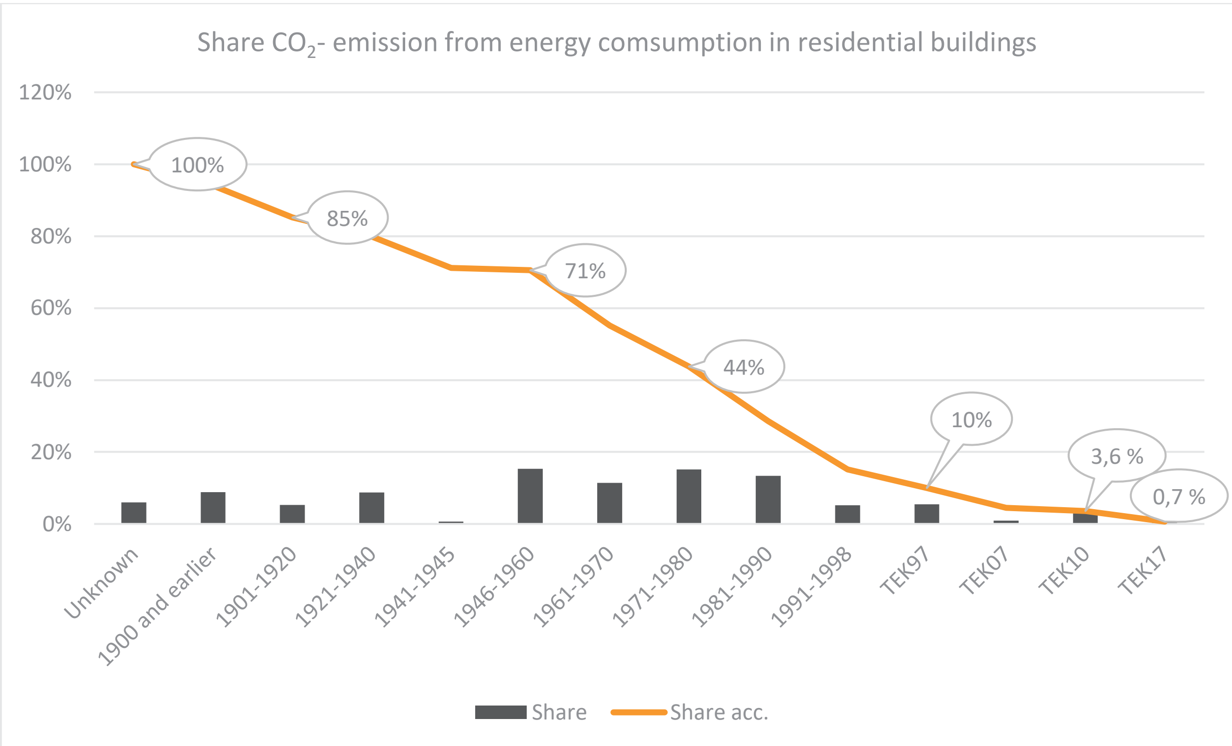


Figure 6 The building stock's relative share of CO2 –emissions related to energy demand dependent on building year and code (Statistics Norway and Multiconsult)

Figure 7 and Figure 8 illustrate how the top 15% most energy efficient buildings may be identified by building code TEK10 (or later codes) until the end of 2024, and by building code TEK17 (or later codes) until the end of the year 2031. These projections are based on building statistics including buildings built in 2019 and NVE's building stock projections used in their energy demand projections.

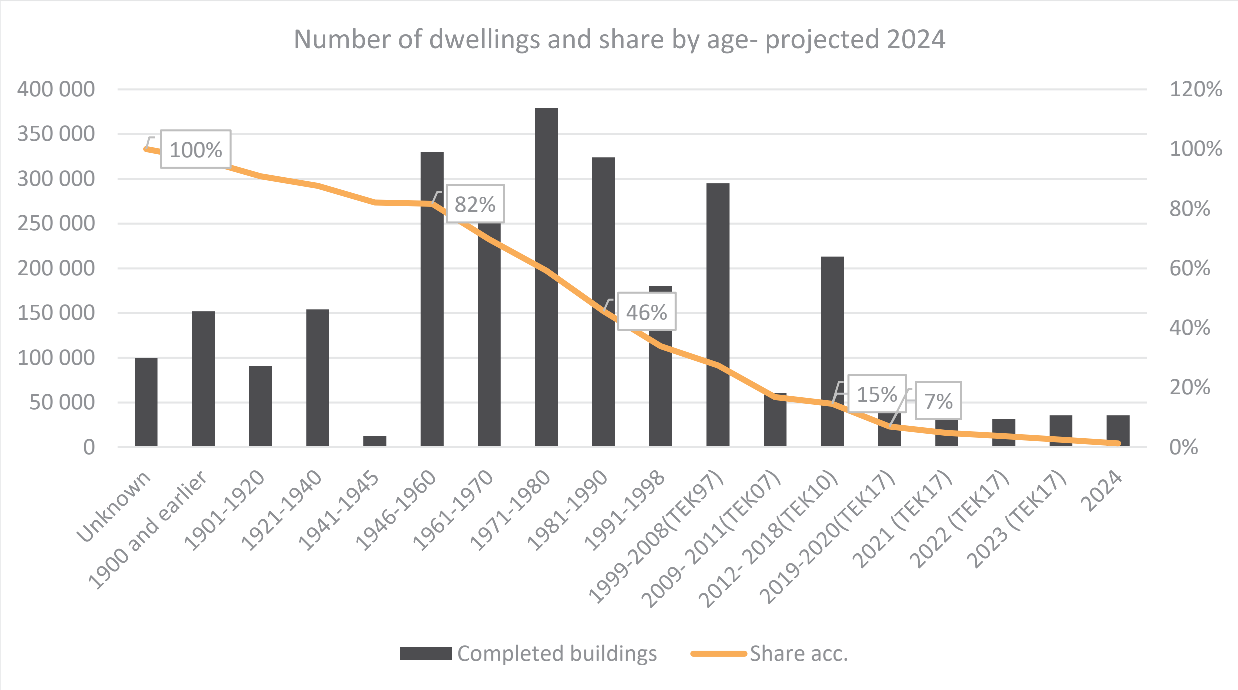


Figure 7 Age and building code distribution of dwellings projected in 2024 (Statistics Norway, NVE and Multiconsult)

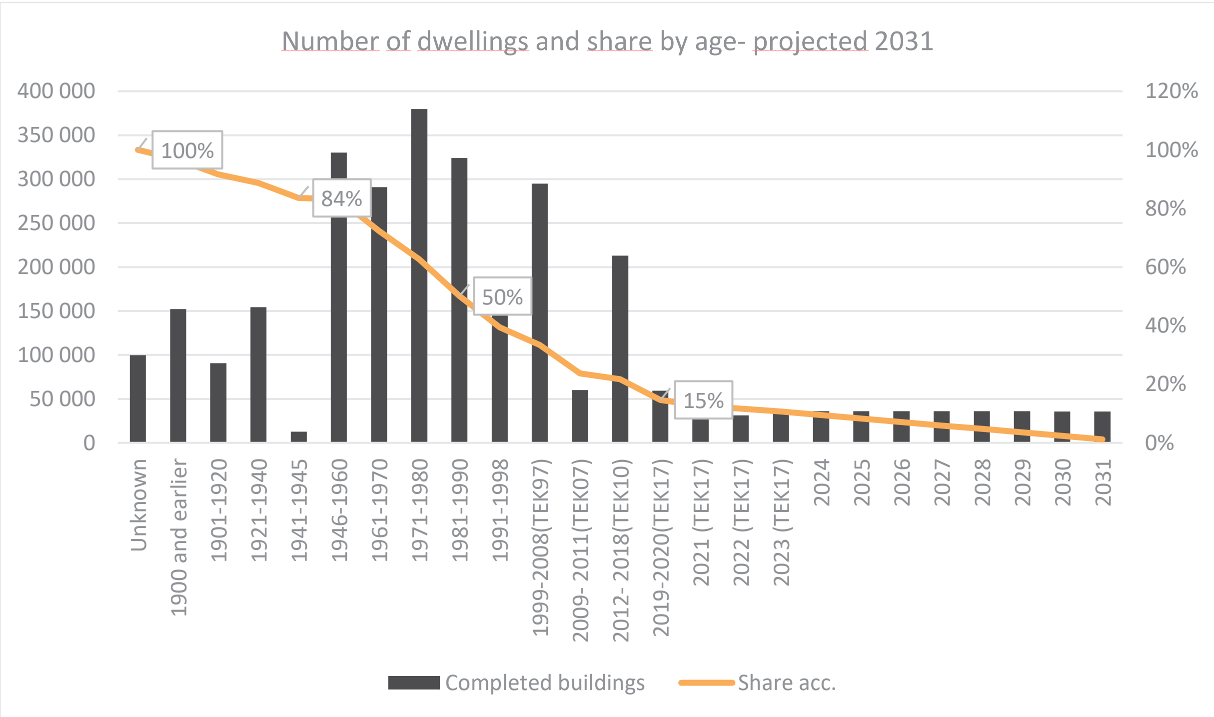


Figure 8 Age and building code distribution of dwellings projected in 2031 (Statistics Norway, NVE and Multiconsult)

2.1.3 *Eligibility under criterion 1*

Over the last several decades, the changes in the building code have pushed for more energy efficient buildings and opens for identifying the 15% most energy efficient buildings based on building year. The national building stock data indicates that 10% of the current residential buildings in Norway were constructed using the code of 2010 (TEK10). Combining the information on the calculated energy demand related to building code in Figure 2 and information on the residential building stock in Figure 4, the calculated average specific energy demand on the total Norwegian residential building stock is 252 kWh/m^2. Building code TEK10 and TEK17 gives an average specific energy demand for existing houses and apartments, weighted for actual stock, of 117 kWh/m^2, 54% lower than the average.

2.2 Norwegian residential buildings with EPC-labels A or B

2.2.1 *EPC labels to identify energy efficient residential buildings*

The Energy Performance Certificate (EPC) system is another source for definition of green mortgages. All buildings with an energy grade of A or B are eligible as green residential buildings according to this criterion.

The Energy Certificate Performance System became operative in 2010. It was made mandatory for all new residences finished after the 1st of July 2010 and all residences that are sold or rented out to have an Energy Performance Certificate.

The figure below shows how the residential buildings with EPCs in Norway are distributed by building code, and their certificate label.

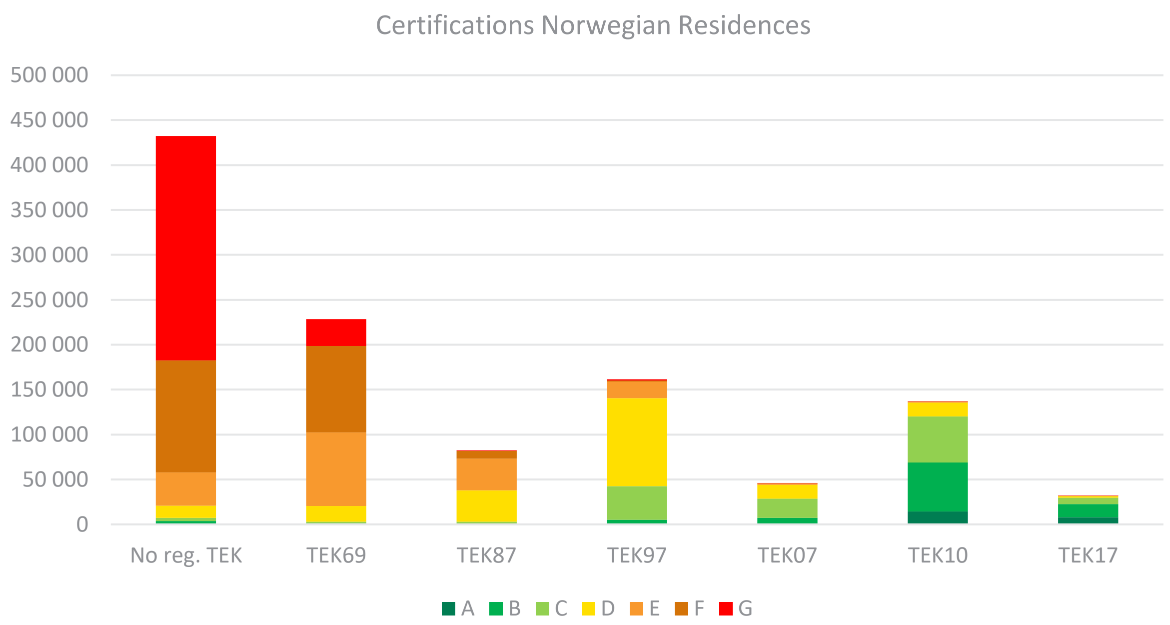


Figure 9 Residences in Norway with Energy Performance Certificates distributed per building code and energy grade in the EPC system. The numbers are based on statistics from the EPC database (representing no more than 42% of the total building stock).

The properties already registered in the EPC database are considered representative for all the residential buildings built under the same building code. However, they are 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 of no more than 42%.

2.2.2 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 does as of today consist 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.

Registration is performed in two ways. Professionals must certify new buildings and non-residence buildings. Non-professional building-owners that are selling their house or apartment can however do the certification themselves in a simplified registration system. The latter system is based on simplified assumptions and conservative values, and its results are therefore less precise and might give a lower energy label than when professionals do the registration.

The energy grade 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 grades for houses 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 2 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 2007/2010, with an assumed moderate system efficiency for the building's energy system.

Residences built after the building code of 2010, which are included in criteria 1, will hence mostly get a C or better, but might in some cases get a D. Extracting only buildings built before 2009 from the EPC database, 5% of the total registered buildings have a C or better. These are buildings that have initially been built with, or through refurbishment attained, higher energy efficiency standards than the original building year (and respective building code) would imply.

As can be seen in Figure 9, some buildings built after TEK 07/10 have indeed received a D. However, these are often 'strong' D's and will by a margin still be among the top 15% of most energy efficient residences and are included in criteria 1.

The Norwegian EPC system requires every apartment to be certified separately. Particularly for apartments, the defined limit values in the grading system are set for an average apartment. An apartment on the top or bottom floor or at a corner 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 label 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 and are included in criterion 1.

Since a dominant part of the certifications for residential buildings are done in the simplified registration mode, and not by professionals, a larger share of existing TEK10-buildings gets 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 2010 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 in more rare cases even E) for TEK07/10-buildings are due to either one or a combination of these things; 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 10 shows the energy grades in granted certificates to Norwegian residential buildings.

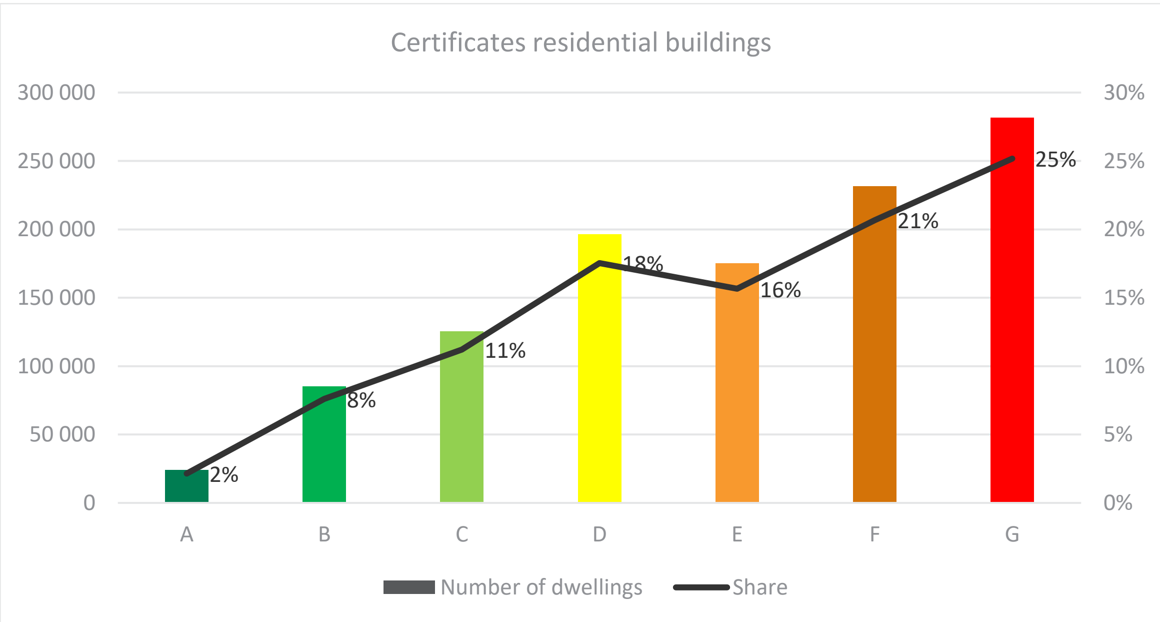


Figure 10 Energy Performance Certificates by grade- residential buildings only, representative only of buildings with EPCs (Source: energimerking.no, December 2020)

The EPC coverage is, however, not equally distributed over the building stock.

Figure 11 shows the age of the buildings with EPCs and in the building stock, respectively, and how much of the building stock is represented in the EPC database. 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 very close to all new registrations in 2020. Building stock data is only updated on a yearly basis, and the figure include buildings finished before the end of 2020.

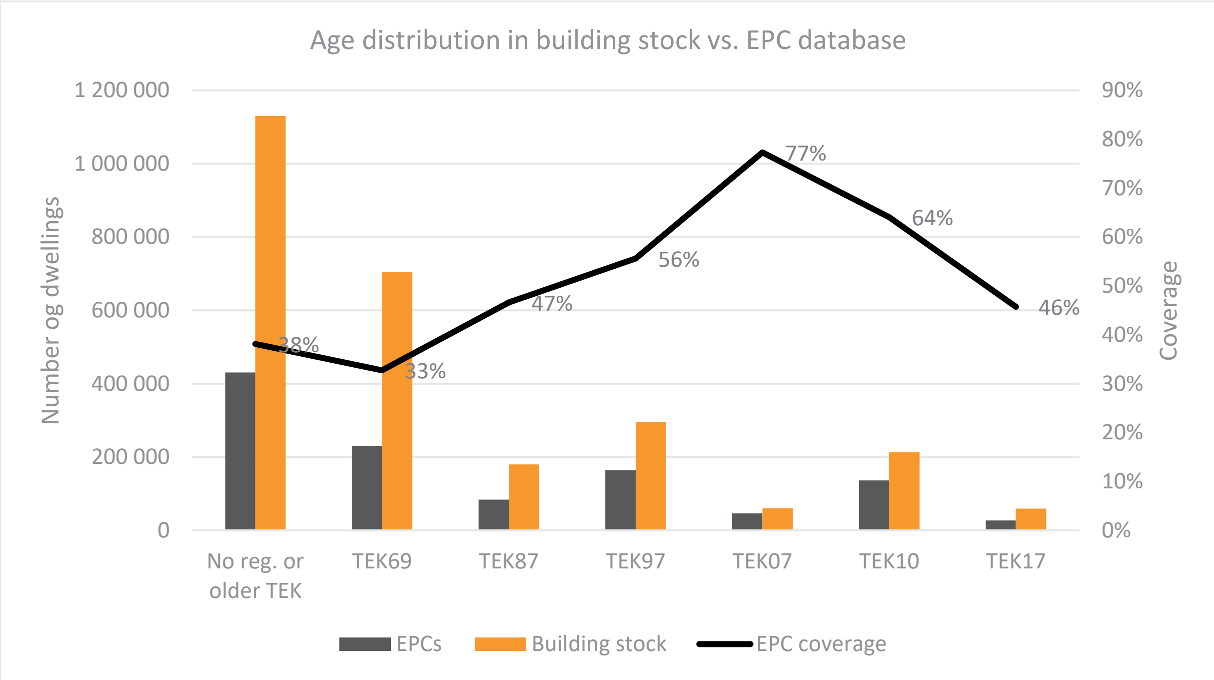


Figure 11 Age distribution in Energy Performance Certificates vs. actual residential building stock and EPC coverage by building year (Source: energimerking.no December 2020 and Statistics Norway incl. 2020 figures)

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 12 illustrates how EPCs would be distributed based on this assumption. 7% of the residences would have a B or better. 15% of the residences would have a C or better.

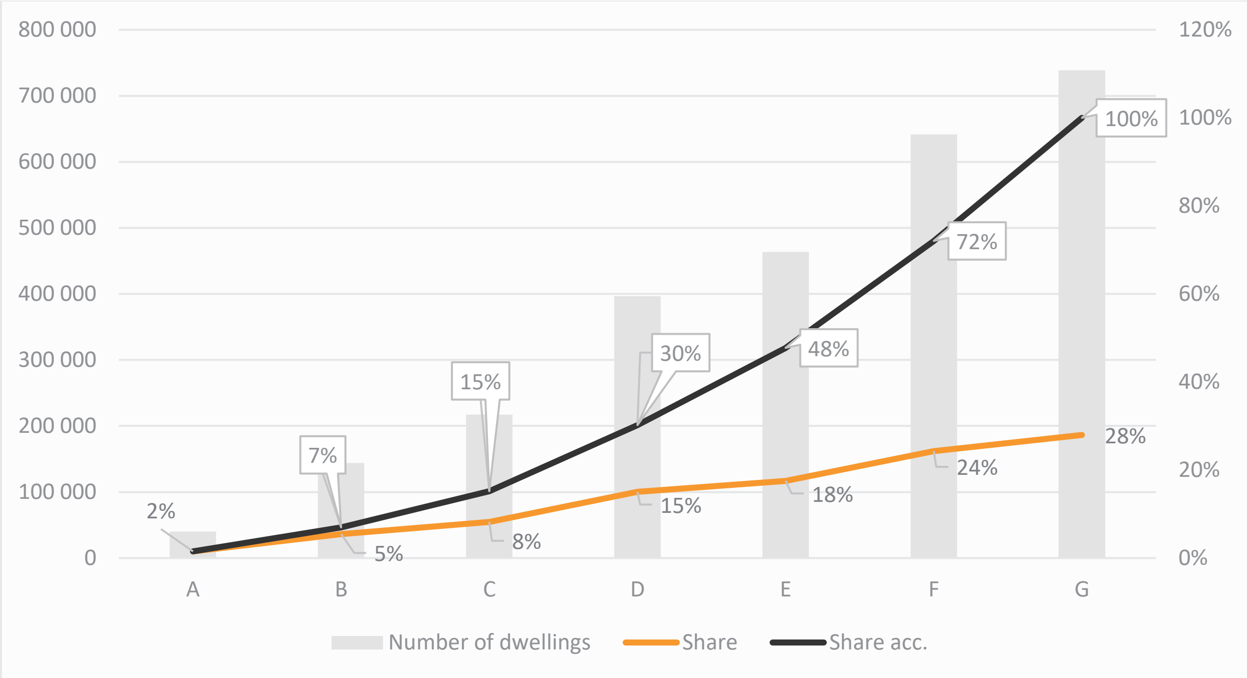


Figure 12 EPCs extrapolated to include the whole residential building stock (Source: energimerking.no and Statistics Norway, Multiconsult)

2.2.3 Eligibility under criterion 2

An Energy Performance Certificate is mandatory for new buildings and existing residential buildings that are sold or rented out, and the criterion is set at EPC energy grade A or B. The EPC data indicates that 7% of the current residential buildings in Norway will have a B or better.

2.3 Refurbished Norwegian residential buildings with an improved energy efficiency of ≥30%

Refurbished buildings with an improved energy efficiency of 30% or more are eligible for Green Bonds. CBI has a similar 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 threshold of minimum 30% improvement is also in line with the refurbishment criteria in the EU Taxonomy Delegated Acts.

To identify qualifying buildings, the EPC energy label before and after the refurbishment may be compared. Identification may also be based on more detailed information on the building and the energy efficiency measures implemented.

3 Eligibility criteria - Commercial buildings

Multiconsult has studied sections of the Norwegian commercial building stock and identified solid eligibility criteria for Green Bonds on energy efficient commercial buildings in specific subcategories. 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. The methodology is based on Climate Bonds Initiative (CBI) taxonomy, where the top 15% most energy efficient buildings are considered eligible. The threshold of top 15% is in line with the relevant building acquisition and ownership of buildings criteria in the EU Taxonomy Delegated Acts[7]

Eligible Commercial Green Buildings for BN Bank must either meet a refurbishment criterion or qualify according to eligibility criteria based on building code.

1. Norwegian commercial 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 commercial building stock.
   a. 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 taken into account. Hence all buildings finished in 2012 or later qualify.
   b. 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.
2. Renovated Norwegian residential buildings which have achieved an improvement in energy-efficiency of at least 30%. (This criterion is not examined further in this report.)

Data quality and sources

To establish a robust methodology, data on number and age of existing buildings are crucial. The data on number of buildings and age in the total stock have good quality for the whole stock in the most relevant period, which is the most recent years and even for a period beyond the criteria cut-off points. These statistical data have been published from 2000. Some building categories are only available on an aggregated level, but the necessary splits are made on the basis of data available for the years 2006 and 2018. Building years for older buildings are somewhat uncertain and assumptions on building rate and demolition rate had to be made. Regarding building area, data is available on new buildings every year from 1983. These data have been supplemented with data in a study on energy efficiency in existing buildings.[8]

[7] https://ec.europa.eu/info/law/sustainable-finance-taxonomy-regulation-eu-2020-852/amending-and-supplementary-acts/implementing-and-delegated-acts_en
[8] Enova publication "Potensial- og barrierestudie Energieffektivisering i norske yrkesbygg", Multiconsult 2011

3.1 New or existing buildings that comply with the building code criteria

New or existing Norwegian <u>hotel and restaurant buildings</u> that comply with the Norwegian building code of 2010 (TEK10) or later codes: 7.0 %

New or existing Norwegian <u>office buildings</u> that comply with the Norwegian building code of 2010 (TEK10) or later codes: 4.9 %

New or existing Norwegian <u>retail/commercial buildings</u> that comply with the Norwegian building code of 2010 (TEK10) or later codes: 4.9 %

New or existing Norwegian small <u>industrial buildings and warehouses</u> that comply with the Norwegian building code of 2010 (TEK10) or later codes: 13.6 %

Changes in the Norwegian building code have consistently over several decades resulted in more energy efficient buildings.

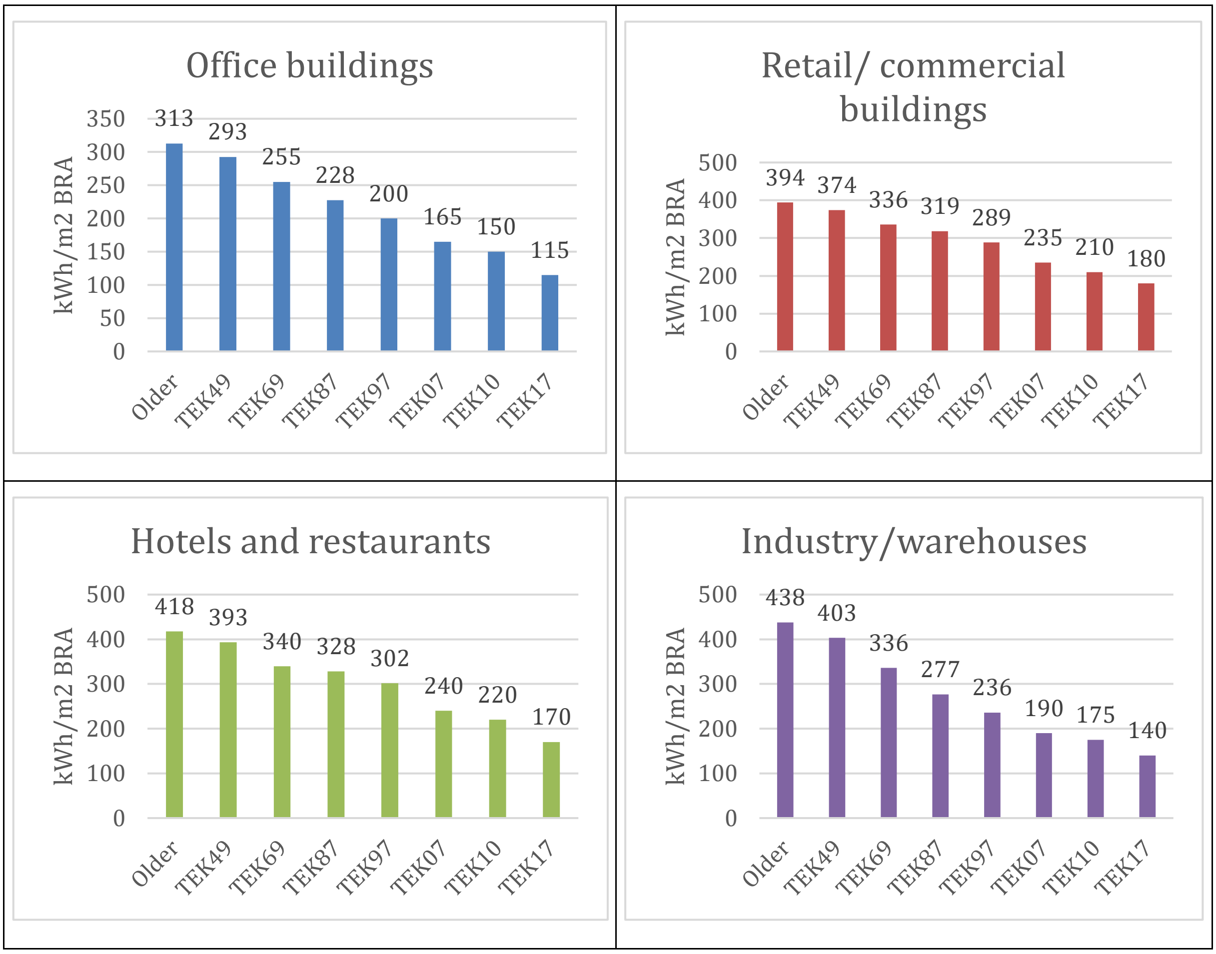


Figure 13 Development in calculated specific net energy demand based on building code and building tradition (Multiconsult, simulated in SIMIEN)

Net energy demand is calculated for model buildings used for defining the building code. The result presented in Figure 13 illustrates how the calculated energy demand declines with decreasing age of the buildings. From TEK10 to TEK17 the reduction is between 14 – 23%. The former shifts from TEK07 to TEK10 was about 10%, and from TEK97 to TEK07 about 20%.

Figure 13 presents theoretical values for representative models of an office building, retail/commercial building, hotel building and industry/ warehouse, 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 is not based on measured energy use. In addition to the guiding assumption in Norwegian Standard NS 3031:2014, experience with building tradition is included. Indoor air quality is assumed not to be dependent on building year. It is assumed that older buildings (TEK69 and older), that originally had natural ventilation or mechanical exhaust with relatively small air volumes, have at one time upgraded to balanced ventilation with satisfactory air volumes - this is assumed to be a necessary upgrade the property owner had to do to meet the tenancy requirements. Many older buildings underwent such upgrades in the 1980s and 1990s. For these, a minimum allowable airflow from NS 3031: 2014 Table A.6 is used. This is the same methodology as used in the EPC-system.

Building code	**Specific energy demand**			
	Office building	**Retail/commercial buildings**	**Industry/ warehouses**	**Hotels and restaurants**
TEK 10	150 kWh/m^2	210 kWh/m^2	175 kWh/m^2	220 kWh/m^2
TEK 17	115 kWh/m^2	180 kWh/m^2	140 kWh/m^2	170 kWh/m^2

Table 3 Specific energy demand as from the building codes

Table 3 includes the specific energy demand as a maximum requirement in the respective building codes, relevant for identifying the top 15%, by a margin, most energy efficient commercial buildings in Norway.

The building codes have a significant effect on energy efficiency.

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. First there is some transition period where two codes are overlapping. Further, 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 factors like the complexity of the site and project, financing, the market and the building category.

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, a reasonable timespan for commercial buildings in this phase is six months to a year. As an illustration, the figure below, based on statistics from Statistics Norway (SSB), indicates that a standard construction period for office buildings is approximately six months to a year.

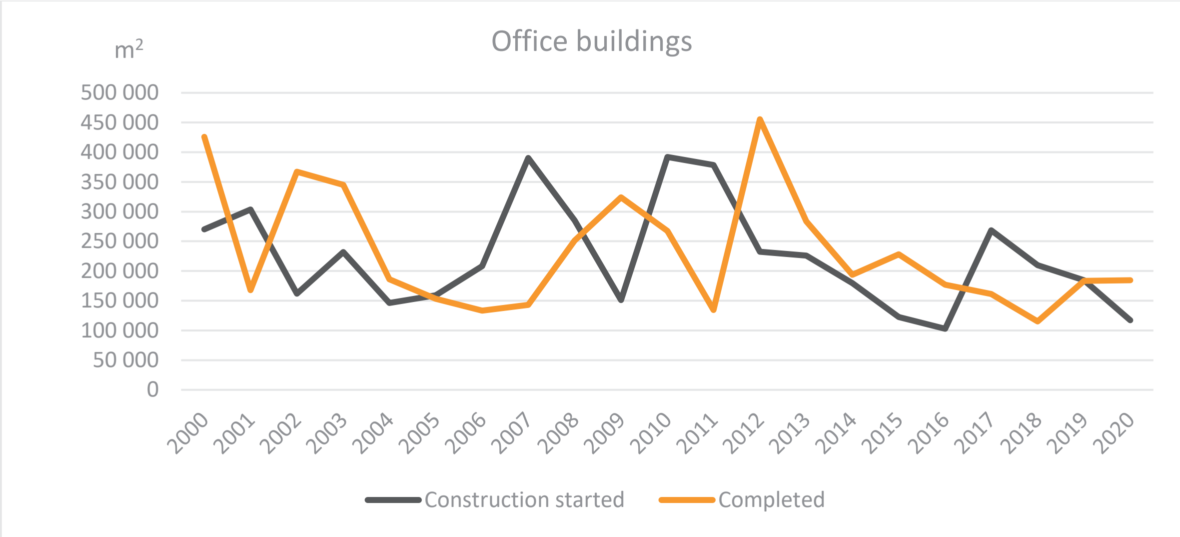


Figure 14 Project start-up and completion (Statistics Norway, bygningsarealstatistikken)

Based on the discussions on time period for design and construction, we regard a time-lag of two years for offices, retail and industry/ warehouses between code implementation and buildings built based on this code to be a robust and conservative assumption. Being more complex buildings, a time-lag of three years is assumed for hotel and restaurant buildings. The data available on completed construction is only available to the issuer on a yearly basis.

3.1.2 Building age statistics

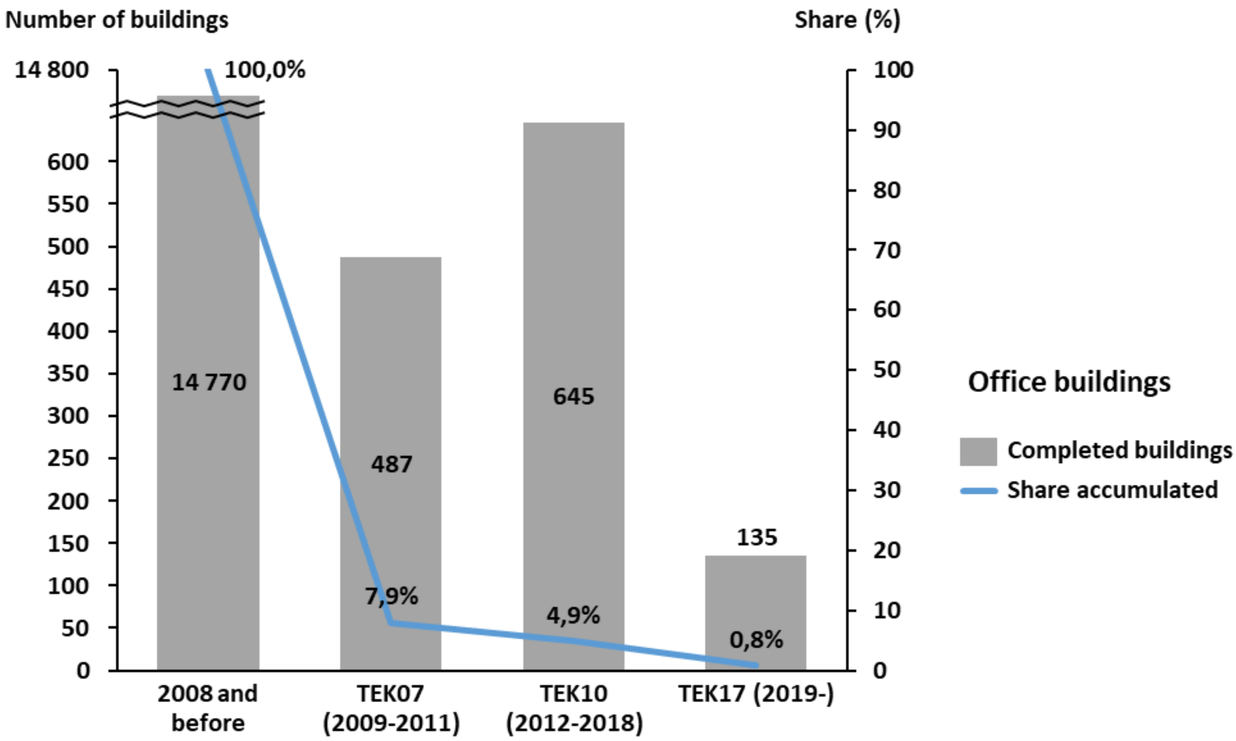


*Figure 15 Age and building code distribution of **office buildings** (Statistics Norway and Multiconsult)*

Figure 15 above shows how the Norwegian office building stock is distributed by age. The figure also shows how office buildings finished in 2012 and later (built according to TEK10 and TEK17) amount to 4.9% of the total stock. The three figures below include the same information for the other three subcategories.

The quality of the commercial building stock data is somewhat flawed, and projections for the future growth in the building stock is highly uncertain. However, assumed that the building stock grows by 1-2% every year, the TEK10 threshold will be valid until around 2028 for office and retail buildings, until around 2024 for hotel and restaurant buildings, and until around 2023 for small industrial buildings and warehouses. In a few years, these thresholds must be adjusted to TEK17.

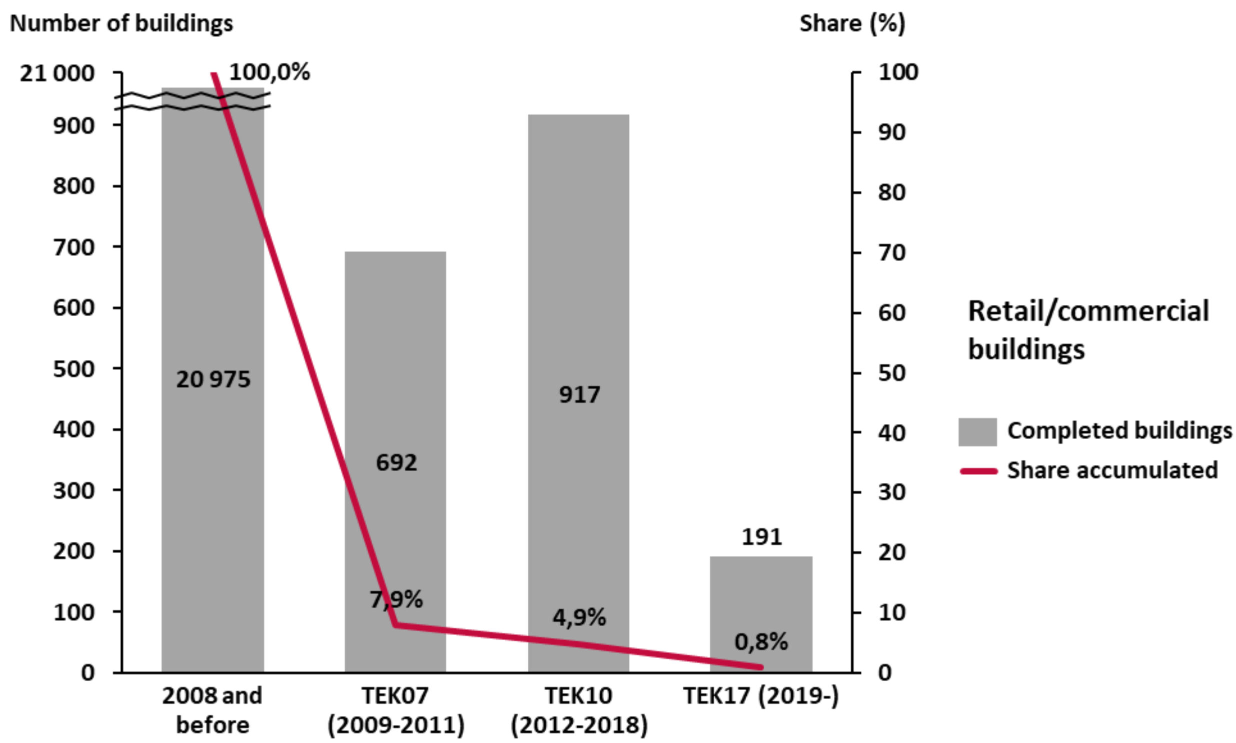


*Figure 16 Age and building code distribution of **commercial/retail buildings** (Statistics Norway and Multiconsult)*

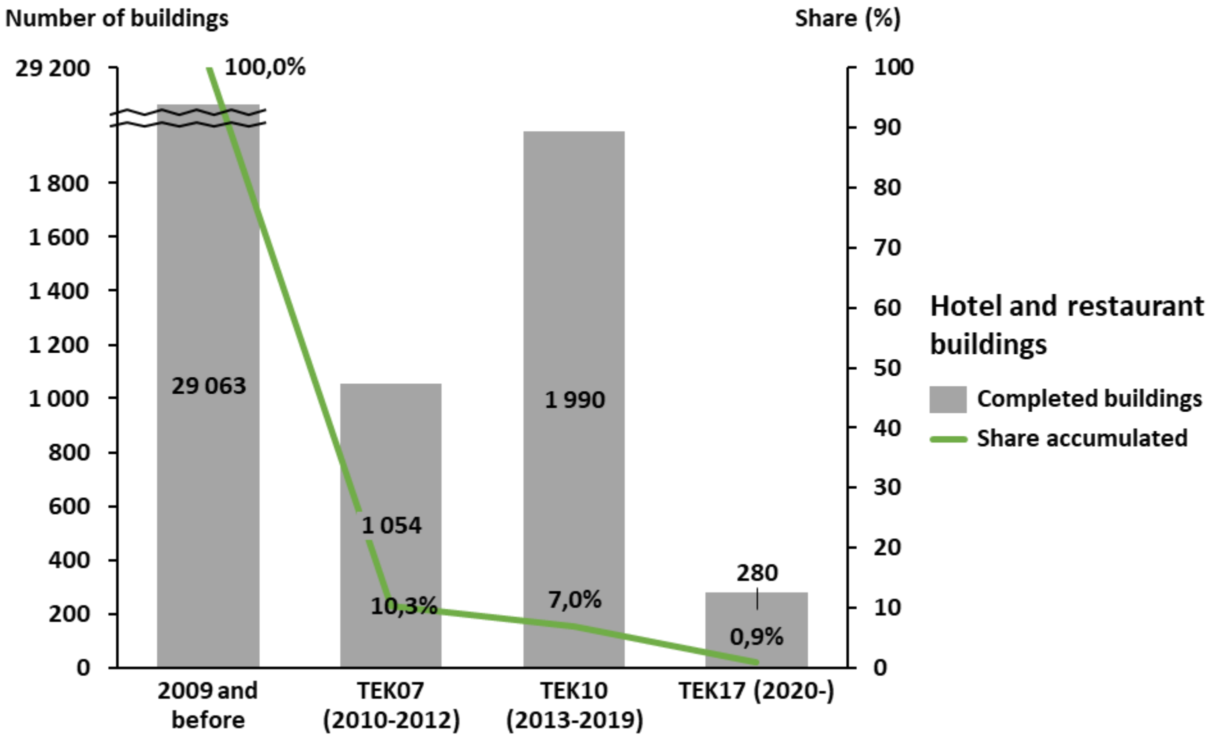


Figure 17 Age and building code distribution of ***hotel and restaurant buildings*** *(Statistics Norway and Multiconsult)*

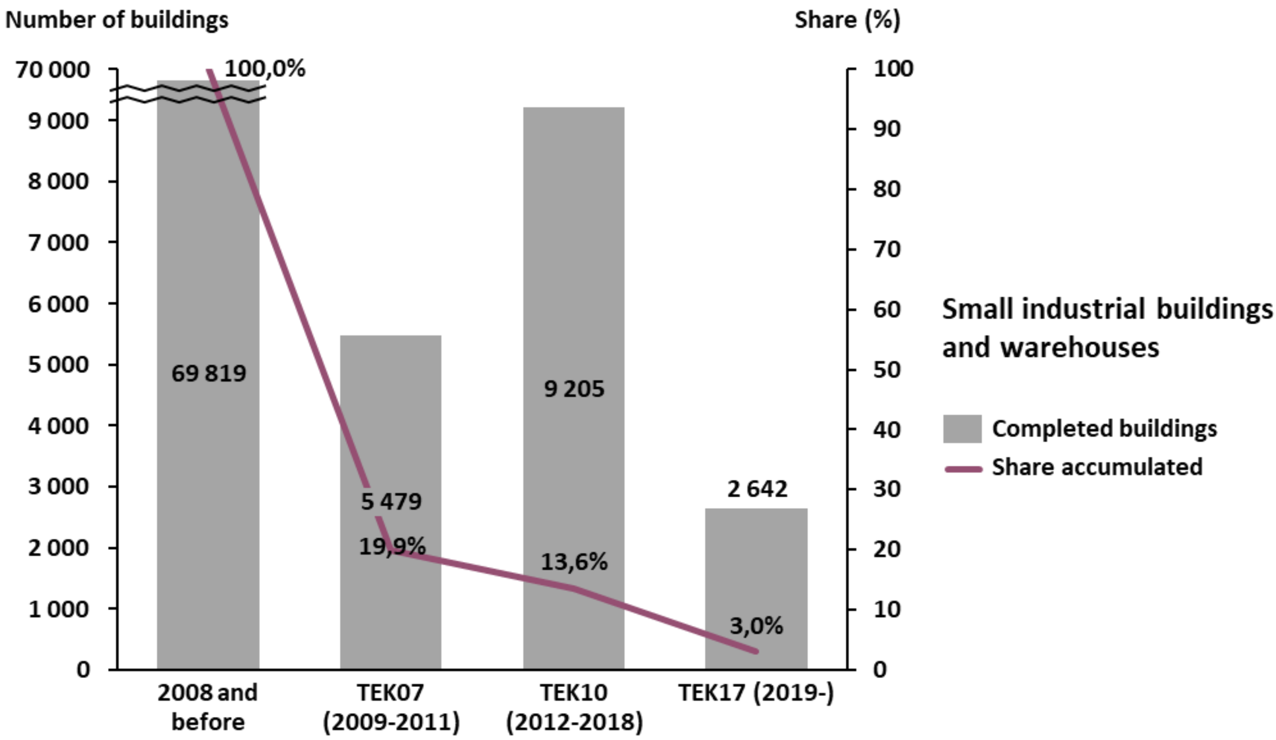


Figure 18 Age and building code distribution of ***small industrial buildings and warehouses*** *(Statistics Norway and Multiconsult)*

Figures 19 through 22 below show how much, based on theoretical energy demand in the same building stock, the same share of the building stock make up in share of the energy demand in the same subcategories. The same picture is relevant for CO_2- emissions.

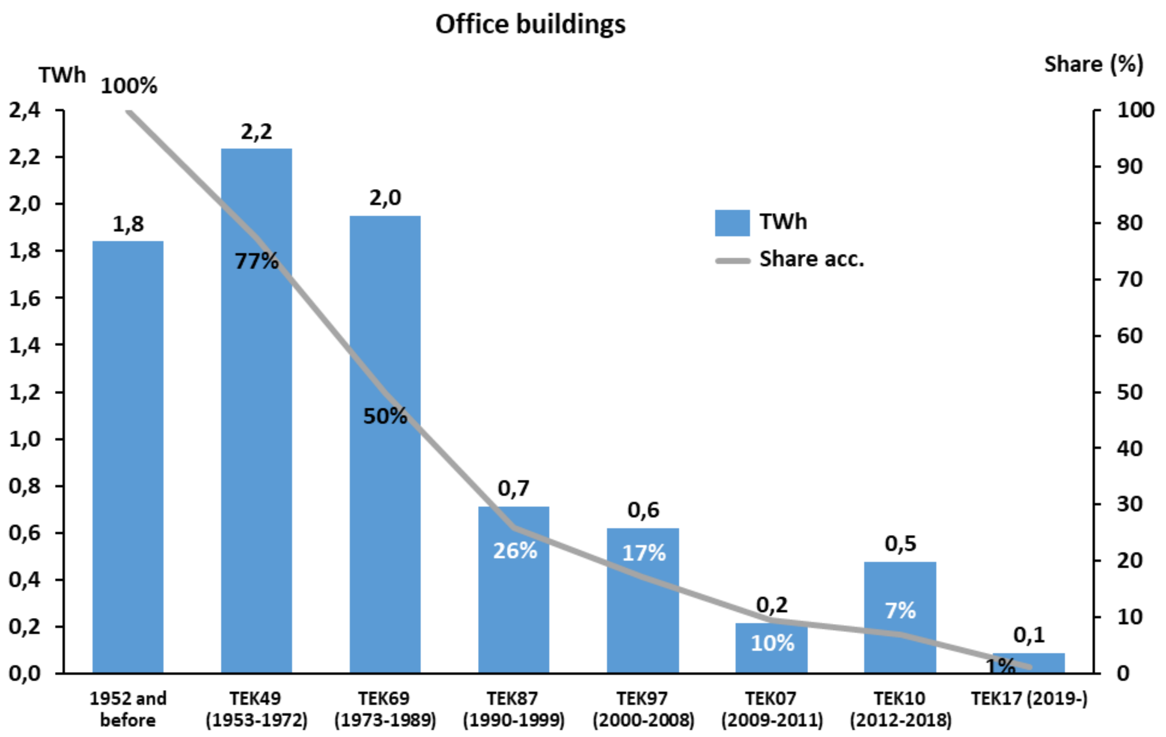


Figure 19 Share energy demand related to ***office buildings*** *depending on building year*

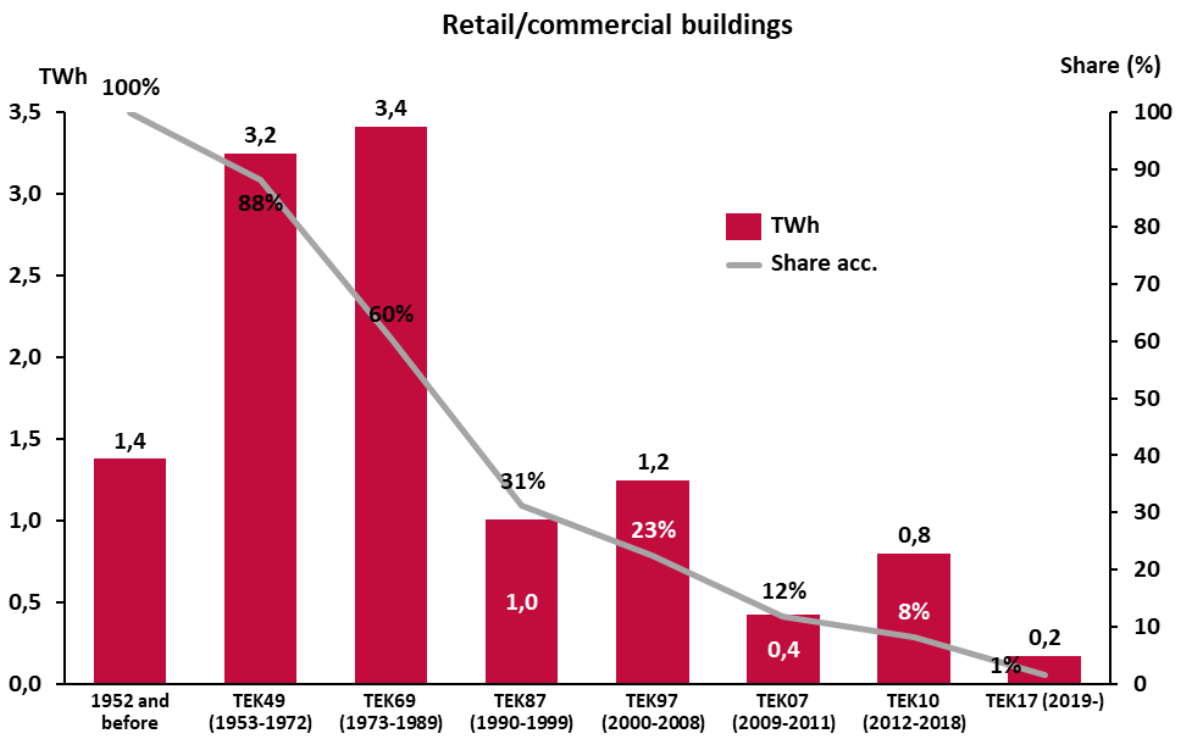


Figure 20 Share energy demand related to retail buildings depending on building year

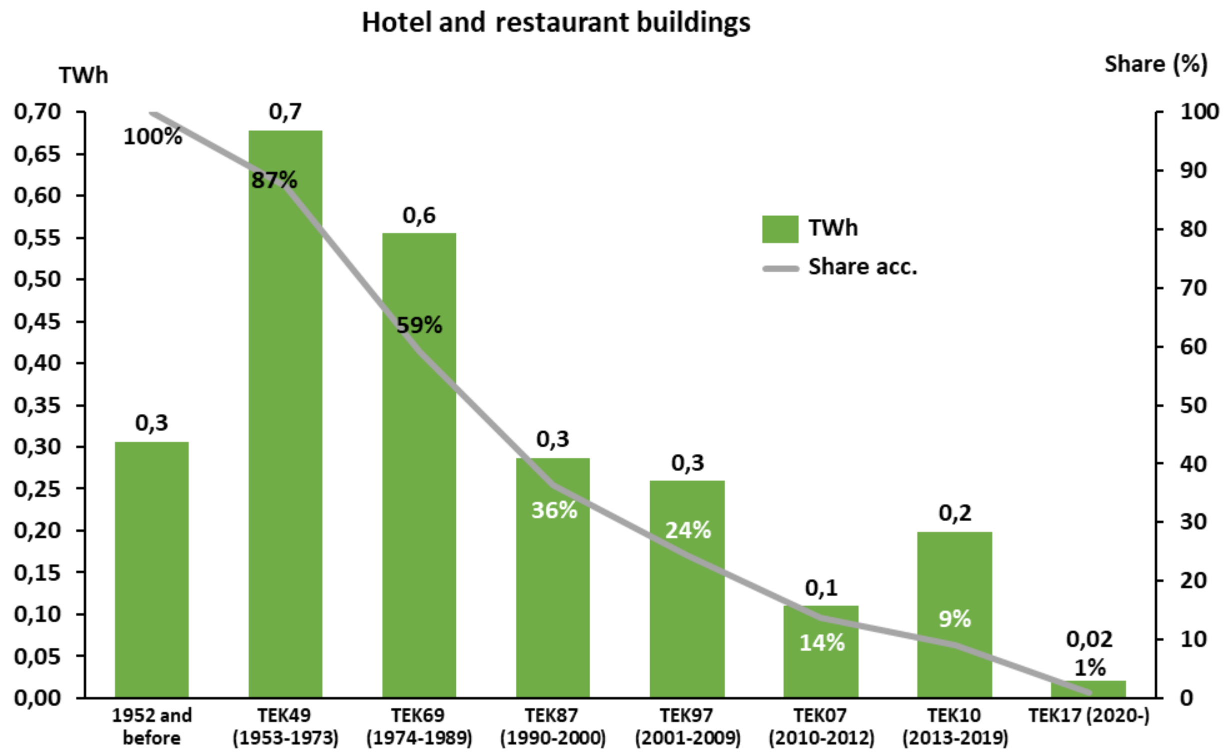


Figure 21 Share energy demand related to ***hotel and restaurant buildings*** *depending on building year*

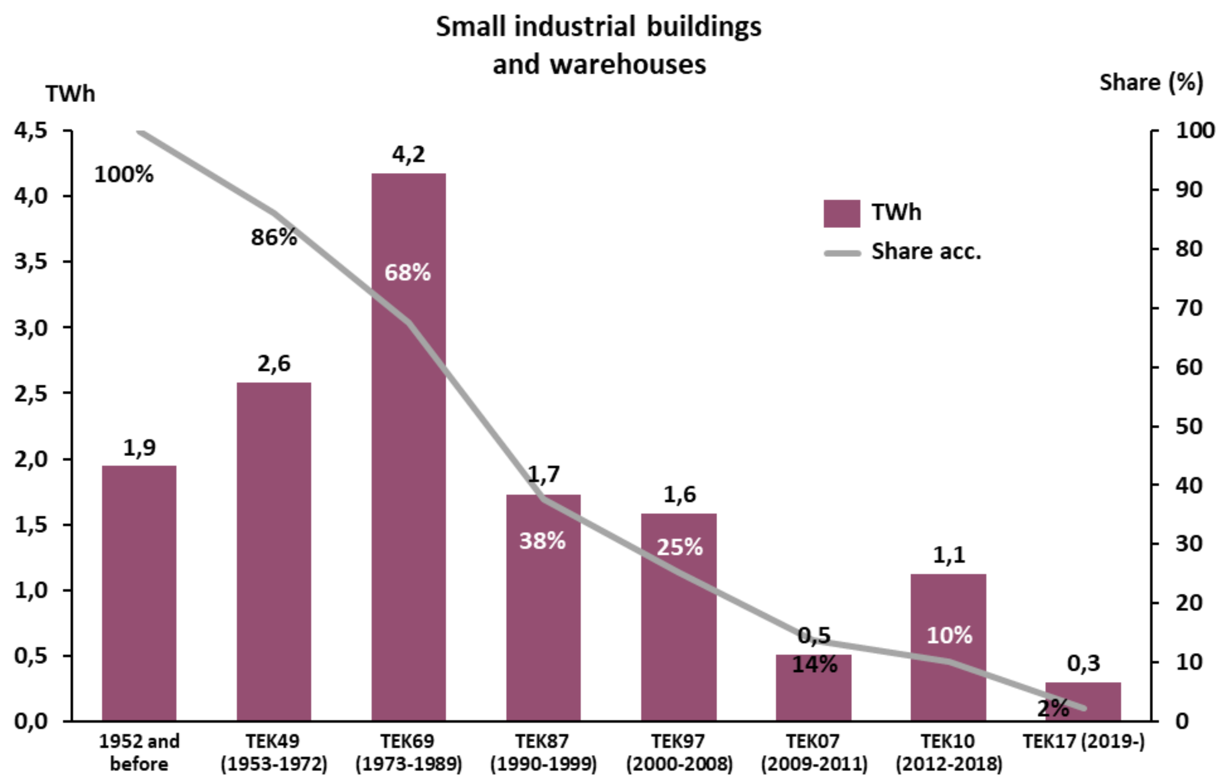


Figure 22 Share energy demand related to small industrial buildings and warehouses depending on building year

3.1.3 Eligibility under the building code criterion

Over the last several decades, the changes in the building code have pushed for more energy efficient commercial buildings. Combining the information on the calculated specific energy demand related to building code in Figure 13 and information on the commercial building stock in figures 15 through 18, the calculated average specific energy demand on the part of the Norwegian building stock that has been 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.

	Total stock average [kWh/m^2]	Qualifying building years average [kWh/m^2]	Reduction [kWh/m^2]
Office buildings	250	143	43 %
Retail/commercial buildings	321	204	37 %
Hotel buildings	330	214	35 %
Small industry and warehouses	294	166	43 %

Table 4 Average specific energy demand for the building stock; total stock, share eligible according to criteria and reduction

3.2 Refurbished Norwegian commercial buildings with an improved energy efficiency of ≥30%

Refurbished commercial buildings with an improved energy efficiency of 30% or more are eligible for Green Bonds. CBI has a similar Property Upgrade Climate Bonds Certification methodology[9] where the carbon reduction targets can be derived using a linear equation between a 30-year bond and a 5-year bond. The threshold of minimum 30% improvement is also in line with the refurbishment criteria in the EU Taxonomy Delegated Acts.

To identify qualifying buildings, the EPC energy label before and after the refurbishment may be compared. Identification may also be based on more detailed information on the building and the energy efficiency measures implemented.

[9] https://www.climatebonds.net/standard/buildings/upgrade

4 Impact assessment

The grid factor on electricity consumption, as average in the building's lifetime, 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[10]. According to Norwegian Standard NS 3720:2018 *Method for greenhouse gas calculations for buildings*, the greenhouse gas factor for electricity used in buildings is to be calculated on a life-cycle basis according to two scenarios:

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

Table 5 Electricity production greenhouse gas factors (CO_2-equivalents) for two scenarios (source: NS 3020:2018, Table A.1)

The following calculations apply the European mix in Table 5. Using a European mix is in line with *Nordic Public Sector Issuers: Position Paper on Green Bonds Impact Reporting* (February 2020)[11]. 136 gCO_2/kWh constitute the average 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.

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 bio energy and district heating, and some use of heat pumps, resulting in a total specific factor of 124 g CO_2eq/kWh. A proportional relationship is expected between energy consumption and emissions.

Multiconsult has investigated BN Bank's portfolio and the objects used in the following analysis have been identified as eligible buildings for green bonds according to BN Bank's eligibility criteria related to residential and commercial buildings.

[10] The expected life of a building from 2010 is 60 years
[11] https://www.kbn.com/globalassets/dokumenter/npsi_position_paper_2020_final_ii.pdf

4.1 Residential buildings

A reduction of energy demand from the average 252 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 achieved energy label and weighted average in the EPC database is used.

Eligibility is first checked against the building code criterion. The ones left are checked against the EPC-criterion, so no double counting of objects will occur. The eligible residential buildings in BN Bank's portfolio are estimated to amount to about 163 000 square meters, whereas the major part, 1430 objects, is eligible through the building code criterion. Of the 55 objects qualifying only according to the EPC-criterion, 7% have energy label A and the rest have energy label B.

Data on dwelling area was for most made available by the bank.

	Number of units				Area qualifying buildings in portfolio [m^2]				Area qualifying in total [m^2]
	TEK10	TEK17	EPC A	EPC B	TEK10	TEK17	EPC A	EPC B	
Apartments	615	282	2	18	47 131	21 001	179	1 693	70 004
Small residential houses	400	133	2	33	63 333	22 976	297	6 372	92 978
Sum	1 015	415	4	51	110 464	43 977	476	8 065	162 982

Table 6 Eligible residential objects and qualifying building area

Based on the calculated figures in tables 1 and 6, the energy efficiency of this part of the portfolio is estimated.

The calculated average specific energy demand for the criterion 1 eligible assets is 117 kWh/m^2. This is 54 % lower than the calculated average of the total residential building stock.

The table 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 the calculated reduction in energy demand constitutes in CO_2-emissions.

	Area [m^2]	Reduced energy compared to baseline [GWh]	Reduced CO_2-emissions compared to baseline [tons CO_2/yr]
Buildings eligible under the building code criterion	154 441	20.8	2 587
Buildings eligible under the EPC criterion	8 541	0.9	108
Eligible buildings in portfolio- total	**162 982**	**21.7**	**2 695**

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

The banks engagement in the qualifying objects makes up a share of the object value. When scaled by the loan-to-value factor, the impact is estimated to 11.7 GWh and 1450 tons CO_2 per year.

4.2 Commercial buildings

The eligible buildings in BN Bank's commercial portfolio are estimated to amount to ~77,000 square meters. 19 objects are found eligible according to a building code criterion.

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.

	Area qualifying buildings in portfolio [m^2]		
	TEK10	TEK17	Total
Retail/ Office buildings	74 533	2 098	76 631
Hotel and restaurant buildings		140	140
Industry and small warehouse buildings	350		350
Sum	74 883	2 238	77 121

Table 8 Eligible commercial objects and calculated building areas

Based on the calculated figures in tables 4 and 8, the energy efficiency of this part of the portfolio is estimated.

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.

	Reduced energy compared to baseline	Reduced CO_2-emissions compared to baseline
Eligible buildings in portfolio	**8.4 GWh/year**	**1 040 tons CO_2/year**

Table 9 Performance of commercial eligible objects compared to average building stock

The banks engagement in the qualifying objects makes up a share of the object value. When scaled by the loan-to-value factor, the impact is estimated to 4.4 GWh and 548 tons CO_2 per year.

4.3 Impact commercial and residential buildings portfolio

The 1 504 unique eligible objects in BN Bank's commercial and residential portfolios combined, is estimated to amount to ~240 000 square meters.

	Reduced energy compared to baseline	Reduced CO_2-emissions compared to baseline
Eligible buildings in portfolio	**30.1 GWh/year**	**3 735 tons CO_2/year**

Table 10 Performance of eligible objects compared to average building stock

The banks engagement in the qualifying objects makes up a share of the object value. When scaled by the loan-to-value factor, the impact is estimated to 16.1 GWh and 1998 tons CO_2 per year.