REPORT

SpareBank 1 Østlandet Green Buildings Portfolio

CLIENT

SpareBank 1 Østlandet

SUBJECT

Norwegian Energy Efficient Buildings- Green residential and commercial buildings

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REPORT

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1 Introduction

Assignment

On assignment from SpareBank 1 Østlandet 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 SpareBank 1 Østlandet's identification criteria, the evidence for the criteria and the result of an analysis of the loan portfolio of SpareBank 1 Østlandet. 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 SpareBank 1 Østlandet'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 through electricity, supplemented by some district heating and bioenergy. The share of fossil fuel 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, all use of fossil oil is banned from use in buildings. The fuel mix in Norwegian district heating production in 2018 included only 5 % from fossil fuels (oil and gas) (Fjernkontrollen[1]). In 2019, the Norwegian power production was 98 % renewable (NVE[2]).

As shown in Figure 1, 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" 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 EU28+ Norway and 18 g CO_2/kWh for Norwegian production mix only. Applying the factor based on EU28 + Norway energy production mix, the resulting CO_2- factor for Norwegian residential buildings[3] is on average 124 g CO_2/kWh.

[1] http://fjernkontrollen.no/
[2] https://www.nve.no/energy-supply/electricity-disclosure/?ref=mainmenu
[3] Multiconsult. Based on building code assignments for DiBK

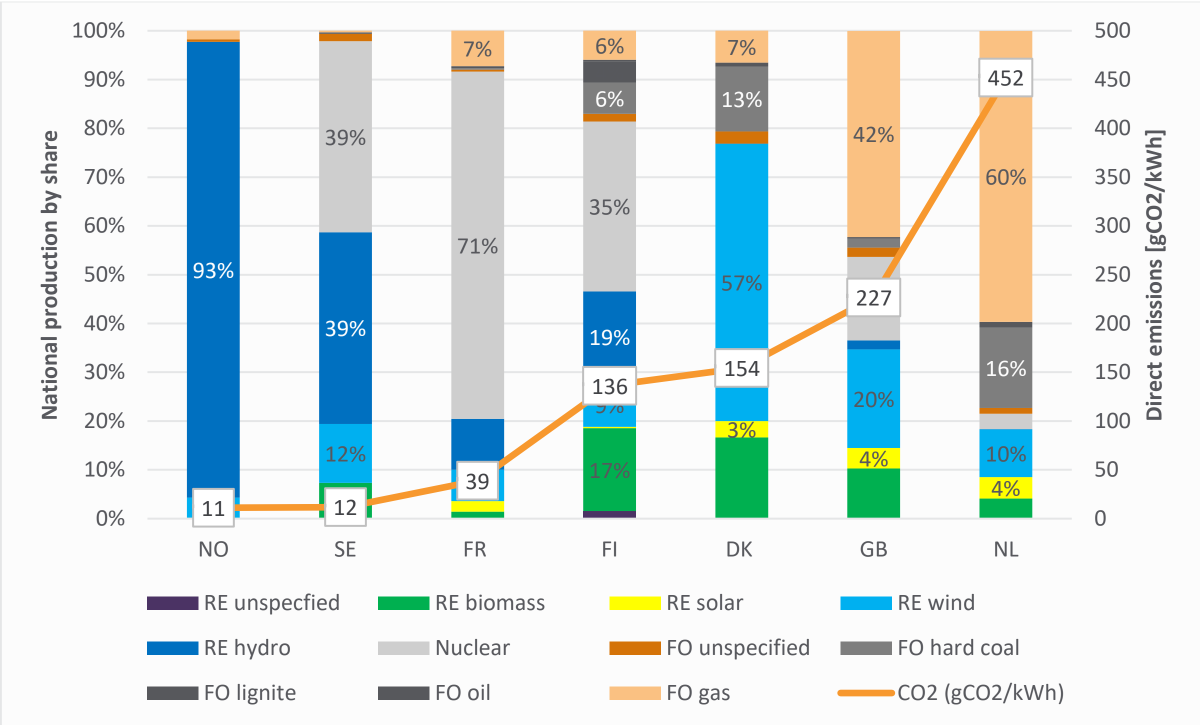


Figure 1 National electricity production mix in some relevant countries (European Residual Mixes 2019, Association of Issuing Bodies[4])

[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 that derive the baseline are similar to the CBI methodology already used in similar markets. Criterion 1 identifies the top 9 % 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 SpareBank 1 Østlandet must meet the following eligibility criteria:

1. 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. 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 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 compared to the calculated specific delivered energy [kWh/m^2] based on building code in the year of construction. These buildings may be identified using the EPC database and estimates (presented in separate tables in this report) that identify which EPC-label corresponds to at least 30% energy reduction for the given construction year.

2.1 New or existing Norwegian residential buildings that comply with a building code no older than TEK10: 9 %

Changes in the Norwegian building code have consistently over several decades resulted in more energy efficient buildings. As of 2020, 9 % of Norwegian residential buildings are eligible according to the SpareBank 1 Østlandet criterion.

The methodology is based on Climate Bonds Initiative (CBI) taxonomy, where the top 15 % most energy efficient buildings are considered eligible. SpareBank 1 Østlandet's 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.

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

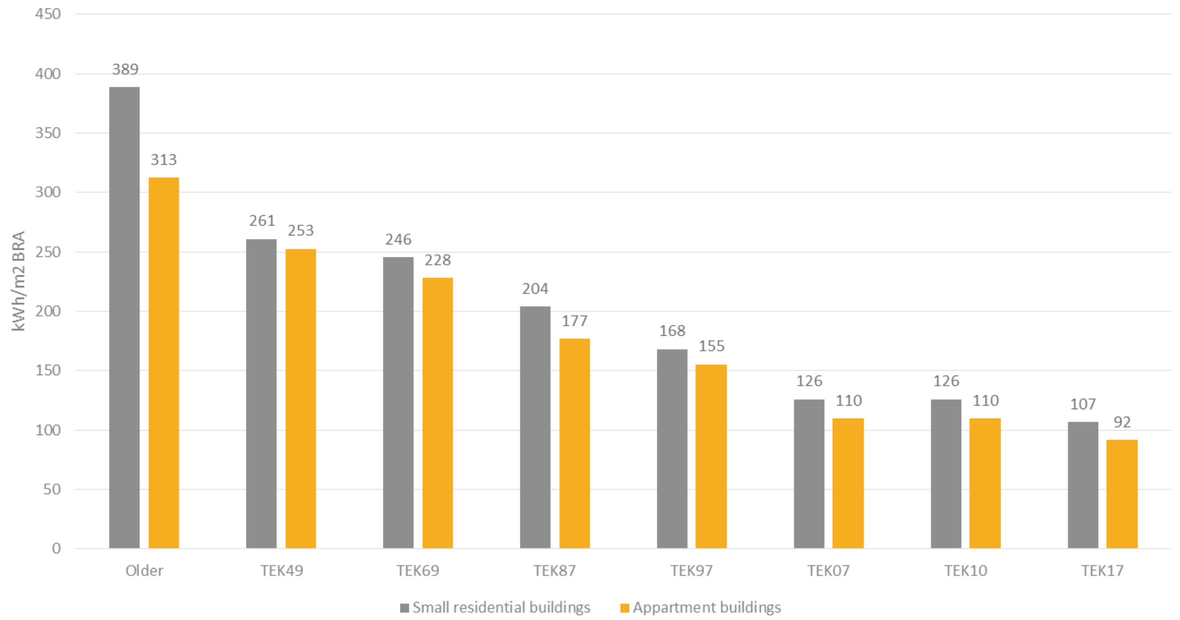


Figure 2 Development in calculated specific net energy demand based on building code and building tradition, (Multiconsult, simulated in SIMIEN)

Net energy demand is calculated using building models 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 to 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. 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 with no heat recovery. In effect, indoor air quality is assumed independent of building year. This is the same methodology as used in the Norwegian EPC-system.

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

Table 1 Specific energy demand calculated for model buildings

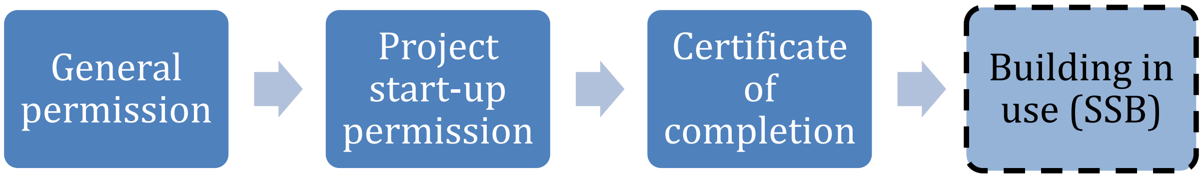
Table 1 includes the specific energy demand calculated by using the standard model buildings for the building codes relevant for identifying the top 9 % most energy efficient residential buildings in Norway.

The building codes are having a significant effect on energy efficiency. An investigation of the energy performance of buildings registered in the EPC database younger than 1997 show a clear improvement in the calculated energy 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 of 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 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.

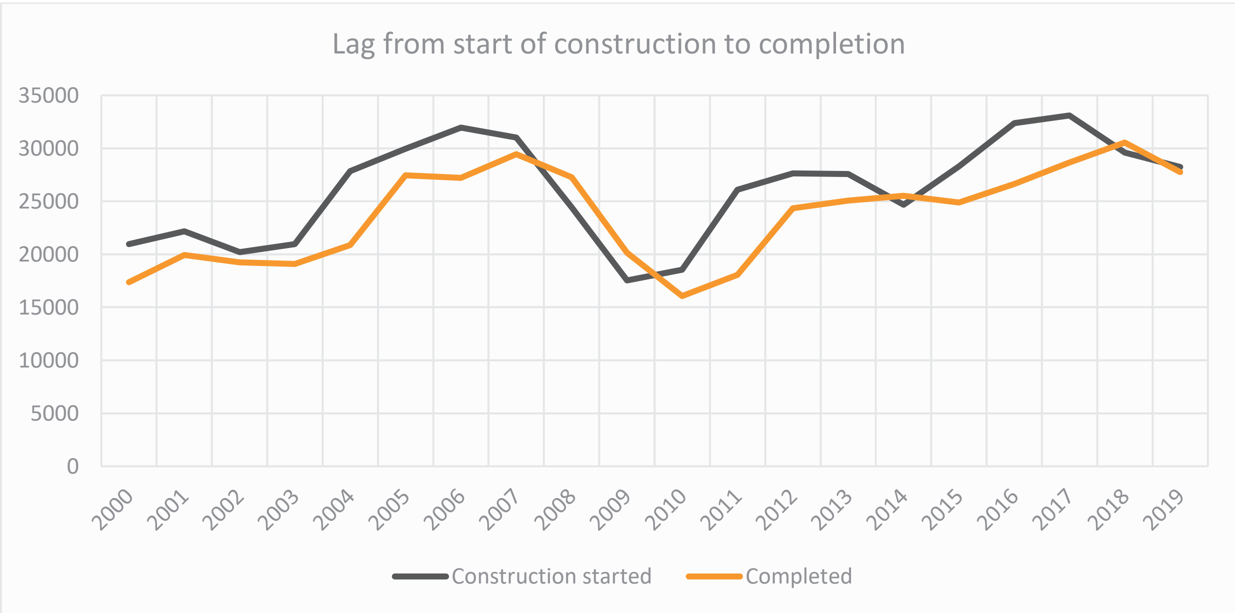


Figure 3 Project start-up and completion (Statistics Norway, bygningsarealstatistikken)

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

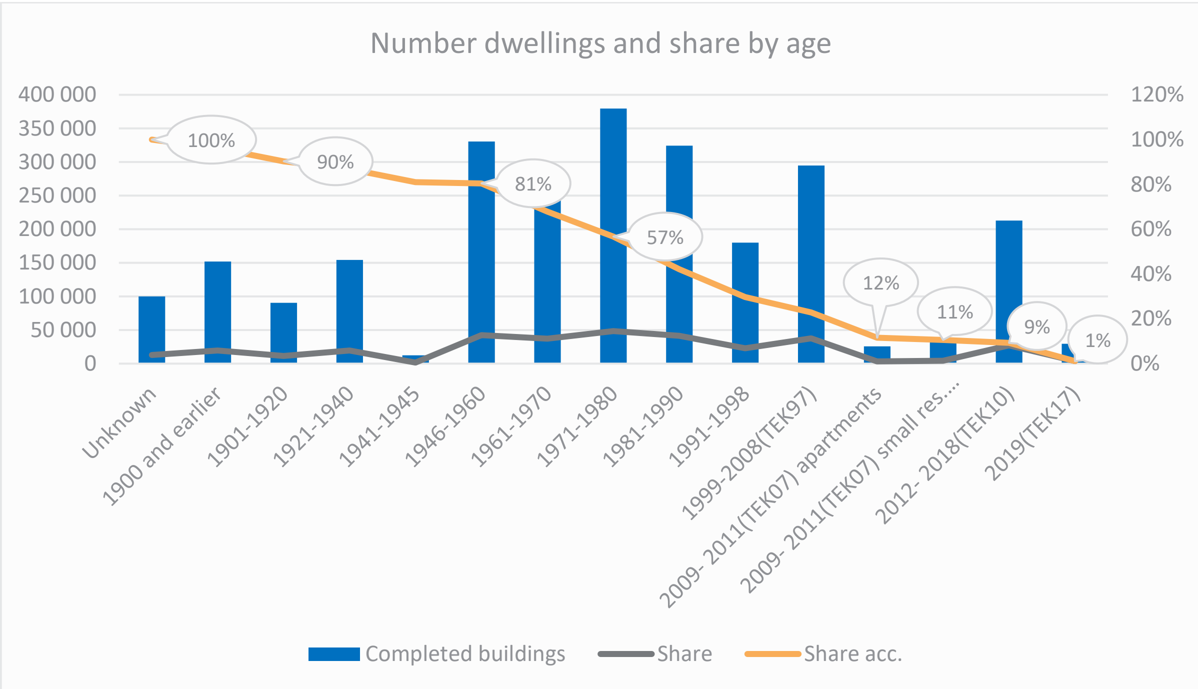


Figure 4 Age and building code distribution of dwellings (Statistics Norway[6] and Multiconsult)

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 9% of the total stock. Based on theoretical energy demand in the same building stock, the same 9% of the stock makes up for only 3,3% of the energy demand in residential buildings (Figure 5) and 3% of the related CO_2- emissions (Figure 6). The difference between energy demand and CO_2-emissions are due to the slightly less CO_2-intensive heating solutions in newer buildings.

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

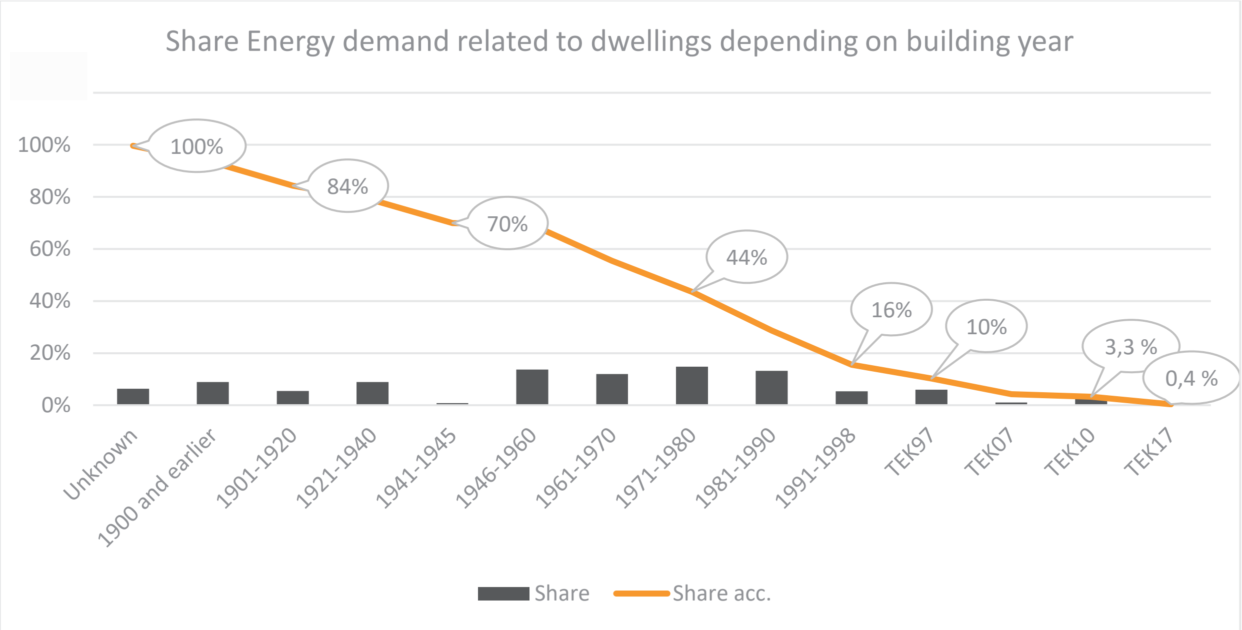


Figure 5 The building stock's relative share of energy demand dependent on building year and code (Statistics Norway and Multiconsult)

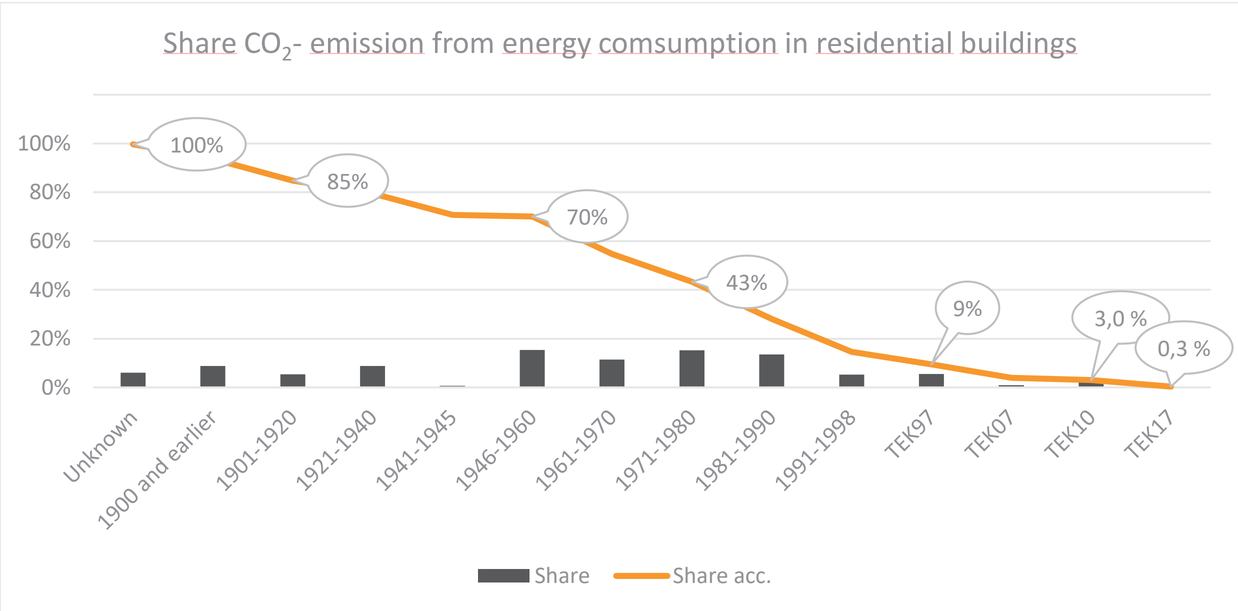


Figure 6 The building stock's relative share of CO_2 –emissions related to energy demand dependent on building year and code (Statistics Norway and Multiconsult)

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.

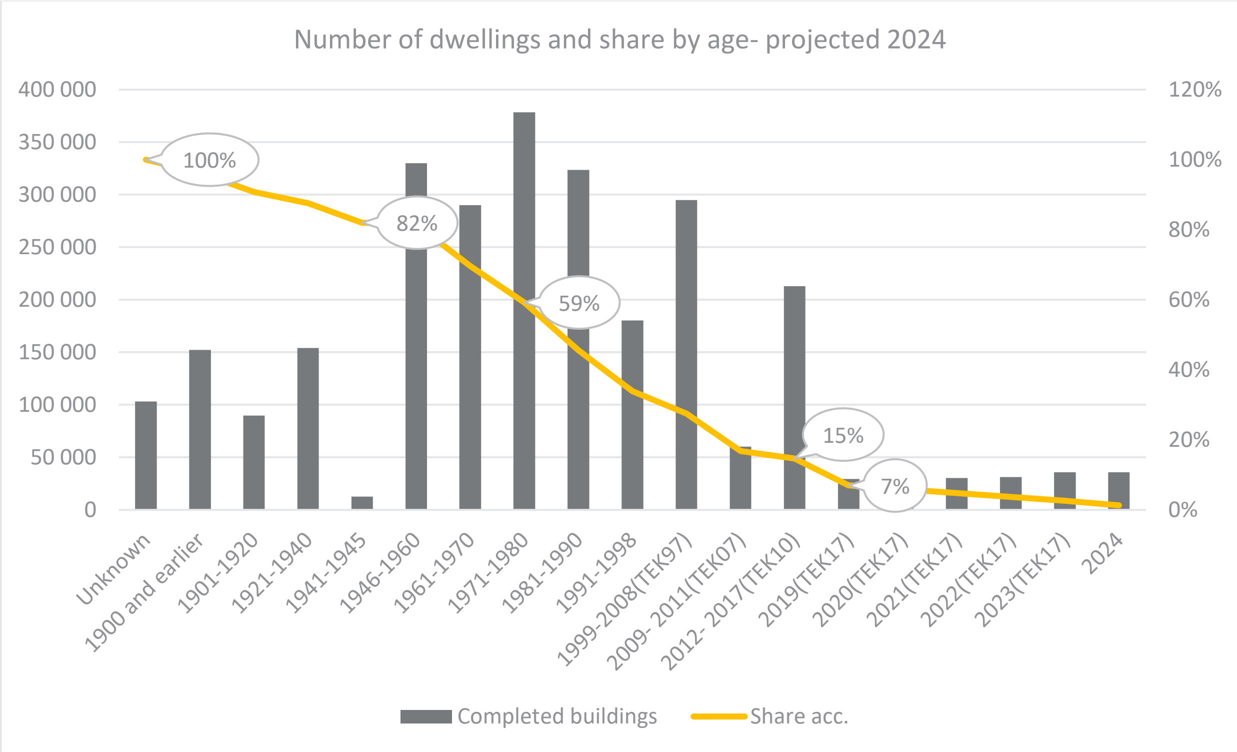


Figure 7 Age and building code distribution of dwellings projected in ultimo 2024 (Statistics Norway, NVE and Multiconsult)

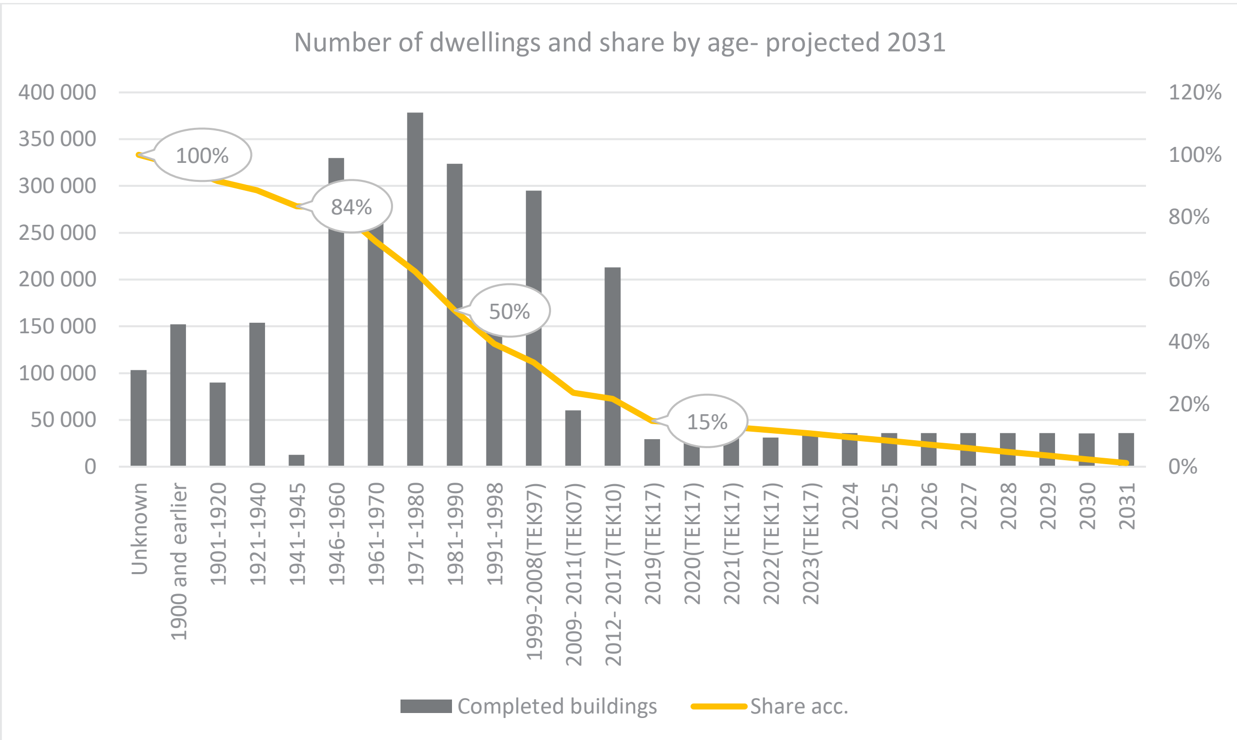


Figure 8 Age and building code distribution of dwellings projected in ultimo 2031 (Statistics Norway, NVE and Multiconsult)

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. The building stock data indicates that 9 % 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 Norwegian residential building stock is 253 kWh/m^2. Building code TEK10 and TEK17 gives an average specific energy demand for existing houses and apartments, weighted for actual stock, of 119 kWh/m^2.

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 and B are eligible as green residential buildings according to this criterion.

The Energy Certificate Performance System became operative in 2010. It was made obligatory 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 building with EPCs in Norway are distributed by building code, and their certificate label.

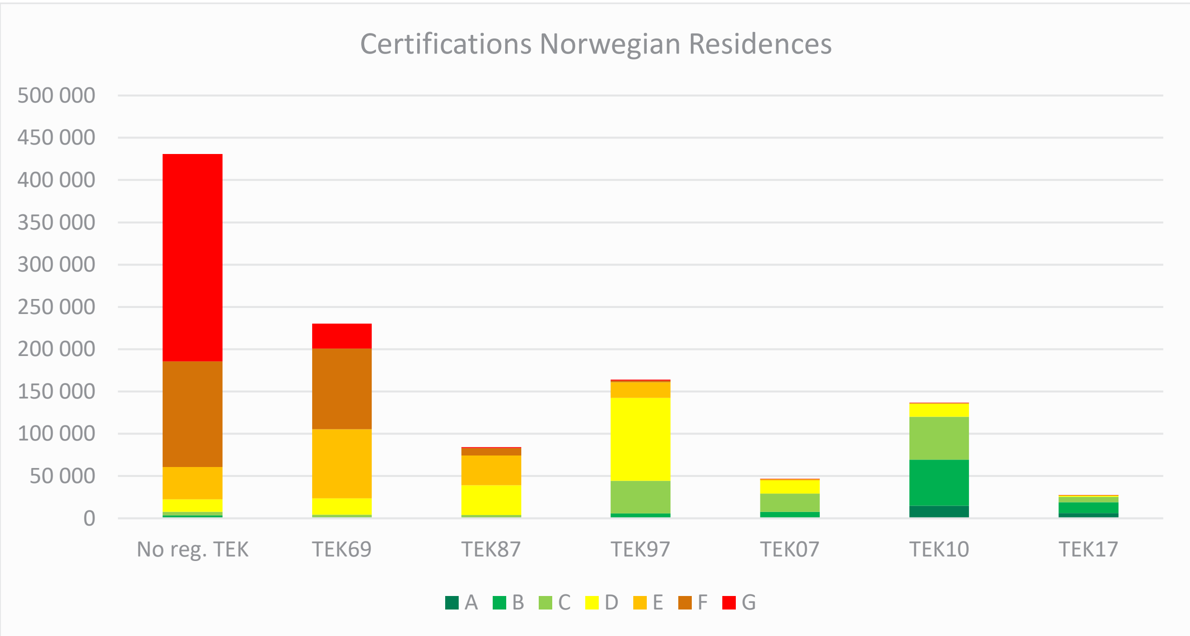


Figure 9 Residences in Norway with Energy Performance Certificates distributed per building code and energy grade the EPC system. The numbers are based on statistics from the EPC database (representative for 43 % of the total building stock).

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 building stock equal to 43 %.

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. This 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 m^2 heated space (kWh/m^2)							
	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/m^2

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 code of 07/10, with an assumed moderate system efficiency for the building's energy system.

Residences built after the building code of 07/10, as are included in criteria 1, will hence mostly get a C or better, but might also get a D. Extracting only buildings built before 2009 from the database, 5 % of the total registered buildings have a B 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.

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.

Particularly for apartments, the defined limit value between C / D in the grading system is set for an average apartment. An apartment in the top or bottom floor or at the corner will have a higher heat loss, and will most likely get a D, and in some rare cases even an E, even though the building code of 07/10 is used. 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 large part of the certifications are done in the simplified registration mode, and not by professionals, a larger share of existing TEK07-buildings do get a D, and in some rare cases even an E. Another reason why some existing houses and apartments built after the code of 07/10 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 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 8 shows the energy grades in the already granted certificates to Norwegian residential buildings.

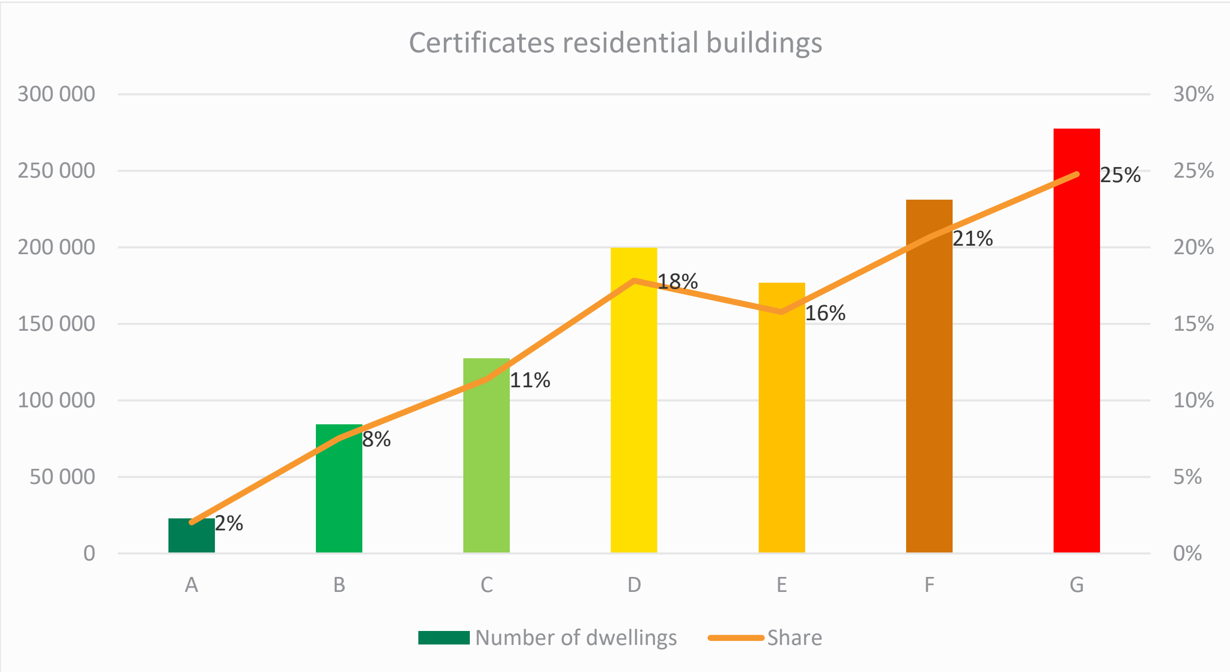


Figure 10 Energy Performance Certificates by grade- residential buildings only, representative only of buildings with EPCs (Source: energimerking.no, September 2020)

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 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.

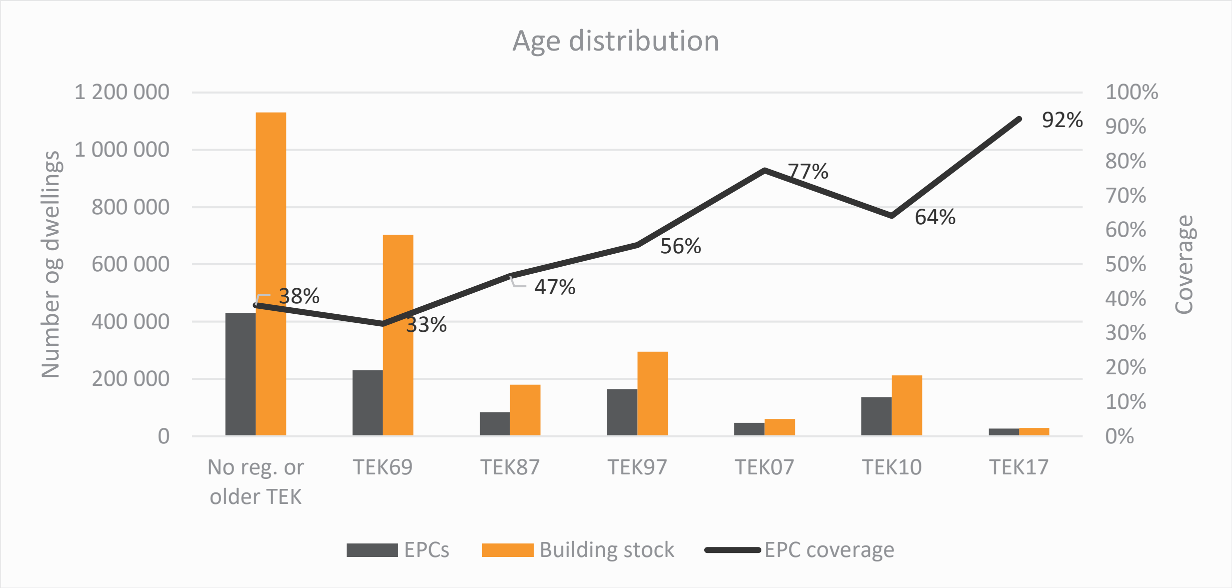


Figure 11 Age distribution in Energy Performance Certificates vs. actual residential building stock and EPC coverage by building year (Source: energimerking.no and Statistics Norway, September 2020)

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. 14 % of the residents would perform according to a C or better. 6% of the residences would have a B or better.

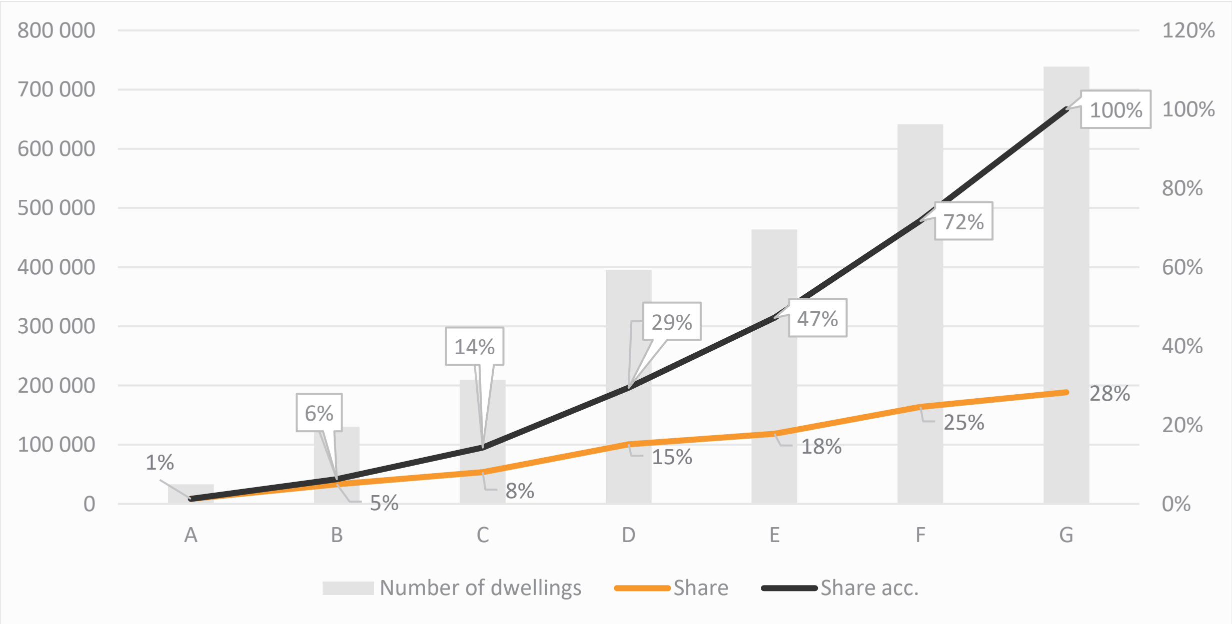


Figure 12 EPCs extrapolated to include the whole residential building stock (Source: energimerking.no and Statistics Norway, Multiconsult, September 2020)

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. The EPC data indicates that 6% 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. In this case, we are looking to identify buildings that already have improved energy performance in this scale. To identify relevant residential buildings, the EPC-labels are compared to calculated energy demand for different TEK periods (shown in figure 2). Energy supply is then assumed to be electricity as the baseline, heating included. This is a conservative assumption as it gives the building a lower specific energy demand as a starting point than a moderate system efficiency which is the basis for the energy labeling scale. In the figures below calculated energy delivered is shown for respectively a small residential building 160 m^2 and apartment 65 m^2 (models which make up the basis for the energy grade scale) for different building periods (building codes) shown in the grade scale (coloured background). In the following figures the EPC grade scale[7] with square meter adjustments as in table 2 make up the limit values of the background, and the TEK limit values as in figure 2 make up the columns.

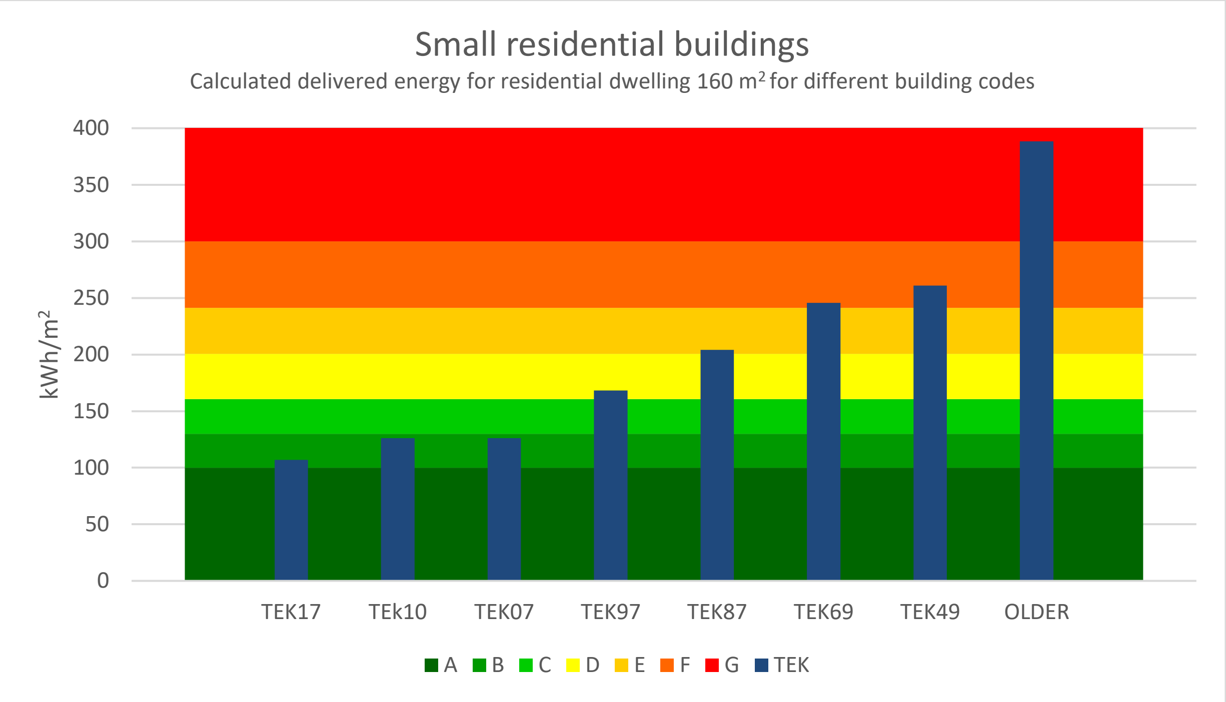


Figure 13 EPC label limit values and TEK - small residential buildings

[7] https://www.energimerking.no/no/energimerking-bygg/om-energimerkesystemet-og-regelverket/karakterskalaen/

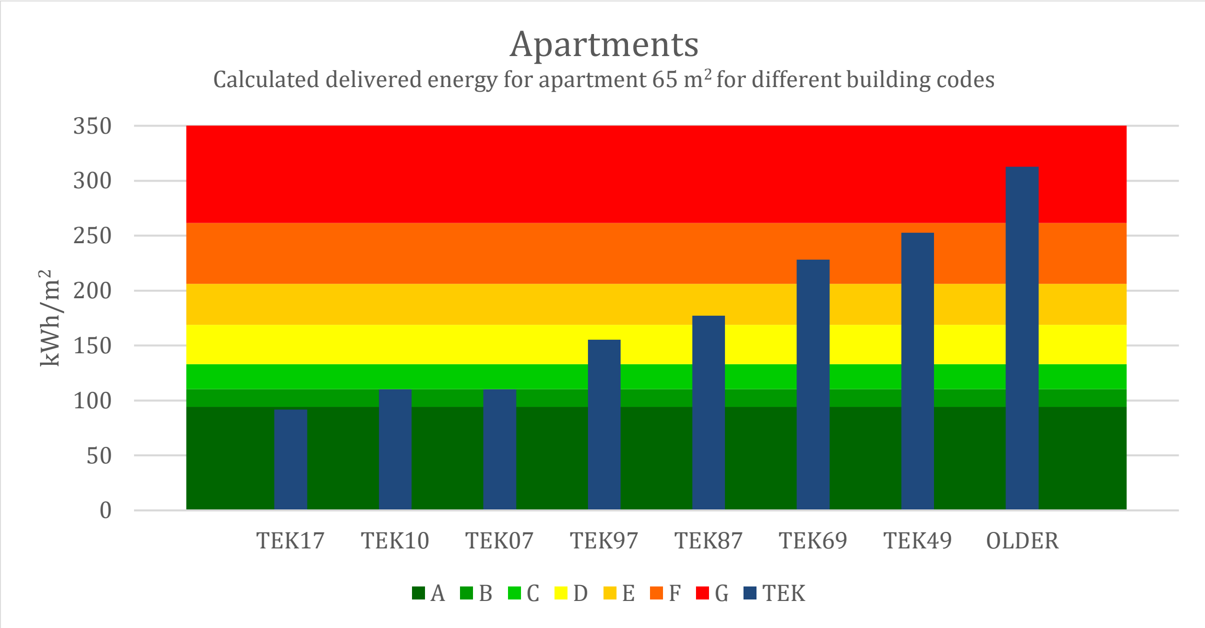


Figure 14 EPC label limit values and TEK – apartments/apartments buildings

A building that has undergone adequate measures on the building envelope (insulation, changing windows, etc.) and/or heat recovery in ventilation and/ or installed highly efficient energy supply (heat pump, solar energy) can thus qualify. A percentage improvement is calculated to the mean value for each grade-interval, and it requires at least 30% improvement to qualify. This is shown in the figures below.

Figure 15 illustrates the calculated delivered energy for a small residential building 160 m^2 for different building codes, and with minimum 30 % improvement, shown in the corresponding EPC grade scale in the background.

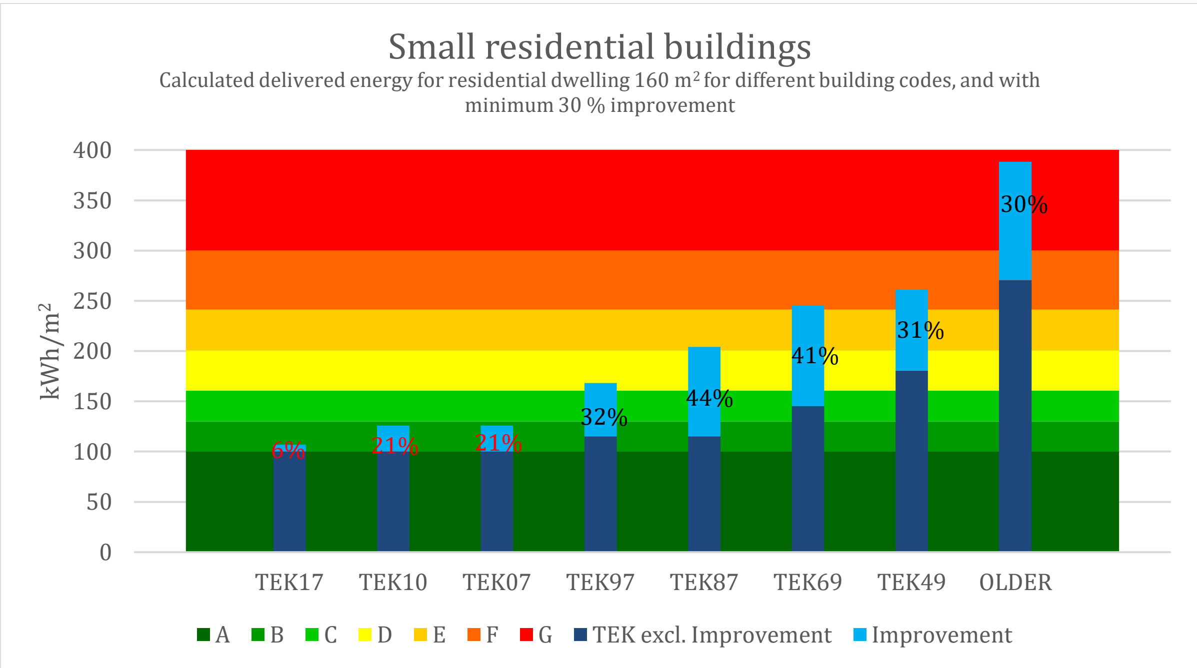


Figure 15 EPC label limit values and improvements from TEK to qualify– small residential buildings

Figure 16 illustrates the calculated delivered energy for apartment 65 m^2 for different building codes, with minimum 30 % improvement, shown in the corresponding EPC grade scale in the background.

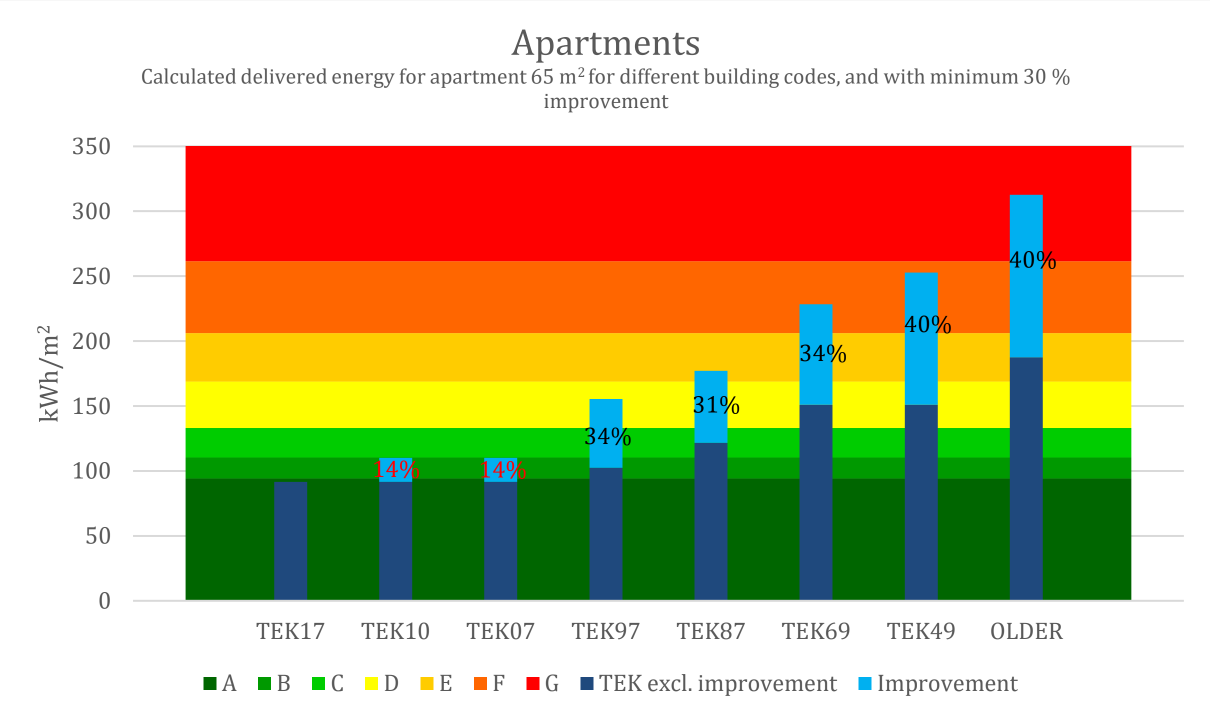


Figure 16 EPC label limit values and improvements from TEK to qualify– apartments/apartments buildings

The figures show that for a building built after the building code of TEK07 or later, the energy label A does not qualify according to this criterion, however, qualifies under criterion 2. This is due to the fact that there is no good estimate on a mean value for specific energy demand for an A.

2.3.1 Eligibility under criterion 3

Refurbished residential buildings with EPC-labels which corresponds to at least a 30 % improvement in energy efficiency compared to the calculated specific delivered energy [kWh/m^2] based on building code in the year of construction. A lower threshold is set at an achieved energy label D.

These buildings may be identified using the EPC database and prepared tables below that verify which EPC-label corresponds to at least 30% energy reduction for the given construction year.

Due to the introduced threshold of not qualifying energy labels below D, **small residential buildings** with an energy label D and built according to building code TEK 49 or older codes qualify to this criterion and not criterion 1 or 2 (circled in table 3).

For **apartments**, the threshold of not qualifying energy labels below D lead to apartments built according to a building code TEK 69, TEK 49 or older codes and an energy label D qualify solely to this criterion (circled in table 4).

Building year:	after 2018	2012-2018	2009-2018	1999-2008	1989-1998	1971-19887	1951-1970	before 1951
Building code:	TEK17	TEK10	TEK07	TEK97	TEK87	TEK69	TEK49	OLDER
Calculated delivered energy [kWh/m²,year]:	106,9	126	126	168,2	204,2	245,6	261	388,5
Improvement (average)								
A	6 %	21 %	21 %	41 %	51 %	59 %	62 %	74 %
B		9 %	9 %	32 %	44 %	53 %	56 %	70 %
C				14 %	29 %	41 %	44 %	63 %
D					12 %	26 %	31 %	54 %
E						10 %	15 %	43 %
F								30 %

Table 3 Eligible small residential building

Building year:	after 2018	2012-2018	2009-2018	1999-2008	1989-1998	1971-19887	1951-1970	before 1951
Building code:	TEK17	TEK10	TEK07	TEK97	TEK87	TEK69	TEK49	OLDER
Calculated delivered energy [kWh/m²,year]:	91,7	110,1	110,1	155,4	177,2	228,3	252,7	312,7
Improvement (average)								
A		14 %	14 %	39 %	47 %	59 %	63 %	70 %
B				34 %	42 %	55 %	60 %	67 %
C				22 %	31 %	47 %	52 %	61 %
D					15 %	34 %	40 %	52 %
E						18 %	26 %	40 %
F								25 %

Table 4 Eligible apartments

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.

Eligible Commercial Green Buildings for SpareBank 1 Østlandet must meet the following eligibility criterion:

Hotel and restaurant buildings. New or existing Norwegian hotel 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 hotel and restaurant building stock. 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.

Office buildings, retail buildings, industrial buildings and warehouses. New or existing Norwegian office and retail buildings, industrial buildings and warehouses 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 office and commercial building stock. 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.

Data quality and sources

To establish a robust methodology, data on number and age of existing buildings are crucial, and for impact assessments, the relevant factors are building area and age.

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 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]

[8] Enova publication "Potensial- og barrierestudie Energieffektivisering i norske yrkesbygg», Multiconsult 2011

3.1 New or existing buildings within the relevant building categories that comply with the chosen criteria

New or existing Norwegian hotel and restaurant buildings that comply with the Norwegian building code of 2010 (TEK10) or later codes: 6.2 %

New or existing Norwegian office buildings that comply with the Norwegian building code of 2010 (TEK10) or later codes: 4.5 %

New or existing Norwegian retail/commercial buildings that comply with the Norwegian building code of 2010 (TEK10) or later codes: 4.5 %

New or existing Norwegian small industrial buildings and warehouses that comply with the Norwegian building code of 2010 (TEK10) or later codes: 11.9 %

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

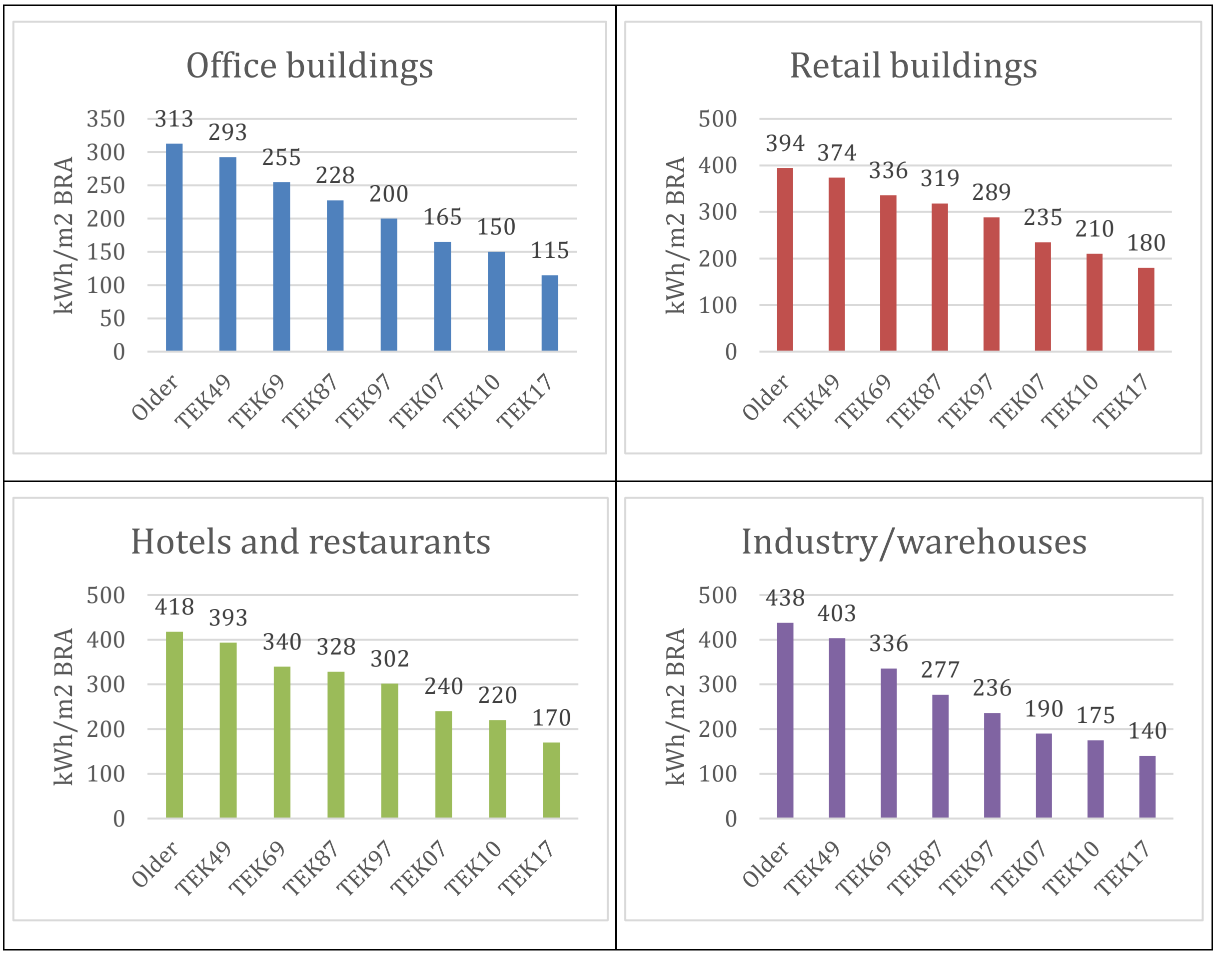


Figure 17 Development in calculated specific net energy demand based on building code and building tradition, (Multiconsult, simulated in SIMIEN)

Net energy demand is calculated for model buildings used for defining the building code. The result presented in figure 15 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 17 present 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 to 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 NS3031:2014, experience with building tradition is included. Indoor air quality is assumed not to be dependent on building year. By that, it is assumed that older buildings (TEK69 - 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 such older buildings underwent such upgrades in the 1980's and 1990's. 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	**Commercial building**	**Industry/warehouse**	**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 5 Specific energy demand as from the building codes

Table 5 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 are having 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 things 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, six months to a year is a reasonable timespan for commercial buildings in this phase. As an illustration, the figure below, based on statistics from Statistics Norway (SSB), indicates that approximately six months to a year construction period is standard for office buildings.

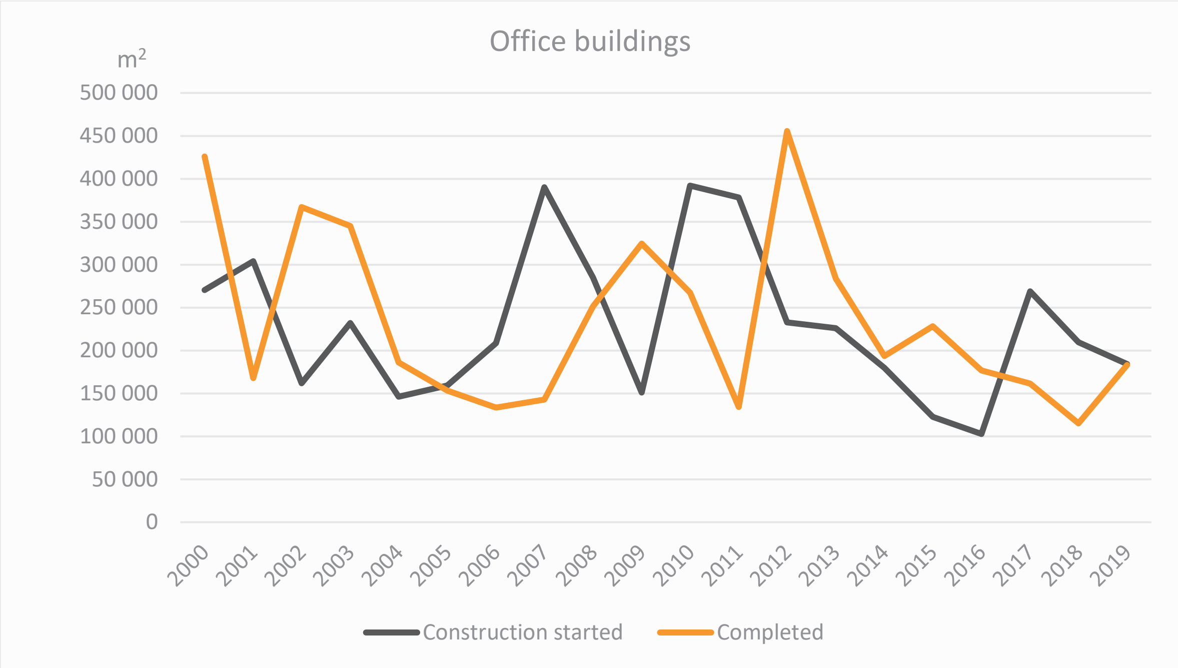


Figure 18 Project start-up and completion (Statistics Norway, bygningsarealstatistikken)

Based on the discussions on time for design and construction, we regard a time-lag of two years for offices, retail and industry/ warehouses between code implementation and buildings 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 19 above shows how the Norwegian office building stock is distributed by age. The figure shows also how office buildings finished in 2012 and later (built according to TEK10 and TEK17) amount to 4.5 % of the total stock. The three figures below include the same information for the other three subcategories.

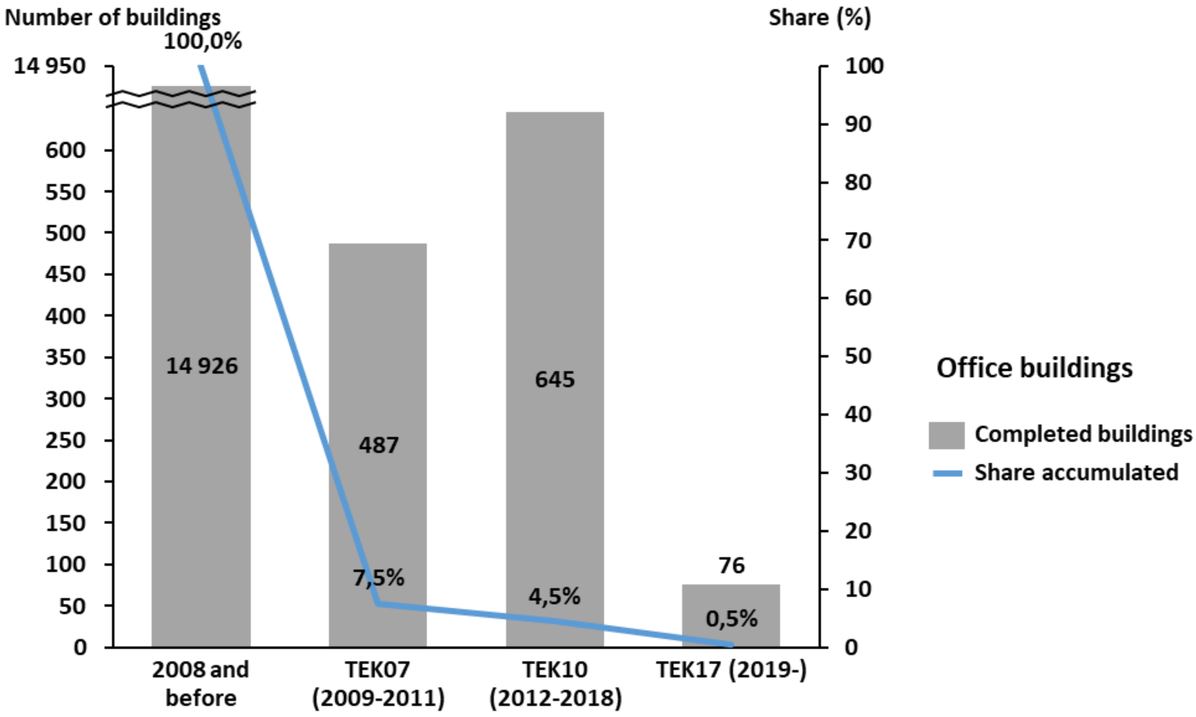


*Figure 19 Age and building code distribution of **office buildings** (Statistics Norway and Multiconsult)*

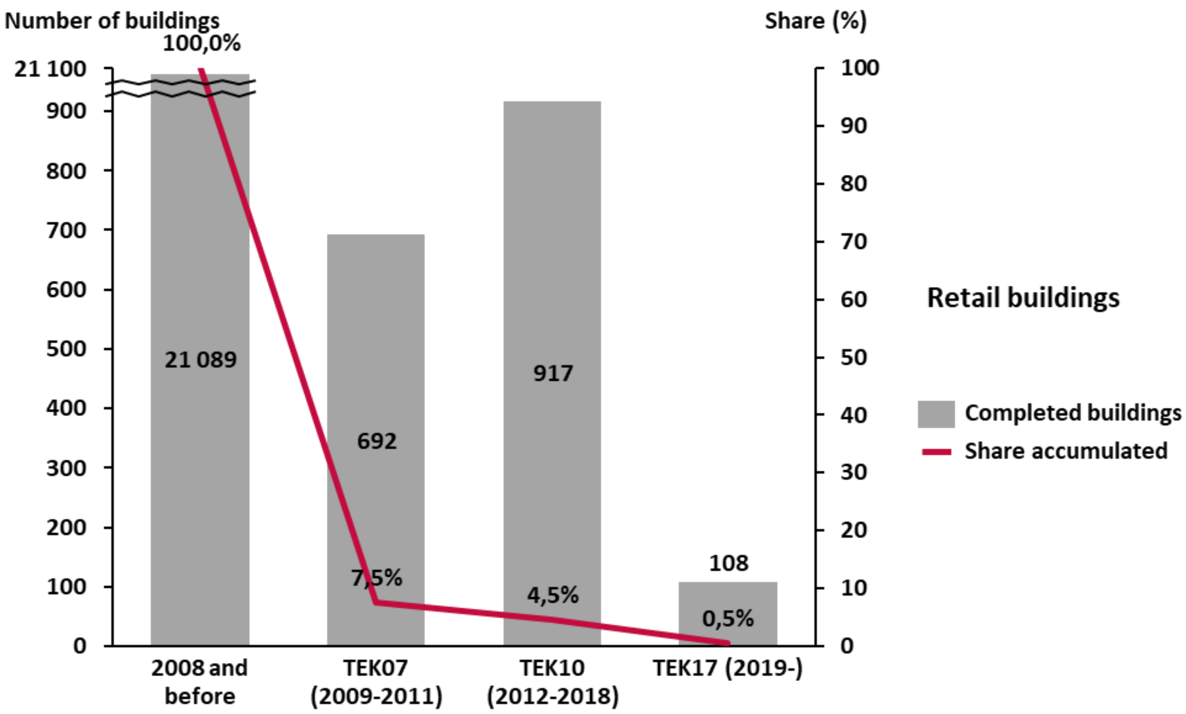


*Figure 20 Age and building code distribution of **commercial/retail buildings** (Statistics Norway and Multiconsult)*

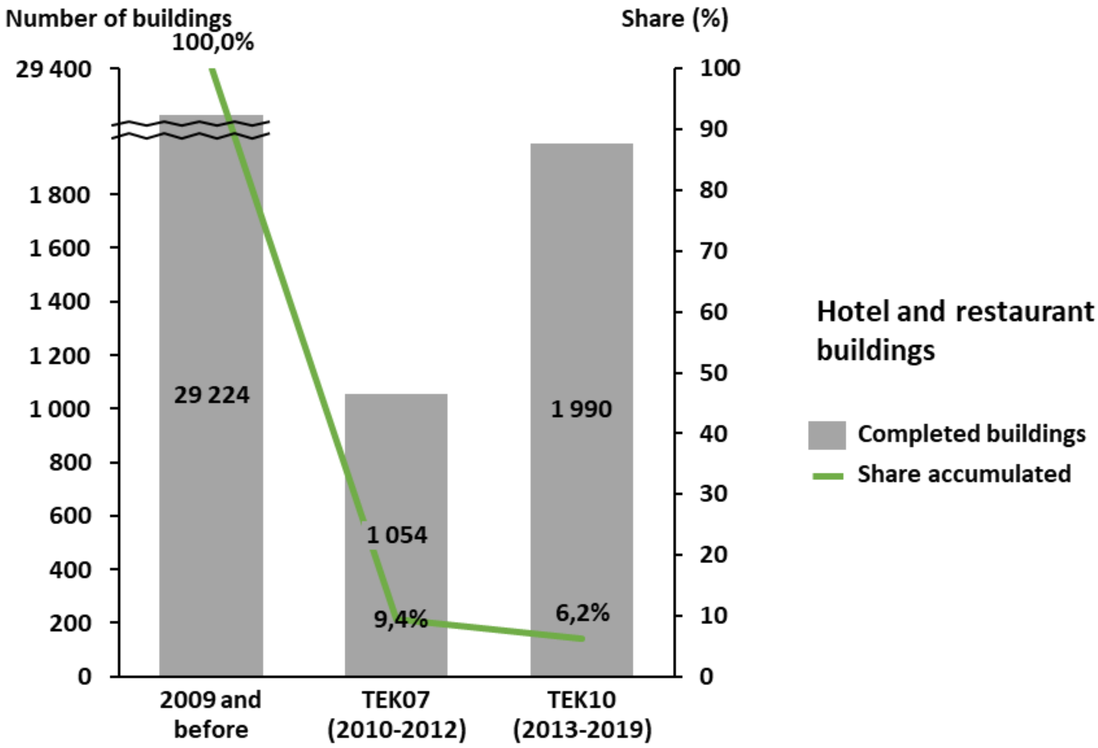


Figure 21 Age and building code distribution of ***hotel and restaurant buildings*** *(Statistics Norway and Multiconsult)*

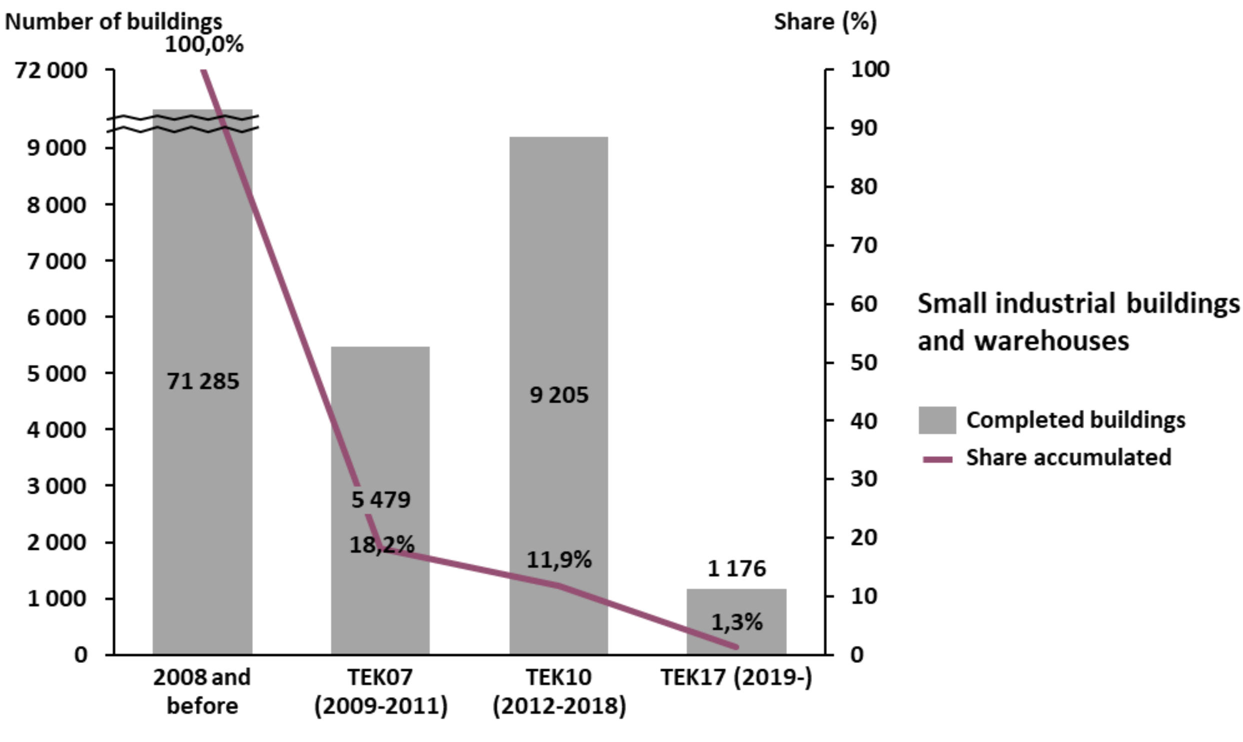


Figure 22 Age and building code distribution of ***small industrial buildings and warehouses*** *(Statistics Norway and Multiconsult)*

Figures 23 through 26 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.

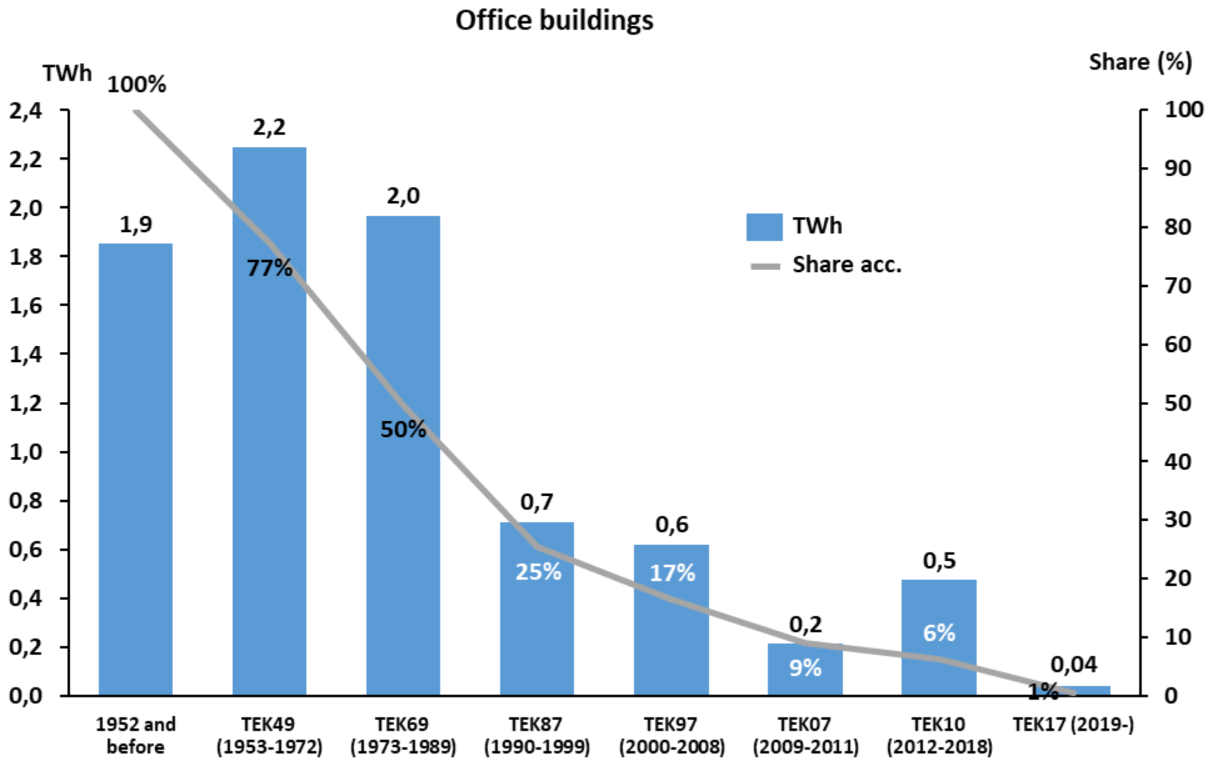


*Figure 23 Share energy demand related to **office buildings** depending on building year*

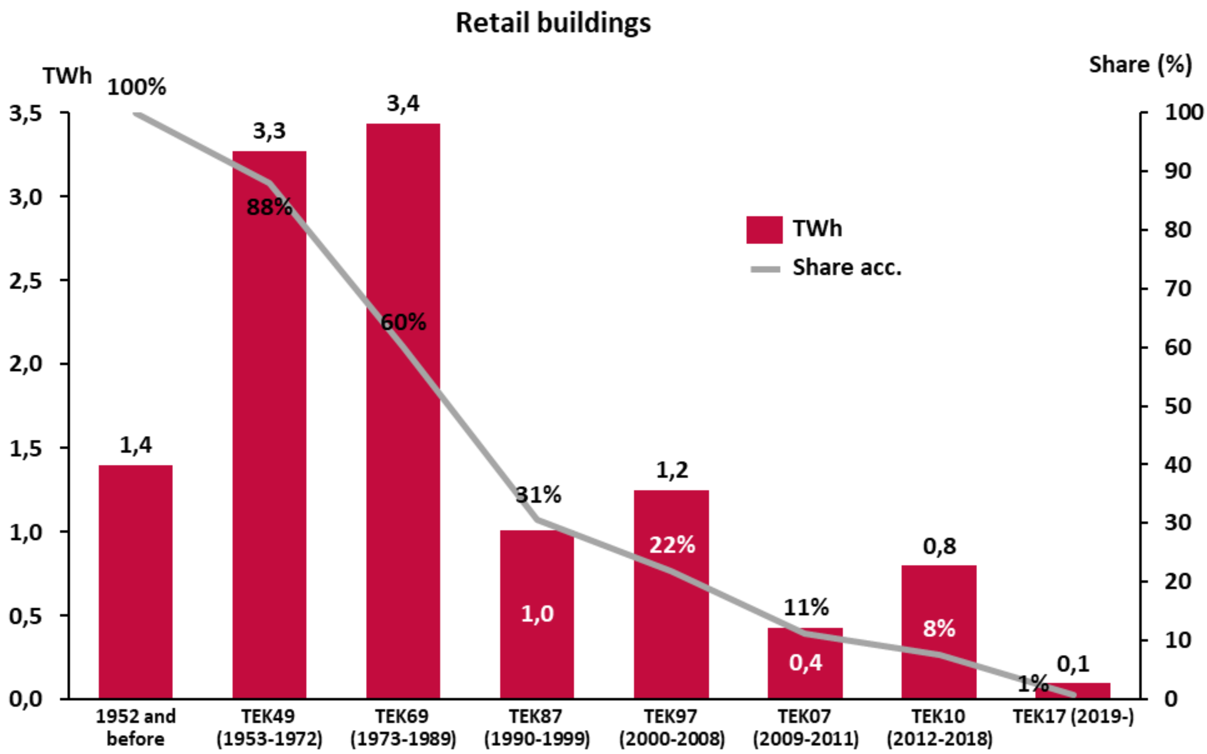


*Figure 24 Share energy demand related to **retail buildings** depending on building year*

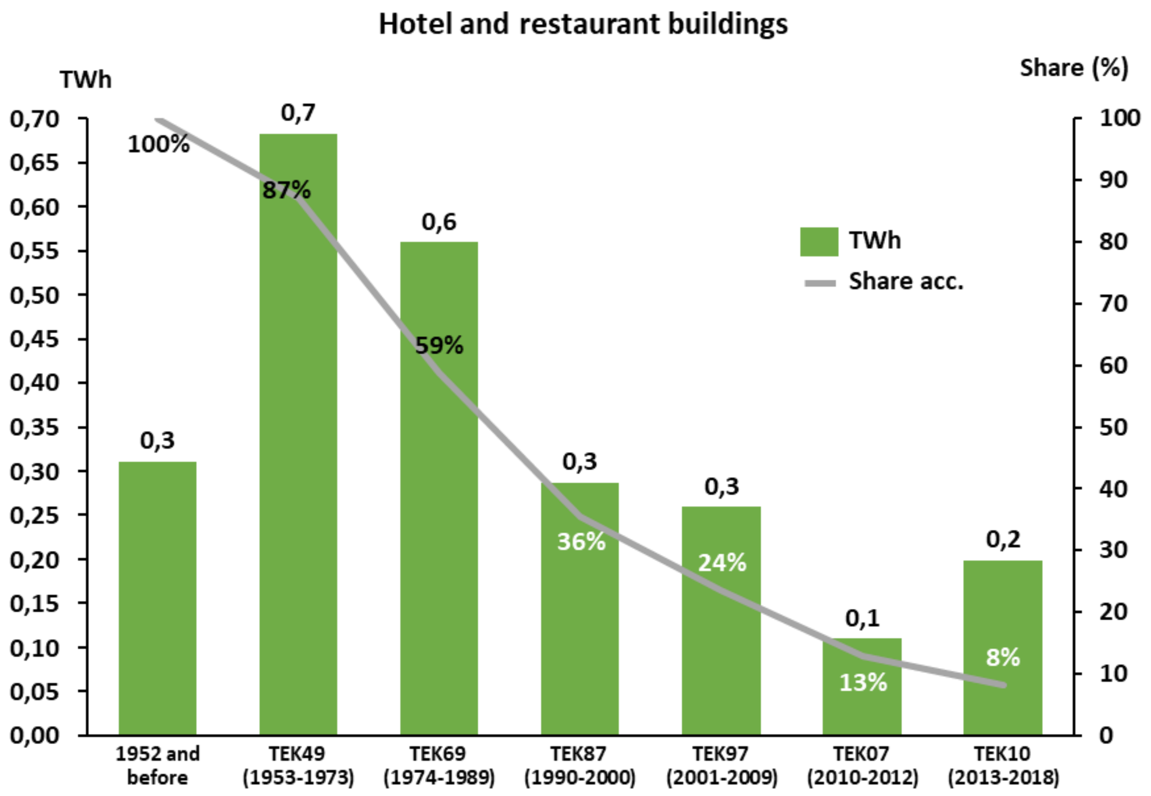


*Figure 25 Share energy demand related to **hotel and restaurant buildings** depending on building year*

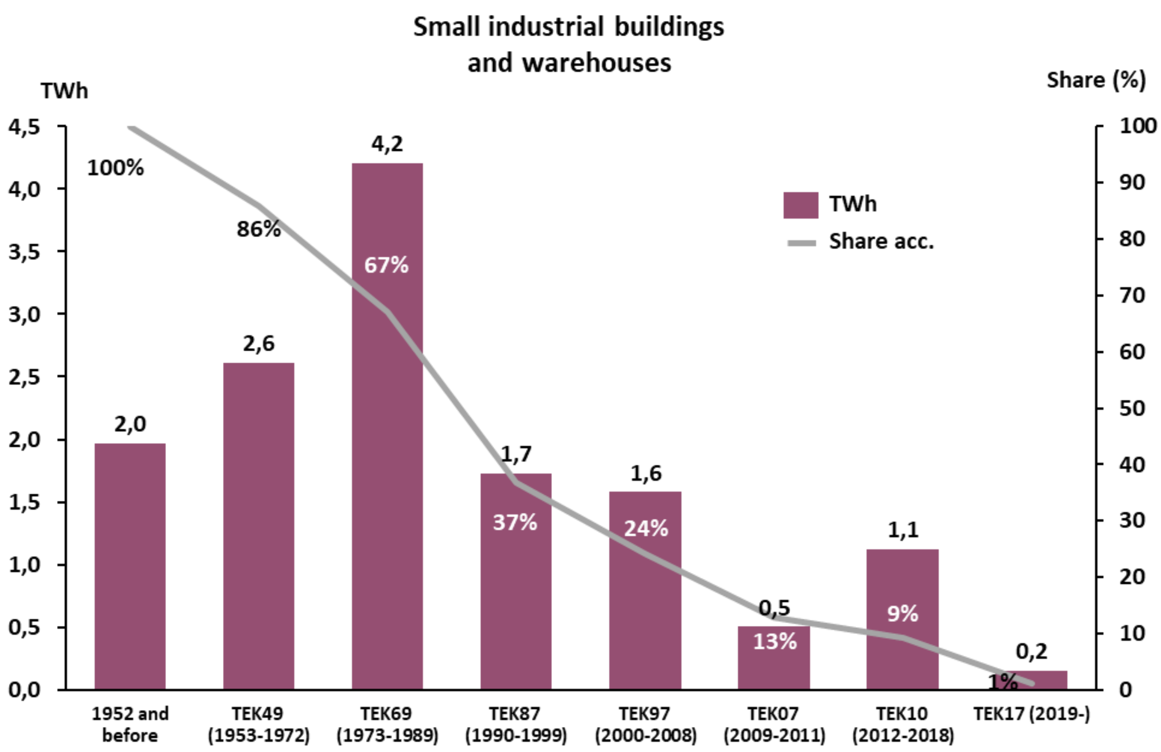


*Figure 26 Share energy demand related to **small industrial buildings and warehouses** depending on building year*

3.1.3 *Eligibility under SpareBank 1 Østlandet's 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 17 and information on the commercial building stock in figures 17 through 20, 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.

	Total stock average [kWh/m^2]	Qualifying building years average [kWh/m^2]	Reduction [kWh/m^2]
Office buildings	251	147	42 %
Commercial/retail buildings	323	206	36 %
Hotel buildings	309	184	41 %
Small industry and warehouses	297	169	43 %

Table 6 Average specific energy demand for the building stock; whole stock, part eligible according to criteria and reduction

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

Refurbished buildings with an improved energy efficiency of at least 30 % or more are eligible for Green Bonds. This is aligned with the CBI taxonomy, where buildings qualify after being refurbished to a standard resulting in at least a 30 % reduction in energy demand[9]. In this case, we are looking to identify buildings that already have improved energy performance in this scale. To identify relevant buildings, the EPC database is a suited source of data. As well as only including a small percentage of the total commercial building stock, the data only include current certificates and do not include historic certificates for the buildings. The historic EPC-labels may, however, be made available at a later stage or retrieved from the customers, so two approaches are included in this criterion;

- one solely based on the EPCs, current and historic, and
- one approach based on the current certificate compared to calculated energy demand for different building code (TEK) periods (shown in Figure 17).

Table 7 below includes limit values for qualifying to the different energy grades in the EPC system[10] that make up the basis for the following calculations. It is important to note that these values are calculated with a different system boundary than the building code requirements.

Building categories	Delivered energy per m^2 heated area (kWh/m^2)						
	A	**B**	**C**	**D**	**E**	**F**	**G**
Office	90	115	145	180	220	275	> F
Hotel and restaurant	140	190	240	290	340	415	> F
Commercial	115	160	210	255	300	375	> F
Industry/warehouse	105	145	185	250	315	405	> F

Table 7 Limit values in specific energy demand for energy grades in the EPC system (Source: energimerking.no)

[9] https://www.climatebonds.net/standard/buildings/upgrade
[10] https://www.energimerking.no/no/energimerking-bygg/om-energimerkesystemet-og-regelverket/karakterskalaen/

Table 8 below presents calculated reduction in energy demand for an improvement of two steps on the energy grade scale in the Norwegian EPC system. To be able to include buildings originally only qualifying for a G, the values are calculated based on average values, and the average G building is assumed to have a specific energy demand as far off from the limit value for F as the average F is from the limit value for E ($G_{av}=F_{lim}+(F_{lim}-E_{lim})/2$).

This can be exemplified by an office building with an F (specific energy demand as average of the limit value for F and limit value for E) will, with a 34 % reduction in energy demand end up with a specific energy demand average of the limit value for a C and the limit value for a D and with a D as new energy grade.

	Two-step improvement D → B	Two-step improvement E → C	Two-step improvement F → D	Two-step improvement G → E
Office buildings	37 %	35 %	34 %	34 %
Commercial buildings	41 %	33 %	31 %	33 %
Hotel buildings	38 %	32 %	30 %	30 %
Small industry and warehouses	43 %	42 %	40 %	37 %

Table 8 Improvement in specific energy demand from a two-step improvement in energy grade in EPC system calculated for average values.

3.2.1 Eligibility under building upgrade criteria

Refurbished Commercial buildings in Norway with an improved energy efficiency of 30 %:

i. Refurbished Norwegian commercial buildings with at least two steps of improvement in energy label compared to the calculated label based on building code in the year of construction.

ii. Refurbished Norwegian commercial buildings with at least a 30 % improvement in calculated energy efficiency, kWh/m^2 delivered energy to the building, compared to the calculated energy efficiency based on building code in the year of construction.

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[11]. 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 (EU28+ Norway) consumption mix	136
Norwegian consumption mix	18

Table 9 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 9. Using a European mix is in line with Nordic Public Sector Issuers: Position Paper on Green Bonds Impact Reporting (February 2020)[12]. 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 SpareBank 1 Østlandet's portfolio and the objects used in the following analysis have been identified as eligible buildings for green bonds according to SpareBank 1 Østlandet's eligibility criteria related to residential and commercial buildings.

As these are portfolios including a large number of assets, the impact is presented both for the total impact related to the objects and impact scaled to reflect the bank's engagement. The latter is calculated by the loan-to-value ratio.

[11] The expected life of a building from 2010 is 60 years
[12] 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 253 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 object will occur. The eligible residential buildings in SpareBank 1 Østlandet's portfolio is estimated to amount to 0.8 million square meters, whereas the major part, 6781 objects, is eligible through the building code criterion. Of the 274 objects qualifying according to the EPC-criterion, 7% are A's and the rest have energy label B.

Data on dwelling area was for this analysis not available so the qualifying building area is calculated based on average area per building sub-category derived from national statistics (Statistics Norway[13]).

	Number of units			Area qualifying buildings in portfolio [m^2]			Area qualifying buildings in portfolio [m^2]
	TEK10	TEK17	EPC A-B	TEK10	TEK17	EPC A-B	
Apartments	2729	661	106	196488	47592	7632	251712
Undetached houses	0	0	0	0	0	0	0
Detached houses	2012	533	134	344052	91143	22914	458109
Semi-detached houses	678	168	34	84750	21000	4250	110000
Sum	5419	1362	274	625290	159735	34796	819821

Table 10 Eligible residential objects and qualifying building area

Based on the calculated figures in table 10, the energy efficiency of this part of the portfolio is estimated. All these residential buildings are not included in one single bond issuance.

The calculated average specific energy demand for the criterion 1 eligible assets is 119 kWh/m^2. This is 53 % 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.

	Reduced energy compared to baseline	Reduced CO_2-emissions compared to baseline
Eligible buildings in portfolio	**109 GWh/year**	**13,514 tons CO_2/year**
Scaled by engagement	**73 GWh/year**	**9,029 tons CO_2/year**

Table 11 Performance of eligible residential objects compared to average building stock

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

4.2 Commercial buildings

The eligible buildings in SpareBank 1 Østlandet's commercial portfolio is estimated to amount to ~210,000 square meters. 46 objects are found eligible according to a building code criterion, and of the 7 buildings identified as eligible according to an EPC- criterion only, all have the energy label B. The buildings qualifying according to both 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.

	Area qualifying buildings in portfolio [m^2]			
	TEK10	TEK17	EPC B	Total
Office buildings	25,955	1,867	33,910	61,732
Retail/commercial buildings	69,168	5,138		74,306
Hotel and restaurant buildings	6,980		26,841	33,821
Industry and small warehouse buildings	35,545	2,400	2,050	39,995
Sum	137,648	9,405	62,801	209,854

Table 12 Eligible commercial objects and calculated building areas

Based on the calculated figures in tables 6 and 12, 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.

	Reduced energy compared to baseline	Reduced CO_2-emissions compared to baseline
Eligible buildings in portfolio	**25 GWh/year**	**3,099 tons CO_2/year**
Scaled by engagement	**13 GWh/year**	**1,589 tons CO_2/year**

Table 13 Performance of commercial eligible objects compared to average building stock

4.3 Impact commercial and residential buildings portfolio

The 7,100 unique eligible objects in SpareBank 1 Østlandet's commercial and residential portfolios combined, is estimated to amount to ~1 million square meters.

	Reduced energy compared to baseline	Reduced CO_2-emissions compared to baseline
Eligible buildings in portfolio	**134 GWh/year**	**16,613 tons CO_2/year**
Scaled by engagement	**86 GWh/year**	**10,618 tons CO_2/year**

Table 14 Performance of eligible objects compared to average building stock