Housing associations and energy efficiency in the North Sea Region

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Smart Renovation Factory by INDU-ZERO

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Index

Introduction

INDU-ZERO is working on developing renovation packages towards energy neutrality, as a solution for quick and inexpensive sustainability improvements of existing homes in the North Sea Region. The aim of the design is to produce standard renovation packages at an industrial scale (at least 15,000 per year). The packages will contain various components that are necessary to make homes sustainable, such as insulation material for walls and roofs, heat pumps, solar panels, energy converters and ventilation systems. The components will be put together in a way that is as circular and bio-based as possible. The aim is to be able to offer the total package of measures for half the current price.

Fifteen organisations from six countries are already working together to design a factory that can produce these renovation packages at an industrial scale. However, more insight in the housing market is required to understand which associations and organisations could be potentially interested in INDU-ZERO. In particular, the focus is on social or affordable housing, since it would be more feasible to carry out large-scale renovations in this sector, than in the private sector.

This report provides an overview of the way social or affordable housing are organised in the different countries of the North Sea Region. The questions it attemps to answer are as follows:

- How is social, public or cooperative housing organised in the various countries of the North Sea Region?
    - Which umbrella organisation represents the social, public or cooperative housing associations?
    - What share of the housing market is owned by these associations?
- What is known about the energy efficiency of the social, public or cooperative housing stock?
    - What are the characterics of the housing stock in this sector?
    - What efforts are currently being made to make this stock more energy efficient?

This report should contribute to a better understanding of the social housing market and energy efficiency in the different countries of the North Sea Region. Its goal is not to offer an in-depth analysis of each particular country, but rather to provide a concise overview. This should help INDU-ZERO to reach out to the relevant organisations in these countries and develop a communication strategy.

This report is the result of desk research. Information provided by Housing Europe has been the starting point of this study. Information about the particular countries was mostly publicly available through the websites of the umbrella organisations or national statistics bureaus, or in some cases specifically provided by these organisations upon request. Detailed information about dwelling typologies can be found on the websites of the European project EPISCOPE and the follow-up project TABULA.[1]

As this report will demonstrate, what constitutes 'social' housing is different in each country. In the Netherlands, social housing constitutes a large share of the housing stock (almost one third). In contrast, social housing in Norway and Sweden is only intended for (short-term) use by the most

[1] https://episcope.eu/welcome/ and http://webtool.building-typology.eu/?c=ie#bm

vulnerable groups and therefore constitutes only a very small sector. Therefore, it is better to look at *cooperative* housing in Norway and *public* housing sector in Sweden, which offer affordable housing but are open to everyone and thus constitute a much larger sector (respectively 20% and 16% of the housing stock). Table 1 offers an overview of the relevant organisations in the North Sea Region.

Table 1: Social, public and cooperative housing organisations in the North Sea Region

Country	Umbrella organisation	Number of dwellings (umbrella organisations)	Share of housing stock
Belgium - Brussels	Société du Logement de la Région de Bruxelles-Capitale (SLRB)	39,757 (2018)	6.8%
Belgium - Flanders	Vlaamse Maatschappij voor Sociaal Wonen (VMSW)	157,285 (2019)	4.9%
Belgium - Wallonia	Sociéte Wallonne du Logement (SWL)	101,914 (2018)	6.3%
Denmark	Boligselskabernes Landsforening (B.L.)	590,000 (2020)	21%
Germany	GdW	6,000,000 (2020)	14%
Ireland	Irish Council for Social Housing (ICSH)	40,000 (2019)	2%
The Netherlands	Aedes	2.268.383 (2018)	29.3%
Norway	Cooperative Housing Federation of Norway NBBL	530,000 (2019)	20%
Sweden	Sveriges Allmannytta	802,000 (2020)	16%
United Kingdom – England	National Housing Federation (NHF)	2,500,000 (2018)	10.3%
United Kingdom – Northern Ireland	Northern Ireland Housing Executive (NIHE)	85,300 (2016)	10.9%
United Kingdom – Scotland	Scottish Federation of Housing Associations (SFHA)	282,000 (2017)	10.8%
United Kingdom - Wales	Community Housing Cymru (CHC)	162,000 (2019)	11.3%

Belgium

Social housing

In Belgium, social housing is an exclusive competence of the regional authorities in Brussels, Wallonia and Flanders. Since the start of 2020, the small German speaking area in south-west Belgium has also gained additional competences over housing policy. Thus, policy, eligibility criteria and other aspects of social housing can vary in Belgium.

Across Belgium as a whole, social housing equates to around 6 per cent of the national housing stock, or almost 300,000 units. Most of this is concentrated in a few large cities.

There are three large social housing providers in Belgium, split across three regions. In the region of Brussels, the Société du Logement de la Région de Bruxelles-Capitale (SLRB)[2] represents 16 social housing associations, with a total of 39.757 dwellings.[3] In Flanders, the Vlaamse Maatschappij voor Sociaal Wonen (VMSW)[4] represents 80 social housing associations, which collectively own 157.285 dwellings. Of these dwellings, 48.691 (31.0%) are located in the province of Antwerp, 39.464 (25.1%) in Oost-Vlaanderen, 30.685 (19.5%) in West-Vlaanderen, 20.907 (13.3%) in Limburg and 17.538 (11.2%) in Vlaams-Brabant. The single largest social housing association is *Woonhaven Antwerpen*, which owns 17.369 dwellings.[5]

Finally, the Sociéte Wallonne du Logement (SWL)[6] unites 64 social housing associations in Wallonia. In 2018, they owned 101.914 dwellings (6.3% of all homes in Wallonia).[7] These dwellings are mostly concentrated in the province of Hainaut (48.0%) and Liège (35.7%). In addition, 7.6% of the social housing units are located in Namur, 6.2% in Brabant wallon and 3.5% in Luxembourg.[8]

Energy efficiency

Brussels

The vast majority (87.4%) of the social dwellings in Brussels are apartments.[9]

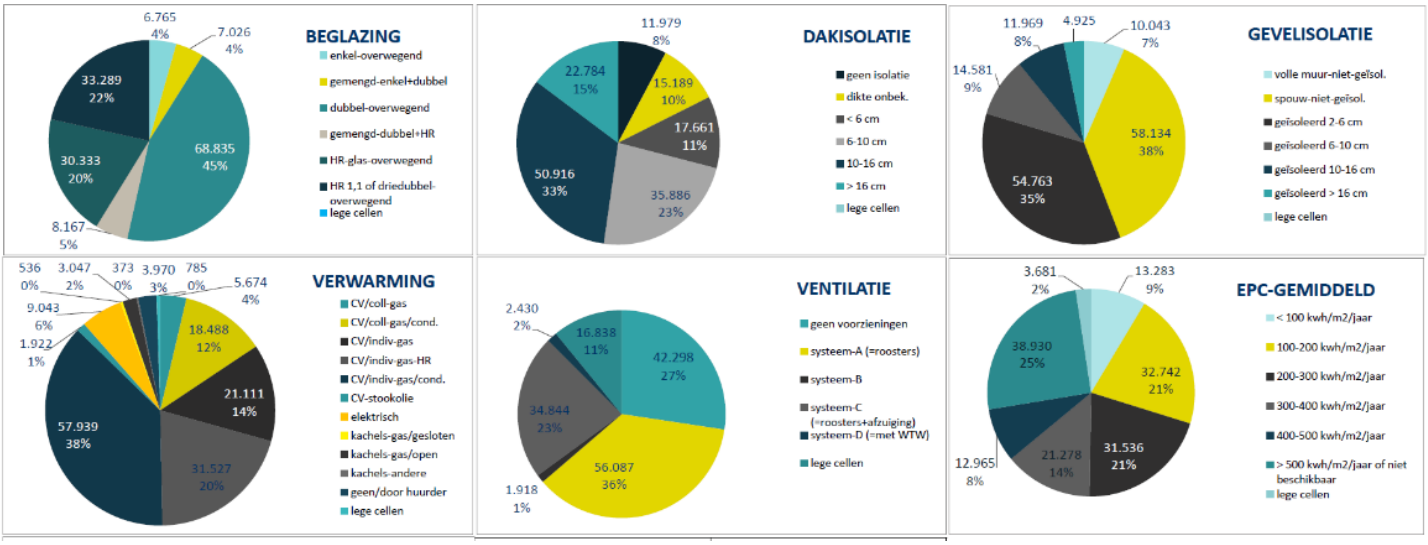
Flanders

More than half (52.7%) of the Flemish social housing units are apartments, while 42.9% are single-family homes. 3.1% of the homes are duplex homes and 1.3% are bungalows. Apartments constitute the majority of the social homes in the provinces of Antwerp (64.4%), Vlaams-Brabant (56.2%) and Oost-Vlaanderen (55.7%). In contrast, single-family homes are the dominant form of social housing in the province of West-Vlaanderen (60.5%). Single-family homes are also the most common type of social housing in Limburg (49.0%). This province also stands out by a relatively high share of duplex homes (5.4%) bungalows (5.3%). On average, the apartments are newer than the single-family homes. According to a 2018 survey[10], 45.5% of the apartments have been constructed after 1994, compared with only 21.6% of the single-family homes. 51.0% of the single-family homes have been built between 1965 and 1984, compared with 34.4% of the apartments.

[2] http://www.slrb.irisnet.be/
[3] https://slrb-bghm.brussels/nl/professioneel/publicaties/onze-publicaties/statistieken-ovms-2018
[4] http://www.vmsw.be/
[5] https://www.vmsw.be/Home/Footer/Over-sociale-huisvesting/Statistieken/Woningen-en-gronden
[6] http://www.swl.be/
[7] https://www.swl.be/images/chiffres-cles-vw.pdf
[8] https://cehd.be/media/1105/chiffres-cl%C3%A9s-du-logement-public-en-wallonie-2016-final_19052017.pdf
[9] https://slrb-bghm.brussels/nl/professioneel/publicaties/onze-publicaties/statistieken-ovms-2018
[10] https://www.vmsw.be/Portals/0/Uploads/objects/Footer/Statistieken/Rapporten_ERP_2018_VL-GW_1.pdf?ver=2019-10-15-160814-003

The 2018 survey shows that 80% of the apartments and 77% of the houses in the social sector had no defects. 4.4% of the dwellings only had single glazing (Figure 1), while another 4.6% had a combination of single and some double glazing. 7.8% of the dwellings had no roof isolation. 6.5% had uninsulated solid walls and 37.6% had uninsulated cavity walls. The vast majority (87.3%) of the dwellings had gas-based central heating, while 5.9% had electric heating. Over a quarter (27.4%) of the homes had no ventilation system.

Figure 1: Insulation, glazing, heating and ventilation in the social housing sector of Flanders



Wallonia

In contrast to Flanders, the majority of the social housing stock in Wallonia consists of single-family homes (55.1%), while 44.9% are apartments.[11]

In 2018, 86.5 million euro was spent on the renovation of the SWL dwellings in Wallonia (Figure 2).[12] These investments concentrated on the province of Hainaut (50%) and Liège (36%). 70% of the social housing stock dates from before 1981 and is therefore at least 40 years old (Figure 3). Thanks to the considerable investments since 2003, circa 43,000 homes have been modernised to improve the energy efficiency. However, an estimated 25,000 homes still require thorough renovations to meet the energy efficiency standards.

[11] https://cehd.be/media/1105/chiffres-cl%C3%A9s-du-logement-public-en-wallonie-2016-final_19052017.pdf
[12] https://www.swl.be/images/chiffres-cles-vw.pdf

Figure 2: Yearly renovation expenditures in the social housing sector of Wallonia (in millions euro)[13]

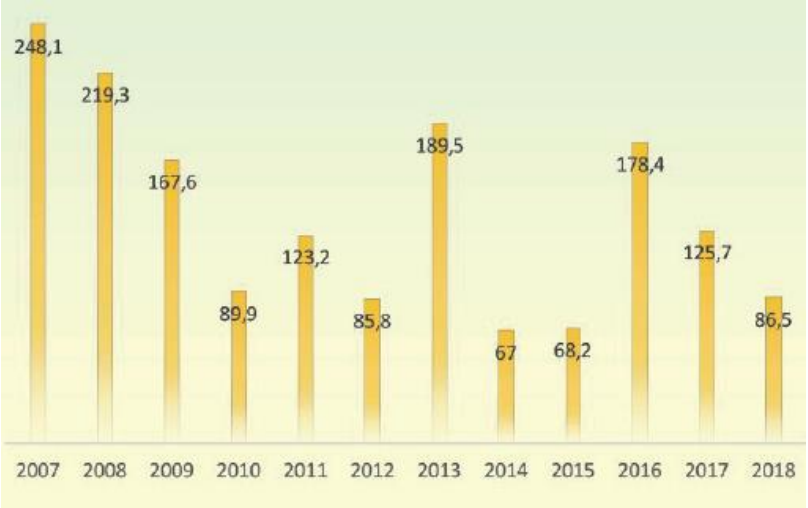
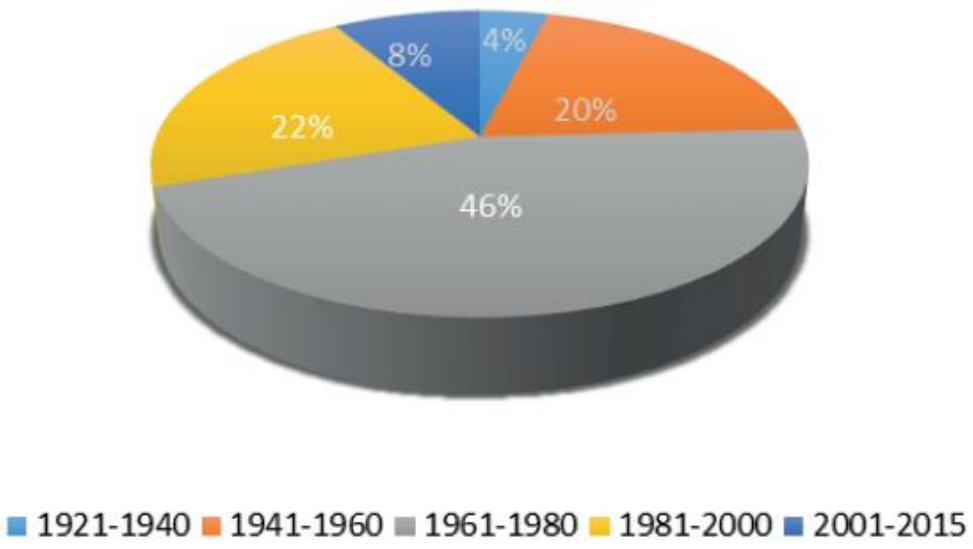


Figure 3: Dwellings in the social housing sector of Wallonia by construction year[14]



[13] https://www.swl.be/images/chiffres-cles-vw.pdf
[14] https://www.swl.be/images/memorendum/memorandum-web.pdf

Figure 4: Typology of Belgian dwellings[15]

Country	Region	Construction Year Class	Additional Classification	SFH Single Family House	TH Terraced House	MFH Multi Family House	AB Apartment Block
	national (Belgie)	... 1945	generic	 BE.N.SFH.01.Gen	 BE.N.TH.01.Gen	 BE.N.MFH.01.Gen	
	national (Belgie)	1946 ... 1970	generic	 BE.N.SFH.02.Gen	 BE.N.TH.02.Gen	 BE.N.MFH.02.Gen	 BE.N.AB.02.Gen
	national (Belgie)	1971 ... 1990	generic	 BE.N.SFH.03.Gen	 BE.N.TH.03.Gen	 BE.N.MFH.03.Gen	 BE.N.AB.03.Gen
	national (Belgie)	1991 ... 2005	generic	 BE.N.SFH.04.Gen	 BE.N.TH.04.Gen	 BE.N.MFH.04.Gen	 BE.N.AB.04.Gen
	national (Belgie)	2006 ... 2011	generic	 BE.N.SFH.05.Gen	 BE.N.TH.05.Gen	 BE.N.MFH.05.Gen	 BE.N.AB.05.Gen
	national (Belgie)	2012 ...	generic				

[15] http://webtool.building-typology.eu/?c=ie#bm

Denmark

Social housing

The social rental sector is quite large in Denmark, equating to around 21 per cent of the national stock (approximately 590,000 social units). While the social sector is open to everyone in theory, in reality it largely caters to households with lower incomes. Municipalities also reserve 10 per cent of new construction for the most vulnerable social groups, while they can individually decide on the rest of the tenancies in a block if they so wish.

The Danish social housing sector is governed by a relatively complex interaction between the state, the municipalities, the housing associations, and the tenants. The state sets the general outline for the sector, while the municipalities manage the local housing policy and decide whether to approve new constructions or not. The housing associations run the housing estates and can decide to build new estates if the municipalities approve. The tenants have a democratic influence on the day-to-day running of the housing estates.

The roughly 590,000 social housing units in Denmark are owned by municipalities through their housing associations. The circa 530 housing associations come together under the heading of their national organisation, Boligselskabernes Landsforening (B.L.).[16] Social housing is largely concentrated in the large urban areas. Among the five largest cities, Aarhus and Aalborg have the highest proportions of social housing, with just under 30% of the total housing stock. In Copenhagen, 20% of the housing stock is social housing.[17]

Energy efficiency

Circa two thirds of the social housing units in Denmark are apartments and one third are flats.[18]

In May 2020, the Danish government announced that between 2020 and 2026, 4 billion euro will be invested in the green renovation of the public housing sector. Up to 90% of these renovations will concern climate-friendly improvement. Out of this 4 billion euro, 2.5 billion will already be invested in 2020 and 2021. 72,000 homes will be renovated in the short term. The Ministry of Housing estimates that these energy efficiency renovations can lead to a reduction of 47,000 tons of CO2.[19]

[16] https://bl.dk/in-english/
[17] https://bl.dk/politik-og-analyser/den-almene-boligsektor-i-tal/boliger/
[18] https://bl.dk/politik-og-analyser/den-almene-boligsektor-i-tal/boliger/
[19] https://stateofgreen.com/en/partners/state-of-green/news/denmark-pushes-billion-euro-investments-for-greener-public-housing/

Figure 5: Typology of Danish dwellings[20]

Country	Region	Contruction Year Class	Additional Classification	SFH Single Family House	TH Terraced House	MFH Multi Family House	AB Apartment Block
	national (Hele Denmark)	... 1850	Generic (Standard)	 DK.N.SFH.01.Gen	 DK.N.TH.01.Gen		 DK.N.AB.01.Gen
	national (Hele Denmark)	1851 ... 1930	Generic (Standard)	 DK.N.SFH.02.Gen	 DK.N.TH.02.Gen		 DK.N.AB.02.Gen
	national (Hele Denmark)	1931 ... 1950	Generic (Standard)	 DK.N.SFH.03.Gen	 DK.N.TH.03.Gen		 DK.N.AB.03.Gen
	national (Hele Denmark)	1951 ... 1960	Generic (Standard)	 DK.N.SFH.04.Gen	 DK.N.TH.04.Gen		 DK.N.AB.04.Gen
	national (Hele Denmark)	1961 ... 1972	Generic (Standard)	 DK.N.SFH.05.Gen	 DK.N.TH.05.Gen		 DK.N.AB.05.Gen
	national (Hele Denmark)	1973 ... 1978	Generic (Standard)	 DK.N.SFH.06.Gen	 DK.N.TH.06.Gen		 DK.N.AB.06.Gen
	national (Hele Denmark)	1979 ... 1998	Generic (Standard)	 DK.N.SFH.07.Gen	 DK.N.TH.07.Gen		 DK.N.AB.07.Gen
	national (Hele Denmark)	1999 ... 2006	Generic (Standard)	 DK.N.SFH.08.Gen	 DK.N.TH.08.Gen		 DK.N.AB.08.Gen
	national (Hele Denmark)	2007 ... 2010	Generic (Standard)	 DK.N.SFH.09.Gen	 DK.N.TH.09.Gen		 DK.N.AB.09.Gen

[20] http://webtool.building-typology.eu/?c=ie#bd

Germany

Social housing

About three-fifths of what could broadly be called 'social' housing in Germany is owned by private companies, with the balance largely consisting of cooperatives and some public agencies. Yet the latter groups are heavily reliant upon private financing.

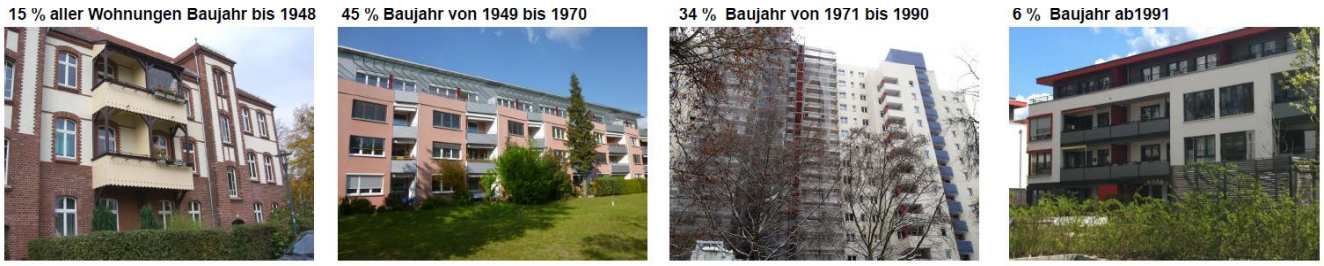
The vast majority of new social housing is built by private companies and developers. These companies are incentivised to build social housing by state financial supports. However, after an agreed period of time (usually 15-30 years), the 'social' housing units move from being rented to social tenants at an affordable price to being part of the private rental stock charging market prices. In recent years, more units have moved from being social to private than new social units have been built. This process is referred to as 'secular decline'. Responsibility for housing policy is divided between the federal and state governments.

The ownership of social housing in Germany is highly diffuse. The GdW[21] (originally *Gesamtverband deutscher Wohnungsunternehmen*) represents around 3,000 housing associations and cooperatives, which are organised in 14 regional groups. Its members possess around 6 million housing units (circa 30% of all rental homes), of which circa 1.2 million are social housing units. Out of these 6 million housing units, 40% are owned by municipal housing companies, 37% by housing cooperatives, 19% by private housing companies and 2% by public and church housing companies.

Energy efficiency

More than half of the housing units owned by GdW members have been built before 1970 (Figure 6).

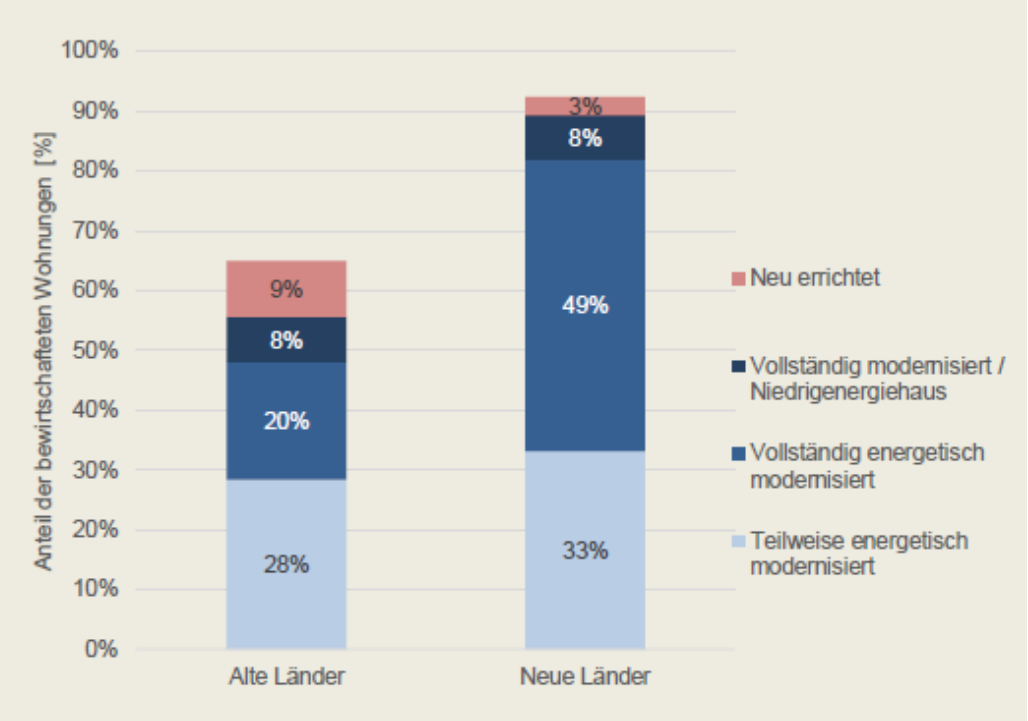
Figure 6: Typology of GdW dwellings by construction year



The GdW states that over two thirds of the housing market has been renovated to reduce energy consumption, but that there are still enormous challenges to meet the climate goals while keeping housing affordable. In recent years, apartment buildings in the territory of the former DDR have been extensively modernised to save energy (Figure 7). In West Germany, dwellings built in the 1950s and 1960s will have to be renovated in the coming years, to be adapted to the changing demand. This also means that substantial energy-saving measures have to be implemented. The GdW is committed to improving the framework conditions for energy-efficient refurbishments, especially for tailored and adequate funding.

[21] https://www.gdw.de/

Figure 7: Share of the GdW dwellings that have been made more energy efficient or have been newly constructed between 1990 and 2017



The *Allianz für einen klimaneutralen Wohngebäudebestand* is an association that unites the housing associations, industry companies and research institutions, which share the goal to reduce heat consumption and CO2 emissions in residential properties and realise a climate-neutral building stock by 2050. This should be done without financially burdening the housing associations and tenants.

The key element of this cooperation is a research project carried out under the leadership of the EBZ Business School – University of Applied Sciences and the Technical University Dresden, which investigates the application of technical measures to contribute to energy efficiency in a simple and convenient way. Between 2016 and 2019, a study was carried out into 700 apartments in buildings across Germany, using 5700 measuring points which together gathered over 13 billion measured values. It specifically looked how a number of low-investment technical measures helped to reduce the heat consumption or to improve the energy efficiency of the heat distribution. The investigated measures included hydronic balancing, programmable smart radiator thermostats for individual room temperatures and regular information for residents about their heat consumption using a consumption display app. The project also looked into the optimised balance between heat generation and ventilation, to prevent mould. The study showed that the complexity of the heat supply of apartment buildings is often underestimated. On average, the heating systems were more than 18 years old and larger than necessary. The existing technology makes it hard to meet the individual demands of tenants. Yet with the effective use of smart thermostats, hydronic balancing and optimal operation of the heat generator, energy consumption for heating can be reduced at the apartment level by 26 percent. User friendly and intuitive interfaces are crucial for the efficient use of smart home systems for individual room temperature control.

Ireland

Social housing

Social housing constitutes only a small share of the Irish housing stock: 40,000 dwellings, or 2% of the total housing stock. Social housing is intended for vulnerable groups, like families on low incomes, older people, people with disabilities or people who experienced homelessness. The Irish Council for Social Housing (ICSH)[22] represents over 270 not-for-profit housing associations across Ireland. These organisations manage 35,000 homes and house 90,000 people.

Of the total Irish housing stock, 71% of the housing stock is owner occupied, 9% is rented from local authorities and the remaining 20% are rented from other owners.[23]

Energy efficiency

Like in the United Kingdom, fuel poverty is an important concern in Ireland. According to a 2017 survey, a third of the ICSH tenants indicated they did not find it affordable to heat their homes. In October 2019, the ICSH stated that 10,000 (almost one third) of the dwellings owned by its member organisations needed to be retrofitted in order to meet energy rating targets in the coming years. It expressed the ambition to make the social housing sector take the lead in making homes future-proof and energy efficient. The Irish government committed to an investment of 45 million euro for retro-fitting homes.[24]

[22] https://icsh.ie/
[23] https://www.cso.ie/en/releasesandpublications/ep/p-cp1hii/cp1hii/tr/
[24] https://www.rte.ie/news/2019/1011/1082535-housing-retro-fit-energy/

Figure 8: Typology of Irish dwellings

Country	Region	Construction Year Class	Additional Classification	SFH Single Family House	TH Terraced House	MFH Multi Family House	AB Apartment Block
	national	... 1899	generic	 IE.N.SFH.01.Gen	 IE.N.TH.01.Gen		
	national	1900 ... 1929	generic	 IE.N.SFH.02.Gen	 IE.N.TH.02.Gen		
	national	1930 ... 1949	generic	 IE.N.SFH.03.Gen	 IE.N.TH.03.Gen		
	national	1950 ... 1966	generic	 IE.N.SFH.04.Gen	 IE.N.TH.04.Gen		 IE.N.AB.04.Gen
	national	1967 ... 1977	generic	 IE.N.SFH.05.Gen	 IE.N.TH.05.Gen		
	national	1978 ... 1982	generic	 IE.N.SFH.06.Gen	 IE.N.TH.06.Gen		 IE.N.AB.06.Gen
	national	1983 ... 1993	generic	 IE.N.SFH.07.Gen	 IE.N.TH.07.Gen		 IE.N.AB.07.Gen
	national	1994 ... 2004	generic	 IE.N.SFH.08.Gen	 IE.N.TH.08.Gen		 IE.N.AB.08.Gen
	national	2005 ... 2010	generic	 IE.N.SFH.09.Gen	 IE.N.TH.09.Gen		 IE.N.AB.09.Gen
	national	2011 ...	generic	 IE.N.SFH.10.Gen	 IE.N.TH.10.Gen		 IE.N.AB.10.Gen

The Netherlands

Social housing

In the Netherlands, social housing constitutes a larger share of the housing stock than in any other country in the North Sea Region. In 2018, 2.268.383 dwellings (29.3% of the total housing stock) were owned by housing associations. A small fraction of these dwellings cannot be considered as social housing because they are more expensive and available to everyone, but 26.6% of the Dutch housing stock falls below the 'liberalisation limit'. This means that a quarter of the Dutch housing stock is intended for low-income households, who are eligible to receive rental subsidies. It is important to note that not all residents of social housing do in fact receive these subsidies, because the low income requirement is only enforced when a resident moves into social housing: once someone is living in a house, they can stay there even after they started earning more. In 2015, an estimated 13.7% of the social housing dwellings were occupied by households that actually earned too much to be eligible for social rent.[25] Aedes represents 284 housing associations, which circa 91% of all housing associations in the Netherlands.[26]

Energy efficiency

Out of the dwellings owned by housing associations, 947 thousand (40.5%) are single family homes, 642 thousand (27.4%) are multi-family homes without an elevator and 609 thousand (26.0%) are multi-family homes with an elevator (Figure 9). The remaining 143 thousand (6.1%) are non-independent (shared) dwellings. The majority of the dwellings (54.3%) have been constructed before 1980. According to a 2019 survey by Aedes, 35.9% of the tenants indicate that there are issues of overdue maintenance in their home.[27] The average energy label of the dwellings is C (energy index of 1.57), while it was still D in 2015 (EI of 1.86). According to Aedes, the housing association homes will reach an average energy label B in 2021. To reach a CO2 neutral housing stock by 2050, the housing associations want to improve the energy efficiency of 70,000 existing homes each year.[28] Between 2019 and 2022, a 100 thousand housing association homes are made natural gas-free as part of the 'Startmotor plan'.[29]

The *Innovatie Centrum Duurzaam Bouwen* (ICDuBo) has proposed to establish a *Platform Duurzame Corporatie* in which housing associations, industry, municipalities and knowledge organisations co-operate. A key objective of this initiative would be to make a national database of housing typologies owned by housing associations, which includes the most appropriate measures to make each type of dwelling more energy efficient. This platform is not active yet, but could potentially be be very interesting for INDU-ZERO.[30]

[25] https://www.aedes.nl/artikelen/klant-en-wonen/huurbeleid/feiten-en-cijfers/lokale-monitor-wonen-woonlasten-huurders-particuliere-sector-hoger-dan-sociale-sector.html
[26] https://www.aedes.nl/
[27] https://aedesdatacentrum.nl/dashboard/dashboard--aedes-datacentrum/ervaren-woningkwaliteit-2/
[28] https://dkvwg750av2j6.cloudfront.net/m/11970090437e67a7/original/AedesAgenda-2020-2023-november-2019.pdf
[29] https://www.aedes.nl/artikelen/energie-en-duurzaamheid/startmotor-100.000-sociale-huurwoningen-sneller-van-het-gas.html
[30] https://www.icdubo.nl/platform-duurzame-corporatie/

Figure 9: Housing stock owned by housing associations, types of dwellings and construction period[31]

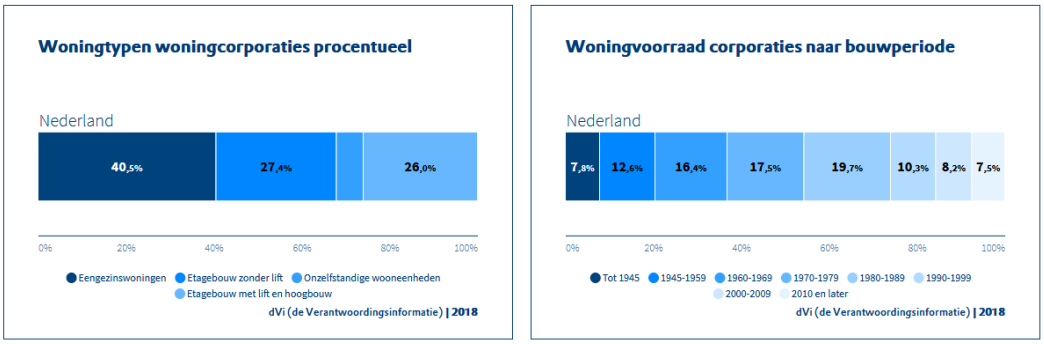
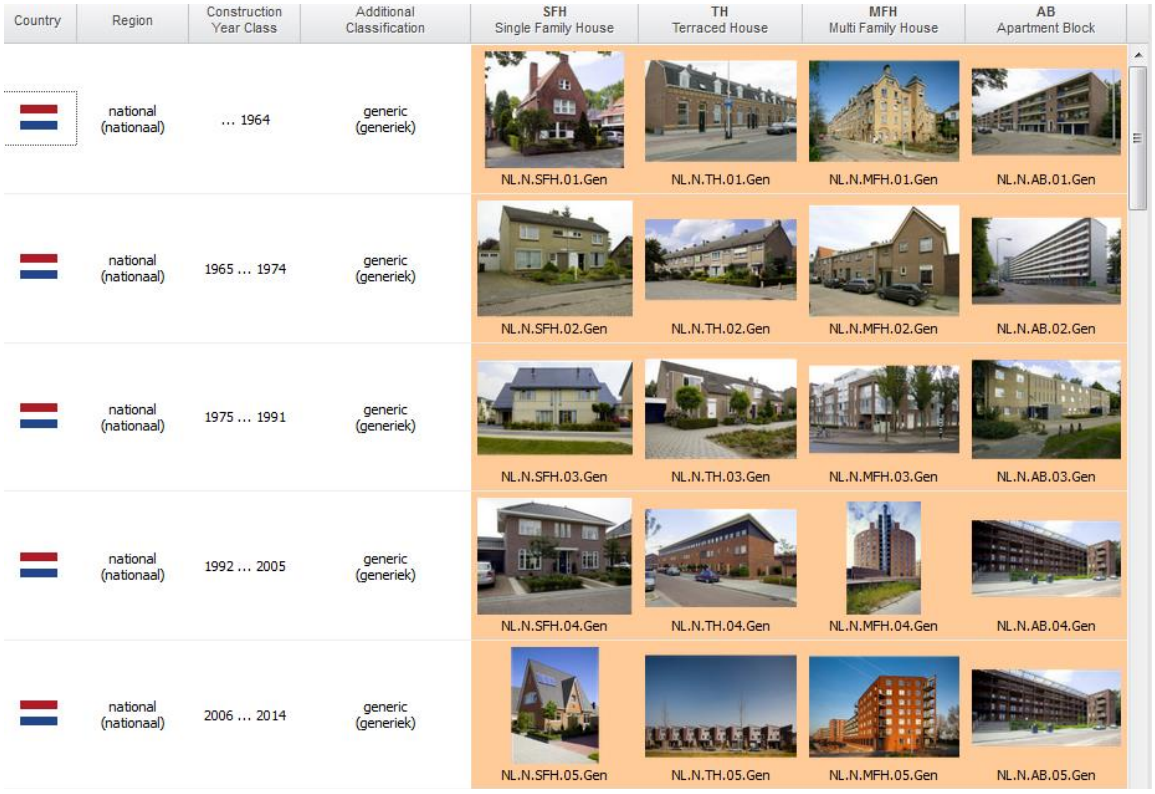


Figure 10: Typology of Dutch dwellings[32]



[31] https://aedesdatacentrum.nl/dashboard/dashboard--aedes-datacentrum/kenmerken-woningen-2/

[32] http://webtool.building-typology.eu/?c=ie#bm

Norway

Social housing

Social housing as a sector is relatively small in Norway compared to other countries in Northern Europe. The municipal rental stock accounts for about 110,000 of Norway's 2.55 million housing stock. Most of the focus in Norway (for generations) has been on providing subsidies to support home ownership, rather than provide social housing.[33] Indeed, about three-quarters of Norwegians are owner-occupiers. In Norway, social housing refers to a relatively marginal system targeted at the most vulnerable groups only (e.g. migrants, addicts, former inmates and low-income families with children). Social housing is mostly municipality-owned.

Thus, the municipal rental sector is quite small. However, cooperative housing (only some of which aims to provide affordable housing options) accounts for around 21 per cent of the national housing stock and half of the rental sector.

The small municipal housing stock is owned by individual municipalities. Yet 41 cooperative housing associations are organised in the Cooperative Housing Federation of Norway NBBL[34], which collectively count 530.000 housing units: one fifth of the total housing stock. This housing stock is concentrated in the urban areas.

Most major cooperative housing associations in Norway are members of the NBBL. The number of separate associations has decreased significantly (by more than 50%) during the last ten years, due to mergers. The associations developed between 3.000-4.000 housing units per year in the period 2015-2017.

Energy efficiency

Figure 11 shows a typology of the dwellings in Norway. While the majority of the total housing stock of Norway are single-family houses, the picture is very different in the cooperative housing sector. Over two thirds (69.5%) of the cooperative housing units are apartments in large buildings. In addition, 23.6% fall in the category of divided small houses (mostly row houses). Detached houses (1.1%) and houses with two dwellings (3.5%) are considerably rarer in this sector.[35] Figure 13 offers a physical description of typical Norwegian apartment buildings, divided by construction year.

Cooperative housing is overrepresented in the four large cities of Norway: Oslo, Bergen, Stavanger/Sandnes and Trondheim. In these cities, 27.6% of the dwellings fall into the category of cooperative housing.

A report from 2009 by the IEA-SHC (International Energy Agency – Solar Heating and Cooling programme) evaluated the Norwegian housing stock and considered the energy saving potential with two types of renovation packages.[36] The moderate package envisioned 10 cm of additional wall and floor insulation , 10-15 cm of additional roof insulation, new doors and windows with an U value of 1.2 W/m^{2}K and reduced air leakage values to 2.5 h^{-1}. The ambitious measures package envisioned double the amount of additional wall, floor and roof insulation, new doors and windows with an U value of 0.7 W/m^{2}K, reduced air leakage values to 1.5 h^{-1}, as well as balanced ventilation with 70-

[33] https://www.researchgate.net/publication/319663882_The_Social_Homeownership_Model_-_the_Case_of_Norway
[34] https://www.nbbl.no/english/
[35] https://www.ssb.no/en/statbank/table/10149/
[36] https://www.sintef.no/globalassets/project/eksbo/dwelling_stock_analysis_norway_010409.pdf

75% recovery. The IEA-SHC study shows that considerable gains can be made by renovating apartments and row houses constructed before 1980 (Figure 14).

Figure 11: Typology of Norwegian dwellings[37]

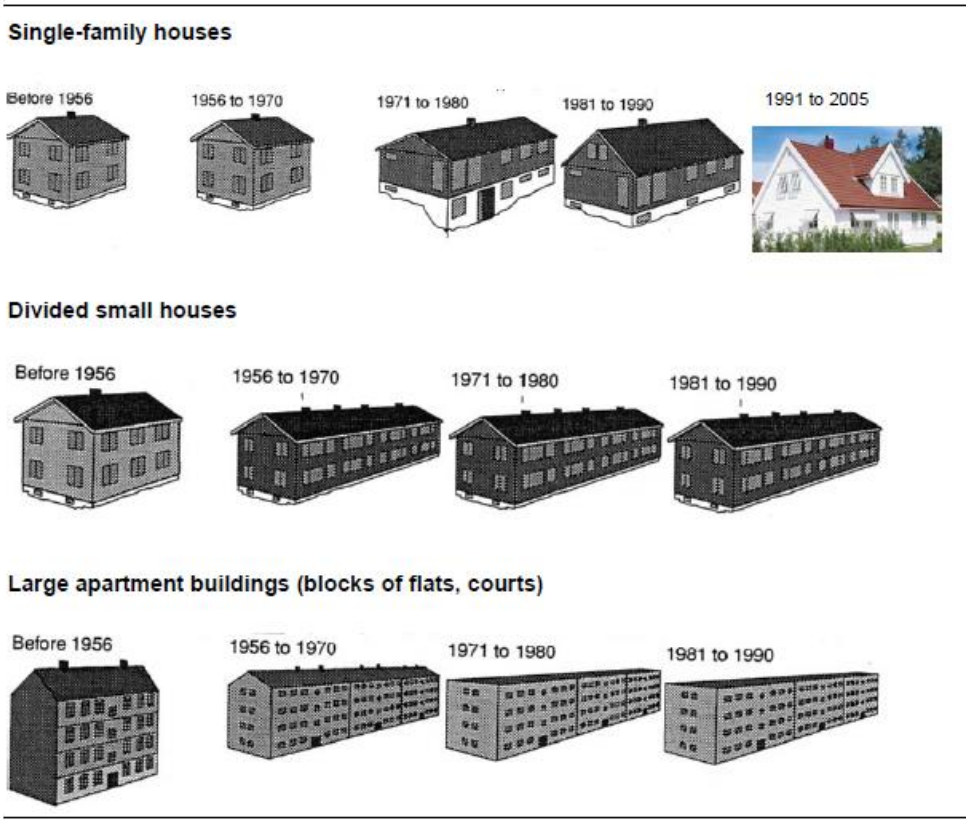
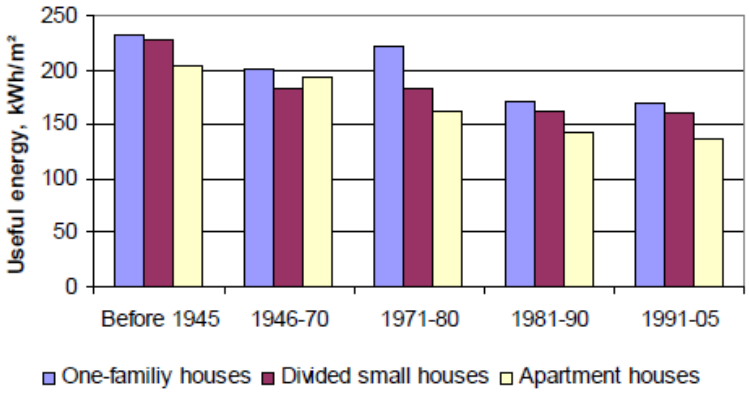


Figure 12: Average net energy consumption of dwellings in Norway by tenure and construction year



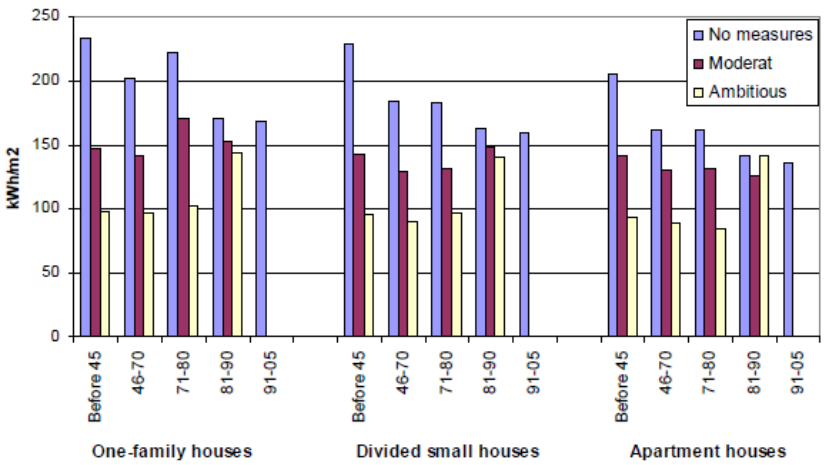
[37] https://www.sintef.no/globalassets/project/eksbo/dwelling_stock_analysis_norway_010409.pdf

Figure 13: Physical description of the typical apartment buildings in Norway

	Before 1945	1945-1970	1971-1980	1981-1990	1991-2005
Number of dwellings in the group	106869	142764	83245	41380	88914
Number of dwellings per building	8	24	24	24	20
Dwelling area	75	68	79	78	81
Number of storeys	4	4	4	4	4
% of dwellings with additional thermal insulation (W = walls and windows, F = floors, C = ceilings)					
- WFC	35 %	20 %	-	-	-
- WF or WC	30 %	30 %	-	-	-
- W	10 %	-	-	-	-
- FC	10 %	-	-	-	-
- F or C	10 %	-	-	-	-
- New windows	-	-	-	-	-
- Unimproved	5 %	50 %	100 %	100 %	100 %%
U-value of building envelope (Original / additionally insulated					
	W/m²K	W/m²K	W/m²K	W/m²K	W/m²K
- Walls	0.9 / 0.4	0.4 / 0.3	0.38 / -	0.26 / -	0.26 / -
- Floors	0.69 / 0.34	0.27 / 0.17	0.36 / -	0.20 / -	0.20 / -
- Ceilings	0.6 / 0.3	0.36 / 0.20	0.20 / -	0.18 / -	0.18 / -
- Windows	2.8 / 2.0	2.8 / 2.0	2.8 / 2.0	2.0 / -	1.8 / -
Rate of air exchange					
- Air leakage number [1]	8 / 6 / 4 / 3	6 / 5 / 4 /3	4	4	3
- Ventilation	0.4 h^{-1}	0.4 h^{-1}	0.4 h^{-1}	0.4 h^{-1}	0.4 h^{-1}
Heat recovery	0	0	0	0	0 / 55 %
Indoor temperature	20 °C	20 °C	20 °C	20 °C	20 °C
Window area	20 %	15 %	15 %	15 %	15 %
Window orientation (s-w-e-n)	60-0-0-40	60-0-0-40	60-0-0-40	60-0-0-40	60-0-0-40
Type of heating					
- Firewood	13 %	13 %	13 %	13 %	13 %
- District heating	0 %	0 %	0 %	0 %	0 %
- Oil/gas	7 %	7 %	7 %	7 %	7 %
- Heat pump air to air	10 %	10 %	10 %	10 %	10 %
- Electricity floor heating	5 %	5 %	5 %	5 %	5 %
- Electricity directly	65 %	65 %	65 %	65 %	65 %
System efficiency of heating system					
- Firewood	40 %	45 %	50 %	55 %	60 %
- District heating	88 %	88 %	88 %	88 %	88 %
- Oil/gas	80 %	80 %	80 %	80 %	80 %
- Heat pump air to air	250 %	250 %	250 %	250 %	250 %
- Electricity floor heating	100 %	100 %	100 %	100 %	100 %
- Electricity directly	100 %	100 %	100 %	100 %	100 %

1 Dependent on which other renovation measures that are assumed

Figure 14: Energy consumption for different types of Norwegian dwellings, split by measure package and year of construction



Sweden

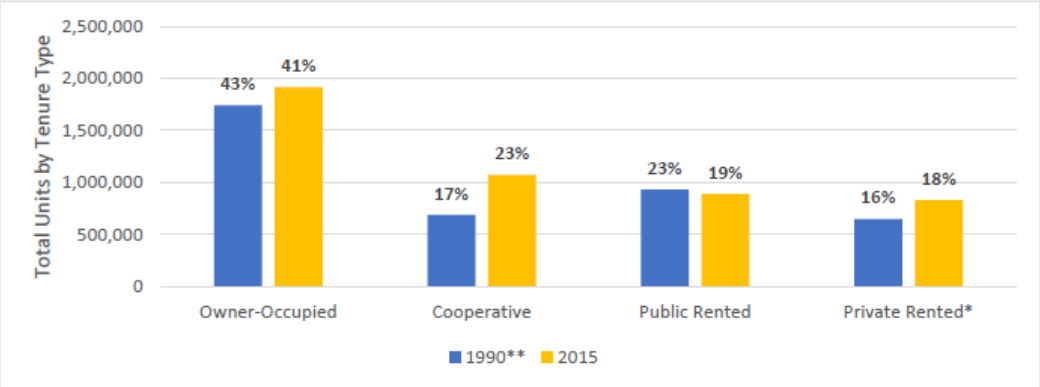
Social housing

In Sweden, there is no housing built specifically to cater to low-income families or other vulnerable groups, outside of a few small-scale projects provided by charities or other similar organisations. These account for about 1% of the housing stock and are intended for short-term use, for households with 'social problems'.

Sweden does have a larger system of 'public' housing though, which accounts for around 19 per cent of the housing stock. Public housing is delivered by mostly municipally owned, limited profit driven, providers and is open to everyone regardless of their income. These companies are legally mandated to be profit making. Since the early 1990s, the Swedish housing market has been privatised and ownership has been facilitated. Rented dwellings have been sold to sitting tenants at often below-market prices.

The share of public housing in new construction decreases due to a loss in public subsidy. In high-cost urban centers, many public apartments have been converted into cooperatives: in Central City Stockholm alone, this was the case for more than 100,000 public apartments. 'Cooperative housing' offers an alternative to ownership and public housing: it is based on 'principles of open membership, democratic administration and cooperative teamwork, and limited returns on investments. In practice, cooperative dwellings provide residents with a form of lease known as "dwelling rights" entitling members to utilize a unit for an unlimited period of time under rules specified in the housing cooperative statute and also granting a democratic share in the management of the housing cooperative.' Nowadays, cooperative housing comprises approximately 23% of the housing stock in Sweden and this shares keeps increasing, as it accounts for the bulk of new multifamily construction (Figure 15). There is also a private rental market, with rent levels tied to those of the public sector. As a result, the average incomes of people living in public and private housing are very similar.[38]

Figure 15: Distribution of Swedish housing units by tenure type, 1990 and 2015



Source: Statistics Sweden – SCB; Andersson et al., "Immigration, Housing and Segregation in the Nordic Welfare States."
**Private rented includes multi-dwelling buildings owned by "private persons" or "other artificial persons", though the majority of these units are rented out.*
***1990 distribution of housing units derived from Andersson et al.*

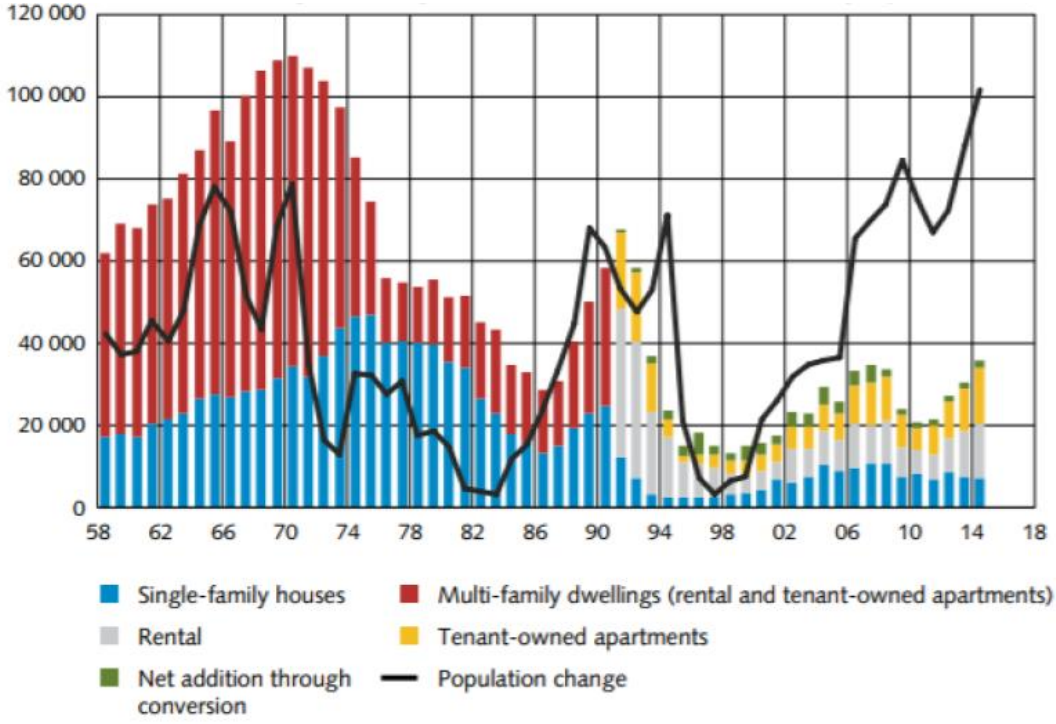
Ownership of public housing is controlled by a large number of usually municipally controlled companies. However, mergers of smaller companies can take place. Public Housing Sweden (Sveriges

[38] http://ternercenter.berkeley.edu/uploads/Swedish_Housing_System_Memo.pdf

Allmannytta)[39] is the interest organisation for municipality owned public housing companies in Sweden. It has approximately 300 member organisations managing some 802.000 dwellings.

The public housing units were predominantly constructed during the 'Million Dwellings Programme' (1965-1974). During this period the goal was to build a 100,000 dwellings each year (Figure 16). The buildings from this period are highly standardised and industrialised.

Figure 16: Housing construction and population changes in Sweden



Note. Prior to 1991, it is possible to distinguish between different forms of occupancy in apartment buildings.

Sources: Statistics Sweden and the Riksbank

Source: Emanuelsson, "Supply of Housing in Sweden."

Energy efficiency

The Riksdag (Swedish Parliament) has decided that the Swedish building stock must reduce energy use by 20 per cent by 2020 and that it should be halved by 2050 compared with 1995 levels. Public housing companies often actively work to reduce energy use in their buildings, both for environmental and financial reasons. One hundred and three of Public Housing Sweden's three hundred or so members have adopted and signed the SABO companies' Skåne Initiative. They jointly own 383,970 apartments, which is a significant proportion of the public housing stock. Companies in the Skåne Initiative have undertaken to jointly reduce their energy use by 20 per cent between 2007 and 2016.

[39] https://www.sverigesallmannytta.se/in-english/

Since so many homes have been constructed during a limited period (1965-1974), many of them now require refurbishments, particularly now that official building requirements (including with regard to energy efficiency) have become more stringent as well. This leads to difficulty coordinating and funding renovations.

'With the construction of so many homes during a limited period (Million Dwellings Programme in 1965 to 1974 period), the country is facing challenges with maintenance. Needs to refurbish largely coincide, especially as official building requirements become more stringent (such as around energy efficiency), leading to difficulty coordinating and funding renovations: "Many of these buildings are now reaching the end of their useful lives, requiring renovations to both repair worn out building elements and adapt to changing tenant needs."[40]

According to Public Housing Sweden, "Ninety-eight per cent of all apartments are supplied by pipe systems with radiators as heaters. One pipe trunk can supply several apartments with heating and one apartment can be supplied by several pipe trunks. The rent for apartments in Sweden includes heating. No shared incentive exists, but the property owner can take appropriate measures to reduce energy use. This may, for instance, involve supplementary insulation in the attic, insulation of the facade, change of windows, introduction of heat recovery and trimming of the heating system. Such measures do not only improve the building itself but also increase indoor comfort for the tenants.

From a European perspective Sweden has a cold climate with well-insulated climate shells that envelope buildings but no insulation between apartments. Swedish municipal public housing companies try to maintain the same temperature in all apartments in their property stock to minimise energy use. The residents themselves cannot adjust the temperature, which is controlled centrally in the building. There is normally a guaranteed temperature of 20 to 21°C in apartments. The inclusion of heating in rents means that there is no energy poverty in Swedish apartments. As a consequence of these circumstances, we have concluded in Sweden that it is not cost effective to install individual metering and billing for heating, but that this would increase energy use instead and have a considerable negative impact on energy efficiency improvements among Public Housing Sweden's member companies."

[40] Terner Center for Housing Innovation (UC Berkeley), Housing in Sweden: an Overview. November 2017. https://vdocuments.mx/housing-in-sweden-an-overview-terner-eight-million-people-at-the-time-to.html

United Kingdom

Social housing

There are two main providers of social and affordable housing in the UK – Local Councils and not-for- or limited-profit Housing Associations. In total there are roughly 5 million social housing units in the UK, divided between its four nations of England, Wales, Scotland and Northern Ireland. Housing policy is largely devolved to the three parliaments in Wales, Scotland and Northern Ireland and regionally in England.

In England, housing associations own 2.5 million dwellings (10.3% of the total housing stock). In addition, 1.6 million dwellings (6.6% of the stock) are rented from local authorities.[41] The National Housing Federation (NHF) represents the housing associations.[42]

In Scotland, 282,000 dwellings (10.8% of the stock) are owned by housing associations and 314,000 dwellings (12.1%) are owned by local authorities.[43] Together, these dwellings constitute the social housing sector. The housing associations are represented by the Scottish Federation of Housing Associations (SFHA).[44] Glasgow has by the far the highest number of housing association homes, both absolutely and relatively: 106,000 homes, which is 34.2% of all dwellings in Glasgow and 37.6% of all housing association homes in Scotland. In comparison, Edinburgh, the second-largest city of Scotland only has 18,000 housing association homes, which is 7.3% of the Edinburgh housing stock.

The Northern Ireland Housing Executive (NIHE) is the public housing authority for Northern Ireland.[45] It is the largest social housing landlord. In total, there are nearly 800,000 homes in Northern Ireland. According to the 2016 Housing Conditions Survey, the NIHE owned 85,300 homes (10.9%) and housing associations owned 35,600 (4.6%) homes. These two together form the social housing sector in Northern Ireland. Only 7.9% of these households have a paid job: 33.6% are unemployed, 46.6% are permanently sick and 15.1% are retired.[46]

In Wales, Community Housing Cymru (CHC) represents more than 70 not-for-profit housing associations and community mutual.[47] Together, they own more than 162,000 housing units, which provides housing for around 10% of the Welsh population.[48] The CHC members intend to build 75,000 new homes by 2036.

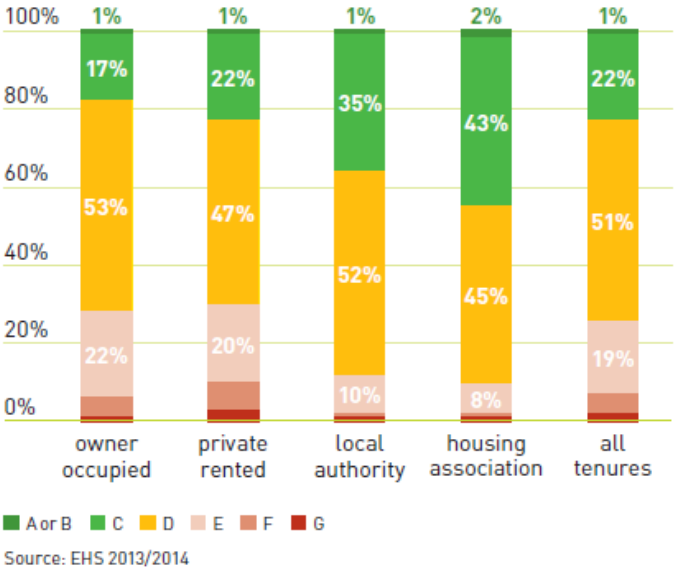
[41] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/803958/Dwelling_Stock_Estimates_31_March_2018__England.pdf
[42] https://www.housing.org.uk/
[43] https://www.gov.scot/publications/housing-statistics-stock-by-tenure/
[44] https://www.sfha.co.uk/
[45] https://www.nihe.gov.uk/
[46] https://www.nihe.gov.uk/Documents/Research/HCS-2016-Main-Reports/HCS-Main-Report-2016.aspx
[47] http://www.chcymru.org.uk/
[48] https://chcymru.org.uk/en/view-news/global-account-figures-published-for-housing-associations-in-wales

Energy efficiency

England

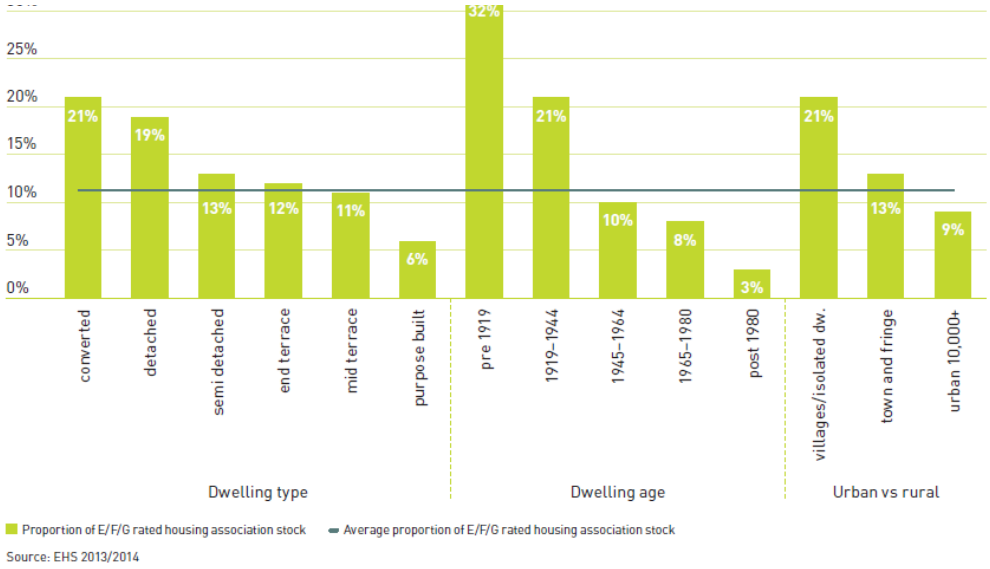
Housing association homes as well as local authority homes are relatively energy efficient, when compared with owner occupied and private rented homes (Figure 17). A or B rated stock is still rare in England, but the housing association stock has the largest share of C-rated dwellings and the lowest share of dwellings rated E or lower (see the figure below). The reason for this is that housing association homes have been built or upgraded to higher standards than the average English home with regard to elements like wall insulation, double glazing, loft insulation and boiler type.[49]

Figure 17: Energy efficiency rating (EPC bands) of English dwellings by tenure



The most energy inefficient houses are often old and rural (Figure 18). Almost half of them (45%, 99,000 units) have uninsulated solid walls (Figure 19). Half of the energy inefficient houses are not on the gas network: they mostly use electrical fuel systems instead (Figure 20). This is a housing stock that is hard to improve in a cost-efficient way.

Figure 18: Energy inefficient housing association stock by dwelling type, age and location (England)



[49] https://www.housing.org.uk/globalassets/files/resource-files/taking_stock_-_understanding_the_quality_and_energy_efficiency_of_housing_association_homes_2016.pdf

Figure 19: Insulation standard of total and energy inefficient housing association stock (England)

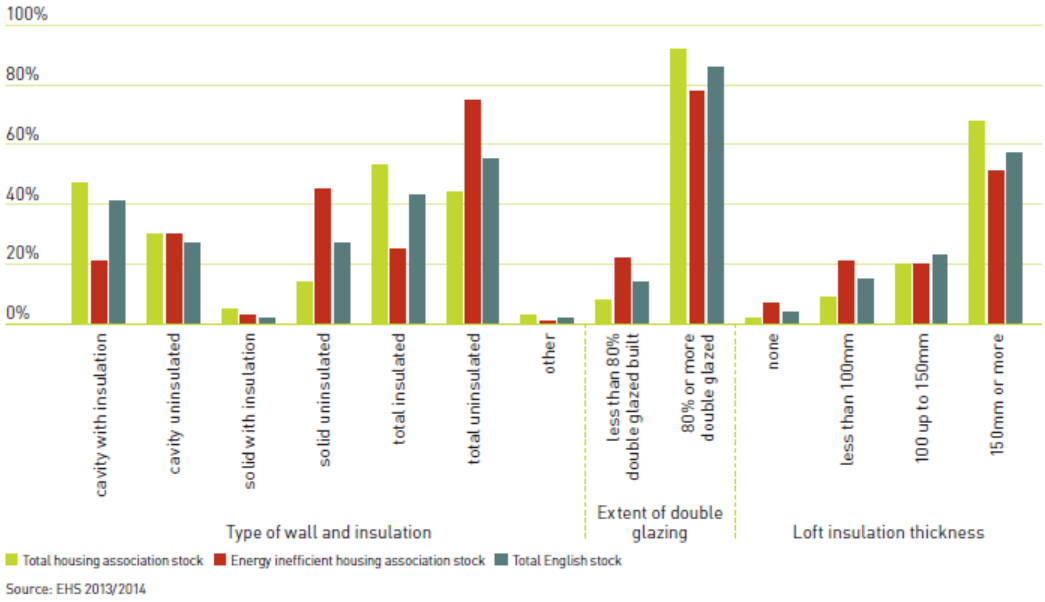
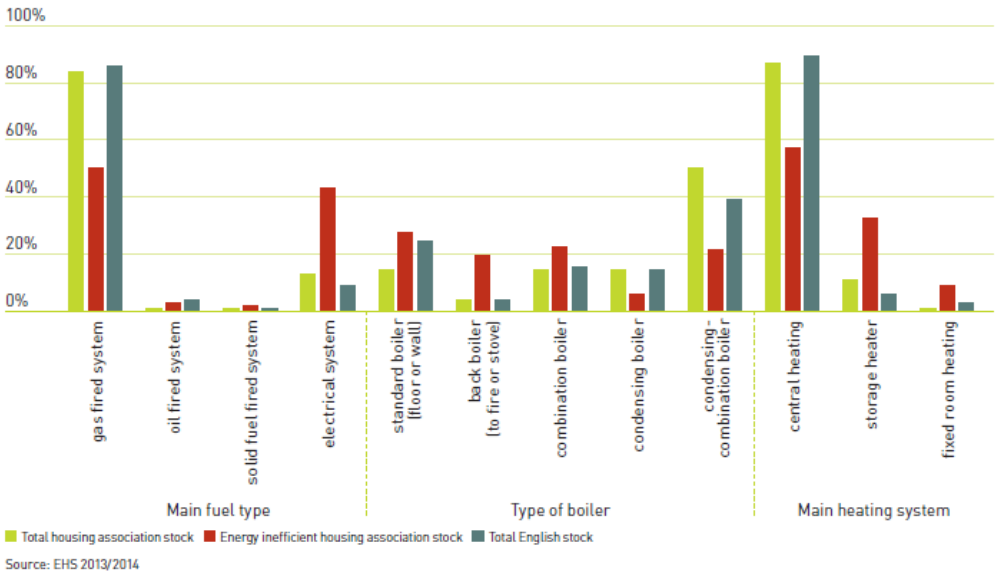


Figure 20: Heating and boiler types of total and energy inefficient housing association stock (England)



A case study was carried out in 2015 to establish the most cost-effective measures to improve the energy efficiency of five typical housing associations (urban, rural, northern, large and small). This study looked into measures to bring dwellings into band C or higher. The most cost-effective measures were estimated to be cavity wall insulation in pre-1976 properties, upgrading inefficient lighting and removing secondary gas heaters.

Scotland

56% of the social rented dwellings in Scotland (housing association homes and local authority homes combined) are flats, while the remaining 46% are houses. For local authority homes, houses and flats are in balance, with 50% each. Among housing association homes, flats (65%) are more common

than houses (35%).[50] Housing association homes are typically more energy efficient than other types of tenure.[51]

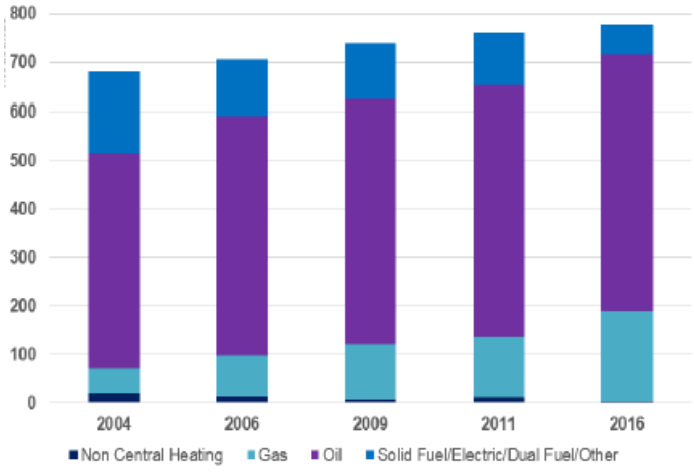
The Scottish Federation of Housing Associations (SFHA) represents its members in the Existing Homes Alliance.[52] This is a coalition of housing, environmental, fuel poverty and industry organisations calling for urgent action to transform Scotland's existing housing stock and make it fit for the 21st century. It calls for an ambitious programme of low-carbon refurbishment of Scotland's homes, along with incentives, support and regulations aimed at cutting greenhouse gas emissions and tackling fuel poverty.

The SFHA is also a partner of Smart Energy GB[53], a UK Government-backed campaign to encourage the rollout of smart meters across the UK, in order to stimulate more efficient energy use.

Northern Ireland

Out of all social housing units (NIHE and housing association homes combined), 40.5% have been construced after 1980, 39.4% between 1965-1980, 12.8% between 1945-1964 and 7.4% before 1945. The largest share (45,9%) of these housing units are terraced houses, followed by bungalows (24.2%), flats/apartments (18.2%) and semi-detached houses (11.1%). Only 0.2% of the social housing units are detached houses. 74,4% of the households living in social housing units earn less than £15,599 per annum.

Figure 21: Central heating in Irish dwellings by fuel type



Until recently Northern Ireland had a lower average SAP than Great Britain, which means homes were less energy efficient than in the UK as a whole. This situation has changed and now Northern Irish homes are slightly more energy efficient than those in Great Britain. Housing Association homes have the highest SAP rating, in comparison with owner occupied and rented homes. Northern Ireland has only had a gas supply since 1996. This is why large part of the country remains dependent on oil (Figure 21). Oil is the main fuel in 67.5% of the homes (oil-fired boilers). This results in high levels of fuel poverty, as 21.5% of the population spends more than 10% of their household income on heating their homes.

However, the situation is comparatively more positive in social housing. The level of fuel poverty in social housing is relatively low, at 9.9%. The share of social housing units with oil-based central heating is relatively low, at 41.9%. In contrast, many social housing units have gas-based central heating (48.5%, versus 23.8% of all housing units). Most social housing units have full cavity wall insulation (79.0%, versus 65.3% of all housing units). Only 8.5% of the social housing units have no wall insulation at all, versus 19.9% of all housing units. The vast majority of the social housing units

[50] https://www.gov.scot/publications/social-tenants-scotland-2017/pages/4/
[51] https://www.gov.scot/publications/scottish-house-condition-survey-2017-key-findings/pages/5/
[52] http://existinghomesalliancescotland.co.uk/
[53] https://www.smartenergygb.org/en

(94,0%) have full double glazing. All in all, 78.5% of the social housing units fall within energy efficiency band A-C (the highest bands), compared to 49.4% of all housing units.

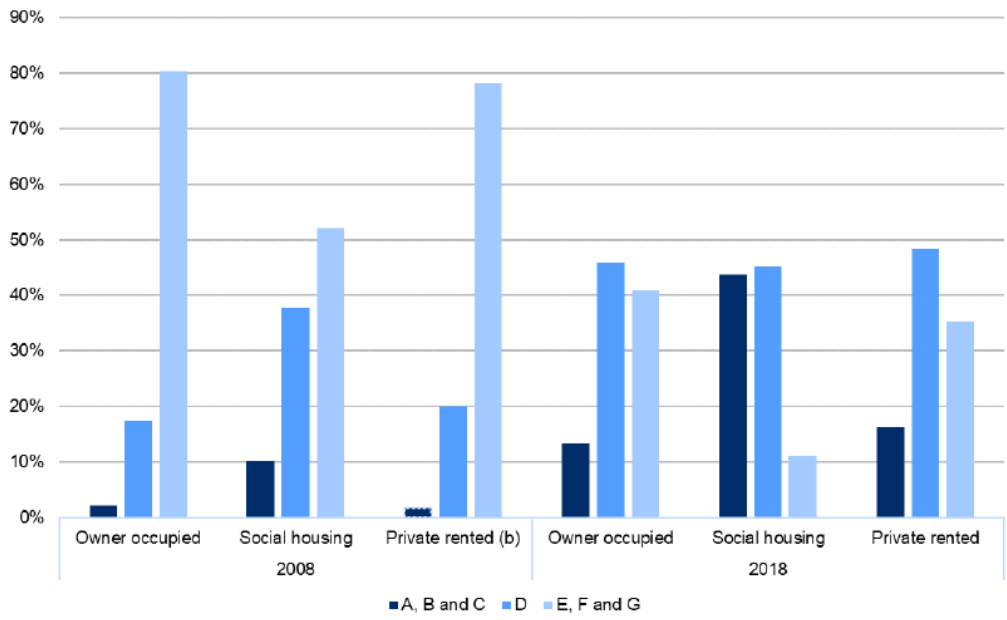
The NIHE and local councils offer the Affordable Warmth Scheme to low income households who experience the effects of fuel poverty and energy inefficiency. It is available for home owners and those who privately rent a home, not to tenants of social housing. They can receive up to £7,500-10,000 for carrying out measures to improve energy efficiency. In 2018/2019 3,205 homes have been improved through this scheme.

Wales

Like in Northern Ireland, social housing units in Wales were considerably more energy efficient than other tenures, according to the Welsh Housing Conditions Survey 2017-18. 44% of the social housing units have an EPC rating of band C and above, compared to 13% of the owner-occupied houses and 16% of the private-rented homes.[54] Social housing has been improved significantly over the past decade: in 2008, only 10% of the homes were rated band C or above (Figure 22).

The patterns of energy efficiency in Wales are similar to those in England and considerably worse than those in Northern Ireland.

Figure 22: Energy efficiency rating (EPC bands) of Welsh dwellings by tenure



Sources: Welsh Housing Conditions Survey 2017-18
Living in Wales Property survey 2008

Practically all social housing units have roof insulation (100%) and double glazing (97%, up from 85% in 2008). Most (90%) of the social dwellings also have thermostatic radiator valves, compared with 82% for owner-occupied and 72% for private-rented dwellings. In this regard, social housing has clearly made more progress than owner-occupied and private-rented dwellings: in 2008, owner occupied dwellings still had the highest percentage of dwellings with thermostatic radiator valves with 58%, compared to social housing and private rented dwellings with 52% and 47% respectively. The

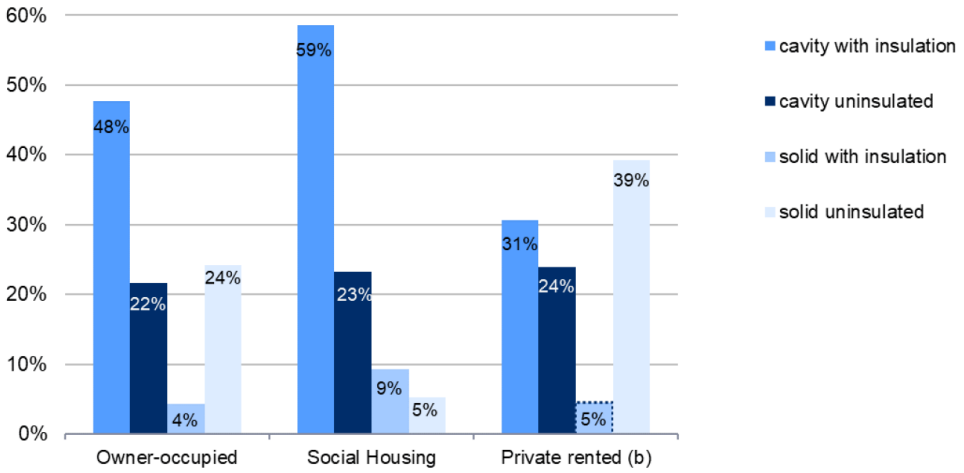
[54] https://gov.wales/sites/default/files/statistics-and-research/2019-10/welsh-housing-conditions-survey-energy-efficiency-dwellings-april-2017-march-2018-795.pdf

vast majority (87%) of the dwellings in the social housing tenure use gas a heating fuel. Only 5% use oil and also 5% use electricity.

The vast majority (82%) of the social housing units have cavity walls, while 24% have solid masonry. Other types of construction, like timber and steel frames are considerably more rare. Almost a quarter (23%) of the social housing units have uninsulated cavity walls, while 5% have uninsulated solid walls (Figure 23).

The number of dwellings using renewable energy is still very low: 8% of the social housing units used renewable energy according to the 2017-18 survey.

Figure 23: Wall type and insulation, by tenure, Wales (2017-18)



Source: Welsh Housing Conditions Survey 2017-18

Interreg
North Sea Region
INDU-ZERO
European Regional Development Fund
EUROPEAN UNION