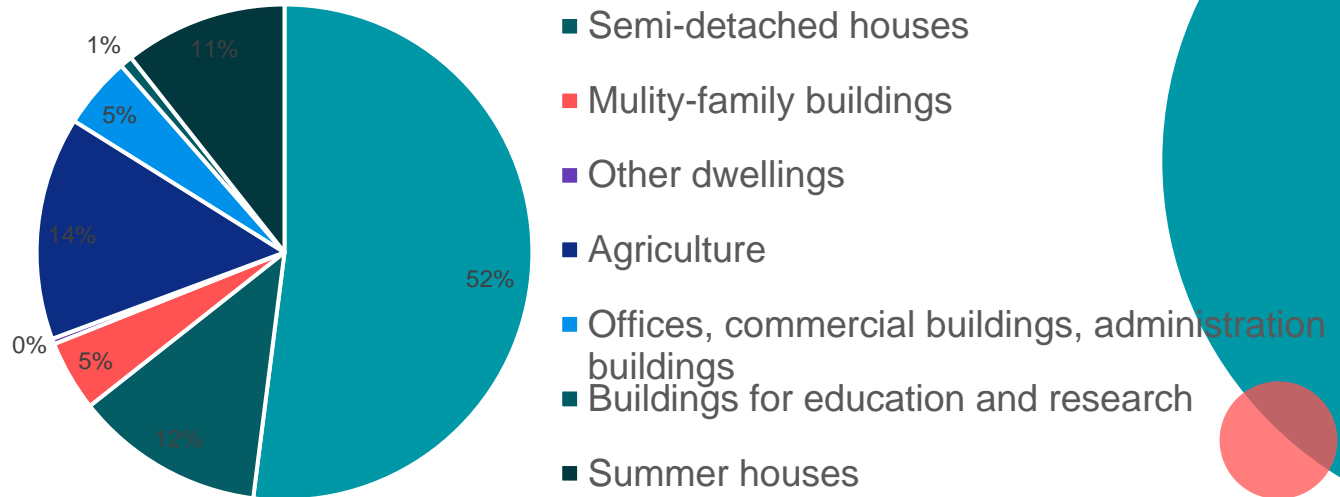




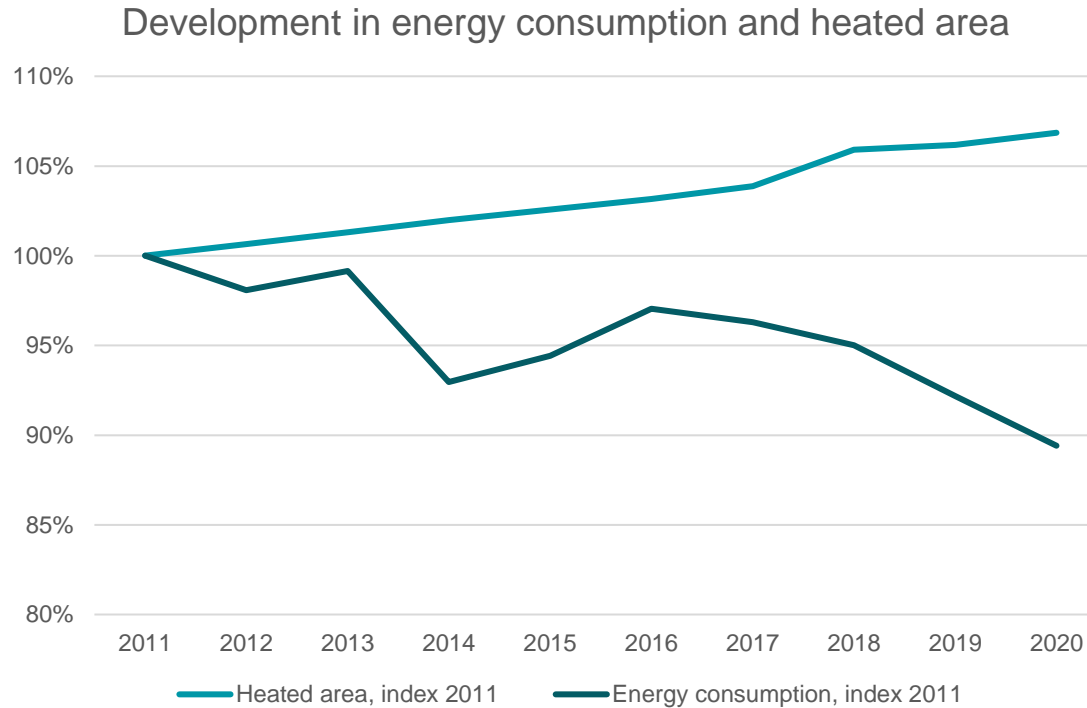
Energy Efficiency
in Buildings
Danish Energy
Agency
Anne Svendsen

The building sector in Denmark

Building stock Denmark 2021



Development in the energy consumption for buildings and heated area



How has Denmark increased energy efficiency in buildings

- Building code since 1979 on energy
- Function performance testing of installations before use
- Energy Performance Certificates
- Funding for energy renovation of private homes
- Funding for renovation of affordable housing
- Funding for renovation of public buildings
- Information to home owners, craftsmen and consultants on EE renovation



EE in buildings, the future

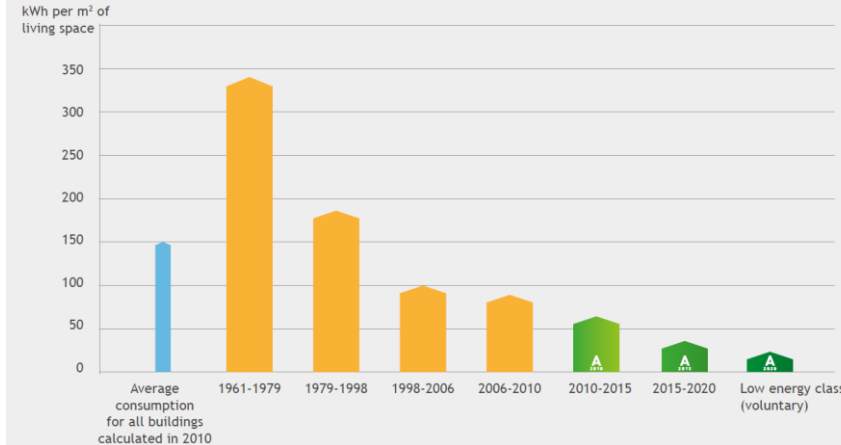
- New building code in 2023
 - LCA
 - nearly Zero Energy (new) Buildings
 - Sustainability requirements
- Energy renovation of buildings
 - Energy renovation of state buildings and municipal buildings – Financial pool for municipalities and regions
 - Subsidy scheme for private homes
- District heating in cities
 - Flexibility
- Electrification of the heating sector
 - Subsidy scheme for heat pumps



The building code

- Mandatory for all new buildings (heated) and for major renovations in existing buildings
- Overall energy performance requirement, U-values for the building materials (walls, windows, doors, roofs, floors –high level of **insulation**)
- Efficiencies of the heating, hot water, ventilation and cooling installations (**pumps**, ventilators, ventilation systems, gas boilers etc.)
- Individual control of temperatures in all rooms (**thermostatic valves**)
- **Functional Performance Testing of technical installations** (Building management system, heating systems incl. hydraulic balancing of heating system, ventilation systems and lighting systems in commercial buildings).

Change in the Building Regulations' requirements for energy demand of single family houses 1961-2020



The Danish Building Code

Building Code	kWh/m ² /Year		Voluntary class, kWh/m ² /Year	
	Domestic buildings	Non-domestic buildings	Domestic buildings	Non-domestic buildings
BR18				
New buildings	30 + 1000/A	41 + 1000/A	27	33
Renovation of buildings	70 + 2200/A	95 + 2200/A	52,5 + 1650/A	71,3 + 1650/A

A is the heated floor area

Approx. **30 kWh/m²** for residential buildings and **41 kWh/m²** for non-residential buildings

Energy Renovation and retrofitting

The Danish Building Code

- When a component of the building envelope is replaced, minimum requirements apply for the U-value for walls, roofs and windows
- Energy improvements shall be made if they are profitable. The profitability is determined by:
 - *Annual energy savings x lifetime of the component / investment > 1.33*
- When retrofitting energy service systems - heating, cooling and ventilation - the minimum requirements for new buildings apply and energy performance of installations apply (EU EcoDesign).
- In areas with district heating it is not possible to install oil or gas boilers (energy supply must be renewable)

The next revision of the Danish Building Code

Sustainability will be included by 2023

- Life Cycle Assessment (LCA) -
- Registration and documentation of resource (energy) use at the construction site
- Life Cycle Costs (LCC)
- Development of an **operation and maintenance plan** for maintaining the indoor climate
- Documentation of **problematic substances** in the building and the building materials
- Detailed verification and documentation of the **daylight level**
- Documentation of **degassing from building materials** to the indoor climate
- Documentation of **noise from ventilation systems** in housing

Sustainability requirement, next building regulation 2023

Year	Kg CO ₂ eq/m ² /year		
2020-2022	Two years testing period		
	New buildings more than 1,000 m ²	New building under 1,000 m ²	Voluntary Class, LCA calculations required
2023 new building code BR23	12	No requirements	8
2025	10.5		7
2027	9		6
2029	7.5		5

Denmark's path to a zero emission country

The Green Energy Transition

Subsidy schemes:

- Subsidy pools for affordable housing
 - 30.2 bill DKK (~ 4 bill €) for 2021-2026

Renovation of affordable housing will:

- Reduce the costs for energy
- Improve the living conditions
- Create jobs



Energy Renovation

Public Buildings

- 2020-2030: All state-owned buildings must achieve a specific saving target by 2030.
- For buildings financed but not owned by the state (e.g. high schools, universities and museums), the requirement is a reduction of the energy demand by 10% from 2020 to 2030.
- The municipalities must make an agreement on setting targets for energy savings. The Danish Energy Agency make voluntarily agreements with the municipalities on the targets. By now most municipalities have signed an agreement to annually reduce their energy demand by 2-4 %.
- The Government provides subsidized funding and cheap loans for energy saving measures in the buildings of the regions and municipalities.



Energy Renovation

Affordable Housing

- Funding is available from the Danish Housing Fund (paid by the tenants)
- Focus must be on energy improvement
- The energy retrofitting of affordable housing also results in more healthy buildings and reduces crime in the neighborhood



Source: Brochure from Danske Arkitektvirksomheder, Renovating

Affordable housing energy renovation

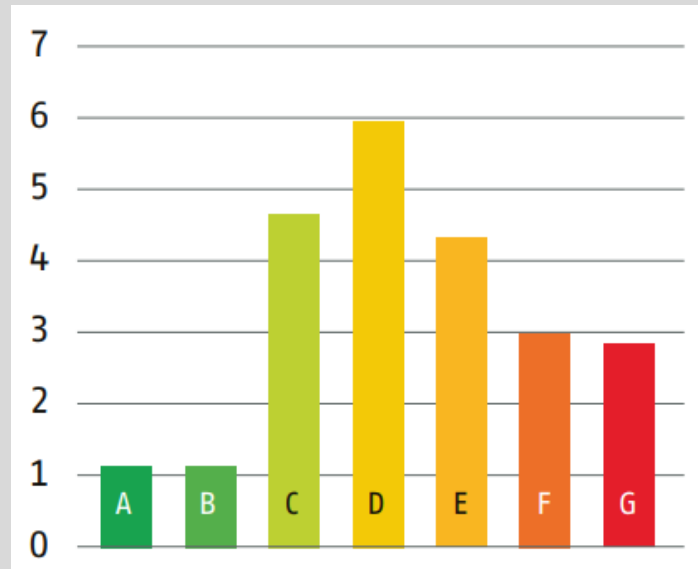
- About 1/5 of the population lives in social housing/affordable housing.
- Funding for energy renovation of affordable housing, also focus on recycling of building materials.



Source: Brochure from Danske Arkitektvirksomheder, *Renovering*

Energy Performance Certificates

- About half of all buildings have an EPC
- A total of around 60,000-80,000 new EPCs are made annually.
- In 2016 a improved EPC led to a higher price for a building, which encourage to perform some if not all of the energy saving measures proposed in the EPC.
- It is estimated that for each increase in the label, the house price will be increased with 10,000-12,000 Euro



EPC for public buildings

Requirements to become an EPC consultant

1

Education

- EC1
- EC2

2

Certification
(ISO9001) +
requirements

3

Registration
of company to
DEA

4

Legislation
and
calculation
program

EC1: Residential and multi-family residential < 500 m² (small buildings)

EC2: Non-residential and multi-family residential > 500 m² (large buildings)

Companies in total = 190 with approx. 600 experts (distributed between EC1 and EC2)

Content of the energy labeling report

Difference in energy labeling report

DIN BOLIG HAR ENERGI-MÆRKE D

ENERGI-MÆRKNINGSRAPPORT
ENERGI-MÆRKE OG FORSLAG TIL ENERGI-OPBEJVEDNING

Rullevæg 10
0200 Højer

Du betaler højest et **24.200 kr.** mere, end du betaler i tilværdig energi.

ENERGIOPBEJVEDNINGENS BEDSTE ANBEJDLINGER

- Konvertering til varmepumpe og installation af et loftvarmeapparat**
 Værdi: 21.000 kr.
 Investering: 120.000 kr.
- Efterisolering af loftetrum med 150 mm isolering**
 Værdi: 1.700 kr.
 Investering: 44.000 kr.
- Udførelse af eksisterende isolering af alle vinduer**
 Værdi: 3.400 kr.
 Investering: 60.000 kr.

DET ÆLST BEHØVDESPOTENTIAL*

ÅRS	OPTEKSTELT	BEHØV
Fjernvarme	20.000 kWh	0 kWh
El-opvarmning	2.200 kWh	1.700 kWh
El-udlad	1.800 kWh	10.000 kWh
Solvarmning	1.100 kWh	0 kWh
Solvarm CO ₂ -udladning	7,44 ton	2,29 ton

FORSERING AF ENERGI-MÆRKE MED BEHØVDESPOTENTIAL AF ALLE RENTABLE FORSLÅN:

A B C **D** E F G

ENERGI-MÆRKNINGSRAPPORT
ENERGI-MÆRKE OG FORSLAG TIL ENERGI-OPBEJVEDNING

Forstue Byvej 20A
0200 Sønderborg 1

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ANBEJDLINGER ENERGI-MÆRKNINGSRAPPORT

	ÅRS-OPTEKSTEL*	INVESTERING	REDUKTION I ÅRSVIS UDLEDTE CO ₂
Bygning	1.700 kWh	44.000 kr.	316 kg CO ₂
Udvalgte forslag	4.000 kWh	138.400 kr.	702 kg CO ₂
Udvalgte forslag med 200 mm isolering	3.400 kWh	62.100 kr.	641 kg CO ₂
Udvalgte forslag med 150 mm isolering	21.000 kWh	120.000 kr.	4.076 kg CO ₂

DIN BOLIG HAR ENERGI-MÆRKE C

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FORSERING AF ENERGI-MÆRKE MED BEHØVDESPOTENTIAL AF ALLE RENTABLE FORSLÅN:

A B C **D** E F G

With building inspection

Without building inspection
(less than 25 years old)

EPC in Denmark

The Green Energy Transition

All building owners can find their EPC in a central Database hosted by Danish Energy Agency:

The building's energy label

CURRENT ENERGY BRAND

A B C D E F G

Estimated savings

With a few energy improvements, you can make a relatively big difference to both your finances and the environment.

Possible calculated savings with the most profitable proposals:

DKK 44,600 / year

How to improve the building's energy label



[DOWNLOAD REPORT](#)

View: Profitable proposals All suggestions

Estimated savings [?]	Estimated consumption [?]	Own production of electricity [?]	Investment [?]
DKK 44,600 / year	DKK 232,100 / year	No production	419,700 kr.

Improvement	Annual savings	Investment
Uninsulated heat distribution pipes and components in the heating plant are insulated	200 kr.	1,400 kr.
District heating exchanger is insulated	200 kr.	3,000 kr.





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