

**Communication from the
Government of the Federal Republic of
Germany
to the Commission of the European Union of
16 April 2014**

Report on the long-term strategy for mobilising investment in the renovation of the national building stock

**pursuant to Article 4 of the Energy Efficiency Directive 2012/27/EU
of the European Parliament and of the Council of 25 October 2012**

The Government of the Federal Republic of Germany has the honour to send the European Commission the following report:

Report on the long-term strategy for mobilising investment in the renovation of the national building stock

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1 Introduction

The German Federal Government hereby sends the European Commission a communication on a long-term strategy for mobilising investment in the renovation of the national stock of both public and private buildings under Article 4 of Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC.

This strategy starts with an overview of the national building stock, the owner and tenant structures, construction activities and the development of floor area increases and energy consumption.

The report goes on to describe the Federal Government's basic national concept for the energy modernisation of the existing building stock and the construction of new buildings to the highest possible efficiency standards. Section 4 then explains Germany's policies to stimulate cost-effective deep renovations of buildings, including staged deep renovations through individual measures.

A forward-looking perspective to guide investment decisions by individuals, the construction industry and financial institutions is provided in Section 5. It describes not only the Federal Government's national energy concept with its long-term goals until 2050, but also short- and medium-term policies, including model projects, research activities and various support programmes.

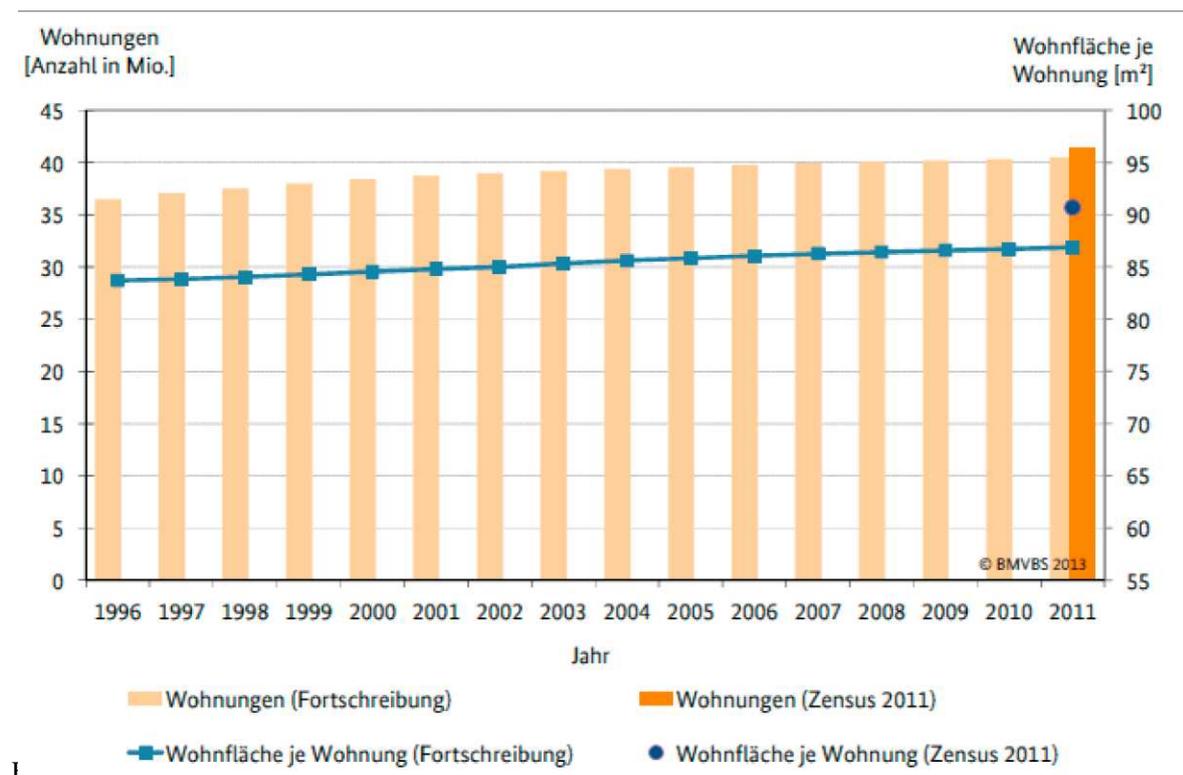
The report ends, as specified by Article 4 EED, with an evidence-based estimate of expected energy savings and wider benefits.

2 Overview of the national building stock

2.1 Residential buildings

The residential building stock in Germany is extremely diverse and comprises a multitude of different building types and age bands with a large variety of architectural and energy performance characteristics.

The official building statistics for 2011 show a stock of approx. 18.2 million residential buildings. Germany has approx. 41 million dwellings with an average living area of around 87 square metres per dwelling. These statistics were slightly adjusted upwards by the 2011 census (Figure 1).



I
Zahlen) 2012]

LEGEND:

Dwellings [number in millions]

Living area per dwelling [m²]

Year

Dwellings (update)

Dwellings (2011 census)

Living area per dwelling (update)

Living area per dwelling (2011 census)

After a considerable decline in construction activity in recent years, it has been increasing again since 2009. In 2012, planning and building permits were granted for 241 000 dwellings, which is a 15 % increase compared to the previous year and around 60 000 dwellings more than five years previously (Figure 2).

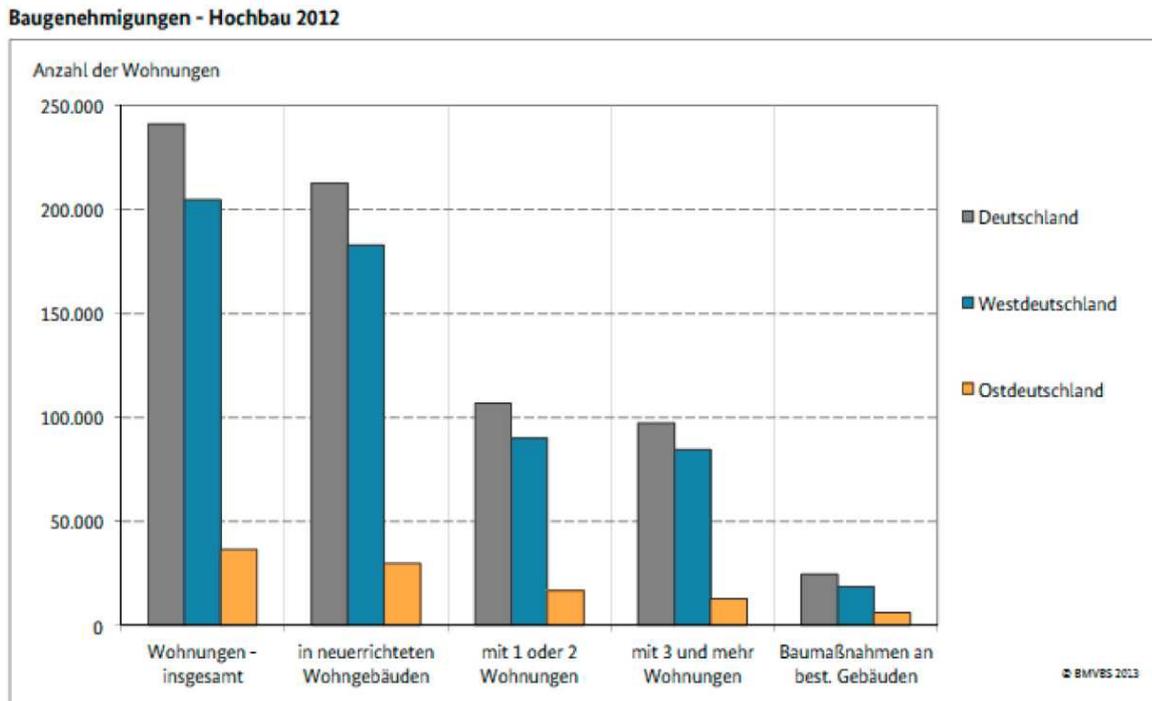


Figure 2: Planning and building permits 2012 [Housing and Building in Figures 2012]

LEGEND:

Number of dwellings

Germany

West Germany

East Germany

Dwellings — total

in newly constructed residential buildings

with one or two dwellings

with three or more dwellings

Building work on existing buildings

Own illustration, base data: Source: Federal Statistical Office [Statistisches Bundesamt] 2012, working tables

New-build construction activities vary considerably from region to region and are mainly focused on conurbations and coastal areas (Figure 3).

Total housing construction activity between 2009 and 2011

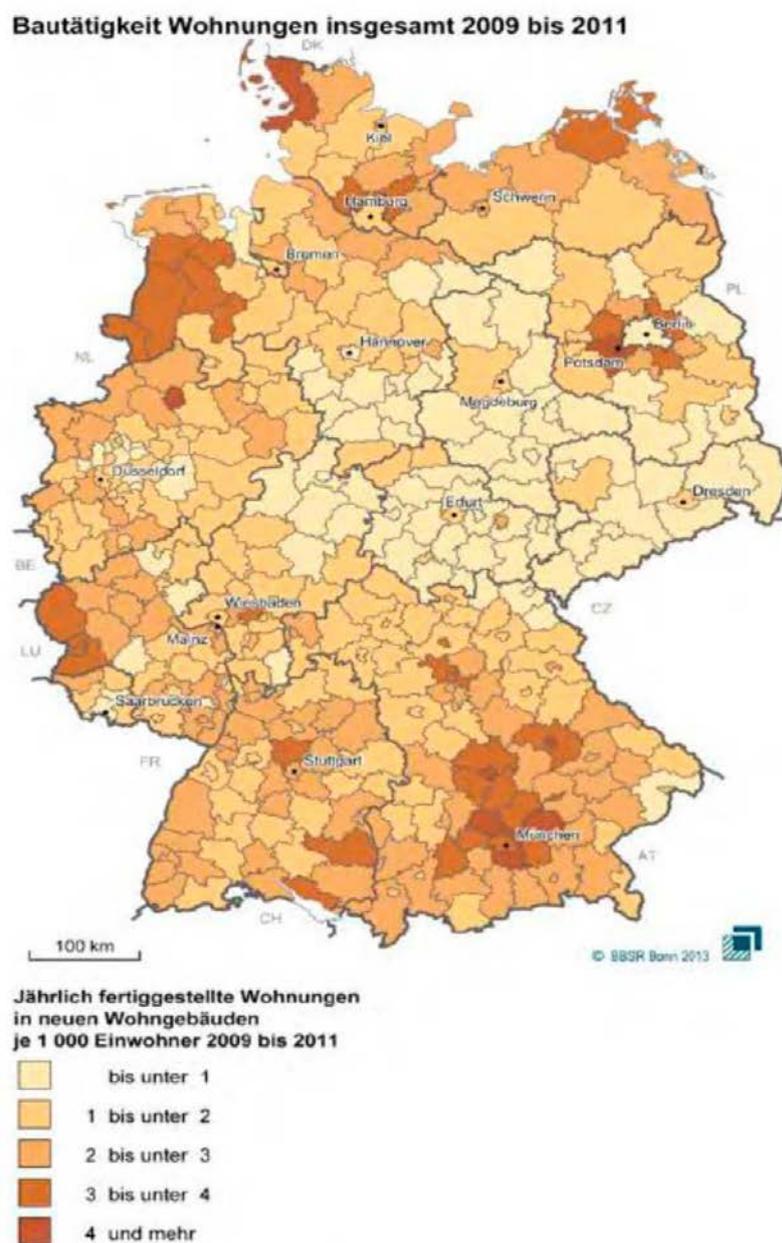


Figure 3: Construction activity in Germany between 2009 and 2011 [Housing and Building in Figures 2012]

LEGEND:

Number of dwellings created in new residential buildings per year per 1 000 inhabitants between 2009 and 2011

- less than 1
- 1 to less than 2
- 2 to less than 3
- 4 and above
- 3 to less than 4

Base data: Housing market monitoring system of the Federal Institute for Research on Building, Urban Affairs and Spatial Development [Bundesinstitut für Bau-, Stadt- und Raumforschung, BBSR], Federal Government and federal states' statistics on construction completions

Geometrical basis: Federal Agency for Cartography and Geodesy [Bundesamt für Kartographie und Geodäsie, BKG], Districts, 31 December 2011 (modified)

Notes: internal differentiation of the districts in Brandenburg into inner, more integrated area and outer development area. The regional district of Hannover and the urban region of Aachen are differentiated into city and former outer conurbations.

Around 68 % of all dwellings are in buildings constructed before 1979. The proportion of dwellings in buildings constructed after 1995 is approx. 13 %. The building age band from the 1950s to the 1970s — less favourable from the energy and structural point of view — accounts for approx. 43 %. The majority of apartment blocks, which provide just under 20 million homes, were also built during this period. Apart from that, one and two-family houses (including semi-detached and terraced houses) dominate every age band and account for just under 18 million homes. A large part of these buildings was also built in the 1950s to 1970s (Figure 4).

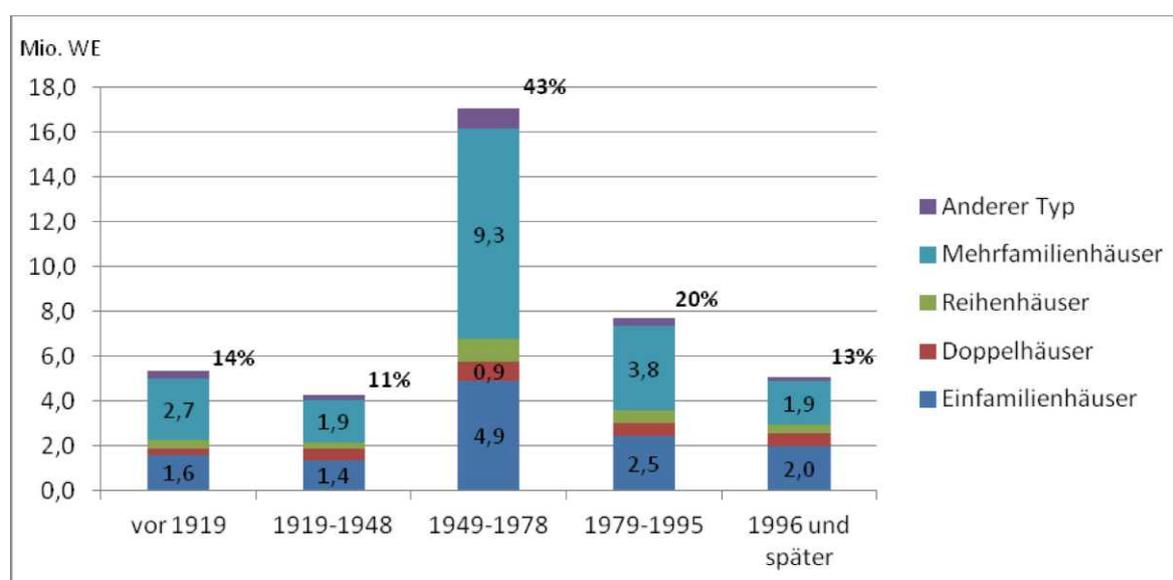


Figure 4: Building structure by age band, building size and type of construction (number of dwellings) [Housing and Building in Figures 2012; own illustration]

LEGEND:

Million dwellings

Other type

Apartment blocks

Terraced houses

Semi-detached houses

One-family houses

before 1919

1996 and later

Just under 23.7 million of the approx. 41 million dwellings are rented; 14.5 million of these are let by private landlords and approx. 9 million by commercial providers. Over 80 % of rental properties are dwellings in apartment blocks. The group of commercial landlords consists mainly of private companies, cooperatives and church and municipal landlords (Figure 5).

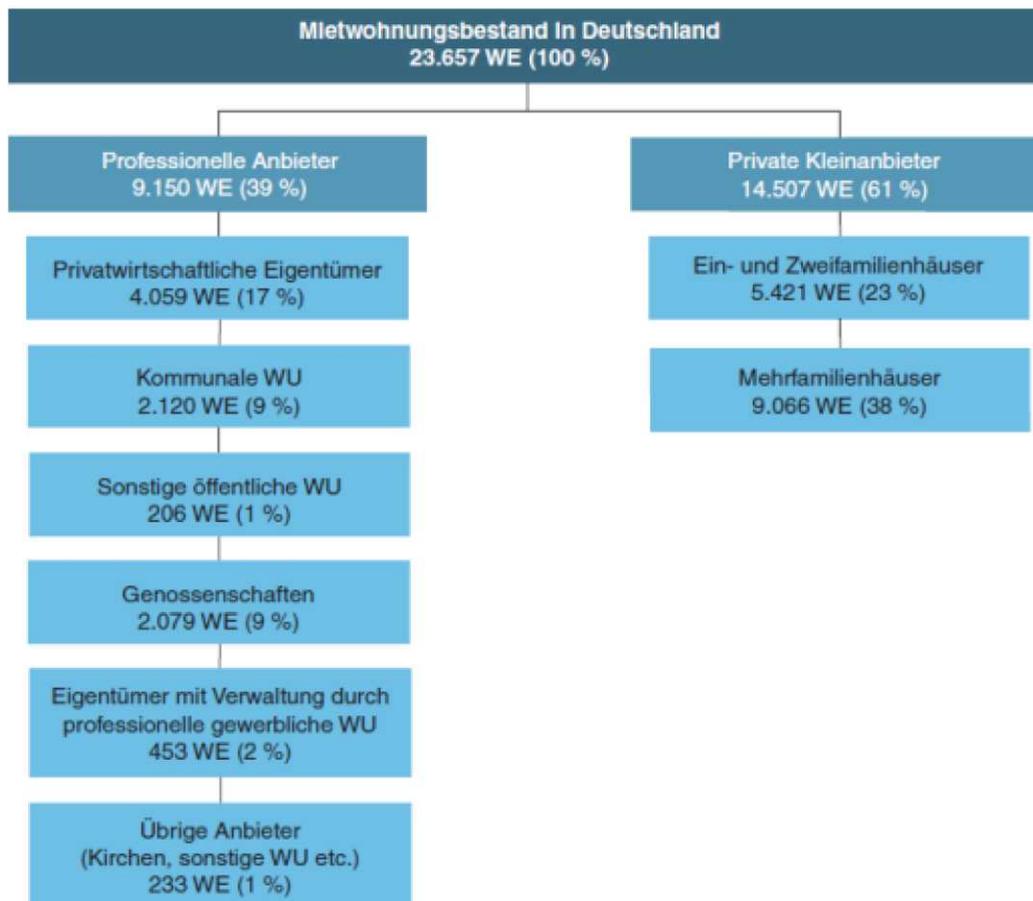


Figure 5: Rental housing stock in Germany [Housing and Building in Figures 2012]

LEGEND:

Rental housing stock in Germany; 23 657 dwellings (100 %)

Professional landlords 9 150 dwellings (39 %)

Small private landlords 14 507 dwellings (61 %)

Private commercial owners 4 059 dwellings (17 %)

One and two-family houses 5 421 dwellings (23 %)

Municipal housing associations 2 120 dwellings (9 %)

Apartment blocks 9 066 dwellings (38 %)

Other public housing associations 206 dwellings (1%)

Cooperatives 2 079 dwellings (9 %)

Owners whose properties are managed by professional commercial housing enterprises 453 dwellings (2 %)

Other providers (churches, other housing enterprises, etc.) 233 dwellings (1 %)

2 .2 Non-residential buildings

Reliable statistical information on the number of heated or cooled non-residential buildings is not available. Estimates suggest that the stock of non-residential buildings amounts to approx. 1.7 million [BEI 2011].

The stock of non-residential buildings is much more varied than the stock of residential buildings. With 22 %, office and administrative buildings make up the largest part of the non-residential building stock, followed by retail buildings (14 %), agricultural buildings (14 %) and the category of ‘hotels, cafés and restaurants’ (13 %) [BEI 2011].

Only rough estimates are so far available for floor areas. With respect to office and administrative buildings, which should account for the largest part of the overall floor area, studies suggest that the average useful floor area per building amounts to just over 1 700 m² for buildings constructed in the most prolific construction years for office buildings (1977 to 2002) [BEI 2011].

2 .3 Public buildings

Federal Government buildings and buildings of the federal states and municipalities account for approx. 20 % of the overall floor area of the non-residential building stock in Germany. Most of this stock of public buildings is made up of municipal non-residential buildings (approx. 14 % of the overall non-residential building stock), followed by the non-residential buildings of the federal states (approx. 4 %) with the remainder accounted for by Federal Government buildings [Fraunhofer ISI 2013].

On the whole, the buildings directly used by the Federal Administration account for only a small part of the overall non-residential building stock in Germany. Their proportion in relation to floor area is around the 2 % mark. Most of the overall floor area is used by military facilities (approx. 31 million m²). The Federal Government’s civil establishments occupy a net floor area of around 8.5 million m².

With regard to its own buildings the Federal Government made a voluntary commitment to reduce energy consumption and CO₂ emissions. This commitment means that CO₂ should be reduced by 50 % by 2020 compared to the year 1990. In 2008, CO₂ emissions amounted to approx. 2.2 m tonnes, which represents a reduction of more than 66 % in CO₂ emissions compared to 1990 (6.3 m tonnes) (Figure 6) [BBSR 2012].



Figure 6: Greenhouse gas emissions from buildings directly used by the Federal Administration [BBSR 2012]

LEGEND:

- Greenhouse gas emissions in million tonnes CO₂ eq/yr
- Total emissions from Federal Government properties (extrapolation)
- Anticipated development of total emissions from 2009 to 2012
- Estimated base level 1990: 6.5 m tonnes CO₂ eq/yr
- Reduction target: - 30 %: 4.55 m tonnes CO₂ eq/yr
- Reduction target: - 50 %: 3.25 m tonnes CO₂ eq/yr
- Reduction achieved in 2008:
- Forecast

Military facilities

The energy consumption in military facilities has steadily gone down since 1990. In 2008, approx. 3.7 terawatt-hours (TWh) of heat energy and 1.2 TWh of electrical energy were used. This is a reduction of more than 70 % in heat energy and approx. 40 % in electrical energy compared to 1990. The area-specific heat energy consumption values fell by 20 % between 1998 and 2008. The area-specific electrical energy consumption however has shown a slight upwards trend since 1998 with an increase of 8 %. The main reasons for this are the increased requirements in the areas of information technology and telecommunications. An important factor influencing the overall reduction in energy consumption in the military facilities however was the reduction in floor areas used [BBSR 2012].

Facilities used for civil purposes

The energy consumption in the civil facilities directly used by the Federal Administration is falling. In 2008, approx. 1.1 TWh of heat energy and 0.4 TWh of electrical energy were used. This is a reduction of more than 22 % in heat energy compared to the energy consumption in 1998. The key factor for the reduction in heat energy consumption in civil properties was the measures taken to improve energy efficiency. This can be seen clearly in the reduced area-specific heat energy consumption values. Improvements of around 30 % were achieved here. Reductions in the areas used played only a minor role. During the same period, the electrical energy consumption in civil properties went up by around 16 %. This increase was caused in particular by the growing use of information technology [BBSR 2012].

Federal Government energy-saving programmes

The Federal Government applies energy-saving programmes in its civil and military buildings and properties with the aim of improving energy efficiency. In the period from 2006 to 2010, a programme was introduced which made approx. EUR 120 million per year available for the renovation of buildings. The measures financed from this programme have already been implemented (60 %) or are still in the process of implementation (40 %). The measures already implemented have so far resulted in final energy savings of around 300 million kilowatt-hours [BBSR 2013].

An energy renovation roadmap for Federal Government buildings ('central government buildings') is currently being drawn up on behalf of the Federal Government as required under Article 5 EED. Refer to this report for further details regarding the 'central government' buildings.

2 .4 *Energy status of buildings*

Buildings account for just under 40 % of the energy consumption in Germany. 26 % is used for heating and another 5 % for hot water. The remaining percentage is used for cooling and lighting (Figure 7) [Energy in Figures (Energie in Zahlen) 2013].

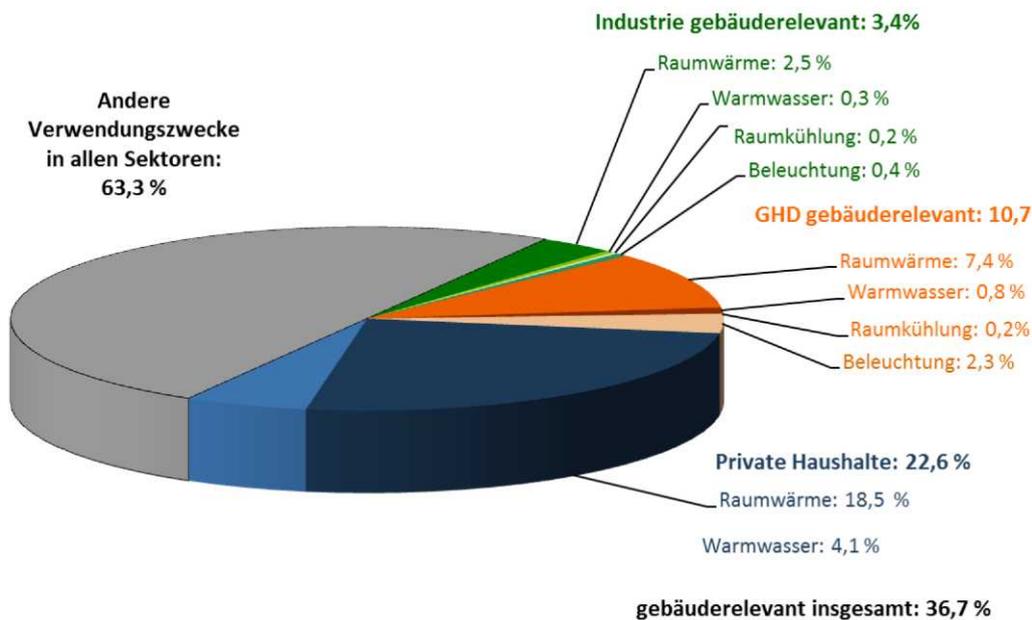


Figure 7: Shares of energy consumption by buildings in the total final energy consumption in Germany in 2012 [Energy in Figures 2013; own illustration]

LEGEND:

- Industry building-related: 3.4 %
- Space heating: 2.5 %
- Other uses across all sectors: 63.3 %
- Hot water: 0.3 %
- Space cooling: 0.2 %
- Lighting: 0.4 %
- Commerce, Trade and Services [GHD] building-related: 10.7 %
- Space heating: 7.4 %
- Hot water: 0.8 %
- Space cooling: 0.2 %
- Lighting: 2.3 %
- Private households: 22.6 %
- Space heating: 18.5 %
- Hot water: 4.1 %
- Total related to buildings: 36.7 %

Great progress has already been made in reducing the space heating consumption in buildings – particularly in private households. The temperature-adjusted value for 2012 was 147 kWh per square metre and year (kWh/m²a), which means consumption was almost 30 % lower than in the late 1990s (205 kWh/m²a). Although the unadjusted value is subject to greater fluctuations, it also shows a decline (Figure 8).

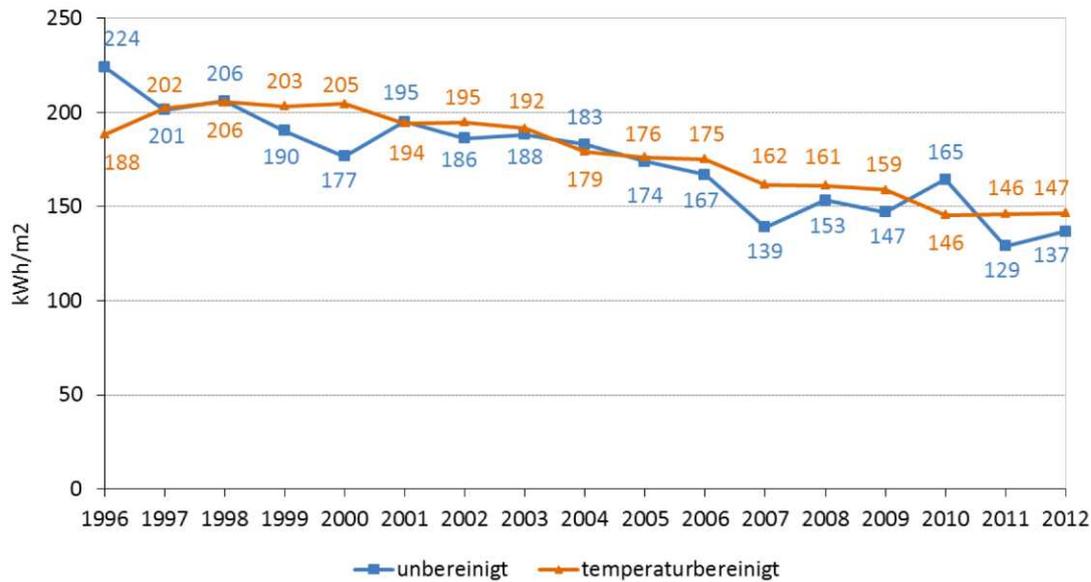


Figure 8: Development of the specific final energy consumption to generate space heating in private households [Second Monitoring Report 2014]

LEGEND:

- unadjusted
- temperature-adjusted

In the same period the total living area in Germany increased by around 17 %. This means that efficiency measures are increasingly leading to a decoupling between use and energy consumption.

The trend in energy consumption in non-residential buildings is similar; particularly in the commercial sector the renewal rate of components is often even higher than in residential buildings. Because of the very diverse building and ownership structures the data available in Germany are currently being enhanced.

The energy performance qualities of individual external components of residential buildings are examined in detail below [Institute for Housing and Environment (Institut für Wohnen und Umwelt, IWU)]:

Energy performance quality of external walls

The energy status of a building and measures already implemented are currently not recorded in official statistics in Germany in a differentiated manner. Current studies by the IWU on the energy performance quality of the German housing stock have found, however, that 42 % of all residential buildings have thermally insulated external walls. In just under half of these cases the thermal insulation was retrofitted in the course of other modernisation work. In approx. 76 % of all residential buildings the roof or top floor ceiling is thermally insulated and in around 37 % of the

cases the basement ceiling is thermally insulated. In around 53 % (roof or top floor ceiling) or just under 26 % (basement ceiling) of these cases the thermal insulation was retrofitted. More than half of the buildings constructed in the period 1979 to 2004 have thermally insulated external walls and in more than 90 % of cases the roofs are also thermally insulated. Over 60 % of these buildings also have thermal floor slab insulation. This development since the late 1970s happened not least as a result of the introduction of the first Thermal Insulation Regulation [Wärmeschutzverordnung] in 1978 (Figure 9).

Thermal insulation: condition of residential buildings

	Insulated component		
	External wall	Roof / top floor ceiling	Floor slab / basement ceiling
Data from 2009			
Buildings total			
Proportion of buildings with insulation in the relevant component in %			
Total	42.1	76.4	37.1
Old buildings constructed up to 1978	35.7	68.2	23.3
Buildings constructed in 1979 – 2004	53.2	92.1	62.1
New builds from 2005 onwards	66.0	98.5	87.3

Figure 9: Thermal insulation in residential buildings according to age band and components [IWU]

Note that the seemingly low value of 66 % of insulated external walls in new builds from 2005 onwards can be explained by the fact that only the additional insulation layers have been accounted for in the statistics. However, buildings of this age band usually either have thermal insulation or a load-bearing external wall with insulating properties (brickwork, porous concrete, etc.). It can also be assumed that buildings constructed after 2005 have external walls with insulating properties as required under the relevant version of the Energy Saving Regulation [Energiesparverordnung, EnEV] (i.e. at least EnEV 2002).

Energy performance quality of windows

The great majority of all residential buildings have windows with at least double-glazing (this includes, for example, countersash windows). Just under 4 % of these buildings already have triple-glazing. In buildings dating from before 1978 with the original windows still in place around 4 % of the windows are only single-glazed (Figure 10).

Glazing types and age of windows 2009

	Residential buildings by year of construction		
	Total	up to 1978	from 2005
Proportion of residential buildings in %			
Windows up to construction year			
1994			
Single-glazed	2.2	4.1	-
Double-glazed	41.2	56.8	-
Triple-glazed	0.5	0.4	-
Windows from construction year			
1995			
Single-glazed	0.3	0.2	0.3
Double-glazed	52.6	36.4	85.0
Triple-glazed	3.2	2.0	14.7
Total	100.0	100.0	100.0

Figure 10: Glazing types in residential buildings by year of construction [IWU]

Energy performance aspects of the ventilation of buildings

The majority of existing buildings do not as yet have a controlled ventilation system. Only 0.4 % of the buildings constructed up to 1978 have (retrofitted) mechanical ventilation. Over three quarters of these are simple ventilation systems without heat recovery. The proportion of new builds constructed from 2005 onwards that have a ventilation system is also only 9 %, but these are mostly systems with heat recovery (Figure 11). The percentage of controlled ventilation systems with heat recovery has steadily increased in recent years however.

Stock of ventilation and air-conditioning systems 2009

	Residential buildings by year of construction		
	Total	up to 1978	from 2005
Proportion of residential buildings in %			
Air conditioning systems	0.9	0.9	1.6
Ventilation systems	1.5	0.4	9.1
Proportion of these			
without heat recovery	49.7	75.3	17.5
with heat recovery	50.3	24.7	82.5
Total	100.0	100.0	100.0

Source: Institute for Housing and Environment [Institut für Wohnen und Umwelt, IWU]: Building stock base data. Survey of energy performance quality and modernisation trends in the German housing stock; Darmstadt 2010 (supported by the 'Zukunft Bau' [Future of Construction] research initiative of the German Federal Ministry of Transport, Building and Urban Development [Bundesministerium für Verkehr, Bau und Stadtentwicklung, BMVBS])

Figure 11: Stock of ventilation and air-conditioning systems [IWU]

Renovation activities in the last ten years

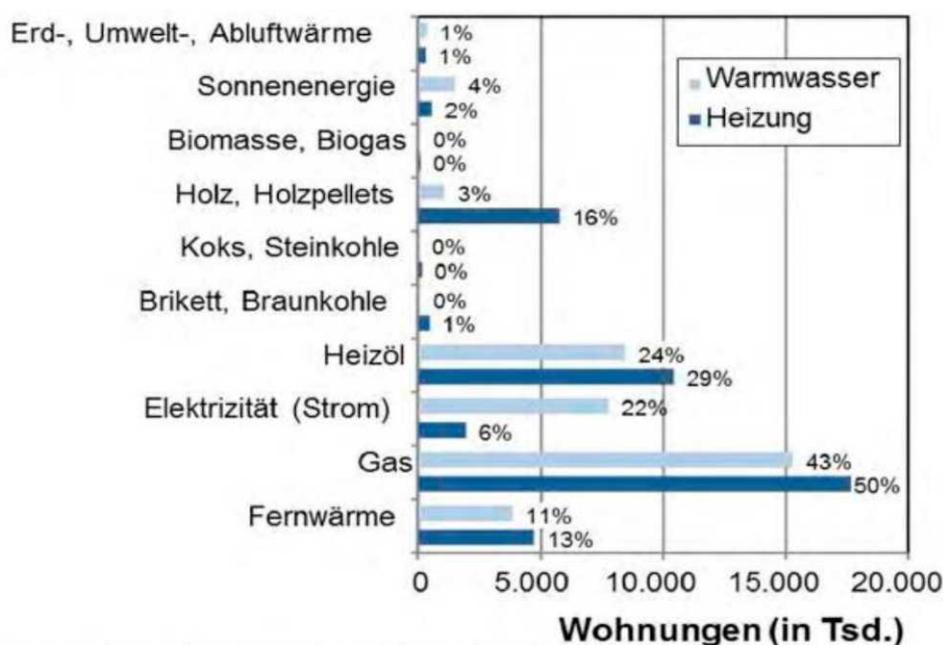
In the years 2000 to 2009, the external wall insulation was modernised in just under 1 % of the buildings constructed before or in 1978 per year, according to surveys carried out by the [IWU]. The annual modernisation rate for thermal insulation of roofs or top floor ceilings during this period is around 1 to 2 %, and for basement ceilings it is well under 1 %. The annual renewal rate of the main heat generator is just below 3 % per year in the residential building stock. It can therefore be assumed that the renovation rate in German is around 1 % on average.

Use of renewable energy sources

Systems using renewable energy sources for heating are not very widely applied in the building stock. In 2010, renewable energy sources (e.g. solar thermal technology or biomass boilers) were used exclusively in around 6 % of all existing buildings and partially in every eighth building (13 %) (Figure 12).

Types of energy used for heating or for hot water in 2010

(multiple selection possible)



Prozentangabe: Anteil an allen Wohnungen

Figure 12: Principal energy sources for heating and hot water in residential buildings [Housing and Building in Figures 2012]

LEGEND:

Geothermal, environmental, exhaust air heat

Solar energy

Hot water

Biomass, biogas

Heating

Wood, wood pellets

Coke, coal

Briquettes, lignite

Fuel oil

Electricity (power)

Gas

District heating

Dwellings (in thousands)

Percentage: proportion of total number of dwellings

3 Renovation policy

There are no one-dimensional answers to cost-effective energy renovation policies in the building sector. A set of instruments is needed that gives the right incentives and provides flexible support and solutions for the various starting points and interests involved. A balanced mix of regulations, incentives and information must enable a consensus-based implementation by property owners.

The approach taken so far in Germany – a combination of reducing energy consumption, increasing efficiency and replacing fossil fuels – has proven successful. The challenge we are now facing is to optimise this combination in technical and economic terms in the relevant building, neighbourhood, municipality or region. The set of instruments must therefore offer solutions for energy performance optimisation in individual buildings as well as in neighbourhood development schemes that are open to the various technologies available and respond to the needs of the relevant target group. The Federal Government's approach is to develop individual policies for property owners and companies that also focus increasingly on measures for neighbourhoods.

Buildings vary enormously in terms of their starting situation, potential and the interests of their respective owners. There are also great regional differences in the real estate markets and investment usually happens where demand already exists or can be generated.

In addition to increasing the number of modernisation measures related to thermal insulation and heating it is also very important to substantially improve the depth of renovation, i.e. the quality of the energy renovation measures. Another point to consider is that for many existing buildings the limits of what can be achieved in terms of thermal insulation under urban planning rules are quickly reached. The reasons for this could be, among other things, listed building or conservation area requirements. However, there are still potential savings to be made even for these types of buildings, not least by converting the energy supply to a fossil fuel free system.

Germany has been working towards the goal of increasing energy efficiency in buildings (new builds as well as existing stock) for many years. This work focuses on the voluntary nature and cost-efficiency of measures and on a balanced mix of instruments according to the formula 'Fordern, Fördern, Informieren - Marktkräfte stärken' [Demand, incentivise and inform — strengthen market forces]. A large number of measures have already been taken in Germany to provide the necessary stimulus for renovation work and energy-efficient new builds.

In future it will be important, among other things, to further optimise the proven combination of defining minimum requirements in energy saving law and further optimising the promotion of energy performance features that exceed these minimum requirements, to offer intelligent incentives for the provision of additional private investment capital in energy modernisation projects, to further improve the transparency and quality of the information and consulting services available and of the measures already implemented and to develop a more integrated and systemic way of thinking.

Alongside individual buildings, neighbourhood schemes and urban planning policies should also be brought more into focus than in the past. Taken together, these various factors can make it even more profitable for investors to combine modernisation projects and necessary maintenance or repair work effectively with energy measures. The set of instruments also takes into account the economic justification of legal measures. Tenants as well as landlords and owner-occupiers should not be unreasonably burdened by the implementation of European regulations. Dwellings must remain affordable and architectural heritage must be preserved.

In order to ensure their speedy implementation as well as maximum acceptance, these tried and tested instruments will be enhanced and expanded in a targeted way, taking into account any potential interactions. The next section focuses on the existing set of instruments and possible new measures or schemes.

4 Strategies for deep renovations

Incentivising deep energy renovations of the buildings stock requires as broad a policy approach as possible. As described in general terms in Section 3, the national approach — the three-fold policy of ‘Fordern - Fördern - Informieren / Marktkräfte stärken’ [Demand, incentivise and inform — strengthen market forces] — includes a broad range of interwoven and coordinated instruments and projects. This system has been consistently enhanced over recent years. The course was initially set in this direction with the 2010 energy concept and the 2011 energy transition as well as with a long view out to 2050. Alongside the policy decisions of the coalition agreement of 2013, the Federal Government is set to take specific steps during the present legislative period to provide an even more effective stimulus for deep energy renovations of the buildings stock.

4.1 Energy Saving Regulation

The legal framework for energy performance requirements for buildings is determined by the Energy Saving Act [Energieeinsparungsgesetz, EnEG] and especially by the Energy Saving Regulation (EnEV) based on the EnEG. New builds must comply not only with the EnEV but also with the Renewable Energies Heat Act [Erneuerbare-Energien-Wärmegesetz, EEWärmeG], which provides for a basic obligation to use renewable energy sources (see Section 4.2).

In 2013, the EnEG already laid down a basic obligation to construct new builds to an ambitious nearly-zero energy building standard. The technical and other details will be determined soon by the Federal Government. This transposes the relevant requirement under the EU Buildings Directive.

The EnEV governs the minimum energy requirements for new builds as well as for voluntary renovations or modernisations. Any modified building components must meet the EnEV energy requirements. A threshold clause exempts minor measures from this obligation. There are also decommissioning obligations, usually applicable to old boilers, retrofit obligations, e.g. for

previously uninsulated, accessible heat distribution and hot water pipes, and insulation obligations for some previously uninsulated top floor ceilings. Furthermore, internally generated and internally consumed electricity from renewable energy sources (e.g. photovoltaics) may be offset against the target value set by the EnEV.

The EnEV 2009 applicable until now will be replaced with the amended Energy Saving Regulation (EnEV 2013) on 1 May 2014. The amended EnEV 2013 includes the decision to reduce the permitted annual primary energy demand by an average of 25 % and the required minimum thermal insulation (permitted U-value of the building envelope) by an average of 20 %. These stricter requirements will apply as of 1 January 2016. The role of the energy performance certificate (EPC) as an educational and informative tool will also be strengthened: In future the energy indicators from the EPC will also have to be disclosed in advertisements for property sales or lets. The EPC must be shown in viewings of properties for sale or to let and, when a property is sold or let, it must be handed over to the buyer or tenant. The display obligations will also be expanded to include larger buildings not used by public authorities and smaller buildings used by public authorities that are frequently visited by the public.

4 .2 Renewable Energies Heat Act

The Renewable Energies Heat Act (EEWärmeG) as amended with effect from 1 May 2011 requires that a proportion of the heat and cooling demand in new builds as well as in existing public non-residential buildings undergoing deep renovation should be covered by renewable energies. It is allowed under the EEWärmeG to opt for certain alternative measures, e.g. energy savings through over-fulfilment of the EnEV requirements, the use of heat from cogeneration or the use of waste heat. These measures can be combined in any way.

In relation to the public building stock the EEWärmeG provides for additional obligations to use renewables. The non-public building stock, however, is exempt from one obligation and may take advantage of financial support offered for the use of renewable energy sources ('market incentive programme for renewable energies in the heating market').

The federal states are expressly allowed to independently provide for obligations to use renewables.

At the end of 2012 the Federal Government published a progress report on the EEWärmeG. Based on the findings of the progress report, the EEWärmeG is to be further developed in an appropriate manner and reconciled with the provisions of the Energy Saving Regulation (EnEV) during the present legislative period.

4 .3 Tenancy law

Tenancy law provides for effective incentives for energy modernisation of the rental housing stock. The current tenancy law allows landlords to request tenants to pay a share of the costs of energy renovation. Under Section 559(1) of the German Civil Code [Bürgerliches Gesetzbuch, BGB] the annual rental charge may be increased by 11 % of the costs for energy renovation. The amount of the modernisation levy on tenants should offset the investment costs advanced by the landlord. Tenants benefit from the modernisation through lower running costs and greater living comfort. However, these savings are often not sufficient to compensate for the modernisation costs attributable to tenants, which are usually not exclusively related to energy saving measures. The result is a significant increase in the total rental charges (including incidental costs).

A socially equitable tenancy law that creates the right incentives for investment and improves the cost-effectiveness of energy modernisations is therefore an important precondition for energy performance measures carried out on existing buildings. The Federal Government has also agreed to take measures to ensure that housing rent remains affordable [coalition agreement (Koalitionsvertrag, KoaV)]. The Federal Government is currently working on the implementation of this agreement.

The general conditions under tenancy law for energy modernisations were further improved with the Tenancy Law Amendment Act [Mietrechtsänderungsgesetz], which entered into force on 1 May 2013, e.g. by a requirement for tenants to permit energy modernisations and by creating a uniform legal framework for the transition to commercial heat supply (contracting) during the ongoing tenancy relationship. An addition to Section 558(2) BGB also took greater account of the importance of energy performance features to establish the reference rent customary in the locality. In future, market transparency as well as the acceptance and financial viability of investment in energy efficiency improvements are to be increased at the municipal level through the application of qualified energy-related rent indexes. An analysis of the existing rent indices in Germany shows that more than half of them already include differentiating energy performance features albeit at a varying degree of detail. For property owners wanting to carry out energy renovations to increase the value of their property, strengthen their market position, limit heating costs for their tenants and avoid vacancies, rent indices with energy performance features can offer adequate market guidance. Model projects in different towns and cities or based on different types of rent indices are used to try out and develop possible ways in which energy performance features could be included in rent indices.

4 .4 Funding

The goals of the energy concept require deep changes to the building stock and its energy supply in a relatively short space of time compared to the long renovation cycles. Such a development needs to be backed up by support instruments to improve the level of acceptance in general and to support and control widespread implementation, improve the cost-effectiveness of measures for owners and

enable the relevant property owners to realise measures with ambitious energy targets. The funding should also reduce the financial burden of construction and heating costs and make their long-term calculation easier for the users.

Funding is a key management tool incentivising owners to combine any necessary renovation work with energy efficiency improvement measures and implement energy renovation work to a high quality standard and as comprehensively as possible. Approximately 3 % of the building stock is currently undergoing renovation, but energy renovation measures — predominantly individual measures — are only carried out on one third of these buildings. For one third of the one- and two-family homes and smaller apartment blocks energy renovation is not profitable unless it is subsidised. Funding can provide an additional incentive here to tap energy saving potential and help reduce the amortisation period to an acceptable level for both deep renovation measures and individual energy efficiency improvement measures.

In the new-build sector funding is already the driver for establishing the ambitious energy standards of the future: approximately half of all residential new builds are supported by the KfW [German government-owned development bank] and are therefore constructed to a significantly higher energy efficiency standard than required by law.

It is therefore essential to motivate property owners to work out and develop the energy savings potential of their buildings as and when renovation work is to be undertaken anyway. Key to this is a good consultation and information policy as implemented in the context of energy consultation for residential buildings in the form of Government supported on-site energy consultation provided by the Federal Office for Economic Affairs and Export Control [Bundesamt für Wirtschaft und Ausfuhrkontrolle, BAFA] or by consumer organisations. At the same time the implementation of partial and comprehensive renovation projects with increasingly ambitious energy-efficiency improvement targets or, where appropriate, high-quality individual measures must be encouraged and their quality ensured so that they can build on each other and result in a good overall energy performance standard of the building.

An analysis of the building envelope and its technical systems should precede any deep renovation in order to initiate the most cost-effective — possibly staged — renovation. Similarly important is the provision of expert support during the renovation project as well as practical monitoring of the intended results. The CO₂ building renovation programme (KfW support programmes for energy-efficient construction and renovation) for residential buildings, municipal buildings and buildings of social bodies, the market incentive programme for renewable energies in the heating market (MAP) and the support of energy consultation by the BAFA are already based on this approach. The research accompanying all these programmes ensures that they are continuously developed and adapted in line with technical progress and market requirements.

The support contributes significantly to establishing ambitious technical standards on a broad scale and is therefore preparing the ground for enhancing the energy saving law.

CO₂ Building Renovation Programme

The funding has supported the energy-efficient renovation or construction of nearly 3.5 million homes from 2006 to today, with an investment volume totalling around EUR 159 billion. The funding leverage ratio of public to private investments averages 1:12. Energy saving measures in buildings of social or municipal bodies have also been supported since 2007 on a total of approx. 1 925 buildings. Greenhouse gas emissions have been reduced since 2006 through funded investments by more than 7.0 million tonnes per year. This calculation is based on an average use period of the measures of 30 years. In 2012 alone the investments made as a result of the programme secured or created 347 000 jobs, particularly in SMEs and in the trades [KfW].

The principles underlying the KfW support programmes should therefore also serve as a guide for future support measures:

- greater energy savings are rewarded by greater support;
- support standards are adjusted on a regular basis in line with technical progress, the market and energy saving law. Results from the associated monitoring will also be taken into account here in future;
- flexible support instruments take account of different starting situations: they range from highly energy-efficient individual measures (that build on each other and lead to the ambitious KfW ‘Efficiency House 55’ standard) to complete renovation projects with various energy performance levels (KfW ‘Efficiency House’ standard). The support programme is open to all types of technology;
- the graded funding approach and the supported energy consultation and planning measures incentivise property owners to look at the whole building and optimise its energy efficiency;
- the eligible area is defined within the legal framework in line with the relevant target group (owner-occupiers/landlords, property owners, municipal and social institutions);
- quality assurance, and consequently the building of trust, by supporting the energy consultation and planning process, the improvement of the qualification of market players and finally also through ensuring compliance with the support standards.

In 2014, EUR 1.8 billion (commitment appropriations) are to be made available for grants and soft loans in support of the CO₂ building renovation programme. Under the coalition agreement [KoaV], it is planned to increase and continue indefinitely the CO₂ building renovation programme within the limits of available funds (see Section 5.2).

Market Incentive Programme for renewable energies in the heating market [Marktanreizprogramm, MAP]

Approx. EUR 438 million (commitment appropriations) are to be made available in 2014 for the MAP. The MAP provides incentives for the use of renewable energies in the heating market and is mainly geared towards measures for the existing building stock. Part of the funding is used for forward-looking infrastructure measures (heat networks, heat storage units) and for the diffusion of innovations. The investment support is supplemented by various, also government-funded energy consultation services offered by the BAFA and consumer organisations.

KfW ‘energy-related urban regeneration’ [Energetische Stadtsanierung] programme

In 2011, based on experience from the ‘energy-related urban renewal’ [Energetische Stadterneuerung] programme and the competition for ‘energy-related renovation of large housing estates based on integrated neighbourhood development schemes’ [Energetische Sanierung von Großwohnsiedlungen auf Grundlage von integrierten Stadtteilentwicklungskonzepten], the KfW introduced its ‘energy-related urban regeneration’ programme which places the renovation process on a wider urban planning basis, moving away from individual buildings to the neighbourhood level. The programme supports energy-related neighbourhood schemes across buildings which provide the basis for energy efficiency improvement measures for buildings as well as infrastructure. As part of an integrated urban development policy they are to be derived from municipal energy schemes or integrated urban (district) development or housing schemes, where these exist. The schemes are to demonstrate the CO₂ reduction potential and measures in the neighbourhood under review, taking into account all relevant urban design, architectural, housing and social aspects. The development and implementation of the neighbourhood schemes are supported by a renovation manager (also funded) who manages complex renovation projects and brings all local stakeholders and players together. He is the ‘caretaker’ creating the link between the relevant players, e.g. housing associations, private owners, tenants and energy suppliers. This means that local people are included in the process of identifying solutions relevant to their neighbourhood. The renovation manager oversees in particular the implementation of the renovation scheme, provides information on the support available and coordinates the public relations work. He is also often already involved in drawing up the renovation scheme. The promotion of renovation schemes will be accompanied by a second support component under the ‘energy-related urban regeneration — neighbourhood supply’ programme. Soft loans are used here to support investment in the sustainable improvement of energy efficiency of the municipal energy supply systems.

4.5 Affordable housing

Affordable but nonetheless high-quality housing must be provided for households on low income too. The purpose of the government support available from the CO₂-building renovation programme

is not only to promote energy saving but also always to limit the burden imposed on tenants and owners by renovation costs. Under German tenancy law (Section 559a BGB) landlords must deduct this financial support from their investment costs before claiming the costs of an energy renovation project from their tenants.

The modernisation programmes of the federal states, in particular the social housing promotional schemes, also ensure that housing, heating and hot water remain affordable for households on low income. Since social housing promotion was transferred to the federal states in 2006, the Federal Government has paid compensation to them. These compensation funds amount to approx. EUR 518 million up to and including 2019.

Households on low income receive direct financial support for their housing costs via the instrument of social security and as part of the unemployment benefit II allowance for housing and heating as well as through housing benefit. The Federal Government promotion also ensures that these households are provided with free energy consultations in 650 consumer advice bureaux across Germany or in municipal offices or through on-site building checks carried out by energy consultants.

4.6 *Tax relief on renovation work*

Owner-occupiers can claim tax relief for services provided by builders and craftsmen as long as they are not claiming public subsidies for this work. The maximum annual tax relief granted is EUR 1 200.

Landlords can also claim tax relief on expenditures for renovation work often immediately and in full under current law. Otherwise, landlords are allowed to pass costs incurred through energy renovation measures on to their tenants. The investment can be charged to tenants at a rate of 11 % per year.

4.7 *Information — advice, planning and construction*

Information and advice must be provided in order to drastically raise the level of acceptance of energy saving measures and also to enable planners, investors and companies implementing the measures to initiate renovation work and structural changes at the required level of quality. On the demand side, consumer awareness must be further increased. The cause of the existing obstacles and difficulties can often be found in a lack of experience and sometimes also a lack of knowledge. Qualification, transfer of knowledge and quality assurance of the planning and execution processes are therefore of great importance. On the supply side, further efforts are required to ensure a high level of quality in advice and execution and to increase trust — especially among private owners/developers — in the services offered.

For the majority of owner-occupiers and ‘small-scale’ landlords it is absolutely essential to receive high-quality, independent energy advice and planning support. In order to assure the quality of planning and implementation of renovation work, on-site energy consultations in residential buildings are supported by the BAFA as an initial measure. The consumer organisations’ ‘energy checks’ supported by the Federal Government offer additional advice to tenants and property owners with inexpensive on-site information provided by independent experts. Such advice is given free of charge to households on low income and ranges from user behaviour to building checks. If a house is renovated to improve its energy efficiency, KfW will fund not only the investment measures to support the developer or owner and the quality assurance but also the planning process and project management by a qualified expert. An important contribution to improving the quality on the market has been provided since the end of 2011 in the form of a list of energy efficiency experts for Federal Government support programmes and energy consultants for monuments and other buildings and structures of particular historic value. The expansion of the regional renovation and consultation networks of cooperating architects, planning experts and craftsmen must continue to be supported.

Information campaigns should address craftsmen who can play an important role in the renovation of buildings. They usually have direct access to the owners and are often perceived as reliable contacts and advisors with regard to improvements to the house. Property managers could play a similar role.

These players also need to be better qualified and better informed about building-related energy efficiency improvement measures and their professional execution, the importance of looking at the building as a whole and the support and funding options available.

At the same time it is important to activate the supply side more strongly: the energy performance quality of a building can be used as a marketing tool and is all too often overlooked in the marketing of homes and houses by estate agents or property managers. Here too, the players often lack up-to-date information and expertise regarding the energy efficiency of buildings.

Furthermore, broad-scale and voluntary measures — such as displaying energy performance certificates in residential buildings, establishing qualified ecological rent indices, disseminating renovation configurators via the internet or heating cost calculators — can also contribute to raising awareness.

‘Building Transition’ [Hauswende] campaign

A renovation campaign aiming to intensify the energy renovation of buildings, called ‘Die Hauswende’ [Building Transition], is currently underway. It was launched at the instigation of the German Alliance for Energy Efficiency in Buildings [Allianz für Gebäude-Energieeffizienz] and is led by the German Energy Agency [Deutsche Energie-Agentur] and supported by trade associations, companies and the Federal Government. The campaign is a cross-trade renovation campaign aiming to drive the energy transition in the area of buildings through a broad alliance. The campaign gives

home owners information on energy saving renovation and supports them in the search for qualified local energy experts. The objective of the campaign is to inform people of the benefits of energy renovation in the area of heating technology, renewable energies and the building envelope by providing them with facts and details. This should intensify renovation activities.

5 Future prospects — energy transition in Germany

5.1 Energy concept of the Federal Government

In September 2010, the Federal Government adopted an energy concept which describes the way forward to the age of renewable energy. This gives Germany a long-term strategy for a reliable, economically viable and environmentally sound energy supply. By 2050, the energy supply in Germany is to be sourced almost exclusively from renewable energies. This requires a comprehensive reconstruction of the supply system.

A high degree of security of supply, effective climate and environmental protection and an economically viable energy supply are also key conditions for ensuring that Germany remains a competitive location for industry and energy remains affordable for private consumers. We want to strengthen competition and a market-based orientation on the energy markets. The main goal of the Federal Government is to reduce the heat demand of the building stock in the long term so that the building stock will be almost climate-neutral by 2050, i.e. that the energy needs of buildings are brought down to a minimum level and the remaining energy demand is covered mainly by renewable energies. This approach supports the European goal that only ‘nearly-zero energy buildings’ will be constructed in the Member States from 2021 (see also the report by the Federal Government on the transposition of Article 9 of the EU Energy Performance of Buildings Directive [EPBD] on increasing the number of nearly-zero energy buildings [report on Article 9 EPBD]).

The instruments used until now will not be sufficient on their own to achieve these ambitious national goals. A suitable, reliable legal framework is required as well as time for its implementation and establishment in the market and considerable investments to realise lasting cost savings. In addition to the funding instruments, we will continue to develop the energy saving law within in the limits of economic viability. It is evident, however, that the application of regulative law — in particular in respect of the existing building stock — has its limits with regard to the economic burden on tenants and owners.

The current strategic approach needs to be developed further to enable us to exploit and cost-justify the technical possibilities for energy renovation of the building stock. It will be increasingly necessary in future to specify the required renovation needs in a manner that allows for long-term planning in the interest of owners and tenants.

The amendment to the EnEV in 2016 will deliver an ambitious 25 % increase in the efficiency standards for new builds. This is the first step on the road to introducing the EU nearly-zero energy building standard (see Section 4.1).

The Federal Government will also develop a long-term renovation road map at the national level. This is to be used as a detailed guide for owners and investors. The renovation road map is to be differentiated by types of buildings and will take account, for example, of the specifics of monuments and other buildings of particular historic and architectural value. It will be developed on the basis of this European strategy.

5 .2 Further development of the support instruments

CO₂ Building Renovation Programme

In order to implement the energy transition in the building sector, the tried and tested CO₂ building renovation programme (KfW funding programmes for energy-efficient construction and renovation) is also to be continued and — within the limits of financial viability — increased and pursued for an indefinite period.

There are a number of different starting situations in the existing building stock resulting from the different types of construction, renovation cycles and possible timing of modernisation measures as well as structural and design restrictions, the local environment and the financial capabilities of the relevant owners. The support offered must be differentiated so as to provide property owners with the right incentives for high-quality energy renovation and to ‘meet’ them at the level they are starting out from. Individual, well-planned and coordinated high-quality energy-efficiency improvement measures are just as valuable in this context as deep renovation projects which not every owner is in a position to finance and which are not necessarily suited to every situation however. Support for individual measures is coordinated in a way that the KfW ‘Efficiency House 55’ [Effizienzhaus 55] standard is achieved after the refurbishment of external walls, roof and windows and possibly also the heating system.

The general economic conditions for supporting a project should be adjusted so that the overall development of the building stock will proceed within the target range to be defined in order to attain the set goals. Financing and planning security are important aspects for property owners, as is the user-friendliness of the instruments offered. At the same time the scientific research accompanying the support programmes and the results from monitoring the renovation road map should be used to further develop the support elements.

System technology and the use of renewable energies

There are various aspects to be taken into account with regard to promoting system technology, in particular the necessary interconnection between energy efficiency and the use of renewable

energies. Power networks (photovoltaics, wind, cogeneration), gas networks (biogas) and district heating networks (solar thermal, cogeneration) all have the potential to considerably increase the proportion of renewable energies, including locally generated energy. In this context, it is important to consider the balancing of fluctuations in energy generation, the storage of renewable energies and the balancing of supply and demand (e.g. in the context of “smart grids”).

There is need for further research to be carried out on these issues, in particular regarding the question of energy storage over shorter and longer periods of time (e.g. power to heat) and in the cross-sectoral interaction of power and heat supply, e.g. by shifting surplus supply of electricity generated from renewable energy to the heat market (e.g. power to heat) or the transport sector (e.g. electromobility). Until such time as comprehensive system research on realistic options for a future interaction of these markets is available, it is important not to obstruct any possible future interaction by focusing too strongly on individual buildings and deriving strategies from this perspective. The enormous infrastructure capital inherent in these systems should be used as intelligently as possible.

The promotion should on the whole give the right incentives that will continue to result in a clear increase in energy efficiency and a higher proportion of renewable energies in the energy mix, in particular for buildings with a very low potential for improving efficiency.

Commonhold associations

A special case are the commonhold associations of the 9.5 million commonhold flats in apartment blocks built between the 1960s and 1980s, the majority of which is in need of renovation. Energy renovations usually need to be carried out on the whole building, i.e. a commonhold association must agree on the measures to be taken. In many cases the homeowners’ reserves are insufficient to cover the necessary energy efficiency investments. Currently only individual banks or the specialist economic development institutions of the federal states [Landesförderinstitute] offer loans to finance projects that are specifically suited to commonhold associations. The option of taking on a loan from their principal bank [Hausbank] is often not viable because of the heterogeneous nature of the commonhold association and the homeowners’ different interests and also because of the lack of feasible solutions for the provision of collateral by the association. These are also the reasons why larger commonhold associations are not very keen on the loan option available under the KfW ‘Energy-efficient renovation’ programme compared to the grant option. Banks as well as the economic development institutions of the federal states have recently begun to develop specialist financing options for energy renovation measures undertaken by commonhold associations. This development is to be welcomed and should be strengthened.

In addition it is advisable to implement measures at different levels (e.g. associations, banks) that offer commonhold associations the support they need: existing counselling services offered by the consumer organisations, for example, and the support services for on-site energy advice offered by the BAFA especially for commonhold associations could be advertised more effectively and used

more often. The Federal Government is planning to publish a brochure designed to address property managers who are often the first to raise the issue and provide advice on renovation and whose competence in energy renovation matters and how to finance them needs to be improved.

5 .3 *Research projects and model projects*

The Federal Government supports the research, development and demonstration projects designed to integrate efficiency technologies and renewable energies in buildings and cities as part of their own energy research programme and model projects carried out in the framework of the construction research and other promotional programmes in the building policy and urban planning context. In addition to the technology aspects, lifecycle costs and cost-efficiency analyses also play an important role.

5 .3.1 6th energy research programme

Research and development in innovative efficiency and solar technologies are central to progress in technology and therefore also to the definition of appropriate and ambitious minimum requirements under regulative law (e.g. energy saving law). These activities are supplemented by research on modern energy supply technologies and planning instruments. Relating this research to a neighbourhood and urban planning context furthers a systemic and integrated approach to energy relevant research topics in the building sector. With an annual funding budget of approx. EUR 50 million (as of 2013) this sector is an important promotional area in energy research. In order to improve the use of synergies and thus increase the efficiency of the research promotion even further, the following research initiatives will be interrelated and bundled more effectively in the future:

- **EnOB: Research for Energy Optimised Building**

‘Buildings of the future’ [Gebäude der Zukunft] is the guiding principle of Research for Energy Optimised Building [Energieoptimiertes Bauen, EnOB]. It focuses on buildings that have minimum energy requirements and offer a high level of comfort to their occupants while requiring only moderate investment and much reduced running costs. One key aspect of the research is to identify and test new building concepts and innovative efficiency technologies for new builds and for building renovations. Another key aspect is the scientific evaluation of energy-optimised model buildings. The aim is to identify promising as well as critical factors for planners, manufacturers and operators of buildings and achieve optimisations based on the findings. Initial pilot applications have already been scientifically evaluated. This should lay the foundation for a broad market application of efficient and sustainable renovations.

- **‘EnEff:Stadt’ research initiative**

The ‘Research for energy-efficient towns and cities’ [EnEff:Stadt] initiative takes a dual approach by looking at comprehensive urban development concepts as well as efficiency measures for individual buildings. The use of an ‘integral planning’ approach opens up a variety of ways in which to increase energy efficiency in urban settlement areas. This potential is to be tapped by the intelligent use and networking of innovative technologies in settlement projects as well as in local and district heating systems. These measures will be accompanied by current planning and evaluation procedures and research related to system components and modes of operation. The ‘EnEff:Stadt’ research initiative supports the establishment of evaluation criteria, concepts and planning tools for communities, the housing sector and public utility companies. It develops combinations of measures optimised in both energy and economical terms for defined neighbourhoods, implements pilot projects and monitors them quantitatively. The research is based on the kinds of settlement typical for Germany.

- **‘Energy-efficient heating and cooling networks’ [EnEff:Wärme] research initiative**

Local and district heating systems open up a range of potential energy savings. On the other hand, their technology is sophisticated, their operation complex and their costs depend largely on population density and the volume of heat required. An increase in energy efficiency can only be achieved if options such as the utilisation of industrial waste heat, cogeneration and regenerative forms of energy are taken into consideration across all systems. The costs of heat distribution can be reduced by innovative concepts, networks and technologies. The ‘EnEff:Wärme’ research initiative is therefore concerned with new network concepts and the development of innovative technologies which should greatly improve heat supply in terms of energy and cost efficiency and in ecological terms.

- **Core research area of low-temperature solar thermal technology in buildings**

The focus of this area of research are solar heating and cooling measures with a high proportion of solar coverage of 50 % and more, including measuring programmes, planning tools and accompanying monitoring activities. The research looks at the next-generation ‘solar houses’ [Sonnenhäuser] where up to 100 % of the heat and electricity supply comes from solar energy provided by a combination of solar thermal technology, photovoltaics and/or solar hybrid technology as well as new solutions for efficient heat storage in buildings.

- **Energy storage research initiative**

The energy storage initiative investigates technologies for the local storage of heat and electricity in buildings and at neighbourhood level as well as with a view to the local energy

supply. Energy stores can contribute to network stabilisation as part of an integral approach and therefore help to stabilise the fluctuating availability of renewable energies. In order to enable thermal stores to contribute effectively to a high-efficiency energy supply system significant improvements must be achieved in storage technology and cost-effectiveness as quickly as possible.

5.3.2 ‘Future of Construction’ [Zukunft Bau] research initiative

With the ‘Future of Construction’ research initiative the Federal Government is also investing in the development of new materials and processes to reinvigorate the area of energy and resource efficiency and the use of renewable energies in the building sector. With its practice-based implementation research in a cross-disciplinary network of scientific institutions and the construction industry, this research initiative plays a key role in making the construction industry more open to innovations and encouraging its financial commitment in the area of building efficiency. Since the start of the initiative in 2006, around 500 research projects with a total volume of approx. EUR 65 million have been funded, in particular

- schemes and prototypes for energy conserving construction, zero-energy or energy-plus house concepts,
- energy efficiency and renewable energies in the building sector, calculation tools,
- modernisation of the building stock,
- materials and methods.

The aim of the initiative is to ensure that the experience gained can quickly be applied in construction practice. Examples of this are the development of high-performance insulating materials (e.g. vacuum insulation panels) or the integration of energy-generating systems in the building envelope at the design stage (e.g. composite insulation systems with photovoltaics (PV), development of coloured thin-film PV modules).

5.3.3 Model projects and local networks

New materials and technologies are also tested in practice in model projects, e.g. projects of the German Energy Agency [Deutsche Energie-Agentur, dena] or in the framework of the ‘Future of Construction’ research initiative of the Federal Government. The model projects are designed to prepare the market for new renovation methods and materials and innovative energy-efficient building technology using renewable energies. Good examples are used to establish new concepts, materials, technologies and methods. It is therefore important to set examples by way of competitions or model projects that can be easily copied even by individual homeowners:

- development of innovative energy renovation and new-build standards;

- knowledge transfer to and qualification of consultants, planners and craftsmen;
- encouraging emulation and public relations work;
- supporting and expanding regional competence networks;
- market launch of energy saving technologies, in particular for renovation measures so that measures can be realised cost-efficiently without funding in the future, and
- promotion of innovative, implementation-oriented concepts and investment measures for monuments and other buildings of historical value as well as conservation areas.

The results achieved with the model projects are also used to enhance the regulative law and promotional programmes.

5.3.4 ‘Efficiency-Plus House’ [Effizienzhaus Plus] — building standards of the future

A potential future new-build standard has been piloted with the ‘Efficiency Plus’ [Effizienzhaus Plus] model homes in the context of the ‘Future of Construction’ research initiative since 2011. Buildings that produce significantly more energy than they need for their own purposes are supported here. Different technology solutions for the Energy-Plus standard are established in a network at national level. A total of 35 model projects have been supported since 2012, ranging from small houses to apartment blocks and using different technological and architectural approaches. Based on this, the Energy-Plus standard is currently being extended to include modernisation work and also implemented, for the first time, in the context of promoting the renovation of old buildings and specifically smaller apartment blocks. At the same time there are pilots for networks that span across neighbourhoods and for the supply to electromobility from the energy surplus over demand.

The Federal Government in Berlin has also constructed its own model building linking it to electromobility. The building consists of recyclable materials and generates its own electricity from photovoltaic systems on the roof and façade. If necessary, the electricity is stored in batteries and used to operate a heat pump. Surplus electricity is used to ‘fill up’ electric cars or is fed into the public network. The accompanying scientific studies are not only concerned with quantitative validation but are also looking at, for example, structural relationships in highly insulated external walls, the energy management system, the electricity network stabilisation and the reusability and sizing of batteries.

5 .3.5 Experimental housing construction and urban development (ExWoSt)

Embedding energy efficiency aspects in urban development planning is central to the ‘Energy-related urban renewal’ [Energetische Stadterneuerung] research area. Methods for integrated and long-term strategic urban development have been piloted in model communities linking urban regeneration, energy conservation, reduction of environmental pollution, socially equitable energy

supply, security of supply, economic development and much more. These pilots resulted in a set of guidelines to be used in practice by players at local level. This enables initial practical steps towards an energy concept as part of an integrated urban development concept by correlating — among other things — the urban structure as a whole, the development structures and the state of repair of the neighbourhoods with the most suitable energy supply system and thereby supporting the urban development related political decision process.

5 .4 *Transposing Article 7 of the Energy Efficiency Directive (EED)*

For additional ‘future prospects’, refer to the communication from the Federal Government on transposing Article 7 EED [Communication on Article 7].

6 Expected energy savings and wider benefits

The second National Energy Efficiency Action Plan (NEEAP) of 2011 already contained evidence of energy savings from measures in accordance with Directive 2006/32/EC on energy end-use efficiency and energy services (ESD) and also provided information on the general conditions, current situation and results of energy efficiency policy in Germany. The measures related to the building sector are used to estimate the expected energy savings as laid down in Article 4(e) of the Energy Efficiency Directive (EED) and a brief description of the main results is provided below. The updated overview of results with regard to the fulfilment of the indicative energy savings targets for final energy consumption set out in Article 4(1) and (2) ESD is also used as provided for in Article 24(2) EED in conjunction with Annex XIV Part 2 No 2b EED in the context of the NEEAP 2014. This also means that current data (as at: March 2014) are included.

The methodological standards of the ESD require the use of a harmonised calculation model, based on a combination of top-down and bottom-up calculation methods, to provide evidence of the fulfilment of the indicative energy savings targets. Official statistical data must be used wherever possible. These calculation methods were specified in detail by the European Commission through appropriate suggestions and they set the framework for measuring and monitoring the energy savings. Aggregated energy efficiency indicators are used to show the relevant trend in energy efficiency over time in the various sectors and sub-sectors or areas of application and the related energy savings are calculated from this (top-down).

The savings currently achieved and to be expected in buildings and in the area of technical building systems are shown below, using the methodological recommendations of the European Commission. The changes in some of the savings values compared to the 2nd NEEAP 2011 result from updated

calculations for the NEEAP 2014 that were required pursuant to Article 24(2) in conjunction with Annex XIV Part 2 No 2b EED. The results of the new calculations and their extrapolation until 2020 confirm the trend in energy savings already demonstrated in the 2nd NEEAP 2011 (Figure 13).

Energy savings	2012	2016	2020
<i>Unit</i>	<i>Saving compared to End of 2007 in PJ/yr</i>		
Heat total	525.6	798.3	936.0
- of which space heating	558.9	798.1	928.7
- of which hot water	-33.3	0.2	7.3

Figure 13: Top-down energy savings in buildings and estimated values until 2020 [NEEAP]

However, as the top-down method does not allow any statements to be made as to the causes or triggers of this development, there is also a need to calculate and show energy savings in the NEEAP that are caused by specific instruments or measures (e.g. standards under regulative law, fiscal policy instruments or support programmes) in the different fields of action (such as buildings, equipment or transport) (bottom-up). The table below shows the ex-ante estimated values for energy savings resulting from measures in the building sector until 2016 in accordance with the update to the calculations of the 2nd NEEAP results carried out in 2014 as required by the EED, and extrapolates these values until 2020. The results and extrapolation of the key measures (Energy Saving Regulation, KfW programmes and MAP) until 2020 highlight their impact with regard to the overall savings in the building sector (Figure 14).

Period	1995–2007	2008–2010	2008–2013	2008–2016	2008–2020
<i>Unit</i>	<i>PJ/yr</i>				
Energy Saving Regulation (residential buildings)	128	27	67	108	162
Energy Saving Regulation (non-residential buildings)	63	9	22	35	53
KfW programme for CO ₂ renovation of buildings	17	7	7	7	7
KfW energy-efficient renovation	-	16	32	50	70
KfW Eco Plus modernisation of dwellings	8	4	4	4	4
KfW energy-efficient construction	-	2	4	6	9
KfW ecological construction	1	1	1	1	1
Market incentive programme (MAP) — BAFA part	10	8	11	14	21
BAFA on-site consultation	1	1	1	2	3
Federal state activities in the building sector	1	2	3	5	7
Total	228	77	153	232	337

Figure 14: Bottom-up overview of savings resulting from selected measures in the building sector and estimated savings until 2020, each compared to 2008 [NEEAP; own illustration]

Other not clearly quantifiable measures

Other relevant measures and projects in the building sector, some of which result in significant energy savings although these savings cannot be quantified in detail (non exhaustive list):

Energy performance certificate

Since 1995, all owners of new builds have to be issued with an energy performance certificate (EPC). The certificate includes details of the year of construction, the type of use and the usable area of the building, the type of heating and hot water provision and the type and proportion of renewable energies used. The EPC also contains modernisation recommendations where there is potential for energy savings in the building which can be realised cost-effectively.

EPCs for buildings must also be issued and presented to potential buyers or tenants if a plot of land, or property rights to a developed plot of land or a commonhold unit or share in property, is sold or leased.

The legal basis for issuing and using energy performance certificates is the Energy Saving Regulation. All certificates have a limited period of validity of 10 years.

Renewable Energies Heat Act [Erneuerbare Energien Wärme-Gesetz — EEWärmeG]

The purpose of the EEWärmeG is to drive the use of renewable energies for the energy supply to buildings in the heating and cooling sector. It imposes an obligation to use renewable energies, including solar thermal systems or heat pumps, in new builds (use obligation under Section 3(1) EEWärmeG). It is also allowed — as a compensatory solution — to implement other measures, for example using waste heat or improving thermal insulation. These will also improve energy efficiency.

Heating Cost Regulation [Heizkostenverordnung]

Based on the Energy Saving Act, the purpose of the Heating Cost Regulation is to create incentives for the economical use of energy through metering and use-based billing of heating and hot water costs. With the amendment to the regulation, which entered into force on 1 January 2009, the consumption-based part of the heating bill has gone up to 70 % for certain buildings. This is meant to provide further incentives for energy saving and therefore also for reducing CO₂ emissions in the building sector. For combined heating systems property owners are also obliged, from no later than 1 January 2014, to always measure with a heat meter the energy share used for heating water. The regulations of the Heating Cost Regulation also create an incentive to achieve ‘passive house’ standard in the construction or renovation of apartment blocks.

Regulation on small and medium-sized combustion plants [Verordnung über kleine und mittlere Feuerungsanlagen]

The Federal Immission Control Act [Bundes-Immissionsschutzgesetz, BImSchG] is the German law on protection against the harmful effects of air pollution, noise, vibration and other types of nuisance

on the environment. This law has energy saving effects, among other things, through its comprehensive licensing requirements for plants, such as determining a combustion efficiency factor. The specific technical standards were issued in a total of 39 implementing regulations. Among others, the 1st Regulation on small and medium-sized combustion plants [1. BImSchV] is particularly relevant here. The purpose of this regulation is to ensure a significant reduction in the emission of particulate matter from small combustion plants. In order to counteract the continuing rise in pollution and reduce the existing high levels of pollution, a long-term and sustainable reduction in emissions from combustion plants within the scope of the 1. BImSchV must be achieved. The means that in new installations a new generation of combustion plants is used and that appropriate refurbishment rules are laid down on the basis of the legal requirements for existing installations. The 1. BImSchV was last amended in 2009 and the new requirements resulting from this amendment have been in force since March 2010.

'Low-energy house in existing building stock' model projects

The 'low-energy house in existing building stock' model projects of the German Energy Agency [Deutsche Energie-Agentur] for residential and non-residential buildings (financed with funds from the CO₂ building renovation programme) have been aimed at specialist planners, architects, craftsmen and developers since 2003, using planning tools, public relations work and guidelines and brochures. The aim is to accelerate knowledge transfer on the construction of low-energy houses, establish ambitious energy renovation standards in the market, raise awareness, enhance and launch innovative technologies for the energy renovation of buildings. By giving transferable, financially viable renovation recommendations and examples people should be inspired to follow suit. The housing associations carry out their own renovation measures. A 'copycat' effect can be observed in energy efficient renovation and 'efficiency house' standards have been established in the market. More than 350 residential buildings and over 90 non-residential buildings demonstrated that energy saving construction methods can significantly reduce the energy demand. The energy consumption of 6 300 dwellings, with a total area of approx. 350 000 m², has been optimised in this project. These dwelling undercut the requirements for energy consumption of similar new builds by an average of 62 %.

Energy saving guidelines

The energy saving guidelines issued by the Federal Government since 2000 for fields of application such as buildings, energy efficiency, energy management, mobility, procurement and financing are directed at private households, the private and the public sector. The purpose of the guidelines is to motivate the relevant target group and inform them of their options to improve energy efficiency. The guidelines are thus a means of raising awareness and changing user behaviour and they are starting points for energy efficiency investments. All sectors have been responding well to the

information provided on energy efficient technologies, financing and procurement options as well as special topics and pragmatic solutions for increasing the energy efficiency potential. The guidelines also support indirectly, for example, the implementation of specific contracting projects and other energy efficiency measures in the municipal sector.

‘Future House’ [Zukunft Haus] information campaign

The ‘Future House’ information campaign by the German Energy Agency has been directed at property owners, tenants, engineers, architects and the construction industry, municipalities and housing associations since 2002, using media and public relations work, websites, trade fair stands and the nationwide Energy Efficiency Congress. The aim is to inform and motivate consumers, those involved in construction, the private and the public sector about energy efficient construction. Products and services that make energy efficient construction and renovation easy, reliable and affordable should be established in the market. On the initiative of the Federal Government, the German Energy Agency manages projects to tap the potential for energy efficiency in the building sector. Under the umbrella brand of the same name, a large number of projects to improve the energy efficiency of buildings are implemented — from the development and launch of the ‘Efficiency House’ seal of quality for residential buildings to nationwide model projects where buildings are being renovated to an exemplary energy efficiency standard and to consumer information. These measures helped to significantly advance the relevance of energy efficiency to the building sector in the market.

‘Renovate your house and benefit’ [Haus sanieren — profitieren] campaign by the German Federal Environmental Foundation [Deutsche Bundesstiftung Umwelt, DBU]

The campaign aims at lessening the reluctance of owners of one- and two-family houses in Germany to tackle the issue of energy renovation. It is supported by the German Federal Environmental Foundation and, complementing the existing advice instruments, it works at a more basic level (establishing initial contact, but not providing any detailed energy advice). The core element of the campaign is the free ‘DBU Energy Check’ carried out on one- and two-family houses by craftsmen, architects or energy consultants. All companies involved in the campaign can access the information material free of charge. They are even allowed to give away vouchers for a free building check, for example after a routine visit to a property owner.

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