

Energy efficiency of buildings A nearly zero-energy future?

SUMMARY

Buildings account for 40% of overall energy consumption in the European Union and could contribute significantly to reaching EU climate and energy targets as well as reducing EU dependency on imported gas and oil, thereby limiting the need for higher electricity production.

The 2010 Energy Performance of Buildings Directive tried to seize this potential by introducing the concept of nearly zero-energy buildings, which is supposed to become a mandatory EU standard for all new and newly rented public buildings by 2019, and all new buildings by 2021. However, with energy efficiency of the overwhelming majority of existing buildings being unsatisfactory, their renovation is even more crucial. While the Directive demands that Member States set stringent energy performance requirements for major renovation, there are no targets for the pace at which this should be done, and the uptake has been slow.

Most of the buildings in the EU are privately owned and their owners have been reluctant to undertake expensive renovations, which are complex decisions that also hinge on technical, legal, financial and organisational considerations. EU funding earmarked for renovations is available, but private owners have had difficulty accessing it. Buildings owned by central governments were supposed to be renovated at an annual rate of 3%, but due to insufficient data, it is unclear whether this has happened. The European Parliament has been ambitious in this field and has repeatedly called for a stronger focus on renovation of existing buildings.



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Why energy efficiency of buildings matters

Improving the energy efficiency of buildings is not just a question of cutting bills for consumers and increasing the comfort of their homes. Buildings account for 40%¹ of final energy consumption in the EU and contribute [about 36%](#) of EU greenhouse gas (GHG) emissions. These numbers appear to be broadly unchanged, despite the energy performance of buildings being on the EU agenda from at least 1984.²

This issue is of crucial importance if the EU is to reach its energy and climate objectives of overall energy efficiency gains and GHG reduction, especially when it comes to attaining the 2050 [goal](#) of an 80-95% reduction in greenhouse gases compared to 1990 levels. Without cutting the energy consumption of buildings, this will be impossible.

Buildings could be the key to achieving other objectives of EU energy policy as well. More than [60% of all imported natural gas](#) in the EU is used in buildings. Lower energy demand would help decrease dependence on energy imports. It could also contribute to solving the problem of peak loads and insufficient energy production in the EU, thus increasing the overall resilience of the EU's energy system.³ Lower energy bills could especially benefit vulnerable customers and help fight against [energy and fuel poverty](#). Renovating the EU's existing energy-inefficient building stock would also help the economy in general, creating jobs in construction and related sectors.⁴

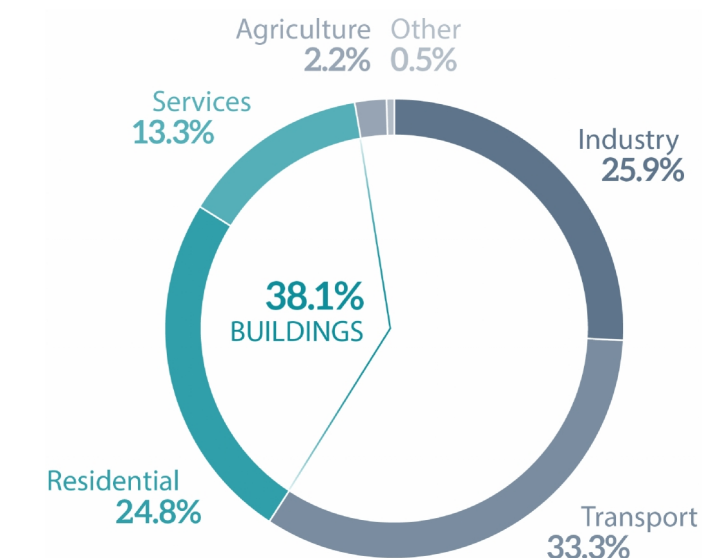
EU policy

The [Effort Sharing Decision](#) of 2009 placed the energy efficiency of buildings in the context of EU climate change policy. The Decision set national targets which should, by 2020, enable Member States to collectively achieve a 10% GHG reduction in sectors not covered by the Emissions Trading System (ETS), including buildings, compared to 2005.

The 2010 [Energy Performance of Buildings Directive](#) (EPBD) made nearly zero-energy buildings (nZEB)⁵ the required norm for all new buildings in the EU from 1 January 2021, provided this is 'cost-optimal' during a building's lifecycle. All buildings undergoing major renovation from 2021 onwards have to meet 'minimum energy performance requirements'. With regard to public authorities, this requirement enters into force two years earlier: from 2019, all new buildings authorities own or occupy have to be nearly zero-energy. The EU's [Energy Roadmap 2050](#) confirmed nZEB as the new standard for buildings in the EU and the 'key' for achieving the 2050 targets.

The Energy Performance of Buildings Directive did not, however, set targets for renovating existing buildings; instead, it only required the Member States to present national plans for the promotion of nZEB buildings. These targets were set in the [Energy Efficiency Directive](#) of 2012, which requires Member States to renovate 3% of the total

Figure 1 – 2014 energy consumption by sector in the EU-28



Data source: [Eurostat](#), 2014.

floor area of buildings every year from 2014 onwards – but only the buildings owned and occupied by the central government. The [Renewable Energy Directive](#) obliges Member States to include a requirement for a minimum level of energy from renewable sources in new and renovated buildings into their building codes.

Additional energy efficiency requirements were introduced by the [Ecodesign Directive](#), which resulted in implementing acts for higher energy efficiency of air conditioning, lighting, heaters and water heaters, and water pumps, as well as a whole [range of appliances](#) which influence the energy consumption of buildings, such as cooking equipment, refrigerators and freezers, vacuum cleaners, washing machines and driers, and electronic equipment on stand-by. The directives for the internal market in [electricity](#) and [natural gas](#) required Member States to roll out [smart meters and networks](#) that could further cut energy consumption in households and offices.

In the 2015 [Energy Union strategy](#), buildings and transport were singled out as having the largest potential for energy savings, while in the [State of the Energy Union](#) the Commission announced a particular focus on buildings in its plans to align energy legislation with 2030 targets.

Nearly zero-energy buildings

The Energy Performance of Buildings Directive defines a nearly zero-energy building as a building having 'a very high energy performance', which requires 'nearly zero or low amount of energy' for meeting 'the energy demand associated with a typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting'. This energy consumption 'should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby'. An nZEB is therefore not just a passive house which is highly efficient, but one which also produces energy from renewable sources where possible. The Directive leaves the precise definition of nZEB to the Member States, and gives them ample room to decide what exactly 'nearly zero' and 'very high' energy performance mean, as well as what nearly zero-energy consumption should cover (heating, cooling, ventilation and hot water, perhaps also lighting and possibly even all electricity used in a building).⁶ This intentional ambiguity helps accommodate the differences in building styles, resources and climate in the EU.

As of April 2015, [definitions of nZEB](#) were in place in 15 Member States, both for new and renovated buildings, with differences both in terms of what they take into account and the values they prescribe. Some countries, for instance, set the maximum primary energy consumption, others the maximum carbon emissions, and still others measure primary energy use against a 'reference building' or set the minimum energy efficiency grade that buildings should attain. Although many countries require that a new nZEB have a maximum primary energy of 50 kWh/m² per year, the range to be found in the existing plans of Member States is from 20 to almost 220 for residential buildings, and from 0 to 270 for non-residential ones. Similar differences exist when it comes to the share of renewable energy sources.

Major renovations

[According to](#) Commission Vice-President for Energy Union, Maroš Šefčovič, only 10% of existing buildings in the EU are energy efficient. At least 40% were built before the 1960s, when most building codes included no energy efficiency requirements.⁷ Owing to advances in technology and more stringent building codes, today's new buildings

[consume half as much energy](#) as buildings from the 1980s. However, at least two thirds of existing buildings will still be there in 2050, by which time the EU plans to have reduced its GHG emissions by 80% to 95%.

The biggest opportunity for reducing energy consumption in existing buildings is in the area of heating, cooling and hot water, which account for more than 60% of their energy consumption. Deep renovation could reduce energy demand for heating by 70% or more.⁸ It could cut the overall energy needed in buildings by half by 2050 compared to 2012, despite the estimated 45% growth of the overall building stock.

Despite this great potential, the targets the EU has set for renovations are not clearly defined or easily measurable. The Energy Performance of Buildings Directive obliges Member States to create national plans for promoting the conversion of existing houses to nZEB, but no binding goal has been set. What is binding is that after 'major renovations', buildings should meet a 'cost-optimal' level of minimum energy performance. Member States can define a renovation as 'major', if the total cost is higher than 25% of the value of the building (excluding the value of the land) or if more than 25% of the surface of the building envelope⁹ is under renovation. The only existing EU target for renovations is the 3% rate for central government buildings, set in the Energy Efficiency Directive.

Deep and other renovations

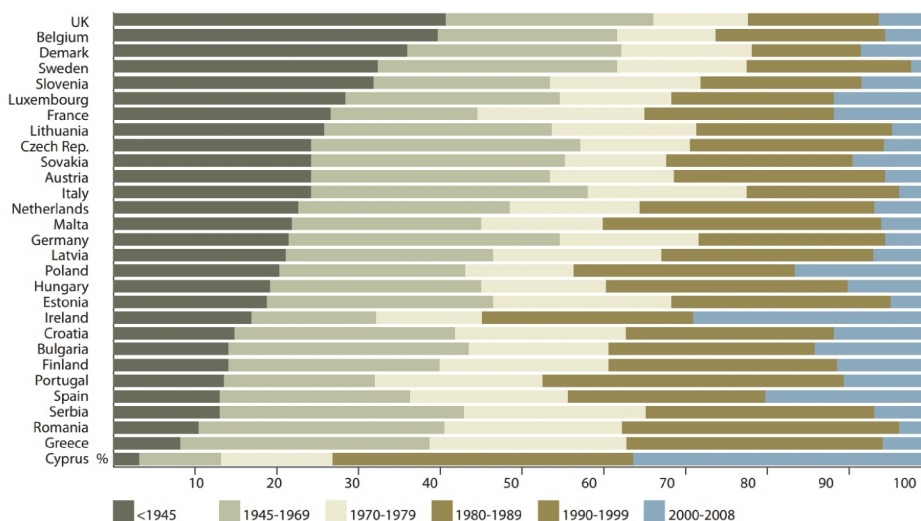
Terminology and definitions regarding renovations do not seem to be fully consistent in EU legislation.

Major renovation, according to the Energy Performance of Buildings Directive, is a renovation whose total cost is higher than 25% of the value of the building (excluding the value of the land) or which encompasses more than 25% of the surface of the building envelope.

Deep renovation is mentioned in the Energy Efficiency Directive, but not defined. A [study](#) by Global Buildings Performance Network, for which a poll was conducted among experts, showed that deep renovation is commonly understood as one that focuses on the building envelope and achieves an energy reduction of 75% or more compared to the situation before the renovation. Also mentioned but not defined in the Energy Efficiency Directive is **staged deep renovation**, that is, deep renovation that happens [in phases](#).

Deep retrofit is a term used in many studies and industries and refers to upgrading the equipment in buildings (such as boilers) and not the building envelope. It generally achieves energy savings of 50% or more.

Figure 2 – EU buildings by construction date



Data source: [Entranze Project](#), 2014.

Obligations prior to 2021

The EPBD introduced obligations prior to 2021 as well: Member States need to set minimum energy performance requirements for buildings and building elements that have a significant impact on the energy performance of both new and renovated buildings. Furthermore, they need to introduce requirements for heating, hot water, air conditioning and large ventilation systems, as well as for regular inspections of heaters and air-conditioning systems. They also need to introduce energy certification of buildings being rented or sold and to make sure that the energy certificates are clearly displayed in public buildings. However, the certification scheme, which some studies show has helped raise the value of properties after renovation, has also encountered some [problems](#), including differing certification standards among Member States, mixed quality of the certificates themselves, and limited influence on the property market.

Challenges of implementation

Transposition issues

According to researchers from the Institute for European Studies in Brussels, energy efficiency legislation for buildings has traditionally not been received with much enthusiasm by the Member States, which have generally preferred to keep the jurisdiction for construction standards and codes to themselves.¹⁰ The implementation of the EPBD similarly [stalled at the first stage](#): by the 2012 deadline no Member State had fully transposed the Directive. The Commission responded by opening infringement procedures against all Member States and in 2014 it referred four of them to the Court of Justice of the EU (CJEU). As of mid-January 2016, the Commission led the procedures at the CJEU against Greece, while infringement procedures were still open against Bulgaria, France, Hungary, Lithuania, Portugal, Spain and the UK.

Similar problems occurred with the transposition of the Energy Efficiency Directive. In 2015, the Commission [brought legal action](#) against all Member States except Malta, and subsequently [referred Greece](#) and Hungary to the CJEU. In mid-January 2016, only Greece was still at the stage of referral to the Court, while 22 Member States were in various other stages of infringement procedures.

A Buildings Performance Institute Europe (BPIE) [study](#) looked at renovation strategies for existing buildings, which Member States were supposed to produce under this Directive by April 2014. Greece, Hungary, Luxembourg and Slovenia missed the deadline, and of the 18 strategies that were available in English, only four were deemed to meet minimum compliance with the Directive.

Despite problems with transposition, in its 2015 energy efficiency [progress report](#) the Commission states that final energy consumption in the residential sector decreased between 2005 and 2013 and that consumption per square metre decreased in all Member States, but stayed the same in Italy and increased by 10% in Estonia. The report suggests this could perhaps be explained by the improved energy efficiency requirements for buildings, appliances and heating systems. Over the same period, energy consumption in the buildings used by the services sector increased.

Uptake of nZEB and deep renovation

A BPIE [study](#) has shown that the nZEB principles were feasible already in 2011, through existing technologies such as insulation materials, heat pumps, biomass, pellet boilers, solar thermal systems, triple-glazed windows, and ventilation with heat recovery. Nevertheless, the gap between cost-optimal levels and nZEB was still notable, although

it was expected that by 2021 it could partly be bridged by a reduction in technology costs due to maturing markets and larger production volumes, and by additional policies and support measures in some Member States. As of 2014, [no Member State](#) has decided not to apply nZEB requirements based on cost-benefit grounds and, moreover, about two thirds have put in place measures for refurbishing existing buildings into nZEBs. However, when it comes to concrete goals, a [study](#) by the European Council for an Energy Efficient Economy (ECEEE) has shown that only 15 Member States set intermediary goals for nZEB and only three set targets for renovations. According to this study, however, some Member States set requirements for new buildings that go beyond the requirements of the EPBD. Examples include the carbon neutral and zero- or positive-energy buildings in the Netherlands, Denmark, Germany, France and UK.

When it comes to setting minimum energy performance requirements which are supposed to guide current construction and renovations, a report by consultancy [Ecofys](#) has shown that about two thirds of the Member States could have introduced more ambitious energy performance standards that would still be cost-optimal, and in about half of the Member States there is a significant gap (more than 15%) between performance standards and cost-optimality.

Evaluating the progress in renovations of existing buildings is complicated by the fact that not much data are available; for instance, Eurostat [does not measure](#) such progress. According to current estimates, the average rate of renovations is between 0.5% and 1.2% per year, at which pace only 40% of buildings will be renovated by 2050.¹¹ A number of studies state a more appropriate renovation rate should be 2.3% to 3% of total surface,¹² while the Commission [states](#) that renovations should speed up to above 2%.

During the Commission's [public consultation](#) on the EPBD in 2015, stakeholders pointed to an array of possible reasons for such a slow uptake of renovations, a major one being the complex nature of deciding whether to renovate. To make this decision, owners need to understand the precise costs and returns, as well as consider relevant legal, technological, organisational and financial issues. Another obstacle seems to be the non-existence of a minimum renovation target, accompanied by appropriate financial mechanisms. This means that owners are still not convinced that they should venture into a costly and risky renovation, because they are not sure whether the requirement for renovation will ultimately extend to all buildings or not and may not be fully convinced that a renovation will bring the promised savings. A paper by Entranze Project, which brings together building experts from research and academia, national decision-makers and key stakeholders, provides an [overview](#) of factors influencing acceptance and adoption of deep renovation.

A major complicating factor seems to be the ownership structure of EU buildings: residential buildings account for 75% of buildings in the EU, and the large majority of them are privately owned. This means that achieving the policy objective of more

Split incentives problem

With [around 30%](#) of residential buildings in the EU being rented, split incentives between the landlords and tenants of buildings present a serious obstacle for renovations. The owners might not have an incentive to make big investments that will primarily benefit tenants who will pay smaller bills, especially in cases where the law prevents the owner from raising rents after renovation. One of the proposed solutions, tried out in California and the UK, is an on-bill payment system, in which the cost of renovation is paid through utility bills. The bill is lower than before the renovation – which brings benefits to the tenant – but higher than the actual post-renovation consumption, which pays for the owner's loan.

renovation depends on the good will of private individuals and their readiness to pay for it by taking on a substantial cost upfront. Decisions are even more complex in multi-family buildings, which account for 47% of all buildings in the EU, and in some countries (for instance, Italy or Estonia) for over 70%. Decision-making rules vary among Member States, and in some a mortgage for renovation can be taken out only if all owners of the building agree.¹³

An Aachen University [study](#) shows that slow renovation can also be the result of overambitious legislation. The study uses the example of Germany to argue that prescribing very deep levels of renovation can be too expensive and overwhelming for home owners. It further argues that legislation should afford greater flexibility and allow cheaper options for renovations which would achieve smaller, but still significant energy savings than the most advanced standards.¹⁴

The situation concerning public buildings is problematic as well. The Commission's 2015 energy efficiency progress [progress report](#) shows that it is impossible to assess the progress of renovation because many Member States which had decided to implement the default 3% renovation rate did not report data on savings achieved in a clear manner. On the other hand, 18 Member States opted not to renovate, but to achieve the same reduction in energy consumption by alternative measures, such as changes in employee behaviour.

Financial issues

An Energy Efficiency Financial Institutions Group (EEFIG) [report](#) from early 2015 shows that to reach the EU energy policy targets for 2020, between €60 billion and €100 billion of both public and private funds would have to be invested in EU buildings annually, and yet financing has been lacking. The measures implemented so far have not been successful in motivating private owners strongly enough to renovate their homes, and the uptake of financing available for energy efficiency in buildings has been slow.¹⁵

In its 2015 energy efficiency [progress report](#), the Commission states that the previous multi-annual financial framework (MFF 2007-2013) set aside €3.4 billion for energy efficiency in public and residential buildings from the European Regional Development Fund (ERDF) and Cohesion Fund. The report estimates that in the current MFF (2014-2020), €13.3 billion will be used for this purpose. This time money will be available for projects addressing energy poverty and projects that do not offer a return on private investment in a reasonable time, but most private homeowners will still be expected to invest significant financial resources.

In the [State of the Energy Union](#), the Commission announced that in 2016 it would introduce initiatives that would make it easier to access financing from the European Structural and Investment Funds (ESIF), especially for small private projects aimed at raising the energy efficiency of buildings. One scheme will enable the aggregating of smaller projects, which should make it easier to apply for funding. Technical and project development assistance is already available through the European Investment Advisory Hub (EIAH), and a European Investment Project Portal (EIPP) has recently been launched to attract investors.

Member States are also expected to establish new, or develop the use of existing, financing facilities, including the possible establishment of a national energy efficiency fund. To stimulate renovations, many have introduced tax/VAT incentives, preferential loans, supplier obligations, grants, subsidies and funds.

Other issues

Apart from the problems with financing, barriers to improving the energy performance of buildings in the EU include a lack of trained construction professionals. The Commission is trying to solve this by the [BUILD UP](#) initiative, which offers education and training to workers who will be delivering renovations and constructing new nZEBs. Also problematic for the introduction of nZEB is the fact that in some Member States, individual producers cannot feed the surplus electricity they produce into the grid.¹⁶

On the other hand, an nZEB expansion could have unexpected effects on the power system. An nZEB would no longer use fossil fuels for heating but would instead use heat pumps powered by electricity, and therefore electricity consumption would rise significantly, requiring further investments in electricity production and grid capacities. A [study](#) by Ecofys shows that, although this increase is inevitable, it will be smaller if improvements of energy efficiency of buildings are more ambitious. Other problems for electricity grids are discussed in a [briefing](#) by think tank Insight Energy.

Position of the European Parliament

The Parliament has generally been the most ambitious EU institution in this field, but its recommendations for strengthening the Commission's proposals have often been thwarted by Member States in the Council. Already in 2001, ahead of the first EPBD, the Parliament [criticised](#) the 'limited or not defined in detail' measures. Ahead of its recast in 2010, Parliament [called](#) on the Commission to require new buildings to be 'positive energy buildings', and to set an exact timetable for standardisation and minimum levels of renewable energy for both new and existing buildings. It also [called](#) for the setting up of energy efficiency funds and a stronger focus on renovations of existing buildings, starting with all public buildings and not just those owned by the central government.

In its 2013 [resolution](#), Parliament again called on public authorities to speed up the renovation of buildings they own using Structural or Cohesion Funds, and to remove the non-technical barriers to renovation of residential buildings, especially in multi-apartment buildings. Ahead of the 2016 review of the Directive, the Parliament adopted a [resolution](#), in which it called for the application of the 'energy efficiency first' principle, which would enable energy efficiency and infrastructure projects 'to be treated as key investments that are of similar importance as investments in new generation capacity'. It also called for increased depth and rate of renovations and for the adoption of a requirement of minimum levels of renewable energy production in new and refurbished buildings, as well as for swift administrative and grid connection procedures.

Stakeholders' views

While most stakeholders think the EPBD has been useful in raising awareness, some believe it has gone too far, while others say that it has not gone far enough.

Four European property-owner organisations [think](#) that EU legislation should be more flexible and allow for more modest, 'cost-effective, incremental, step-by-step' renovations, not just deep ones. Not only does the current legislation make many owners avoid renovating their homes at all, but it is also 'politically unacceptable for EU regulation to directly impose massive deep renovation at direct cost to EU citizens when even leveraged EU funding can't come near to covering the cost'. When it comes to financing building improvements, the EU should set aside financial resources for subsidising the renovation of all buildings, not just public buildings and social housing, because renovations are seldom profitable within a five-to-ten-year framework. The

organisations also criticise the current system of energy certificates as unreliable and too often based on theoretical calculations instead of actual energy consumption.

A similar [opinion](#) was voiced by CEFIC, the association of the European chemical industry, which represents the sector producing raw materials used in construction. Its view is that complex requirements within the EPBD incentivise avoidance of renovation instead of stimulating it. It is of the opinion that the Directive has done a lot for raising the standards for new buildings, but not for renovations. While heating efficiency has improved, the Directive has not done much for cooling, especially for prevention of overheating, hence CEFIC calls for the introduction of parameters for summer comfort within the nZEB.

On the other hand, a number of stakeholders are calling for a new EPBD and the introduction of new energy performance standards. The [PU Europe](#), which represents the insulation industry in 11 Member States, calls for the new directive to shift the focus from new to existing buildings and to introduce clear renovation targets. Lobbying group [E3G](#) argues that the Commission should even enact a separate Buildings Renovations Directive, as one of the easiest ways for the EU to cut energy consumption. European Insulation Manufacturers Association ([EURIMA](#)) calls for setting a long-term goal to make all buildings nZEB by 2050, including clear intermediate targets. It also recommends that energy efficiency be considered an infrastructure priority.

The [Entranze Project](#) recommends that the enhanced EPBD should ask the Member States to present plans for closing the gap between nZEB and cost-optimal energy performance by 2020, and should clearly state that the cost-optimal performance is the bare minimum. It also recommends gradual introduction of nZEB requirements for existing buildings and, in a future recast of the Energy Efficiency Directive, either a clear definition of 'deep renovation' or replacing it with the term 'nZEB renovation'.

Next steps

The Commission has announced that in the framework of evaluating the Energy Union Package and its fitness for the 2030 energy objectives, it will evaluate the Energy Performance of Buildings Directive in 2016 and possibly introduce legislative amendments. This is to be accompanied by a Smart Finance for Smart Buildings initiative, to resolve some of the problems with delivering financing where it is needed. The Commission has also announced a revised Energy Efficiency Directive.

Main references

Ecofys, [Towards nearly zero-energy buildings](#), 2013.

IEA, [Transition to Sustainable Buildings: Strategies and Opportunities to 2050](#), 2013.

BPIE, [Europe's Buildings under the Microscope](#), 2011.

Claire Dupont, Sebastian Oberthuer, *Decarbonization in the European Union: Internal Policies and External Strategies*, Palgrave Macmillan, 2015.

Endnotes

¹ This figure is habitually mentioned in studies (for instance, BPIE: [Europe's Buildings under the Microscope](#)) and Commission documents (for instance, [Communication on Energy Efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy](#)). It includes residential buildings and the services sector (residential, commercial and public) buildings.

² In 1984, the Commission launched a strategy for the buildings sector, but the Member States rejected it. That strategy stated that buildings consume 40% of the energy in the EU. See Dupont & Oberthuer, *Decarbonization in the European Union: Internal Policies and External Strategies*, Palgrave Macmillan, 2015, p. 139.

- ³ A highly energy efficient building stock in the EU could save the equivalent of the current total electricity production capacity in Austria and the Netherlands (Ecofys, [The role of energy efficient buildings in the EU's future power system](#), 2015).
- ⁴ According to the [Principles for Nearly Zero-Energy Buildings](#), the implementation of nearly-zero energy buildings could create 345 000 additional jobs.
- ⁵ In the Directive, the abbreviation NZEB is used. However, because this has already been established within the construction industry as the abbreviation for 'net zero energy buildings', many authors started using nZEB to make a distinction (ECEEE, [Understanding \(the very European concept of\) Nearly Zero-Energy Buildings](#), 2014).
- ⁶ For a discussion of possible definitions, see BPIE, [Principles for Nearly Zero-Energy Buildings](#), 2011.
- ⁷ In most of western Europe, these were introduced around the 1970s, but in some countries this happened later. In Portugal no thermal insulation was prescribed before the EPBD (See BPIE, [EU Buildings Under the Microscope](#), 2011, p. 50)
- ⁸ See for example Ecofys, [Building Renovation in Europe: What are the choices](#), 2012. It examines three possible scenarios: shallow renovation with a 3% renovation rate to average energy efficiency and a reduction in energy for heating of 32% in comparison to 2010; shallow renovation with high use of renewable energy with a renovation rate of 2.3% and reduction of 58% in energy for heating; and deep renovation, with a 2.3% renovation rate and high efficiency of the building envelope, ventilation systems with heat recovery and high renewable energy use, which lead to 75% reduction of energy for heating. The deep renovation scenario led to a 90% cut in CO₂ emissions, 95% reduction of gas consumption and 97% of oil consumption by 2050, while the shallow renovation scenario did not reduce the demand for gas. The middle scenario also reduced demand for gas and oil, but was more expensive than the deep renovation scenario. The study concluded that deep renovation can be a good way to achieve EU targets.
- ⁹ The EPBD defines the building envelope as 'integrated elements of a building which separate its interior from the outdoor environment', in other words, walls, roofs, floors, windows, doors etc.
- ¹⁰ Dupont & Oberthuer, *Decarbonization in the European Union: Internal Policies and External Strategies*, Palgrave Macmillan, 2015.
- ¹¹ For instance BPIE, [Europe's Buildings under the Microscope](#), 2011.
- ¹² See for instance Ecofys, [Building Renovation in Europe: What are the choices](#), 2012.
- ¹³ Entranze, [Laying Down the Pathways to Nearly Zero-Energy Buildings: a Toolkit for Policy Makers](#), 2014. A table on page 11 shows types of decisions needed in various countries.
- ¹⁴ Galvin, R. (2014), [Why German homeowners are reluctant to retrofit](#), *Building Research & Information*, 42 (4).
- ¹⁵ During the Horizon 2020 Energy Efficiency Info Day on 8 December 2015, Marie Donnelly, Director, Renewables, Research and Innovation, Energy Efficiency, European Commission, DG Energy, said: 'I find it ironic that I have to say: 'There is no shortage of money.' There's an enormous amount of money. It's out there. Quite honestly, the real challenge with money is to get it from out there to down here... The money really, really is there, but accessing it, drawing it down and using it is the challenge that we are confronted with.' See [video](#) - starts at 4:10.
- ¹⁶ EU Energy Commissioner Miguel Arias Cañete [warned](#) that 'too often citizens who self-generate are not allowed to feed their electricity back to the grid', and when they do, they 'often get a poor deal'. The [State of the Energy Union](#) also called for further efforts in the vast majority of Member States for better integration of renewable energy into the market.

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