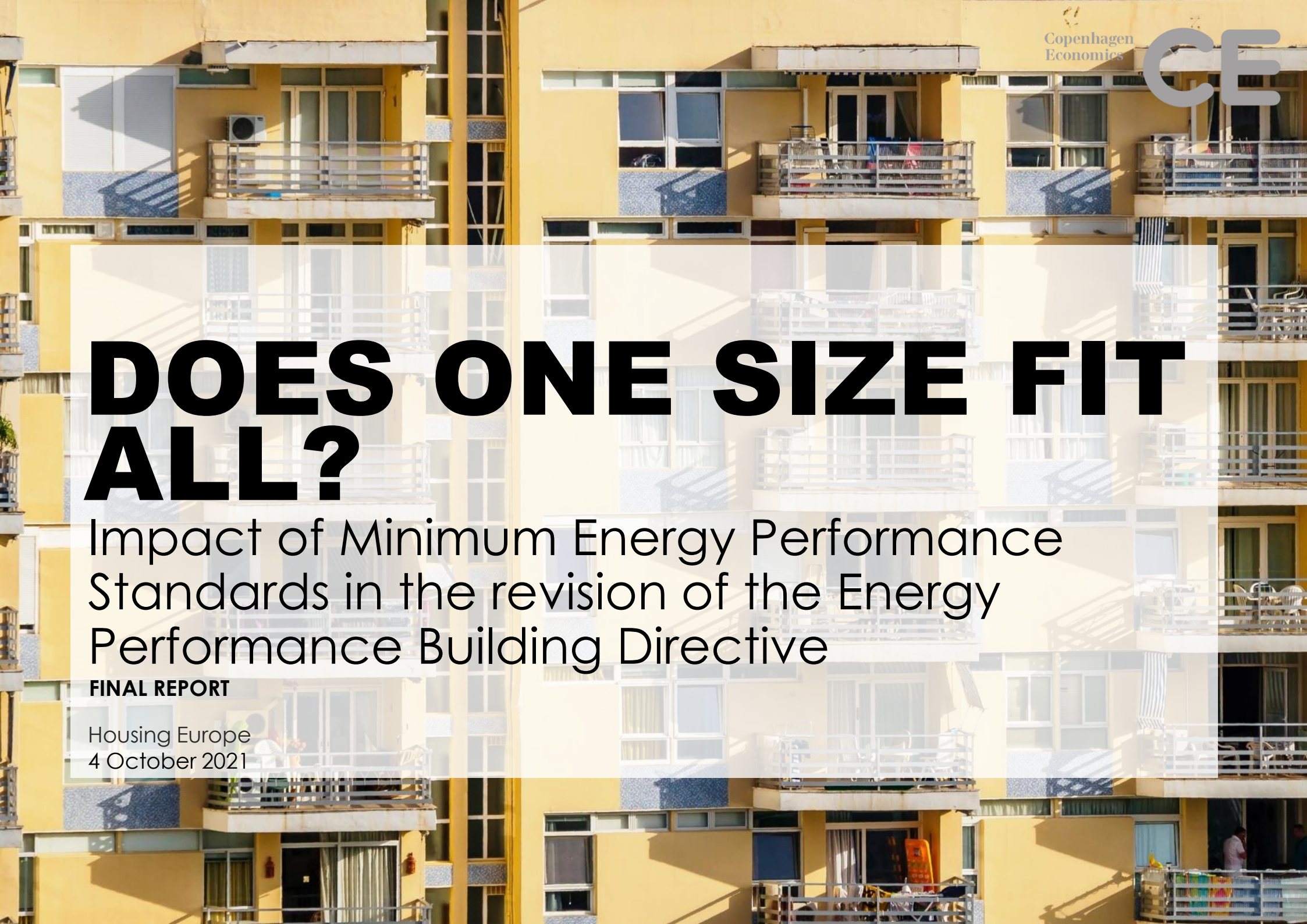


Copenhagen Economics

DOES ONE SIZE FIT ALL?

Impact of Minimum Energy Performance Standards in the revision of the Energy Performance Building Directive

FINAL REPORT

Housing Europe
4 October 2021

Preface

As part of the European Green Deal and Fit for 55 package, the Energy Performance of Buildings Directive (EPBD) is under revision with the legislative process envisaged for Q4 2021.

A central part of the revised EPBD is phased introduction of minimum energy performance standards[1] (MEPS) for new buildings, existing buildings undergoing major renovations, and for the replacement or retrofit of central building elements like heating and cooling systems, roofs and walls.

However, it is a **key concern of the public, cooperative and social housing sector that inflexible and uncarefully implemented Minimum Energy Performance Standards may result in sub-optimal policies from an economic, environmental and social perspective.**

Housing Europe is the European Federation of Public, Cooperative and Social Housing, representing almost 25 million dwellings, approximately 200,000 new dwellings and the same number of renovations per year.

Housing Europe has asked CE to provide a study that focuses on three key questions:

- What is the overall structure of **energy performance for the EU building stock** and the resulting **potential for energy savings?**
- What are the **key economic, social and environmental factors** to be considered when implementing measures to improve energy performance standards at **local, national and EU level?**
- Which **policy recommendations** follow from this analysis?

1) European Commission (2020), *A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives*

1 Executive summary

There is large potential for energy savings and other benefits from renovating the EU building stock

The EU building stock has varying energy efficiency levels

The bulk of the existing building stock in the EU has a very substantial potential for reducing its energy consumption. Indeed, almost half of the 215 million houses in the EU have an energy rating performance of D or below.

Energy performance certificates (EPCs) are a rating scheme to summarise the energy efficiency of buildings. The buildings are rated between A (very efficient) to G (inefficient).

The distribution of EPC labels across countries is highly uneven. For example, in the Netherlands, Slovakia or Ireland, up to or more than 50% of all houses have an EPC label of C or above. In Spain, Bulgaria or Lithuania, the share of EPC labels of D or below exceeds 73%.

The old EU building stock bears large potential for energy savings

The EU building stock is dominated by old houses. Roughly 50% of houses were constructed before 1979 and around 20% even before 1945.

There are considerable synergies from combining major general renovations of old houses with energy renovations. Indeed, many measures that will reduce the energy bill, will at the same time, lift the quality of life in the building such as insulation ensuring a warmer, drier, or better ventilated home. This lowers the risk of illnesses and growth of mold.

Further, fixed costs of any renovation effort are large and rationalise the integration of energy renovations with general improvements of a building.

The total benefits can be substantial

The combination of low overall energy ratings and an old building stock suggest substantial social and environmental benefits from energy renovations.

Policy measures to improve energy efficiency of buildings need to be targeted. The measures should deliver on three critical parameters in the policy agenda for the EU and for housing policies more specifically: positive economic, social and environmental benefits.

1) Housing Europe (2021), *Reality and challenges of the decarbonisation of the building stock*

Key factors drive the economic, social and environmental results of measures to support energy renovations

Energy renovations have sharply declining returns to the point where they do not pay for themselves anymore

We find strong evidence, inter alia from the Netherlands, Germany and Austria, that aiming for the highest EPC label in energy renovations delivers poor returns for society. Increasing the EPC label from B to A is substantially more costly than raising it from e.g. D to C. At the same time, the typical energy savings associated with the energy renovation are relatively smaller. In other words, higher marginal costs for a smaller benefit.

The poor return performance will manifest itself in two types of adverse outcomes:

First, from a pure housing policy perspective, the savings from a lower energy bill will be too small to pay for the investments required to deliver the lower energy bill.

Second, it is costly in terms of climate and wider environmental policy. For high EPC labels, the emission reduction per Euro investment is lower than for low EPC labels and might even be lower than emission reduction measures elsewhere in the economy. In other words: going for the highest labels is not a cost-effective way of implementing EUs climate policy goals.

Hence, there is overall a strong case for supporting policy measures that reduce barriers to investment that can lift energy performance standards, but not for enforcing the highest EPC labels.

The success of energy renovations varies across the EU due to varying climate conditions…

Not surprisingly, the economic and environmental value from insulating a house in the European north differs from undertaking the same measure in the European south.

Hence, uniform measures across EU countries with substantial variations in weather conditions are likely to provide very unequal benefits in the different locations.

…and varying access to renewable energy

The cost of producing renewable energy has decreased immensely in recent years and even become competitive to fossil fuel energy production. For example, the cost of onshore wind energy reduced by 13% only in 2020. In turn, this has also reduced the cost of decarbonising the housing stock.

However, not all parts of the EU have, at the moment, equal access to heating based on renewable energy. This also implies that the most cost-effective away to achieve decarbonisation of the housing stock is very much affected by local energy systems and their development in the coming years.

Different preferences of building owners further determine timing and scope of energy renovations

The best timing and scope of a major renovation effort is narrowly linked to local conditions and preferences that vary substantially across the EU; not only *between* Member States but also *within* Member States.

The variation in local conditions goes beyond differences in climatic conditions and energy systems, e.g. political support or the availability of relevant workforce.

Housing associations, in contrast to private home owners, make extensive renovation plans where energy efficiency is documented for the whole portfolio of buildings rather than for individual buildings.

Affordability of housing is essential in the social housing sector

Tenants in the social housing sector are vulnerable and hence, investment costs cannot easily passed on without worsening affordability. Access to financing is thus crucial for social housing associations, alongside well-balanced minimum energy efficiency requirements.

We propose three concrete policy recommendations

While there is a strong case for supporting major energy renovations of the EU building stock, there is also a need for targeted measures that specifically address the key factors outlined above:

- The measures should be flexible to account for the heterogeneity in the EU.
- The measures should allow for diverging preferences, e.g. as to the exact timing and scope of energy renovations.
- The measures should remove existing barriers to energy renovations.

2
The EU building stock: Potential for energy savings and other benefits from renovation

The EU building stock has a large potential for renovation

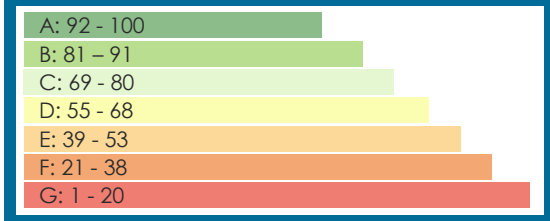
EPC labels are a rating scheme for buildings

Energy performance certificates (EPC) are a rating scheme based on energy cost per square metre and depict the energy efficiency of buildings.

The requirements per EPC label do not increase proportionately. An energy renovation that increases a building's EPC label from B to A does not necessarily imply larger CO_2 emission reductions than an energy renovation that increases the building's EPC label from D to C.

In fact, the opposite might often be the case: energy renovations at lower EPC labels deliver more CO_2 emission savings than energy renovations at higher EPC labels.[1]

Fact box: EPC labels



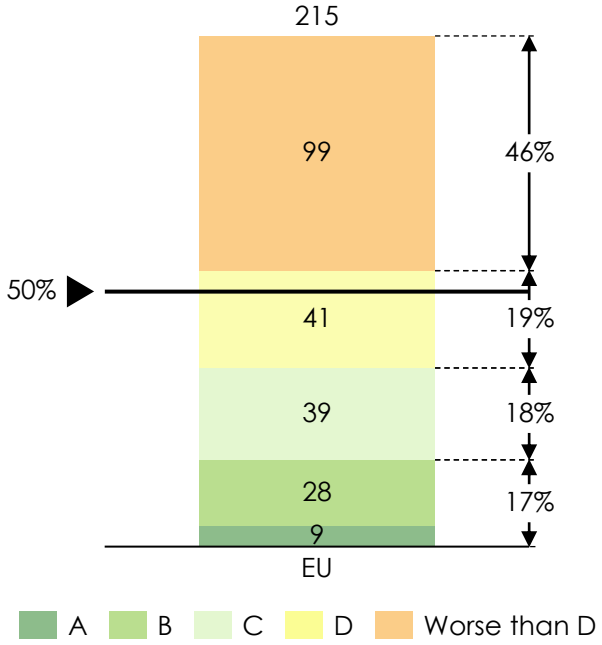
The building undergoes an SAP (Standard Assessment Procedure) and receives 1-100 SAP points that divide the ratings. The buildings are rated between A (very efficient) and G (inefficient) in most EU Member States, but the requirements per EPC label and energy consumption measures (i.e., kWh/m2) also vary across countries.[2] Netherlands, e.g., recently introduced EPC labels up to A++++.[3]

Almost half of the EU building stock has an EPC label below D

The EU building stock comprises around 215m buildings. The median EPC label of the EU building stock is D. Almost half of the EU building stock has an EPC label worse than D, while only 17% of the EU building stock has an EPC label of A or B, see Figure 1.

Figure 1. Median EPC label of the EU building stock

Million buildings



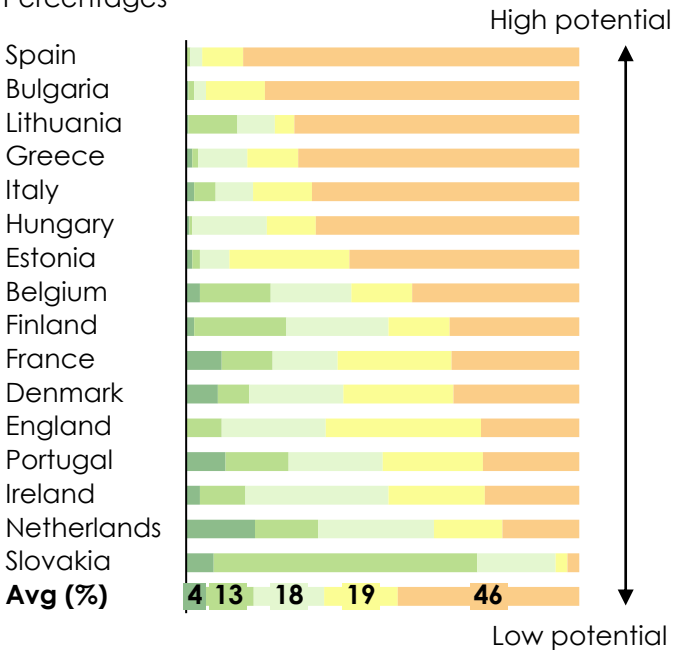
Note: We assume the avg. distribution of EPC in the 16 EU countries is similar to the distribution in all of EU.
Source: EU Buildings Factsheets | Energy (europa.eu); EU Building Stock Observatory | Energy (europa.eu); National databases;

The distribution of EPC labels across EU countries is highly uneven

Some EU countries have a modernised building stock with high EPC labels. Slovakia, the Netherlands, and Ireland have a relatively low share of buildings below EPC label D and at the same time a large share of buildings with EPC label A and B. Spain, Bulgaria, or Lithuania showcase the opposite, see Figure 2. This suggest a large potential for improvement in energy efficiency in these countries.

Figure 2. Distribution of EPC labels in EU countries

Percentages



Source: EU Buildings Factsheets | Energy (europa.eu); EU Building Stock Observatory | Energy (europa.eu); National databases;

1) Economisch Instituut voor de Bouw (2018), *"Klimaatbeleid en de gebouwde omgeving"* / 2) Atanasiu and Constantinescu (2011), *"A comparative analysis of the energy performance certificates schemes within the European Union"* / 3) Government Netherlands, https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/wetten-en-regels/bestaande-bouw/energielabel-woningen

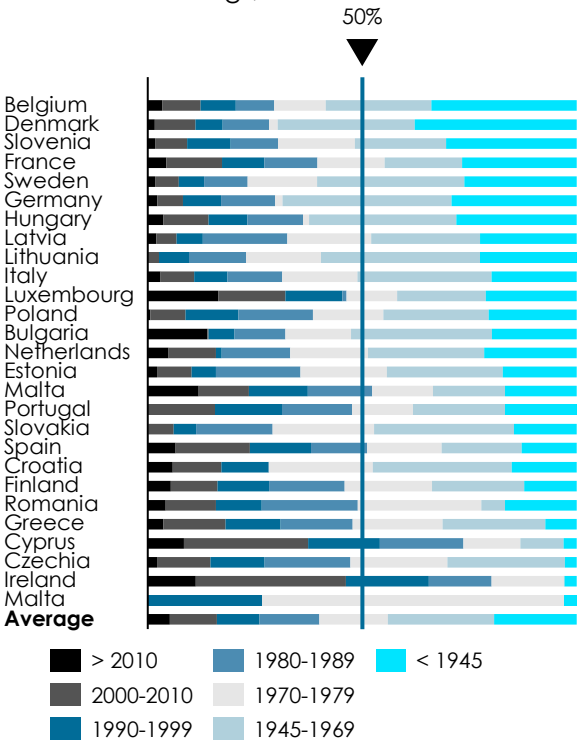
The old EU building stock implies large synergies of combining ordinary and energy renovations

The EU building stock is old

On average, over 50% of EU buildings were built before 1979. Around 20% were even built before 1945. But again, the age of *national* building stocks varies largely across the EU. Ireland, Cyprus or Malta, e.g., have a lower average building age than Denmark, Belgium or Germany, see Figure 3.

Figure 3. Residential buildings by construction year

Number of buildings, 2014



Source: EU Buildings Factsheets | Energy (europa.eu) / EU Building Stock Observatory | Energy (europa.eu) / National databases

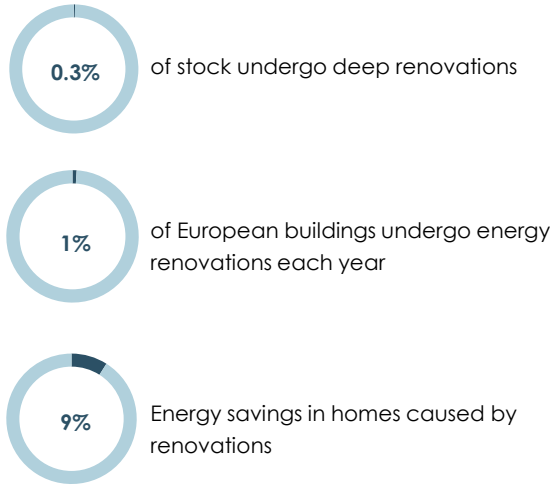
Energy efficiency measures are often carried out during overall renovations

We distinguish between two types of renovations:

- Ordinary renovations covering modernization, retrofit, restoration and rehabilitation to simple maintenance, repairs and routine upgrades.
- Energy renovations covering interventions that lead to energy savings. Deep renovations are renovations that attain energy savings of 60% or more, but not all renovations are deep renovations, see Figure 4.

However, there is no EU-wide definition of renovations, which makes it difficult to link the depth of energy renovations directly to the energy savings.[1]

Figure 4. Key figures of energy renovations



Source: Energy Post; Energy renovation | E3P (europa.eu)

There are large synergies of combing ordinary and energy renovations

Old buildings are more likely than new buildings to be eligible for ordinary renovations paired with energy renovations soon. Combining both renovations has large potential for synergies as these quotes exemplify.

> "Renovations have almost always an energy and a non-energy related component. […] there is not (yet) a specific approach for energy efficiency but rather an approach of building modernization and increased comfort for tenants."[2]

> "An important part of the multi-family housing stock in Sweden was built during the record years 1961–1975 and is in need of extensive renovation to be modernized. The stock is also at the center of political discussion of how to sustain 'good housing for all', especially in the rental sector. **These renovation needs coincide with present energy targets and provides an opportunity to combine renovation with energy efficiency measures.**"[3]

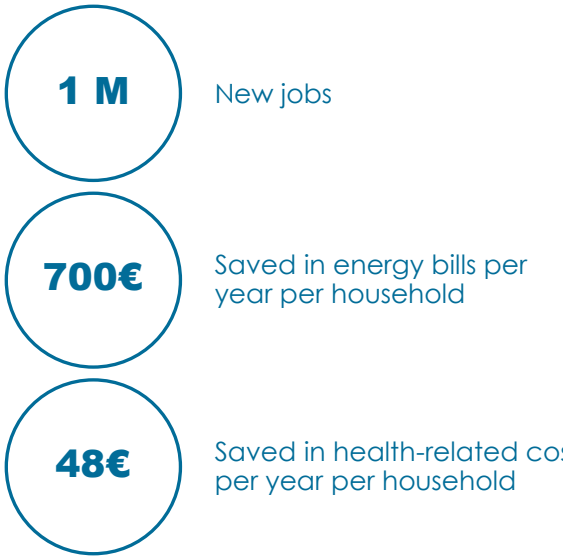
1) Energy renovation | E3P (europa.eu) / 2) Housing Europe (2018), *The financing of renovation in the social housing sector* / 3) MDPI: Renovation Strategies for Multi-Residential Buildings from the Record Years in Sweden—Profit-Driven or Socioeconomically Responsible

With the right measures, the total benefits from renovating the EU building stock can be substantial

Low EPC labels and an old building stock bear substantial potential for energy renovations that pay for themselves

Low EPC labels and an old building stock in the EU bear substantial for energy savings from energy renovations.

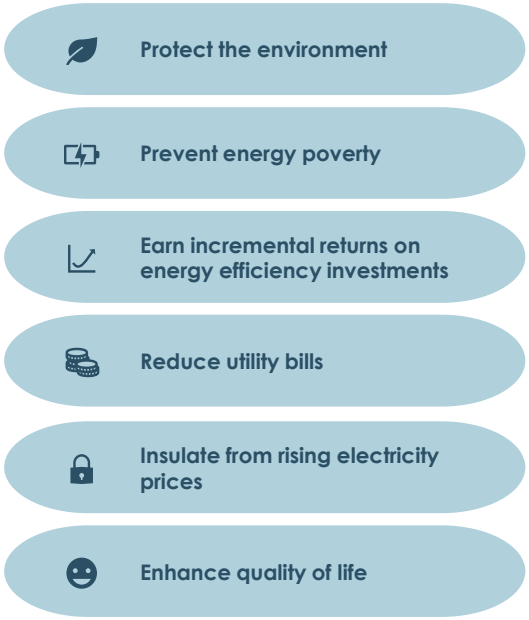
Figure 5. Renovation of 4 million homes would contribute to:



Source: Housing Europe (2021), *Reality and challenges of the decarbonisation of the building stock*

Energy renovations have several benefits

Energy renovating the old EU building stock has at least the following benefits for building owners, tenants and society. [1]



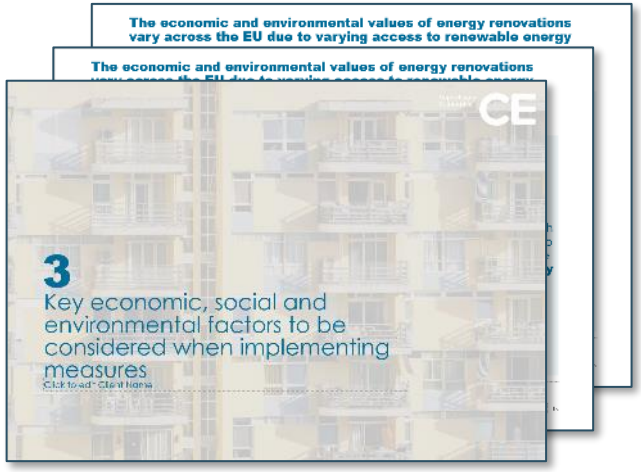
Some of these benefits are simple, e.g., the protection of the environment and lower utility bills. Others are less easy to quantify, e.g., incremental returns on energy efficiency investments. The relation between costs and energy savings for small investments compared to large investments is not clear.

However, policy measures need to be targeted to the characteristics of the EU building stock

The policy measures to incentivise energy renovations of buildings need to be targeted and safeguard affordability and access to financing.

The measures must fulfil the three critical parameters: economic, social, and environmental benefits.

In the next chapter, we outline what comprises these three key parameters and how they play a role in the revision of the EPBD.



Sources: 1) Energy Sage

3

Key economic, social and environmental factors to be considered when implementing measures to support energy savings

Energy renovations have sharply declining returns

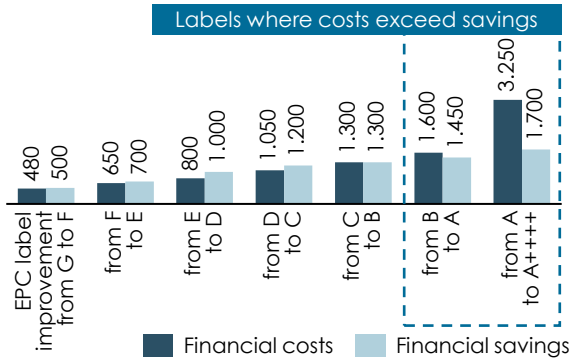
Cost and benefits of energy renovations are not the same for all EPC labels

The relationship between costs and benefits is not the same for all energy efficiency levels of buildings. There is evidence that in the higher ranges of EPC labels, the costs outweigh the benefits of energy renovations.

For example, in the Netherlands, an energy renovation that increases a building's EPC label from D to C is potentially less costly than an energy renovation increasing a building's EPC label from B to A, see Figure 6.

Figure 6. Financial cost and savings of energy renovations per EPC label in the Netherlands

Euro per housing unit per year



Note: 25 years investment horizon at a 6% discount rate

Source: Economisch Instituut voor de Bouw (2018), "Klimaatbeleid en de gebouwde omgeving"

At the same time, the energy savings from an energy renovation are in most cases larger for a renovation that increases a building's EPC label from D to C than on that increases a building's EPC label from B to A.

For energy renovations that lift buildings' EPC labels from B to higher, the costs of renovations exceed the energy savings.

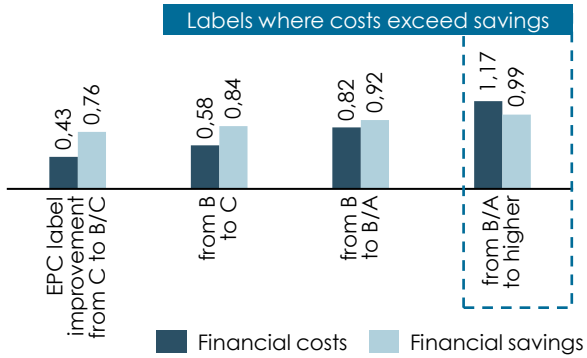
The relation between costs and savings from renovations varies across the EU

A similar picture emerges in Germany. Energy renovations that lift a building's EPC label above EPC label A do not seem to outweigh costs, see Figure 7. We find similar evidence for Austria.[1]

This case is less clear for other countries. In Spain, energy renovations are in general less beneficial, because of different demand for heating and cooling due to a warmer climate.[2] A Greek study on cost-optimality of energy renovations concludes that all renovation benefits can outweigh costs if the time horizon for savings is sufficiently long.[3] In Finland, despite the cold temperatures, many energy savings do not outweigh costs, as the Finish building stock consists of many newer buildings.[4]

Figure 7. Financial cost and savings of energy renovations per EPC label in Germany

Euro per m^2 per month



Note: We convert the German energy standards using /www.energieeffizienzklasse.com/, and use "Effizienzhaus 100" for EPC label C, "Effizienzhaus 85" for EPC label B/C, "Effizienzhaus 70" for EPC label B, and "Effizienzhaus 55" for EPC label A/B.

Source: Dena (2010), "dena Sanierungsstudie"

1) https://nachhaltigwirtschaften.at/resources/hdz_pdf/berichte/endbericht_1514_innoCost.pdf / 2) Odyssee-Mure (2021) / 3) Greek government (2014) / 4) Hirvonen et al. (2018), Towards the EU emissions targets of 2050: optimal energy renovation measures of Finnish apartment buildings

The low returns for energy renovations for higher EPC labels entail two adverse outcomes

1 Energy renovations at high EPC labels do not always pay for themselves

When energy savings do not make up for the investment costs, energy renovations do no longer pay for themselves. Other benefits, such as improved health, are unlikely to outweigh the costs of renovation at high EPC labels even from a societal point of view.

The benefits of energy renovations do not necessarily accrue to the investor/owner of building when the building is rented out. E.g., the reduction in energy bills and enhanced quality of life in a rented object will be beneficial for the tenant, while the building owner finances the renovation.

2 Emission reductions come at a high price for high EPC labels

Emission savings decline for energy renovations at high EPC labels, while costs increase, which translates into a declining environmental return on energy savings investments. An energy renovation that increases a building's EPC label from D to C saves CO_2 emissions at lower cost than an energy renovation that increases the building's EPC label from B to A.

Efficient climate policy, however, incentivises emission savings where they are cheapest. In other words, climate policy targets do optimally not strive to net zero at any cost but to a reduction of emissions where the cost per unit reduction is lowest.

Some renovations might be too expensive relative to the respective emission savings. From a societal point of view, the same investment that would otherwise be used for an energy renovation could reduce emissions more elsewhere in the economy.

Hence, economic reasoning lets us conclude that policy measures that incentivise investments in energy renovations to increase EPC labels are **economically and environmentally efficient up to a certain level.**

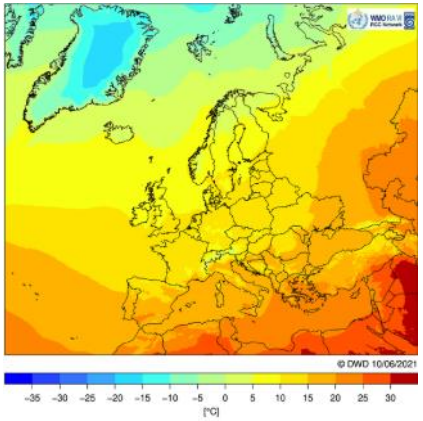
1) Mjörnell et al. (2019), Renovation Strategies for Multi-Residential Buildings from the Record Years in Sweden—Profit-Driven or Socioeconomically Responsible?

The success of energy renovations varies across the EU due to varying climate conditions and access to renewable energy

The EU comprises different climate conditions

The climate in the EU varies considerably. Mean temperatures that are determinant for the success of energy renovations, are lower in the European north than the European south, see Figure 8.

Figure 8. Monthly mean temperatures in Europe, May 2021



Source: Deutscher Wetterdienst

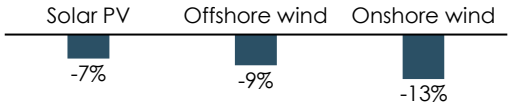
In areas, where average temperatures are high, buildings have less need for energy for heating.[1] However, such areas may have a higher need for cooling, e.g. in Spain and Greece. Hence, for some regions, energy renovations may have less energy savings potential and thus less benefits. In Spain, current energy efficiency requirements for buildings depend on the respective climate area.

Renewable energy is cheap…

Through advances in technologies, the cost of producing renewable energy has fallen considerably in recent years, see Figure 9.[2] Renewable energy production is now competitive to fossil fuel energy production, even without subsidies.

Cheap renewable energy reduces the cost of heating and cooling, especially for radiators or heat pumps, and hence also reduces the energy savings potential of energy renovations.

Figure 9. Reduction in cost of producing renewable energy in 2020



Source: IRENA Renewable Cost Database

… but access to renewable energy differs and thus impacts differently on the savings potential from energy renovations

Different regions within the EU have diverging access to cheap renewable energy. Countries at the European coastline, e.g. Denmark, have access to offshore wind, while countries with many sunlight hours, e.g. Spain, can produce solar power.

The energy savings potential is lower for countries with access to cheap renewable energy than for other countries.[3] In other words, the cost of decarbonisation is higher, as a one-unit reduction in emissions requires more energy savings and hence higher renovation investments. More available renewable energy can, next to energy efficiency, contribute to a greener housing sector.

Hence, it follows that uniform measures across EU countries with substantial variations in weather conditions and different accessibility to renewable energy are **likely to provide unequal benefits in different locations.**

1) https://heatroadmap.eu/wp-content/uploads/2018/09/STRATEGO-WP2-Background-Report-4-Heat-Cold-Demands.pdf / 2) https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Jun/IRENA_Power_Generation_Costs_2020.pdf / 3) Risholt and Berker (2013), *Success for energy efficient renovation of dwellings—Learning from private home owners*

Different preferences of building owners further determine timing and scope of energy renovations

Preferences for timing and scope of an energy renovation vary across the EU

Building owners' preferences for timing and scope of energy renovations vary across Member States as well as within Member States and can be divided into three aspects:

First, the chosen point in time to conduct an energy renovation depends on local circumstances. Such circumstances can be political support, availability of relevant information, etc.[1]

The chosen point in time further depends on the age of buildings as well as the incentives to conduct more general renovations that could be combined with energy improvements.[2]

Second, the chosen scope of an energy renovation depends on local circumstances that go beyond climate conditions and access to renewable energy. Political support or the availability of relevant workforce, e.g., determine the scope of energy renovations.

Third, the desired scope of energy renovations depends on the type of building owner, i.e. private home owners or housing associations. Housing associations make extensive renovation plans that comprise multiple years. The energy efficiency is documented for the portfolio as a whole rather than for induvial buildings.

Local stakeholder involvement has proven to be successful

In Denmark, the social housing association involves tenants in the decisions for various energy renovations. Tenants are made aware of the investment costs as well as the consequences for their rents. This dialogue has proven successful in gaining support for renovation initiatives.[3]

Fact box: Local stakeholder involvement in Denmark

A pioneer project in Denmark helps tenants in social housing buildings to understand the CO_2 emissions of the building in the current state and after energy renovations. The calculation tool employed in the project allows tenants to calculate the consequences of their choice for their own economy and the climate. This creates a solid ground for founded decision-making.[4]

Fact box: Guidelines on how to recover investment costs in the Netherlands

The Dutch tenant organisation ("Woonbond") and the Dutch social housing association ("AEDES") have together developed a renumeration table for energy renovations to give housing investors guidelines on how to recover the investment costs upon an energy renovation.[5]

Hence, it follows that uniform measures across EU countries with different preferences for the timing and scope of energy renovations are **likely to provide unequal benefits in the different locations.**

1) Cattaneo (2019), Internal and external barriers to energy efficiency: which role for policy interventions? / 2) Risholt and Berker (2013), *Success for energy efficient renovation of dwellings—Learning from private home owners* / 3) Scanlon and Vestergaard (2007), *The solution or part of the problem? Social housing in transition* / 4) AlmenNet / 5) Woonbond

The EU social housing sector has limited options to conduct energy renovations that do not pay for themselves in savings

Affordability of housing is essential in the social housing sector

Affordability is a key focus for the social housing sector. This makes it even more important that energy renovations do not lead to overall higher costs for tenants.

It is essential that the savings on the energy bill over time fully pay for the initial investment costs. If not, either the overall tenant bill, i.e. pure rent plus the energy bill, will need to go up or the housing association will experience a financial squeeze ultimately resulting in a lower quality and supply of social housing. The split of the burden between tenant and social housing association depends on the regulation of rents that differs substantially between EU countries, see the fact box below.[1]

Fact box: Rent regulation in the EU

In the Netherlands, the possibility to increase rent after renovation is limited, and the limit is independent of the investment. In Austria, the maximum allowed rent increase is dependent on local measures, such as climate and geography. In Germany, the rent increase is capped at 8%, in Poland at 10%. In Denmark, the rent increase must be proportional to the increase in property value.[2]

In Finland, Estonia or Latvia, there is more room to recover investment costs upon renovation measures.

The success of energy renovations in the social housing sector depends on access to financing

Investors need access to affordable financing possibilities, especially if, as in the EU social housing sector, investment costs cannot easily be passed on to tenants without worsening the affordability of housing to social housing tenants.

The absence of access to affordable financing possibilities limits the possibility to conduct energy renovations.[3]

Fact box: Financing possibilities in the EU

There are funding possibilities on EU level, such as the European Structural and Investment Funds or InvestEU.[4]

The most popular form of financing possibility are grants and subsidies, that all EU Member States offer. Loans are available in over half of the countries, while they are supported by state guarantees e.g., in Bulgaria, Estonia, or France. Tax incentives are primarily popular in e.g., Denmark, Italy, or the Netherlands.[5]

Hence, it follows that **the EU social housing sector is limited** to pass on investment costs to tenants and to have access to financing. This **may hinder energy renovations that are beneficial for society.**

1) Enpor (2020), *Structural Factors Impacting Energy Efficiency Policy Implementation in the European Private Rented Sector* / 2) Bundesinstitut für Bau-, Stadt- und Raumforschung (2016), *Tenancy law and energy renovation in European comparison* / 3) Palm and Reindl (2018), *Understanding barriers to energy-efficiency renovations of multifamily dwellings* / 4) https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/financing-renovations_en / 5) Economidou et al. (2019), *Accelerating energy renovation investments in buildings – Financial & fiscal instruments across the EU*

4 Policy recommendations

In light of the revision of the EPBD, we present three concrete policy recommendations

There is a strong case for major energy renovations in the EU building stock. However, energy renovations do not always pay for themselves nor are they necessarily equally economic in their capacity to reduce emissions. The success of energy renovations depends on climate conditions, access to renewable energies, as well as local stakeholder involvement.

Given these considerations, policy measures, such as the **minimum energy performance standards (MEPS) must be targeted** to address these key factors. Specifically, we draw the following three policy recommendations:

1 The measures should allow for a large degree of flexibility

The measures should account for the heterogeneity of the EU Member States and:

- Take into account the different current level of EPC labels of the building stock.
- Take into account local climate conditions.
- Take into account differences in access to renewable energy.

Hence, the measures should avoid the mandatory imposition of the highest EPC labels across the EU.

2 The measures should allow for diverging preferences

The measures should account for differences in preferences of the stakeholders involved and:

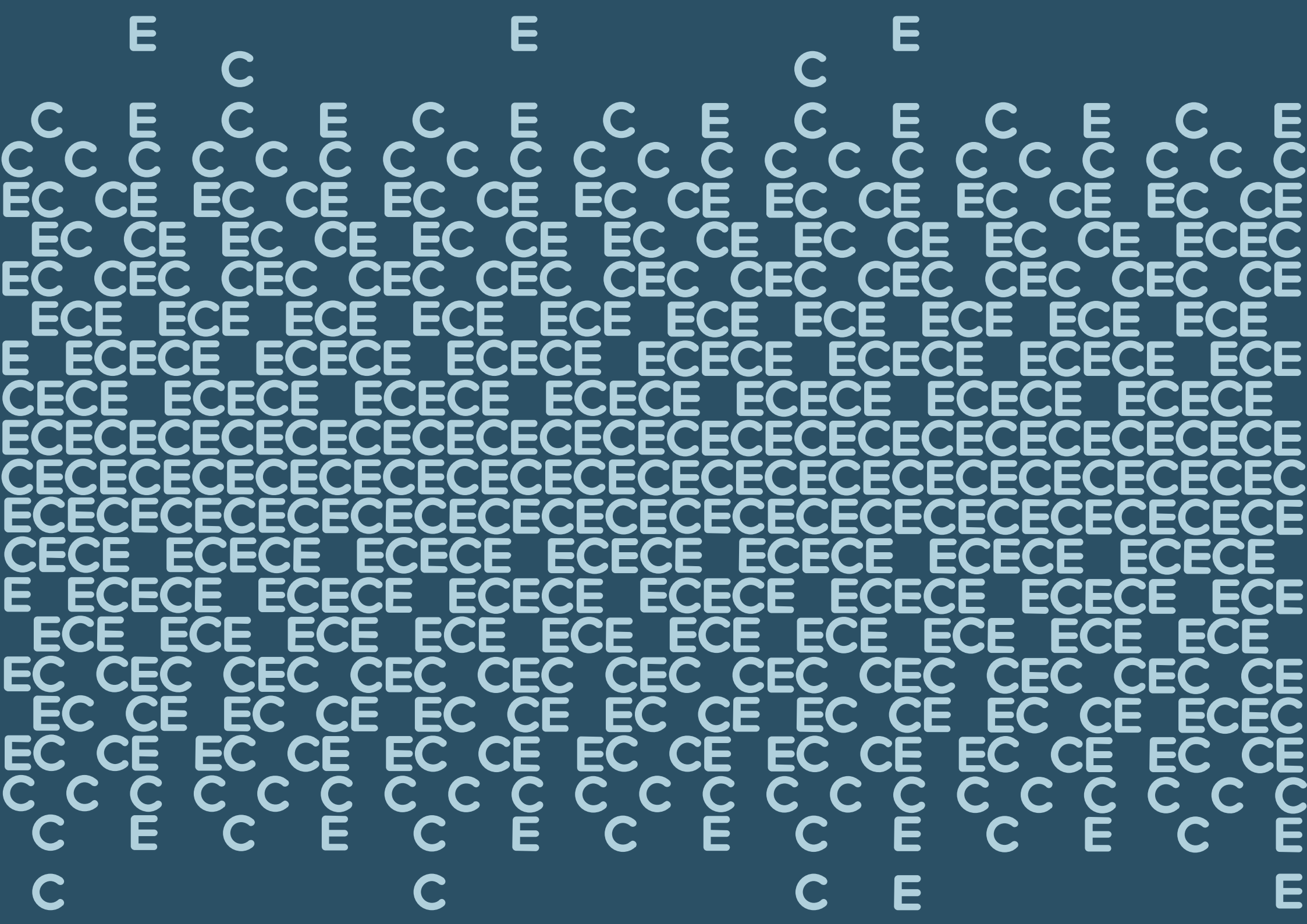
- Allow relevant local stakeholders sufficient leeway in determining the precise timing and scope of energy renovations.
- Allow different building owners to implement the measures differently. Private home owners can implement measures differently than housing associations that measure energy efficiency on portfolio level.
- Allow for a combination of lower energy efficiency investments and the decarbonisation of heat.

3 The measures should overcome existing barriers to renovations[1]

The measures should remove barriers to projects that have high societal returns, i.e. high economic and environmental benefits and:

- Promote national differences in rent regulation and possibilities to share the costs of energy renovations between payers and beneficiaries.
- Promote differences in access to public funding and the impact on the cost of renovations.

1) United Nations Economic Commission for Europe (2017), *Overcoming barriers to investing in energy efficiency*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