

ENPER - TEBUC



Energy Performance
of Buildings

**Application of Energy
Performance Regulations
to Existing Buildings**

Under the Kyoto protocol, the European Union has committed itself to reduce the emissions of greenhouse gases (GHG) by 8 % in the period 2008 to 2012 compared to the level in the year 1990. The emission of carbon dioxide (CO₂), the prevailing greenhouse gas, is for the larger part linked to the combustion of fossil energy carriers. In particular, energy use in buildings accounts for about 40 % of the final energy demand in the EU and is responsible for more than 30% of the CO₂ emissions. It is obvious that increases in energy efficiency will contribute considerably to the achievement of the GHG emission reduction goals.

In recent years numerous efforts have been undertaken at national level to improve the energy efficiency of buildings. In particular building codes have been tightened gradually in most countries within the last three decades. However, until recently, only few initiatives were taken to establish Europe wide harmonised regulations for buildings. This situation is now substantially changing due to the new Energy Performance of Buildings Directive (2002/91/EC).

The ENPER-TEBUC project dealt with the issue of harmonisation in European Building Codes. It integrated the project proposals 'ENPER' and 'TEBUC' into one single clustered project.

Energy Performance (EP) standardisation and legislation is in many member states considered to be an attractive strategy for increasing the energy efficiency of new and existing buildings, and the work of the ENPER project has been focused on these aspects.

Several countries have already an Energy Performance Regulation (EPR) in place (Netherlands, France, Spain, Sweden, etc.) and/or are preparing a new regulation (Belgium, Denmark, France, Germany, Greece, etc.).

Whereas a whole range of European standards are prepared and/or adopted that cover several sub-domains of an EP

standard, there are major differences in the overall approach used in the different countries for determining the EP level of a building.

The EnPeR project was launched to create a European platform for exchange of information on the existing energy regulations in the participating countries and on the development of new procedures and regulatory measures. The aim was to learn from the experiences of the other countries and to draft a set of best practice receipts and recommendations to design, eventually, a harmonised model code for the energy performance assessment of buildings.

An important new element in these developments has been the new European Directive on the Energy Performance of buildings (published 4 January 2003). This directive requires member states to develop calculation procedures according to a number of requirements and to set minimum standards for the energy performance. The project provides basic information fitting into the objectives of the directive. Certainly, the work is not finished: the implementation of the energy performance directive in all member states will need a lot of efforts for which ENPER cannot provide all of the answers. But at least, EnPeR now provides a route map which may guide through the world of Energy Performance Regulations.

The ENPER project results are expected to achieve on the short, medium and long term a substantial impact on the energy efficiency of the European building stock:

- by providing the member states with valuable information, allowing them to save time and money when preparing or updating EP regulations;
- by guiding the member states to the most optimal procedures and by reducing the risk of implementing procedures that are less effective;
- by assisting the member states in a quicker implementation of an EP regulation;
- by spontaneously leading to a more uniform set of national regulations,

facilitating the free flow of products and technology among the different countries.

The project has been complementary to actions by the member states and work carried out in other EU projects (e.g. TEBUC, EUROPROSPER, Build-on-RES,...). For most of the member states participating in this project, the project partners were also involved in national activities dealing with an EP regulation. Therefore, the dissemination of the project results has been quite effective since the national teams were able to immediately apply the knowledge gained in the course of the project.

The EnPeR project was initiated and coordinated by the Belgian Building Research Institute (BBRI-WTCB-CSTC) in the framework of the SAVE programme of the European Commission, DG TREN. It involved partners from 15 countries on the topic of energy performance standardization and regulation. In addition, 6 other European countries were associated on a voluntary basis.

On request of DG TREN, the EnPeR project was clustered with TEBuC

'Towards a European Building Code', another SAVE project of 3 countries which also deals with the issue of harmonization in European Building Codes. The final report of this associated project is available from the TEBuC project co-ordinator IER.

Contract SAVE 4.1031/C/00-018.

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As part of the ENPER project, a series of publicly available reports has been produced as well as a website (www.enper.org). Further information and all reports are available on this website.

www.enper.org

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Task A: Project Co-ordination	BBRI
Task B1: EP calculation procedures	CSTB
Task B2: Innovative concepts	BBRI
Task B3: Legal aspects	NKUA
Task B4: Applicability on existing buildings	BRE
Task B5: Impact on market	TNO Bouw
Task B6: Model building code	TNO Bouw
Task B7: Website	FhG-ISI
Task B8: Seminars	UCD-ERG
Task B9: Priorities	BBRI
Task C1 – C4: TEBUC	IER

The ENPER-TEBUC work plan, subdivided into tasks

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SUMMARY OF REPORT ON TASK B4

This report describes the application of Energy Performance (EP) regulations to existing buildings in the EU. The recently published Directive on the Energy Performance of Buildings highlights the need to address the energy consumed by buildings across the EU. Although EP regulations can demand high levels of energy efficiency from new buildings, their impact on the existing building stock can be limited.

This report summarises the size and energy consumption of the building stock across Europe and estimates the impact that EP regulations can have through their application to new buildings and also existing buildings when they are renovated. The report goes on to describe how EP regulations in Member States (MS) are applied to a building's envelope as well as its services and fittings during renovation or when a building undergoes a change of use. A particular focus of the report is the requirement of the EP Directive to improve the performance of existing buildings as set down in a number of its articles (e.g. the need for boiler inspections and the need to certify buildings when they are constructed, sold or rented out).

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This report is the final report of the Task B4 of the contract DG-TREN 4.1031/C/00-018/2000 ENPER TEBUC

Disclaimer:

The authors of this report have made their best efforts to obtain reliable information. Comments of readers on errors or inaccuracies are welcomed.

The authors of this report are not responsible for the use which might be made of the information contained in this report.

The views given in this report do not represent the views of the DG TREN or of the funding partners.

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1. INTRODUCTION

The publication of European Directive 2002/91/EC on the Energy Performance of buildings in January 2003¹ highlights the need to improve the energy performance of buildings in all Member States (MS) in the European Union (EU). In May 2001 the Commission published a proposal for the Directive² which indicated that the final energy demand of all buildings (i.e. residential and tertiary) in the EU in 1997 was 380 Mtoe (15,900 PJ). This made up 41% of the total final energy demand, the remainder being made up by industry and transport.

Many Member States have recently or are currently revising their EP (Energy Performance) Regulations³ in order to improve the performance of their buildings, but whilst these can have a significant impact on new buildings the impact on the existing building stock can be much more limited. Often, EP regulations can apply to existing buildings when they are renovated or subject to a change of use, but on the remainder of the existing stock their impact can be negligible. Obviously, given the considerable energy consumption of buildings in the EU this is an important issue.

The Directive indicates that when existing buildings undergo major renovation the opportunity should be taken to implement cost-effective energy efficiency measures. It defines major renovation as meaning one where the total cost of the renovation is greater than 25% of the value of the building (excluding the value of the land upon which the building is situated), or one where more than 25% of the building envelope undergoes renovation.

The Directive goes on to indicate that the improvement in the overall energy performance does not necessarily mean a total renovation of the building but could be confined to those parts that are most relevant for the energy performance of the building and which are cost-effective: it allows requirements to be set either for the building as a whole, or to be related just to the renovation works.

Specifically, the Directive has four articles which impact directly on existing buildings. These are:

- Article 6 *Existing buildings*
- Article 7 *Energy performance certificate*
- Article 8 *Inspection of boilers*
- Article 9 *Inspection of air conditioning systems*

The text of these articles is re-produced in Box 1 overleaf.

¹ The Directive can be found at: http://europa.eu.int/eur-lex/en/dat/2003/l_001/l_00120030104en00650071.pdf

² The proposal for the Directive can be found at: http://europa.eu.int/eur-lex/en/com/pdf/2001/en_501PC0226.pdf

³ In this context and throughout this report 'EP Regulations' is taken to mean energy efficiency regulations for buildings be they framed in terms of a full energy performance calculation or a simple prescriptive approach (e.g. maximum U-values for walls, floors, roofs etc.). For further details see the ENPER report for Task B1.

Box 1. Directive on the Energy Performance of buildings – Articles of relevance to existing buildings

Article 6 - Existing buildings

Member States shall take the necessary measures to ensure that when buildings with a total useful floor area over 1,000m² undergo major renovation, their energy performance is upgraded in order to meet minimum requirements in so far as this is technically, functionally and economically feasible. Member States shall derive these minimum energy performance requirements on the basis of the energy performance requirements set for buildings in accordance with Article 4. The requirements may be set either for the renovated building as a whole or for the renovated systems or components when these are part of a renovation to be carried out within a limited time period, with the above mentioned objective of improving the overall energy performance of the building.

Article 7 - Energy performance certificate

1. Member States shall ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant, as the case might be. The validity of the certificate shall not exceed 10 years.

Certification for apartments or units designed for separate use in blocks may be based:

- on a common certification of the whole building for blocks with a common heating system, or
- on the assessment of another representative apartment in the same block.

Member States may exclude the categories referred to in Article 4(3) from the application of this paragraph.

2. The energy performance certificate for buildings shall include reference values such as current legal standards and benchmarks in order to make it possible for consumers to compare and assess the energy performance of the building. The certificate shall be accompanied by recommendations for the cost-effective improvement of the energy performance. The objective of the certificates shall be limited to the provision of information and any effects of these certificates in terms of legal proceedings or otherwise shall be decided in accordance with national rules.

3. Member States shall take measures to ensure that for buildings with a total useful floor area over 1,000m² occupied by public authorities and by institutions providing public services to a large number of persons and therefore frequently visited by these persons an energy certificate, not older than 10 years, is placed in a prominent place clearly visible to the public⁴.

The range of recommended and current indoor temperatures and, when appropriate, other relevant climatic factors may also be clearly displayed.

Article 8 - Inspection of boilers

With regard to reducing energy consumption and limiting carbon dioxide emissions, Member States shall either:

- (a) lay down the necessary measures to establish a regular inspection of boilers fired by non-renewable liquid or solid fuel of an effective rated output of 20 kW to 100 kW. Such inspection may also be applied to boilers using other fuels.

Boilers of an effective rated output of more than 100 kW shall be inspected at least every two years. For gas boilers, this period may be extended to four years.

For heating installations with boilers of an effective rated output of more than 20 kW which are older than 15 years, Member States shall lay down the necessary measures to establish a one-off inspection of the whole heating installation. On the basis of this inspection, which shall include an assessment of the boiler efficiency and the boiler sizing compared to the heating requirements of the building, the experts shall provide advice to the users on the replacement of the boilers, other modifications to the heating system and on alternative solutions; or

- (b) take steps to ensure the provision of advice to the users on the replacement of boilers, other modifications to the heating system and on alternative solutions which may include inspections to assess the efficiency and appropriate size of the boiler. The overall impact of this approach should be broadly equivalent to that arising

⁴ There has been some discussion as to the meaning of 'public buildings' and how Member States would interpret it. The principles of subsidiarity and proportionality mean that Member States are free to choose exactly how they will implement the Directive, but indications from a recent DG TREN workshop on the Directive suggest that most Member States would interpret the phrase in the broad sense of buildings visited by substantial members of the public. However, interpretations by individual countries would need to be agreed with Commission lawyers.

from the provisions set out in (a). Member States that choose this option shall submit a report on the equivalence of their approach to the Commission every two years.

Article 9 - Inspection of air-conditioning systems

With regard to reducing energy consumption and limiting carbon dioxide emissions, Member States shall lay down the necessary measures to establish a regular inspection of air-conditioning systems of an effective rated output of more than 12 kW.

This inspection shall include an assessment of the air-conditioning efficiency and the sizing compared to the cooling requirements of the building. Appropriate advice shall be provided to the users on possible improvement or replacement of the air-conditioning system and on alternative solutions.

In addition, Article 11 *Review* covers evaluation of the Directive and, in particular, indicates that in the light of experience of applying the Directive proposals could be made with respect to (amongst other things):

“...possible complementary measures referring to the renovations in buildings with a total useful floor area less than 1,000m².”

Member States must bring into force Article 6 of the Directive within 3 years of the entry into force of the Directive, i.e. January 2006. They can delay implementation of Articles 7, 8 and 9 by a further 3 years where there is a lack of qualified and/or accredited experts. As a consequence, many Member States are considering revisions to their EP Regulations in order to accommodate the requirements of the Directive.

2. OBJECTIVES

The objectives of ENPER project Task B4 were:

- Review existing and developing methods of applying building regulations to existing buildings.
- Identify limitations of these methods and suggest ways in which they might be overcome.
- Identify other potential measures and make recommendations for further work that might be required.
- Look at the potential for building certification to provide an effective vehicle for improving the existing building stock.

3. APPROACH

ENPER Task B4 was linked very closely to TEBUC Task C2 which was also concerned with the application of EP regulations to existing buildings. Accordingly, an initial survey questionnaire was developed by the two project teams to address the objectives. This questionnaire was then issued to all project participants to complete, and the responses analysed. The results are contained in the TEBUC report Task C2, but for completeness these are given in Annex 1.

- France
- Germany
- Greece
- Ireland
- Italy
- Netherlands
- Norway
- Portugal
- Spain
- Sweden
- UK

Subsequently, following the publication of the Directive and particularly in the light of Article 6, a follow-up questionnaire was required in order to clarify when and how EP regulations are applied to existing buildings when they are renovated. A copy of the follow-up questionnaire is given at Annex 2. The results from these two surveys were supplemented with EU housing statistics^{5,6} and data (primarily from the UK) on buildings in the tertiary sector, i.e. offices, shops, hospitals, educational establishments etc.

These constitute 14 of the current 15 EU Member States (the exception being Luxembourg which was not part of the ENPER project) together with Norway.

In addition, ENPER Task B3 *Legal context for the practical application of EP regulations* and TEBUC Task C4 which was concerned with building certification both cover aspects of relevance to the objectives of project Task B4. In particular, Task B3 surveyed project participants about how far each of their countries already met the requirements of the Directive and what steps they proposed to take in order to comply in the future. Therefore, it was important to integrate the results from these surveys with those obtained in Task B4 to ensure consistency.

Responses were received from 15 countries:

- Austria
- Belgium (Flanders region)
- Denmark
- Finland

⁵ University of Liège. *Housing Statistics in the European Union 2002*. Available on European Housing Forum website at: <http://www.union-hlm.org/structu/m-europe.nsf/62569fb6fa5eb929c12566e20077b9ba/b6b27a4cd30cd8d4c1256875001bdd32?OpenDocument>

⁶ Office of Deputy Prime Minister (ODPM) *Table 112 Dwelling stock: stock and housebuilding, European Union, 2000*. Available on ODPM website at: http://www.odpm.gov.uk/stellent/groups/odpm_control/documents/contentservertemplate/odpm_index.hcst?n=1537&l=1

4. SIZE AND ENERGY CONSUMPTION OF BUILDING STOCK IN EUROPE

4.1 INTRODUCTION

Before presenting the results of the surveys it is helpful to put the size and the energy use of the existing building stock in the EU into context. This is important in the light of the observations made earlier about the limitations of EP regulations with regard to their impact on existing buildings. Such an analysis is also helpful in that it can help in assessing the likely impact of the Directive, particularly Articles 6 and 7.

4.2 SIZE OF BUILDING STOCK

4.2.1 RESIDENTIAL BUILDINGS

Graph 1 overleaf shows the number of dwellings⁷ in each of the 15 Member States together with Norway. Most of the data covers the time period 1998 to 2001.

The graph shows that the situation is dominated by five countries: France, Germany, Italy, Spain and UK. Together these five make up 79% of the total housing stock. The number of persons per dwelling ranges from 2.1 (Denmark, Germany, Italy and Sweden) to 3.0 (Ireland) and averages about 2.4.

Graph 2 overleaf shows another way of illustrating the size of the existing housing stock by expressing it in terms of floor area⁸. The data covers the time period 1991 to 2000.

This graph, unsurprisingly, mirrors Graph 1 with the same five countries dominating. As with persons per dwelling the useful floor area per dwelling is reasonably

consistent across all countries, ranging from 77 (Finland) to 125m² (Luxembourg) and averaging out at about 88m².

4.2.2 TERTIARY SECTOR BUILDINGS

As stated above, it is important to note that Article 6 of the Directive currently only applies to existing buildings with a useful floor area greater than 1,000m². Therefore, only buildings in the tertiary sector are likely to be captured by this article and so it is instructive to investigate the number/proportion of such buildings that would be affected. However, the quantity of data on tertiary sector buildings appears to be limited across Europe and not reported on a consistent basis⁹. Reasonable data is available for the UK^{10,11} though. Graphs 3a and 3b overleaf show data for the size distribution of offices, retail buildings, warehouses and factories in England & Wales.

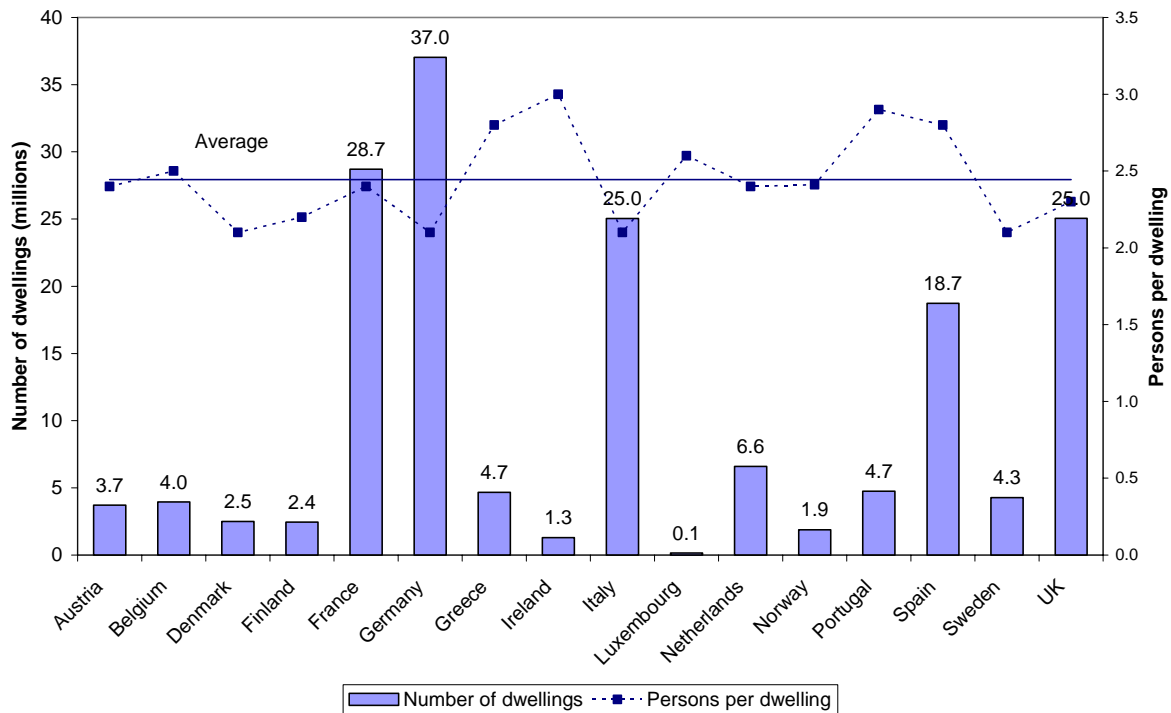
⁷ Care is required in interpreting the data as there are differences between countries as to what is meant by the term 'dwelling'. A full discussion is given on the EU housing statistics website.

⁸ The definition of useful floor area (per dwelling) varies across the Union. Examples of differences are whether the area is bound by the internal or external walls and whether corridors etc. are included. For a fuller discussion see the EU housing statistics website. The total floor area is calculated from the useful floor area per dwelling multiplied by the number of dwellings.

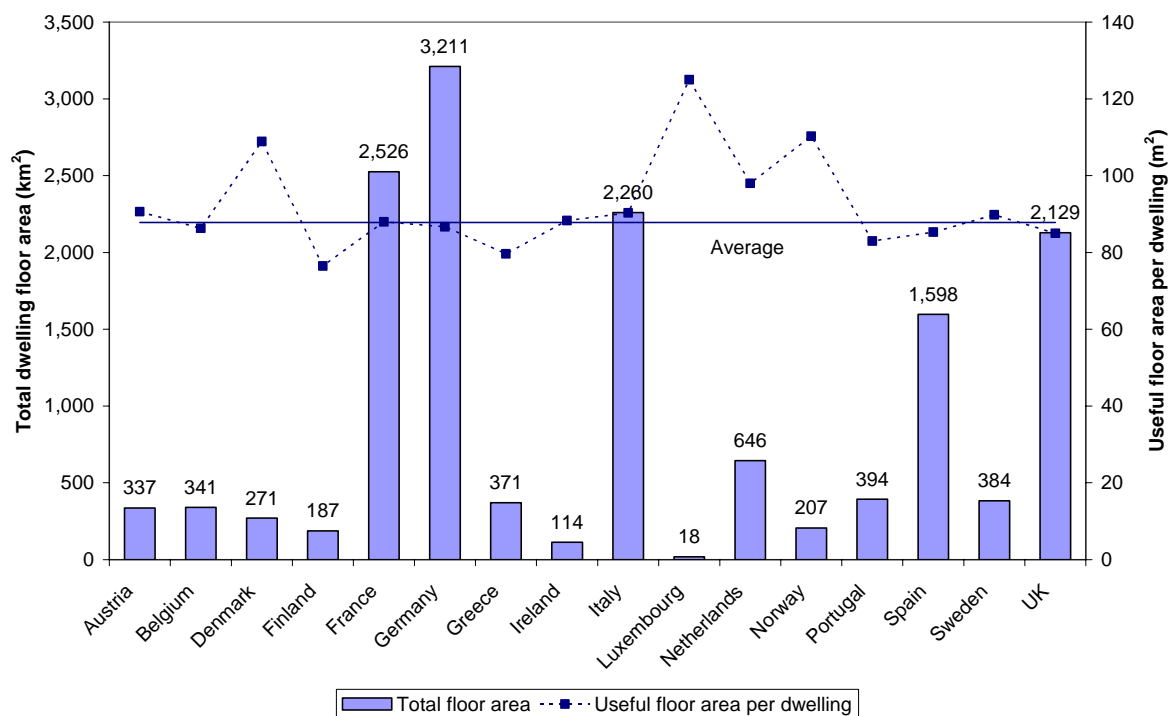
⁹ ENPER project members were asked for such data but it was sparse and there were difficulties in drawing meaningful conclusions.

¹⁰ Pout,C.H., Moss,S.A. & Davidson,P.J. 1998. "Non-Domestic Building Energy Fact File". BRE Report 339.

¹¹ Pout,C.H., MacKenzie,F. & Bettle,R. 2002. "Carbon dioxide emissions from non-domestic buildings: 2000 and beyond". BRE Report 442.



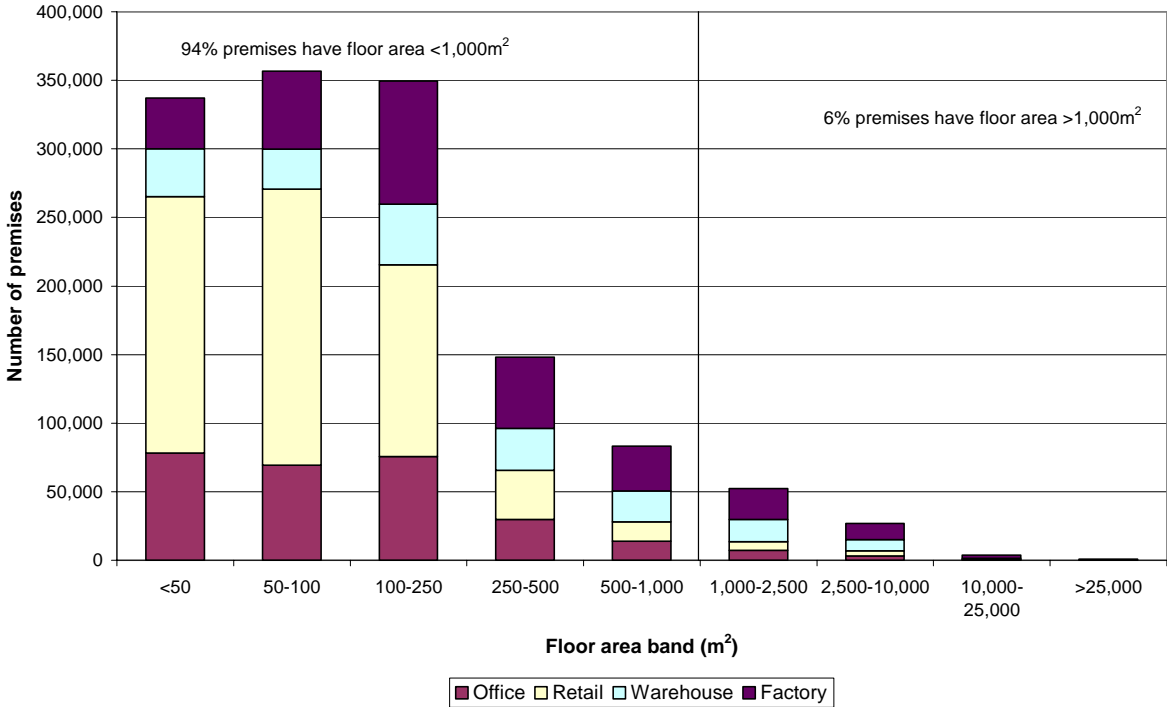
Graph 1. Number of dwellings and persons per dwelling in each EU Member State together with Norway



Graph 2. Total floor area of dwellings and useful floor area per dwelling in a number of European countries

The bulk class 'offices' excludes national government offices (which could be considered as 'public' buildings, and as such may be required to display energy performance certificates) since government properties are exempt from rates. Also excluded from Graphs 3a and 3b are schools, other educational establishments, hotels and hospitals all of

which could also be considered as 'public' buildings. Together these excluded categories make up a floor area of some 250km² which gives a total floor area of the tertiary sector of about 750km².



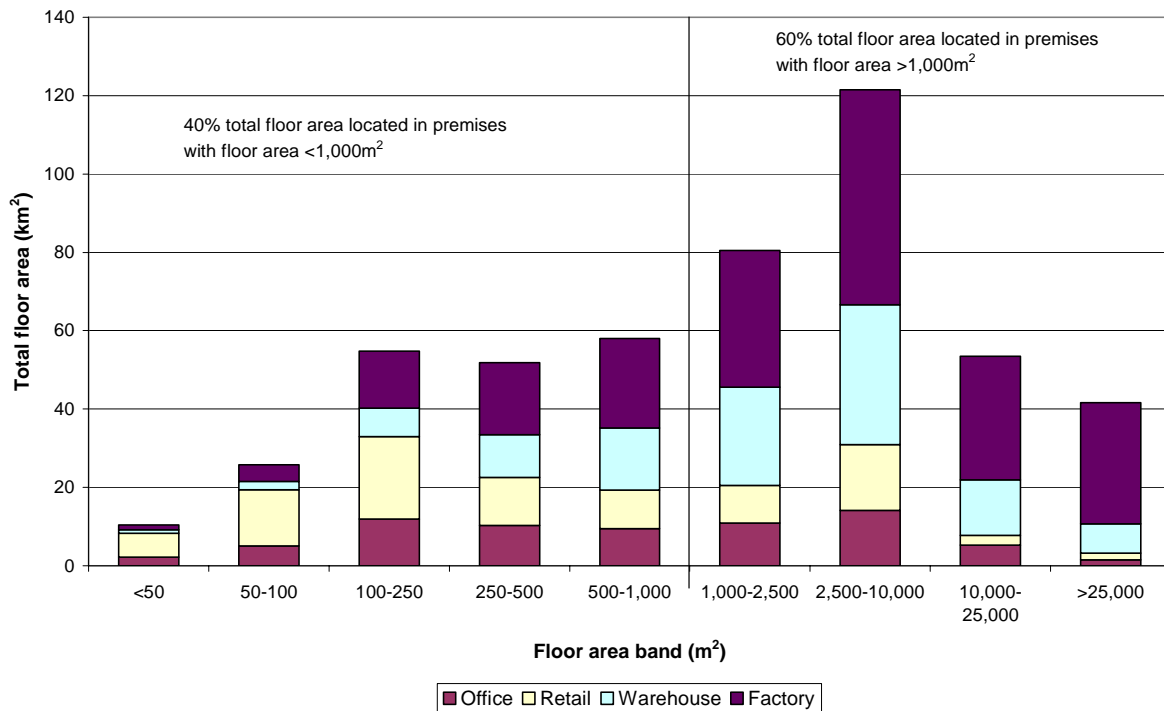
Graph 3a. Size distribution of tertiary sector buildings in England & Wales by bulk class (Number of premises)

Graph 3a shows that the vast majority (94%) of premises¹² have a floor area less than 1,000m² and, if this distribution is mirrored throughout the Member States, the impact of the Directive in its current requirements would at first appear to be limited (only 6% of premises).

However, Graph 3b shows that the proportion of total floor area¹³ affected could in fact be quite significant (about 60%) since there are a reasonable number of factories and warehouses with very large floor areas (>2,500m²).

¹² Number of premises in England & Wales refers to hereditaments which are the distinct business units on which rates are paid. A single hereditament can be anything from a part of a building to a site of buildings.

¹³ Floor area in this context is the net rateable or valued area. Studies indicate that for a given premise the difference between this area and the gross floor area is of the order 10-20%, the actual difference depending on the type of premise (office, industrial complex etc.).



Graph 3b. Size distribution of tertiary sector buildings in England & Wales by bulk class (Total floor area)

Overall therefore the impact of the Directive could be quite extensive in that it focuses on some of the largest energy users in the tertiary sector. Article 11 proposes a review of the 1,000m² floor area limit in due course, and if this was, say, halved to 500m² then the proportion of affected premises would be doubled although it would still be quite small (increasing from 6% to 12%). The proportion of affected floor area would rise from 60% to 71%.

Care should be taken in interpreting these figures in that they include factories and these make up a large proportion of the stock of tertiary buildings. The Directive does not apply to “industrial sites” and “workshops” so it could be that factories should be eliminated from the above analysis. In this case the proportion of premises affected by the 1,000m² floor limit would be 4% and the proportion of total floor area affected would be 51%. In absolute terms as well, the total floor area would be reduced by eliminating factories, falling from nearly 500km² to just over 280km². However, it is unlikely that all factories will be exempt from the Directive, e.g. those containing offices and those

housing low intensity energy processes (e.g. food, drink, packaging, printing, textiles etc.) may need to be considered.

Overall, data on the size of the stock of tertiary buildings appears limited across Europe, but data for the UK suggests that the number of premises and the total floor area will be a fraction of that for dwellings, about a tenth and a half respectively. The impact of the Directive is likely to be pronounced in this sector simply because of the larger individual floor areas. However, care will be needed in implementing the Directive by Member States due to difficulties in interpretation.

4.3 ENERGY CONSUMPTION OF BUILDING STOCK

4.3.1 RESIDENTIAL BUILDINGS

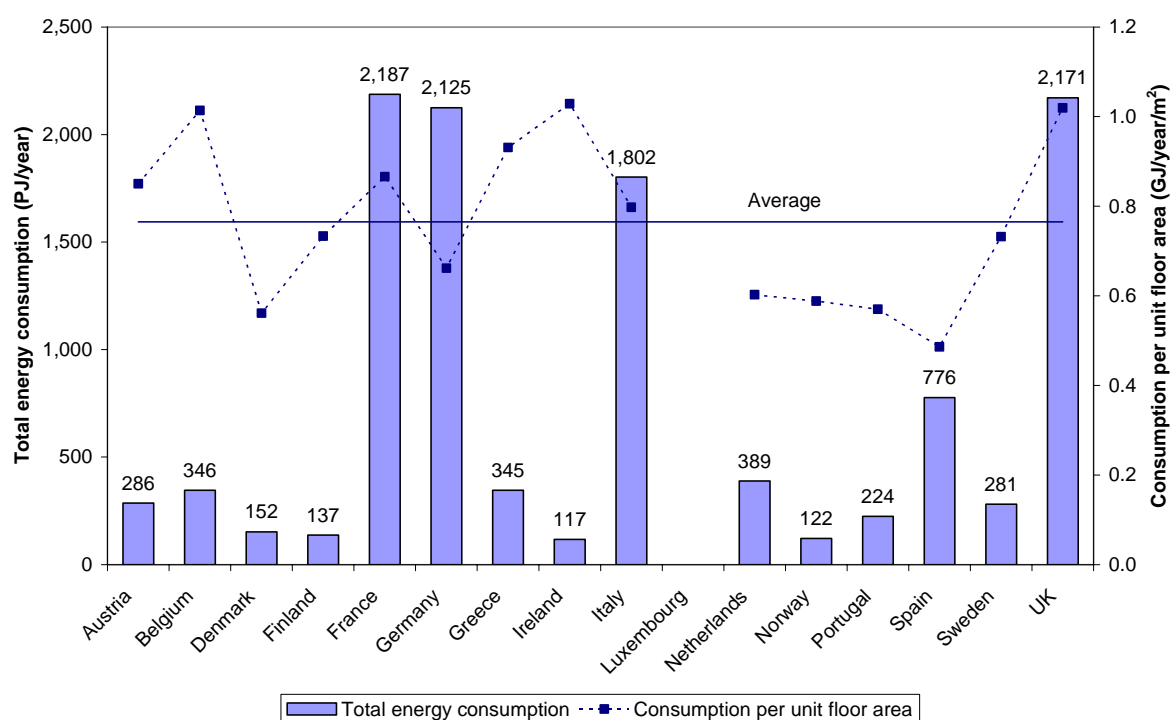
Graph 4 overleaf shows the total annual energy consumption and total annual energy consumption per unit floor area for dwellings. The consumption data (which includes heating, lighting and appliances) was taken from the energy efficiency indicators derived as part of the

ODYSSEE project¹⁴. The consumption figures have been expressed for an average EU climate.

As might be expected, the highest total consumption figures are seen in the five 'big' countries France, Germany, Italy, Spain and the UK. Energy consumption per unit floor area data falls in the band 0.5 to 1.0 GJ/year/m². Curiously, even though the data has been corrected to an

average EU climate, Spain has the lowest consumption per unit floor area, and the figures for Sweden and Finland are only just below average. This is despite the fact that EP regulations in northern Europe are generally more stringent than in southern Europe. The reasons for this are not clear but it is probably a consequence of the procedure for correcting the consumption data to an average EU climate. Higher lighting loads in northern Europe could also be a factor.

¹⁴ <http://www.odyssee-indicators.org/>



Graph 4. Annual energy consumption and energy consumption per unit floor area for dwellings in a number of European countries (adjusted to average EU climate)

4.3.2 TERTIARY SECTOR BUILDINGS

With respect to tertiary sector buildings the total energy consumption in Europe is likely to be comparable to that of the residential sector. For example, delivered energy consumption for the residential sector in the UK in 2000 was 1,960 PJ and that for tertiary buildings (commercial, public as well as industrial buildings) was 1,160 PJ. Available data is limited, but what data that could be provided by ENPER partners supports this assertion – see Table 1.

Country	Residential sector	Tertiary sector
Austria	227	79
Denmark	200	250
France	1,532	669
Netherlands	445	243
Norway	162	119
UK	1,960	1,160

Table 1. Annual energy consumption (PJ/year) in buildings in some European countries

4.4 CONCLUSIONS

Overall, the above analysis shows that the size of the existing building stock and its energy consumption in Member States is considerable. The likelihood is that the energy efficiency of the majority of it is poor. The purpose of the next section is to try to quantify how far EP Regulations in Member States can address this.

4.5 RECOMMENDATIONS

The main difficulty in this section has been collecting data on the size, floor area, distribution and energy use of the building stock in the EU. There were particular difficulties with regard to the tertiary sector. It is therefore recommended that greater efforts are made to collate data from individual Member States in a consistent manner. The definitions of building types and uses in the tertiary sector will require particular attention. This activity could perhaps be undertaken within the context of the Odyssee¹⁵ project

¹⁵ <http://www.odyssee-indicators.org/>

and build on the existing energy efficiency indicators so as to analyse trends in energy consumption, CO₂ emissions and energy efficiency.

Such data would be extremely valuable in assessing the size of the building stock, its energy use, the scope for improving its

energy performance (including targeting of energy efficiency measures) and, finally, for determining the impact of the EP Directive. Some preliminary work was done in this area using the MURE¹⁶ database and so should be continued and extended.

¹⁶ *Mesures d'Utilisation Rationnelle de l'Énergie.*
Can be found at: <http://www.mure2.com/>

5. POSSIBLE IMPACT OF EP REGULATIONS ON THE BUILDING STOCK

5.1 INTRODUCTION

EP Regulations in Member States already address new buildings but given new build rates in Europe it will be some time before they have a significant impact on the energy efficiency of the building stock as a whole. Anecdotal information suggests that some 1-2% of existing buildings are replaced each year. As a first step it is helpful to test the validity of this figure in order to more fully understand how far EP regulations can impact on the existing stock.

5.2 CONSTRUCTION RATES IN EUROPE

5.2.1 RESIDENTIAL BUILDINGS

To determine the rate of construction of dwellings in Europe the EU housing statistics were again analysed. The results of this are presented in Graph 5 overleaf.

As might be inferred from Graphs 1 and 2, the countries with the highest rates of construction are France, Germany, Italy, Spain and the UK (ranging from 150,000 to 450,000 dwellings per year). Italy's rate though is quite small in comparison to the other four countries. Graph 5 also has a figure called annual new build rate as a % of the existing stock. (This is simply the new build rate divided by the size of the existing stock.) The observation about Italy is supported by the fact that it has one of the lowest values of annual new building rate to size of existing stock. In fact, the figures range from 0.3% in Sweden to 3.5% in Ireland with an average of 1.1%. The Irish figure is considerably larger than all the others and is a consequence of the rapid development of the Irish economy.

Although this analysis supports the anecdotal numbers presented above, it should be borne in mind that this variable does not actually tell us the rate at which the existing stock is replaced (or

renovated). It merely shows that rate at which new dwellings are being constructed in comparison to the size of the existing stock – the existing (perhaps energy inefficient) dwellings may well still remain. What is needed is a clearer idea of the actual replacement rate of the existing stock. This can be derived if we know the annual demolition rate of dwellings in Member States. Unfortunately, this data is not readily available but four members of the ENPER project (Denmark, Germany, Netherlands and UK) were able to provide some data.

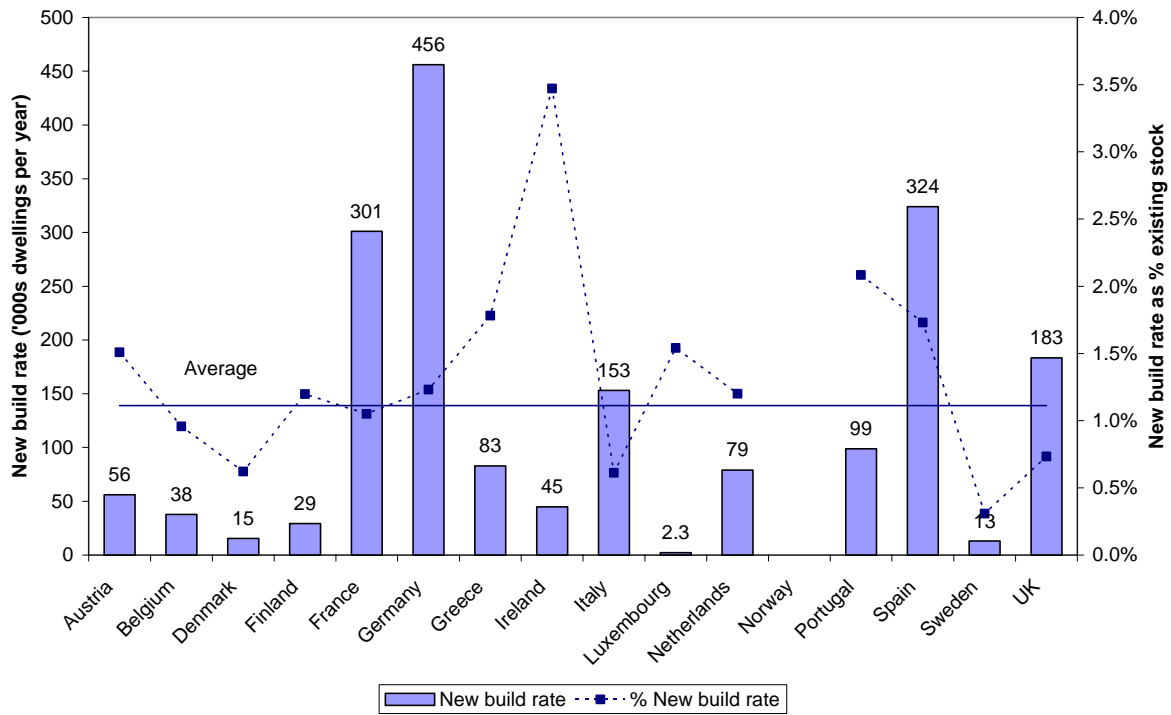
Therefore, two further variables have been calculated:

- **% Annual replacement rate** which is: $(\text{Annual demolition rate})/(\text{Size of existing stock})$
- **% Annual growth rate** which is: $(\text{Annual new build rate} - \text{Annual demolition rate})/(\text{Size of existing stock})$

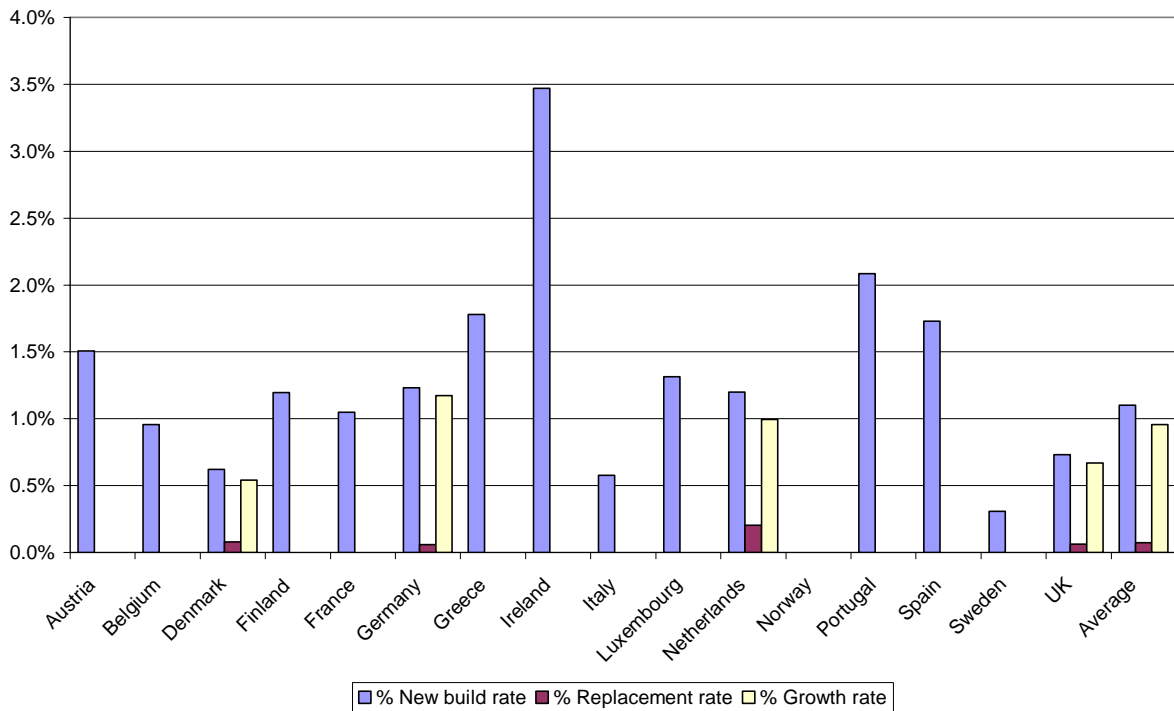
These two variables together with the % annual new build rate have been plotted on graph 6 overleaf.

Although we have information for only four countries they make up some 41% of the total number of dwellings. The data suggest that the annual replacement rate for dwellings in Europe is actually very low, only 0.07%. This is considerably lower than the figures for annual new build rate as a % of existing referred to earlier. Growth rate, as might be expected from its definition, is close to new build rate and averages out at just under 1%.

Overall therefore we see that if EP regulations apply only to new buildings then their impact on total energy use is very minimal (around about 0.1% per year) which is an order of magnitude less than the figures presented at the beginning of this section.



Graph 5. Annual new build rate for dwellings in a number of European countries (average 1995 to 2001)



Graph 6. % Annual new build, replacement and growth rates for dwellings in a number of European countries

However, if EP Regulations apply to buildings when they are renovated (or undergo a change of use, e.g. conversion of warehouse to flats) then their impact is potentially much greater. This is the intended purpose of Article 6 of the Directive (see Box 1). The impact of EP regulations can be increased still further if they are applied to existing buildings regardless of whether they undergo any form of renovation. This is the purpose of Articles 7, 8 and 9 of the Directive (see Box 1).

It is possible to estimate the extent of the impact of EP regulations in Europe when buildings undergo renovation. For example, data from Pilkington¹⁷ shows that in its four largest markets (France, Germany, Italy and UK which together contain 68% of the total number of dwellings) the ratios of renovation window installations to new build installations are: 2, 1.5, 4 and 4 respectively. If we then multiply the new build rate by these ratios in each of the four countries concerned and divide by the size of the existing stock we derive what can be referred to as the **% annual renovation rate**.

For the four countries the renovation rates are: France (2.1%), Germany (1.8%), Italy (2.3%) and UK (2.9%). This shows that if window replacements are controlled by EP regulations (e.g. window replacements need to meet new build standards) then regulation can have a much greater impact on the existing stock. Similarly, using EP regulations to control upgrades or replacement of heating systems and controls, upgrading walls, floors and roofs etc. could also have a considerable impact.

This is only a tentative analysis and would need to be extended to cover other forms of renovation work in more countries. For example, in the UK it is estimated that there are just over a million boiler installations each year of which the vast

majority (80%) are in the replacement market. This suggests that around 5% of dwellings in the UK have improvements to their heating systems.

5.2.2 TERTIARY SECTOR BUILDINGS

Similarly, there is a need to investigate renovation and refurbishment work in the tertiary building sector. Here again the quantity of data is low and its quality poor, but analysis of such buildings in different sectors in UK gives figures ranging from 2 to 8% with an average of just under 3% of existing buildings¹⁸.

5.3 CONCLUSIONS

Overall therefore it appears that up to 5% of buildings in Europe could be subject to some form of renovation work each year which if controlled by EP regulations (e.g. renovation work needs to meet the standards of new build as far as practical) could lead to substantive improvements to the energy efficiency of the stock. This would certainly have a greater impact than through the construction of new buildings alone.

5.4 RECOMMENDATIONS

As with the recommendations made at the end of Section 4 it is suggested that further efforts are made to collect and derive data on replacement and renovations rates across Europe, both for residential and tertiary sector buildings. This can then be linked into data on the size of the European building stock and its energy use.

¹⁷ Wilberforce, R. "Impact of an energy performance regulation on the building and technology market". Presentation given at ENPER Workshop. Delft, Netherlands, February 2003. Can be obtained on ENPER website at <http://www.enper.org>

¹⁸ Data derived from: Pout, C.H., Moss, S.A. & Davidson, P.J. 1998. "Non-Domestic Building Energy Fact File". BRE Report 339.

6. EP REGULATIONS AND THE EXISTING BUILDING STOCK

6.1 INTRODUCTION

Task B4 of ENPER has attempted to determine the extent to which each project member's EP regulations actually apply to existing buildings undergoing renovation. As noted in Section 3 this is the purpose of Article 6 of the Directive. The approach was to issue a questionnaire to ask project members specifically about this. The actual responses received from each partner are given in Annex 2. Again as noted in Section 3 a preliminary questionnaire had been circulated as part of TEBUC to determine the impact of EP regulations on existing buildings, and the results of this survey are contained in Annex 1.

6.2 BUILDING SERVICES AND FITTINGS

Building services were taken to be: heating system (e.g. boiler), heating controls, hot water system (e.g. vessel), hot water controls, lighting and HVAC systems. Fittings were taken to be windows, doors and rooflights. Each of the project members was asked:

“Do your energy performance regulations apply to existing buildings when any of a building's services or fittings is replaced (because they are old or not working)? (This may be regardless of whether the building is undergoing a change of use or a (major) renovation.)”

They were also asked to provide details where appropriate. As noted above 14 responses were received. The key results are:

- In less than half of countries EP regulations apply when building services or fittings are replaced (because they are old or not working efficiently).
- Generally when EP regulations apply, they apply to nearly all services and fittings, although occasionally it applies to just a few, e.g. windows and doors

as is the case in Austria and Netherlands.

- In most cases the replacement has to meet the new-build standards.
- Lighting is the service most likely not to be included (although Spain is developing a regulation).
- Residential buildings and tertiary sector buildings are usually treated the same.

A problem here is to try and define what is meant by a renovation. A simple replacement of old windows for example could be defined as renovation in one country and a repair in another, or it may depend on the number (or proportion) of windows being replaced. Further, countries also allow individual local authorities (or municipalities) to exercise their own judgement as to when and how to apply EP regulations.

6.3 CHANGE OF USE

Project members were asked:

“Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)?”

They were also asked to provide details and to define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). The key results are:

- EP Regulations apply in the majority (10) of countries when generally buildings have to meet new build standards.
- Regulations consider both envelope and the building's services and fittings (exception is Spain where currently just services are considered).
- Often improvements are required to envelope U-values but not often to envelope tightness.
- Three countries (Finland, Netherlands and Portugal) may apply the Regulations. In Finland and Netherlands it is at the discretion of the local authority how far they are

applied, and in Portugal they can apply if heating/cooling load exceed given value(s).

- Only one country (France) does not apply them.
- To prevent excessive work the requirements only apply to altered part of building (as in Norway), when large parts of the building are changed (e.g. Germany) or where work is actually done (UK). There can be relaxation in standards, e.g. lower U-value (UK and Ireland), through practical considerations of working on existing buildings.
- Services only have to meet new build standards if they are replaced (which is often an economic decision); only in Denmark does it appear to be mandatory but even here it is not always met in practice.
- Often there are exceptions for historic buildings (Belgium, Greece, Ireland and UK) but also where work may be considered excessive (Belgium) or for buildings occupied only part of the year (Sweden and Norway).

6.4 RENOVATION

Project partners were asked:

“Do your energy performance regulations apply to existing buildings when they undergo renovation?”

Again they were asked to provide details, for example whether application of EP regulations depended on the size of the building or the cost of the work with respect to the value of the building. The key results are:

- Results are very similar to the position with regard to change of use.
- Regulations apply in the majority (10) of countries where buildings generally have to meet new build standards.
- Two countries (Finland and Netherlands) may apply the regulations - it is at the discretion of the local authority.
- Only one country (France) does not apply them.
- Generally buildings are required to meet new build standards. To prevent

excessive work the requirements only apply to altered part of building (Norway and Sweden), or when large parts of building are changed (Germany) or where work is actually done (UK). Portugal appears to be the only country to specify limitations in terms of the value of work (as is mentioned in the Directive). There can be relaxation in standards in appropriate situations.

- Often there are exceptions for historic buildings (Belgium, Germany, Greece and UK) or for buildings heated only for part of the year (Norway).

6.5 APPLICATION REGARDLESS OF RENOVATION AND CHANGE OF USE

Project partners were asked:

“Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or renovation?”

As before they were asked for details, e.g. what triggers this action. As might be expected the vast majority (12) of the countries said that regulations did **not** apply in this case. The two exceptions were Germany and Greece. Specifically in Germany there is a requirement that by 31/12/2006:

- (a) boilers manufactured before 1978 have to be replaced,
- (b) hot water and heating pipes located in unheated rooms have to be insulated, and,
- (c) ceilings of heated rooms (to an uninsulated roof or the outside) have to be insulated with a U-value of at least 0.30.

In Greece the new EP regulations will require a periodic energy inspection of existing buildings which may require improvements to building components and services. This is closely aligned to the requirements in Articles 8 and 9 of the Directive. For further discussion of these Articles see Section 7.

6.6 EXTENSIONS

Finally, project partners were asked:

“Do your energy performance regulations apply to extensions to dwellings?”

They were again asked to provide details, including whether there was a minimum size of extension at which regulations would be applied, and whether they were framed in terms of a full EP calculation or just a simple prescriptive requirement for the extension.

In all 14 countries the answer was yes. The regulations usually just apply to the extension (as opposed to the whole ‘new’ dwelling), and in many cases the requirement was just a simple prescriptive one, i.e. the U-values of the walls, roof and floor of the extension had to meet the new build requirements. A number of countries stipulate a minimum size of extension (in terms of floor area or house volume) to which the regulations apply.

6.7 ALTERNATIVES TO REGULATION

As an alternative to EP regulation many countries have voluntary initiatives or provide financial support to improve and promote the energy efficiency of existing buildings. These market drivers were investigated as part of the TEBUC survey (see Annex 1).

Austria and Belgium provide financial support amounting to 15% and 40% respectively to help pay for improved heating controls such as thermostatic radiator valves and room thermostats. They also provide a 15% incentive for boiler replacements. A number of countries (Austria, Denmark, France and Netherlands) provide financial incentives to individuals proposing to install solar hot water systems. With regard to lighting, the Netherlands also provides subsidies on the purchase of presence detection and/or high frequency lighting for tertiary sector buildings. A key concern of such schemes though is that once the incentive is withdrawn the take-up rates of measures reduce back to their original levels.

In the UK the energy supply companies are required through the Energy Efficiency Commitment (EEC) to improve the energy

efficiency of homes occupied by their customers¹⁹. The suppliers run schemes to provide householders with energy efficiency measures such as cavity wall insulation, loft insulation, high efficiency boilers etc., and grants of up to 50% are available. The suppliers have agreed an overall energy saving target of 62 TWh (223 PJ) between April 2002 and March 2005.

Countries also have government funded agencies whose remit is to promote energy efficiency in existing buildings through publications, seminars, demonstration projects etc. Examples include: Motiva²⁰ in Finland, ADEME²¹ in France and SEI²² in Ireland. However, a detailed review of their activities was beyond the scope of the TEBUC questionnaire.

In addition, ENPER Task B5 looks at, amongst other things, the impact of labelling schemes and subsidies on the market for energy efficient technologies. Although the focus of the report is predominately on new-build construction, where labels are linked to EP regulations this can have an impact on existing buildings as well. An example is the Dutch HR-label for condensing boilers. Because of the label’s high visibility, boilers with an HR-label are often installed during building renovation work even though there are no regulations requiring this. For further details see the Task B5 report. The wider issue of labelling and certification for buildings is discussed in Section 8.

6.8 CONCLUSIONS

Overall it appears that most countries apply EP regulations when buildings undergo renovation or a change of use. There are often requirements on a building’s envelope (usually in terms of

¹⁹ Further details are available at: <http://www.ofgem.gov.uk/ofgem/work/index.jsp?section=/areasofwork/energyefficiency>

²⁰ See: <http://www.motiva.fi/english/English>

²¹ See: <http://www.ademe.fr>

²² See: <http://www.irish-energy.ie/home/index.asp>

insulation as opposed to air tightness) as well as its services and fittings.

Requirements are that new build standards have to be met in these cases but that there are major differences between countries as to when and how these standards apply. For example, changes may be limited to those parts of the building undergoing renovation and this may be determined by the value of the work, the proportion of building subject to work or whether the work is deemed reasonable (and the character of historic buildings is not compromised) or even whether it is cost-effective. In a few cases the decision whether to apply regulations is at the discretion of the local authority, although it is not clear whether they have a framework in which to operate. This could lead to differences in approach between local authorities. In all cases though the intention is to ensure that the requirements for improved energy efficiency are not onerous and that they are proportionate.

It generally appears that requirements are expressed prescriptively (e.g. in terms of maximum U-values) rather than through a full EP calculation, although greater clarity is required on this issue.

Article 6 of the Directive acknowledges that practical limitations have to be considered when setting minimum energy performance requirements for renovated buildings. For example, if the energy performance for the renovated building as a whole is to be considered then the level of required performance is likely to be somewhat lower than that for an equivalent new building. The Directive does allow performance requirements to be framed in terms of systems or components as an alternative and this seems to accord with current practice in Europe.

Overall though, the impact on the energy performance of the existing building stock is unlikely to be significant given that the renovation rate is only a few % per year (see Section 5.2).

A number of countries have government funded agencies to promote energy efficiency and offer financial incentives to

encourage the uptake of energy efficient measures and technologies. The impacts of these initiatives have not been established in this project though, although indications from the UK's EEC scheme show that these could be considerable.

Significant impacts could perhaps be achieved through the use of boiler and air conditioning inspections (see Section 7) and building certification schemes (see Section 8).

6.9 RECOMMENDATIONS

Further work is required to understand exactly how EP Regulations are applied to existing buildings. Given the wide range of approaches there is a need to investigate the most effective way in which regulations can be applied to buildings undergoing renovation or change of use. In the first instance, and in keeping with the guidance in the Directive, the cost-effectiveness of applying various measures to different types of buildings should be determined.

Such an exercise should establish which are the most cost-effective measures and when they should be applied, i.e. when more than a specified proportion of the building envelope is renovated, the value of the work exceeds a specified proportion of the building's value etc. The exercise should also establish how requirements should be expressed, i.e. a simple prescriptive approach or a detailed EP calculation.

How to undertake such cost-effectiveness calculations should also be considered. For example, the lifetime of measures needs to be considered as does the rate at which future savings (and costs) should be discounted. When considering long lifetimes (e.g. those over 20 years) then lower discount rates are often used. Further, the global impacts of using energy should perhaps also be included in such cost-effectiveness calculations. This can be integrated into the calculations by using internationally agreed values for the social cost of carbon.

This approach is in keeping with the fact that EP Regulations – like all regulations – should not be onerous and should adhere

to the principles of good regulation, i.e. they should be proportionate, transparent and targeted.

This exercise could then be linked to a parallel exercise on determining renovation and replacement rates throughout Europe (Section 5.2) so that overall energy savings attributable to the application of EP Regulations to existing buildings can be calculated. This can be undertaken by extending work on the MURE database.

Finally, enforcement of EP Regulations by local authorities should also be considered. Such bodies may well require guidance and training to ensure that regulations are properly applied. This will help to ensure that calculated savings are realised. Poor enforcement and understanding can lead to very low levels of compliance as illustrated by the case of a new insulation requirement that was introduced in the Flanders region of Belgium. Follow-up monitoring revealed that there was no improvement in the thermal performance of the envelopes of new buildings. For further details of this see the report for ENPER Task B5.

Alternatives to EP Regulation are also widely used across Member States but it is not clear how effective (in terms of energy saved, measures taken up etc.) these approaches are. Further research is required to establish this and would probably involve a review of each country's own internal evaluations. Such a review would be helpful since the standards and technologies promoted through voluntary initiatives are often subsequently taken up in revisions to EP Regulations.

7. ARTICLES 8 & 9 OF EP DIRECTIVE

7.1 INTRODUCTION

Three questions in the initial TEBUC questionnaire (see Annex 1) asked the project partners specifically about their countries' provisions for the inspection of boilers (Article 8 of EP Directive) and air conditioning systems (Article 9), and are worth discussing here. (See Box 1 for further details.) These articles are designed to ensure that heating and cooling systems continue to work efficiently throughout their service life. They potentially can have significant impact on the energy performance of existing buildings.

7.2 BOILER INSPECTIONS

With respect to boiler inspections, just over half of surveyed countries had compulsory inspection of boilers in some form or other.

At their most comprehensive, inspection schemes applied to all building types and boilers and are carried out annually. This is the case in four countries: Austria, Belgium, Denmark and Germany, although the Belgium system currently only applies to oil burning heaters. There is no link to the boiler age. Inspections are invariably carried out by chimney sweeps.

The remaining countries (France, Greece, Italy and Spain) have limitations in terms of frequency of inspection (only every 2 or 3 years), type of buildings (not applied in single occupancy dwellings) and the size of boiler (e.g. >100kW).

It is not clear what these inspection visits actually consist of, although it presumably includes adjusting and servicing the boiler to ensure optimum performance. However, the scope for improving the performance/efficiency of gas boilers is limited – there is more scope for oil boilers which are prone to 'drift' over time.

Some of the other countries (e.g. Finland and Norway) do have regular chimney sweeping which is either mandatory or

recommended, but this is mostly related to ensuring health and safety (i.e. preventing chimney fires and ensuring the adequate dispersal of combustion products).

Article 8 of the Directive also refers to the need to have a one-off inspection of a whole heating installation where the boiler is older than 15 years and has an output rating >20kW. Such a review has to include an assessment of the boiler efficiency as well as advice on its replacement.

Only Denmark currently has a scheme that is equivalent to this and, indeed, in some respects it exceeds the Directive's requirements. The Danish regulation came into force in 1998 and it requires that boilers greater than 20 years old are replaced. It applies to all buildings and, again, chimney sweeps check compliance.

7.3 AIR CONDITIONING INSPECTIONS

With respect to regular inspection of air conditioning systems only two countries have such schemes: Spain and shortly Greece. This is probably due to the fact that southern European countries have a greater use of air conditioning systems so it is more important that they are properly maintained.

The two schemes invariably apply to multiple occupancy dwellings and non-domestic buildings. The Spanish scheme is now established and applies to installations >100kW. The frequency of inspection varies with the component, e.g. evaporators and condensers are cleaned every year, and refrigerant and oil levels are checked every month.

7.4 CONCLUSIONS

Responses to these questions indicate that most Member States will need to develop inspection procedures and perhaps legislation as well in order to implement these two articles of the EP Directive. A key issue to address is likely to be the need to recruit (and/or train)

suitably qualified inspectors, which is why Member States have been given an additional three years to implement Articles 8 and 9. Boiler inspection procedures appear fairly well developed in over half of the Member States so the impact will not be as great compared to air conditioning inspections where nearly all countries need to develop procedures.

The impact of Article 8 is not as pronounced as it might be simply because the current boiler output limit excludes appliances in many residential buildings. Countries with existing procedures for ensuring health and safety may well be able to extend these to include energy efficiency which could further lessen the impact.

Overall though it is not clear what energy savings have been realised through current inspection procedures in existing buildings. As mentioned in the introduction the scope for savings could be considerable.

Since responding to the ENPER and TEBUC questionnaires many countries have taken steps in order to implement these two Articles. Further information on the situation in Member States with regard to their current level of compliance with Articles 8 and 9 and, indeed, all articles of the EP Directive is given in the report for ENPER Task B3.

7.5 RECOMMENDATIONS

One key recommendation is that Member States are followed up to determine how they propose to implement these two Articles and to understand the problems that they have faced. This will be very important in terms of determining the impact of the Directive as well as learning from each other. In particular, it would be helpful to understand what inspection visits consist of - such visits perhaps include an informal review of the heating system as well and could lead to inefficient boilers being replaced sooner than they otherwise might (owners often wait until boilers break down before replacing them).

Impacts should include costs and burdens to industry who are required to undertake

the inspection procedures as well as governments who are required to implement the Articles either through changes to existing EP regulations or by introducing new legislation.

The other main recommendation is that the resulting energy savings should also be determined. This is particularly important in the case of Member States who, in the case of Article 8, chose to provide advice to users on the replacement of boilers and other modifications to the heating system rather than implementing an inspection procedure. The Directive requires that the 'advice' option should produce comparable energy savings to the 'inspection' option. Determining energy savings will also help in assessing the impact of any proposed changes to these Articles (e.g. in terms of frequency of inspection or appliance output rating).

8. BUILDING CERTIFICATION

8.1 INTRODUCTION

The final objective of ENPER Task B4 was to investigate the scope for building certification to improve the efficiency of the existing stock. Article 7 of the Directive requires that an energy performance certificate is made available every time a building is constructed, sold or rented out. (See Box 1 for further details.) ENPER Task B3 summarises how far Member States already comply with this article.

This section briefly discusses some of the building certification schemes already in existence in Europe and suggests what savings they might produce. It draws on information produced as part of TEBUC Task C4 and the experience gained in Denmark which appears to be the most advanced country with regard to building certification. For further details see the report for TEBUC Task C4.

8.2 CERTIFICATION SCHEMES IN EUROPE

8.2.1 OVERVIEW

Denmark, the Netherlands and the UK appear to have the most experience with regard to building certification schemes, and all three countries have mandatory schemes covering specific building types. The experience in each of these countries is summarised below.

8.2.2 UNITED KINGDOM

The UK mandatory certification scheme is known as SAP²³ and is for new dwellings and has been linked to building regulations since 1994. Some 180,000 new dwellings are labelled each year in this way. It is also used to rate existing dwellings but this is voluntary, although SAP has been very widely used in the social housing sector in this respect and, indeed, about two-thirds of such dwellings have been labelled.

²³ SAP (Standard Assessment Procedure). Further details can be found at: <http://projects.bre.co.uk/sap2001/>

Work is underway to develop SAP so that it can be used to generate an energy report (meeting the requirements of Article 7) which could form part of a Home Information Pack which it is proposed should be prepared every time a dwelling is sold.

There is also the BREEAM (BRE Environmental Assessment Method)²⁴. It is a voluntary scheme which considers the wider environmental performance of buildings (e.g. water consumption, transport links, use of 'green' materials etc.) as well as energy efficiency. The scheme was introduced in 1990, and since then some 400 major office buildings have been assessed. There are also schemes for industrial units, supermarkets and homes. The homes version of BREEAM is called EcoHomes.

8.2.3 THE NETHERLANDS

The Netherlands has its voluntary EPA (Energy Performance Assessment) scheme for existing dwellings which was introduced in 1999²⁵. The scheme consists of a rating model to calculate the dwelling's energy performance; another output of the model is a list of energy efficiency measures to improve the dwelling's performance. Subsidies are available for such measures which are greater when linked to the EPA scheme. To date over 50,000 EPAs have been undertaken by about 500 registered consultants. In the light of the Directive the EPA is being developed into a mandatory scheme but new legislation is required. Further, a voluntary EPA scheme for some types of tertiary sector buildings is under development.

²⁴ Further details are available at: <http://products.bre.co.uk/breeam/index.htm>

²⁵ Poel, B. "Energy Performance Assessment for existing dwellings". Presentation given at ENPER Workshop, Watford, UK, September 2002. Can be obtained on ENPER website at <http://www.enper.org>

The Netherlands also has its mandatory EPN certification scheme for new buildings, both in the residential and tertiary sector. The EPN – introduced in 1995 - is related to the Dutch building code and results in an Energy Performance Coefficient (EPC). The building code sets criteria for the EPC which is dependent on building type.

8.2.4 DENMARK

Since 1997 Denmark has had two mandatory certification schemes to promote energy and water savings in both new and existing buildings²⁶. One scheme – the EM scheme - is used for 'small' buildings (defined as having a floor area less than 1,500m²), and the other – the ELO scheme - for 'large' buildings (having a floor area greater than 1,500m²).

The EM scheme uses a standard energy model to rate the building's performance. The certification process makes recommendations for energy efficiency measures to improve the energy performance, and a register of the building and its installations is prepared. This information is presented as an energy plan and must be prepared each time the building is sold.

An evaluation of the scheme in 2000/01 showed that some 40,000 to 45,000 buildings are labelled each year amounting to over 200,000 small buildings since the scheme began. About 15% of all single family homes have been labelled. Each year more than €130m worth of investment is proposed in the energy plans and it is possible to reduce energy costs by more than €17k per year in small houses. Although the scheme appears to have been successful, real estate agents were not positive in the beginning and could not see the advantages of the label. Therefore agents, buildings owners and buyers required more information.

²⁶ Engelund Thomsen, K. "Energy audits in Denmark". Presentation given at ENPER Workshop, Watford, UK, September 2002. Can be obtained on ENPER website at <http://www.enper.org>

The ELO scheme uses data from energy meters to register consumption. Again buildings are rated and an energy plan prepared. This process should be undertaken annually with the objectives of raising awareness of energy consumption and highlighting ways in which performance can be improved.

The scheme was evaluated in 2000/2001 and the saving potential was calculated to be 3.6 PJ heating and 170 GWh electricity which is considerable. The coverage of the scheme though is only 50-60% despite being mandatory. Although it is well known by consultants it is less well known by building owners so publicity campaigns are required to boost awareness.

Although certification is well advanced in Denmark there is still a need to adapt the existing schemes to meet all of the requirements of the EP Directive.

8.2.5 SCHEMES IN OTHER MEMBER STATES

A number of other European countries have established schemes although these are all voluntary. For example, Austria has its *Energieausweis* (introduced in 1999), but less than 5% of buildings are labelled; and Norway has its *Ecoprofile* schemes for existing commercial buildings (1999), existing dwellings (2000) and new dwellings (2001), although only 60 commercial buildings and 30 existing dwellings are so far labelled.

Many countries (e.g. Belgium, France, Germany, Greece, Spain and Portugal) have schemes that have recently or are soon to be introduced. For example, France has a voluntary scheme for single family dwellings and a method for apartment buildings is under development; and the new EP regulations in Greece and Portugal will have certification schemes that will meet the requirements of Article 7.

A number of other countries (i.e. Finland, Ireland, Italy and Sweden) currently do not have any certification schemes, although in Sweden the energy consumption of a building should be made available to the seller when a building is sold.

8.3 CONCLUSIONS

Mandatory certification schemes in Europe are not widespread so Member States will need to undertake a lot of work to implement Article 7 of the Directive. Indeed, a number of countries have already taken steps in this direction. Although a number of voluntary schemes exist much effort will be required to pass the necessary legislation and put in place the systems (e.g. sufficient number of trained assessors) required to operate these schemes successfully. Even where schemes are mandatory there can be resistance, and coverage is not necessarily comprehensive as was seen in Denmark. This highlights the need to promote the schemes widely and to provide authorities with the necessary enforcement powers.

One of the main technical areas to address is the difficulty in modelling the energy performance of tertiary sector buildings such as offices, schools, shops etc.²⁷ A particular difficulty to address is calculating the cooling load. This is a key reason why certification schemes for these building types are not very common in Europe. Models will be required in order to audit, benchmark and certificate such buildings in accordance with the requirements of the EP Directive. Although a number of such models exist they will have to meet a number of requirements, e.g. they should be in the public domain, assumptions underlying their derivation should be clear and calculations should be repeatable. Many Member States are already co-operating in attempt to learn from each other.

In respect of benchmarking and certification, the SAVE funded Europrosper²⁸ project is concerned with benchmarking the energy use of existing office buildings as a tool for saving energy. Key outputs of the project will be quality assured good practice procedures and a

training package that will enable the know-how embodied in the procedures to be disseminated to Member States. These should support their efforts to implement the EP Directive.

Despite difficulties in implementing certification schemes the scope for energy savings is likely to be considerable. For example, as part of the SAVE funded BELAS²⁹ project (“Energy Labelling of Existing Buildings”) the energy savings arising from the introduction of a housing scheme in Finland were estimated. Each year approximately 10,000 new houses are built and 15,000 existing houses are sold. Assuming that the implementation of energy conservation measures identified in the energy certificate would result in 10-20% energy savings in existing houses, and that the labelling procedure would increase energy efficiency of new house designs by another 10-20%, the estimated impacts of annual certification would be of order 0.18-0.25 PJ. By 2010 the cumulative saving would be approximately 1.8 PJ per year.

8.4 RECOMMENDATIONS

In a similar vein to the recommendations in Section 7.5 the impacts of implementing certification in each Member State should be determined. In addition, the total energy savings arising from certification should be assessed.

²⁷ A seminar to discuss these issues was held in the UK in June 2003. For details see: <http://projects.bre.co.uk/EPBD/>

²⁸ Further details are available at: <http://www.europrosper.org/>

²⁹ Further details are available at: <http://belas.jrc.it/>

ANNEX 1 - REVIEW OF REGULATORY MEASURES APPLYING TO EXISTING BUILDINGS (TEBUC REPORT FOR TASK C2)

INTRODUCTION

As noted in the main body of the report a preliminary questionnaire was circulated as part of Task C2 of the TEBUC project that covered many of the issues addressed by Articles 7, 8 and 9 of the Directive. These are summarised below:

- Limit(s) on indoor temperature (heating/cooling)
- Measures making it compulsory to implement thermostatic zone control
- Measure requiring individual billing
- compulsory measures related to a periodic inspection of boilers
- compulsory measures related to a periodic inspection of HVAC
- compulsory measures related to control systems for heating
- compulsory measures for hot water in existing building
- compulsory retrofit/replacement of existing boilers depending on their age
- compulsory measure(s) related to efficient lighting
- mandatory energy audit
- mandatory energy labelling in buildings

For each of these measures, a questionnaire was developed in order to collect information on:

- Whether the measure exists in the country on a mandatory basis for existing buildings
- Which types of (existing) buildings are concerned
- What is or are the precise requirements
- What kind of conditions for application or exemption
- How the compliance is checked
- When the regulation has been (or will be) implemented
- Which is (are) the main reason(s) that impede a mandatory application
- Whether there any non-regulatory measures on the same topic and of which kind

SITUATION IN THE EU: OVERVIEW

For detailed discussion see below.

Country :	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
Indoor temperature limit(s)	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes	Yes	yes
Thermostatic zone control	No	No	Yes	No	Yes	No	Yes	Yes	No	No	No	No	No	No
Individual billing	Yes	No	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No
Periodic inspection of Boilers	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	No	No
Periodic inspection of HVAC	No	No	No	No	No	No	Yes	No	No	No	No	Yes	No	No
Control systems for heating	No	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No	Yes	No	No
Domestic Hot Water	No	No	Yes	No	No	No	Yes	Yes	No	No	No	No	No	No
Boilers replacement	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No
Efficient lighting	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes
Energy Audit	No	No	No	Yes	No	No	Yes	No	No	No	Yes	No	No	No
Energy labelling in buildings	No	No	No	Yes	No	Yes	Yes	No	No	No	No	No	No	No

To date most of these measures are not applicable in the most of the countries. Greece plans to impose many of the measures but not until end of 2002 or 2003.

LIMIT(S) ON INDOOR TEMPERATURE (HEATING/COOLING)

SUMMARY

Country :	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
Indoor temperature limit(s)	No	No	No	No	Yes	Yes	No	No	No	No	Yes ^b	Yes	Yes	Yes
Temperature limits for heating					21°C ^a	19°C					20	20-23°C	18/20°C	19°C ^b
....for cooling					27°C	none					25	23-25°C	none	none

(a) with some exceptions

(b) non-domestic only

(c) Only for building with HVAC system and if heating or cooling power greater than 25 kW or if their sum greater than 40 kW, however there is no dependency of building age or HVAC system

These temperatures are both calculation values for designing system power AND value of (average) ambient temperature in normal running conditions not to be exceeded.

Countries which have this type of measure have no compliance checking system. In Portugal there is an initial checking to obtain the licence in order to initiate the activities inside the building. The indoor temperature may differ depending on the type of building (health sector...).

Many reasons impeding a mandatory application are presented, but it seems that the principal drawback is the difficulty to check compliance.

DETAILED INFORMATION ON EXISTING RULES

country	building types concerned			
	Single family homes	Multi family dwellings	Non residential buildings	Other (e.g. public buildings...)
FI	X	X	X	
FR	X	X	X	
PO		X	X	X
SP	X	X	X	X
SW	X	X	X	
UK			X	X

Is there a dependency on building age or HVAC system ?

country	
FI	No
FR	none
PO	Only for building with HVAC system and if heating or cooling power greater than 25 kW or if their sum greater than 40 kW, however there is no dependency of building age or HVAC system typer
SP	
SW	none
UK	

Does the limit depends on the use of the building ?

country	
FI	We have separate temperature limits for all uses of buildings. The limits and tolerances are tabulated in our indoor climate regulations. The regulations are changing in year 2003, and 21 °C will simply be the temperature limit for the "living space" with some exceptions
FR	different limits exist in specific building categories such as hospitals, kindergarden...
PO	No (see above limitations)
SP	These temperature limits must be used for the HVAC system sizing and design, but the designer can use other temperatures for spaces with different temperature needs.
SW	18C for habitable rooms and workrooms, 20C for sanitary accommodations and institutional premises

UK	Applies to offices and similar
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Is information on temperature displayed to occupants or customers ?

country	
FI	No
FR	No
SP	yes
SW	no
UK	

When has the regulation been or when will it be implemented

country	
FI	1987
FR	1974
PO	1998
SP	1998 (RITE) ³⁰
SW	1998 (originally from 1993)
UK	About 1985

main reason(s) that impede a mandatory application ?

country	
AT	The maximum temperature depends on the thermal quality of the house and from many circumstances so that it is not easy to specify the temperature. Also monitoring the temperature is difficult. In general, nobody will be willing restrict the individual use
BE	There is a summer conditions criterion for new buildings, but there is no absolute temperature limit. However a penalty in the calculation is given when cooling load gets higher. NOTE: on longer term efforts will be made to make this regulation applicable on existing buildings too.
DE	?
DK	Impossible to apply in practice
GR	The energy efficiency of the buildings is based on the annual energy consumption. This is the main parameter that determines the EP of the building.
IR	The focus has been on insulation
NL	deregulation + cost-benefit reasons + Building Code doesn't want to interfere with comfort questions (in case of a max. temperature in the cooling season)
NO	A guidance to the building code recommends indoor air temperatures. The recommendations refer to ISO 7730 Thermal comfort. Mandatory requirements for thermal comfort is difficult to enforce in practice
PO	In the Portuguese Building Regulation, there are no limitation on inside temperature in buildings itself, nevertheless there are imposed temperatures for the heating and cooling loads calculation

MEASURES MAKING IT COMPULSORY TO IMPLEMENT THERMOSTATIC ZONE CONTROL

SUMMARY

Country	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
Thermostatic zone control	No	No	Yes	No	Yes*	No	Yes	Yes	No	No	No	No	No	No
When has the regulation been or when will it be implemented			2001		1987		2002 or 2003	1992						

³⁰ The Spanish regulation is divided in two documents (both of them are mandatory): * NBE-CT-79: which is the present energy performance regulation related to the building envelope and restrict the U-values of the components and a global U-value for the whole building, So it is only a regulation for thermal insulation on buildings. This will be changed in the near future. RITE: which is the present energy performance regulation related to the thermal installations in buildings.

* Only in practice. The mandatory thermostatic zone control is not mentioned in our regulations, but the tolerance of ± 1 °C enforce the designers to use thermostatic control.

Although the measure is not widely implemented as mandatory in all existing buildings, it is either:

- compulsory when the building is renovated like in Denmark

in DK: The answer NO is valid for existing buildings which are not retrofitted. If an existing building is retrofitted the same regulations are valid as for new buildings (then it would have been a yes). The global philosophy in Denmark for existing buildings is that we haven't got any regulations at all (except labelling see later on). Anyhow it is normal in Denmark in existing buildings to have thermostatic zone control and valves, individual billings and inspection of the heating systems etc.

- Or strongly recommended and supported by incentives like in Austria, Denmark, Norway or UK

In UK: There are many initiatives that encourage householders and building owners and occupiers to install adequate controls for heating systems amongst other things. These are run as part of the UK government's Energy Efficiency Best Practice Programme (EEBPP) - now called Action Energy - which generally applies to all buildings except existing housing. This sector is mainly targeted by the Energy Saving Trust (which is funded by government). In addition, there are government grants available for householders, particularly those who are 'old and cold' through the Home Energy Efficiency Scheme (HEES) and related schemes. Energy suppliers are also under an obligation to improve the energy efficiency of their customers.

DETAILED INFORMATION ON EXISTING RULES

Building type(s) on which the regulation apply

Country	thermostatic valves			other thermostatic zone control		
	Single family homes	Multi family dwellings	Non residential buildings	Single family homes	Multi family dwellings	Non residential buildings
DE	X	X	X			
FI	X	X	X		X	X
GR					X	X
IR	X	X	X	X	X	X

Dependency on building age

Country	
DE	owners of buildings which do not have these valves but are equipped with a central heating device have to install thermostatic valves independent of age
FI	The thermostatic valves are more accurate in new buildings. The temperature is more rarely possible to be controlled by the user in the old buildings.
GR	No, at the present state of the regulation
IR	No

Exemptions

Country	
DE	
FI	
GR	For residential buildings it is not mandatory to install a thermostatic zone control
IR	Buildings requiring only a low level of heating, and buildings used exclusively as holiday homes.

How is the compliance checked

Country	
DE	chimney sweepers
FI	the control checks are done during and after the construction phase
GR	During the energy audits the inspector checks the installation of the thermostatic valves or any other control system, which is related to the thermostatic zone control
IR	Building control officers in local authorities

When is the regulation be applied ?

Country	
DE	retrofit, if a central heating device is installed - else it will apply after new legislation comes into force
FI	With new buildings, the major renovations and extensions
GR	In new buildings, during large retrofitting actions and in case of extensions to existing buildings
IR	Material alterations to buildings

Main reasons that impede a mandatory application ?

Country	
AT	This point should be part of the next regulation in most of the federal states
BE	For new buildings (schools, office buildings and dwellings), the use of refined controls and regulations will cause benefit in the calculation.
DK	The answer NO is valid for existing buildings which are not retrofitted. If an existing building is retrofitted the same regulations are valid as for new buildings (then it would have been a yes).
FR	no particular explanation
NL	
NO	Thermostatic zone control is not mentioned in the code. No particular explanation is given for this.
SP	The thermostatic zone control is mandatory for new buildings and installation (residential central heating systems and non-residential installations > 100 kW) , but not for existing ones. I don't know the reason
SW	
UK	Limitation of 1984 Building Act (underpinning legal framework for UK Building Regulations), although this is currently being assessed

OTHER MARKET STIMULI

	Voluntary schemes		Public support (incentives)		other comments
	Thermostatic valves	Other thermostatic zone control	Thermostatic valves	Other thermostatic zone control	
AT			financial support (15%)	financial support (15%)	
BE			financial support (40%)		
DK	Yes	Yes			
FR					
NL	The use of thermostatic valves is positively rated in the voluntary energy audit for existing dwellings (= advise on measures combined with subsidies)				
NO				Subsidising of temperature control systems by some local energy efficiency programmes	
SP					
SW					
UK	There are many initiatives that encourage householders and building owners and occupiers to install adequate controls for heating systems amongst other things. These are run as part of the UK government's Energy Efficiency Best Practice Programme (EEBPP)				

MEASURE REQUIRING INDIVIDUAL BILLING

SUMMARY

country	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
Individual billing	Yes	No	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No
When has the regulation been or when will it be implemented	1998		1989	1997		1979								

This measure is naturally more frequently observed in countries having a large proportion of collective dwellings equipped with central heating. France has the most ancient regulation in this field.

In FR: all collective dwellings with central heating system must be equipped:

- From initial construction for those having a building permit dated later than February 1980,
- all those constructed prior to this date must have been equipped before December 1985 unless: either 1) it is impossible from a technical point of view or 2) it is economically unacceptable (cost > 10 years of energy consumption for heating)

Although it contributed to important savings, some poor consequences have been observed:

- The savings do not remain stable in the long term because of slackening behaviour
- Designers tend to abandon collective heating for individual heating

DETAILED INFORMATION ON EXISTING RULES

Dependency on building age or other limitation ?

country	
AT	Only for buildings with more than three flats. Only for buildings after implementation of the regulation
DE	No
DK	No
FR	All collective dwellings with central heating system must be equipped. From construction for those having a building permit later than February 1980, all those constructed prior to this date must have been equipped before December 1985 unless: either 1) it is impossible from a technical point of view or 2) it is economically unacceptable (cost >10 years of energy consumption for heating)

Other factors that can be taken into account

country	
AT	The individual billing is normally a mixture of individual consumption and floor area. 70 % individual consumption, 30% floor area
DE	for floor area that is used by all tenants, the energy costs are calculated per head, dwelling floor area or volume
DK	The placement of the different apartments (in the middle, house end etc).
FR	floor area is the default factor to share energy costs

How is the compliance checked ?

country	
AT	By the occupants
DE	
DK	
FR	any occupant can sue the property manager

Main reasons that impede a mandatory application ?

country	
BE	There is no direct reason, it is not a part of our legislation (nor in the past, nor in the near future)
FI	
GR	
IR	
NL	
NO	
PO	The central heating systems for collective use are not very comon in Portugal
SP	?
SW	
UK	Has not been considered up to now

OTHER MARKET STIMULI

country	Voluntary schemes	Public support (incentives...)
BE		
FI		
GR	It is possible to have individual billing of actual energy consumption	
IR		
NL	national sustainable building guidelines	subsidy in case of ind. billing (multi family houses)
NO		
PO	Yes	
SP		
SW		
UK		

COMPULSORY MEASURES RELATED TO A PERIODIC INSPECTION OF BOILERS

SUMMARY

country	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
Periodic inspection of Boilers	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	No	No
When has the regulation been or when will it be implemented	2000	1978	1994	1980		1977	2002					1998		

This seemingly rather frequently implemented measure encompasses in practice two different situations:

- Countries (Austria, Belgium and Denmark) where all types of buildings and boiler sizes are considered on a yearly basis
- Countries like France and Spain where only large equipment (>100 kW) is concerned by a visit (periodicity is variable: yearly or twice a year in Spain depending on the fuel used, every 3 years in France)

DETAILED INFORMATION ON EXISTING RULES

building types concerned

country	Single family homes	Multi family dwellings	Non residential buildings
AT	X	X	X
BE	X	X	X
DE	X	X	X
DK	X	X	X
FR		(X)	X
GR	X	X	X
SP	(X)	X	X

frequency of application

country	
AT	Yearly
BE	Yearly
DE	Yearly
DK	Yearly
FR	every 3 years for boilers of rated output > of 1000 thermies (300 kW)
GR	Not yet determined
SP	Boilers > 100 kW (Gas: every year, Fuel oil: 2 times every year)

link with regulation for new buildings

country	
AT	None
BE	None
DE	for new boilers the same threshold values apply as in the regulation
DK	
FR	none
GR	Same procedure. An energy inspection takes place 1 year after construction
SP	

How is the compliance checked ?

country	
AT	Chimney sweep
BE	the installer checks the boiler on a yearly basis and certifies the good working of the boiler
DE	Chimney sweepers
DK	Chimney sweeper measures the parameters of the loss of flue gas
FR	The Regional Direction of Industry and Environment must collect the report on all the plants that are declared and listed for security reasons
GR	During the energy inspection/audit various parameters are measured such as temperature of the exhaust gases, CO, CO ₂ , O ₂ concentration, etc. in order to estimate the efficiency and the status of the boiler
SP	

Dependency on the building and/or boiler age

country	
AT	none
BE	none
DE	no dependency on building age or boiler age. But limitation of flue gas losses
DK	none
FR	none
GR	During the energy inspection/audit of the building, the age of the boiler is recorded. But at the present state of the EP regulation any link between the building and/or the boiler age is not included. On the other hand the total energy consumption of the building should be less than certain limits
SP	

Dependency on the size of the boiler

country	
AT	none
BE	none
DE	boilers with an output between 4 and 400 kilowatts have to be CE marked when they are to be installed in buildings
DK	There are a dependency, we distinguish for oil-burners between large and small and the limit for small burners is 120 kW or about 10 kg of oil per hour of total input effect
FR	rated output > of 1000 thermies (electricity 300 kW)
GR	As previous, the size of the boiler is recorded during the energy inspection of the building
SP	Mandatory inspection only for installations > 100 kW

Dependency on the fuel used

country	
AT	none
BE	For all boilers using liquid or solid fuel ³¹
DE	applicable for gas or liquid fuel fired boilers
DK	For single family houses there are no compulsory measures if using gas
FR	none
GR	No, but the fuel consumption is recorded during the energy inspection, according to the fuel type (e.g. electricity, diesel, solid fuels, etc)
SP	

³¹ a new regulation (only for Flanders) is under development for gas boilers

Do you have a regulation on chimneys?

country	
FI	The chimneys must be swept and checked every year.
IR	
NL	no, but from an environmental point of view, inspection of gas installations (>130kW) every two years is mandatory
NO	Regularly chimney sweeping (in order to reduce the number of chimney fires)
SW	
UK	No, excepting that they (a) disperse the products of combustion safely and (b) do not catch fire, which are requirements of the Building Regulations (although not the energy efficiency document). If a chimney is brought back into use it needs to meet (a) and (b)
AT	
BE	
DE	
DK	Yearly chimney sweeping
FR	Yearly chimney sweeping (in order to reduce the number of chimney fires) for fire places
GR	
SP	

OTHER MARKET STIMULI

country	Voluntary schemes	Public support (incentives...)
FI	The inspections are of course always recommended.	The improvements are supported in certain cases.
IR		Promotion by Irish Energy Centre
NL		
NO	Fuel oil suppliers offer boiler inspection schemes	
PO	there are not an extensive use of these equipment for heating, therefore the inspection are made on a voluntary basis by the owners	
SW		
UK	Yes	Only from the point of view of ensuring that they are operating properly safely (i.e. not producing excessive amounts of carbon monoxide). EST and EEBPp encourage householders, building owners etc. to install efficient heating systems

COMPULSORY MEASURES RELATED TO A PERIODIC INSPECTION OF HVAC

SUMMARY

The measure exists only in Spain for the time being (and is planned soon for Greece) which may be due to the fact that, in those southern countries, there is much more need for air conditioning and thus more concern related to HVAC plants good running and maintenance.

DETAILED INFORMATION ON EXISTING RULES

building types concerned

country	Single family homes	Multi family dwellings	Non residential buildings
GR		X	X
SP	(X)	X	X

Conditions of application

country	frequency of application	dependency on the building and/or HVAC system size
GR	Not yet determined	Same as in boiler inspection case
SP	Every concept has a different period, for example: Evaporators and condenser cleaning (every year), Refrigerant and oil level checking (every month), etc...	Mandatory inspection only for installations > 100 kW

OTHER MARKET STIMULI

country	Voluntary schemes	Public support (incentives...)
AT		
BE	under development	
DE		
DK	Denmark has an energy management scheme for houses bigger than 1500 m ²	
FI	The maintenance of the buildings is well done in most cases (because of our cold climate).	
FR		
IR		
NL		
NO		
SW		
UK		

COMPULSORY MEASURES RELATED TO CONTROL SYSTEMS FOR HEATING

SUMMARY

country	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
Control systems fo heating	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No	Yes	No	No
When has the regulation been or when will it be implemented			2001			1978	2002	1992				1998		

In practice, all the countries that have mandatory indoor temperature limits for heating (Finland, Sweden or UK) make it somehow obligatory to have some control system for heating, at least in large buildings of the collective residential or non residential type.

When evaluating the potential gains for this type of measure, one should not add it to the savings provided by mandatory temperature limits. The latter defines an objective, control systems (including the different thermostatic zone controls) are only means to reach it.

DETAILED INFORMATION ON EXISTING RULES

building types concerned

Country	Single family homes	Multi family dwellings	Non residential buildings
DE	X	X	X
FR		X	X
GR			X
IR	X	X	X
NO	X	X	X
SP	X	X	X

type of requirement

Country	Linked with outdoor T°	Night T° decrease	Other
DE	X		time-dependent or other suitable reference variable
FR	X		
GR		X	Thermostatic control of each zone
IR	X		Independent control of space heating and hot water, time control, optimum start control
NO			There is a general requirement that the heating systems shall have regulation equipment to ensure that the indoor temperatures are not too high. No specific temperature is specified.
SP	X		

When is the measure compulsory

Country	
DE	replacement of heating, retrofit but it is also compulsory to upgrade existing heating device in existing buildings
FR	for all buildings with a heating system of a rated power > 250 kW
GR	Not yet determined
IR	Material alterations to buildings
NO	For all buildings
SP	In the installation setting up

How is the compliance checked

Country	
DE	
FR	not checked
GR	During the energy inspection/audit the installation and the operation of the control system is checked
IR	Building control officers in local authorities
NO	According to the general control system in the Norwegian regulations
SP	

main reasons that impede a mandatory application

Country	
AT	This point should be part of the next regulation in most of the federal states
BE	Energy regulations in Belgium (and thus in Flanders) focussed on transmission losses until now. Therefore none of these energy related issues are obligatory nor voluntary.
DK	
FI	Our approach is quite different. We have very strict regulations for indoor climate, but you can choose the methods to achieve them. So, we don't have special regulations for heating systems. We don't have any commissioning methods for existing buildings, but we are developing them during the next years.
NL	
PO	the non generalised used of heating systems
SW	
UK	Has not been considered

OTHER MARKET STIMULI

Country	Voluntary scheme	Public support (incentives...)
AT		financial support (15%)
BE		new fiscal incentives for boiler replacement(15%), installation of thermostatic valves and use of room thermostat (40%) into force from 2003
DK	Denmark has a energy management scheme for houses bigger than 1500 m ²	
FI	The indoor temperature and the heating systems are usually well controlled in Finland. Our building stock is also quite new. .	
NL		
SW		
UK		

COMPULSORY MEASURES FOR HOT WATER IN EXISTING BUILDING

SUMMARY

country	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
Domestic Hot Water	No	No	Yes	No	Yes	No	Yes	Yes	No	No	No	No	No	No

Correct sizing, water temperature limit and cylinder + pipe work insulation are the measures related to domestic hot water considered for mandatory application in a few EU countries.

When voluntary and/or support schemes (AT, DK, FR) exist, they seem to favour solar thermal solutions.

DETAILED INFORMATION ON EXISTING RULES

building types concerned

Country	Single family homes	Multi family dwellings	Non residential buildings
DE ³²	X	X	X
FI	X	X	X
GR			X
IR	X	X	X

type of requirement

Country	Solar thermal use :	pipework insulation :	Water temperature limit: maximum limit: °C	Other
DE		X	60°C	
FI			X	
GR	X	X	According to the ASHRAE handbook 1997, HVAC systems & applications volume, for installations >40000 kcal/h	
IR				Cylinder insulation, and connecting pipework

When is the measure compulsory

Country	
DE	replacement or retrofit
FI	
GR	Not yet determined
IR	Material alterations to buildings

How the compliance is checked

Country	
DE	
FI	We don't have any systematic commissioning for hot water systems
GR	During the energy inspection/audit the systems related to the hot water are checked
IR	Building control officers in local authorities

³² with the new regulation (ENEV) in force, the old regulation does not apply any more. The temperature limit of hot water is not in the new regulation although it was in the old one concerning heating devices of 1998. Pipework insulation is still mandatory, hot water temperature limits were mandatory.

OTHER MARKET STIMULI

Country	Voluntary schemes	Public support (incentives...)
AT		financial support e.g. solar thermal use (15%)
BE		
DK	Denmark has a energy management scheme for houses bigger than 1500 m ²	If using solar heating
FR		incentives for solar systems
NL	free energy audit for dwellings: result is an advise on measures combined with subsidies. Also measures advised on hot water systems	subsidy for purchase of solar hot water systems and high performance combi boilers for space heating and hot water
NO		
SP		
SW		
UK		

COMPULSORY RETROFIT/REPLACEMENT OF EXISTING BOILERS DEPENDING ON THEIR AGE

SUMMARY

country	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
compulsory measure on existing boilers depending on their age	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No

Whereas most people agree on the fact that old boilers (more than 15 years) should be replaced to limit greenhouse gas emissions and that it is a cost effective measure in almost all cases, no country has decided to make it compulsory. It is widely supported on a voluntary basis and when buildings encounter major renovation, they should have their heating system upgraded to the level required by current regulation for new construction.

The main reason that impedes mandatory application is that it would be very unpopular. In general, current legislation does not permit imposing costs on people as implied here, i.e. to oblige people to undertake measures that they had not intended to.

DETAILED INFORMATION ON EXISTING RULES

country	DE
building types concerned	
Single family homes	X
Multi family dwellings	X
Non residential buildings	X
boiler retrofit	X
boiler replacement	X
only boilers inspection	
how is the compliance checked	chimney sweepers
dependency on boiler age, age limit	20 years
When has the regulation been or when will it be implemented	1998

OTHER MARKET STIMULI

country	Voluntary schemes	Public support (incentives...)
AT		financial support (15%)
BE		fiscal incentives for boiler replacement (15%) came into force from 2003
DK	Denmark has a energy management scheme for houses bigger than 1500 m ²	If using condensing gas boilers
FI	Boilers are in quite good shape in Finland because our cold climate. The maintenance is also usually well done. Only very old buildings may have old and inefficient boilers.	
FR		
GR	Yes, in case where the building owner wants to increase the energy efficiency of the building	
IR		
NL	free energy audit for dwellings: result is an advise on measures combined with subsidies. Also measures advised on new boilers	subsidies for the purchase of a high performance boiler
NO		
SP		
SW		
UK	Yes	As mentioned above, there has always been encouragement for householders, building owners etc. to upgrade their heating systems. Grants are also available for the socially disadvantaged.

COMPULSORY MEASURE(S) RELATED TO EFFICIENT LIGHTING

SUMMARY

country	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
Efficient lighting	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes
When has the regulation been or when will it be implemented							2002							2002

Some national regulations for new construction impose minimum efficiency for the lighting service or for its components (sources, fixtures, controls). From a technical point of view, most of these requirements are easily applicable to existing buildings.

Yet, this type of measure seems to have been envisaged only recently. In practice two countries so far have considered its application and this is starting only in 2002.

Conditions of application are still limited (within an audit in Greece, when renovating the lighting system for a floor area of more than 100 m² for the UK. Little can be said on the practical ways for checking compliance. In both countries, the stress will be put on lighting control systems .

DETAILED INFORMATION ON EXISTING RULES

building types concerned

country	Single family homes	Multi family dwellings	Non residential buildings
GR			X
UK			X

dependency on lighting system efficiency

country	
GR	The energy consumption for lighting is included for the labeling of the building.
UK	Applies when replacing a complete lighting system serving more than 100 m ² of floor area. In which case you have to provide a new lighting system as if for a new building.

OTHER MARKET STIMULI

country	Voluntary schemes	Public support (incentives...)
UK	Yes	Again, EEBPp and EST encourage this. Electricity suppliers also pursue this as part of their Energy Efficiency Commitment obligations.
AT		
BE		
DE		
DK	Denmark has an energy management scheme for houses bigger than 1500 m ²	
FI	Motiva is our voluntary organisation that have had many campaigns also for energy efficient lighting and savings on it.	It is possible to get information e.g. from Motiva or our communal power stations for efficiency of lighting .
FR	Green Light and other decision making schemes	support by ADEME+ EDF on demonstration projects
IR		
NL		subsidy on the purchase of presence detection and/or high frequency lighting for non residential buildings
NO		
PO	yes	in the new incentive program to energy efficiency in buildings
SP		
SW		

MANDATORY ENERGY AUDIT

SUMMARY

country	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
compulsory measure on energy audit	No	No	No	Yes	No	No	Yes	No	No	No	Yes	No	No	No
When has the regulation been or when will it be implemented				1997			2002 or 2003				80s			

This measure is applicable in Denmark since 1997 and is foreseen to become mandatory in Greece this year. Many countries have voluntary schemes, sometimes supported by state or utilities incentives.

When an energy audit is conducted, all energy end uses and all energy types are considered.

In Portugal, although existing for a long time, the scheme is not very much used unless mandatory for incentives, but the aim of the audit is clearly to foster work because the building owner needs to present a set of measures for reduction the energy consumption in the building

DETAILED INFORMATION ON EXISTING RULES

building types concerned

country	Single family homes	Multi family dwellings	Non residential buildings
DK	X	X	X
GR	X	X	X
PO			X

Conditions of application or exemptions

country	dependency on building age	dependency on building size
DK		
GR	The energy audit will be mandatory for new buildings,. For existing buildings an energy audit is possible in order to improve their energy and environmental performance.	Residential buildings where the volume is lless than 250m ³ and the floor area less than 80m ² , are exempt
PO		indirectly, for buildings with an energy consumption greater more than 1000tep

frequency of the measure

country	
DK	Energy labelling of commercial and residential buildings. The seller of a small building (less than 1500 m ²) is responsible to ensure that the energy rating and energy plan is not older than 3 years. For larger buildings (1500 m ² or more) it is obliged to have an energy rating and an energy plan drawn up for the building once a year. The energy rating includes efficiency of boilers, hot water production and electricity consumption
GR	Not yet determined
PO	Every 5 year

parameters analysed during the audit

country	Building shell	Heating system	HVAC systems	Hot water production	Appliances
DK	X	X	(X)	X	X
GR	X	X	X	X	X
PO	X	X	X	X	

OTHER MARKET STIMULI

country	Voluntary schemes	Public support (incentives...)
AT		
BE	A method is under development for dwellings (same method as those use for energy labeling)	The electricity producers and distributors (Electrabel) reserve a yearly amount for energy audits for our communities Fiscal incentive (40%) is foreseen for the realization of energy audits in dwellings
DE		
FI	We have developed regulations for evaluation of the maintenance and renovation need for the buildings. It might be possible to make the EP-audit as a part of it depending of course the skill of the evaluator. We are just starting a project concerning commissioning for the EP of the buildings in TUT.	Only in relation to the renovation.
FR	general auditing scheme supported by ADEME	50% to 70% support depending on study specifications
IR		
NL	a free energy audit can be requested for dwellings by the building owner. Result: an advise on energy saving measures combined with certain subsidies	subsidies given when certain energy measures are implemented
NO	Energy audit schemes are available	It is possible to get funding for carrying out energy audits in buildings from some national and local energy efficiency programmes
SP		
SW		
UK		

MANDATORY ENERGY LABELLING IN BUILDINGS

SUMMARY

country	AT	BE	DE	DK	FI	FR	GR	IR	NL	NO	PO	SP	SW	UK
compulsory measures related to energy labelling in buildings	No	No	No	Yes	No	Yes	Yes	No	No	No	No	No	No	No
When has the regulation been or when will it be implemented				1997		2002	2002 or 2003							

Similarly to energy audits (to which it may often be related) energy labelling is compulsory in Denmark since 1997 and should be applicable from 2002 in Greece and in France.

It is under development in many other countries (BE, FI, PO) and available on a voluntary basis in IR, AT, and UK. It is also incorporated in ECOPROFILE, the voluntary environmental labelling for buildings in Norway.

DETAILED INFORMATION ON EXISTING RULES

building types concerned

country	Single family homes	Multi family dwellings	Non residential buildings	dependency on building age	dependency on building size
DK	X	X	X	No	No
FR	X	X	X	none	(?)
GR	X	X	X	None	

frequency of application

country	
DK	Energy labelling of commercial and residential buildings. The seller of a small building (less than 1500 m ²) is responsible to ensure that the energy rating and energy plan is not older than 3 years. For larger buildings (1500 m ² or more) it is obliged to have an energy rating and an energy plan drawn up for the building once a year. The energy rating includes efficiency of boilers, hot water production and electricity consumption
FR	at sale or rent
GR	Not yet determined

How is the information displayed

country	
DK	Energy rating means that the property is examined by an approved energy consultant who draws up two documents: an Energy rating and an Energy plan. The building is awarded A, B or C, where A is the highest mark. For heating A, B and C is divided into 5 subgroups from 1 to 5. The consultants notes the estimated annual consumption for heating and the costs. Similarly rating contains consumption of electricity, water and CO ₂ .
FR	not decided yet, might be like energy scale for electrical appliances
GR	Three indices are presented. Two for the energy consumption for heating and cooling (5 categories, at the present state of the regulation, according to the consumption. The last 2 categories determine the limit where the energy consumption out of the acceptable range). Also, an environmental index is calculated according to the environmental performance of the building (CO ₂ emission, water consumption, indoor comfort, etc.). This index has also 5 categories.

OTHER MARKET STIMULI

country	Voluntary schemes	Public support (incentives...)
AT	yes	
BE	A method is under development for dwellings (same method as used for energy audit)	
DE	an energy label can be done voluntarily by building owners based on the regulation for new buildings (2001 ENEV) including building shell, heating system, HVAC system and hot water. A data sheet is available	
FI	under development	
IR	Energy rating of dwellings carried out by Energy Action Ltd.	
NL		
NO	Energy is an important parameter in the Norwegian environmental labelling scheme for buildings (Ecoprofile)	
SP		
SW		
UK	Yes	There are labelling schemes for dwellings in the UK. See BELAS project.

EXPECTED SAVINGS

Few countries have been able to provide detailed data connected to actually monitored results of on going regulations. The most significant figures are indicated in the following table.

Measures	Energy saving as % of total consumption					
	AT	DK	FI	FR	GR	UK
1. Temperature limits	5-10% of heating	-	5%	5 to 10% of heating	~7%	
2. Thermostatic valves	5-10% of heating	-	2%			17% of heating*
3. Individual billing	5-20% of heating	-	1%	from 0 to 17%		
4. Boilers inspection	5-10% of heating	-	2%	8% (average)	~1-2%	
5. HVAC inspection	3-10% of heating	-	3%		~1-2%	
6. Heating control	5-10% of heating	-	1%	5-10%		17% of heating**
7. Hot water	50-70% of hot water (solar collector)	-	1%	35-60 % (solar collectors)		
8. Boilers retrofit/replacement	10-30% of heating	-	2%		~3-5%	20% to 32% (if condensing)*
9 Energy efficient lighting	10-50% of lighting	-	1%		~3%	26% of lighting*
10. Energy audit	?	-	2%	0 (indirect 10-25%)		
11. Energy label	?	Expected: 2-3% of total heating and electricity consumption	2%	?		

* figures only for dwellings

** with all control systems implemented

NOTE: UK also provided figures in CO₂ emissions reductions; they are not indicated here for consistency reasons with the other information.

SAVING POTENTIALS

Based on energy data in the residential sector (as compiled in the annex), it is possible to draw a very rough evaluation of the potential for energy savings.

The calculation is based on the average saving percentage as indicated in the above table. It is not calculated for those countries who have already implemented the measures (assuming that a EU wide regulation would not bring additional savings on a cost efficient basis to those already generated by the actual measure). For those countries for which insufficient data was gathered, the calculation has not been conducted either (indicated by a question mark "?"). Saving potentials are indicated in PJ.

	Indoor temperature limit(s)	Thermostatic zone control	Individual billing	Periodic inspection of Boilers	Domestic Hot Water*	Boilers replacement	Efficient lighting	Energy Audit	Energy labelling in buildings
AT	7	7	0	0	3	7	0	5	5
BE	?	?	?	0	?	?	?	?	?
DE	77	0	0	0	0	0	14	51	51
DK	6	6	0	0	3	6	0	0	0
FI	0	0	2	1	0	3	1	2	2
FR	0	46	0	0	23	33	13	31	0
GR	?	0	?	0	0	?	0	?	?
IR	1	0	0	0	0	1	0	1	1
NL	13	13	14	5	7	11	2	9	9
NO	5	5	4	2	2	1	4	3	3
PO	0	2	?	1	1	2	0	0	2
SP	0	?	?	0	?	?	?	?	?
SW	0	7	9	3	4	5	2	5	5
UK	0	76	27	30	38	61	0	51	51
	109	162	56	42	81	130	36	158	129

*Generalisation of solar water heaters!

All these savings cannot be accumulated as already indicated (example of temperature limits and heating control) and those actions that could be associated would not lead to total of savings because of reductions due to combinations.. Still, the calculation being very conservative, it shows that there is a very large potential for measures of rather limited complexity. Many countries are implementing other market stimuli than regulation to disseminate those activities which is a confirmation of their global interest and large potential, even if some technical, economical or regulatory barriers are still to overcome.

Complementary work will have to be conducted to evaluate properly the potential savings of each of these measures and to assess their average cost and cost effectiveness as well as the potential for reduction of green house gases emissions.

CONCLUSIONS

Although the existing building stock represents a very large potential for energy savings, very little seems to have been harvested through mandatory application of measures that are frequently imposed on new constructions.

Unless the buildings face a major renovation, no consideration is made to the building envelope or energy losses due to ventilation.

Generally speaking, regulations are not widely used to take advantage of the progress made in new buildings to extend these to the already built premises. The Directive of 1993 - which addressed some of these measures - has been little implemented in the field of existing buildings and it will need a huge effort to bring into force the laws, regulations and administrative provisions to comply with the new EU Building Energy Directive in each Member country when it is adopted.

ANNEX 2 – INDIVIDUAL MEMBER STATE RESPONSES TO ENPER QUESTIONNAIRE ON EP REGULATIONS AND EXISTING BUILDINGS

BELGIUM (Flanders)

General comments: answers refer to situation as expected to be applicable from 01.01.04 in Flanders

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced (because they are old or not working)? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system (e.g. vessel) • Hot water controls • Lighting • ACMV 	(a) /No (b) /No (c) /No (d) /No (e) /No (f) /No	(h) /No (i) /No (j) /No (k) /No (l) /No (m) /No
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) /No	(n) /No

If any answers are 'Yes' please provide details
(a).
(b).
(c).
(d).
(e).
(f).
(g) if the works would happen to be subject to a building permit, then there is a max U-value; but bldg permit normally only needed for larger refurbishments
(h)
(i)
(j)
(k)
(l)
(m)
(n) see (g)
Any other comments?

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes**

- *If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' then can you say why not.*

rqmts apply only when building permit is needed;
AND

1. if bldg was previously not heated
2. OR bldg had an industrial use and is converted to residential, office or school function

- rqmts as for new bldgs apply to works: maximum U-values
- average overall U-value
- ventilation provisions
- no overall energy performance, or other partial requirements

as for the entire regulation (general rule), exceptions can be applied for IF great architectural values, protected monument, etc. OR excessive investments would be required relative to expected energy savings

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/renovation? **Yes**

- *If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' can you say why not.*

only if works are subject to bldg permit

max U-value requirement as for new bldg, for envelope components

1. being replaced
2. or becoming part of heated room (and previously unheated)

also some rqmts with respect to ventilation provisions (supply in rooms where windows are replaced)

there are also varying requirements when bldgs are extended (w/wo previous partial demolition)

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

see Q2: only

if bldg permit required, and

if previously unheated OR industrial function (which is changed)

Building envelope measures		Details
Roof insulation	Yes/	only if previously unheated
Floor insulation	Yes/	idem
Wall insulation	Yes/	idem
Sealing to improve air tightness	/No	nowhere in regulation explicit rqmt

if previously heated: only requirement on average overall U-value; not on any specific component

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

change of use: under same conditions as Q2 and Q4b: only installation of ventilation provisions mandatory; no energy requirements on systems
 refurbishment: only if bldg permit required
 if deconstruction down to the concrete skeleton: requirements as new bldgs (overall EP, ...)

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	/No	
Hot water	/No	
Lighting	/No	
ACMV	/No	
Windows, doors and rooflights	Yes/	max U-value, if replacement or previously unheated

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **/No**

<ul style="list-style-type: none"> • <i>If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?</i> • <i>If 'No' then can you say why not.</i>
EPR is linked to bldg permits, which are definitely not needed if nothing is done

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes/**

<ul style="list-style-type: none"> • <i>If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?</i> • <i>If 'No' then can you say why not.</i>
if extension subject to bldg permit, which is usually the case if extension < 800m ³ : only U-max and provisions for ventilation if extension > 800m ³ : rqmts as new bldgs

AUSTRIA

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced (because they are old or not working)? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system (e.g. vessel) • Hot water controls • Lighting • ACMV 	(a) Yes/ (b) /No (c) Yes/ (d) /No (e) No (f) YNo	(h) Yes/ (i) /No (j) Yes (k) /No (l) /No (m) /No
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) Yes/	(n) Yes/

If any answers are 'Yes' please provide details
(a). When boilers are replaced, they have to have an efficiency as if it is in a new dwelling.
(b).
(c). When vessels are replaced, they have to have an efficiency as if it is in a new dwelling.
(d).
(e).
(f)
(g) When windows, doors,.. are replaced, they have to have the quality as if it is in a new dwelling.
(h) When boilers are replaced, they have to have an efficiency as if it is in a new non domestic building.
(i)
(j) When vessels are replaced, they have to have an efficiency as if it is in a new non domestic building.
(k)
(l)
(m)
(n) When windows, doors,.. are replaced, they have to have the quality as if it is in a new non domestic building..
Any other comments?

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes/No**

<ul style="list-style-type: none"> • <i>If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?</i> • <i>If 'No' then can you say why not.</i>
When you have a change of use, the building has to have the Standard which is needed for new use.

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/rennovation? **Yes/No**

- *If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' can you say why not.*

Only if parts of the building are completely new: E.C. When a wall or roof is complete new it has to have the actually quality of the building regulation. In the other way there is no relationsip to the energy performance regulation. But in Austria normally you get only a benefit for renovation when the part (wall, roof, Window,...) has the quality of the actually performance regulation (most time 15%)

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	/No	Only the roof is complete new – then yes
Floor insulation	/No	Only the floor is complete new – then yes
Wall insulation	/No	Only if the wall is complete new – then yes
Sealing to improve air tightness	/No	

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	No	When it gets replaced – then yes
Hot water	/No	When it gets replaced – then yes
Lighting	No	
ACMV	YNo	
Windows, doors and rooflights	YNo	Wen it gets replaced – then yes

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **No**

- *If 'Yes' please provide details of when the regulations apply. What triggers this action? Are they any exceptions or relaxations in particular cases (e.g. historic buildings)?*
- *If 'No' then can you say why not.*

Because no policy maker has the courage to do this. In Austria you get in all countrys an monetary benefit if you improve your building (normally 15%)

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes/**

- *If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?*
- *If 'No' then can you say why not.*

Extensions must have the same Quality than a new building (U-values).

FINLAND

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced (because they are old or not working)? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system (e.g. vessel) • Hot water controls • Lighting • ACMV 	(a) Yes/No (b) Yes/No (c) Yes/No (d) Yes/No (e) Yes/No (f) Yes/No	(h) Yes/No (i) Yes/No (j) Yes/No (k) Yes/No (l) Yes/No (m) Yes/No
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) Yes/No	(n) Yes/No

If any answers are 'Yes' please provide details

(a).

(b).

(c).

(d).

(e).

(f)

(g)

(h)

(i)

(j)

(k)

(l)

(m)

(n)

Any other comments?

We don't have any separate regulations for existing buildings. In practice the energy regulations are applied to e. b., if a new construction permit is needed. That is the case, at least, if the use of the building is changed. That is not clearly mentioned in any regulation, but the local authorities may apply the regulations that are meant for the new buildings. The practice is are always more strict than the nonexistent regulations for the e. b. The regulations are applied to e. b. more strictly in the big cities than in the other areas of Finland.

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes/No**

- *If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*

- *If 'No' then can you say why not.*

The answer is yes and no. The local authorities have quite much power to make the decisions which of the EP-regulations are applied to the existing buildings. In the case of major renovation, the regulations are applied depending on the case.

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/rennovation? **Yes/No**

- If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?
- If 'No' can you say why not.

The application of the regulations is case specific.

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	Yes/No	Local authorities can make the decision
Floor insulation	Yes/No	Local authorities can make the decision
Wall insulation	Yes/No	Local authorities can make the decision
Sealing to improve air tightness	Yes/No	Local authorities can make the decision

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	Yes/No	Local authorities can make the decision
Hot water	Yes/No	Local authorities can make the decision
Lighting	Yes/No	Local authorities can make the decision
ACMV	Yes/No	Local authorities can make the decision
Windows, doors and rooflights	Yes/No	Local authorities can make the decision

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **Yes/No**

- If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?
- If 'No' then can you say why not.

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes/No**

- If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?
- If 'No' then can you say why not.

The regulations of the new buildings are applied to the new part of the building as such. The existing part can remain untouched.

NORWAY

Q1. Do your energy performance regulations apply to existing buildings when any of a building’s services or fittings are replaced (because they are old or not working)? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system (e.g. vessel) • Hot water controls • Lighting • ACMV 	(a) Yes (b) Yes (c) Yes (d) Yes (e) Yes (f) Yes	(h) Yes (i) Yes (j) Yes (k) Yes (l) Yes (m) Yes
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) Yes	(n) Yes

If any answers are ‘Yes’ please provide details
(a). The code is applicable for major and minor changes and for repairs of building services.
(b). “
(c). “
(d). “
(e). “
(f). “
(g). The code is applicable for major changes.
(h). The code is applicable for major and minor changes and for repairs of building services.
(i). “
(j). “
(k). “
(l). “
(m). “
(n). The code is applicable for major changes.
Any other comments?

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes**

<ul style="list-style-type: none"> • <i>If ‘Yes’ please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?</i> • <i>If ‘No’ then can you say why not.</i>
<p>The energy performance of a building must be brought up to the level for a new building when there is a change of use. This is only valid for the part of the building that is affected by the change.</p>

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/rennovation? **Yes**

- If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?
- If 'No' can you say why not.

The energy performance regulations apply to existing buildings in case of major refurbishments. This is also the case for additions to the building (sideways, beneath or above). When the authorities find that the building is changed essentially, the whole building must comply with regulations for new buildings. When only part of the building is changed, or there are additions to the building, the regulations for new buildings only apply for the part that is affected. This is not valid for historical buildings, farm buildings and cottages not being permanently heated. What a major refurbishment is, is not defined in the regulations, this is evaluated by the local authorities.

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	Yes	Up to standard of new buildings. See also above.
Floor insulation	Yes	"
Wall insulation	Yes	"
Sealing to improve air tightness	Yes	"

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	Yes/No	When the buildings undergo a change of use or are changed essentially, the building services must comply with the regulations for new buildings. Whether this implies replacements is dependent on the quality of the services. See also Q1.
Hot water	Yes/No	"
Lighting	Yes/No	"
ACMV	Yes/No	"
Windows, doors and rooflights	Yes/No	"

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **No**

- If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?
- If 'No' then can you say why not.

The energy performance regulations do not apply to existing buildings if no changes are done in the building or in the services.

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes**

- *If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?*
- *If 'No' then can you say why not.*

See Q3.

GERMANY

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced (because they are old or not working)? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system (e.g. vessel) • Hot water controls • Lighting • ACMV 	(a) Yes/ Ne (b) Yes/ Ne (c) Yes/ Ne (d) Yes/ Ne (e) Yes /No (f) Yes/ Ne	(h) Yes/ Ne (i) Yes/ Ne (j) Yes/ Ne (k) Yes/ Ne (l) Yes /No (m) Yes/ Ne
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) Yes/ Ne	(n) Yes/ Ne

If any answers are 'Yes' please provide details
(a). If the whole system has to be replaced, it is treated like an installation in a new building; this holds for (a) to (d) and (f) and similar for non-domestic buildings.
(b).
(c).
(d).
(e).
(f).
(g) If more than 20% of the area of a component has to be changed it has to be replaced according to the new regulation. A component is the outer walls, the windows (all), the roof etc.
(h)
(i)
(j)
(k)
(l)
(m)
(n)
Any other comments?

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes/No**

<ul style="list-style-type: none"> • If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case? • If 'No' then can you say why not.
In most of these cases a major alteration or renovation takes place and then the answers for Q1 are valid.

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/rennovation? **Yes/No**

- If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?
- If 'No' can you say why not.

see Q1, exceptions for historical buildings can be proposed to the local authorities. They can accept or refuse your proposal and demand more insulation ore other measures.

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	Yes/No	See Q1 (g)
Floor insulation	Yes/No	See Q1 (g)
Wall insulation	Yes/No	See Q1 (g)
Sealing to improve air tightness	Yes/No	

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	Yes/No	Only if the system has to be changed for technical reasons then see Q1(a)
Hot water	Yes/No	"
Lighting	Yes/No	
ACMV	Yes/No	"
Windows, doors and rooflights	Yes/No	"

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **Yes/No**

- If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?
- If 'No' then can you say why not.

- 1) Boilers built before 1978 have to be replaced until 2006/12/31
- 2) Fittings and pipes of the heating and hot water system which are located in not heated rooms have to be insulated until 2006/12/31
- 3) Ceilings of heated rooms (to the not insulated roof or outside) have to be insulated with a U-value of at least 0.30 W/(m² *K) until 2006/12/31

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes/No**

- *If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?*
- *If 'No' then can you say why not.*

Only if the outer hull of a building is affected the regulation takes effect.

DENMARK

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced (because they are old or not working)? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system (e.g. vessel) • Hot water controls • Lighting • ACMV 	(a) -/No (b) -/No (c) -/No (d) -/No (e) -/No (f) -/No	(h) -/No (i) -/No (j) -/No (k) -/No (l) -/No (m) -/No
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) -/No	(n) -/No

If any answers are 'Yes' please provide details

(a).

(b).

(c).

(d).

(e).

(f)

(g)

(h)

(i)

(j)

(k)

(l)

(m)

(n)

Any other comments?

If the services/fittings are replaced they have to fulfil the requirements valid as when the building was constructed

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes/-**

- *If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' then can you say why not.*

The Building Act covers construction of new buildings, conversion of and other alterations to buildings, the house is divided into several dwellings in the form of flats and any changes in the use of buildings that are significant in relation to the provisions of the Building Act or building regulations, together with demolition of buildings.

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/renovation? **Yes!**

- If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?
- If 'No' can you say why not.

Only major renovation

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	Yes/	In principle yes for change of use, but in practice it is not always possible.
Floor insulation	Yes/	
Wall insulation	Yes/	
Sealing to improve air tightness	Yes/	

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	Yes/	Only if it is due to change of use, the installations shall fulfil the requirements – in principle yes, but in practice not always done.
Hot water	Yes/	
Lighting	Yes/	
ACMV	Yes/	
Windows, doors and rooflights	Yes/	

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **No**

- If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?
- If 'No' then can you say why not

As mentioned above

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes!**

If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?

- *If 'No' then can you say why not.*

The extension has to fulfil the regulations in the Building Act

PORTUGAL

Q1. Do your energy performance regulations apply to existing buildings when any of a building’s services or fittings are replaced (because they are old or not working)? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system (e.g. vessel) • Hot water controls • Lighting • ACMV 	(a) No (b) No (c) No (d) No (e) No (f) No	(h) Yes (i) No (j) No (k) No (l) No (m) No
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) No	(n) Yes/No

If any answers are ‘Yes’ please provide details

The Portuguese regulation has two different general approaches; one regulation (rccte) published in 1990, which is applicable to all buildings or renovations (if the value of the renovation is half the value of the building) and in this cases there are a set of minimum requirements, basically related with the envelope. Depending the climatic zones some uvalues are required. Then an energy balance is made in order to get the heating or cooling load (kwh/m2) which need to be inferior than a reference value. In this methodology a trade off is possible concerning the building shell elements (it is possible not to insulate walls but use double glazing).

The second approach (rsece) is a second document published in 1998, is basically concerned with buildings with heating and cooling systems. And also in this case, no matter if the building is new or existent, if the heating or cooling systems is >25 kW or (heating + cooling >40kW) the regulation is mandatory.

(a).If the heating load > than 25kW

- (b).
- (c).
- (d).
- (e).
- (f)
- (g)
- (h)
- (i)
- (j)
- (k)
- (l)
- (m)

(n) it is not compulsive but it may be necessary to change some of these fittings

Any other comments?

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **No**

- *If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' then can you say why not.*

In the Portuguese regulation, there are not a measures or requirements depending of the use of the building but the load (heating or cooling)

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/renovation? **Yes/No**

- *If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' can you say why not.*

Yes, if the refurbishment/renovation is greater than half the values of the building. In this case building regulation requires the same type of calculations.

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

The use is not a cause for nothing in Portuguese regulation, if the refurbishment is greater than a certain value, as said in previous answer, there are requirements. These do not point specific measures for some part of the shell (wall, roof and so on). The overall scheme, oblige to have a balance (gains and losses) through the shell, the results is a net value, which should be less than a reference values (kWh/m²)

Building envelope measures		Details
Roof insulation	Yes/No	
Floor insulation	Yes/No	
Wall insulation	Yes/No	
Sealing to improve air tightness	Yes/No	A kind of trade off can be applied to all the building shell elements

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings? **No**

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	Yes/No	
Hot water	Yes/No	
Lighting	Yes/No	
ACMV	Yes/No	
Windows, doors and rooflights	Yes/No	

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **No**

- *If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?*
- *If 'No' then can you say why not.*

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes/No**; yes if the extension fall down in the general conditions of application of the regulations

- *If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?*
- *If 'No' then can you say why not.*

GREECE

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment/rennovation.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system • Hot water controls • Lighting • HVAC 	(a) Yes (b) Yes (c) Yes (d) Yes (e) Yes (f) Yes	(h) Yes (i) Yes (j) Yes (k) Yes (l) Yes (m) Yes
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) Yes	(n) Yes

If any answers are 'Yes' please provide details
(a) If the area > 30m ² of the existing dwelling the replacement of the boiler should have an efficiency as for new dwellings
(b) Heating controls should be as for new dwellings
(c) Hot water system should be as for new dwellings
(d) Hot water controls should be as for new dwellings
(e) Lighting should be as for new dwellings
(f) HVAC system should be as for new dwellings
(g) Should be according to the insulation requirements concerning the new dwellings
(h) Heating system should be as for new buildings
(i) Heating controls should be as for new buildings (this includes timing and thermostatic control)
(j) Hot water system should be as for new buildings
(k) Hot water controls should be as for new buildings
(l) Lighting system should be as for new buildings
(m) HVAC system should be as for new buildings
(n) Should be according to the insulation requirements concerning the new buildings
Any other comments? For existing buildings the application of the EPR is required only after an Energy Inspection in order to improve the building energy performance. In the frame of this condition the results of the Energy Inspection can "force" in a way, the replacement of the previous mentioned services or fittings. And in this case, the replacement of a service or fitting in the existing building should be the same as if for a new building.

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes**

- *If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' then can you say why not.*

The energy performance regulation is applicable in this case. There is some exceptions for the following kind of buildings:

- Open buildings or buildings with no heating/cooling requirements (storage, farm building, some industrial buildings, etc)
- Religion related buildings such as churches
- Buildings of historical or cultural importance, where EP regulation cannot be applied
- Stand alone buildings with area <30sqm
- Extension to existing buildings when extension <30sqm

It is important to underline that these type of buildings are excluded by the regulation except the part that concerns the thermal insulation requirements.

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/renovation? **Yes**

- *If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' can you say why not.*

The energy performance regulation is applicable in this case. The regulation determines that existing buildings under major renovation are included in the regulation, but until now (EPR is still under development) there are no details about the term "major renovation". There are some exceptions for the previous mentioned kind of buildings (Q2).

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	Yes	If the renovation concerns the roof elements, the requirements of the thermal insulation of new buildings should be met.
Floor insulation	Yes	If the renovation concerns the floor elements, the requirements of the thermal insulation of new buildings should be met.
Wall insulation	Yes	If the renovation concerns the wall elements, the requirements of the thermal insulation of new buildings should be met.
Sealing to improve air tightness	Yes	If the scope of the refurbishment is the improve air-tightness.

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	Yes	Yes if the service or fitting is a part of the refurbishment procedure, but also if it is decided that a certain replacement or an additional installation can improve the energy performance of the building in order to meet the minimum energy consumption required by the EPR. As previously mentioned any replacement of services or fittings should be as for new building.
Hot water	Yes	
Lighting	Yes	
HVAC	Yes	
Windows, doors and rooflights	Yes	

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **Yes**

- *If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?*
- *If 'No' then can you say why not.*

The new Greek EPR requires the periodic energy inspection of existing buildings. In this case the results of the Energy Inspection can "force" in a way, the replacement or the installation of various building components, systems or services, in order to improve the energy performance of the building.

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes**

- *If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?*
- *If 'No' then can you say why not.*

Yes if the extension is greater than 30m². In this case the regulation that concerns the new buildings is considered, but it is unclear, until the present moment, if only the extension is treated according to the "new building" regulation or the whole building.

IRELAND

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment/rennovation.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system • Hot water controls • Lighting • HVAC 	(a) Yes/No (b) Yes/No (c) Yes/No (d) Yes/No (e) Yes/No (f) Yes/No	(h) Yes/No (i) Yes/No (j) Yes/No (k) Yes/No (l) Yes/No (m) Yes/No
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) Yes/No	(n) Yes/No

If any answers are 'Yes' please provide details
(a) Not yet, but from 1 July 2003, the average U-value of replacement windows, doors and rooflights in existing dwellings must not exceed 2.2 W/m ² C (i.e. low-emissivity double glazing).
(b)
(c)
(d)
(e)
(f)
(g)
(h)
(i)
(j)
(k)
(l)
(m)
(n)
Any other comments?

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes/No**

<ul style="list-style-type: none"> • <i>If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?</i> • <i>If 'No' then can you say why not.</i>
Yes, the Building Regulations apply to buildings undergoing material alterations or changes of use. The requirements are less stringent than those for new buildings (for example, higher U-values are allowed).
The Regulations dealing with energy efficiency do not apply to buildings of architectural or historic interest which are 'protected structures' or 'proposed protected structures' within the meaning of the Planning and Development Act 2000.

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/rennovation? **Yes/No**

- If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?
- If 'No' can you say why not.

Yes. For small extensions not exceeding 6.5 m2 in floor area, reasonable provision for the conservation of fuel and energy can be considered to have been made if the new construction is similar to the existing construction.

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	Yes/No	Yes
Floor insulation	Yes/No	Yes
Wall insulation	Yes/No	Yes
Sealing to improve air tightness	Yes/No	Yes

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details (It may be appropriate to refer to your answers to Q1)
Heating	Yes/No	No
Hot water	Yes/No	No
Lighting	Yes/No	No
HVAC	Yes/No	No
Windows, doors and rooflights	Yes/No	Yes

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **Yes/No**

- If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?
- If 'No' then can you say why not.

No. The Regulations only apply when there is a material alteration or change of use.

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes/No**

- If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?
- If 'No' then can you say why not.

Yes, except small extensions of floor area less than 6.5 m2.

SPAIN

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment/rennovation.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system • Hot water controls • Lighting • HVAC 	(a) Yes/ No (b) Yes/ No (c) Yes/ No (d) Yes/ No (e) Yes /No (f) Yes/No	(h) Yes/ No (i) Yes/ No (j) Yes/ No (k) Yes/ No (l) Yes /No (m) Yes/ No
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) Yes /No	(n) Yes /No

If any answers are 'Yes' please provide details
(a) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(b) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(c) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(d) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(e) A new regulation for lighting is now been developed
(f) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(g) A new regulation for the building envelope is now been developed
(h) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(i) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(j) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(k) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(l) A new regulation for lighting is now been developed
(m) Any extension or revision of the heating, cooling , ventilation or hot water systems must comply with the RITE "Energy performance regulation related to thermal installation in buildindgs"
(n) A new regulation for the building envelope is now been developed
Any other comments?

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes/No**

- If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?
- If 'No' then can you say why not.

Only when an extension or revision of the heating, cooling, ventilation or hot water systems is done independently of the change of use.

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/renovation? **Yes/No**

- If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?
- If 'No' can you say why not.

Only when an extension or revision of the heating, cooling, ventilation or hot water systems. The new regulations will include refurbishment/renovation of the envelope and the lighting system, but at present it is not included.

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope? No in the present regulation, yes in the future new regulation

Building envelope measures		Details
Roof insulation	Yes/No	
Floor insulation	Yes /No	
Wall insulation	Yes /No	
Sealing to improve air tightness	Yes /No	

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details (It may be appropriate to refer to your answers to Q1)
Heating	Yes/No	
Hot water	Yes /No	
Lighting	Yes /No	
HVAC	Yes /No	
Windows, doors and rooflights	Yes /No	

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **Yes/No**

- *If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?*
- *If 'No' then can you say why not.*

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes/No**

- *If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?*
- *If 'No' then can you say why not.*

The new regulations will include extensions of the envelope, but at present it is not included.

SWEDEN

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment/renovation.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system • Hot water controls • Lighting • HVAC 	(a) No (b) No (c) No (d) No (e) No (f) No	(h) No (i) No (j) No (k) No (l) No (m) No
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) No	(n) No

If any answers are 'Yes' please provide details
(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
(i)
(j)
(k)
(l)
(m)
(n)
Any other comments? In the comments to our regulations it is stated that if for example the HVAC system is altered or exchanged one are to comply as far as possible to the current regulations.

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes**

<ul style="list-style-type: none"> • <i>If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?</i> • <i>If 'No' then can you say why not.</i>
Current regulations apply to the changed part of the building and some times the neighbouring parts of the building. Regulations do not apply to buildings used only shorter part of the year such as vacation homes or summer restaurants.

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/renovation? **Yes**

- If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?
- If 'No' can you say why not.

As long as the renovation is not a maintenance. Regulations usually only apply to renovated parts of the building.

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	Yes/No	It is up to the owner/Byggherre to decide what measures he chooses to use to fulfil the regulations.
Floor insulation	Yes/No	
Wall insulation	Yes/No	
Sealing to improve air tightness	Yes/No	

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	Yes/No	It is up to the owner/Byggherre to decide what measures he chooses to use to fulfil the regulations.
Hot water	Yes/No	
Lighting	Yes/No	
HVAC	Yes/No	
Windows, doors and rooflights	Yes/No	

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **No**

- If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?
- If 'No' then can you say why not.

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes**

- If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?
- If 'No' then can you say why not.

Current regulations apply to the added part and if the addition is considerably prolonging the buildings expected life span or drastically changes the buildings use then current regulations apply also to neighbouring parts of the building.

UK

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced (because they are old or not working)? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system (e.g. vessel) • Hot water controls • Lighting • HVAC 	(a) Yes/ Ne (b) Yes/ Ne (c) Yes/ Ne (d) Yes/ Ne (e) Yes/ Ne (f) Yes /No	(h) Yes/ Ne (i) Yes/ Ne (j) Yes/ Ne (k) Yes/ Ne (l) Yes/ Ne (m) Yes/ Ne
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) Yes/ Ne	(n) Yes/ Ne

If any answers are 'Yes' please provide details
(a) If existing dwelling has a total floor area >50m ² then replacement boiler has to have an efficiency as if it was a new dwelling.
(b) Provide controls for boiler as if for a new dwelling.
(c) Provide a hot water system as if for a new dwelling.
(d) Provide controls (e.g. time switch or programmer, room thermostat, vessel thermostat etc.) to ensure reasonable efficiency.
(e) Provide lighting as if for a new dwelling.
(f) HVAC systems rarely used in UK dwellings.
(g) Replacement windows, doors and rooflights should have an average U-value as for new dwelling, or a centre-pane U-value no worse than 1.2 W/m ² K.
(h) When substantially replacing heating system then new system has to be as for a new building. In lesser work then reasonable provision for insulation, zoning, timing, temperature etc.
(i) See (h).
(j) When substantially replacing hot water systems, pipes and vessels provide controls and insulation as if for new buildings. In lesser work make reasonable provision for insulation, timing and thermostatic controls.
(k) See (j)
(l) When replacing a complete lighting system serving more than 100m ² of floor area provide a new lighting system as if for a new building.
(m) When replacing HVAC systems serving more than 200m ² floor area in office buildings then new system has to have a reasonable standard of performance as defined using the Carbon Performance Rating (CPR) method. This performance is not as high as for new buildings as it is acknowledged that there are practical limitations in existing buildings. In buildings other than offices then the specific fan power (SPF) of the replacement HVAC system should be no greater than 3 W/litre/sec (in new buildings the limit is 2 W/litre/sec).
(n) As (g)
Any other comments? Overall, the aim is that the replacement service or fitting in the existing building should be the same as if for a new building. However, there can be practical limitations. This is acknowledged in specific circumstances in which case a lower standard of performance is allowed.

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes/No**

- *If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' then can you say why not.*

They do apply in this case, however only those parts of the building where building work is being undertaken anyway are required to have improvements in energy efficiency, e.g. replacing the roof (see Q4a and 4b below for details). Overall, reasonable provision should be made to ensure the energy efficiency of the 'new' dwelling.

There are exceptions to this for historic buildings. In these cases there is a need to achieve a balance between improvements to energy efficiency and conserving the character of the building. Each case is dealt with on its merits and specific guidance has been produced.

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/renovation? **Yes/No**

- *If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' can you say why not.*

They do apply in this case, however only those parts of the building where building work is being undertaken anyway are required to have improvements in energy efficiency (see Q4a and 4b below for details). It is **not** dependent on ground floor area or the cost of the work relative to the building's insurance value. Overall, reasonable provision should be made to ensure the energy efficiency of the 'new' building.

As mentioned above, there are exceptions or relaxations for historic buildings.

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	Yes/No	When substantially replacing major elements of a roof you should provide insulation to meet the U-value for a new dwelling.
Floor insulation	Yes/No	Where the structure of a ground floor or exposed floor is to be substantially replaced you should provide insulation in heated rooms to the standard for new dwellings.
Wall insulation	Yes/No	When substantially replacing complete exposed walls or their external renderings etc. then you should provide a reasonable thickness of insulation. Note: it is not a requirement to meet the U-value as for a new dwelling; it is acknowledged that when converting buildings this is difficult to do.
Sealing to improve air tightness	Yes/No	When carrying out any building work then should carry out sealing work to improve air tightness (but should not compromise indoor air quality).

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	Yes/No	When replacing services or fittings then they should – as far as possible - be as for a new building. For specific details see answers to Q1 above.
Hot water	Yes/No	
Lighting	Yes/No	
HVAC	Yes/No	
Windows, doors and rooflights	Yes/No	

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **Yes/No**

- *If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?*
- *If 'No' then can you say why not.*

Building Regulations in the UK do not apply in these cases. They only apply when building work is actually done (as described in Q1 to Q3 above). This is a limitation of the primary legislation (The Building Act 1984). There are a number of voluntary initiatives (e.g. Energy Efficiency Best Practice Programme, EEBPp, now replaced by Action Energy) to improve the performance of the existing building stock which are summarised in the main questionnaire.

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes/No**

- *If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?*
- *If 'No' then can you say why not.*

Reasonable provision for energy efficiency should be made for the extension. There are two options to meet the requirement:

- The individual fabric U-values for walls, floors, roofs and openings of the extension should be as for a new dwelling. It is possible to trade-off these U-values, e.g. higher roof U-value for a lower floor U-value.
- The whole house (existing house plus extension) can comply using the Target U-value or Carbon Index Method (which is an EP_{MAX} approach).

In practice, because of the difficulty of (ii), option (i) is the preferred approach.

NETHERLANDS

Q1. Do your energy performance regulations apply to existing buildings when any of a building's services or fittings are replaced? (This may be the case even though the building is not actually undergoing a change of use or a (major) refurbishment/rennovation.)

Please delete as appropriate	Dwellings	Non-domestic buildings
Services <ul style="list-style-type: none"> • Heating system (e.g. boiler) • Heating controls • Hot water system • Hot water controls • Lighting • HVAC 	(a) Yes /No (b) Yes /No (c) Yes /No (d) Yes /No (e) Yes /No (f) Yes /No	(h) Yes /No (i) Yes /No (j) Yes /No (k) Yes /No (l) Yes /No (m) Yes /No
Fittings <ul style="list-style-type: none"> • Windows, doors and rooflights 	(g) Yes / No	(n) Yes / No

If any answers are 'Yes' please provide details
(a)
(b)
(c)
(d)
(e)
(f)
(g) When a building permit is needed for the replacement (can be the case with the replacement of windows, doors and rooflights on a major scale), the building needs to meet the EP standard for new buildings. It is possible for the municipality to lower the demands to a minimum level of the energy performance which the building had when it was build (or somewhere in between this minimum level and the level for new buildings).
(h)
(i)
(j)
(k)
(l)
(m)
(n) see g
Any other comments? The 'yes' and 'no' in the overview are very misleading, because of the buts and boundary conditions. In principle no for services, BUT: There are no energy performance regulations for existing buildings. But a building always needs to remain the level of energy performance which it had when it was build. This means that when for instance the HVAC is replaced, it should be replaced with a system which is at least as energy efficient as the old one, OR when it is replaced by a less energy efficient installation: the energy use has to be compensated in such a way that the EP meets the original level. Also see Q4b

Q2. Do your energy performance regulations apply to existing buildings when they undergo a change of use (e.g. an office or warehouse converted into flats etc.)? **Yes/No**

- *If 'Yes' please provide details of when the regulations apply. Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' then can you say why not.*

No, BUT...

See answer to Q1: There are no energy performance regulations for existing buildings. But a building always needs to remain the level of energy performance which it had when it was build. But when a building permit is needed when the change of use is accompanied by major renovation, the building needs to meet the EP standard for new buildings. With the possibility for the municipality to lower the demands as explained above (Q1).

Q3. Do your energy performance regulations apply to existing buildings when they undergo refurbishment/renovation? **Yes/No**

- *If 'Yes' please provide details when the regulations apply (e.g. is it dependent on the ground floor area of the building, the cost of the work relative to the building's insurance value, etc.?). Please define the circumstances when exceptions or relaxations apply (e.g. for historic buildings). Is it required to bring the energy performance up to the level for a new building, or are there lesser standards that apply in this case?*
- *If 'No' can you say why not.*

Yes, BUT...

If the renovation is major enough and therefore a building is needed, the building needs to meet the EP standard for new buildings. With the possibility for the municipality to lower the demands as explained above (Q1). If not the building always needs to remain the level of energy performance which it had when it was build

Q4a. When existing buildings undergo a change of use or a refurbishment is there a need to improve the performance of the building envelope?

Building envelope measures		Details
Roof insulation	Yes/No	For the performance of the building envelope goes more or less the same as for the energy performance of the building: When a building permit is needed, also the building envelope (roof, floor and wall insulation and building tightness) needs to meet the demands for new buildings. The municipality again has the possibility to lower this demands to a certain expend.
Floor insulation	Yes/No	idem
Wall insulation	Yes/No	idem
Sealing to improve air tightness	Yes/No	idem.

Q4b. When existing buildings undergo a change of use or a refurbishment is there a need to replace the building's services or fittings?

Building services and fittings		Details <i>(It may be appropriate to refer to your answers to Q1)</i>
Heating	Yes/No	same answer as given for Q1. We have legislation which demands the replacement of building services and other reduction of energy use: The Environmental Protection Law. This law says that buildings with a higher electricity, gas or water use (usually industrial buildings) need to investigate energy and water saving measures and need to apply economic reasonable measures (in practice when the payback time is less than 5 years). In practice there are no sanctions, so enforcement of this law is hard. Therefore long-term agreements are reached between government and market.
Hot water	Yes/No	idem
Lighting	Yes/No	idem
HVAC	Yes/No	idem
Windows, doors and rooflights	Yes/No	Same story as for insulation

Q5. Do your energy performance regulations apply to existing buildings regardless of whether their services or fittings are replaced or whether they undergo a change of use or refurbishment? **Yes/No**

<ul style="list-style-type: none"> <i>If 'Yes' please provide details of when the regulations apply. What triggers this action? Are there any exceptions or relaxations in particular cases (e.g. historic buildings)?</i> <i>If 'No' then can you say why not.</i>
No, but see remarks above

Q6. Do your energy performance regulations apply to extensions to dwellings? **Yes/No**

<ul style="list-style-type: none"> <i>If 'Yes' please provide details of when the regulations apply. Are there exceptions, e.g. based on the ground floor area of the extension, value of the work etc.? How is compliance achieved, e.g. do the walls, roof and floor etc. of the extension have to meet specific U-values, does the 'new' dwelling as a whole have to achieve an EP_{MAX} etc.?</i> <i>If 'No' then can you say why not.</i>
The new dwelling as a whole has to meet the EP standard for new buildings. With the possibility for the municipality to lower the demands as explained before. The same goes for Rc- and U-values. In practice the extension will have to meet the demands for new buildings concerning Rc- and U-values, but the municipality won't demand to change the existing boiler, even if it also will be used for extension.