Final report

Exploratory study with regard to Ecodesign of thermal insulation in buildings (Lot 36): MEErP tasks 0, 1 and 7 (partly)

Spirinckx Carolin (VITO), Peeters Karolien (VITO), Debacker Wim (VITO), Vandeveldt Birgit (VITO), Geerken Theo (VITO), Durand Antoine (WIKUE), Götz Thomas (WIKUE), Lemeire Caroline (VITO) and Lust Arnoud (VITO)

Study accomplished under the authority of DG ENERGY, under specific contract No ENER/C3/2012-418-Lot1/02/SI2.652413, within the multiple framework service contract No ENER/C3/2012-418-Lot 1, preparatory studies and related technical assistance on specific product groups

2013/TEM/R/38

February 2014
DISTRIBUTION LIST

European Commission:
- Toth Andras, DG Energy, ENER.C.3.001 Energy efficiency of products, Policy Officer – contact person Commission
- Acedo Juan Moreno, DG Energy, ENER.C.3.001 Energy efficiency of products, Policy Officer
- Bennett Michael, DG Enterprise, ENTR.B.1. Sustainable Industrial Policy and Construction, Policy Officer
- Fuchs Manfred, DG Enterprise, ENTR.B.1.001 Sustainable Construction, Policy Officer
- Katsarakis Georgios, DG Enterprise, ENTR.B.1.001 Sustainable Construction, Policy Officer
- Kubiak Ruben, DG Energy, ENER.C.3.001 Energy efficiency of products, Policy Officer
- Lindblom Josefin, DG Environment, ENV.A.1. Eco-Innovation and Circular Economy, Policy Officer
- Pekar Ferenc, DG Environment, ENV.A.1. Eco-Innovation and Circular Economy, Policy Officer

Project team:
- Spirinckx Carolin, VITO, Project Manager Insulation Materials, contact person project team
- Debacker Wim, VITO, Expert Insulation Materials
- Durand Antoine, WIKUE, Quality Manager
- Geerken Theo, VITO, Expert Ecodesign
- Götz Thomas, WIKUE, Quality Expert
- Lemeire Caroline, VITO, Deputy Framework Contract Manager
- Lust Arnoud, VITO, Contract Manager
- Peeters Karolien, VITO, Expert Life Cycle Assessment
- Vandevelde Birgit, VITO, Expert Buildings

Disclaimer:
The project team does not accept any liability for any direct or indirect damage resulting from the use of this report or its content.
The report contains the results of research by the authors and is not to be perceived as the opinion of the European Commission.
VITO (the Flemish Institute for Technological Research) and WIKUE (Wuppertal Institute for Climate, Environment and Energy) have performed this exploratory study with regard to Ecodesign of thermal insulation in buildings on behalf of the European Commission DG Energy. The study analysed only parts of the so-called MEErP methodology (Methodology for Energy related Products, DG ENTR 2011). The information provided can serve as a preparation for subsequent phases, including the performance of a full preparatory study in accordance with the MEErP methodology.

The study follows the European Commission’s MEErP methodology and consists of three tasks:

1. Quickscan (task 0 of the MEErP methodology);
2. Scope (task 1 of the MEErP methodology);
3. Scenarios (task 7, in part, of the MEErP methodology).

Our findings in brief (in MEErP task order) are the following:

Task 0 - Quickscan

Task 0 is an optional task that is intended to be carried out in the case of large or inhomogeneous product groups, for which it is recommended to carry out a first product screening that takes into account the environmental impact and potential for improvement of the products, as referred to in Article 15 of the Ecodesign Directive. The objective of this task was to regroup or narrow the product scope, as appropriate, from an Ecodesign point of view, for subsequent analysis within the MEErP tasks 1 and 7 (part).

In accordance with ISO 9229, thermal insulation products for buildings are defined as: "... factory made products in the form of rolls, bats, boards or slabs, with or without facings, or 'in-situ' applied materials, which have a primary function to reduce heat transfer through the structure against which, or in which, it is installed. Products covered by this definition may also be used in prefabricated thermal insulation systems and composite panels."

Excluded from the study are building materials (or components), of which the material that is responsible for a thermal performance is the same material that also fulfils other primary functions, such as structural integrity, (e.g. lightweight concrete, certain gypsum building blocks, and even straw bale construction could be mentioned here). For these products, a different Ecodesign study would apply, tackling all of the primary functions of the materials and their consequences with regard to the definition of potential Ecodesign measures. Special attention will have to be devoted to the definition of a functional unit that takes into account all primary functions or the definition of multiple ones covering the functions separately. Thermal insulation products intended to be used for the insulation of equipment and industrial installations are also excluded from this assessment, since the application and operating conditions of these 'equipment and installation' insulation products may be very different from the application as thermal insulation products for buildings, even though in many cases the same materials may be used. Reflective foils or the use of light-coloured materials/finishing are not considered as “insulation” solutions, rather solutions to prevent “heat absorption” through the building skin. Consequently, these products are not included in the scope of the study. Furthermore, overheating needs to be

1 Reflective insulation, often called foil insulation is included in this study, as it is not only related to overheating – see page 2 for further information.
considered at a building level, since it is influenced by many parameters: windows (surface, transmittance), thermal capacity, the location of the insulation material in the wall, etc.

It appears to be difficult to define a single functional unit – to analyse and compare different thermal insulation solutions in an objective way – covering all functionalities and relations with the rest of the building. Establishing a definition of a reference system at building or building element level that takes into account different constructive solutions and that is applicable in all Member States of the European Union, is complex and time-consuming. For these reasons, the research team recommends defining the functional unit at product level and has communicated in the report about the restrictions that would apply when using a product-based approach.

Although thermal insulation products for buildings are not easily defined or categorized, the Quickscan revealed strong indications that their economic and environmental importance is very significant. The volumes of sales and trades within this market are significant and exceed the threshold of 200 000 units (based on annual sales data from 2009 to 2011, according to the Prodcom\(^2\) categories). The major environmental impacts of insulation lie in the environmental benefits it provides during the use phase of the building in which it is installed (i.e. bringing about a reduction in the energy used by the building). Compared to the reduction of energy use in the use phase of the building, embodied impacts relating to the manufacturing and EOL of thermal insulation products are generally smaller. Furthermore, other building components often dominate the environmental profile of building elements and buildings.

Nevertheless, in light of the 2019-2021 EPBD targets and the increase in insulation waste released as a result of demolition, the environmental impacts relating to manufacturing, replacement and end-of-life will gain in importance. However, it would be counter-productive if attempts to reduce the embodied impact of thermal insulation solutions led to an increase of energy consumption and therefore extended the payback time. Providing affordable and energy-efficient solutions is something that has to be considered for each building project separately. For each building application and building context, a balance must be achieved between low periodic operational energy costs due to sufficient thermal insulation (and choosing energy efficient technical services) and low initial costs due to the limitation of material and installation costs (and choosing technical services with a low investment cost). A same line of thinking can be used regarding environmental impacts.

Furthermore the Quickscan resulted in the suggestion to exclude from this assessment building materials (or components) of which the material that is responsible for its thermal performance is the same material that also fulfils other primary functions such as structural integrity (e.g. lightweight concrete, certain gypsum building blocks, and even straw bale construction could be mentioned here). For those products, a different Ecodesign study would be necessary, tackling all primary functions of the materials and their consequences with regard to the definition of potential Ecodesign measures. In addition, thermal insulation products intended to be used for the insulation of equipment and industrial installations have been excluded.

Finally, many of the issues addressed in the Quickscan, such as the energy efficiency of buildings, the environmental performance of building elements and indoor air quality, need to be addressed on a systemic level.

\(^2\) PRODuction COMmunautaire, see http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/database
Task 1 - Scope

In task 1, the product category and the system boundaries of the ‘playing field’ for Ecodesign are defined for thermal insulation in buildings. Furthermore, task 1 will serve as a basis for the testing and calculation methods to be used to regulate relevant Ecodesign parameters. Task 1 is important as:

- it draws up an inventory of what measures already exist in the EU (European Union), and of possible regulatory failures;
- it analyses the legislation in EU Member States, which the Ecodesign directive is setting out to harmonize for the sake of a European Single Market (ESM);
- it indicates – also with a view towards global competitiveness and hinting at feasible target levels—what measures have been taken in the rest of the world, outside the EU.

In the scoping, a large number of standards and legislation are addressed and discussed. In the case of insulation materials, a large quantity of (test) standards and legislation is already available, which address primary and secondary functional performance parameters, the use of resources (energy and materials, incl. waste), emissions, other product-specific test procedures, etc. A complete overview can be found in CHAPTER 4.

An overview of existing mandatory and voluntary approaches in relation to insulation products has been established. The EPBD (Energy Performance of Buildings Directive) and the CPR (Construction Products Regulation) provide a mandatory common European framework, within which Member States are free to provide targets, methodology for Cost Optimality, and to develop building codes. There also exists a wide array of European standards regarding the technical performance of insulation products. With regard to environmental performance, a voluntary EPD (Environmental Product Declaration) scheme is quite successful in a number of countries, although full market coverage is not achieved yet.

Task 7 – Scenarios (partly)

MEErP task 7 was performed only partially in this screening study for thermal insulation in buildings. The following three tasks formed part of the Terms Of Reference (TOR):

- Determination of the type (but not yet the precise content) of possible requirements governing building thermal insulation products under Ecodesign and/or Energy Labelling, taking into account any constraints inherent to the product group, and the need to avoid duplicating existing legislation / standards mapped in the MEErP task 1;
- Provision of a rough estimate of the potential for improvement attributable to the policy instruments recommended;
- Performance of an approximate sensitivity analysis of the estimated improvement potential, assuming various degrees of effectiveness of the recommended policy instruments and of the existing legislation / standards mapped in MEErP task 1.

Some possible policy instruments have been recommended in paragraph 5.1.1. The few policy options that we identified are more difficult to quantify than the usual minimum requirements in ecodesign measures, therefore the improvement potential cannot be estimated in a meaningful way.

Potential for requirements in the scope of the Labelling Directive

The labelling of insulation materials is far from straightforward, as the energy saving contribution is dependent on climatic conditions and is determined by different building practices. The possibility to obligate insulation material producers to indicate thermal conductivity on their products has
already been provided for under the Construction Products Regulation (CPR Art 60(a)). The appropriate level for product information for end-users regarding energy performance in the use phase is at the level of the building envelope, for which EPBD policy already exists for new and existing buildings. (See also section on specific ecodesign requirements in the use phase (paragraph 5.2.2)).

**Potential for requirements in the scope of the Ecodesign Directive**

The imposition of a specific target on energy performance in the use phase with regard to insulation products, is impossible. The energy saving (in terms of thermal performance) for the same insulation product varies across Member states. The appropriate level at which a target could be imposed is at the level of the building envelope. Requirements regarding the building envelope are handled by the implementation of EPBD in the Member States.

The level of significance of Ecodesign requirements on environmental performance in the production phase is rather low and it is difficult to judge which impact category is the most important one. Moreover, a large variation in needs/constraints exists, especially during renovation projects, which requires a broad range of insulation solutions. Through the voluntary EPD system, information on these differences is provided nowadays on dozens of different insulation products, although full coverage of the market has not been achieved. There is an option to make the declaration of environmental performance by means of EPDs mandatory in the form of Ecodesign implementing measures or CPR delegated acts. This would allow the consumer to compare the different insulation materials on offer (if the EPDs are based on the same functional unit and with the same framework assumption and assessed according to the same methodology). In some Member States, the submission of EPDs is already obligatory. The CPR could make the submission of EPDs obligatory by means of a Delegated Act issued under Art 60 (a). From the moment BWR 7 of CPR becomes mandatory, manufacturers will have to declare information regarding the sustainable use of resources. Today, only the first 6 basic work requirements and REACH are mandatory. Stakeholders do not refuse mandatory EPDs, but claim that if they are introduced for insulation products, they should also be introduced for all other construction products. This would allow the assessment of the environmental profile of the entire building (see Annex C).

A potential generic implementing measure on energy performance in the use phase could address the issue of installation of insulation products. Ecodesign requirements (generic) regarding information about the optimal installation of insulation products may provide help to architects and installers. Since information requirements are tackled within the CPR, Ecodesign should give greater focus to generic requirements, e.g. describing what information should be available in a manual. This potential measure can be considered if other more important opportunities for ecodesign requirements are also to be found. Setting up an ecodesign regulation only for this possible measure is not advisable.

Requirements for measuring emissions in the use phase are being developed by TC 351. Having a sound measurement method and measured emission data established on that basis forms a condition for further policy measures. Ecodesign requirements (generic) regarding information about emissions in the use phase may provide help to installers. Stakeholders have indicated the need for harmonised EN standards and refer to mandate M/103 of the European Commission and the CPR (see Annex C). Where CEN TC 351 only covers emissions in the use phase, some stakeholders have indicated that enlarging this so that it includes the entire life cycle would be desirable.
We do not consider a generic implementing measure with information on best EoL options to be appropriate, unless perhaps through EPDs. The reason for this is the small significance of this life-cycle stage in the life-cycle of an insulation product. Moreover, the group of insulation products is responsible for only a small percentage of the waste of building waste. We believe that the most appropriate way to handle information-sharing regarding the EoL of insulation materials is through EPDs and the existing EPD standards.

Generic implementing measures on design for disassembly and minimum lifespan requirements have been investigated as well. Reliable and accurate data on the lifespan of thermal insulation is important in order to create a better design and assessment (LCA/LCC) of building solutions. Although data on the reference service life and internal and external parameters is often lacking, we believe that the most appropriate way to share information regarding the lifespan of thermal insulation products is through EPD’s and existing EPD standards. Since EPDs (produced since 2012) already include this information, it will be a matter of time, until sufficient data is available in relation to thermal insulation products (through new EPDs), to have a more effective insight into the possible effect of service life on life-cycle environmental impacts, financial costs and comfort of the building. For this reason, no implementing measure is proposed that is directly related to this issue. To speed up data collection, EPDs for thermal insulation (and other construction) products could/should be made mandatory. As is the case for many other (environmental) issues related to this Ecodesign study, we would recommend making EPDs mandatory. Based on discussions during the stakeholder meeting, we know that most producers and federations would not be against such a measure.
TABLE OF CONTENTS

Distribution List
Summary
Table of Contents
List of Figures
List of Tables
List of Acronyms

CHAPTER 1  PREFACE

CHAPTER 2  INTRODUCTION

CHAPTER 3  MEErP TASK 0 - QUICKSCAN

3.1.  Introduction
    3.1.1.  Ecodesign directive
    3.1.2.  Goals and structure of Quickscan

3.2.  Product group categorization and definitions
    3.2.1.  Defining thermal insulation products for buildings
    3.2.2.  Categorisation

3.3.  Economic and market analysis
    3.3.1.  Determination of sales and trades of thermal insulation in the European Union
    3.3.2.  Conclusion

3.4.  Analysis on environmental significance
    3.4.1.  Thermal insulation in relation to the entire life cycle of the building
    3.4.2.  Thermal insulation in relation to energy efficiency during the use phase
    3.4.3.  Thermal insulation in relation to production, end-of-life and recovery phase
    3.4.4.  Thermal insulation in relation to indoor air quality during the use phase
    3.4.5.  Conclusion

3.5.  Analysis on environmental improvement potential

3.6.  Conclusions

CHAPTER 4  MEErP TASK 1 - SCOPE

4.1.  Introduction

4.2.  Product scope
    4.2.1.  Definition of the product scope
    4.2.2.  Categorisation of insulation materials
    4.2.3.  Definition of preliminary product scope, including preliminary product definitions

4.3.  Overview and description of test standards
    4.3.1.  Background information on European and International standardization bodies
    4.3.2.  Description of different standards

2013/TEM/R/38
VII
4.3.3. A comparative analysis for overlapping test standards on performance, resources use and/or emissions .......................... 82
4.3.4. Analysis and reporting on new test standards, problems and differences covering the same subject ................................................. 86

4.4. Overview and description of legislation ........................................ 88
4.4.1. EU legislation (legislation on resources use and environmental impact, EU voluntary agreements, labels) ........................................ 88
4.4.2. Member State legislation (as above, for legislation indicated as relevant by Member States), including a comparative analysis ................ 110
4.4.3. Third country legislation, including a comparative analysis .............. 120
4.4.4. Summary of Legislation .................................................................. 124

CHAPTER 5 MEErP TASK 7 – SCENARIOS (PARTLY) .............................................. 126

5.1. Introduction ...................................................................................... 126
5.2. Type of possible requirements .......................................................... 126
5.2.1. Potential requirements in the scope of the Labelling Directive ......... 127
5.2.2. Potential requirements in the scope of the Ecodesign Directive .......... 128
5.2.3. Other policy options ..................................................................... 137
5.3. Rough estimate of the improvement potential attributable to the policy instruments recommended ................................................. 137
5.4. Sensitivity analysis for the improvement potential ................................ 137

CHAPTER 6 CONCLUSIONS ........................................................................... 138

References .............................................................................................. 141

Annex A – Minutes of the stakeholder meeting ....................................... 145
Annex B – Questions for stakeholders ...................................................... 164
Annex C – Stakeholder comments ............................................................. 168
LIST OF FIGURES

Figure 1: Temperature gradient in insulated wall __________________________________________ 1
Figure 2: MEER structure ____________________________________________________________ 4
Figure 3: Illustration of in-situ insulation material (cellulose) (left) and factory made insulation material (mineral wool) (right) ________________________________________ 12
Figure 4: Three types of ErP (VHK, 2011) ______________________________________________ 13
Figure 5: Systemic overview of thermal insulation application levels ________________________ 15
Figure 6: The global warming impact of insulation, relative to other construction materials and operational energy demand within the life cycle assessment of a number of French house designs, modelling improved thermal performance levels with increased insulation in 2 climatic locations (according to PE NWE, 2011) ________________________________ 21
Figure 7: Primary energy and some environmental indicators of new residential buildings in EU-25, over a life span of 40 year (Nemry and Uihlein, 2008) ___________________________ 22
Figure 8: Contribution to total primary energy in the use phase of the individual elements according to zone and building group, (Nemry and Uihlein, 2008) ___________________________ 23
Figure 9: Primary Energy from Manufacture, Transport and End of Life, compared to the Benefits of Insulation per m² of insulation (PE NWE, 2011) ________________________________ 24
Figure 10: The energy balance throughout the total life cycle of plastics insulation boards applied on external walls in Europe in 2004 to increase insulation standards (Pilz and Mátra, 2006) __ 25
Figure 11: Primary energy and some environmental indicators of existing residential buildings in the EU-25, over a life span of 40 years (Nemry and Uihlein, 2008) ___________________________ 26
Figure 12: Typical non-renewable embodied energy of the (massive) building envelope of a representative Belgian zero-energy dwelling based on two thermal insulation scenarios: i.e. meeting Belgian energy regulations applicable from 2014 (GSM-right) and meeting the passive house standard (GPM-left), according to their functional composition (Himpe and Trappers, 2011) ___________________________________________ 28
Figure 13: Life cycle environmental impacts of building materials by material type for net-zero energy building (from Thiel et al., 2013) ____________________________________________ 29
Figure 14: Normalised environmental impacts for 1 m² façade with EPS external wall insulation, with an U-value of 0,234 W/m².K ______________________________________ 34
Figure 15: Comparison normalised environmental impacts for 1m² façade using EPS external wall insulation ________________________________________________________________ 36
Figure 16: Comparison normalised environmental impacts for 1m² façade using PUR external wall insulation _____________________________________________________________ 36
Figure 17: Comparison normalised environmental impacts for 1m² façade using glass wool external wall insulation ________________________________________________________________ 37
Figure 18: Average normalised impacts of different insulation product groups on basis of common functionality (thermal resistance of 3 W/m².K) (PE North West Europe, 2011) __________ 38
Figure 19: Relative manufacturing, transport and disposal impacts of insulation products, compared per unit of thermal resistance (W/m².K) (PE North West Europe, 2011) __________ 39
Figure 20: Comparison of the environmental impacts associated with 9 stone wool products with a French FDES, compared on the basis of common thermal resistance (PE NWE, 2011) _______ 40
Figure 21: Composition of building layers for a reference and dynamic renovation alternative, based on Paduart (2012) _______________________________________________ 42
Figure 22: Reduction in life cycle environmental impacts of a representative elderly care home per net floor area (m²) x year (service life of 60 years) through some improvement options, from Annemans et al. (2012) ___________________________________________ 43
Figure 23: Effect of improved thermal insulation on energy consumption of buildings with central heating -Reference and improvement scenario, from VHK (2011) _________________ 48
List of Figures

Figure 24: Estimations for global (not only EU) final energy use for heating and cooling (GEA, 2012) ................................................. 49
Figure 25: Examples of the most common applications of thermal-insulation products in buildings (according to ISO/FDIS 9774) - sketches ............................................. 54
Figure 26: Consideration of energy/eco labels (EU and beyond) and GPP (VHK, 2011) ............................................................. 59
Figure 27: LCA Based information in an EPD (EN 15804) ................................................................. 84
Figure 28: Overview of the impact categories and assessment methods according to EN 15804 and PEF ................................................................. 85
Figure 29: Consideration of other relevant community policies ........................................................................ 88
Figure 30: Waste treatment hierarchy (VHK, 2011) ............................................................................. 102
Figure 31: Example of an energy label of a refrigerator ........................................................................ 104
Figure 32: Summary of building energy code requirements and prescriptive criteria ................................................. 113
Figure 33: Legend for Figure 32 ......................................................................................................................... 114
Figure 34: Performance-based requirements for new buildings (part a) ......................................................... 116
Figure 35: Performance-based requirements for new buildings (part b) ......................................................... 117
Figure 36: Building envelope insulation requirements (BPIE, 2011) ........................................................................ 118
Figure 37: Blue Angel label ......................................................................................................................... 119
Figure 38: Energy Star label ......................................................................................................................... 121
Figure 39: Good Environmental Choice Australia label ........................................................................ 121
Figure 40: Environmental Choice New Zealand label .................................................................................. 122
Figure 41: Ecologo label ............................................................................................................................. 123
Figure 42: Reference service life data to be included according to the EN 15804 ........................................... 136
LIST OF TABLES

Table 1: Overview of insulation product families, based on their origin and form 11
Table 2: Overview of insulation product families based on their origin and type of manufacturing 11
Table 3: Annual sales in 2009 – 2011 of (thermal) insulation, expressed in kg per product, according to Prodcom statistics 18
Table 4: European market shares in 2008 of different types of thermal insulation for buildings, expressed in percentages, based on (VHK, 2011) 19
Table 5: Annual amount of new buildings in five EU countries, based on (PE NWE, 2011) 19
Table 6: Estimated environmental impact associated with the European insulation industry in 2007 according to PE NWE (2011) 31
Table 7: Environmental gains/losses of dynamic renovation alternative compared to reference renovation of a multi-storey social housing block, based on Paduart (2012)* 42
Table 8: Indicated improvement of operational energy demand by applying insulation products 48
Table 9: PRODCOM categorization for insulation materials 52
Table 10: Examples of the most common applications of thermal-insulation products in buildings (according to ISO/FDIS 9774) 53
Table 11: Summary of key obligations under the EU Ozone regulation (Department for Environment, Food and Rural Affairs (GB), 2012) 99
Table 12: Summary of key obligations under the EU F-gas regulation (Department for Environment, Food and Rural Affairs (GB), 2012) 100
Table 13: Requirements on life cycle parameters included in existing legislation 125
## LIST OF ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADP</td>
<td>Acidification Potential</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>avg</td>
<td>Average</td>
</tr>
<tr>
<td>BAT</td>
<td>Best Available Technology</td>
</tr>
<tr>
<td>BAU</td>
<td>Business As Usual</td>
</tr>
<tr>
<td>BEE</td>
<td>Bureau of Energy Efficiency</td>
</tr>
<tr>
<td>BEEP</td>
<td>Building Energy Efficiency Policies</td>
</tr>
<tr>
<td>BNAT</td>
<td>Best Not yet Available Technology</td>
</tr>
<tr>
<td>BoD</td>
<td>total burden of disease</td>
</tr>
<tr>
<td>BOM</td>
<td>Bill of Materials</td>
</tr>
<tr>
<td>BWR</td>
<td>Basic Work Requirement</td>
</tr>
<tr>
<td>CA</td>
<td>Concerted Action</td>
</tr>
<tr>
<td>C&amp;D</td>
<td>Construction and Demolition</td>
</tr>
<tr>
<td>C&amp;D Waste</td>
<td>Construction and Demolition Waste</td>
</tr>
<tr>
<td>CENELEC</td>
<td>European Committee for Electro technical Standardization</td>
</tr>
<tr>
<td>CEN</td>
<td>European Committee for Normalisation</td>
</tr>
<tr>
<td>CFC</td>
<td>Chloro Fluoro Carbon</td>
</tr>
<tr>
<td>CML</td>
<td>Centre for Environmental Sciences in Leiden (the Netherlands)</td>
</tr>
<tr>
<td>CPD</td>
<td>Construction Products Directive</td>
</tr>
<tr>
<td>CPR</td>
<td>Construction Products Regulation</td>
</tr>
<tr>
<td>CTUe</td>
<td>Comparative Toxic Unit - environment</td>
</tr>
<tr>
<td>CTUh</td>
<td>Comparative Toxic Unit – human health</td>
</tr>
<tr>
<td>DfD</td>
<td>Design for Disassembly</td>
</tr>
<tr>
<td>DOE</td>
<td>US Department of Energy</td>
</tr>
<tr>
<td>DoP</td>
<td>Declaration of Performance</td>
</tr>
<tr>
<td>EAD</td>
<td>European Assessment Document</td>
</tr>
<tr>
<td>EN</td>
<td>European Norm</td>
</tr>
<tr>
<td>EOL</td>
<td>End Of Life</td>
</tr>
<tr>
<td>EOTA</td>
<td>European Organisation for Technical Assessment in the area of construction products</td>
</tr>
<tr>
<td>EP</td>
<td>Eutrophication Potential</td>
</tr>
<tr>
<td>EPD</td>
<td>Environmental Product Declaration</td>
</tr>
<tr>
<td>EPS</td>
<td>Expanded Polystyrene</td>
</tr>
<tr>
<td>ESL</td>
<td>Estimated Service Life</td>
</tr>
<tr>
<td>ESM</td>
<td>European Single Market</td>
</tr>
<tr>
<td>ETAG</td>
<td>European Technical Approval Guidelines</td>
</tr>
<tr>
<td>ETICS</td>
<td>External thermal insulation composite systems'</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>EuP</td>
<td>Energy using Products</td>
</tr>
<tr>
<td>ErP</td>
<td>Energy related Products</td>
</tr>
<tr>
<td>ETA</td>
<td>European Technical Assessment Standard</td>
</tr>
<tr>
<td>ETICS</td>
<td>External Thermal Insulation Composite System</td>
</tr>
<tr>
<td>ETSI</td>
<td>European Telecommunications Standards Institute</td>
</tr>
<tr>
<td>FDES</td>
<td>Fiches de Déclaration Environnementale et Sanitaire (from the French EPD system)</td>
</tr>
<tr>
<td>GUA</td>
<td>Gesellschaft für umfassende Analysen (Corporation for Comprehensive Analyses)</td>
</tr>
<tr>
<td>GWP</td>
<td>Global Warming Potential</td>
</tr>
<tr>
<td>HD</td>
<td>Harmonization Document</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>hEN</td>
<td>Harmonized European Product Standard</td>
</tr>
<tr>
<td>HM</td>
<td>Heavy Metals</td>
</tr>
<tr>
<td>IAQ</td>
<td>Indoor Air Quality</td>
</tr>
<tr>
<td>IEE</td>
<td>Intelligent Energy Europe</td>
</tr>
<tr>
<td>IEEA</td>
<td>Intelligent Energy Executive Agency</td>
</tr>
<tr>
<td>JRC</td>
<td>Joint Research Centre</td>
</tr>
<tr>
<td>k</td>
<td>Kilo ($10^3$)</td>
</tr>
<tr>
<td>LCA</td>
<td>Life Cycle Assessment</td>
</tr>
<tr>
<td>LCC</td>
<td>Life Cycle Cost</td>
</tr>
<tr>
<td>LCEA</td>
<td>Life Cycle Energy Analysis</td>
</tr>
<tr>
<td>MEErP</td>
<td>Methodology for Ecodesign of Energy related Products</td>
</tr>
<tr>
<td>MEEuP</td>
<td>Methodology for Ecodesign of Energy using Products</td>
</tr>
<tr>
<td>MEPS</td>
<td>Minimum Energy Performance Standard</td>
</tr>
<tr>
<td>MS</td>
<td>Member State</td>
</tr>
<tr>
<td>NEEAP</td>
<td>National Energy Efficiency Action Plan</td>
</tr>
<tr>
<td>NMVOC</td>
<td>Non Methane Volatile Organic Compound</td>
</tr>
<tr>
<td>NIEHS</td>
<td>National Institute of Environmental Health Sciences</td>
</tr>
<tr>
<td>NRE</td>
<td>Non Residential</td>
</tr>
<tr>
<td>NZEB</td>
<td>Nearly Zero Energy Building</td>
</tr>
<tr>
<td>ODP</td>
<td>Ozone Depletion Potential</td>
</tr>
<tr>
<td>ODS</td>
<td>Ozone Depleting Substance</td>
</tr>
<tr>
<td>OEF</td>
<td>Organisational Environmental Footprint</td>
</tr>
<tr>
<td>PEF</td>
<td>Product Environmental Footprint</td>
</tr>
<tr>
<td>PEFCRs</td>
<td>Product Environmental Footprint Category Rules</td>
</tr>
<tr>
<td>PM</td>
<td>Particulate Matter</td>
</tr>
<tr>
<td>POP</td>
<td>Persistent Organic Pollutants</td>
</tr>
<tr>
<td>POCP</td>
<td>Photochemical Oxidant Creation Potential</td>
</tr>
<tr>
<td>PRODCOM</td>
<td>PRODuction COMmunauteire - Community Production</td>
</tr>
<tr>
<td>REMODECE</td>
<td>Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe</td>
</tr>
<tr>
<td>RES</td>
<td>Renewable Energy Sources</td>
</tr>
<tr>
<td>RSL</td>
<td>Reference Service Lifespan</td>
</tr>
<tr>
<td>RoHS</td>
<td>Restriction of the use of certain Hazardous Substances in electrical and electronic equipment</td>
</tr>
<tr>
<td>SBR</td>
<td>Stichting Bouw Research (in the Netherlands)</td>
</tr>
<tr>
<td>CI/SfB</td>
<td>Construction Index/Samarbetskommitten for Byggnadsfrago</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium sized Enterprise</td>
</tr>
<tr>
<td>TC</td>
<td>Technical Committee</td>
</tr>
<tr>
<td>TCO</td>
<td>Total Cost of Ownership</td>
</tr>
<tr>
<td>TOC</td>
<td>Total Operational Cost</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>TR</td>
<td>Technical Report</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>VITO</td>
<td>Flemish Institute for Technological Research</td>
</tr>
<tr>
<td>VOC</td>
<td>Volatile Organic Compounds</td>
</tr>
<tr>
<td>WIKUE</td>
<td>Wuppertal Institute for Climate, Environment and Energy</td>
</tr>
<tr>
<td>WBCSD</td>
<td>World Business Council for Sustainable Development</td>
</tr>
<tr>
<td>WRI</td>
<td>World Resource Institute/</td>
</tr>
<tr>
<td>XPS</td>
<td>Extruded Polystyrene</td>
</tr>
</tbody>
</table>
The present report was prepared by the Flemish Institute for Technological Research (VITO) in association with the Wuppertal Institute for Climate, Environment and Energy (WIKUE), as members of the consortium, under the Multiple Framework Contract relating to preparatory studies and related technical assistance on specific product groups (ENER/C3/2012-418-Lot 1), and in response to the Terms of Reference included in the Contract No. SI2.652413 "Exploratory study with regard to Ecodesign of thermal insulation in buildings: MEerP tasks 0, 1 and 7 (partly)".

Sustainable industrial policy aims in particular at developing a policy to foster environmental and energy efficient products within the European Single Market (ESM). The Ecodesign Directive 2009/125/EC forms the cornerstone of this approach. It establishes a framework for the setting of Ecodesign requirements for energy-related products (ErPs), with the aim of ensuring the free movement of those products within the internal market. Directive 2009/125/EC repealed the original Directive 2005/32/EC for the setting of Ecodesign requirements for energy-using products only.

ErPs account for a large proportion of the consumption of energy and natural resources in the Community and have a number of other environmental impacts. It is in the public interest to encourage the continuous improvement of the overall impact of those products by identifying the major sources of adverse energy and environmental impacts without entailing excessive costs (European Commission, 2012). By optimising the environmental and energy performance of products while maintaining their functional qualities, the Directive is meant to provide new opportunities for manufacturers, consumers and society as a whole.

According to Article 16(1) of the Ecodesign Directive, the Commission adopted on 7 December 2012 a Working Plan for the period 2012-2014, setting out an indicative list of energy-related products which will be considered for the adoption of implementing measures for the following three years. The Commission established an indicative list of twelve broad product groups to be considered between 2012 and 2014 for the adoption of implementing measures. According to the principle of better regulation, preparatory studies will collect evidence, explore all policy options and recommend the best policy mix (Ecodesign and/or labelling and/or self-regulation measures), if any, to be deployed on the basis of the evidence and stakeholder input. For some of the identified product groups, there is the possibility that overlaps may exist with a number of on-going preparatory studies and regulations due for review. This is the reason why the list of product groups to be considered was split into a priority list and a conditional list.

Thermal insulation products for buildings are on the list of conditional product groups, in relation to which the launching of a preparatory study will be dependent on the outcome of on-going regulatory processes and/or reviews.

The Methodology for the Ecodesign of Energy-related Products (MEerP) was developed in 2012 to contribute to the creation of a methodology allowing an evaluation as to whether and to what extent various energy-related products fulfil certain criteria that make them eligible for implementing measures under the Ecodesign Directive 2005/32/EC.
Against this background, the objective of the underlying study is to give the Commission sufficient information so that it can decide whether the conditions have been met for the product group of thermal insulation products in buildings to be moved from the conditional to the priority list in the Ecodesign Working Plan 2012 – 2014.

The study was carried out within the scope of three tasks specified in the tender specifications and included public stakeholder involvement:

1. Task 0 of the MEerP methodology – Quickscan;
2. Task 1 of the MEerP methodology – Scope;
3. Parts of task 7 of the MEerP methodology – Scenarios (partly).

The public stakeholder consultation took place in Brussels on 1 October 2013. The draft report had been circulated to the stakeholders a few weeks in advance, together with some questions which the project team wanted to discuss during the stakeholder meeting. The minutes of the stakeholder meeting are available in Annex A, the circulated questions are listed in Annex B. Responses to the questions received during the stakeholder meeting form part of Annex A. After the stakeholder meeting there was also an opportunity to provide written feedback (until November 1\textsuperscript{st}). Annex C provides an overview of the feedback received.
CHAPTER 2  INTRODUCTION

According to Article 16(1) of the Ecodesign Directive, the Commission adopted on 7 December 2012 a Working Plan for the period 2012-2014, setting out an indicative list of energy-using products which will be considered in priority for the adoption of implementing measures. “Thermal insulation products for buildings” is included in the list of conditional product groups, in relation to which the launching of a preparatory study will be dependent on the outcome of ongoing regulatory processes and/or reviews.

The goal of this study is to provide sufficient information so that the Commission can decide whether the conditions have been met for the product group of insulation materials to be moved from the conditional to the priority list.

**Thermal insulation of buildings**

*How does insulation work in a building?*

Heat flows naturally from a warmer to a cooler space. In winter, the heat moves directly from all heated living spaces to the outdoors and to adjacent unheated attics, garages, and basements - wherever there is a difference in temperature. During the summer, heat moves from outdoors to the house interior. To maintain comfort, the heat lost in winter must be replaced by the heating system and the heat gained in summer must be removed by the air conditioner. Insulating ceilings, walls, and floors decreases the heating or cooling needed by providing an effective resistance to the flow of heat.

![Figure 1: Temperature gradient in insulated wall](image)

---

The insulation traps pockets of air which slows down the transfer of heat from one area to another. The material which makes up the insulation also slows down the transfer of heat. This slowing down is called resistance, hence the measurement of insulation, R-values. Some types of insulation do act as an air barrier (and some can even act as a moisture barrier); however this is not always the case.

Bulk insulation works by trapping dry air in lightweight, bulky materials. Still air is a poor conductor of heat, so bulky materials that can trap large amounts of air can reduce the ability for heat to be transferred by conduction. If a material consists of many small pockets of trapped air rather than a large, contiguous volume of air, the ability to transfer heat by convection is also reduced. Bulk insulating materials such as wool, polyester, glass wool and foam boards acquire their insulating capacity by trapping air and reducing the speed of heat transfer.

Reflective insulation, often called foil insulation, can typically be installed under timber suspended floors where it is draped over the joists before the flooring is installed to create still air zones between joists. Reflective insulation, acquires its insulation performance by reducing radiant heat transfer through the building envelope. It has no inherent R-value and is not an insulating material in its own right. The insulation is successfully installed when a still air space is seldom achieved between the foil and the underside of the flooring. The foil also loses reflectivity (as a result of dirt accumulation and tarnishing) and therefore loses efficiency.

In addition to factory made thermal insulation materials (produced in the factory and installed in the building), in-situ foams are also used in building (produced on site). They are produced with state-of-the-art equipment "in-situ” on the building site itself. In-situ foams are mainly used for technical insulation applications. The in-situ foam is sprayed onto the desired surface or poured into moulds, producing a seamless structure. Application of these types of insulation materials, such as rigid polyurethane foam (PUR/PIR), requires careful handling of reactive ingredients and must be carried out in accordance with manufacturer’s instructions.

What is an R-Value?

Insulation is rated in terms of thermal resistance, known as the R-value, which indicates the resistance to heat flow. The higher the R-value, the greater the insulating effectiveness. The R-value of thermal insulation depends on the material’s thermal conductivity, its thickness and its density and is expressed in m²K/W.

\[ R = \frac{d}{\lambda} \]

In this formula, d represents the thickness of the insulation layer and \( \lambda \) represents the material’s thermal conductivity.

In calculating the R-value of a multi-layered installation, the R-values of the individual layers are added. The effectiveness of an insulated ceiling, wall or floor depends on how and where the insulation is installed.

What is a U-Value?

A U value is a measure of heat loss through a building element such as a wall, floor or roof. It can also be referred to as an ‘overall heat transfer co-efficient’ and measures how well parts of a
building transfer heat. This means that the higher the U value the worse the thermal performance of the building envelope. A low U value usually indicates high levels of insulation. They are useful as it is a way of predicting the composite behaviour of an entire building element rather than relying on the properties of individual materials.

What is an λ-Value?

The λ-value represents the thermal conductivity of a material and is expressed in W/(m.K). The lower the λ-value, the better the insulation capacity of a material. The thermal conductivity of materials can be influenced by the moisture content, the density, the age and the environment temperature in which the material is applied.

What is a thermal bridge or a cold bridge?

A thermal bridge, also called a cold bridge, is a fundamental of heat transfer, in which a penetration of the insulation layer by a highly conductive or non-insulating material takes place in the separation between the interior (or conditioned space) and exterior environments of a building assembly (also known as the building enclosure, building envelope, or thermal envelope). Thermal bridging is created when materials that are poor thermal insulators come into contact, allowing heat to flow through the path of least thermal resistance (R-value; or a material’s effectiveness in resisting the conduction of heat) created, although nearby layers of material separated by airspace allow little heat transfer. Insulation around a bridge is of little help in preventing heat loss or gain due to thermal bridging; the bridging has to be eliminated, rebuilt with a reduced cross-section or with materials that have better insulating properties, or with a section of material with low thermal conductivity installed between metal components to retard the passage of heat through a wall or window assembly, called a thermal break.

Methodology for Ecodesign of Energy-related Products (MEErP)

Over the past 5 years, MEEuP 2005 (Methodology for Energy-using Products version 2005) has proven to be an effective methodology for Ecodesign preparatory studies. The new MEErP 2011 can and should now focus more on the ‘how’ instead of on the ‘why’.

This is the key message from stakeholders following a questionnaire reported in the MEErP 2011 Project Report. The MEErP 2011 Methodology Report is therefore about maintaining the qualities of the former MEEuP methodology, extending the scope from energy-using products to energy-related products and providing more guidance to analysts and stakeholders involved in the Ecodesign preparatory studies.

The design of the methodology in the former MEEuP 2005 was enshrined in Directive 2005/32/EC on Ecodesign of Energy-using Products. For the new methodology MEErP 2011, it is proposed to follow the same route with the recast Directive 2009/125/EC on Ecodesign of Energy-related Products (hereafter ‘Ecodesign directive’).

More specifically, the MEErP tasks entail (see Figure 2):
- Task 1 – Scope (definitions, standards and legislation);
- Task 2 – Markets (volumes and prices);
- Task 3 – Users (product demand side);
- Task 4 – Technologies (product supply side, includes both BAT and BNAT);
- Task 5 – Environment & Economics (Base case LCA & LCC);
Task 6 – Design options;  
Task 7 – Scenarios (Policy, scenario, impact and sensitivity analysis).

Tasks 1 to 4 can be performed in parallel, whereas 5, 6 and 7 are sequential (see Figure 2).

The MEErP structure makes a clear split between:

- Tasks 1 to 4 (product definitions, standards and legislation; economic and market analysis; consumer behaviour and local infrastructure; technical analysis) that have a clear focus on data retrieval and initial analysis;
- Tasks 5 (assessment of base case), 6 (improvement potential) and 7 (policy, scenario, impact and sensitivity analysis) with a clear focus on modelling.

![Figure 2: MEErP structure](image)

The subject of this specific contract is a study to:

1. Screen the environmental improvement potential of thermal insulation in buildings (MEErP task 0 – Quickscan);
2. Define the product groups and the product systems involved, and map existing legislation and standards (MEErP task 1 – Scope);
3. Assess the extent to which measures under the Ecodesign and energy labelling directives could, if at all, contribute to the achievement of the improvement potential, taking into account the other existing policies (parts of MEER task 7 – Scenarios).

The overall aim of the study is to give the Commission a view to decide whether the conditions have been met for the product group to be moved from the conditional to the priority list in the Ecodesign Working Plan 2012 – 2014.
3.1. INTRODUCTION

This chapter provides an overview of the Quickscan, in order to gain an insight into the economic and environmental importance of thermal insulation products and to define potential environmental improvement actions. The results of the Quickscan will identify the most relevant issues with regard to determining whether thermal insulation products should be included under the “priority list” of products covered by the Second Working Plan on Ecodesign.

This first product screening is mainly based on:


- VHK (2011), Study on Amended Working Plan under the Ecodesign Directive: Final Report, commissioned by the European Commission, version 16 December 2011. This study identifies thermal insulation for buildings as the single most important energy-related product group when it comes to making energy savings in buildings.


- Nemry F., Uihlein A. (2008), Environmental Improvement Potentials of Residential Buildings (IMPRO-Building), Joint Research Centre – Institute for Prospective Technological Studies (European Commission), Luxembourg: Office for Official Publications of the European Communities. This public initiative provides an insight into the environmental profile and improvement potential of the European dwelling stock.

Additionally, consultations with the following parties resulted in further input for this study:

- The European Insulation Platform (EIP), as an umbrella organisation of:
  - Mineral Wool (EURIMA);
  - Expanded Polystyrene (EUMEPS);
  - Extruded Polystyrene Boards (EXIBA);
  - Rigid Polyurethane Foams (PU Europe).

- The European Technical Committee for Standardisation on Thermal Insulating materials and products (CEN/TC 88). CEN/TC 88 develops European Standards in the field of thermal insulation materials and products for application in buildings, including insulation for installed equipment and for industrial insulation.
3.1.1. ECODESIGN DIRECTIVE

In order to combine environmental and energy efficient products for a European market, the Ecodesign Directives 2005/32/EC and 2009/125/EC establish a framework for the setting of Ecodesign directives for energy-using and energy-related products respectively, with the aim of achieving the free movement of those products within the ESM. Both directives are not binding, but provide rules and criteria for the setting of product (or product system) requirements by means of implementing measures. Such implementing measures are prepared by the European Commission only for products that fulfill three important conditions.

According to paragraph 2 of Article 15 of Ecodesign Directive 2009/125/EC, energy-related products such as thermal insulation are required to (EU 2009):

1. represent a significant volume of sales and trade, indicatively more than 200,000 units a year within the Community, according to the most recently available figures;
2. have a significant environmental impact within the Community – as specified in the Community strategic priorities as set out in Decision No 1600/2002/EC – considering the quantities placed on the marker and/or put into service;
3. present significant potential for improvement in terms of their environmental impact without entailing excessive costs, taking into account in particular:
   i. the absence of other relevant Community legislation or the failure of market forces to address the issue properly; and
   ii. a wide disparity in the environmental performance of products available on the market with equivalent functionality.

These three criteria will be addressed in the Quickscan as guiding principles in order to determine whether insulation products should be included under the “priority list” of products covered by the Second Working Plan on Ecodesign.

In addition, the Ecodesign directive 2009/125/EC demands to consider the (entire) life cycle of the product and all its significant environmental aspects (including energy efficiency during the use phase of the product) (article 15, paragraph 4, item (a)). Furthermore, implementing measures shall meet the following criteria (article 15, paragraph 5):

a) There shall be no significant negative impact on the functionality of the product, from the perspective of the user;
b) Health, safety and the environment shall not be adversely affected;
c) There shall be no significant negative impact on consumers in particular as regards the affordability and the life cycle cost of the product;
d) There shall be no significant negative impact on the competitiveness of the industry;
e) In principle, the setting of an Ecodesign requirement shall not have the consequence of imposing proprietary technology on manufacturers; and
f) No excessive administrative burden shall be imposed upon manufacturers.

3.1.2. GOALS AND STRUCTURE OF QUICKSCAN

This preparatory study on “thermal insulation materials” follows from the request for services ENER/C3/2012-418 LOT1/02. The scope of the Quickscan is defined as follows:

“... This initial screening should be carried out on the basis of the structure of materials established by CEN TC88 in harmonized standards for thermal insulation products. It should not yet apply the life-cycle analysis methodology in MEErP, but rather be based on available evidence from previous
studies and other sources, including from European standards for environmental product declarations developed by CEN TC350 in existing assessment schemes. The objective is to re-group or narrow the product scope, as appropriate, from an Ecodesign point of view, for the subsequent analysis.”

It does so by gathering initial data for the study tasks in order to allow scrutiny against the Article 15 criteria of the Ecodesign Directive 2009/125/EC. Accordingly, the structure of the Quickscan is based on the three major criteria in Article 15, paragraph 2, as explained in section 3.1.1.

Based on the conclusions of the Quickscan a detailed scope and improvement potential of the most important thermal insulation products groups will be elaborated.

3.2. PRODUCT GROUP CATEGORIZATION AND DEFINITIONS

3.2.1. DEFINING THERMAL INSULATION PRODUCTS FOR BUILDINGS

The product group 'thermal insulation products for buildings' is considered by many as one of the key energy-related products. The product group was mentioned in recital (4) of the 2009/125/EC Ecodesign Directive as an example of an energy related product with high energy saving potential ('insulation materials') (VHK, 2011).

Thermal insulation products are applied in building envelope components (e.g. floor, wall and roof) that separate indoor from outdoor or to separate zones with different thermal regimes. The insulation materials are applied in the form of rolls, batts, boards or slabs, or as (spray) foams, beads or fibres that can fill oddly shaped cavities (often applied in 'in-situ' insulation), but may also be integrated in prefabricated products used for such components (floor, wall or roof panels). Based on ISO 9229, thermal insulation products for buildings are defined as:

“... factory made products in the form of rolls, bats, boards or slabs, with or without facings, or 'in-situ’ applied materials, which have a primary function to reduce heat transfer through the structure against which, or in which, it is installed. Products covered by this definition may also be used in prefabricated thermal insulation systems and composite panels.”

Numerical limits can be set only when the specific application is defined. Nevertheless, based on existing European standards (EN13162 to EN13171), insulation materials typically have a declared thermal resistance higher than 0.15 m².K/W or a declared thermal conductivity lower than 0.10 W/(m.K) at a measuring temperature of 10 °C. The values for thermal resistance in the different standards differ for the different insulation products. The above given definition is however valid for all the insulation products in the mentioned standards.

Excluded from this assessment are building materials (or components) of which the material that is responsible for a thermal performance is the same material that also provides other primary functions such as structural integrity (e.g. lightweight concrete, certain gypsum building blocks, and even straw bale construction could be mentioned here). For those products another Ecodesign study would apply, tackling all primary functions of the materials and their consequences on the definition of potential Ecodesign measures. Special attention will have to go towards the definition of a functional unit that takes into account all primary functions or the definition of multiple ones covering the functions separately.
Also excluded from this assessment are thermal insulation products intended to be used for the insulation of equipment and industrial installations, since the application and operating conditions of these 'equipment and installation' insulating products may be very different from the application as thermal insulation product for buildings, although in many cases the same materials may be used. For the use of thermal insulation in building equipment reference is made to the corresponding MEEuP studies:

- Gas and oil-fired central heating boilers (ENER Lot 1);
- Water heaters (ENER Lot 2);
- Solid fuel boilers (ENER Lot 15);
- Residential and non-residential ventilation systems (ENER Lot 10 and ENTR Lot 6);
- Central heating products using hot air to distribute (ENER Lot 21).

Thermal insulation for piping (e.g. for hot water distribution) and edges (e.g. to avoid thermal bridges between floor slab and foundation) are included in this assessment study. Most of these thermal insulation products are available separately and made of the same materials as for surface insulation.

Reflective foils\(^4\) or the use of light-coloured materials/finishing are not considered as “insulation” solutions, rather solutions to prevent “heat absorption” through the building skin. Consequently, these products are out of the scope of the study. Furthermore, overheating needs to be considered at a building level, since it is influenced by many parameters: windows (surface, transmittance), thermal capacity, location of the insulation material in the wall, etc.

3.2.2. Categorisation

Classification on product level

Based on PE NWE (2011), VHK (2011) suggests to group thermal insulation products for buildings according to the origin of basic materials (oil-based, mineral-based or biomass-based) and form (fibre, foam or other). This provides a good basis to establish the market and sales shares of different thermal insulation product families (see paragraph 3.3).

Feedback from CEN/TC88\(^5\) resulted in the addition of a third categorisation layer, i.e. manufacturing type (factory-made or on-site). Furthermore, it suggests using material or product names in accordance with the working group list of CEN/TC88. Nevertheless, other insulation materials and products presently not covered by CEN/TC88 have been added to the survey. Table 1 and Table 2 give an overview of categorisation of insulation products on material level. Due to the vast amount of possible combinations of insulation materials and other materials such as binders and foils, these differentiations have not been included in the product groups.

This double framework is used to investigate the market and sales shares of thermal insulation products for buildings (see section 3.3).

\(^4\) Reflective (foil) insulation is included in this study, as it is not only relates to overheating.

\(^5\) Communication with Roger De Block (CEN/TC88), on July 2\(^{nd}\) and 3\(^{rd}\) 2013
Table 1: Overview of insulation product families, based on their origin and form

<table>
<thead>
<tr>
<th>Origin Form</th>
<th>Oil-based</th>
<th>Mineral-based</th>
<th>Biomass-based</th>
<th>Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibre</td>
<td>Polyester fibre Other plastic fibre</td>
<td>Glass wool Stone wool Slag wool</td>
<td>Wood fibre Wood wool Cellulose Cotton Flax Hemp Sheep wool</td>
<td></td>
</tr>
<tr>
<td>Foam</td>
<td>Expanded polystyrene Extruded polystyrene Polyurethane Polyisocyanurate Phenolic</td>
<td>Expanded perlite Cellular glass Calcium silicate Expanded vermiculite Expanded clay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Polyethylene               Aerogel</td>
<td>Expanded cork Feather Straw 6 Strawboard</td>
<td>Reflective(foil) insulation Vacuum Insulation Panels Expanded polystyrene mortar Hemp lime composite</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Overview of insulation product families based on their origin and type of manufacturing

<table>
<thead>
<tr>
<th>Origin Manufacture</th>
<th>Oil-based</th>
<th>Mineral-based</th>
<th>Biomass-based</th>
<th>Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site</td>
<td>Spray polyurethane Expanded polystyrene beads</td>
<td>Expanded perlite pellets Expanded vermiculite pellets Expanded clay pellets Loosefill glass wool Loosefill stone wool Aerogel</td>
<td>Cellulose, loosefill pellets Feather Straw 7 Cotton, loosefill pellets Hemp, loosefill</td>
<td>Expanded polystyrene mortar</td>
</tr>
<tr>
<td>Factory-made</td>
<td>Rigid cellular polyurethane Rigid cellular polyisocyanurate Rigid cellular phenolic</td>
<td>Prefabricated products of bonded expanded perlite Glass wool Stone wool</td>
<td>Expanded cork boards Wood fibre boards Strawboard Flax Cotton, board</td>
<td>Reflective (foil) insulation Vacuum insulation products Hemp lime composite</td>
</tr>
</tbody>
</table>

6 In case straw is used for straw bale construction, then straw is not only used as thermal insulation but also for (primary) structural reasons. According to the definition on thermal insulation products for buildings, this should then be omitted. Nevertheless, straw is also used in other applications without a primary structural function.

7 In case straw is used for straw bale construction, then straw is not only used as thermal insulation but also for (primary) structural reasons. According to the definition on thermal insulation products for buildings, this should be then omitted. Nevertheless, straw is also used in other applications without a primary structural function.
Because energy performance relates to the entire building – and also the relation between different building elements – the system approach should be fully addressed in the MEErP task 3 (users) for preparatory studies with the MEErP methodology, which is not part of the Terms of Reference (TOR) for this study. The system approach has been included in the context of Task 0, the Quickscan of MEErP in order to possibly re-group or narrow the product scope.

Investigating the influence of thermal insulation on the energy efficiency – and accordingly the environmental performance - of buildings cannot be done on a merely material level. Judging insulation materials on their environmental performance has to be based on their overall performance on building level, taking into account many aspects of their functionality and their influence on the building design and operation, without merely focussing on their impacts in manufacture and disposal, unless these are pertinent to the impact of the building (PE NWE, 2011).

Selecting a particular insulation product often implies the use of additional or auxiliary products, such as battens, adhesives, fixings and vapour control layers. Furthermore the ease of construction and de-construction – and thus the waste or disposal rate – is often related to the design and construction method. For example, a wall element which is pre-assembled in the factory and designed to be easily deconstructed will generally have a lower waste rate (on site) than a wall constructed in-situ and designed and constructed in such a (static) way that replacement or repair of the thermal insulation layer is only possible through demolition of other wall layers.

Thermal insulation is only one layer of the building skin. Although other layers have other primary functions - such as guaranteeing strength, stability and stiffness of the building, enhancing the acoustic behaviour and fire resistance of the building skin, and interior and exterior aesthetics - all building skin components add to the thermal performance of the building. Furthermore thermal bridging is created when materials that are poor thermal insulators come into contact, allowing heat to flow through the path of least thermal resistance (R-value; or a material's effectiveness in resisting the conduction of heat) created, although nearby layers of material separated by airspace.

---

| foam (open or closed cell) | Expanded polystyrene foam | Rigid cellular extruded polystyrene polyester | Cellular glass | Slag wool | Hemp, roll | Wood wool, Cellulose, mat | Sheep wool, roll or bat |

Figure 3: Illustration of in-situ insulation material (cellulose) (left) and factory made insulation material (mineral wool) (right)

→ Classification on system level
allow little heat transfer. Insulation around a bridge is of little help in preventing heat loss or gain due to thermal bridging.

Accordingly, investigating the environmental performance of thermal insulation implies a systemic approach, incorporating the relation of all building skin components. All building skin components and their interrelations play a vital role in the environmental performance of a given building. Therefore all building components need to be specified correctly. The international CI/SfB classification system (CI/SfB stands for Construction Index/Samarbetskommitten for Byggnadsfrågor) is a Scandinavian system of classification originally set up in 1959 and specially designed for the construction sector. This system is now generally used worldwide for any technical and trade literature in the broad construction area.

Furthermore, enhancing the thermal insulation of a building has a direct effect on the choice and dimensioning of technical services, such as space heating, hot water production and ventilation. It has, however, to be stated that for low-energy buildings small heat production appliances are not always available (yet) on the market. (Debacker et al., 2013).

Studying the effect of using thermal insulation and/or enhancing the thermal insulation has to be done on building level.

Considering the below indicated grouping in MEErP of ErP products (see Figure 4) thermal insulation products are an example of an ErP with indirect impact, i.e. they show a close interaction with the “affected energy system” which in this case should be best defined as “buildings”.

To choose a representative functional unit, it should ideally relate to current (and near future) energy performance regulations on building element level. Most thermal insulation manufacturers design their products in line with these regulations, e.g. manufactures can change the composition of the insulation product to achieve a normative thermal resistance that meets dimensional constraints laid by other building skin components.
The definition of a functional and declared unit is further discussed in CHAPTER 4.

In addition to the fact that the implemented measures to be in line with EPBD directives are country-specific, other energy performance constraints are set per building application, i.e. residential and non-residential buildings. Generally, industrial buildings are too case-specific and are therefore looked at separately. Also a distinction has to be made between regulations for new buildings and existing ones.

Furthermore, different thermal constraints are set on the type of the building (skin) element – such as an outer wall, a flat or inclined roof, ceiling or attic, a floor – in relation to the outside environment or zones with another thermal regime. Different thermal insulation solutions are provided for each of them.

The location of the thermal insulation layer gives an indication among others:

- how easily thermal insulation products can be replaced in relation with the other components;
- if and how easily VOC (Volatile Organic Compounds) emissions from thermal insulation products can find a path to the indoor environment (health issues related to VOC are discussed in paragraph 3.4.4).

Therefore a classification based on the relation of thermal insulation products with other building components is important. Justification is based on the following arguments.

According to Dutch information centre SBR (2012) the technical lifespan of typical thermal insulation products for roofs and façades is defined by a broad range: 20-100 years. According to the German Institute for Building, Urban Affairs and Spatial Development BBSR (2011) the range is somewhat different: 40 years to 50 years and higher. Nevertheless, both references indicate that especially for façade solutions some of the surrounding layers, such as structural wall components and exterior finishing, usually have a much longer technical lifespan (Van Steenkiste, 2012). On the other hand interior finishing is characterised by smaller life spans (typically lower than 25 years). These differences in lifespan suggest that besides the location of thermal insulation products in the building element, the ease of replacement is also related to the way they are fixed to surrounding components. If building element layers with different technical lifespans are connected in an irreversible way, e.g. using glue, (strong) mortar or nails, the real service life of the assembly is determined by the component of the smallest life span. This means that environmental and financial burdens related to replacement are in such cases ‘dependant’ of surrounding components. Without design for disassembly (DfD) measures, replacement of thermal insulation products can for example induce a premature replacement of the exterior finishing. Otherwise, replacement of interior finishing (e.g. boarding) glued to the thermal insulation layer will lead to unwanted damage and could have an adverse effect on the energy performance of the building if no repair works are planned.

Further research regarding the lifespan of insulation materials in different applications is desirable.

Based on the above arguments, a simplified categorisation of thermal insulation solutions on system level is shown in Figure 5.

---

According to SBR (2012) and BBSR (2011) the service lifespan of most structural façade components equals the lifespan of the building

According to SBR (2012) most exterior finishing in the Netherlands exceeds 75 years
Figure 5: Systemic overview of thermal insulation application levels
This overview – or a part of it – is used to investigate the significance of the environmental impact of thermal insulation for buildings. Classification of thermal insulation solutions is done on 5 levels:

1. their application in new buildings, refurbishment of existing buildings or combined (level “building period”);
2. their application for residential, non-residential means or combined (level “building application”);
3. their application in a particular building element: wall, floor, roof, ceiling to attic and/or other (level “element application”);
4. the location of the thermal insulation product in the building element (outer side, inner side, inside) and way of connecting to other components (level “relation to other components”);
5. the thermal insulation product(s) used within the thermal solution: see Table 1 and Table 2 (level “thermal insulation product”).

The application of building materials should always be assessed regarding their fitness for use. The technical characteristics, durability and financial aspects of building materials should all be considered given the application they will be used for.

Thermal insulation can be intended for warming as well as for cooling needs. However, in addition to window appliances, sun screens and shading systems, the thermal capacity of the building (skin) is of even greater importance for (passive) cooling. For example a simple insulation material with a too low mass cannot store heat. For example a light roof composed of insulation combined with a steel sheet or tiles, will arise a “caravan” effect. This is a rapid heating of the building subject to solar radiation causing discomfort due to excessive heat.

Reflective foils and/or light-coloured materials or finishing can in addition prevent overheating through radiance. Because these products fall all out of the scope of this study, VITO recommends to make no further distinction between heating and cooling.

A more detailed overview of thermal insulation solutions on building element level and the specific properties of insulation products per building element application is given in ISO 9774 (2004).

Thermal insulation in windows and (outside) doors is not integrated here, because they belong to another product family which will be investigated in another Ecodesign study on Window products (contract No ENER/C3/2012-418-Lot1/03/SI2.655814). Non building element-specific application (e.g. thermal insulation for piping and ducts for space heating and hot water distribution, edge and perimeter insulation products) are categorised under the label ‘other’ in Figure 5.

Conclusion:
Due to its direct relation to the energy performance of the building, an assessment of thermal insulation products is preferably done on a system level. This is also confirmed by a study conducted by PU Europe\(^\text{10}\), providing evidence on how important it is to take a whole building perspective. Nevertheless, the above arguments make it very difficult to define a single functional unit – to analyse and compare different thermal insulation solutions in an objective way – covering all functionalities and relation with the rest of the building. Furthermore, defining a reference

system on the building or building element level that takes into account different constructive solutions and which is applicable for all European Member States is complex and time-consuming. For these reasons the research team recommends to define the functional unit on product level and communicate in a transparent way about the restrictions using a product approach.

3.3. ECONOMIC AND MARKET ANALYSIS

3.3.1. DETERMINATION OF SALES AND TRADES OF THERMAL INSULATION IN THE EUROPEAN UNION

For energy-using products such as heating, ventilation and electricity devices the number of sold units is relatively easy to calculate. As shown by Table 1 and Table 2, thermal insulation is found in many forms and types of products – e.g. boards, rolls, beads and pellets – which results in different units used to describe sales figures: e.g. m³, m² and tonnes, number of (packaged) boards or rolls, thermal resistance provided, or number of buildings insulated (PE NEW, 2011). Consequently, calculating the significance in annual sales of all thermal insulation products in the European community is not a straightforward task. Based on the available economic data different approaches are possible.

Prodcom data give a first insight of the annual sales of products related to thermal insulation. Based on the Prodcom figures for 2009-2011, shown in Table 3, a prospective amount of more than 14 million tonnes per year is sold.
Table 3: Annual sales in 2009 – 2011 of (thermal) insulation, expressed in kg per product, according to Prodcom statistics

<table>
<thead>
<tr>
<th>Production Code</th>
<th>Description</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>13204600</td>
<td>Woven fabrics of glass fibre (including narrow fabrics, glass wool)</td>
<td>436.286</td>
<td>563.527</td>
<td>481.979</td>
</tr>
<tr>
<td>16102200</td>
<td>Wood wool; wood flour</td>
<td>1,988.935</td>
<td>280.722</td>
<td>213.321</td>
</tr>
<tr>
<td>17211230</td>
<td>Sacks and bags, with a base width &lt;= 40 cm, of paper, paperboard, cellulose wadding or webs of cellulose fibres</td>
<td>968.434</td>
<td>1,128.893</td>
<td>1,141.721</td>
</tr>
<tr>
<td>17211250</td>
<td>Sacks and bags of paper, paperboard, cellulose wadding or webs of cellulose fibres (excluding those with a base width &lt;= 40 cm)</td>
<td>950.153</td>
<td>957.438</td>
<td>1,010.383</td>
</tr>
<tr>
<td>20162035</td>
<td>Expansible polystyrene, in primary forms</td>
<td>1,845.757</td>
<td>1,946.323</td>
<td>1,521.316</td>
</tr>
<tr>
<td>20165670</td>
<td>Polyurethanes, in primary forms</td>
<td>2,419.148</td>
<td>2,986.237</td>
<td>2,379.874</td>
</tr>
<tr>
<td>23141210</td>
<td>Glass fibre mats (including of glass wool)</td>
<td>227.809</td>
<td>243.709</td>
<td>274.180</td>
</tr>
<tr>
<td>23141230</td>
<td>Glass fibre voiles (including of glass wool)</td>
<td>118.060</td>
<td>134.159</td>
<td>138.385</td>
</tr>
<tr>
<td>23991910</td>
<td>Slag wool, stone wool and similar mineral wool and mixtures thereof, in bulk, sheets or rolls</td>
<td>2,072.907</td>
<td>2,062.714</td>
<td>2,371.071</td>
</tr>
<tr>
<td>23991920</td>
<td>Exfoliated vermiculite, expanded clays, foamed slag and similar expanded mineral materials and mixtures thereof</td>
<td>2,255.099</td>
<td>2,799.930</td>
<td>3,103.152</td>
</tr>
<tr>
<td>23991930</td>
<td>Mixtures and articles of heat/sound-insulating materials n.e.c.</td>
<td>1,353.309</td>
<td>1,485.501</td>
<td>1,571.892</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>14,635.897</td>
<td>14,589.153</td>
<td>14,207.274</td>
</tr>
</tbody>
</table>

Analysis:
- Realising that most insulation products in the table above are half products needed to be installed on site;
- Most insulating products can be handled by one man;
- Maximum 25kg can be lifted by one man (cf. labour directives in Belgium);
- This adds up to a minimum of 560 million ‘units’ per year;
- This is far more than the required 200,000 units to be implemented in the Ecodesign Directive.

Since far from all insulation product families are listed in the Prodcom dataset, there are strong indications that annual sales based on mass units (e.g. tonnes) are significant. However, it should be noted that the short product description per Prodcom code and nomenclature given by the Eurostat website do not give any guarantee that these products were all used for thermal insulation in buildings.

PE NWE (2011) calculated the total market size of 6,7 billion Euro, of which circa 80% is spent in Western Europe and circa 20% in Central and Eastern Europe. The production volume is just under 100 million m³.

As indicated in Figure 5, thermal insulation is used for new buildings as well as for renovation and retrofit of existing buildings. Most of thermal insulation products in Europe end up in existing buildings.
buildings. In Germany, for example, already 70% of all insulation activity is related to renovation and this percentage is expected to rise even further as a direct consequence of the need for improved energy efficiency (EUMEPS, 2009).

Based on sales figures of 2008 (see Table 4), glass and stone wool represent over 50% of the EU market. Expanded and extruded polystyrene, polyurethane and polyisocyanurate make up the major part of rest of the market. Only a very small fraction (maximum 6%) is biomass based. Of this latter fraction wood fibre materials (including cellulose) are most common (VHK, 2011).

Table 4: European market shares in 2008 of different types of thermal insulation for buildings, expressed in percentages, based on (VHK, 2011)

<table>
<thead>
<tr>
<th>Insulation</th>
<th>Western Europe</th>
<th>Central and Eastern Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass wool</td>
<td>39.5%</td>
<td>12.9%</td>
</tr>
<tr>
<td>Stone wool</td>
<td>16.1%</td>
<td>47.7%</td>
</tr>
<tr>
<td>Expanded polystyrene (EPS)</td>
<td>21.9%</td>
<td>28.7%</td>
</tr>
<tr>
<td>Extruded polystyrene (XPS)</td>
<td>8.3%</td>
<td>7.4%</td>
</tr>
<tr>
<td>Polyurethane/polyisocyanurate (PUR/PIR)</td>
<td>8.0%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Other</td>
<td>6.2%</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

Based on data from EuroACE on the average annual area of new buildings in five EU countries from 2005-2008, PE NWE calculated in Table 5 for three building applications the annual number of buildings requiring thermal insulation to meet national building regulations. Without taking into account the size of the buildings, residential buildings represent an important part of the new building market. For most studied countries – with the exception of Germany – the amount of new non-residential buildings is much smaller. On the other hand, this last type of buildings is characterised by a much bigger size – and thus more thermal insulation per building element is required.

Table 5: Annual amount of new buildings in five EU countries, based on (PE NWE, 2011)

<table>
<thead>
<tr>
<th>Number of new buildings per year in various EU countries</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>Assumption</td>
<td>Single family houses</td>
<td>flats</td>
</tr>
<tr>
<td>Denmark</td>
<td>130m² per house, 105m² per flat and 2000m² per non-residential building</td>
<td>18.981</td>
<td>7.055</td>
</tr>
<tr>
<td>France</td>
<td>130m² per house, 105m² per flat and 2000m² per non-residential building</td>
<td>1.86.723</td>
<td>95.253</td>
</tr>
<tr>
<td>Germany</td>
<td>130m² per house, 105m² per flat and 2000m² per non-residential building</td>
<td>35.963</td>
<td>19.300</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2000m² per non-residential building</td>
<td>47.881</td>
<td>25.316</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>69.464</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.3.2. Conclusion

The volumes of sales and trades of this market are significant and exceed the 200.000 units threshold, required to be implemented in Ecodesign Directive.
3.4. **Analysis on Environmental Significance**

3.4.1. **Thermal Insulation in Relation to the Entire Life Cycle of the Building**

Taking the building sector’s impact on the environment into consideration, the European Union has set a ‘nearly zero-energy’ target for all newly built houses by 2021 (EU, 2010).

The Energy Performance of Buildings Directive (EBPD) (EU, 2010) defines a nearly zero-energy house as: “a house that has a very high energy performance and in which the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby”.

Thanks to the EPBD the operational energy demand of European building stock is gradually decreasing. With the target set for newly built houses the (non-renewable) energy use during the life cycle phases before and after the operational phase, i.e. the embodied energy and end-of-life energy, becomes more and more important in relative terms. Furthermore, an absolute increase in embodied energy occurs since high-performance houses generally require a larger amount of thermal insulation materials and building services than conventional houses (European Commission, 2010).

The main research question here is: to what extent do environmental impacts related to pre- and post-use life cycle phases outweigh the environmental benefits related to the energy reduction during the use phase by applying thermal insulations in buildings?

The relative shift of energy use by using thermal insulation from the use phase to the production and end-of-life phases (including replacement), generally results in a relative increase in environmental impacts related to these pre- and post-use life cycle phases. To determine the environmental importance of thermal insulation over the life cycle of a building, it is important to take into account the energy performance of the building. In the following paragraphs this is analysed for the most important life cycle phases separately. Transport of building products to the construction site and from the sorting and EOL site, and the construction phase are discarded due to their relative low share in the overall environmental profile of the building (Debacker et al., 2013).

By reviewing a number of research studies, it can be demonstrated that insulation provides a net benefit, considering the full life cycle of the product, and benefits from using insulation are substantial (see Figure 6).

Ecobilan (2010) calculated and analysed the environmental impacts of two houses that met the requirements of the French thermal regulation (RT 2005 and BBC-label – for shadowing RT2012). The study took into account building systems and materials representative of the French market. Mineral wool was used to insulate attics and walls. Two houses were studied (called M12 and Mozart in the study). For these two houses, the amount of insulation was varied to achieve the two levels of energy performance (RT and BBC) and the houses were located in two different climatic regions in France. This resulted in 8 different models for evaluation. For the modelling of embodied

---

12 Embodied Energy is the sum of all the energy required to produce any goods or services, considered as if that energy was incorporated or ‘embodied’ in the product itself.
impact of the necessary building products, EPDs were sourced from the Inies website\textsuperscript{13}. Operating scenarios for these houses symbolizing the life of a family were modelled over 50 years.

The Figure 6 shows the embodied impact in terms of GHG emissions related to the insulation, the other construction materials and the impacts from the operation of the eight house models. The figure shows the contribution of the insulation materials to climate change, both in comparison to the embodied impact of construction materials overall, and most importantly in comparison to the impact from energy use and the savings in impacts from energy that increased insulation provides. It can be concluded that the relative contribution of the insulation materials, considering the full life cycle of the building, represents less than 2\% of the total contribution (including use phase) of the building to climate change. For acidification, water consumption, waste and primary energy, contribution of the thermal insulation to the overall environmental profile never exceeds 10\%.

![Perimeter building](image)

\textit{Figure 6: The global warming impact of insulation, relative to other construction materials and operational energy demand within the life cycle assessment of a number of French house designs, modelling improved thermal performance levels with increased insulation in 2 climatic locations (according to PE NWE, 2011)}

Figure 7 shows the influence of the different life cycle phases for new build construction within the EU, as modelled within the IMPRO-Building study. This shows that for most environmental impacts considered, the use phase is by far the most relevant. The construction phase (including the production, manufacturing and transport of building products to the construction site) has less than 30\% of the impacts, and the end of life phase has a negligible impact. The construction phase

\textsuperscript{13} \url{http://www.inies.fr}
covered here includes impacts of all construction materials used in the new buildings - not only thermal insulation products.

![Figure 7: Primary energy and some environmental indicators of new residential buildings in EU-25, over a life span of 40 year (Nemry and Uihlein, 2008)](image)

**Conclusion:**
The environmental impacts of current buildings are dominated by the use phase. For most environmental impact categories considered, the use phase contributes for more than 70% (80% in terms of energy). Embodied environmental impacts related to building materials (including thermal insulation products) are currently much smaller than the impact related to the use phase.

### 3.4.2. Thermal Insulation in Relation to Energy Efficiency During the Use Phase

Applying thermal insulation in buildings is recognized as one of the most cost effective methods to reduce energy consumption. Enqvist et al. (2007) and Lodewijks et al. (2008) showed thermal insulation has the best cost abatement profile to reduce greenhouse gas emissions. To quantify the environmental benefits in the use phase by using thermal insulation the related (operational) energy reduction has to be calculated first.

*The benefits of applying thermal insulation in buildings are dependent of the geographic location where the building is situated.* Introducing thermal insulation with a same thickness and material composition in a similar building (and orientation) and building element composition in Northern and Southern Europe has a different effect, as in the warmer climate the amount of heat which

---

14 no replacement of building components is assumed in the IMPRO study. This results in an absence of the construction phase, including (re-)production of building components during the life cycle of the existing buildings.
could be saved is lower, since the days of heating and the difference between internal and external temperatures is greater in Northern Europe for both measures.

In the IMPRO-Building study (Nemry and Uihlein, 2008) 72 representative buildings (53 existing and 19 new building types) were selected along three geographic zones: (Z1) South Europe, (Z2) Middle Europe and (Z3) North Europe. The 72 selected building models (single-family houses, multi-family houses and high-rise buildings) were assessed to be representative for about 80% of the residential building stock in the EU-25.

In Figure 8 contribution to total primary energy in the use phase of the individual elements are shown according to pre-defined zone and building groups.

![Figure 8: Contribution to total primary energy in the use phase of the individual elements according to zone and building group](image)

Besides the fact that the IMPRO-Building study only takes into account residential buildings, it has to be noted that (primary) energy and environmental impact results are only shown on building and building element level, and not specifically for the studied thermal insulation products. The figure shows per unit of floor area and per year how much energy is lost through the different building elements and through ventilation losses (gaps in the envelope), and how much energy is used for cooling. Note that in the IMPRO study (Nemry and Uihlein, 2008, page 22) it is argued that “…the interior construction, fittings and finish, and heating and cooling systems (e.g. HVAC, heating

15 the suffix "_N" denotes new buildings. “Roof”, “walls”, “floors/ceilings” and “Basement” refer to the heat losses through the respective opaque parts of the building envelope. “Windows” refer to the heat losses through transparent parts and “ventilation” corresponds to the losses resulting from gaps in the envelope (e.g. window frames). the calculation of the ventilation losses is based on proposed losses in 1/h, ranging from 0.3 1/h up to 1.5 1/h, thus covering realistic air changes in existing buildings in Europe (though in some European countries the minimum air change rate is limited to 0.5 1/h because of hygienic reasons). (Nemry and Uihlein, 2008, p. 42-44)
systems and cooling equipment/services, mechanical ventilation systems and building automation) are not considered as they are not relevant for the identification of improvement options. The exterior area surrounding the building and the infrastructure services are also not considered. Accordingly, only ventilation losses resulting from gaps in the envelope (e.g. window frames) have been taken into account, based on realistic air changes in existing building in Europe (Nemry et al 2008, page 42 to 44). Cooling energy – but not the cooling appliances – is only considered for dwellings situated in South Europe Z1).

A review of all verified FDES (from the French EPD system – Inies database)\textsuperscript{16} for insulation providing information on the savings from the use of insulation in the archetypal model (Mozart House) shows that all provide very significant savings in energy from their use relative to the primary energy used to manufacture, transport and disposal of the insulation (shown in blue in Figure 9). For climate change, the savings from use are between 3.8 and 270 times more than the cradle to grave impact of the insulation (PE NWE, 2011). The Figure below relates only to primary energy and not to GHG emissions.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure9.png}
\caption{Primary Energy from Manufacture, Transport and End of Life, compared to the Benefits of Insulation per \textit{m}² of insulation (PE NWE, 2011)}
\end{figure}

In a study (Pilz and Mátra, 2006) of the Gesellschaft für Umfassende Analysen GmbH (GUA) the benefit of the “use-phase” for the current situation in Europe is quantified taking plastics insulation boards for external walls as an example for calculation. To calculate the net energy balance within the total life cycle of plastic insulation boards, the savings of the use phase are completed by the energy needed for production of insulation boards and by energy effects within waste

\textsuperscript{16} http://www.inies.fr
management. Plastics insulation boards used for thermal insulation of external walls (EPS, PUR, XPS) consume about 100 MJ of energy per kg product when they are produced. The results of the GUA study (Pilz and Mátra, 2006) show that the same amount of energy is already saved within the first 4 months of use. In their total use phase, plastics insulation boards save more than 14.500 MJ per kg insulation material or 150 times more energy that was needed for production. The total net energy saving of plastics insulation boards sold in 2004, improving insulation standards of external walls in Europe, is estimated at 5.150 Mill GJ in their lifetime of 50 years (uncertainty range: 5.150 – 10.800 Mill GJ). Total net-savings of greenhouse gas emissions by additional plastic insulation boards sold in 2004 for use on external walls are approximately 290 Mill tonnes of CO₂ equivalents in their lifetime (uncertainty range: 290 – 610 Mill GJ) (PE NWE, 2011).

Figure 10: The energy balance throughout the total life cycle of plastics insulation boards applied on external walls in Europe in 2004 to increase insulation standards (Pilz and Mátra, 2006)

→ Existing building types

Comparing the total primary energy use (non-renewable as well as renewable energy) between existing and new buildings (see Figure 8), a clear distinction in energy consumption is visible. The higher energy performance of new buildings compared to existing buildings is mainly attributed to a higher thermal insulation level, a higher performance of HVAC and a better air tightness, leading all to lower heat losses.

Figure 8 shows that for existing buildings, heat losses through roofs and external walls are important for most single and multi-family houses. However, both the absolute and relative levels vary from one building type to another. The relative importance of heat losses from external walls in high-rise buildings is also significant, but roofs are of low importance in this case. This results from both the lower share of roof surface to the total building envelope surface and from a higher insulation level.

Looking at environmental indicators such as Global Warming Potential (GWP), Acidification Potential (AP), Eutrophication Potential (EP), Photochemical Ozone Creation Potential (POCP) and Ozone Depletion Potential (ODP), a similar trend is visible as for Primary energy (non-renewable and renewable): new buildings show a higher energy performance than existing buildings.

In the IMPRO-Building report, Nemry and Uihlein (2008) calculated an overall heating/cooling consumption of around 9500 PJ for the EU (indicative for year 2006-2008) based on billion m² floor space per building type and base case energy consumption per m² per building type.
The energy consumption required for space heating is not entirely attributable to transmission losses alone; also ventilation and infiltration losses and losses of the heating system itself have to be taken into account, together with solar and internal gains. Considering a transmission loss component of 40%, Nemry and Uihlein (2008) calculated that in 2005 some 4200 PJ was transmitted through building skin components related to thermal insulation – excluding windows – and that it is expected to decrease to some 3500 PJ in 2025 due to on-going general improvement of the building envelope (VHK, 2011).

![Graph showing energy consumption](image)

Figure 11: Primary energy and some environmental indicators of existing residential buildings in the EU-25, over a life span of 40 years\(^\text{17}\) (Nemry and Uihlein, 2008)

Figure 11 illustrates, at aggregated EU level, the dominance of the use phase in the environmental impacts of the existing residential building stock in the EU-25. The End-of-Life phase accounts for only -1.3 to +2.7% of the environmental impacts. For Primary Energy (non-renewable and renewable), and Ozone Depletion Potential, the contribution of the EOL phase is negative, i.e. the EOL results in credits due to material recycling (-1.3 to -0.1%). For GWP, Acidification Potential, Eutrophication Potential and Photochemical Ozone Creation Potential, the EOL phase causes environmental impacts instead of credits (+0.1 to +2.7% when compared to the impacts from the use phase) (Nemry and Uihlein 2008).

It has to be noted that no replacement cycles were assumed in Figure 11. Furthermore, because the IMPRO-Building study does not take into account discounting of the environmental impacts.

\(^{17}\) no replacement of building components is assumed in the IMPRO study. This results in an absence of the construction phase, including (re-)production of building components during the life cycle of the existing buildings.
related to prior construction processes of existing buildings, the construction phase - including the (re-production of building components) is not shown.

→ New building types

As newly built dwellings follow EPBD, these buildings limit heat losses to a certain extent. At the moment of writing the IMPRO-Building report, the use phase dominated the environmental impacts at EU level. Figure 7 shows that the construction phase, including the production of building components, is responsible for 8,3 to 34,3% of the environmental impacts. The highest share is represented by the Eutrophication Potential indicator and the lowest for Photochemical Ozone Creation Potential. Again, the EOL stage is of minor importance only (-1.7 to 3.2% of the environmental impacts). For Primary Energy (non-renewable and renewable), and Ozone Depletion Potential, the End-of-Life comes with credits while for GWP, AP, EP and POCP, the End-of-Life shows positive environmental impacts (Nemry and Uihlein 2008).

Because the IMPRO-Building study only looks at current representative building cases, the calculations omit nearly-zero-and net-zero-energy-houses in which primary energy from renewable sources (almost) balances the primary operational energy (OE) requirements for heating for heating, cooling, domestic hot water (DHW) supply and auxiliaries on a yearly basis in standardised conditions. Although very high energy performance buildings are currently still scarce, the EPBD aims for it in the near future: i.e. 2019 for public buildings and after 2020 for all other new buildings. It is thus of importance to take these building concepts into account, when the environmental and energetic benefits and loads of new buildings are investigated.

Himpe et al. (2013) described the primary energy consumption over a life span of 60 years of a representative Belgian free-standing zero-energy dwelling (143m²). In their study two thermal performance scenarios were analysed: a ‘standard scenario’ (GSM) following the Belgian EPBD regulations applicable from 2014 and a ‘passive scenario’ (GPM) following the Passive House standard. Only on-site generated renewable energy systems were considered to balance the primary operational energy required for space heating, domestic hot water supply and auxiliaries on a yearly basis. As the energy demand is different for both scenarios, the standard scenario implies a bigger dimensioning for heating appliances, but a lesser use of thermal insulation. For the passive scenario it is the other way around.  

Based on Figure 12 it can be argued that the embodied energy of thermal insulation products becomes more important in zero-energy building concepts. Their embodied energy represents 26-28% of the total embodied energy of the building envelope retrieved from non-renewable energy sources over the entire service life of the zero energy dwelling. The material intensive structure of the building envelope and its (interior) finishing layers, characterised by a relative high replacement rate have a non-renewable embodied energy of 34-38% and 34%-40% respectively.

---

18 A net energy demand for space heating of 70kWh/year/m² floor area was typically estimated for a Belgian new dwelling meeting energy regulation applicable from 2014 (cf. standard alternative). For an alternative based on the Passive House concept, this is lower than 15 kWh/year/m² floor area. Related to the entire service life of the dwelling studied by Himpe et al, this would respectively account for 2.162.160MJ and 463.320MJ for the standard and passive design alternatives. Relatively, this means that the operation energy consumption for the standard Belgian free-standing dwelling still takes about 70% of the entire environmental profile (taking into account a service life of 60 years). For the passive alternative this figure is reduced to circa 30% of the total life cycle impacts. (Himpe and Trappers, 2011)
As expected, the embodied energy of building components is dominant over the life cycle of a zero-energy building, as opposed to new dwellings complying with the current energy regulation in Belgium. This means that one should shift the attention to the manufacturing of building components to enhance the environmental profile of buildings – instead of merely looking at the operational energy demand.

Vandaele (2013) used the same Belgian case study to determine the environmental impacts of the zero-energy dwelling. Using ReCiPe H/A Endpoint (Goedkoop et al., 2008) as a life cycle impact method, similar trends as in the life cycle energy analysis (LCEA) are discerned for the embodied environmental impacts: i.e. that embodied environmental impacts are more important than operational impacts. ‘Climate Change’ and ‘Fossil fuel depletion’ are dominant indicators in the environmental profile of all (massive) building envelope scenarios – and this for the embodied as well as for operational impacts. According to Vandaele, this high correlation between climate change and fossil fuels is mainly attributed to the fact that the West European energy mix used for production (and construction) is still greatly dependent on non-renewable energy sources – such as fossil fuels and nuclear. Changing the energy mix to more renewable energy sources in the future will make other environmental indicators more important (Vandaele, 2013).

Conclusion:
Appropriate thermal insulation is the single factor which influences the most the energy performance of buildings. The energy savings that accrue from the use of insulation over the lifetime of a building are 150 times more than that needed for the fabrication of the insulation material itself (Pilz and Mátra, 2006).

Figure 12: Typical non-renewable embodied energy of the (massive) building envelope of a representative Belgian zero-energy dwelling based on two thermal insulation scenarios: i.e. meeting Belgian energy regulations applicable from 2014 (GSM- right) and meeting the passive house standard (GPM- left), according to their functional composition (Himpe and Trappers, 2011)
3.4.3. THERMAL INSULATION IN RELATION TO PRODUCTION, END-OF-LIFE AND RECOVERY PHASE

Section 3.4.2 suggests that for existing as well as for new buildings – except for (nearly) zero energy buildings – the use phase dominates the environmental profile of buildings. Even if thermal insulation products help to reduce the operation energy demand, the related EOL and manufacturing phases usually have a low significance.

Embodied environmental impacts related to the manufacture stage and the end-of-life (EOL) stage of thermal insulation products are currently much smaller than their benefits during use (see Figure 6 for global warming potential and Figures 20 to 22 for other environmental impacts). Other building components (besides insulation materials) often dominate the environmental profile of building elements and buildings. Thiel et al. (2013) calculated the environmental impacts of a net zero energy three-storey office in the USA, Pennsylvania (24.350 ft² floor area). Here, the structural components and PV system dominate the environmental profile. The environmental impacts related to the manufacturing and EOL stage of the insulation materials do not exceed a contribution of 10% in relation to the total impacts generated by the building materials (Thiel et al., 2013).

The last column in the figure below is not in contradiction with Figure 10 (<5% of energy demand here versus 26-28% according to Figure 10) because:

- the building application is different and accordingly the energy demand is also;
- building height – and thus structural system – is different;
- besides the structural components, also the PV system dominates the environmental profile in figure 11.

Figure 13: Life cycle environmental impacts of building materials by material type for net-zero energy building (from Thiel et al., 2013)

To have a better insight in the environmental impacts related to the manufacturing and EOL of thermal insulation products (on product level) PE NWE (2011) has analysed all available verified environmental product declarations (EPDs), all provided free of charge through the EPD program operators. They evaluated the impacts of different insulation products in order to model the impact of the industry. Because the different EPD programmes (still) have varying sets of rules
underlying the scope of assessment, the indicators used, and the declared units used, EPDs were not directly comparable in many instances, although all are compliant with ISO 14025.\textsuperscript{19} Consequently, PE NWE converted all the EPDs to two common declared units: the first, for 1 m\(^2\) of insulation, providing a thermal resistance equivalent to 3 W/m\(^2\)K, and the second, for 1 m\(^3\) of insulation (PE NWE, 2011).

Table 6 shows estimated impacts to cover manufacturing, transport and disposal at end-of-life of thermal insulation products for 2007. Applying the life cycle impact assessment method developed by the Centre for Environmental Sciences in the Netherlands (CML-method version 3.7), the figures show that the industry behind thermal insulation products for buildings has a very small impact compared to normalised Western European impact in 1995. This relative impact would be even smaller if normalized to the impact of the whole of Europe. The categories ‘Climate change’, ‘Photochemical Ozone creation potential’ and ‘Acidification’ are considered as equally important, and to a higher extent than ‘Ozone depletion’ and ‘Eutrophication’ (PE NWE, 2011).

\textsuperscript{19} The PE NWE study, commissioned by EIP, was performed before the publication of EN15804, standardising the development of (comparable) environmental product declarations of construction products.
Table 6: Estimated environmental impact associated with the European insulation industry in 2007 according to PE NWE (2011)\textsuperscript{20}

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Product Volume (m$^3$)\textsuperscript{xxx}</th>
<th>Climate Change (kg CO$_2$ eq)</th>
<th>Photochemical Ozone Creation (kg C$_2$H$_4$ eq)</th>
<th>Acidification (kg SO$_2$ eq)</th>
<th>Stratospheric Ozone Depletion (kg CFC$_{11}$ eq)</th>
<th>Eutrophication (kg PO$_4$ eq)</th>
<th>Water extraction (m$^3$ water)</th>
<th>Primary Energy (MJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass wool</td>
<td>32852866</td>
<td>7.56E+08</td>
<td>5.25E+05</td>
<td>5.08E+06</td>
<td>2.35E+03</td>
<td>1.51E+04</td>
<td>5.42E+09</td>
<td>2.37E+10</td>
</tr>
<tr>
<td>Expanded Polystyrene</td>
<td>27880958</td>
<td>1.72E+09</td>
<td>7.88E+06</td>
<td>1.69E+06</td>
<td>5.09E-03</td>
<td>1.83E+05</td>
<td>1.71E+09</td>
<td>3.68E+10</td>
</tr>
<tr>
<td>Stone wool</td>
<td>25581058</td>
<td>3.78E+09</td>
<td>1.19E+06</td>
<td>3.23E+07</td>
<td>1.46E+02</td>
<td>7.09E+05</td>
<td>1.15E+10</td>
<td>6.18E+10</td>
</tr>
<tr>
<td>Extruded polystyrene</td>
<td>79180866</td>
<td>1.60E+09</td>
<td>3.51E+06</td>
<td>4.15E+06</td>
<td>2.58E+01</td>
<td>1.59E+05</td>
<td>4.56E+09</td>
<td>2.26E+10</td>
</tr>
<tr>
<td>Polyurethane</td>
<td>6542734</td>
<td>1.07E+09</td>
<td>1.77E+06</td>
<td>4.53E+06</td>
<td>2.14E+03</td>
<td>5.44E+05</td>
<td>1.23E+10</td>
<td>1.81E+10</td>
</tr>
<tr>
<td>Cellulose (recycled)</td>
<td>1592975</td>
<td>1.88E+07</td>
<td>1.97E+04</td>
<td>2.12E+05</td>
<td>2.57E+01</td>
<td>2.43E+04</td>
<td>1.04E+08</td>
<td>1.25E+09</td>
</tr>
<tr>
<td>Cellulose (cotton fibre)</td>
<td>1393853</td>
<td>-4.98E+06</td>
<td>3.46E+04</td>
<td>4.20E+05</td>
<td>-8.53E+00</td>
<td>8.20E+04</td>
<td>5.24E+08</td>
<td>4.10E+09</td>
</tr>
<tr>
<td>Wood fibre or wool</td>
<td>448024</td>
<td>2.43E+07</td>
<td>3.02E+04</td>
<td>1.94E+05</td>
<td>3.26E+01</td>
<td>4.85E+03</td>
<td>6.47E+07</td>
<td>4.47E+08</td>
</tr>
<tr>
<td>Hemp</td>
<td>199121</td>
<td>1.00E+07</td>
<td>1.61E+04</td>
<td>1.01E+05</td>
<td>1.45E+01</td>
<td>1.01E+04</td>
<td>9.19E+07</td>
<td>1.92E+08</td>
</tr>
<tr>
<td>Wool</td>
<td>116154</td>
<td>1.87E+07</td>
<td>3.19E+03</td>
<td>3.59E+04</td>
<td>1.43E+01</td>
<td>4.01E+03</td>
<td>5.01E+07</td>
<td>4.19E+08</td>
</tr>
<tr>
<td>Foamed Glass</td>
<td>116154</td>
<td>2.65E+07</td>
<td>3.27E+03</td>
<td>7.82E+04</td>
<td>8.44E+00</td>
<td>5.91E+03</td>
<td>2.69E+08</td>
<td>6.48E+08</td>
</tr>
<tr>
<td>Perlite</td>
<td>116154</td>
<td>1.30E+07</td>
<td>1.86E+04</td>
<td>6.39E+04</td>
<td>6.58E+00</td>
<td>1.01E+04</td>
<td>1.94E+05</td>
<td>2.07E+08</td>
</tr>
<tr>
<td>Phenolic</td>
<td>995609</td>
<td>2.76E+08</td>
<td>2.70E+04</td>
<td>3.64E+05</td>
<td>7.24E+01</td>
<td>5.97E+04</td>
<td>4.25E+08</td>
<td>6.34E+09</td>
</tr>
</tbody>
</table>

**TOTAL IMPACT in units of measurement**
- 9.43 M tonnes CO$_2$ eq
- 15.1 k tonnes C$_2$H$_4$ eq
- 49.3 k tonnes SO$_2$ eq
- 4.85 tonnes CFC$_{11}$ eq
- 1.80 k tonnes PO$_4$ eq
- 37.400 Million m$^3$ water
- 17.7 Peta Joules

**TOTAL IMPACT OF EUROPEAN INSULATION INDUSTRY**

\textsuperscript{xxx} Green cells have used average impact data for all insulation reporting these indicators, as no verified EPD data was available reporting these indicators;
Blue cells have used data for feather insulation as no verified (or unverified) EPD data was available for sheep’s wool insulation;
Grey cells represent products taken to represent the remaining ―other‖ category (0.4%) (PE NWE, 2011)\textsuperscript{20}
Based on generic Swiss life cycle inventory (ecoinvent 2.2)\textsuperscript{21} and harmonised to the West-European energy mix and Belgian building context, the normalised\textsuperscript{22} environmental impacts of a 1 m\textsuperscript{2} façade with EPS external wall insulation (ETICS - External thermal insulation composite systems) was calculated for the environmental indicators set by EN15804 (see Figure 14). Transmission losses related to the external wall system are based on the equivalent degrees method (see next paragraph). The environmental impacts of the ETICs wall are normalised to the emissions of a European inhabitant (emissions of one European multiplied with 60, estimated life time of the building wall). From the graph we learn for example that the contribution to abiotic depletion of a 1 m\textsuperscript{2} ETICS wall – fossil is 0,062\% of the emissions of an average European).

The operational energy use of the building wall is calculated by means of the equivalent degree method. For the analysis of energy use during the use phase only the energy consumption of heating due to transmission losses will be considered\textsuperscript{23}. The energy use has been be modelled by means of the ‘equivalent degree days’-method using the following assumptions:

- 1200°d\textsuperscript{24} (Allacker 2010);
- Condensation boiler with global efficiency of 88\%;
- Cooling is not considered for the Belgian climate;
- As proposed by EN 15804 (CEN, 2012) equipment for cooking, washing, entertainment, communication, etc. is not included.

Because the object of study is limited to (the life cycle of) 1m\textsuperscript{2} of exterior wall, energy consumption during the life span of the wall (and building) is therefore restricted to transmission losses via 1m\textsuperscript{2} of wall under clearly defined conditions

**Operational energy use (only space heating) is defined as:**

\[
Q_{d,SH} = q_{d,SH} \times ESLB
\]

With:
- \(Q_{d,SH}\): design value of space heating energy consumption over the estimated life span of the building
- \(q_{d,SH}\): space heating energy consumption over one year
- \(ESLB\): estimated service life span of the building

In this study a service life span of 60 years is assumed\textsuperscript{25}

**Yearly energy consumption due to space heating is defined as:**

\[
q_{d,SH} = \frac{q_{SH,demand}}{\eta_{SH}}
\]

With:

\textsuperscript{21} ecoinvent (2010), ecoinvent v2.2 database, www.ecoinvent.org
\textsuperscript{22} Normalisation factors were calculated based on the average impacts of a European over the entire life span of the wall element under study (i.e. 60 years). The year 2000 was taken as reference for normalisation.
\textsuperscript{23} In line with EN 15978:2011 §8.6.5
\textsuperscript{24} The lower the K-value of a building, the lower the equivalent degree days. 1200 equivalent degree days corresponds to a well insulated house with an average inner temperature of 18°C.
\textsuperscript{25} In a sensitivity analysis a service life of 120 years will be assumed.
\( q_{\text{SH,demand}} \): energy demand for space heating over one year (i.e. an entire heating season)

\( \eta_{\text{SH}} \): overall performance of space heating system

The overall performance of space heating service(s) is defined as:

\[
\eta_{\text{SH}} = \eta_{\text{production}} \times \eta_{\text{distribution}} \times \eta_{\text{emission}} \times \eta_{\text{control}}
\]

With:
- \( \eta_{\text{production}} \): performance of the production system of space heating service(s)
- \( \eta_{\text{distribution}} \): performance of the distribution system of space heating service(s)
- \( \eta_{\text{emission}} \): Performance of the emission system of space heating service(s)
- \( \eta_{\text{control}} \): performance of the control system of space heating service(s)

For this study a modulating condensing gas furnace, coupled to panel radiators and floor heating with no tubing beyond the protected volume (or insulated) and controlled by thermostatic valves and an outside temperature sensor is assumed. Therefore, the overall performance (according to the lower heating value) of the space heating system is characterised as \( \eta_{\text{SH}} = 0.88^\text{26} \) with (VITO & ECONOTEC 2011) (Renders et al., 2011):

- \( \eta_{\text{production}} = 1.04 \)
- \( \eta_{\text{distribution}} = 0.95 \)
- \( \eta_{\text{emission}} = 0.95 \)
- \( \eta_{\text{control}} = 0.95 \)

Yearly energy demand for space heating demand is based on the equivalent degree days method. The calculation is based on the PhD of Karen Allacker (Allacker, 2010): 1200 equivalent degree days = 1200*24*60*60 equivalent degree seconds and 1/1000000 if expressed in MJ instead of J). Neglecting ventilation losses - since the assessment is conducted at building element level and not at building level - the yearly space heating demand is defined as:

\[
q_{\text{SH,demand}} = U \times S \times \Delta t_{\text{ime}} \times \Delta t_{\text{emperature}}
\]

with:
- \( U \): value of heat transfer coefficient for wall including insulation material (in W/(m\(^2\).K) or J/(m\(^2\).K.s))
- \( S \): area of wall (in m\(^2\))
- \( \Delta t_{\text{ime}} \): number of heating days over an entire heating season
- \( \Delta t_{\text{emperature}} \): difference in (equivalent) temperature outside and an internal temperature

For this study a surface losses area of 1m\(^2\) and 1200 equivalent degree days are considered (\( \Delta t_{\text{ime}} \times \Delta t_{\text{emperature}} \)). The latter is chosen independent of the insulation rate of the building (wall). Converting the formula to SI units, the formula above can be simplified to:

\[
q_{\text{SH,demand}} = U_m \times 103,68 \times 10^6 K.s.m^2
\]

This means that for the following common U-values the space heating demand and related energy consumption can easily be calculated:

\text{\textsuperscript{26}} the overall performance based on the upper heating value is 93%, i.e. 88%/0.90

\text{\textsuperscript{27}} To take into account external heat gains due to solar radiation and internal heat gains due to humans and heat emitting household appliances, an (lower) average over time and space inside temperature is considered
<table>
<thead>
<tr>
<th>$U_m$ (in W/m².K)</th>
<th>$q_{SH,demand}$ (in MJ/year)</th>
<th>$q_{d,SH}$ (in MJ/year)</th>
<th>$Q_{d,SH}$ (in MJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.24</td>
<td>25</td>
<td>28</td>
<td>1697</td>
</tr>
</tbody>
</table>

Figure 14: Normalised environmental impacts for 1 m² façade with EPS external wall insulation, with an $U$-value of 0.234 W/m².K

In this ETICS wall type, the load bearing structure is masonry in hollow brick with a thickness of 14 cm. Finished at the inside with a 1.5 cm thick gypsum plaster. The insulation material is plugged against the outside of the brickwork masonry, finished and protected by a layer of 3 cm of facade plaster. The wall solution meets current Belgian regulations and is defined with a $U$-value of 0.234 W/m².K.

Figure 14 shows the dominance of ‘Climate change’ and ‘Abiotic Depletion of Fossils’ in the overall environmental profile. Both environmental indicators are characterised by a major contribution of the operation energy related to transmission losses. In a smaller extent ‘Eutrophication’, ‘Terrestrial acidification’ and ‘Photochemical oxidation’ are of significance. These indicators are mainly characterised by contributions of the production and manufacturing of the wall components. The production of EPS is non-negligible for these indicators (i.e. circa 20% of the overall profile).
Based on a screening of the environmental improvement of the highly insulated ETICS wall compared to a non-insulated alternative we can conclude that for every environmental indicator addressed by EN15804 the environmental benefits by decreasing the operational energy is higher than the net environmental impact due to the increase of production of thermal insulation (and auxiliary components). The comparison of the normalised environmental results related to the ETICS wall is shown in Figure 15.

In order to validate the conclusions two other wall types and insulation materials were investigated as well.

Figure 16 compares a loadbearing brick wall with timber cladding and PUR insulation (U-value 0.24) to a non-insulated wall. It can be concluded that for every environmental indicator addressed by EN15804 the environmental benefits by decreasing the operational energy is higher than the net environmental impact due to the increase of production of thermal insulation (and auxiliary components).

Figure 17 compares a cavity wall with brickwork inner and outer layer insulated with glass wool to a non-insulated cavity wall. It can be concluded that for almost every environmental indicator addressed by EN15804 the environmental benefits by decreasing the operational energy is higher than the net environmental impact due to the increase of production of thermal insulation (and auxiliary components). The only exception is discerned for the ‘Abiotic depletion-non fossil’ indicator, where the production processes are responsible for an overall increase of impact (i.e. more than 65% compared to the badly insulated solution). In contrast, the environmental benefits related to ‘Climate Change’, ‘Abiotic Depletion of fossil resources’ and ‘Ozone depletion’ due to the enhancement of energy performance dwarfs the net environmental impact due to the increase of production of thermal insulation (i.e. with an improvement factor of circa 75%, 72% and 79% respectively).
Figure 15: Comparison normalised environmental impacts for 1m² façade using EPS external wall insulation

Figure 16: Comparison normalised environmental impacts for 1m² façade using PUR external wall insulation
As applying thermal insulation is only recently a mainstream event and buildings tend to have a long life span, the amount of insulation coming out of (partly) demolished buildings is still relatively small. Different insulation producers have set up take-back and recycling systems related to construction waste and production waste. Nevertheless, the amount of recovered waste only represent a small fraction of all C&D waste (Construction and Demolition Waste) and is often not enough to make recycling and (energy) recovery processes profitable (PE NWE, 2011).

End-of life environmental impacts for thermal insulation are not only dependent on the material composition of the product, but also on the disposal route chosen. Disposal scenarios vary significantly between European countries, as in some regions such as Flanders landfill bans are placed on recyclable fractions of Construction and Demolition waste (C&D waste), and in other countries such as Germany plastic and biomass based insulation are used for energy recovery. In Germany, also, high rates were achieved although there are no national bans on landfilling of C&D waste material. In Spain, however, the lack of control of unauthorized landfills and the high differences in landfill taxes between regions were identified as the main barriers to the recovery of C&D waste (Monier et al., 2011).

→ How much does the impact of insulation vary?

In the PE North West Europe (2011) study, an analysis is made on the variation between the reported cradle to gate (i.e. raw material and production) impacts from verified EPDs, recalculated to a common functional unit of thermal resistance. At this level, although the insulations are not directly comparable in terms of use due to differences in functionality, they all provide equivalent functionality in terms of their main purpose, providing insulation. The results are presented in
Figure 18. Note that 4 product groups did not report on Ozone Depletion and 3 product groups did not report on Eutrophication – impacts in these categories may be greater than zero as shown in Figure 18.

![Figure 18: Average normalised impacts of different insulation product groups on basis of common functionality (thermal resistance of 3 W/m².K) (PE North West Europe, 2011)](image)

If there are 4 EPDs recording Eutrophication impacts for a given product type, then the impacts from each will be represented in the average on an equal basis (25% each). Impacts are normalised to the impacts of Western Europe in 1995, as provided by CML (Centre for Environmental Sciences at the University of Leiden). As CML do not publish normalisation data for primary energy or water consumption, these impacts have not been included in Figure 18. The main conclusion here is that the impacts of significance for insulation are climate change, photochemical ozone creation potential (POCP) and acidification, as the products show greater impact in these categories relative to Europe in general. The product type with high impact in climate change is actually a single product (Calcium Silicate board, IBU EPD-CSP-2008112-D) with significant additional functionality (fire protection, high temperature resistance, moisture control) and fairly high conductivity (0.09 W/m.K) and density (259 kg/m³), accounting for its higher cradle to gate impacts. There is also not a clear conclusion that products with higher climate change impacts have higher POCP or Acidification impacts, or those with lower climate change impacts have lower POCP or Acidification impact.
Figure 19: Relative manufacturing, transport and disposal impacts of insulation products, compared per unit of thermal resistance (W/m².K) (PE North West Europe, 2011)
Figure 19 shows the relative cradle to grave impacts of insulation products, compared on the basis of a common thermal resistance. Insulation materials are included on the basis of a published and verified EPD. Impacts are normalised to the highest impact in each category. A number of EPDs do not report primary energy or Eutrophication (no bar shown). This shows that there is significant variation between different insulation products in terms of impacts. Individual products with high impacts in categories frequently provide significant additional functionality in terms of technical performance (e.g. bending or compressive strength, fire resistance or acoustics). For example, high density mineral wools provide fairly similar thermal resistance for a given thickness, compared to low density mineral wools, but because of their much higher density, have correspondingly much higher impact. However these products can be used in many situations where their low density alternatives cannot – for example where the insulation needs to be trafficked in flat roofs. Products with high primary energy but low climate change impacts are often using biomass energy, with the CO$_2$ emissions from combusting the biomass balancing the sequestered CO$_2$ in the fuel. These products also have higher eutrophication and acidification impacts relative to their climate change impacts.

For stone wool the range of the impacts for 9 stone wool products (illustrated the wide range in functionality) is presented in Figure 20. The increased impact correlates well with the mass per m$^2$ which aligns with increased functionality for the higher mass products. It can be concluded that the environmental impacts related to producing the higher mass products are higher because of the increased use of raw materials, and the increased use of energy. Insulation manufacturers do not make their products with higher mass than necessary, unless it is to provide additional and required functionality.

![Figure 20: Comparison of the environmental impacts associated with 9 stone wool products with a French FDES, compared on the basis of common thermal resistance (PE NWE, 2011)](image-url)
According to Figure 20 there is a variation in impacts across the product range. Due to differences in conductivity (0.032-0.045 W/m.K), and density (8-31 kg/m³) required to achieve specific functionality in terms of compression, stability and tensile stress in particular, the mass of insulation needed to meet the functional unit varies from around 900 grams to around 3.5 kilograms. However, although low mass products do generally have lower environmental impacts than high mass products, there is still fairly wide variation in performance (PE NWE, 2011).

→ Environmental significance of Design for Disassembly.

Due to a lack of data on design for disassembly of insulation materials, it is not possible to determine the exact environmental significance of thermal insulation that is designed (and installed) to be easily be removed and eventually reused in other buildings. As discussed in section 3.2.2 the ease of removing and reusing building components is determined by the dependency related to other building components (cf. location in the building element, connection type, etc.). For this reasons the paragraphs below give only an indication what the importance of Design for Disassembly is on building and building element is.

Paduart (2012) compared a reference renovation of a multi-storey social housing block from the 1970s with a dynamic re-design alternative. Three renovation scenarios were used to gain more understanding about the potential benefits and burdens related to a dynamic re-design strategy. Environmental impacts have been calculated with the ReCiPe endpoint method. In a first scenario an early demolition of the building is assumed due to external motives (i.e. scenario 1). Here no replacements are considered during the remaining service life of the building. The second scenario meets the short term objectives of renovation practices today, by implying that the renovation will fulfil minimal comfort standards for the coming 45 years and no major updates and changes will be needed (i.e. scenario 2). The only interventions that occur in this scenario are replacements of building layer components during the remaining service life of the building. In a last scenario a dynamic use of the renovated building is assumed. In this scenario it is believed that frequent upgrades and changes of the internal and external building layers will be needed to answer evolving living and building standards and support demographic evolution (i.e. scenario 3). Here, the functional life span of building layers is considered instead of the technical lifespan. Except for the bearing structure, the functional life spans are much smaller than the technical ones (see legend of Table 7). By designing building layers to be easily demountable, it is assumed that sound building components will be reused.

In Figure 21 the composition of each building layer for the reference renovation and a dynamic alternative for a multi-storey social housing block from the 1970s is described.
**Figure 21**: composition of building layers for a reference and dynamic renovation alternative, based on Paduart (2012)

**Table 7**: environmental gains/losses of dynamic renovation alternative compared to reference renovation of a multi-storey social housing block, based on Paduart (2012)*

<table>
<thead>
<tr>
<th>Building skin</th>
<th>facade</th>
<th>roof</th>
<th>floor</th>
<th>partition. wall</th>
<th>internal wall</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IE</strong></td>
<td>+9%</td>
<td>+3%</td>
<td>-7%</td>
<td>-23%</td>
<td>+46%</td>
</tr>
<tr>
<td><strong>LCE</strong></td>
<td>+9%</td>
<td>+3%</td>
<td>-7%</td>
<td>-23%</td>
<td>+46%</td>
</tr>
<tr>
<td><strong>scenario 1</strong></td>
<td>+9%</td>
<td>+3%</td>
<td>-7%</td>
<td>-19%</td>
<td>-10%</td>
</tr>
<tr>
<td><strong>scenario 2</strong></td>
<td>-32%</td>
<td>-49%</td>
<td>-42%</td>
<td>-78%</td>
<td>-51%</td>
</tr>
<tr>
<td><strong>scenario 3</strong></td>
<td>-32%</td>
<td>-49%</td>
<td>-42%</td>
<td>-78%</td>
<td>-51%</td>
</tr>
</tbody>
</table>

* with IE: initial environmental impact gains (-) or losses (+); LCE: life cycle environmental impact gains (-) or losses (+); scenario 1: period of analysis: 15 years; no replacements; scenario 2: period of analysis: 45 years, replacement of all elements over 45 years; scenario 3: period of analysis: 45 years, replacement of internal walls over 10 years, replacement of portioning walls and facade over 15 years and replacement of roof and floor elements over 20 years.

Environmental impacts were calculated with the ReCiPe endpoint method. This means that the following environmental impact categories were taken into account: Climate change, human health, climate change ecosystems, ozone depletion, terrestrial acidification, freshwater eutrophication, human toxicity, photochemical oxidant formation, particulate matter formation, terrestrial ecotoxicity, freshwater ecotoxicity, marine ecotoxicity, ionising radiation, agricultural
land occupation, urban land occupation, natural land transformation, metal depletion, fossil depletion.

On building level an increase of initial environmental impacts (i.e. primarily related to the production stage) of 9% related to the dynamic renovation alternative is discerned. On building layer level both initial environmental gains and losses are observed (see Table 7). The biggest reduction in initial environmental impacts is attributed to the partitioning wall elements. While the biggest increase is attributed to the internal walls. Other elements are characterised by small gains or losses. Assuming a dynamic use of the building (i.e. scenario 3) the relatively small addition of initial environmental impacts on building level is fully compensated by significant gains over the life cycle of the building: i.e. 44% of life cycle impacts. Considering the short term facility management attitude of today (i.e. scenario 2) and early demolition of the building (i.e. scenario 1) the functionalities of dynamic building solutions would remain unused, leading to higher life cycle environmental impacts. However, the environmental losses over the building service life are small: i.e. 9% for scenario 1 and 5% for scenario 2.

Annemans et al. (2012) describe the potential environmental benefits and gains of some design options related to a representative design of a new elderly care residence of 93 beds to improve the environmental profile of the building over its entire estimated life span, i.e. 60 years. After reducing life cycle environmental impacts by 40% by designing a low energy alternative of the care home (i.e. option 1.1), primary attention was given to reduce environmental impacts related to the life cycle of the building components. In option 2.0 building materials were selected based on results within the SuFiQuaD project (Allacker et al 2011). For each building element those solutions showing an optimal ratio between initial external environmental costs (taken into account environmental impacts primarily related to production stage of building components) and life cycle external environmental costs were chosen.

Figure 22: Reduction in life cycle environmental impacts of a representative elderly care home per net floor area (m²) x year (service life of 60 years) through some improvement options, from Annemans et al. (2012)

This selection of environmentally friendly materials resulted in life cycle environmental gains of 21% compared the low energy alternative (without taking operational energy during the use phase
CHAPTER 3 MEErP TASK 0 - QUICKSCAN

into account\(^{28}\). **Option 2.1**, wherein all building elements were designed in such a way they could be easily reused and structural and functional changes of the care home are made possible without changing the aesthetics of the building, resulted in life cycle environmental gains of 28%. Combining option 2.0 and 2.1. (i.e. **option 2.2**) resulted in a reduction of life cycle impacts by 35%. See Figure 22 for an overview.

**Conclusion:**
The analysis has shown that insulation has embodied impacts in manufacture and disposal, but also very much more significant benefits from its use in buildings, which far outweigh the embodied impacts. The impact of insulation is also small in comparison with the impact of the other construction materials used within buildings.

Although the exact magnitude of the environmental significance for thermal insulation products is difficult to establish, there are some strong indications that Design for Disassembly can provide important environmental benefits on building and building element level. There are several reasons why refurbishment/ replacement of insulation material is necessary several times to ensure optimal performance over the lifetime of a building. Those reasons are for example the deterioration of the insulation performance of the insulation material over time or a change in energy standards of the building which forces increased insulation during renovation. Further research is needed to establish the role of thermal insulation in this.

### 3.4.4. **THERMAL INSULATION IN RELATION TO INDOOR AIR QUALITY DURING THE USE PHASE**

Indoor air contains a wide variety of pollutants, typically a wider range than encountered outdoors. Moreover, some pollutants are present at higher concentration levels indoors. *Overall exposure to air pollution is mainly determined by the indoor environment due to the time activity patterns of the population* (Envie, 2006). People spend on average typically 85% indoors (Leech et al., 2002, Brasche and Bischof, 2005). It is therefore an important environmental determinant of an individual’s health. Indoor air quality (IAQ) is typically determined by the ambient air, by the building envelope (e.g. air tightness, building ventilation and ventilation system) and by indoor sources (such as heating, building materials, consumer products). As a consequence, global trends in sustainability, resulting in more energy efficient and better insulated dwellings and buildings with controlled mechanical ventilation systems, may have an important additional effect on the indoor environment in the future.

The contribution of non-ideal IAQ to the loss of healthy life expectancy, expressed as disability adjusted life years (DALY) has been calculated in the EU Envie study (2006) for 7 diseases: asthma, cardiovascular diseases, COPD, lung cancer, sick building syndrome, respiratory infectious diseases and acute CO intoxication. This involves at the EU level overall 2 million DALYs/year for a population of 480 million. According to Jantunen et al. (2011) in the follow-up study (IAIAQ, 2011), ambient outdoor air is responsible for 2/3 of the total burden of disease (BoD) from indoor air exposures in Europe (mostly fine PM and bio-aerosols, but also some Volatile Organic Compounds (VOCs)). The other 1/3 of the BoD related to indoor air exposures is caused by heating and combustion equipment (cooking and heating with solid fuels), water systems, and water leaks. Condensation and underlying soil as source of radon are other important sources for the IAQ associated BoD. Jantunen et al. (2011) state that, although the roles of furnishings, decoration materials, household products and building materials appear small compared to the other listed indoor sources, the nature of the emitted VOCs should also be taken into account. In the IAIAQ

---

\(^{28}\) In all options the same energy demand level is considered (very low energy level)
study health benefits of IAQ policies were calculated for a selection of 12 policies. The figures for Belgium varied from 0.7 to 17 kDALYs/year per policy. The most important indoor contaminants in terms of BoD were found to be: fine PM, dampness, bio aerosols, radon, CO, VOC’s.

In leaky buildings, ventilation can often be reduced by improving air-tightness without compromising IAQ. Care must be taken, however, to ensure that the minimum ventilation requirements are always provided. Increasing the levels of thermal insulation must be carried out with care because of the resulting changes in distribution of temperature and humidity in the building envelope. In some circumstances this can lead to interstitial condensation and thermal bridges.

Indoor VOC emissions related to building materials originate from a wide variety of products, among which thermal insulation materials. Emission rates of insulation material, based on product emission tests under controlled conditions, have been reported in open literature (such as Choczynski et al., 2010 and Gallego et al., 2007). When constructing a building, the emissions of the used materials may be function of the structure in which they are applied (inside or outside the building envelope; covered, glued, etc.). To assess product emissions resulting from the combined use of different materials and products in a building, simulated constructions in real-life emission test chambers provide the opportunity to quantify emissions, sink effects and secondary reactions (Gunschera et al., 2013). Certain studies have also focused on emissions from organic insulation materials, such as bast fibres of flax, linseed and hemp, where besides (low) VOC emissions, the microbial emissions may become an important aspect as well (e.g. in bast fibrous insulations certain taxa of fungi were detected, some of which may produce toxins in suitable conditions) (Koivula et al., 2005). The BUMA database (Prioritisation of Building Materials emissions as indoor pollution sources, an EU funded project)\(^{29}\) inventories data sources and specific emission rates of building materials in order to assess the exposure to emitted compounds in indoor air (Missia et al., 2010). The share of the insulation products in the total indoor air emissions from building materials should be investigated as soon as possible by means of adapted simulations in which exposure and health risk assessment will be mapped. Investigations should first be conducted by researchers and afterwards a measurement method can be implemented in practice.

### 3.4.5. Conclusion

The environmental impacts and benefits related to manufacturing and EOL of thermal insulation products are currently small – related to the entire life cycle. The potential benefits in the use phase related to insulating buildings are much larger than potential environmental burdens during the manufacturing and EOL phase. Currently, the environmental focus should thus be put on increasing the energy efficiency of existing and new buildings. At this time, the use of thermal insulation in buildings is identified as the single most important factor for the building envelope. However, more appropriately-sized and more efficient heating and cooling equipment also have a very important role, as acknowledged in the various EPBD calculation methodologies in Member States.

However, as the use of thermal insulation will increase to meet the 2019-2021 EPBD targets and also the amount of insulation waste released through demolition will increase, the (environmental and economic) demand to recover thermal insulation will increase as well. **National waste routes (including take-back and recovery initiatives) and waste infrastructure will need to prepare for handling of larger volumes of insulation waste in the long term.** In order to avoid waste and

\(^{29}\) [http://www.uowm.gr/bumaproject/](http://www.uowm.gr/bumaproject/)
increase the life expectancy of building components, the way thermal insulation products are integrated in buildings have to be rethought from the design stage. Thermal insulation products typically have a lower estimated life span than surrounding building components (BBSR 2011; SBR 2012). Replacement of thermal insulation products in building elements that are not designed to be easily dismantled, will generate unnecessary waste and decrease the life expectancy of surrounding building components and the building element in which it is placed.

From a health perspective, indoor air quality is another issue to be looked at in relation to possible VOC and microbial emissions from specific insulating materials. As for energy efficiency and environmental aspects related to thermal insulation solutions, IAQ has to be studied at system level and not merely on product level.
3.5. **Analysis on Environmental Improvement Potential**

Before determining the improvement potential related to thermal insulation products, one should first establish the dominant processes in which improvement are possible and best achievable. In previous paragraphs it is argued that adding thermal insulation in a building improves the energy performance of the building – and accordingly decreases the impact of the operational energy consumption over the service live of the building.

Based on a screening of the environmental improvement of the highly insulated walls discussed in 3.4.3 (see Figure 15 to Figure 17), we can tentatively conclude that most of the environmental improvement related to thermal insulation products still lies in improving the energy performance of the existing and new building stock, the focus is set here on reducing transition losses of buildings, together with other initiatives to reduce heat losses.³⁰

VHK (2011) modelled a building stock improvement scenario to calculate an indicative environmental improvement potential for the thermal insulation industry. It is not realistic to assume that the complete stock can be retrofitted or improved in one single year. It is logical to assume a certain transition period for the measures to take effect. For the calculation of the indicative saving potential the following assumptions were made by VHK (2011):

- based on Kemna et al. (2007) the energy consumption in 2005 is taken as a reference (i.e. 10.926 PJ), which includes tertiary heating systems;
- the average energy saving for the total heating energy input after an improvement of thermal insulation is 33% (this can be any combination of facade, roof, floor/basement insulation, whichever is most optimal for the building) - this value represents the overall average saving potential indicated by the IMPRO-Building study (Nemry and Uihlein, 2008);
- a stock improvement rate of 10% per 5 year is assumed (i.e. 2% of the stock of buildings is improved per year). This may be considered as a conservative scenario given the relative saving potential to unlock. However, VHK arguments that the experience of the past years has shown that applying energy saving measures in existing building stock is difficult.

This scenario indicates savings of some 307 PJ in 2020 to over 1.000 PJ in the year 2030. Higher savings are possible if a) the stock improvement rate is increased or if b) the improvement is done at a higher insulation standard.

³⁰ This focus is justified by the Ecodesign Directive: “In preparing a draft implementing measure the Commission shall consider the life cycle of the product and all its significant environmental aspects, inter alia, energy efficiency. The depth of analysis of the environmental aspects and of the feasibility of their improvement shall be proportionate to their significance”
Table 8: Indicated improvement of operational energy demand by applying insulation products

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy saving of improved ‘product’</strong></td>
<td></td>
<td></td>
<td></td>
<td>-33%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Implementation in stock</strong></td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>20%</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Stock not yet improved</strong></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>90%</td>
<td>80%</td>
<td>60%</td>
</tr>
<tr>
<td><strong>Savings</strong></td>
<td></td>
<td></td>
<td>307</td>
<td>581</td>
<td>1095</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 23: Effect of improved thermal insulation on energy consumption of buildings with central heating - Reference and improvement scenario, from VHK (2011)**

This assessment shows an indicative saving potential of over 1.000 PJ/year in 2030. The savings are realised through a lower energy consumption of heating (and cooling) systems by changes in the thermal performance of building components of which the thermal insulation material is an important, but not the only element (VHK, 2011). Other elements are for example facade, roof, floor/basement insulation. It is however not further elaborated in the VHK study (2011).

Analysis carried out under the GEA pathway framework (GEA, 2012) demonstrates that a reduction of global final energy use for heating and cooling of about 46% is possible by 2050 compared with 2005 through full use of today’s best practices in design, construction, and building operation technology and know-how. This can be obtained even while increasing amenities and comfort and simultaneously accommodating an increase in global floor area of over 126% (Figure SPM-4). It is not stated explicitly in the report, but one of the main drivers for energy use reduction in new buildings and retrofit buildings is the application of insulation.
The uncertainty about the improvement potential of environmental impacts related to non-operational-energy aspects is due to the following factors:

- There are strong indications that for the time being the improvement of (operational) energy performance dwarfs other environmental impacts (based on a LCA basis) – see Figure 15 to Figure 17.
- The significance of thermal insulation products related to some environmental or health aspects are difficult to establish:
  - **Indoor air quality (IAQ):** Paragraph 3.4.4. describes the influence of bad IAQ to health problems – often related to energy efficient and highly insulated buildings. Furthermore, some studies given in paragraph 3.4.4. report important emission rates of (semi) volatile organic compounds emissions (SVOC) and/or microbial emissions from some thermal insulation products. SVOC are for example pesticides (DDT, chlordane, plasticizers (phthalates) and fire retardants (PCBs, PBB)). Because for the time-being there is not yet a harmonised basis for protocols and evaluation strategies, the share of the insulation products in the total indoor air emissions from building materials is difficult to determine (in building as well as in a building element). This is especially true for SVOCs emissions, such as flame retardants, phthalates or polycyclic aromatic hydrocarbons (PAHs). Despite this lack of data, IAQ is considered as an important aspect to take into account (even today), since most people spend an important part of their life inside, exposing themselves to building related air pollution. Ecodesign measures related to IAQ may lead to exclusion of some toxic substances in products, due to the importance of the indoor emissions related to the individual, but also public health. Requirements for measuring emissions in the use phase are being developed by CEN TC 351. Having a sound measurement method and based on that measured emission data is a condition for further policy measures. Stakeholders also indicated the need for harmonised EN standards and refer to mandate M/103 of the European Commission and the CPR (see Annex C).
  - Where CEN TC 351 only covers emissions in the use phase, some stakeholders indicate that an enlargement to the whole life cycle is desirable.
Design for Disassembly (DfD): Paragraph 3.4.3 elaborates on the environmental significance of DfD for some representative building design cases – especially when frequent upgrades and multiple replacements have to be considered. The two examples given in paragraph 3.4.3 demonstrate that the improvement potential of DfD on the life cycle impacts of a building may be different for each case: e.g. depending on the building application and the building (element) structure. Due to a lack of representative data, it is therefore not possible to calculate the improvement potential of DfD related to thermal insulation only.

- Assessing the role of IAQ and DfD in the overall environmental performance of (European) buildings requires a systemic approach. Determination of the improvement potential of DfD and IAQ on the environment (and health) will require a considerate amount of effort to do this for a representative set of constructive solutions for building elements (e.g. exterior and interior walls, flat and pitched roofs, floor on grade, etc.) and building applications (e.g. dwelling, office, store, etc.).

Despite of the difficulties listed above, measures against production-phase impacts, leaching, emission of harmful substances and EOL impacts will be briefly discussed in paragraph 5.2 of this report.

3.6. CONCLUSIONS

Although thermal insulation products for buildings are not easily categorized nor defined, the Quickscan revealed strong indications that their economic and environmental importance is very significant. The major environmental impacts of insulation lie in the environmental benefits it provides during the use phase of the building in which it is installed (i.e. reduction of energy use of the building). Compared to the reduction of energy use in the use phase of the building, embodied impacts relating to the manufacturing and EOL of thermal insulation products are generally smaller. Furthermore, other building components often dominate the environmental profile of building elements and buildings.

Nevertheless, in light of the 2019-2021 EPBD targets and the increase in insulation waste released through demolition, the environmental impacts related to manufacture, replacement and end-of-life will gain in importance. However, it would be counter-productive if attempts to reduce the embodied impact of thermal insulation solutions led to an increase in energy consumption and therefore extended the payback time. Providing affordable and energy efficient solutions have to be considered for each building project separately. For each building application and building context, a balance has to be established between low periodic operational energy costs due to sufficient thermal insulation (and choosing energy efficient technical services) and low initial costs due to limitation of material and installation costs (and choosing technical services with a low investment cost). The same line of thinking can be used with regard to environmental impacts.

Finally, many of the issues addressed in the Quickscan, such as the energy efficiency of buildings, the environmental performance of building elements and indoor air quality, need to be addressed on a systemic level.
4.1. INTRODUCTION

The objective of Task 1 is to define the product category and the system boundaries of the ‘playing field’ for Ecodesign for thermal insulation in buildings, and to do so from a functional, technical and environmental point of view.

In Task 0, the product group thermal insulation product was defined (see paragraph 3.2.1).

This is important in order to gain a realistic definition of the design options and improvement potential and it is also relevant in the context of achieving a technical definition of any implementing legislation or voluntary measures (if any).

Task 1 forms the basis for the test and calculation methods that could be used to potentially regulate relevant Ecodesign parameters for thermal insulation used in buildings. Checks have been carried out in order to determine whether accurate, reliable and reproducible methods exist and/or, if they don’t exist or the methods are partly flawed, how that problem could be addressed.

Task 1 consists of the categorization of thermal insulation for buildings according to Prodcom categories (used in Eurostat) and to other schemes (e.g. EN standards), the description of relevant definitions and of the overlaps with the Prodcom classification categories and scope definition.

During the definition of the product scope (including product definitions) categorisation is linked to the primary performance parameter (the "Functional Unit"). If needed, sub-categorisation can take place on the basis of secondary performance parameters. Discussion of product definition and product scope issues also include an analysis of product-system interactions in relation to the products’ environmental impacts and potential improvements.

In addition, harmonized test and performance standards and additional sector-specific procedures for product-testing are identified and discussed, covering the test protocols for:

- Primary and secondary functional performance parameters (Functional Unit);
- Resource use (energy and materials, including waste) during the entire product-life;
- Safety (flammability, electric safety, EMC, stability of the product);
- Noise and vibrations, if applicable;
- Other product-specific test procedures possibly posing barriers to Ecodesign measures.

Finally, task 1 identifies existing legislations, voluntary agreements, and labelling initiatives at the EU level, in the Member States, and in the countries outside the EU.

The MEERP task 1 for thermal insulation used in buildings has been subdivided into three subtasks:

1. Definition of the product scope;
2. Overview and description of test standards;
3. Overview and description of legislation.

These subtasks are described in the next paragraphs.
4.2. Product Scope

4.2.1. Definition of the Product Scope

This section defines the categories of products covered by this study and defines the preliminary product scope, including preliminary product definitions, taking into account that categorisation and preferably linked to primary performance parameter (the "functional unit"). If needed sub-categorisation can take place on the basis of secondary performance parameters.

4.2.2. Categorisation of Insulation Materials

→ Prodcom categories (Eurostat)

PRODCOM is a system for the collection and dissemination of statistics on production of manufactured goods. It is based on a product classification called the PRODCOM list. It originates from the Europroms\(^{31}\)-Prodcom\(^{32}\) statistics database.

The PRODCOM classification for insulation materials is presented in Table 9.

<table>
<thead>
<tr>
<th>Production Code</th>
<th>Description</th>
<th>2009 (in ton)</th>
<th>2010 (in ton)</th>
<th>2011 (in ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13204600</td>
<td>Woven fabrics of glass fibre (including narrow fabrics, glass wool)</td>
<td>436.286</td>
<td>563.527</td>
<td>481.979</td>
</tr>
<tr>
<td>16102200</td>
<td>Wood wool; wood flour</td>
<td>1,988.935</td>
<td>280.722</td>
<td>213.321</td>
</tr>
<tr>
<td>17211230</td>
<td>Sacks and bags, with a base width &lt;= 40 cm, of paper, paperboard, cellulose wadding or webs of cellulose fibres</td>
<td>968.434</td>
<td>1,128.893</td>
<td>1,141.721</td>
</tr>
<tr>
<td>17211250</td>
<td>Sacks and bags of paper, paperboard, cellulose wadding or webs of cellulose fibres (excluding those with a base width &lt;= 40 cm)</td>
<td>950.153</td>
<td>957.438</td>
<td>1,010.383</td>
</tr>
<tr>
<td>20162035</td>
<td>Expansible polystyrene, in primary forms</td>
<td>1,845.757</td>
<td>1,946.323</td>
<td>1,521.316</td>
</tr>
<tr>
<td>20165670</td>
<td>Polyurethanes, in primary forms</td>
<td>2,419.148</td>
<td>2,986.237</td>
<td>2,379.874</td>
</tr>
<tr>
<td>23141210</td>
<td>Glass fibre mats (including of glass wool)</td>
<td>227.809</td>
<td>243.709</td>
<td>274.180</td>
</tr>
<tr>
<td>23141230</td>
<td>Glass fibre voiles (including of glass wool)</td>
<td>118.060</td>
<td>134.159</td>
<td>138.385</td>
</tr>
<tr>
<td>23991910</td>
<td>slag wool, stone wool and similar mineral wools and mixtures thereof, in bulk, sheets or rolls</td>
<td>2,072.907</td>
<td>2,062.714</td>
<td>2,371.071</td>
</tr>
<tr>
<td>23991920</td>
<td>Exfoliated vermiculite, expanded clays, foamed slag and similar expanded mineral materials and mixtures thereof</td>
<td>2,255.099</td>
<td>2,799.930</td>
<td>3,103.152</td>
</tr>
<tr>
<td>23991930</td>
<td>Mixtures and articles of heat/sound-insulating materials n.e.c.</td>
<td>1,353.309</td>
<td>1,485.501</td>
<td>1,571.892</td>
</tr>
</tbody>
</table>

\(^{31}\) Europroms is the name given to published Prodcom data. It differs from Prodcom in that it combines production data from Prodcom with import and export data from the Foreign Trade database.

\(^{32}\) Prodcom originates from the French “PRODuction COMmunautaire”
Categories according to EN- or ISO-standard(s) and ETAGs

ISO/FDIS 9774

ISO/FDIS 9774 - Thermal insulation for building applications — Guidelines for selecting properties. This International Standard gives guidelines to the standards writer in selecting thermal-insulation material properties for standards used in building applications.

In the ISO/FDIS 9774 one can find examples of the most common applications of thermal-insulation products in buildings (see Table 10).

Table 10: Examples of the most common applications of thermal-insulation products in buildings (according to ISO/FDIS 9774)

<table>
<thead>
<tr>
<th>Application</th>
<th>Sketch No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitched roof</td>
<td></td>
</tr>
<tr>
<td>Unloaded insulation between rafters, fully supported</td>
<td>1</td>
</tr>
<tr>
<td>Insulation separating rafters and outer covering</td>
<td>2</td>
</tr>
<tr>
<td>Insulation separating supporting construction and outer covering</td>
<td>3</td>
</tr>
<tr>
<td>Insulation beneath rafters</td>
<td>4</td>
</tr>
<tr>
<td>Roof</td>
<td></td>
</tr>
<tr>
<td>Insulation between rafters or beams</td>
<td>5</td>
</tr>
<tr>
<td>Inverted, insulation above roofing membrane including roof gardens and parking decks</td>
<td>6</td>
</tr>
<tr>
<td>On steel deck, insulation beneath roofing membrane</td>
<td>7</td>
</tr>
<tr>
<td>Accessible to light or heavy traffic or loads from roof garden (soil layer, plants, etc.) and parking decks (concrete pavers or slabs), insulation beneath roofing membrane</td>
<td>8</td>
</tr>
<tr>
<td>Accessible only to maintenance personal, insulation beneath roofing membrane</td>
<td>9</td>
</tr>
<tr>
<td>Flat roof</td>
<td></td>
</tr>
<tr>
<td>Masonry or concrete wall, external insulation covered by rendering</td>
<td>10</td>
</tr>
<tr>
<td>Timber stud construction, outside insulation and rendering directly supported by the studs</td>
<td>11</td>
</tr>
<tr>
<td>Masonry or concrete wall, fully supported internal insulation supporting light protective internal facing (e.g. gypsum board)</td>
<td>13</td>
</tr>
<tr>
<td>Masonry or concrete wall, internal insulation supporting light protecting facing, partly supported by studs</td>
<td>14</td>
</tr>
<tr>
<td>Masonry or concrete wall, internal insulation with heavy self-supported protective internal facing (e.g. tiles at roomside)</td>
<td>15</td>
</tr>
<tr>
<td>Timber or metal stud construction with boards covering, insulation between the studs</td>
<td>16</td>
</tr>
<tr>
<td>Cavity wall construction, insulation between the leaves, cavity ventilated</td>
<td>17</td>
</tr>
<tr>
<td>Cavity wall construction, cavity fully filled with insulation, outer leaf not watertight</td>
<td>18</td>
</tr>
<tr>
<td>Timber or metal stud construction with boards covering, insulation supported by boards; or masonry or concrete wall, supporting the insulation with ventilated exterior covering</td>
<td>19</td>
</tr>
<tr>
<td>Wall under ground, external insulation behind waterproof membrane with mechanical protection</td>
<td>20</td>
</tr>
<tr>
<td>Wall under ground, external insulation with direct contact to the ground</td>
<td>21</td>
</tr>
<tr>
<td>Cellar or crawlspace hall, internal insulation with or without covering</td>
<td>22</td>
</tr>
<tr>
<td>Ceiling/floor</td>
<td></td>
</tr>
<tr>
<td>Insulation over the supporting construction or between the beams</td>
<td>23</td>
</tr>
<tr>
<td>Insulation under load distributing flooring, fully supported</td>
<td>24</td>
</tr>
<tr>
<td>Insulation under the construction</td>
<td>25</td>
</tr>
<tr>
<td>Foundation</td>
<td></td>
</tr>
<tr>
<td>Concrete, insulation under the slab with direct contact to the ground</td>
<td>26</td>
</tr>
<tr>
<td>Concrete, insulation supported by the slab, above waterproof membrane, beneath load distributing flooring</td>
<td>27</td>
</tr>
<tr>
<td>Concrete, insulation under the slab above waterproof membrane</td>
<td>28</td>
</tr>
<tr>
<td>Frost insulation in or against the ground</td>
<td>29</td>
</tr>
</tbody>
</table>
Figure 25: Examples of the most common applications of thermal-insulation products in buildings (according to ISO/FDIS 9774) - sketches
EN standard categories

The existing EN standards divide insulation materials into two main categories, based on the place where the insulation material is formed (factory made or in-situ formed). Subcategories are based on the type of material.

According to the Construction Products Regulation, all insulation materials in the building should be considered as construction products.

Factory made insulation materials

Factory made insulation materials for buildings are further subdivided into 10 product groups:

1. mineral wool;
2. expanded polystyrene;
3. extruded polystyrene foam;
4. rigid polyurethane foam;
5. cellular glass;
6. wood wool;
7. expanded perlite board;
8. expanded cork;
9. wood fibre;
10. phenolic foam.

On top of those ten product groups, two standards exists for “External thermal insulation composite systems” (ETICS):

11. ETICS based on expanded polystyrene;
12. ETICS based on mineral wool.

However in the near future these two last standards for ETICS will be replaced by one standard valid for all ETICS, including product specific annexes (Mandate M/489).

For building equipment and industrial installations additionally flexible elastomeric foam (FEF), cellular glass (CG), calcium silicate (CS), rigid polyisocyanurate foam (PIR), polyethylene foam (PEF) and exfoliated vermiculite are considered.

The relevant EN standards for buildings are listed below:
<table>
<thead>
<tr>
<th>Technical Committee</th>
<th>Standard Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC 88</td>
<td>EN 13162: 2012</td>
<td>Thermal insulation products for buildings. <strong>Factory made mineral wool (MW)</strong> products — Specification</td>
</tr>
<tr>
<td></td>
<td>EN 13163: 2012</td>
<td>Thermal insulation products for buildings. <strong>Factory made expanded polystyrene (EPS)</strong> products — Specification</td>
</tr>
<tr>
<td></td>
<td>EN 13166:2012</td>
<td>Thermal insulation products for buildings. <strong>Factory made phenolic foam (PF)</strong> products. Specification</td>
</tr>
<tr>
<td></td>
<td>EN 13170: 2012</td>
<td>Thermal insulation products for buildings. <strong>Factory made products of expanded cork (ICB).</strong> Specification</td>
</tr>
<tr>
<td></td>
<td>EN 16069: 2012</td>
<td>Thermal insulation products for buildings. <strong>Factory made products of polyethylene foam (PEF).</strong> Specification</td>
</tr>
<tr>
<td></td>
<td>EN 13499: 2003</td>
<td>Thermal insulation products for buildings. <strong>External thermal insulation composite systems (ETICS) based on expanded polystyrene — Specification</strong></td>
</tr>
<tr>
<td></td>
<td>EN 13500:2003</td>
<td>Thermal insulation products for buildings. <strong>External thermal insulation composite systems (ETICS) based on mineral wool - Specification</strong></td>
</tr>
</tbody>
</table>

**In-situ formed insulation materials**

In-situ formed insulation materials are further subdivided into 6 product groups:
1. expanded clay lightweight aggregate products;
2. loosefill mineral wool;
3. sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam;
4. expanded perlite (EP);
5. exfoliated vermiculite (EV);
6. dispensed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam.;
7. cellulose (draft standard available).
The relevant EN standards for buildings are listed below:

<table>
<thead>
<tr>
<th>Technical Committee</th>
<th>Standard Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC 88</td>
<td>EN 14063-1: 2004</td>
<td>Thermal insulation products for buildings - <em>In-situ formed expanded clay lightweight aggregate products</em> - Part 1: Specification for the loose-fill products before installation</td>
</tr>
<tr>
<td></td>
<td>EN 14063-2: 2013</td>
<td>Thermal insulation materials and products. <em>In-situ formed expanded clay lightweight aggregate products (LWA)</em>. Part 2: Specification for the installed product-1</td>
</tr>
<tr>
<td></td>
<td>EN 14315-1:2013</td>
<td>Thermal insulating products for buildings - <em>In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products</em> - Part 1: Specification for the rigid foam spray system before installation</td>
</tr>
<tr>
<td></td>
<td>EN 14315-2: 2013</td>
<td>Thermal insulating products for buildings - <em>In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products</em> - Part 2: Specification for the installed insulation products</td>
</tr>
<tr>
<td></td>
<td>EN 14317-1:2004</td>
<td>Thermal insulation products for buildings - <em>In-situ thermal insulation formed from exfoliated vermiculite (EV) products</em> - Part 1: Specification for bonded and loose-fill products before installation</td>
</tr>
<tr>
<td></td>
<td>EN 14318-1:2013</td>
<td>Thermal insulating products for buildings - <em>In-situ formed dispensed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products</em> - Part 1: Specification for the rigid foam dispensed system before installation</td>
</tr>
<tr>
<td></td>
<td>EN 14318-2: 2013</td>
<td>Thermal insulation products for buildings - <em>In-situ</em></td>
</tr>
</tbody>
</table>
formed dispensed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products - Part 2: Specification for the installed insulation products.

<table>
<thead>
<tr>
<th>TC 88</th>
<th>prEN 15101 -1</th>
<th>Thermal insulation products for buildings - In-situ formed loose fill cellulose (LFCI) products - Part 1: Specification for the products before installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>prEN 15101 -2</td>
<td>Thermal insulation products for buildings - In-situ formed loose fill cellulose (LFCI) products - Part 2: Specification for the installed insulation products.</td>
<td></td>
</tr>
</tbody>
</table>

**European Technical Approval Guidelines (ETAGs)**

Since the 1st of July 2013, European Assessment Documents (EADs) are applicable. They are harmonised technical specifications that serve as the basis for the issuing of European Technical Approvals (ETAs) (see 4.3.1). Formerly, European Technical Approval Guidelines (ETAGs) were used as a basis for European Technical Approvals. Existing ETAGs remain valid and can be used as EAD. No new ETAGs will be developed however. ETAs can also be issued without a guideline. ETAs are product (brand) specific and are not issued for a certain category of insulation materials.

ETAG 004 and ETAG 031 are two examples of ETAGs relevant for the group of insulation materials in buildings and are presented below.

**ETAG 004:** amended: External Thermal Insulation Composite Systems with Rendering (October 2011):

From the design point of view, ETICS are differentiated according to the methods of fixing:

1. Purely bonded ETICS: ETICS may be fully bonded (over the entire surface) or partially bonded in strips and/or dabs.
2. Bonded ETICS with supplementary mechanical fixings: the load is totally distributed by the bonding layer. The mechanical fixings are used primarily to provide stability until the adhesive has dried and act as a temporary connection to avoid the risk of detachment. They can also provide stability in case of fire.
3. Mechanically fixed ETICS with supplementary adhesive: the load is totally distributed by the mechanical fixings. The adhesive is used primarily to ensure the flatness of the installed ETICS.
4. Purely mechanically fixed ETICS: the ETICS are secured to the wall by mechanical fixings only.

A mandate has been issued (M/489) on external thermal insulation composite systems/kits with rendering (ETICS).

**ETAG 031:** Inverted Roofs Insulation Kits - Part 1: General - Part 2: Insulation with protective Finish (14 December 2010):

ETAs issued on the basis of this guideline, cover either:

- The thermal insulation with filter or separation layer (e.g. geotextile) and all other components the assembled system within a set generic specification.

---

33 Other components are gravel ballast, paving, drainage layers, bedding layer material and growing medium.
The thermal insulation and a water flow-reducing layer, with all other components of the assembled system within a set generic specification.

→ Labelling categories (EU Energy Label or Eco-label)

The Study for the Amended Ecodesign Working Plan – task 4 (VHK, 2011) gives an overview of the different Eco labels available in the EU and beyond. This overview is given in Figure 26.

![Figure 26: Consideration of energy/eco labels (EU and beyond) and GPP (VHK, 2011)](image)

The categories for insulation materials available within those labels are discussed below. Some additional labels including categorisation are discussed as well. Labels are described into more detail in paragraph 4.4.2.

**German Blue Angel**

Since 1978 the Blue Angel has set the standard for eco-friendly products and services selected by an independent jury in line with defined criteria. The Blue Angel is only awarded to products and services which - from a holistic point of view - are considered to offer significant comparative benefit to the environment and, at the same time, meet high standards of serviceability, health, and occupational protection.

The Blue Angel-label can be awarded for:

- RAL-UZ 132: low-emission thermal insulation material and suspended ceilings for use in buildings
  These basic criteria apply to thermal insulation material according to DIN EN 13162 to DIN 13171 and suspended ceilings according to DIN EN 13964 for use in buildings by fields of application:
  - WI – interior insulation of the wall;
  - WZ – insulation of double-leaf walls;
  - WH – insulation of timber frame and timber panel constructions;
  - WTR – insulation of partition walls;
  - DI – interior insulation of the ceiling (on the underside) or roof;
  - DZ – intermediate rafter insulation;
  - DEO – interior insulation of the ceiling or base plate (on the upper side) without sound-proofing requirements;
  - DES – interior insulation of the ceiling or base plate (on the upper side) with sound-proofing requirements) according to DIN 4108-101;
  - Insulation material and suspended ceilings approved by the building inspection authorities.

- RAL-UZ 140: external thermal insulation composite systems
  These basic award criteria apply to external thermal insulation composite systems generally approved by the building authorities and designed in accordance with DIN 55699, February 2005, „Application of external thermal insulation composite systems“.

**Natureplus**

Natureplus is the international quality seal for high quality, sustainable building materials, building products and furnishings. Products which carry this label pose no danger to health, are produced in an environmentally-friendly manner and are tested for their functionality.

The following categorization is made:

- Insulation from Renewable Raw Materials
  - Flax;
  - Hemp;
  - Wood Shavings;
  - Wood Fibres;
  - Rye;
  - Sheep’s Wool;
  - Cork;
  - Cellulose.
- Mineral-Based Insulation:
  - Natural-Stone Based Insulation;
  - Expanded Clay Insulation;
  - Expanded Glass Insulation;
  - Mineral-Based Foam Boards;
  - Foam Glass Insulation.
- ETICS – Composite Insulation Systems

**Umweltzeichen (Austrian Ecolabel)**

Distinction is made between:

- Insulation materials based on fossil resources with hydrophobic properties;
- Insulation materials based on renewable resources.

**UK Energy Saving Recommended (ESR) logo**

Energy Saving Trust Recommended is a product certification and labelling scheme in the UK that highlights products that are among the most energy efficient on the market and will help consumers to save energy in the home.

---

35 [http://www.natureplus.org](http://www.natureplus.org)
36 [http://www.umweltzeichen.at/](http://www.umweltzeichen.at/)
For insulation materials, the following categorisation is used:

- Cavity wall insulation;
- Domestic pipe insulation;
- External wall insulation;
- Internal wall insulation;
- Loft insulation;
- Radiator reflector panels.

**Labels outside EU**

**ENERGY STAR**

ENERGY STAR is a U.S. Environmental Protection Agency voluntary program that helps businesses and individuals save money and protect the climate through superior energy efficiency.

In the field of thermal insulation for building there is a category: “air seal and insulate with ENERGY STAR”.

The different categories of insulation products are listed below:

- **Blankets, in the form of batts or rolls:**
  
  Product materials (non-exhaustive list):
  
  - Mineral fiber, typically of stone, slag, or glass;
  - Natural fibers such as cotton and wool.

  The product may or may not be faced.

- **Spray or pour foam Insulation:**

  Foamed materials (non-exhaustive list):
  
  - Polyurethane;
  - Polyisocyanurate;
  - Polycyene;
  - Phenolic;
  - Cementious insulation.

- **Loose Fill Insulation** (granular, nodular, fibrous, powdery or similar form):

  Materials (non-exhaustive list):
  
  - Fibre glass;
  - Stone wool in the form of loose fibers or fiber pellets;
  - Cellulose;
  - Cotton;
  - Wool.

- **Board Insulation:**

  Materials (non-exhaustive list):
  
  - Fiberglass;
  - Expanded polystyrene (EPS);
  - Extruded polystyrene (XPS);
  - Polyisocyanurate;
  - Polyurethane.

  The product may or may not be faced.

- **Structural insulation systems definitions:**

  - Insulated Concrete Forms (ICFs);
  - Structural Insulated Panels (SIPs).

---

[^38]: [http://www.energystar.gov](http://www.energystar.gov)
Good Environmental Choice Australia (GECA)\textsuperscript{39}


GECA makes the following categorisation:
- Resistive-type boards;
- Blankets;
- Batts;
- Loose-fill and spray-on thermal insulation.

Environmental Choice New Zealand Label\textsuperscript{40}

Environmental Choice New Zealand (ECNZ) is an environmental labelling programme which has been created to help businesses and consumers find products and services that ease the burden on the environment.

The following categorisation is applied:
- Sheep’s wool insulation;
- Glass wool insulation;
- Mineral wools;
- Cellulose insulation;
- Polymer-based materials.

Environment Canada’s Environmental Choice Program – Ecologo programme\textsuperscript{41}

Founded in 1988 by the Government of Canada but now recognized worldwide, EcoLogo\textsuperscript{TM} is North America’s largest, most respected environmental standard and certification mark. EcoLogo provides customers – public, corporate and consumer – with assurance that the products and services bearing the logo meet stringent standards developed by the EcoLogo\textsuperscript{TM} Standard Development and Revision process.

The following categorisation of Thermal Insulation Materials can be found within the programme:
- Batt and blanket type:
  - Fiberglass;
  - Mineral wool.
- Rigid board-type:
  - Plastic;
  - Fiberglass;
  - Mineral wool.
- Spray-on / loose-fill type:
  - Cellulose;
  - Plastic foam;
  - Glass or mineral fibre.
- Reflective insulation: aluminium foil on various substrates.

\textsuperscript{39} \url{http://www.geca.org.au}
\textsuperscript{40} \url{http://www.environmentalchoice.org.nz/}
\textsuperscript{41} \url{http://www.ecologo.org/en/}
There are no criteria for radiant barriers (e.g., single layers of aluminum foil, or reflective paints) that have no single “R-value.”

Distinction is made between:
- Board-type thermal insulation;
- Loose fill thermal insulation;
- Spray-on thermal insulation;
- Blatt/blanket-type thermal insulation.

4.2.3. Definition of Preliminary Product Scope, Including Preliminary Product Definitions

During the definition of the product scope (including product definitions) categorisation is linked to the primary performance parameter (the "Functional Unit"). If needed sub-categorisation can take place on the basis of secondary performance parameters. Discussion of product definition and product scope issues also includes an analysis of product-system interactions in relation to the products’ environmental impacts and potential improvements.

→ Preliminary product group definition

Thermal insulation products in buildings are mainly applied in building envelope components (floor, wall, roof) that separate indoor from outdoor or to separate zones with different thermal regimes, also insulation of ductwork is a common application for insulation materials in buildings. Equipment, e.g. boilers, also often make use of insulation materials, but are not included in the scope of this study. The insulation materials are applied in the form of rolls, batts, boards or slabs, or as (spray) foams, beads or fibres that can fill oddly shaped cavities (often applied in 'in-situ' insulation), but may also be integrated in prefabricated products used for such components (floor, wall or roof panels).

Based on ISO 9229 and EN13162 to EN 13171, thermal insulation products for buildings are defined as:

"... factory made products in the form of rolls, batts, boards or slabs, with or without facings, or 'in-situ' applied materials, which have a primary function to reduce heat transfer through the structure against which, or in which, it is installed. Products covered by this definition may also be used in prefabricated thermal insulation systems and composite panels."

Numerical limits can be set only when the specific application is defined. Nevertheless, based on existing European standards (EN 13162 to EN13171 and Product standards EN 14063 to EN 14064 and EN 14315 to 14320), insulation materials typically have a declared thermal resistance higher than 0.15 m².K/W or a declared thermal conductivity lower than 0.10 W/(m.K) at a measuring temperature of 10°C. The values for thermal resistance in the listed standards differ however for the different insulation products. The above given definition is however valid for all the insulation products in the mentioned standards.

The proposed categorisation of the different insulation materials and their application can be found in paragraph 3.2.
Primary performance parameter (Functional Unit)

A functional unit defines the way in which the identified ‘functions’ or ‘performance characteristics’ of the product are quantified. The primary purpose of the functional unit is to provide a reference by which material flows (input and output data) of a construction product’s LCA results and any additional information are normalised to produce data expressed on a common basis.

Due to the fact that it will be impossible for realistic day-to-day construction techniques to obtain identical functional solutions for thermal insulation materials, the functional unit in a cradle to grave LCA for an insulation material will primarily be based on the thermal performance of the insulation material. The other performance characteristics can be defined too: acoustics, moister buffering, impact resistance, etc.

Definition of the primary performance parameter

The functional unit represents the quantified performance of a product system for use as a reference unit for the LCA study. It is the unit of scale or reference on which the LCA results are based, and relates to the given function of the product. In other cases, the functional unit should be defined according to the future use of the building. A functional unit comprises a function, a quantity, a duration and a quality. The declared unit is used instead of a functional unit when the precise function of the product at the building level is not stated or known, or when the LCA does not cover a full life cycle. It is necessary to distinguish between these two concepts for product LCA, and to give operational guidance.

The primary performance parameter for thermal insulation in building can be defined at the product level from cradle to gate (declared unit) and at the product level cradle to grave (functional unit) taken into account the specific application of the insulation material in the building.

- **Product level: cradle to gate (independent from application/use) – declared unit (DU)**

A declared unit is used instead of the functional unit when the precise function of the product or scenarios for its life cycle stages at the building level are not stated or unknown (EN 15804). A declared unit is defined based on an expected value (declared) of thermal property of the insulation material assessed from measured data at reference conditions of temperature and humidity.

The declared unit (cradle-to-gate) can be defined as 1 m² of a thermal insulation material with a thickness that gives a declared thermal resistance of 1 (R = 1 m²K/W).

The declared unit (cradle-to-gate) can be expressed as:

\[
\text{Declared unit} = DU = R \cdot \lambda \cdot \rho \cdot A \quad \text{[kg]}
\]

Where:

- \(R\) = thermal resistance [m²K/W]
- \(\lambda\) = thermal conduction [W/m.K]
- \(\rho\) = density of insulation product [kg/m³]
- \(A\) = Area [m²], here 1 m²
- **Product level: cradle to grave (from a specific application point of view) – primary functional unit (FU)**

In paragraph 3.2 it has been discussed that it is very difficult to define a functional unit – to analyse and compare different thermal insulation solutions in an objective way – covering all functionalities and relation with the rest of the building.

The functional unit (cradle-to-grave from a specific application point of view) can be defined as 1 m² of a thermal insulation material with a thickness that gives a design thermal resistance of 1 (R = 1 m²K/W) and with a certain expected average reference service life for a specific application.

→ **Secondary performance parameters**

In most of the product norms a list of (maximum) 25 performance parameters, in addition to the thermal resistance, is included. Insulation product families and individual insulation products have very considerable variation in these parameters. The most important are listed below:

- Acoustic performance;
- Compressive strength;
- Vapour permeability and its influence on the air tightness of a building;
- Thermal mass;
- Ability to be self-supporting;
- Trafficability (ability to support people walking over them);
- Vermin resistance;
- Rot and mould resistance;
- Resilience to damage and physical degradation;
- Handling characteristics such as flexibility and/or ability to fully fill spaces;
- Ease of installation;
- Fire resistance (performance parameter which is only valid on the system level);
- Moisture resistance (performance parameter which is only valid on the system level).

These very different properties mean that in many situations regarding use within buildings, particular insulation materials and products are not interchangeable and only a limited number of products are suitable.

Some performance parameters cannot be correctly measured and described at the product level, but only at the system level:

- Fire resistance (EN testing norms available);
- Moisture resistance (measurement method and standard at the system level – CEN TC 351 has informed the Commission that moisture cannot be measured at the product level, this performance parameter actually is situated in between the product level and the system level).

### 4.3. **Overview and description of test standards**

The first aim of this subtask is to give an overview of existing measurement or test standards and associated test methods for the insulation materials considered and to identify needs and requirements for new standards to be developed. These measurement and test standards or procedures are essential for any future legislation, because they allow quantifying the product performance. The second aim is to describe the other standards for the product.
Product standards that lay down requirements to be accomplished by a product (or product group) certifying its fitness for use, make reference to test standards. In most product standards reference is made to 30 to 40 test standards. More test standards can be available for each performance parameter.

4.3.1. **BACKGROUND INFORMATION ON EUROPEAN AND INTERNATIONAL STANDARDIZATION BODIES**

Article 4 of the CPR (Construction Product Regulation) states:

> ‘When a construction product is covered by a harmonized standard or conforms to a European Technical Assessment which has been issued for it, the manufacturer shall draw up a declaration of performance when such a product is placed on the market.’

Under the CPR, harmonised technical specifications are:

- Harmonised European product standards (hENs) established by CEN/CENELEC; or
- European Assessment Documents (EADs) produced by the European Organisation for Technical Approvals (EOTA).

Since July 1st, 2013, the EADs are the basis for issuing ETAs (European Technical Assessments) for products not covered by hENs. The main route to a harmonised technical specification under the CPR is for hENs to be drawn up and published by CEN/CENELEC. However, if hENs cannot be produced or foreseen within a reasonable period of time, or if a product deviates from the scope of a hEN, an ETA may be issued on the basis of an EAD. An ETA can only be issued if the product is not or not fully covered by a hEN.

In the next paragraphs we will describe both CEN/CENELEC standards and the creation of EADs and ETAs by EOTA.

→ **CEN/CENELEC**

CEN/CENELEC internal regulations define a standard as a document, established by consensus and approved by a recognized body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context. Standards should be based on consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits. The European EN standards are documents that have been ratified by one of the three European standards organizations, CEN (European Committee for Normalisation), CENELEC (European Committee for Electrotechnical Standardization) or ETSI (European Telecommunications Standards Institute).

In addition to “official” standards, there may be other sector specific procedures for product testing, which could be considered as standards when they have been recognized both by the sender and the receiver, that is, when they are using the same parameters or standards.

Following the EU’s ‘New Approach’[^42], any product-oriented legislation should preferably refer to harmonized (EN) test standards in order to verify the compliance with set measures. The referenced test standard should be accurate, reproducible and cost-effective, and model as well as

[^42]: [http://www.newapproach.org](http://www.newapproach.org)
possible the real-life performance. If no suitable test standard exists, they need to be developed (possibly based on existing sector specific procedures) for the relevant parameters in the view of implementing measures.

In technical use, a standard is a concrete example of an item or a specification against which all others may be measured or tested.

In the context of this study most of the EN test standards are equivalent to the ISO standards (EN/ISO standards). On ISO level, there are only few product standards for thermal insulation materials.

Thermal insulation product standards are developed within the Technical Committee 88 (CEN TC88 – Thermal insulating materials and products). Standards on the building level are developed within the Technical Committee 89 (CEN TC89 – Thermal performance of buildings and building components). Work on the sustainability of construction works is performed within the Technical Committee 350 (CEN TC350: Sustainability of construction works). And finally the work of the Technical committee 351 is important in the framework of this study because it concerns the release of dangerous substances from construction products (CEN TC351: Construction products: Assessment of release of dangerous substances).

→ EOTA

EOTA is the European Organisation for Technical Assessment in the area of construction products, an organisation of the Technical Assessment Bodies designated by the Member States under the Construction Products Regulation. It is based in Brussels (Belgium). As required in the CPR, EOTA develops and adopts European Assessment Documents (EADs) by using the scientific and technological expertise of its members. The European Assessment Document (EAD) is a harmonised technical specification and forms the basis for the issuing of ETAs. The EAD is developed by the European Organisation of Technical Assessment (EOTA) in cases where a product is not or not fully covered by a harmonised European Standard.

The European Technical Assessment (ETA) is the documented assessment of the performance of a construction product, in relation to its essential characteristics, in accordance with the relevant European Assessment Document.

→ Mandates issued by the European Commission to the European Standardisation Organisations (ESOs)

A standardisation request (mandate) is a demand from the European Commission to the European standardisation organisations (ESOs) to draw up and adopt European standards in support of European policies and legislation (website European Commission43). European standards, even developed under a mandate and for European legislation, remain voluntary in their use. Draft mandates are drawn up by the Commission services through a process of consultation with a wide group of interested parties (social partners, consumers, SMEs (small and medium enterprises), relevant industry associations, etc.). Before being formally addressed to the ESOs, they are submitted to the Committee on Standards of the Regulation (EU) 1025/2012.43

43 http://ec.europa.eu/enterprise/policies/european-standards/standardisation-requests/
The mandates relevant for thermal insulation materials in buildings are listed below:

- M/103 rev.1 Amendment to mandate to CEN and CENELEC concerning the execution of standardisation work for harmonised standards on thermal insulation products (M/103) (No.: 103 rev.1);
- M/138 Addendum to mandate 103 to CEN and CENELEC concerning the execution of standardisation work for harmonised standards on thermal insulation products (No.: 138);
- M/367 Addendum to mandate to CEN/CENELEC Concerning the execution of standardisation work for harmonised standards on M 103 “thermal insulation products (No.: 367);
- M/489 Mandate to CEN concerning the execution of harmonization work for harmonized standards on external thermal insulation composite systems/kits with rendering (ETICS) (No.: 489).

→ Transitory Measurements Methods

The European Commission can provide a list of transitory measurement methods in the Official Journal. These methods are supposed to be replaced by references to the harmonised standards containing the measurement methods when the ESO’s finish their harmonisation work.

4.3.2. Description of different standards

→ ISO test standards

ISO, the International Organization for Standardization, develops voluntary International Standards that give state of the art specifications for products, services and good practice, helping to make industry more efficient and effective. Developed through global consensus, they help to break down barriers to international trade.\(^{44}\)

Product standards:

- ISO 2509:1989 - Sound-absorbing expanded pure agglomerated cork in tiles (ISO/TC 87)

\(^{44}\) [www.iso.org](http://www.iso.org)
CHAPTER 4 MEERp TASK 1 - SCOPE


Measurement standards:
- ISO 9366:2001 - Agglomerated cork floor tiles -- Determination of dimensions and deviation from squareness and from straightness of edges (ISO/TC 87)
- ISO 12344:2010 - Thermal insulating products for building applications -- Determination of bending behaviour (ISO/TC 163/SC 1)
- ISO 12624:2011 - Thermal insulating products for building equipment and industrial installations -- Determination of trace quantities of water soluble chloride, fluoride, silicate, sodium ions and pH (ISO/TC 163/SC 1)
- ISO 13787:2003 - Thermal insulation products for building equipment and industrial installations -- Determination of declared thermal conductivity (ISO/TC 163/SC 2)
- ISO 16537:2012 - Thermal insulating products for building applications -- Determination of shear behaviour (ISO/TC 163/SC 1)
- ISO 16544:2012 - Thermal insulating products for building applications -- Conditioning to moisture equilibrium under specified temperature and humidity conditions (ISO/TC 163/SC 1)
- ISO 16545:2012 - Thermal insulating products for building applications -- Determination of behaviour under cyclic loading (ISO/TC 163/SC 1)
- ISO 29465:2008 - Thermal insulating products for building applications -- Determination of length and width (ISO/TC 163/SC 1)
- ISO 29470:2008 - Thermal insulating products for building applications -- Determination of the apparent density (ISO/TC 163/SC 1)
- ISO 29471:2008 - Thermal insulating products for building applications -- Determination of dimensional stability under constant normal laboratory conditions (23 degrees C/50 % relative humidity) (ISO/TC 163/SC 1)
- ISO 29472:2008 - Thermal insulating products for building applications -- Determination of dimensional stability under specified temperature and humidity conditions (ISO/TC 163/SC 1)
- ISO 29764:2008 - Thermal insulating products for building applications -- Determination of deformation under specified compressive load and temperature conditions (ISO/TC 163/SC 1)
- ISO 29765:2008 - Thermal insulating products for building applications -- Determination of tensile strength perpendicular to faces (ISO/TC 163/SC 1)
- ISO 29769:2008 - Thermal insulating products for building applications -- Determination of behaviour under point load (ISO/TC 163/SC 1)
- ISO 29803:2010 - Thermal insulation products for building applications -- Determination of the resistance to impact of external thermal insulation composite systems (ETICS) (ISO/TC 163/SC 1)
- ISO 29804:2009 - Thermal insulation products for building applications -- Determination of the tensile bond strength of the adhesive and of the base coat to the thermal insulation material (ISO/TC 163/SC 1)
→ EN test standards

CEN TC88 - Thermal insulating materials and products

- **Standards EN 13162 to EN 13171, EN 16069 and 13499 to 13500 for factory made insulation products**
  - EN 14308: 2009+A1: 2013: Thermal insulation products for building equipment and industrial installations – Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products – Specification
These European Standards specify the requirements for different types of factory made insulation products, which are used for the thermal insulation of buildings. This series of standards describes product characteristics and includes procedures for testing, evaluation of conformity, marking and labelling.

Products covered by the standards are also used in prefabricated thermal insulation systems and composite panels; the performance of systems incorporating these products is not covered. The standards do not specify the required level of a given property to be achieved by a product to demonstrate fitness for purpose in a particular application. The levels required for a given application are to be found in regulations or non-conflicting standards.

Products with a declared thermal resistance lower than 0,15 m².K/W or a declared thermal conductivity greater than 0,10 W/(m.K) at 10 °C are not covered by the above listed standards.

The product standards refer to about 25 performance parameters (listed in 4.2.3). When a product for instance does not have an acoustic performance, this is not described in the standard. Only the performance parameters that are valid for a specific product are dealt with in the product norms. Resource use, waste and emissions are not yet described in the product norms. For emissions during the use phase reference is made to CEN TC 351.

Stability is not applied in the product norms, since insulation materials are no structural materials. Structural performance parameters are out of the scope of TC 88 and TC 89.

- **Standards EN 14063 to EN 14064 and EN 14315 to 14318 for in-situ formed insulation products**
- EN 14315-1:2013: Thermal insulating products for buildings - In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products - Part 1: Specification for the rigid foam spray system before installation
- EN 14315-2: 2013: Thermal insulating products for buildings - In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products - Part 2: Specification for the installed insulation products
- EN 14318-1:2013: Thermal insulating products for buildings - In-situ formed dispensed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products - Part 1: Specification for the rigid foam dispensed system before installation
- EN 14318-2: 2013: Thermal insulating products for buildings - In-situ formed dispensed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products - Part 2: Specification for the installed insulation products
- EN 14319-1:2013: Thermal insulation products for building equipment and industrial installations – In-situ formed dispensed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products – Part 1: Specification for the rigid foam dispensed system before installation
- EN 14319-2:2013: Thermal insulation products for building equipment and industrial installations – In-situ formed dispensed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products – Part 2: Specification for the installed insulation products
- EN 14320-1:2013: Thermal insulating products for building equipment and industrial installations – In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products – Part 1: Specification for the rigid foam spray system before installation
- EN 14320-2:2013: Thermal insulating products for building equipment and industrial installations – In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products – Part 2: Specification for the installed insulation products
- EN 15600-1:2010: Thermal insulation products for building equipment and industrial installations – In-situ thermal insulation formed from exfoliated vermiculite (EV) products – Part 1: Specification for bonded and loose-fill products before installation
These European Standards specify the requirements for different types of in-situ formed insulation products, which are used for the thermal insulation of buildings and for building equipment and industrial installations.

Part 1 of these European Standards have specifications for the insulation products before installation. They describe the product characteristics and include procedures for testing, marking and labelling. The documents do not specify the required level of a given property to be achieved by a product to demonstrate fitness for purpose in a particular application. Such levels required for a given application are to be found in regulations or non-conflicting standards.

Products with a declared thermal resistance lower than 0,15 m².K/W or a declared thermal conductivity greater than 0,1 W/(m.K) at 10 °C are not covered by the documents. This document does not cover products intended for airborne sound insulation and for acoustic absorption applications.

Part 2 of these European Standard describes, when taken together with Part 1, the product characteristics that are linked to the essential requirements of the EU Construction Products Regulation. Part 2 of the standards also specifies the checks and tests to be used for the declarations made by the installer of the product and the rules for the evaluation of conformity. These European Standards specify the requirements for products installed in lofts, masonry cavity walls and frame constructions. It is a specification for the installed insulation products.

- **Test standards**
  - EN 12085:2013: Thermal insulating products for building applications - Determination of linear dimensions of test specimens
  - EN 12086:2013: Thermal insulating products for building applications - Determination of water vapour transmission properties
  - EN 12087:2013: Thermal insulating products for building applications - Determination of long term water absorption by immersion
  - EN 12088:2013: Thermal insulating products for building applications - Determination of long term water absorption by diffusion
  - EN 12089:2013: Thermal insulating products for building applications - Determination of bending behaviour
  - EN 12090:2013: Thermal insulating products for building applications - Determination of shear behaviour
  - EN 12091:2013: Thermal insulating products for building applications - Determination of freeze-thaw resistance
  - EN 12429:1998: Thermal insulating products for building applications - Conditioning to moisture equilibrium under specified temperature and humidity conditions
  - EN 12430:2013: Thermal insulating products for building applications - Determination of behaviour under point load
  - EN 12431:2013: Thermal insulating products for building applications - Determination of thickness for floating floor insulating products

---

45 Regulation No 305/2011
o EN 13494:2002: Thermal insulation products for building applications - Determination of the tensile bond strength of the adhesive and of the base coat to the thermal insulation material
o EN 13495:2002: Thermal insulation products for building applications - Determination of the pull-off resistance of external thermal insulation composite systems (ETICS)(foam block test)
° EN 13496:2002: Thermal insulation products for building applications - Determination of the mechanical properties of glass fibre meshes
° EN 13497:2002: Thermal insulation products for building applications - Determination of the resistance to impact of external thermal insulation composite systems (ETICS)
° EN 13498:2002: Thermal insulation products for building applications - Determination of the resistance to penetration of external thermal insulation composite systems (ETICS)
° EN 13793:2003: Thermal insulating products for building applications - Determination of behaviour under cyclic loading
° EN 13820:2003: Thermal insulating materials for building applications - Determination of organic content
° EN 15715:2009: Thermal insulation products - Instructions for mounting and fixing for reaction to fire testing - Factory made products
° EN 1602:2013: Thermal insulating products for building applications - Determination of the apparent density
° EN 1603:2013: Thermal insulating products for building applications - Determination of dimensional stability under constant normal laboratory conditions (23 °C/ 50 % relative humidity)
° EN 1604:2013: Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions
° EN 1605:2013: Thermal insulating products for building applications - Determination of deformation under specified compressive load and temperature conditions
° EN 1606:2013: Thermal insulating products for building applications - Determination of compressive creep
° EN 1607:2013: Thermal insulating products for building applications - Determination of tensile strength perpendicular to faces
° EN 1608:2013: Thermal insulating products for building applications - Determination of tensile strength parallel to faces
° EN 1609:2013: Thermal insulating products for building applications - Determination of short term water absorption by partial immersion
° EN 16025: 2013: Thermal and/or sound insulating products in building construction. Bound EPS ballastings. Requirements for factory premixed EPS dry plaster
° EN 822:2013: Thermal insulating products for building applications - Determination of length and width
° EN 823:2013: Thermal insulating products for building applications - Determination of thickness
° EN 824:2013: Thermal insulating products for building applications - Determination of squareness
° EN 825:2013: Thermal insulating products for building applications - Determination of squareness
° EN 826:2013: Thermal insulating products for building applications - Determination of compression behaviour
° EN 13467:2001: Thermal insulating products for building equipment and industrial installations – Determination of dimensions, squareness and linearity of preformed pipe insulation
For certain characteristics of insulation materials, a test standard is not yet available. An example is the release of dangerous substances for which test standards are being developed within TC351.

CEN TC350 - Sustainability of construction works

CEN TC350 is responsible for the development of voluntary horizontal standardized methods for the assessment of the sustainability aspects of new and existing construction works and for standards for the environmental product declaration of construction products. It was mandated in this by the Commission, and has been developing a suite of European Standards. The intention of the standard is to integrate the assessment of both the operational and embodied impacts of buildings, ensure that the evaluation of embodied impact of materials is done in a consistent manner using life cycle assessment, and that information is provided in a way that allows the information for materials to be aggregated to allow evaluation at the building level.

The Standards are also intended to be the mechanism for assessing Basic Works Requirement 3 and 7 from the Construction Products Regulation\(^\text{46}\). They also integrate with the Energy Performance of Buildings Directive\(^\text{47}\) to ensure that the assessment of operational impacts is consistent. Standards from CEN TC351 regarding emissions to air, water and land from construction products in use will be integrated once published.

The following standards have already been published or are awaiting publication:

- EN 15643-1: 2010: Sustainability of construction works - Sustainability assessment of buildings - Part 1: General framework

\(^{46}\) Regulation No 305/2011
\(^{47}\) 2010/31/EU
CEN TC 350 and more specifically the EN 15804 covers resources use (energy and raw materials, incl. waste) and emissions during production. The CEN TC 351 covers emissions during the use phase.

**CEN TC351 - Construction products: Assessment of release of dangerous substances:**

CEN TC351 Committee 351 aims to develop standardised test and assessment methods for the release scenario of dangerous substances from construction products.

The following documents are already made available by CEN TC 351:
- CEN/TR 15855:2009 Construction products – Assessment of release of dangerous substances – Barriers to trade
- CEN/TR 15858:2009 Construction products – Assessment of the release of regulated dangerous substances from construction products based on the PW, WFT/FT procedures
- CEN/TR 16045:2010 Construction Products – Assessment of release of dangerous substances – Content of regulated dangerous substances – Selection of analytical methods
- CEN/TR 16098:2010 Construction products: Assessment of release of dangerous substances – Concept of horizontal testing procedures in support of requirements under the CPD
- CEN/TR 16220:2011 Construction products – Assessment of release of dangerous substances – Complement to sampling
- CEN/TR 16410:2012 Construction products – Assessment of release of dangerous substances – Barriers to use – Extension to CEN/TR 15855 Barriers to trade.

The following documents are in development within CEN TC351:
- FprCEN/TR 16496 Construction Products - Assessment of release of dangerous substances - Use of harmonised horizontal assessment methods No (89/106/EEC)
- FprCEN/TR 16516 Construction products - Assessment of release of dangerous substances - Determination of emissions into indoor air No (89/106/EEC)
- FprCEN/TS 16637-1 Guidance standard for CEN Product TCs for selection of leaching tests appropriate for their product(s) - General principles No (89/106/EEC)
- FprCEN/TS 16637-2 Generic horizontal dynamic surface leaching test (DSLT) for determination of surface dependent release of substances from monolithic or plate-like or sheet-like construction products No (89/106/EEC)
- CEN/TC 351/WG 1 N 162 Generic horizontal up-flow percolation test for determination of the release of substances from granular construction products No (89/106/EEC)
- Construction products - Assessment of release of dangerous substances - Terminology No (89/106/EEC)
Construction products - Assessment of release of dangerous substances - Guidance on evaluation of conformity  No (89/106/EEC)

Construction products - Assessment of release of dangerous substances - Determination of the activity concentrations of 226Ra, 232Th and 40K using gamma-ray spectrometry  No (89/106/EEC)

Construction products - Assessment of release of dangerous substances - Digestion of construction products by aqua regia  No (88/609/EEC)


CEN TC89 - Thermal performance of buildings and building components

CEN/TC 89 contributes to the reduction of technical barriers to trade for products and services by elaborating standards which serve as reference documents in national building regulations. The following standards have been developed by CEN/TC 89:

- CEN/TR 14613:2003: Thermal performance of building materials and components - Principles for the determination of thermal properties of moist material and components
- CEN/TR 15131:2006 Thermal performance of building materials - The use of interpolating equations in relation to thermal measurement on thick specimens - Guarded hot plate and heat flow meter apparatus
- CEN/TR 15601:2012 Hygrothermal performance of buildings - Resistance to wind-driven rain of roof coverings with discontinuously laid small elements - Test methods
- EN 12114:2000 Thermal performance of buildings - Air permeability of building components and building elements - Laboratory test method
- EN 12664:2001 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Dry and moist products of medium and low thermal resistance
- EN 12667:2001 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance
- EN 12865:2001 Hygrothermal performance of building components and building elements - Determination of the resistance of external wall systems to driving rain under pulsating air pressure
- EN 12939:2000 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Thick products of high and medium thermal resistance
- EN 13009:2000 Hygrothermal performance of building materials and products - Determination of hygric expansion coefficient
- EN 15026:2007 Hygrothermal performance of building components and building elements - Assessment of moisture transfer by numerical simulation
- EN 15255:2007 Energy performance of buildings - Sensible room cooling load calculation - General criteria and validation procedures
- EN 15265:2007 Energy performance of buildings - Calculation of energy needs for space heating and cooling using dynamic methods - General criteria and validation procedure
- EN 16012:2012 Thermal insulation for buildings - Reflective insulation products - Determination of the declared thermal performance
- EN 1946-1:1999 Thermal performance of building products and components - Specific criteria for the assessment of laboratories measuring heat transfer properties - Part 1: Common criteria
- EN 1946-2:1999 Thermal performance of building products and components - Specific criteria for the assessment of laboratories measuring heat transfer properties - Part 2: Measurements by guarded hot plate method
- EN 1946-3:1999 Thermal performance of building products and components - Specific criteria for the assessment of laboratories measuring heat transfer properties - Part 3: Measurements by heat flow meter method
- EN 1946-4:2000 Thermal performance of building products and components - Specific criteria for the assessment of laboratories measuring heat transfer properties - Part 4: Measurements by hot box methods
- EN 1946-5:2000 Thermal performance of building products and components - Specific criteria for the assessment of laboratories measuring heat transfer properties - Part 5: Measurements by pipe test methods
- EN ISO 10456:2007 Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007)


EN ISO 13791:2012  Thermal performance of buildings - Calculation of internal temperatures of a room in summer without mechanical cooling - General criteria and validation procedures (ISO 13791:2012)


Guidance on Environmental footprints

PEF – Product Environmental Footprint

The European Commission DG Environment has worked together with the European Commission's Joint Research Centre (JRC IES) and other European Commission services towards the development of a harmonised methodology for the calculation of the environmental footprint of products (including carbon).

This methodology has been developed building on the International Reference Life Cycle Data System (ILCD) Handbook as well as other existing methodological standards and guidance documents (ISO 14040-44, PAS 2050, BP X30, WRI/WBCSD GHG protocol, Sustainability Consortium, ISO 14025, Ecological Footprint, etc.).

The final methodology was published as an Annex to the Commission Recommendation on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (COMMISSION RECOMMENDATION of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations - Text with EEA relevance - 2013/179/EU).

This version was developed taking into account the results of 2011 road test, the results of the invited expert consultation and of a consultation between Commission services.

Testing the methodology:
The technical guide developed by JRC IES was tested using a limited number of pilot studies representative of a wide variety of goods and services based on a call for volunteers. Due to time and resource constraints, the number of pilot tests was limited to 10. The sectors covered through the testing include: agriculture, retail, construction, chemicals, ICT, food, manufacturing (footwear, televisions, paper. The results of the testing were used for the development of the final technical guide.

PEF covers resources use (energy and raw materials, including waste) and emissions during production. PEF does not address emissions to indoor air (VOC etc.) during the use phase.

PEFCRs – Product Environmental Footprint Category Rules

The aim of the PEFCRs is to provide specific rules to calculate the environmental footprint for a certain product group, including benchmark and, if appropriate, performance grades. Each PEFCR focuses on the most relevant life cycle stages, processes and impact categories for the product group in scope. A declaration compliant with a PEFCR can be used to make comparisons and comparative assertions.

Testing the PEFCRs:
Product Environmental Footprint Category Rules aim at providing detailed technical guidance on how to conduct a product environmental footprint study. PEFCRs complement general methodological guidance for environmental footprint by providing further specification at the product level. PEFCRs will increase reproducibility and consistency in product environmental footprint studies.

**Pilot:**
In 2014 a three-year pilot project led by DG Environment will start, aiming at developing Product Environmental Footprint Category Rules for thermal insulation.

**→ Test standards in individual Member States**

Test standards in the individual Member States have been replaced by the European standards. There are a few standards available in the Member States which link products with applications (e.g. German DIN 4108-10 - Thermal insulation and energy economy in buildings — Application-related requirements for thermal insulation materials — Part 10: Factory made products).

Certification guidelines are also available on the level of the different Member States.

**→ Third country test standards regarding different kind of test procedures**

The largest share of third country test standards is available in the US (ASTM)\(^{48}\).

In the category Construction Standards ASTM provides a list of thermal insulation standards, with following main standard groups:

- Blanket and Loose Fill Insulation;
- Homogeneous Inorganic Thermal Insulations;
- Insulation Finishes and Moisture;
- Insulation Systems;
- Organic and Nonhomogeneous Inorganic Thermal Insulations;
- Reflective Insulation.

**4.3.3. A COMPARATIVE ANALYSIS FOR OVERLAPPING TEST STANDARDS ON PERFORMANCE, RESOURCES USE AND/OR EMISSIONS**

Little overlap can be found in the test standards on performance, resources use and/or emissions. Only the EN 15804 and the PEFCR show some similarities.

**→ EN 15804 and PEFCRs – different methods for different scopes**

*Short description EN 15804 developed within the framework of CEN TC350*

The EN 15804 (Sustainability of Construction Works – Environmental product declarations – Core rules for the product category of construction products) provides core product category rules for all

\(^{48}\) http://www.astm.org/
construction products and services. It provides a structure to ensure that all Environmental Product Declarations (EPDs) are derived, verified and presented in a harmonized way.

It is organized in modules covering different life cycle stages. Some modules are mandatory, others are optional. The indicators declared in the individual information modules of a product life cycle shall not be added up in any combination of the individual information modules into a total or sub-total of the life cycle stages.

The LCA based information in an EPD may cover (see Figure 27):
- The product stage only. Such an EPD covers raw material supply, transport, manufacturing and associated processes; this EPD is said to be “cradle to gate” and becomes an EPD based on information modules A1 to A3;
- The product stage and selected further life cycle stages. Such an EPD is said to be “cradle to gate with options” and becomes an EPD based on information modules A1 to A3 plus other selected optional modules, e.g. end-of-life information modules C1 to C4. Information module D may be included in this EPD;
- The life cycle of a product according to the system boundary. In this case the EPD covers the product stage, installation into the building, use and maintenance, replacements, demolition, waste processing for re-use, recovery, recycling and disposal and is said to be ‘cradle to grave’ and becomes an EPD of construction products based on a LCA, i.e. covering all information modules A1 to C4. In this EPD the information module D may be included.

Declarations based on the EN 15804 are no comparative assertions.

**Short description PEFCRs - Product Environmental Footprint Category Rules**

The aim of the PEFCRs is to provide specific rules to calculate the environmental footprint for a certain product group, including benchmark and, if appropriate, performance grades.

Each PEFCR focuses on the most relevant life cycle stages, processes and impact categories for the product group in scope.

A declaration compliant with a PEFCR can be used to make comparisons and comparative assertions.
Figure 27: LCA Based information in an EPD (EN 15804)
EN 15804 and PEFCRs – Where are the methodological differences?

End of life (EOL)

According to the EN 15804 the system boundary is defined as “until the end-of-waste state is reached”. Furthermore the EN 15804 standard states: “Materials from which energy is recovered with an efficiency rate below 60% are not considered materials for energy recovery.”

The PEF method does include recycling and energy recovery at end of life (EOL) within the system boundaries.

Impact categories and assessment methods

The PEF method comprises a more extended list of impact categories. These might be reduced to the EN 15804 list in future PEFCRs for construction products if proven to be justified.

Some measurement units are different in the EN 15804 compared to PEFCR.

An overview is given in Figure 28.

<table>
<thead>
<tr>
<th>PEF</th>
<th>EN 15804</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming, kg CO2 eq</td>
<td>Global warming, kg CO2 eq</td>
<td>identical</td>
</tr>
<tr>
<td>Ozone depletion, kg CFC eq</td>
<td>Ozone depletion, kg CFC eq</td>
<td>identical</td>
</tr>
<tr>
<td>Acidification, mol H+ eq</td>
<td>Acidification, kg SO2 eq</td>
<td>different unit and thus model (+ characterisation)</td>
</tr>
<tr>
<td>Eutrophication terrestrial, mol N eq</td>
<td>Eutrophication, kg (PO4)3- eq</td>
<td>different unit and thus model (+ characterisation)</td>
</tr>
<tr>
<td>Eutrophication freshwater, kg P eq</td>
<td></td>
<td>not included in EN 15804</td>
</tr>
<tr>
<td>Eutrophication marine, kg N eq</td>
<td></td>
<td>not included in EN 15804</td>
</tr>
<tr>
<td>Photochemical ozone creation, kg NMVOC eq</td>
<td>Photochemical ozone creation, kg ethene eq</td>
<td>different unit and thus model (+ characterisation)</td>
</tr>
<tr>
<td>Abiotic, non fossil, kg Sb eq</td>
<td>Depletion of abiotic resources, non fossil, kg Sb eq (characterisation factors shall be taken from CML)</td>
<td>identical</td>
</tr>
<tr>
<td>Abiotic, fossil, kg Sb eq</td>
<td>Depletion of abiotic resources, fossil, MJ net calorific value (characterisation factors shall be taken from CML)</td>
<td>EN 15804: CML is mentioned to be used for characterisation factors, but CML expresses it in Sb eq</td>
</tr>
<tr>
<td>Ecotoxicity, CTUe</td>
<td></td>
<td>not included in EN 15804</td>
</tr>
<tr>
<td>Human Toxicity - cancer effects, CTUh</td>
<td></td>
<td>not included in EN 15804</td>
</tr>
<tr>
<td>Human Toxicity – non-cancer effects, CTUh</td>
<td></td>
<td>not included in EN 15804</td>
</tr>
<tr>
<td>Particulate Matter/Respiratory Inorganics, kg PM2.5 eq</td>
<td></td>
<td>not included in EN 15804</td>
</tr>
<tr>
<td>Ionising Radiation – human health effects, U235 eq</td>
<td></td>
<td>not included in EN 15804</td>
</tr>
<tr>
<td>Resource Depletion – water, m3 water use</td>
<td></td>
<td>not included in EN 15804</td>
</tr>
<tr>
<td>Land Transformation, % or Mg/ha</td>
<td></td>
<td>not included in EN 15804</td>
</tr>
</tbody>
</table>

Figure 28: Overview of the impact categories and assessment methods according to EN 15804 and PEF
Other minor issues:

- PEF have clear nomenclature rules;
- The EN 15804 allows cut-offs whilst no cut-offs are allowed in the PEF;
- PEF includes more stringent requirements related to data quality;
- PEFCRs requires normalization and weighting;
- In the EN 15804 there are no requirements for reviewer qualifications.

4.3.4. Analysis and Reporting on New Test Standards, Problems and Differences Covering the Same Subject

New test standards being developed - description of major changes

There are new product standards under development by CEN TC 88 for VIP (Vacuum Insulation Panels) and reflective foils (outside scope of the study). The product standards for ETICS based on expanded polystyrene (EN 13499) and ETICS based on mineral wool (EN 13500) will be replaced by one standard valid for all ETICS, including product specific annexes. A product standard for In-situ formed loose fill cellulose products is in development (prEN 15101).

A complete overview is given below:

- Thermal insulation products for building applications - Instructions for mounting and fixing for determination of the reaction to fire testing of external thermal Insulation composite systems (ETICS) (Analogue to EN 15715) - Under Drafting - 2016-02
- FprEN 13496 Thermal insulation products for building applications - Determination of the mechanical properties of glass fibre meshes as reinforcement for External Thermal Insulation Composite Systems with renders (ETICS) - Under Approval - 2013-10
- prEN 16382 Thermal insulation products for building applications - Determination of the pull-through resistance of anchors through thermal insulation products - Under Approval - 2014-09
- prEN 16383 Thermal insulating products for building applications - Determination of the hygrothermal behaviour of external thermal insulation composite systems with renders (ETICS) - Under Approval - 2014-09
- Thermal insulation products for buildings - In-situ formed products from loose-fill expanded polystyrene (EPS) beads and bonded expanded polystyrene beads - Part 1: Specification for the bonded and loose filled products before installation No (93/68/EEC) - Under Drafting - 2016-04
- Thermal insulation products for buildings - In-situ formed products from loose-fill expanded polystyrene (EPS) beads and bonded expanded polystyrene beads - Part 2: Specification for the installed insulation products - Under Drafting - 2016-04
- PrEN 15101-1 Thermal insulation products for buildings - In-situ formed loose fill cellulose (LFCI) products - Part 1: Specification for the products before installation Yes (89/106/EEC) - Under Approval - 2013-10
- PrEN 15101-2 Thermal insulation products for buildings - In-situ formed loose fill cellulose (LFCI) products - Part 2: Specification for the installed products - Under Approval - 2013-10
- Thermal insulation products for buildings - Factory made reflective insulation products (RI) - Specification - Under Drafting - 2016-02
- Urea formaldehyde (building equipment and industrial applications) – Part 1: Specification for the cellulose before installation (WI 00088197)
- PrEN 16447: Thermal insulation products for building equipment and industrial installations – Factory made expanded perlite (EP) and exfoliated vermiculite (EV) products - Specification
- Thermal insulation products for buildings – In-situ bonded expanded polystyrene (EPS beads) – Part 1: Specification for the bonded products before installation (WI00088274)
- Plastics-thermoplastic jackets for insulation products for building equipment and industrial installations – Requirements and test methods (prEN 15701)
Possible problems on accuracy (tolerances), reproducibility and to what extend the test standards reflect real-life – drafting of outlines of mandate(s) to the ESOs as appropriate

Product standards and test methods are based on hypotheses. All parameters are defined in order to make the test reproducible. From then on calculations or other methods can be used in order to reflect real life. For the thermal performance parameter, many standards exist.

Differences between standards covering the same subjects - comparative analysis

The standards developed by CEN never cover the same subjects. There are however differences between the CEN standards and standards discussing the same subject developed by ISO, in America, Japan, etc.

4.4. OVERVIEW AND DESCRIPTION OF LEGISLATION

This section identifies the relevant legislation and agreements for the products within the scope of this study. It is divided into three parts:
1. Legislation and Agreements at European Union level;
2. Legislation at Member State level;

4.4.1. EU LEGISLATION (LEGISLATION ON RESOURCES USE AND ENVIRONMENTAL IMPACT, EU VOLUNTARY AGREEMENTS, LABELS)

The Study for the Amended Ecodesign Working Plan – task 4 (VHK, 2011) gives an overview of the relevant community policies. The study first discusses the Energy Labelling Directive, the Ecolabel Regulation and Green Public Procurement. Afterwards other relevant community policies are discussed. Figure 29 gives an overview of relevant community policies for the product group Thermal insulation products for buildings.

![Figure 29: Consideration of other relevant community policies](image)

Below we will discuss the listed policies and discuss their effectiveness in terms of achieving potential for improvement of the product group insulation materials.
Construction Products Regulation (305/2011/EC)

The Construction Products Regulation (305/2011/EC - CPR) - replacing the Construction Products Directive (89/106/EEC - CPD) is aimed at creating a single market ("Article 95") for construction products, through the use of CE Marking. It outlines key requirements relating to materials intended for construction, which is defined in the Directive as products that are manufactured to form a permanent part of structures.

The materials must meet fundamental requirements including mechanical resistance and stability, safety in case of fire, hygiene, health and environment, safety and accessibility in use, protection against noise, energy economy and heat retention, sustainable use of natural resources. The Directive (now Regulation) mandates that standardisation organisations such as CEN develop standards in consultation with industry (CEN TC 350 and CEN TC 351) (DG Environment, 2010). A list of these standards can be found on the European Commission’s website and in paragraph 4.2 of this document. Where harmonised standards are not available, existing national standards apply.

When compared to other products, the cross-border trade on construction products within the Internal Market has traditionally not been as commonplace. National markets have often obstacles preventing foreign products from being efficiently commercialized. Therefore, as one of the first efforts of such Community-wide harmonisation, the Council adopted in 1988 the Construction Products Directive (the CPD), based on Article 95, referring to the single market. The replacement of Council Directive 89/106/EEC by the Regulation (CPR) serves the aim to better define the objectives of Community legislation and make its implementation easier.

Concerning the Construction activity itself, the focus is on the competitiveness of the sector, in particular by accompanying and encouraging actions from industry and Member States, not least in the field of sustainable construction and by promoting actions and supporting the development of common tools facilitating for companies and other actors to better adapt to the changes in the sector. The CPR contains seven basic working requirements:

1. Mechanical resistance and stability;
2. Safety in case of fire;
3. Hygiene, health and the environment;
4. Safety and accessibility in use;
5. Protection against noise;
6. Energy economy and heat retention;
7. Sustainable use of natural resources.

Today only the first 6 basic work requirements are mandatory to report. The 7th BWR is a requirement related to the sustainable use of natural resources, stating that: "The construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable and ensure the following (basic work requirement 7 of CPR):

a) Recyclability of the construction works their materials and parts after demolition;
b) Durability of the construction works;
c) Use of environmentally compatible raw and secondary materials in the construction works.”

50 http://ec.europa.eu/enterprise/construction/index_en.htm
Safety in construction and the free movement of services, engineering and construction services, are also an important policy priority, which is developed through the promotion of the Eurocodes and their implementation by the Member States.

The particular nature of construction products, predominantly intended to be used by professionals (constructors, architects, civil engineers) has also brought along a need to differentiate the regulatory structure and the role of standards from the general horizontal rules of the Internal Market Package for Goods. Also the meaning of the CE marking in this context is specific: it attests that the information accompanying the product has been attained in accordance with the methods specified in the standards.

The objective of the CPR is thus not to define the safety of construction products, but to ensure that reliable information is presented in relation to their performance. This is achieved by providing, mainly in standards, a common technical language, to be used not only by manufacturers, but also by public authorities when defining their requirements on construction works, directly or indirectly influencing the demands placed on the products to be used in them.

All declarations of performance must be individually communicated to each customer by post or email. In October 2013 however, the European Commission launched a proposal that will enable manufacturers of construction products to upload digital declarations of performance on their websites. This will enable faster communication through the supply chain, reduce producer costs, facilitate sales of construction products and make it easier for consumers to find out what performance they should expect from the product they are about to buy, thus increasing consumer confidence.

**Impacts the of Construction Products regulation on the product group “thermal insulation”**

The objective of the CPR is to ensure that reliable information is presented in relation to the performance of insulation materials. The CPR ensures the use of a common technical language and that a Declaration of Performance (DoP) shall be drawn up by the manufacturer in case the insulation product is covered by a harmonized standard or conforms to a European Technical Assessment. This DoP shall express the performance of the insulation material in relation to its essential characteristics in accordance with the relevant harmonized technical specifications.

In relation to insulation, the harmonized European product standards developed under the CPD (now CPR) introduced a specific approach on how thermal conductivity is measured and declared; the results of thermal conductivity tests are now analysed using a statistical procedure called lambda 90/90. This change makes insulation one of the most tightly controlled materials in the building market (DG Environment 2010).

Certain insulation products like cellulose, sheep wool and other biomass based thermal insulation products do not bear the CE mark today. This is because no harmonized standards have been realized yet. The absence of harmonized and uniformly applied methods to measure and present thermal performance of all thermal insulation products on the market has already created friction between the suppliers of the different materials (VHK 2011).

The implementation of the construction product regulation so far has not directly led to environmental improvements. The CE marking sets no performance levels, it just indicates that the product was tested according to a harmonized national standard.

The 2002/91/EC Energy Performance of Buildings Directive (EPBD) is, at European level, the main policy driver affecting energy use in buildings. As originally formulated in 2002, the EPBD sets out the following key requirements for Member States:

- Minimum standards on the energy performance of new buildings and large (>1000m²) existing buildings undergoing a ‘major renovation’;
- A general framework; for a methodology for calculating the integrated energy performance of buildings;
- Energy certification for both new and existing buildings whenever they are constructed, sold or rented out;
- Implement an inspection and assessment regime for air conditioning and boilers or, in the case of the latter, develop alternative measures to reach the same level of energy performance.

In 2010 amendments to the EPBD were finalized and published, adding several new or strengthened requirements, in particular:

- Minimum energy performance requirements for building elements that form part of the building envelope and have a significant impact on the energy performance of the building envelope once retrofitted or replaced;
- Setting up EU-wide nearly zero-energy buildings requirements and development of national plans for increasing the number of NZEB buildings;
- Abolishment of the 1000m² threshold for major renovations (now: 50m²);
- Introducing a calculation framework for calculating the cost-optimal levels of minimum energy performance requirements;
- Minimum energy performance requirements of building systems (to be applied in existing buildings and voluntarily be applied new buildings);
- Requirement of an inspection and assessment regime for air conditioning and heating systems or develop alternative measures to reach the same level of energy performance;
- Requirement of an inspection report for heating and air-conditioning systems (in case of application);
- Independent control systems for EPC and inspection reports;
- Reinforcement of the energy certification of the buildings;
- Introduction of penalties.

In 2005 a Concerted Action (CA) EPBD was launched by the European Commission to assist the Member States (MS) in implementing the Energy Performance of Buildings Directive and to support dialogue and exchange of best practice between MS. This CA approach was elaborated more in 2007, with Member States sharing real operating experiences. Besides the EU-27 Member States, also Norway and Croatia are part of this CA.

The CA EPBD works on following core themes:

- Certification;
- Inspections;
- Training Experts;
- Energy Performance Requirements using the Cost Optimal Methodology;
- Towards 2020 – Nearly Zero-Energy Buildings (NZEBs);
- Compliance and Control;
- Effectiveness of Support Initiatives.
The Core Themes in bold are tackling parts of the Directive that have an impact on insulation materials since they include requirements or recommendations for the building envelope. The issues from these core themes and the parts of the Directive they refer to regarding insulation materials (or buildings, building units, building elements, ...) are discussed in this report.

Certification

‘Member States shall ensure that an energy performance certificate is issued for (a) buildings or building units which are constructed, sold or rented out to a new tenant; and (b) buildings where a total useful floor area over 500 m² is occupied by a public authority and frequently visited by the public. On 9 July 2015, this threshold of 500 m² shall be lowered to 250 m².’

Certification refers mainly to following articles of the recast EPBD:

- Article 11 ‘Energy Performance Certificates’;
- Article 12 ‘Issue of Energy Performance Certificates’;

The issuing of EPCs has an important role in the transformation of the building sector. By providing information, potential buyers and tenants can compare buildings/building units. Also recommendations are provided for a cost-effective improvement, encouraging home owners to refurbish their building to a better energetic standard.

The EPBD imposes that recommendations for improving energy performance should be part of the EPC. These recommendations (standard or tailor-made) are an important communication tool for the energetic improvement potential of the building. However it should be considered that EPC recommendations cannot substitute detailed building specific energy audits. Standard recommendations for the thermal envelope will mostly depend on the U-value of the construction element. Recommendations should not only focus on an improved U-value, but also require attention to the indoor climate (CA EPBD 2010).

Cost-optimal methodology

‘Member States shall calculate cost-optimal levels of minimum energy performance requirements using the comparative methodology framework established in accordance with paragraph 1 of the recast EPBD and relevant parameters, such as climatic conditions and the practical accessibility of energy infrastructure, and compare the results of this calculation with the minimum energy performance requirements in force.’

Following articles of the recast EPBD are mainly important for the cost-optimal methodology:

- Article 3 ‘Adoption of a methodology for calculating the energy performance of buildings’
- Article 4 ‘Setting of minimum energy performance requirements’
- Article 5 ‘Calculations of cost-optimal levels of minimum energy performance requirements’
- Article 6 ‘New buildings’
- Article 7 ‘Existing buildings’

Article 8 ‘Technical building systems’

The cost optimal level is defined as “the energy performance level which leads to the lowest cost during the estimated economic lifecycle” (CA EPBD 2012) (Article 2.14) it is intended as a tool for Member States to see if they need to adjust their own regulations with regard to the economic optimum. Cost optimal framework is not intended for comparisons between Member States. Member states must set national minimum energy performance requirements to achieve these cost-optimal levels. Also measures must be taken so that cost-optimal levels are achieved by new buildings or building undergoing a major renovation, but also for replaced or retrofitted building components that are part of the building envelope.

A framework for cost-optimal procedures is provided by the Commission Delegated Regulation (EU) No 244/2012 accompanied by Guidelines (2012/C 115/01). The Regulation is based on CEN-standards. Estimations on energy price developments on the long-term are provided by the Commission. Member States must define reference buildings (new, and existing, both residential as non-residential) and energy efficiency measures that are assessed for those reference buildings. Both for the reference buildings, as well as the reference buildings with the energy efficiency measures applied, final and primary energy needs are assessed and costs are calculated. Cost optimal levels from a macroeconomic as well as from investor’s perspective are calculated, but MS can choose on which perspective they base their energy performance requirements.

New buildings need to develop towards Nearly Zero-energy Buildings (NZEBs), but also the existing housing stock needs to be improved. Therefore also requirements for existing buildings are set in place, building requirements as well as component requirements or combinations of both. EPBD recast states that both kinds of requirements need to be set. Requirements for components are easily comprehensible and might be adopted easier by people planning minor renovation works. However they miss a holistic approach and are often less ambitious than whole-building requirements for major renovations\(^5\).

Nearly Zero-Energy Buildings

‘Member States shall ensure that (a) by 31 December 2020 all new buildings are nearly zero-energy buildings; and (b) after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings. Member States shall draw up national plans for increasing the number of nearly zero-energy buildings. These national plans may include targets differentiated according to the category of building. Member States shall furthermore, following the leading example of the public sector, develop policies and take measures such as the setting of targets in order to stimulate the transformation of buildings that are refurbished into nearly zero-energy buildings.’

Following article of the recast EPBD is mainly important for the Nearly Zero-Energy Buildings:

- Article 9 ‘Nearly zero-energy buildings’.

An NZEB is defined as “a building that has a very high energy performance, determined in accordance with Annex I. The nearly zero or very low amount of energy required should to a very significant level be covered by energy from renewable sources, including renewable energy\(^5\).

produced on-site or nearby” (VHK 2011). This definition was left vague to allow MS to define their own standards (DG Environment 2010).

The calculation of the energy performance of buildings has to be performed following a common general framework given in Annex I of the recast EPBD. The energy performance shall reflect the heating energy needs and cooling energy needs to maintain the envisaged temperature conditions of the building and domestic hot water needs (CA EPBD 2012). These heating and cooling energy needs relate to technical installations and to the building envelope and its elements and the insulation materials used in these building elements. Besides the main indicator (primary energy for most MS), also mean U-values, thermal transmittance coefficient or transmission losses will be used as indicator by some MS.

By beginning of 2019 (new buildings occupied and owned by public authorities, leading the way) and 2021 (all new buildings) have to be NZEB and are supposed to meet also cost-optimal calculations. Therefore NZEB shall have a cost-optimal combination of building envelope and building service systems. Cost-optimal calculations from 2013 shall be reviewed once more before 2019/2021.


The Energy Performance of Buildings Directive and its recast are the main policy drivers at European level for reducing the energy use of buildings. Insulation materials are indirectly addressed by the EPBD when applied in building elements. Article 7 of the EPBD recast states that building elements that form part of the building envelope and have significant impact on the energy performance of the building envelope, should meet minimum energy performance requirements if technically, functionally and economically feasible when retrofitted or replaced.

EPBD recast calls EU Member States to use a new cost-optimal methodology for calculating the energy performance of buildings defining cost-optimal level as “the energy performance level which leads to the lowest cost during the estimated economic lifecycle”. Article 5 of the EPBD recast describes the methodology how to calculate cost-optimal levels. Cost-optimal levels are to a large extent dependent on the energy use of the building during its life time. Thermal insulation is of great influence to this life-cycle energy use.

Besides the requirement to calculate cost-optimal levels, also NZEB requirements must be set up, to ensure that by the end of 2020 all newly constructed buildings will consume nearly zero energy (beginning of 2019 for buildings owned and occupied by public authorities). This NZEB-requirement, which is closely related to the cost-optimal levels, will also be of influence for the use of insulation materials. However, the whole building must be assessed to see if the building uses nearly zero energy.

The EPBD addresses energy issues and indoor climate and has an impact on the sales of insulation materials. However, it does not affect the characteristics of the insulation products as such, since for example insulation materials with higher $\lambda$-values can also be applied in building elements that need to live up to the standard, but they shall need a thicker insulation layer in reference to materials with a lower $\lambda$-value.
Green Public Procurement

Green Public Procurement (GPP) is a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured. (COM, 2008)

The criteria used by Member States should be compatible to avoid a distortion of the single market and a reduction of EU-wide competition. Having common criteria reduces considerably the administrative burden for economic operators and for public administrations implementing GPP.

Common GPP criteria are of a particular benefit to companies operating in more than one Member State as well as SMEs (whose capacity to master differing procurement procedures is limited).

The EU GPP is a voluntary system. However, Member States are invited to formally endorse the already developed common GPP criteria. Formal endorsement by Member States would imply that the common GPP criteria would be included in the National Action Plans and guidance on GPP which Member States have set up or are in the process of setting up.

Impacts of Green Public Procurement on the product group “thermal insulation”

GPP criteria for the product group Thermal insulation have been developed. GPP criteria for the product group thermal insulation address:

- Product performance: $\lambda < 0.044 \text{ W/(m*K)}$;
- Avoiding hazardous substances;
- Extra points for: wood based materials are sustainably managed, 20-year warranty for installation, recycled content, low GWP blowing agents.

The criteria are described in the product sheet on Thermal insulation available on the website of DG Environment.$^{54}$

ETS - EU Emissions trading system

The EU emissions trading system (EU ETS) is a cornerstone of the European Union’s policy to combat climate change and its key tool for reducing industrial greenhouse gas emissions cost-effectively. The first - and still by far the biggest - international system for trading greenhouse gas emission allowances, the EU ETS covers more than 11,000 power stations and industrial plants in 31 countries, as well as airlines.$^{55}$

It covers:

- $\text{CO}_2$ emissions from installations such as power stations, combustion plants, oil refineries and iron and steel works, as well as factories making cement, glass, lime, bricks, ceramics, pulp, paper and board, petrochemicals, ammonia and aluminium, and the aviation sector;
- $\text{N}_2\text{O}$ emissions from the production of nitric, adipic and glycolalicylic acid production;
- perfluorocarbons from the aluminium sector;
- the capture, transport and geological storage of all greenhouse gas emissions.

---

$^{54}$ [http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm](http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm)

$^{55}$ [http://ec.europa.eu/clima/policies/ets/index_en.htm](http://ec.europa.eu/clima/policies/ets/index_en.htm)
By putting a price on carbon and thereby giving a financial value to each tonne of emissions saved, the EU ETS has placed climate change on the agenda of company boards and their financial departments across Europe. A sufficiently high carbon price also promotes investment in clean, low-carbon technologies. The 2013 cap for emissions from power stations and other fixed installations in the 27 EU Member States (before Croatia's accession on 1 July 2013) has been provisionally set at 2,039,152,882 allowances. Croatia's contribution to the cap is being determined. For each year after 2013, this cap will decrease by 1.74% of the average total quantity of allowances issued annually in 2008-2012. In absolute terms this means the number of general allowances will be reduced annually by 37,435,387. Thanks to the decreasing cap, in 2020 emissions from fixed installations will be 21% lower than in 2005. The annual reduction in the cap will continue beyond 2020, but may be revised no later than 2025.

**Impacts of EU emission trading system on the product group “thermal insulation”**

The ETS regulation affects the larger manufacturers of insulation materials. Due to this system they are forced to find solutions for their contribution to climate change.

For each year after 2013, the cap of allowances will decrease and the number of general allowances will be reduced. This will affect the operational costs of the companies which fall under the ETS. Companies are therefore forced to find improving CO₂ or N₂O efficiencies in production.

The system of CO₂ allowances will also affect the sales volume of insulation materials because large production companies falling under the ETS will try to improve the level of insulation of hot processes and buildings.

→ **Effort Sharing Decision (406/2009/EC)**

The Effort Sharing Decision establishes binding annual greenhouse gas emission targets for Member States for the period 2013–2020. These targets concern emissions from most sectors not included in the EU Emissions Trading System (see above), such as transport (except aviation), buildings, agriculture and waste. The Effort Sharing Decision forms part of a set of policies and measures on climate change and energy – known as the climate and energy package - that will help to move Europe towards a low-carbon economy and increase its energy security. Many of the important decisions will be made at Member State level.

**Impacts of the Effort Sharing Decision on the product group “thermal insulation”**

The Effort Sharing Decision addresses the sectors that do not come under the EU ETS, such as buildings and road transport. Individual EU governments can introduce policies and measures to promote adequate insulation. The influence of the Effort Sharing Decision on the product group insulation will vary from country to country. It will influence the sales volume of insulation materials, as the building sector is covered by this Decision. It will also affect the emissions of manufacturers of insulation materials as they are forced to reduce their greenhouse gas emissions.

---


2013/TEM/R/38

96
The EC Packaging Directive seeks to reduce the impact of packaging and packaging waste on the environment by introducing recovery and recycling targets for packaging waste, and by encouraging minimisation and reuse of packaging. A scheme of symbols, currently voluntary, has been prepared through Commission Decision 97/129/EC. These can be used by manufacturers on their packaging so that different materials can be identified to assist end-of-life recycling. The Packaging Directive (94/62/EC) was amended in 2004 by Directive 2004/12/EC. This amendment included a number of key revisions. These included further clarification regarding the definition of packaging, amendments to the provisions relating to prevention and revised targets for the recovery and recycling of packaging materials.

Member States must ensure that packaging placed on the market complies with the essential requirements (VHK, 2011):

- To limit the weight and volume of packaging to a minimum in order to meet the required level of safety, hygiene and acceptability for consumers;
- To reduce the content of hazardous substances and materials in the packaging material and its components;
- To design reusable or recoverable packaging.

**Impacts of Packaging Directive on the product group “thermal insulation”**

The Directive is of relevance for insulation materials as they use primary, secondary or tertiary packaging. Manufacturers of insulation materials are forced to reduce the weight and volume of packaging materials and to reduce the content of hazardous substances used to pack the insulation product. Moreover this Directive will force the companies to design reusable or recoverable packaging. Developing minimum requirements or restrictions on the use, design or end-of-life treatment of packaging under the Ecodesign Directive in parallel to the Packaging Directive is not favoured.

**Ecolabel Regulation (Regulation (EC) No 66/2010)**

The EU Ecolabel helps to identify products and services that have a reduced environmental impact throughout their life cycle, from the extraction of raw material through to production, use and disposal. Recognised throughout Europe, EU Ecolabel is a voluntary label promoting environmental excellence which can be trusted.

**Impacts of Ecolabel Regulation on the product group “thermal insulation”**

There are no EU Ecolabel requirements for Insulation materials at the moment. The task of creating criteria for the eco-labelling of thermal insulation product was given to the Danish government by the European Commission in the early nineties. The work was abandoned because it became evident that the benefit from use of insulation products overwhelmed the deficit created during their manufacture (DG Environment, 2010). This benefit was also documented in the quickscan of this report (see CHAPTER 3).

REACH (EC 1907/2006)

The REACH Regulation came into force on 1 June 2007 and deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances. It provides an improved and streamlined legislative framework for chemicals in the EU, with the aim of improving protection of human health and the environment and enhancing competitiveness of the chemicals industry in Europe. REACH places the responsibility for assessing and managing the risks posed by chemicals and providing safety information to users in industry instead of public authorities, promotes competition across the internal market and innovation.

Manufacturers are required to register the details of the properties of their chemical substances on a central database, which is run by the European Chemicals Agency in Helsinki. The Regulation also requires the most dangerous chemicals to be progressively replaced as suitable alternatives are developed.

This legislation will provide further controls on the chemicals used in the manufacture of blowing agents used in thermal insulation.

Impacts of REACH on the product group “thermal insulation”

There are a variety of other substances within insulation products that can be regarded as toxic to the environment and to human health. Many of these are covered by the REACH legislation which applies to substances manufactured or imported into the EU in quantities of 1 tonne per year or more. Generally, it applies to all individual chemical substances on their own, in preparations or in articles, such as insulation products (if the substance is intended to be released during normal and reasonably foreseeable conditions of use from a product). However the Study for the Amended Ecodesign Working Plan (VHK, 2011) indicates that certain stakeholders suggest that many more substances applied in products should be restricted. The choice than arises to address this either by product specific legislation (as “in product x shall not contain substance y” i.e. by Ecodesign) or by horizontal legislation such as RoHs (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment) or REACH. A parallel approach to such restrictions was not favoured by the stakeholders participating in the project.

Regulation on Substances that Deplete the Ozone Layer (EC 1005/2009)

This Regulation applies to organisations that produce, import, export, sell and recover/recycle or destroy substances such as CFCs and HCFCs, which are classified as ozone depleting substances (ODSs). One difference to the Montreal protocol is that it specifies an accelerated HCFC phase-out schedule.

The Regulation 1005/2009 is a recast of original Regulation 2037/2000. A recast was deemed appropriate due to the large number of amendments that had been made to the original regulation and further amendments that needed to be made. The original regulation phased out a large proportion of ODS previously produced in the European Community, with others still to be phased.

http://www.hse.gov.uk/reach/about.htm
out between 2010 and 2015. This means that further environmental benefits from production controls will be limited, therefore the new regulation addresses issues such as identifying measures to prevent ODS in existing products and equipment from escaping into the atmosphere. (DG Environment, 2010)

The Department for Environment, Food and Rural Affairs in Great-Britain (2012) created a guidance on F-gas and ozone regulations for insulation foam producers and users. They state that the production and use of foam containing ODS is affected by the requirements of EU Regulation 1005/2009. The obligations are listed in Table 11. With the exception of recovery from end of life foam, the listed obligations are the responsibility of the producer. Importers and distributors must ensure that labelling requirements are correctly followed. All end users will need to monitor the current requirements for recovery on disposal.

Table 11: Summary of key obligations under the EU Ozone regulation (Department for Environment, Food and Rural Affairs (GB), 2012)

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ban</td>
<td>The use of CFC or HCFC blowing agents for the production of foam is completely banned.</td>
</tr>
<tr>
<td>Recovery from waste foam</td>
<td>Any ODS in foams used in domestic refrigerators and freezers that have reached the end of life must be recovered. At end-of-life ODS in other types of foam must be recovered, ‘if practicable’.</td>
</tr>
</tbody>
</table>

**Impacts of the Regulation on Substances that Deplete the Ozone Layer on the product group “thermal insulation”**


It is unlikely that ozone depleting substances will be found in new products, following developments in product design and manufacture, however it is worth being aware of this regulation, as it will be applicable to the recovery of ozone depleting substances from older products as they are replaced (VHK 2011).

Certain polymer based insulation materials that require blowing agents use ODS in their manufacture, therefore these insulation materials must be recovered and destroyed by an environmentally acceptable technology such as incineration at the end of their life.

---


The objective of Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases is to contain, prevent and thereby reduce emissions of the fluorinated greenhouse gases covered by the Kyoto Protocol.

Fluorinated gases (F-gases) are a family of man-made gases used in a range of industrial applications. Because they do not damage the atmospheric ozone layer, they are often used as substitutes for ozone-depleting substances. However, F-gases are powerful greenhouse gases, with a global warming effect up to 23 000 times greater than carbon dioxide (CO2), and their emissions are rising strongly.\(^{62}\)

The three groups of F-gases are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF\(_6\)). Excluded are substances controlled under Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer.

The obligations created by the Department for Environment, Food and Rural Affairs in Great Britain (2012) are listed in Table 12. They state that the production and use of foam containing F-gases is affected in a number of ways by the requirements of EU Regulation 842/2006 and Statutory Instrument 2009 No 261. With the exception of recovery from end of life foam, the listed obligations are the responsibility of the producer. Importers and distributors must ensure that labelling requirements are correctly followed. All end users will need to monitor the current requirements for recovery on disposal.

Table 12: Summary of key obligations under the EU F-gas regulation (Department for Environment, Food and Rural Affairs (GB), 2012)

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting</td>
<td>Producers must report to the Commission and the Member State if they are directly importing more than 1 tonne per annum of F gas for use in foam production from outside the EU either on its own or in pre-blended systems.</td>
</tr>
<tr>
<td>Recovery from F-gas containers</td>
<td>Blowing agent recovery must take place at end of life of containers used for supply of F gases.</td>
</tr>
<tr>
<td>Recovery from waste foam</td>
<td>At end-of-life F gas must be recovered from foam, ‘to the extent that it is technically achievable and does not entail disproportionate cost’. The applicability of this requirement depends on the cost effectiveness of F gas recovery. For example, waste foam from a foam factory (e.g. off cuts) could be collected and processed to recover the blowing agent. Foam in domestic refrigerators can be reprocessed at special treatment facilities. However, HFCs from foam in general demolition waste is less likely to be recoverable in a cost effective way.</td>
</tr>
<tr>
<td>Ban</td>
<td>The placing on the market of one component foams (OCFs)3 formulated with F gases from 4th July 2008 is banned, except where they have been manufactured prior to that date.</td>
</tr>
<tr>
<td>Labelling</td>
<td>Certain products must be marked with a specific type of label that shows that the foam contains a high Global Warming Potential F gas. The text shall read “foam blown with</td>
</tr>
</tbody>
</table>

fluorinated greenhouse gases”. In GB, this requirement will only apply to: “refrigeration and air conditioning products and equipment as well as heat pumps, which are insulated with foam blown with fluorinated greenhouse gases”.

<table>
<thead>
<tr>
<th>Training</th>
<th>Where any recovery activities are performed, personnel must be appropriately qualified.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taking delivery</td>
<td>Companies taking delivery of containers of F gas need to employ personnel with appropriate qualifications if undertaking F gas recovery.</td>
</tr>
</tbody>
</table>

**Impacts of F-Gas Regulation on the product group “thermal insulation”**

Certain polymer based insulation materials that require blowing agents use Hydrofluorocarbons (HFCs). Fluorinated blowing agents such as HFCs have been used because they reduce the conductivity of the foams in which they are used, and also have benefits in terms of fire resistance (PE NWE, 2011). The supply of these substances, which contribute to a large extent to climate change is already regulated by the F-Gas Regulation. As stated by PE NWE (2011) the industry is now moving away from the use of HFCs to pentane or CO$_2$, with pentane replacing HFCs in all PU foams, unless switching to pentane is not possible for safety reasons (spray foam).

Certain polymer based insulation materials that require blowing agents use F-gasses in their manufacture, therefore these insulation materials must be recovered and destroyed by an environmentally acceptable technology such as incineration at the end of their life.


End of 2012, the European Commission published a proposal for a new regulation on F-gases. The proposal maintains the current provisions of the F-Gas Regulation, with adjustments to ensure better implementation and enforcement by national authorities. The most important new measure is the introduction of quantitative limits on the supply of bulk HFC substances in the EU, decreasing over time.

The phase-down mechanism involves a gradually declining cap on the total placement of bulk HFCs (in tonnes of CO$_2$ equivalent) on the market in the EU reaching 21 % of the levels sold in 2008–11 by 2030. The result of this cap will be that producers of products and equipment who face a restricted supply of F-gases will switch to alternative technologies where feasible in a cost-efficient way. The phase-down mechanism is based to a large extent on the experience gained from phasing down the consumption of ODS.

Additional bans are proposed to restrict the use of F-gases not covered by the mechanism and which have been found to be cost-effective in relation to the overall required level of emissions reduction, including fire extinguishers, domestic and commercial refrigerators and freezers and movable air-conditioners.

The revised F-gas regulation is still being discussed and is expected to be finalised end of 2013 or beginning of 2014.
Impacts of the proposal F-Gas Regulation on the product group “thermal insulation”

For foams and foam boards containing fluorinated greenhouse gases no restrictions apply in the proposal. There is a labelling obligation for foams. Foams that contain fluorinated greenhouse gases shall identify the fluorinated greenhouse gases with a label using the industry designation or the chemical name. The label shall clearly indicate that the foam contains fluorinated greenhouse gases.


Directive 2008/98/EC sets the basic concepts and definitions related to waste management, such as definitions of waste, recycling or recovery. It explains when waste ceases to be waste and becomes a secondary raw material (so called end-of-waste criteria), and how to distinguish between waste and by-products. The Directive lays down some basic waste management principles: it requires waste to be managed without endangering human health and harming the environment, and in particular without risk to water, air, soil, plants or animals, without causing a nuisance through noise or odours, and without adversely affecting the countryside or places of special interest. Waste legislation and policy of the EU Member States shall apply as a priority order the following waste management hierarchy:

![Waste treatment hierarchy (VHK, 2011)](image)

The Directive introduces the "polluter pays principle" and the "extended producer responsibility". It incorporates provisions on hazardous waste and waste oils (old Directives on hazardous waste and waste oils being repealed with effect from 12 December 2010), and includes two new recycling and recovery targets to be achieved by 2020: 50% preparing for re-use and recycling of certain waste materials from households and other origins similar to households, and 70% (by weight) preparing for re-use, recycling and other recovery of construction and demolition waste. The Directive requires that Member States adopt waste management plans and waste prevention programmes.

Impact of Waste Directive on the product group thermal insulation

VHK (2011) reports that end-of-life treatment is an issue all insulation products are faced with. End-of-life treatment is already covered by European legislation through the Waste Framework Directive. This stipulates that 70% of construction waste needs to be recycled or recovered by 2020. The clients of the insulation industry are therefore increasing pressure with the view to
obtaining products meeting the requirements of this directive. It can be assumed that most insulation products put on the market today can be recycled provided they are not contaminated in the use phase. The ratio should be even higher in 50 years, i.e. at the end of the life of insulation products installed today. However, recycling or recycled content are not goals in themselves, in particular for products with a long service life.

VHK (2011) also states that environmental policies must aim at reducing the overall environmental impact of buildings over their life cycle. This requires an analysis of the impacts of different end-of-life scenarios such as recycling, recovery, waste-to-energy and landfill. If small waste quantities have to be shipped over hundreds of kilometres to a recycling plant, this option may turn out more environmentally harmful than the waste-to-energy scenario. Very importantly, the impacts of different end-of-life solutions are included in Environmental Product Declarations (EPD). This allows the specifier to make a sound and informed choice comparing the different options available at the building level.

Certain polymer based insulation materials that require blowing agents use ODS in their manufacture, therefore these insulation materials must be recovered and destroyed by an environmentally acceptable technology such as incineration at the end of their life63. This is also valid for the use of F-gasses.

The following legislation was not mentioned in Figure 29, but could also be important for the product group ‘thermal insulation’

→ Energy Labelling Directive (2010/30/EU - recast)

The recast Energy Labelling Directive 2010/30/EU108 was adopted by the European Parliament and Council the 19th May 2010. The directive introduces the possibility for new efficiency classes A+, A++ and A+++ on top of the existing A grade for the most energy-efficient household products.

---

The new directive extends the energy label to energy-related products in the commercial and industrial sectors, e.g. cold storage rooms and vending machines. Acts adopted by the Commission in a delegated procedure (with involvement of Member State experts and right of objection of the European Parliament and of the Council) determine the energy classes of the specific products that are to be labelled.

The extension of the scope from energy-using to energy-related products (including construction products) implies that the Directive covers any good having an impact on energy consumption during use. These products could not only consume energy but could also "have a significant direct or indirect impact" on energy savings. Examples are window glazing and outer doors.

Energy labelling requirements are already in force for a number of products and the Commission will adopt delegated regulations for energy labelling in parallel with the adoption of the Ecodesign regulations. The new labels will be mandatory for products placed on the market a defined time after the regulation has been published in the Official Journal of the European Union.

According to the new Energy Labelling Directive, the layout of the energy efficiency label gives room to up to three new energy classes to reflect technological progress. However, the total number of classes will still be limited to seven (except if the lower classes are still populated). The labelling colour scheme will be adjusted accordingly, so that the highest energy efficiency class will remain dark green and the lowest energy efficient class will be red.
The Energy Labelling Directive requires retailers to display a comparative label showing the level of energy consumption of household appliances to consumers at the point of sale. This Directive complements other instruments including the Ecodesign Directive and the Eco-label Regulation.

**Impact of the Energy Labelling Directive on the product group “thermal insulation”**

The implementation of the Energy Labelling Directive is linked to the Ecodesign Directive. Requirements and benchmarks defined for individual product group under the Ecodesign Directive are used as references for setting the energy labelling classes.\(^64\) Thermal insulation for buildings is currently not on the priority list of products in the Second Ecodesign Working Plan. This study investigates the extent to which measures under the Ecodesign directive could contribute to the achievement of the improvement potential. The Commission could decide on basis of the results of this study to move the product group of thermal insulation for buildings to the priority list in the Second Ecodesign Working Plan.


The Directive states, amongst others, that Member States should make long term strategies to increase the renovation rate and that public bodies’ buildings have an exemplary role. Also, the Directive states that by 30 April 2014, and every three years thereafter, Member States shall submit National Energy Efficiency Actions Plan (NEEAPs) that cover significant energy efficiency improvement measures and expected and/or achieved energy savings.

Member States have to transpose most of Directive’s provisions into national legislation by 5 June 2014.

The Directive establishes a common framework for promoting energy efficiency in the Union to ensure that the 20% energy efficiency target in 2020 (i.e. reaching a 2020 energy consumption of no more than 1483 Mtoe of primary energy consumption and no more than 1086 Mtoe of final energy consumption) is met and to pave the way for further energy efficiency afterwards.

The Directive provides for the establishment of indicative national energy efficiency targets for 2020 and requires the Commission to assess in 2014 whether the Union can achieve its target of 20% energy efficiency in 2020 and to submit its assessment to the European Parliament and the Council, accompanied, if necessary, by proposals for further measures.

The Energy Efficiency Directive lays down rules designed to remove barriers and overcome some of the market failures that impede efficiency in the supply and use of energy. For end-use sectors, the Directive focuses on measures that lay down requirements on the public sector, both as regards renovating the buildings on it owns and applying high energy efficiency standards to the purchase of buildings, products and services. The Directive requires Member States to reach certain level of final energy savings by using national energy efficiency obligation schemes or alternative policy

\(^{64}\) [http://www.orgalime.org/page/energy-labelling-directive](http://www.orgalime.org/page/energy-labelling-directive)
measures. It requires regular mandatory energy audits for large companies and lays down a series of requirements regarding metering and billing.

For the energy supply sector, the Directive requires Member States to adopt national heating and cooling assessment to develop the potential for high-efficiency generation and efficient district heating and cooling, and to ensure that spatial planning regulations are in line with these plans. Member States must adopt authorisation criteria that ensure that a cost-benefit analysis of the possibilities for cogeneration for all new and substantially refurbished electricity generation installations and industrial installations above certain threshold is carried out and the results are taken into account. Member States should however be able to lay down conditions for exemption from this obligation where certain conditions are met. Sets requirements on priority/guaranteed access to the grid, priority dispatch of electricity from high efficiency cogeneration and the connection of new industrial plants producing waste heat to district or cooling networks, and measures to encourage the use of demand side resources.

Other measures include requirements for national energy regulatory authorities to take due regard of energy efficiency, information and awareness-raising actions, requirements concerning the availability of certification schemes, action to promote the development of energy services, and an obligation for Member States to remove obstacles to energy efficiency, including the split of incentives between the owner and tenant of a building or among building owners.

**Impacts of the Energy Efficiency Directive on the product group “thermal insulation”**

The Directive states that Member States should make long term strategies to increase the renovation rate. For end-use sectors, the Directive focuses on measures that lay down requirements in the public sector, both as regards renovating the building on its owns and applying high energy efficiency standards to the purchase of buildings, products and services. The measures in the Directive should support the uptake of energy efficiency solutions, including of thermal insulation, by energy consumers.

→ **Regulation on the classification, labelling and packaging of substances and mixtures (CLP) (No 1272/2008)**

CLP is the Regulation on classification, labelling and packaging of substances and mixtures. This Regulation aligns previous EU legislation on classification, labelling and packaging of chemicals to the GHS (Globally Harmonised System of Classification and Labelling of Chemicals). Its main objectives are to facilitate international trade in chemicals and to maintain the existing level of protection of human health and environment. The GHS is a United Nations system to identify hazardous chemicals and to inform users about these hazards through standard symbols and phrases on the packaging labels and through safety data sheets (SDS).

The CLP Regulation was published in the Official Journal 31 December 2008 and entered into force on 20 January 2009. According to the Regulation, the deadline for substance classification according to the new rules will be 1 December 2010. For mixtures, the deadline will be 1 June 2015. The CLP Regulation will ultimately replace the current rules on classification, labelling and packaging of substances (Directive 67/548/EEC) and preparations (Directive 1999/45/EC ) after this transitional period.
**Impacts of the Regulation on the classification, labelling and packaging of substances and mixtures (CLP) on the product group “thermal insulation”**

The regulation contributes to the United Nations Globally Harmonised System aim that the same hazards will be described and labelled in the same way all around the world. The regulation also complies with the REACH regulation and requires manufacturers of insulation products to share information on the use of hazardous substances.

→ **Biocidal Product Directive (98/8/EC)**


The Directive applies to biocidal products, i.e. non-agricultural pesticides as defined in Article 2 of the Directive.

The Directive concerns:

- the authorisation and placing on the market of biocidal products in the Member States;
- the mutual recognition of authorisations within the Community;
- the establishment at Community level of a list of active substances which may be used in biocidal products.

Member States must ensure the authorisation, classification, labelling, packaging and proper use of the biocidal products in line with this Directive. Proper use includes measures necessary to keep the use of biocidal products to a minimum as well as an obligation to ensure that their use in the workplace is in compliance with the directives on health and safety protection for workers.

An active substance for use in biocidal products may be placed on the market if:

- a dossier has been submitted to a Member State accompanied by a declaration that the active substance is intended for inclusion in a biocidal product. This condition applies to active substances which did not have an authorisation to be placed on the market before 14 May 2000;
- the active substance is classified, packaged and labelled in accordance with Directive 67/548/EEC which is applicable until 1 June 2015.

A system of specific information is introduced in order to enable professional and industrial users of biocidal products to take the necessary measures for the protection of the environment and health. This system must take the form of a data safety sheet provided by those responsible for placing the product on the market.

**Impacts of the Biocidal Product Directive on the potential for improvement of the product group “thermal insulation”**

Biocides could be used in flax insulation, cellulose and sheep wool insulation. This Directive regulates the placing on the market of biocidal products in the Member States and it establishes at Community level a list of active substances which may be used in biocidal products.
CHAPTER 4 MEErP TASK 1 - SCOPE

→ Timber Regulation (Regulation (EU) No 995/2010)

Regulation (EU) No 995/2010 of the European Parliament and of the Council of 20 October 2010 laying down the obligations of operators who place timber and timber products on the market – also known as the (Illegal) Timber Regulation counters the trade in illegally harvested timber and timber products through three key obligations:

- It prohibits the placing on the EU market of illegally harvested timber and products derived from such timber;
- It requires EU traders who place timber products on the EU market to exercise 'due diligence';
- Once on the market, the timber and timber products may be sold on and/or transformed before they reach the final consumer. To facilitate the traceability of timber products economic operators in this part of the supply chain (referred to as traders in the regulation) have an obligation to keep records of their suppliers and customers.

The Regulation covers a broad range of timber products including solid wood products, flooring, plywood, pulp and paper. Not included are recycled products, as well as printed papers such as books, magazines and newspapers. The product scope can be amended if necessary.

The Regulation applies to both imported and domestically produced timber and timber products.

The Regulation is legally binding on all 27 EU Member States, which are responsible for laying down effective, proportionate and dissuasive penalties and for enforcing the Regulation.

**Impacts of the Timber Regulation on the product group “thermal insulation”**

The Regulation guarantees that timber based insulation products are produced from sustainably managed timber.

→ Directive on the incineration of waste (2000/76/EC)

The European Union (EU) has introduced measures to prevent or reduce air, water and soil pollution caused by the incineration or co-incineration of waste, as well as the resulting risk to human health. These measures specifically require a permit be obtained for incineration and co-incineration plants, and emission limits for certain pollutants released to air or to water. Incineration of both hazardous and harmless wastes may cause emissions of substances which pollute the air, water and soil and have harmful effects on human health. In order to limit these risks, the European Union (EU) shall impose strict operating conditions and technical requirements on waste incineration plants and waste co-incineration plants.

In order to guarantee complete waste combustion, the Directive requires all plants to keep the incineration or co-incineration gases at a temperature of at least 850°C for at least two seconds. If hazardous waste with a content of more than 1 % of halogenated organic substances, expressed as chlorine, is incinerated, the temperature has to be raised to 1 100 °C for at least two seconds. The heat generated by the incineration process has to be put to good use as far as possible.

The limit values for incineration plant emissions to air are set out in Annex V to the Directive. They concern heavy metals, dioxins and furans, carbon monoxide (CO), dust, total organic carbon (TOC),
hydrogen chloride (HCl), hydrogen fluoride (HF), sulphur dioxide (SO2) and the nitrogen oxides (NO and NO2).

The determining of limit values for co-incineration plant emissions to air is set out in Annex II. In addition, special provisions are laid down relating to cement kilns and combustion plants which co-incinerate waste.

Incineration and co-incineration plants must have a permit which authorises them to discharge used water caused by exhaust-gas clean-up. This permit will ensure that the emission limit values set out in Annex IV to the Directive are complied with.

Incineration or co-incineration residues must be reduced to a minimum and, as far as possible, recycled. When dry residues are transported, precautions must be taken to prevent their dispersal in the environment. Tests must be carried out to establish the physical and chemical characteristics, and polluting potential, of residues.

**Impacts of the directive on the incineration of waste on the product group “thermal insulation”**

During delivery and reception of waste, the operator of the incineration plant or co-incineration plant shall take all necessary precautions to prevent or limit negative effects on the environment and risks to people. Furthermore, prior to accepting hazardous waste at the incineration plant or co-incineration plant, the operator of the plant must have at their disposal the administrative information on the generating process, the physical and chemical composition of the waste, as well as on the hazardous characteristics of the waste.

Insulation material should thus contain information on the generating process, the physical and chemical composition of the insulation product and on the hazardous characteristics of the insulation products. In this case the necessary information will be available to the operator of the incineration plant at the end-of-life of the insulation material.


This directive demonstrates the European Union's strong commitment to improving air quality in the EU by setting binding standards for fine particles PM$_{2.5}$. Under the directive Member States are required to reduce exposure to PM$_{2.5}$ in urban areas by an average of 20% by 2020 based on 2010 levels. It obliges them to bring exposure levels below 20 mg/m$^3$ by 2015 in these areas. Throughout their territory Member States will need to respect the PM$_{2.5}$ limit value set at 25 mg/m$^3$. This value must be achieved by 2015 or, where possible, already by 2010.

**Impacts of the council directive CAFE cleaner air for Europe on the product group “thermal insulation”**

The CAFE Directive provides further incentive to apply thermal insulation, as insulation reduces the need also for heating that emits fine particles.
The below mentioned legislations have links with the insulation sector, but is considered less important for this study.

This has been checked during the stakeholder consultation held in October 2014. The list initially also contained the Directive on the incineration of waste (2000/76/EC) and the Council Directive CAFE cleaner air for Europe (2008/50/EC). Those legislation were mentioned during the meeting as being relevant for insulation products. Therefore they have been taken up in the previous paragraphs.

Legislation with links to the insulation sector, but considered less important:

- Directive on national emission ceilings for certain atmospheric pollutants (2001/81/EC);
- Regulation on shipments of waste ((EC) No 1013/2006);
- Directive on industrial emissions (integrated pollution prevention and control) (2010/75/EU);
- Regulation concerning the establishment of a European Pollutant Release and Transfer Register;
- Forestry Strategy for the EU (1999/C 56/01).

4.4.2. Member State legislation (as above, for legislation indicated as relevant by Member States), including a comparative analysis

→ EPBD

The Energy Performance of Buildings Directive requires the EU Member States to take measures to reduce the energy use of their building stock and new buildings. Specific requirements, with regard (direct or indirect) to insulation materials are described in 4.4.1. Only those topics relating to insulation materials will be discussed in this comparative analysis on MS legislation.

In 2005 the Concerted Action EPBD was launched to support MS in their task implementing the Directive. This CA EPBD offers an active forum for the EU27 as well as Norway and Croatia to exchange best practice and focuses on finding common approaches to the most effective implementation of this EU legislation. The activities of the Concerted Action comprise meetings and working groups. A second phase of the CA EPBD was launched in December 2007 focusing on a long list of topics related to the various Core Themes. Also the recast of the EPBD was launched and adopted by this CA EPBD 2. In March 2011 a CA EPBD III was initiated that runs until 2015. This CA conducted a study on experiences and challenges for setting cost optimal levels for energy performance requirements. The results of this study were used as input by the EU Commission in their work of establishing the Regulation on a comparative methodology framework for calculating cost optimal levels of minimum energy performance requirements.

Since 2008, every two years, the CA EPBD reports on the status and on the progress achieved in a book containing national reports with snapshots of the status of implementation.

Energy Performance Certificates (EPCs)

[65 http://prtr.ec.europa.eu/]
[67 Reports can be downloaded from www.epbd-ca.eu.]

2013/TEM/R/38

110
The implementation of the EPC schemes has been gradual in almost all Member States due to the nature of application of the certificates. While most countries set up the first certification relation to new buildings, the scheme for renovated, existing and new and existing public buildings were usually left for later implementation. Before the EPBD was created, both The Netherlands and Denmark had already set up energy certification schemes for buildings at national level (in 1995 and 1997 respectively). Germany started in 2002 (having recast it in 2009) and from then on, most of the countries stared the implementation and enforcement of the EPC schemes from 2007 to 2009. Generally, Member States found it easier to introduce requirements for new buildings, as there are already processes in place to approve new buildings. However, greater benefit can be derived from identifying and stimulating uptake of energy savings measures within the existing stock. (BPIE, 2011)

According to the report of BPIE68, by the end of 2010 all countries had started the certification process, but some countries were due to implement some remaining requirements. Also, some countries (Bulgaria, Denmark, Estonia, Greece, Ireland, Lithuania, the Netherlands, Portugal, Sweden, Slovakia and the UK) already had an up and running database for the registered EPCs (BPIE 2011).

Cost-optimal methodology (CA EPBD 2012) and Nearly Zero-Energy Buildings (CA EPBD 2012)

Member States are busy implementing the cost-optimal methodology and NZEB. More information on the status of this implementation can be found in Implementing the Energy Performance of Buildings Directive (EPBD) – featuring country reports (ADENE, 2013) For this report it is however not relevant to discuss the status in the different Member States.

Building Codes

Before the EPBD-requirements, some Member States already had building code requirements associated with the thermal performance of buildings. These requirements were in most countries inspired by the oil price increases in the 1970s, but already in the mid-1940s requirements were in place in some Scandinavian countries. These requirements were in most cases prescriptive requirements for building envelopes en did not assess the building as a whole.

The introduction of the EPBD was the first major attempt requiring all Member States to introduce a general framework for setting building energy code requirements based on a “whole building” approach. So not only requirements for elements were in place, but a holistic approach was set up, where the energy performance of the whole building was assessed.

Since the EPBD in 2002 requirements have therefore gradually started shifting from prescriptive to performance-based approach. With the introduction of the cost optimality concept it is to be expected that requirements will be improved and further strengthened. Also the gradual convergence of the cost optimal levels to nearly zero energy standards shall have an influence of building requirements. Figure 30 gives a summary of the key performance-based requirements and prescriptive criteria adopted by different countries.

---

It should be noted that the elements in the prescriptive criteria can act as supplementary demands or as an alternative approach for setting requirements. In some cases they represent embedded elements in the performance-based methodology. Also, in some cases the performance based requirements may cover only heating demands and in others it may also include domestic hot water, electricity and other end uses. Single element requirements can be just supplementary demands to the energy performance requirements ensuring the efficiency of individual parts of a building is sufficient or they can act as alternative methods where the two approaches exist in parallel. (BPIE, 2011).
<table>
<thead>
<tr>
<th>Building code requirements</th>
<th>Performance based requirements</th>
<th>Prescriptive/element-based criteria in building codes</th>
<th>Other requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AT</strong></td>
<td>Y Y Y Y Y Y Y N</td>
<td>N</td>
<td>Summer comfort requirements</td>
</tr>
<tr>
<td><strong>BE-WI</strong></td>
<td>Y Y Y N Y Y N N</td>
<td>N</td>
<td>Overheating indicator should not exceed 17 500h, T&lt;sub&gt;max&lt;/sub&gt; must be under 28°C for 90% of year in RH. E-values on global thermal insulation of entire building. Thermal bridges</td>
</tr>
<tr>
<td><strong>BE-Bt</strong></td>
<td>Y Y Y N Y N Y N</td>
<td>N</td>
<td>E-values on global thermal insulation of entire building. Thermal bridges</td>
</tr>
<tr>
<td><strong>BE-FI</strong></td>
<td>Y Y Y N Y N Y N</td>
<td>N</td>
<td>Solar collectors in new RH</td>
</tr>
<tr>
<td><strong>BG</strong></td>
<td>Y Y Y Y Y Y N N</td>
<td>N</td>
<td>Thermal bridges, solar shading, max 30% of demand for heating &amp; DHW covered by non-RH</td>
</tr>
<tr>
<td><strong>CH</strong></td>
<td>Y Y Y Y Y Y N N</td>
<td>N</td>
<td>Thermal bridges, solar shading, max 30% of demand for heating &amp; DHW covered by non-RH</td>
</tr>
<tr>
<td><strong>CY</strong></td>
<td>Y Y Y Y Y Y N N</td>
<td>N</td>
<td>Solar collectors in new RH</td>
</tr>
<tr>
<td><strong>CZ</strong></td>
<td>Y Y Y Y Y Y N N</td>
<td>N</td>
<td>T&lt;sub&gt;max&lt;/sub&gt; of 20°C in winter and 17°C summer</td>
</tr>
<tr>
<td><strong>DE</strong></td>
<td>Y Y Y N Y Y Y Y</td>
<td>N</td>
<td>T&lt;sub&gt;max&lt;/sub&gt; of (30-26°C), humidity, air change rate &amp; air velocity requirements</td>
</tr>
<tr>
<td><strong>DK</strong></td>
<td>Y Y Y N Y Y Y Y</td>
<td>N</td>
<td>Max T&lt;sub&gt;max&lt;/sub&gt; 26°C, Thermal bridges requirements</td>
</tr>
<tr>
<td><strong>EE</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>N</td>
<td>RH &amp; office temperature requirements</td>
</tr>
<tr>
<td><strong>ES</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>N</td>
<td>Thermal comfort, T&lt;sub&gt;max&lt;/sub&gt; 21°C (winter), 26°C (summer), mandatory RH &amp; EUS (solar collectors/PV)</td>
</tr>
<tr>
<td><strong>FI</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>BO</td>
<td>Max T&lt;sub&gt;max&lt;/sub&gt; applies typically 26°C, Max CO&lt;sub&gt;2&lt;/sub&gt; concentration in indoor air.</td>
</tr>
<tr>
<td><strong>FR</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>N</td>
<td>Max T&lt;sub&gt;max&lt;/sub&gt; applies based on a number of factors</td>
</tr>
<tr>
<td><strong>GR</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>N</td>
<td>Max T&lt;sub&gt;max&lt;/sub&gt; applies based on a number of factors</td>
</tr>
<tr>
<td><strong>HU</strong></td>
<td>Y Y Y Y Y Y N N</td>
<td>N</td>
<td>Thermal bridges</td>
</tr>
<tr>
<td><strong>IE</strong></td>
<td>Y Y Y N Y Y Y Y</td>
<td>N</td>
<td>Orientation, window size, air temperature, air humidity &amp; air velocity, specific heat losses of whole building 9% per m&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>IT</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>N</td>
<td>Orientation, window size, air temperature, air humidity &amp; air velocity, specific heat losses of whole building 9% per m&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>LT</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>N</td>
<td>Orientation, window size, air temperature, air humidity &amp; air velocity, specific heat losses of whole building 9% per m&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>LV</strong></td>
<td>Y Y Y Y N N Y Y Y Y</td>
<td>N</td>
<td>Orientation, window size, air temperature, air humidity &amp; air velocity, specific heat losses of whole building 9% per m&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>MT</strong></td>
<td>Y N N N Y Y N N</td>
<td>N</td>
<td>Window size, glazing</td>
</tr>
<tr>
<td><strong>NL</strong></td>
<td>Y Y Y Y N Y Y Y</td>
<td>N</td>
<td>Daylight</td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>N</td>
<td>Window size, ventilation, solar shading, ventilation fan power, heat recovery, summer/winter T&lt;sub&gt;max&lt;/sub&gt;</td>
</tr>
<tr>
<td><strong>PL</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>N</td>
<td>Max g-value, thermal bridge, solar collector, cooling, DHW, eq. apply</td>
</tr>
<tr>
<td><strong>PT</strong></td>
<td>Y Y Y Y Y N Y N</td>
<td>N</td>
<td>Max g-value, thermal bridge, solar collector, cooling, DHW, eq. apply</td>
</tr>
<tr>
<td><strong>RO</strong></td>
<td>Y N N N Y N N N</td>
<td>N</td>
<td>Over thermal coefficient g-value</td>
</tr>
<tr>
<td><strong>SE</strong></td>
<td>Y Y Y Y Y Y Y N</td>
<td>N</td>
<td>Over thermal coefficient g-value</td>
</tr>
<tr>
<td><strong>SI</strong></td>
<td>Y Y Y Y Y Y Y N</td>
<td>N</td>
<td>Solar shading, max T&lt;sub&gt;max&lt;/sub&gt;</td>
</tr>
<tr>
<td><strong>SK</strong></td>
<td>Y Y Y Y Y Y Y N</td>
<td>N</td>
<td>Solar shading, max T&lt;sub&gt;max&lt;/sub&gt;</td>
</tr>
<tr>
<td><strong>UK</strong></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>N</td>
<td>Solar shading, max T&lt;sub&gt;max&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

*Figure 32: Summary of building energy code requirements and prescriptive criteria*
Performance based requirements for new buildings

For many countries the EPBD was the means of introducing new elements in their building codes prior to which there were no energy performance requirements concerning the building as a whole or specific elements.Nearly all countries have now adopted a national methodology which sets performance-based requirements for new buildings. An overview of the performance-based requirements can be found in Figure 34 and Figure 35.

Many countries have adopted an approach broadly compatible with the CEN methodology (EN 15603 and/or EN 13790), but no country has directly and fully applied the CEN standards in their methodology procedures. Many different approaches have been applied and no two countries have adopted the same approach. Therefore it is important not to attempt to compare the performance requirements set by Member States. The setting of building code requirements with legally binding performance targets is normally based on either an absolute (i.e. not to exceed) value, generally expressed in kWh/m²a, or on a percentage improvement requirement based on a reference building of the same type, size, shape and orientation. Some countries express the performance requirement as having to meet a defined “E value” on a 0 to 100 scale, or on an A+ to g scale (BPIE, 2011).

Element based requirements for new buildings

Besides the performance based requirements for buildings, also prescriptive requirements for elements are set by the Member States for new buildings. These are more directly related to insulation materials, since they comprise U-values. Limiting the thermal conductivity of major construction elements is the most common thermal performance requirement for buildings. These are based upon U-value requirements (worst acceptable standards) for the main building envelop construction elements. It is necessary to emphasize that these U-value requirements do not necessarily mean that a building meets the overall performance-based requirements. (BPIE, 2011).

Figure 34 shows maximum U-value requirements for various construction elements. Heating degree days are represented in the abscissa, showing the differences in the climatic conditions, explaining the variety of U-value requirements. Also the cost optimal U-values published by EURIMA/Ecofys in 2007 are represented, showing that U-value requirements of the Member States should be made more demanding (BPIE, 2007).
The requirements implying a maximum U-value are linked with the insulation materials. However, the U-value is imposed not for the insulation material as such, but for the whole construction element.

In addition to specifying maximum U-values, also limits for maximum permissible thermal bridging (expressed in W/m.K) are set in several countries. Thermal bridging is an important issue, since thermal bridges can cause significant heat losses or gains. Avoiding thermal bridging can be challenging, specifically in existing buildings, so attention to insulations solutions must be given to this aspect in design phase.

Besides the U-value requirements, there are also air tightness requirement for the building envelope in most countries. Since insulation materials are part of the building envelope, they can also contribute to these requirements, however, no direct rules for the insulation materials are imposed, since the requirements are intended for the building envelope as a whole.
CHAPTER 4 MEErP TASK 1 - SCOPE

<table>
<thead>
<tr>
<th>Country</th>
<th>Single family houses</th>
<th>Apartment Blocks</th>
<th>Offices</th>
<th>Educational Buildings</th>
<th>Hospitals</th>
<th>Hotels &amp; Restaurants</th>
<th>Sports facilities</th>
<th>Wholesale &amp; retail trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT</td>
<td>H.66 kWh/m²a</td>
<td>H.66 kWh/m²a</td>
<td>H.22.75 kWh/m²a</td>
<td>H.22.75 kWh/m²a</td>
<td>H.22.75 kWh/m²a</td>
<td>H.22.75 kWh/m²a</td>
<td>H.22.75 kWh/m²a</td>
<td>H.22.75 kWh/m²a</td>
</tr>
<tr>
<td>BE - Br</td>
<td>E73</td>
<td>E75</td>
<td>E100</td>
<td>E100</td>
<td>E100</td>
<td>E100</td>
<td>E100</td>
<td>E100 (services)</td>
</tr>
<tr>
<td>BE - WI</td>
<td>E&lt;100, E&lt;100</td>
<td>E&lt;100</td>
<td>E&lt;100</td>
<td>E&lt;100</td>
<td>E&lt;100</td>
<td>E&lt;100</td>
<td>E&lt;100</td>
<td>E&lt;100</td>
</tr>
<tr>
<td>CH</td>
<td>Space heating demand (effective energy): 5 litre heating oil equivalent per m² (based on Muken 2008)</td>
<td>H:54 kWh/m²a</td>
<td>H:42 kWh/m²a</td>
<td>H:46 kWh/m²a</td>
<td>H:43 kWh/m²a</td>
<td>H:44 kWh/m²a</td>
<td>H:56 kWh/m²a</td>
<td>H:40 kWh/m²a</td>
</tr>
<tr>
<td>CY</td>
<td>A or B category on the EPC scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CZ</td>
<td>F: 142 kWh/m²a</td>
<td>F: 120 kWh/m²a</td>
<td>F: 117 kWh/m²a</td>
<td>F: 130 kWh/m²a</td>
<td>F: 310 kWh/m²a</td>
<td>F: 294 kWh/m²a</td>
<td>F: 145 kWh/m²a</td>
<td>F: 183 kWh/m²a</td>
</tr>
<tr>
<td>DE</td>
<td>New buildings must not exceed a defined primary energy demand for heating, hot water, ventilation, cooling and lighting installations (lighting installations only for commercial) based on a reference building of the same geometry, floor area, alignment and utilization.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>P:52.5+650/0/A kWh/m²a</td>
<td>P:52.5+650/0/A kWh/m²a</td>
<td>P:71.3+1650/0/A kWh/m²a</td>
<td>P:71.3+1650/0/A kWh/m²a</td>
<td>P:71.3+1650/0/A kWh/m²a</td>
<td>P:71.3+1650/0/A kWh/m²a</td>
<td>P:71.3+1650/0/A kWh/m²a</td>
<td>P:71.3+1650/0/A kWh/m²a</td>
</tr>
<tr>
<td>EE</td>
<td>P: 180 kWh/m²a</td>
<td>P: 150 kWh/m²a</td>
<td>P: 220 kWh/m²a</td>
<td>P: 300 kWh/m²a</td>
<td>P: 400 kWh/m²a</td>
<td>P: 300 kWh/m²a</td>
<td>P: 300 kWh/m²a</td>
<td>P: 300 kWh/m²a</td>
</tr>
<tr>
<td>EL</td>
<td>The Primary energy requirement for new and renovated building in Greece is $=0.33 - 2.73 \times \text{Reference Building energy performance}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>The energy performance requirements is not expressed in units of kWh/m²a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FI</td>
<td>This is based on thermal transmittance (heat loss) measured in units of W/K. For a single family house, a typical value is 134 W/K</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FR-H1</td>
<td>$P_{\text{e,T}}\geq 130\text{W/m²}$</td>
<td>$P_{\text{e,T}}\geq 130\text{W/m²}$</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>FR-H2</td>
<td>$P_{\text{e,T}}\geq 110\text{W/m²}$</td>
<td>$P_{\text{e,T}}\geq 110\text{W/m²}$</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>FR-H3</td>
<td>$P_{\text{e,T}}\geq 80\text{W/m²}$</td>
<td>$P_{\text{e,T}}\geq 80\text{W/m²}$</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>HU</td>
<td>P: 110-230 kWh/m²a</td>
<td>P: 110-230 kWh/m²a</td>
<td>P: 132-260 kWh/m²a</td>
<td>P: 90-254 kWh/m²a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IE</td>
<td>MPEPC = 0.6 &amp; MPEPC = 0.6 &amp; MPEPC = 0.6 &amp; MPEPC = 0.6 &amp; MPEPC = 0.6 &amp; MPEPC = 0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT</td>
<td>Regulations for new buildings are based on a set limit for heating, DHW, cooling and lighting. Only Class A to C buildings comply with requirements for new buildings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 34: Performance-based requirements for new buildings (part a)
CHAPTER 4 MEERP TASK 1 - SCOPE

Figure 35: Performance-based requirements for new buildings (part b)

| LT | Min Class C buildings: 80 kWh/m²a for buildings over 3 000 m², 100 kWh/m²a for buildings between 301 and 3 000 m², 115 kWh/m²a for buildings up to 500 m². |
| LV | No performance requirements are set |
| MT | No performance requirements are set |
| NL | P: 65 398-88 552 MJ/a |
|  | 855 MJ/a |
| NO | N: 120-173 kWh/m²a |
|  | N: 115 kWh/m²a |
|  | N: 150 kWh/m²a |
|  | N: 120-166 kWh/m²a |
|  | N: 300-335 kWh/m²a |
|  | N: 220 kWh/m²a |
|  | N: 170 kWh/m²a |
|  | N: 210 kWh/m²a |
| PL | F: 142 kWh/m²a H&C: 108 kWh/m²a |
|  | F: 123 kWh/m²a H&C: 93 kWh/m²a |
|  | F: 174 kWh/m²a H&C: 183 kWh/m²a |
| PT | P: 203 kWh/m²a |
|  | P: 203 kWh/m²a |
|  | P: 203 kWh/m²a |
|  | P: 203 kWh/m²a |
|  | P: 174 kWh/m²a |
|  | P: 140 kWh/m²a |
|  | P: 65 kWh/m²a |
|  | P: 1.270 kWh/m²a |
| RO | No performance-based requirements are set |
| SE | F: 55-95 FNE: 110-150 kWh/m²a |
|  | F: 55-95 FNE: 100-140 kWh/m²a |
|  | F: 55-95 FNE: 100-140 kWh/m²a |
|  | F: 55-95 FNE: 100-140 kWh/m²a |
|  | F: 55-95 FNE: 100-140 kWh/m²a |
|  | F: 55-95 FNE: 100-140 kWh/m²a |
| SI | P: 170-200 H&C: 50 kWh/m²a |
|  | P: 170-200 H&C: 50 kWh/m²a |
|  | P: 163-180 kWh/m²a |
|  | P: 163-180 kWh/m²a |
|  | P: 163-180 kWh/m²a |
|  | P: 163-180 kWh/m²a |
| SK | P: 81-160 H&C: 42-96 kWh/m²a |
|  | P: 31-160 H&C: 27-53 kWh/m²a |
|  | T: 42-64 H&C: 28-56 kWh/m²a |
|  | T: 101-241 H&C: 27-70 kWh/m²a |
|  | T: 84-147 H&C: 14-71 kWh/m²a |
|  | T: 48-95 H&C: 28-56 kWh/m²a |
|  | T: 81-161 H&C: 27-70 kWh/m²a |
| UK | 17-20 kg CO₂ | 16-18 kg CO₂ |
|  | Other TIE (Target Carbon Dioxide Emission Rate) values apply for non-domestic buildings |

NOTES

- Based on gross floor area and gross building volume
- Based on assumption of D=0.10, A=1.2 for SHL, A=0.8 for other buildings
- Effective space heating demand for a typical building shape calculated on the basis of the SHNORM 30/01/2009
- A denotes gross floor area in the Danish Formula, example 78.1 P 32.2 m² + 0.7 g 30 m²
- DI is for a single family house with building volume 122 m³, gross floor area 193 m², and height between floor 3m.
- H:1, I:4, M:1, C:2, P:2 is the new main climatic regions in France
- IEA MEPDC and ESMEP denote the Maximum Permitted Energy Performance and Maximum Permitted Carbon Performance Coefficients used in the Inland chart

LEGEND

- P: Primary Energy
- F: Final
- N: Overall Net energy demand limit (includes all electricity for lighting and appliances)
- T: Total delivered energy
- H: Heating
- C: Cooling
- H&C: Heating and Cooling
- MEPDC: Irish Maximum Permitted Energy Performance Coefficient
- ESMEP: Irish Maximum Permitted Carbon Performance Coefficient

- IEA (subscript): Space heating provided by electricity (incl. heat pumps)
- ES (subscript): Space heating provided by electric heating
- MEPDC: Electrically heated building
- ESMEP: Non-electrically heated building
- IE: Ireland
- BE: Belgium
- FI: Finland

2013/TEM/R/38
117
Figure 36: Building envelope insulation requirements (BPIE, 2011)
→ Labels implemented at MS level

**Blue Angel**

![Image of Blue Angel label](image)

*Figure 37: Blue Angel label*

Since 1978 the Blue Angel has set the standard for eco-friendly products and services selected by an independent jury in line with defined criteria. The Blue Angel is only awarded to products and services which - from a holistic point of view - are of considerable benefit to the environment and, at the same time, meet high standards of serviceability, health, and occupational protection. The Blue Angel considers itself as a market-conform instrument of environmental policy designed to distinguish the positive environmental features of products and services on a voluntary basis. Companies use the label to professionally promote their eco-friendly products in the market. Thus, it is an ecological beacon showing the consumer the way to the ecologically superior product and promotes environmentally conscious consumption.

Blue Angel labels can be awarded to insulation materials.

The label sets requirements for the manufacturing phase, the use phase and requirements for declaration of consumer information. The requirements can be found in the document ‘Basic Criteria for award of the environmental label, Low emission thermal insulation material and suspended ceilings for use in buildings (RAL gGmbH, 2010)’.

- **Requirements for the manufacturing phase:**
  - General substance requirements;
  - Halogens;
  - Flame retardants;
  - Plasticizers;
  - Requirements for insulation materials: fibrous materials, blowing agents and biocides;
  - Requirements for Suspended Ceilings: pigments and preservation;
- **Requirements for the use phase:**
  - Indoor air quality (not exceed emission values)
  - Serviceability;
- **Declaration of consumer information:**
  - amongst others on installation and disposal.
UK Energy Saving Recommended (ESR) logo

![UK Energy Saving Recommended label](image)

Energy Saving Trust Recommended is a product certification and labelling scheme in the UK that highlights products that are among the most energy efficient on the market and will help consumers to save energy in the home.

Criteria have been developed for following types of insulation products:
- Cavity wall insulation;
- Domestic pipe insulation;
- External wall insulation;
- Loft insulation;
- Radiator reflector panels.

4.4.3. THIRD COUNTRY LEGISLATION, INCLUDING A COMPARATIVE ANALYSIS

The availability of minimum requirements (or minimum energy performance standards - MEPS) for buildings and/or building components in third (non EU countries) can be checked on various websites and a short survey shows that many countries have MEPS for buildings in place.

The World Energy Council (WEC) offers an online database on energy efficiency policies and measures[^69].

The Sustainable Buildings Centre (SBC, IEA) offers the BEEP database as the global one stop-shop for Building Energy Efficiency Policies from all over the world[^70].

The Global Buildings Performance Network (GBPN) has recently reviewed 25 state of the art building energy efficiency codes using 15 criteria developed with some of the world’s leading experts in the field[^71].

Providing a detailed picture of the actual building codes (expressed in U-value per component for instance) from all over the world however is much more elaborate as most websites do not always provide a full description of these codes.

[^69]: http://www.wec-policies.enerdata.eu/measure.php#resultat
[^70]: http://www.sustainablebuildingscentre.org/pages/beep
[^71]: http://www.gbpn.org/databases-tools/purpose-policy-comparative-tool
No approaches to regulating thermal insulation products in third countries have been identified that would be complementary to current practice in the EU or in the EU Member States. Therefore this study does not provide detailed building code information of countries outside the EU.

→ Third country labels

**ENERGY STAR**

![Energy Star label](image)

*Figure 38: Energy Star label*

ENERGY STAR is a U.S. Environmental Protection Agency voluntary program that helps businesses and individuals save money and protect the climate through superior energy efficiency. The ENERGY STAR program covers, amongst others, a topic on how to save energy at home, including information on insulation materials.

The label sets requirements for:
- Testing requirements on significant digits and rounding;
- R-value test requirements;
  - Min R-value of 3.0;
- Surface burning characteristics;
- Representative samples of each product line shall be selected for testing.


**Good Environmental Choice Australia (GECA)**

![Good Environmental Choice Australia label](image)

*Figure 39: Good Environmental Choice Australia label*

72 [http://www.energystar.gov](http://www.energystar.gov)

GECA 33-2007 – Thermal Building Insulation Materials - standard seeks to define good environmental performance benchmarks for bulk insulation materials for use in the construction of buildings. The voluntary environmental labelling standard implemented by the Australian Environmental Labelling Association (GECA) specifies environmental performance criteria for insulation materials including batts, boards and blankets. These products form a significant proportion of items manufactured for the thermal insulation of residential, commercial and government structures. This standard stipulates the environmental load of such products throughout the major aspects of their life cycle.

The label sets requirements for:
- Fitness for purpose;
- Material requirements (e.g. recycled content);
- Hazardous substance (Prohibited substances, blowing agent...);
- Packaging requirements;
- Product information.

More information is available in the standard on thermal building insulation materials (Good Environmental Choice Australia, 2007).

**Environmental Choice New Zealand Label**

![Figure 40: Environmental Choice New Zealand label](http://www.environmentalchoice.org.nz/)

Environmental Choice New Zealand (ECNZ) is an environmental labelling programme which has been created to help businesses and consumers find products and services that ease the burden on the environment. The programme results from a New Zealand Government initiative and has been established to improve the quality of the environment by minimising the adverse and maximising the beneficial environmental impacts generated by the production, distribution, use and disposal of products, and the delivery of services. The programme is managed by the New Zealand Ecolabelling Trust (the Trust). ECNZ operates to the ISO 14024 standard "Environmental labels and declarations - Guiding principles" and the Trust is a member of the Global Ecolabelling Network (GEN) an international network of national programmes also operating to the ISO 14024 standard. At the ECNZ website there is a list available of companies that have licensed green/eco-friendly insulation products with the Environmental Choice NZ eco-label.

The label sets requirements for:
- Recycled content;

---

• Hazardous substances;
• Waste management;
• Energy management;
• Packaging requirements;
• Emissions to indoor air.

More information is available in the document describing the licence criteria for Thermal Building Insulants (The new Zealand Ecolabelling Trust, 2012).

**Environment Canada’s Environmental Choice Program – Ecologo programme**

*Figure 41: Ecologo label*

Founded in 1988 by the Government of Canada but now recognized world-wide, EcoLogo™ is North America’s largest, most respected environmental standard and certification mark. EcoLogo provides customers – public, corporate and consumer – with assurance that the products and services bearing the logo meet stringent standards of environmental leadership. With thousands of EcoLogo Certified products, including insulation materials (batt type, blanket type, board type, loose fill, spray on), EcoLogo certifies environmental leaders covering a large variety of categories, helping you find and trust the world’s most sustainable products. The EcoLogo Program is a Type I eco-label, as defined by the International Organization for Standardization (ISO). This means that the Program compares products/services with others in the same category, develops rigorous and scientifically relevant criteria that reflect the entire lifecycle of the product, and awards the EcoLogo to those that are verified by an independent third party as complying with the criteria. The EcoLogo Program is one of two such programs in North America that has been successfully audited by the Global Ecolabelling Network (GEN) as meeting ISO 14024 standards for eco-labelling.

The label sets requirements for:
- Not labelled as toxic
- Instructions for proper handling and installation
- May not use polybrominated diphenyl ether flame retardants, formaldehyde containing binders, lead catalyst
- Blowing agents:
  - ODP = 0
  - GWP < 15
  - Less than 6% in case of EPS resin
- Requirements for recycled content
- Comply with performance standards

More information is available in the Certification Criteria document (Ecologo, 2005).

---

RoofPoint is a voluntary, consensus-based green rating system developed by the Center for Environmental Innovation in Roofing in the US. The aim is to provide a means for building owners and designers to select nonresidential roof systems based on long-term energy and environmental benefits.

The focus is on roofs, since they represent a great potential in surface that can be insulated. By only looking at the roof, also roofing retrofits without interventions at other building elements can be awarded.

By providing a simple, transparent and professional measure, RoofPoint wants to ensure that new and replacement roof systems are designed, installed and maintained in accordance with best sustainable practices available today.

4.4.4. SUMMARY OF LEGISLATION

In this paragraph we present a summary table (draft version) for the entire section 4.4 indicating which environmental impacts of thermal insulation products are covered by which piece of EU/MS/3rd country legislation, and with what sort of requirement (product information or minimum requirements).

The life cycle impact assessment indicators of the MEErP study (Kemna, 2011) are used in the table. For each of the above discussed legislations the influence on an environmental impact category is indicated by means of 'X'. Only direct requirements are indicated. Some legislation may have an indirect influence on other impact categories. This has not been indicated in the table.

---

76 http://www.roofpoint.org
### Table 13: Requirements on life cycle parameters included in existing legislation

<table>
<thead>
<tr>
<th>Material Resources</th>
<th>Energy Resources in use phase</th>
<th>Energy Resources in other phase</th>
<th>Water Resources</th>
<th>Waste</th>
<th>Global Warming Potential</th>
<th>Acidification Potential</th>
<th>Persistent Organic Pollutants (POP)</th>
<th>Heavy Metals</th>
<th>PAHs²</th>
<th>Particulate Matter (PM, dust)</th>
<th>Eutrophication Potential</th>
<th>EU Legislation</th>
<th>Type of requirement</th>
<th>Substances (SUB)/ Product (P)/ System (S) level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU Legislation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction Product Regulation</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x mandatory if hEN or ETA established P</td>
</tr>
<tr>
<td>Green Public Procurement Insulation Materials</td>
<td>x x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x V P</td>
</tr>
<tr>
<td>ETS - EU Emissions Trading System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x M /</td>
</tr>
<tr>
<td>Effort Sharing Decision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x M /</td>
</tr>
<tr>
<td>Directive on Packaging and Packaging waste</td>
<td>x x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x M P</td>
</tr>
<tr>
<td>Regulation on the Classification, Labelling and Packaging of Substances and Mixtures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x M SUB</td>
</tr>
<tr>
<td>REACH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x x M SUB</td>
</tr>
<tr>
<td>F-Gas Regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x M SUB</td>
</tr>
<tr>
<td>Revised F-gas regulation (draft future proposal)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x M SUB</td>
</tr>
<tr>
<td>Waste Framework Directive</td>
<td>x x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x M P</td>
</tr>
<tr>
<td>Energy Labelling Directive</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x M P</td>
</tr>
<tr>
<td>Energy Efficiency Directive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x M S</td>
</tr>
<tr>
<td>Regulation on the Ozone Layer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x M SUB</td>
</tr>
<tr>
<td>Timber Regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x M SUB/P</td>
</tr>
<tr>
<td>Directive on the incineration of waste</td>
<td>x x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x M P</td>
</tr>
<tr>
<td>Council Directive CAFE cleaner air for Europe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x x M S</td>
</tr>
<tr>
<td>Member State Legislation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x M S</td>
</tr>
<tr>
<td>Energy Performance of Buildings Directive</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x M S</td>
</tr>
</tbody>
</table>

1. Non-Methane Volatile Organic Compounds
2. Polycyclic Aromatic Hydrocarbons emissions to air
3. Hazardous Substances and Substances of Very High Concern
4. Ozone Depletion Potential: This indicator is no longer part of the list of indicators in the MEErP methodology. ODP-emissions are now practically non-existing, due to the Montreal agreement.
5. Direct effect on ODP, but CFC and HCFC also contribute to global warming

2013/TEM/R/38

125
5.1. INTRODUCTION

The aim of carrying out a part of task 7 of the MEErP methodology is to assess the extent to which measures under the Ecodesign and Energy Labelling Directives could, if at all, contribute to the achievement of the improvement potential for insulation materials, taking into account other existing policies. Also, it must be ensured that possible measures deal with all insulation materials in a similar way, so a level-playing field is created.

According to the MEErP methodology, task 7 should summarize and bring together the outcomes of all previous tasks. It must examine suitable policy-related means of achieving the potential e.g. implementing LLCC as a minimum and BAT as a promotional target, using legislation or voluntary agreements, labelling, benchmarks and possible incentives. Task 7 should draw up scenarios 1990 – 2020/2030/2050 quantifying the improvements that can be achieved vs. a Business-as-Usual scenario and compares the outcomes to EU environmental targets. Task 7 should make an estimate of the impact on consumers and industry (employment, profitability, competitiveness, investment level, etc.) as described in Annex II of the Ecodesign Directive 2009/125/EC, explicitly describing and taking into account the typical design cycle (platform change) in a product sector. Finally, in the context of a sensitivity analysis of the main parameters, it studies the robustness of the outcome, amongst others regarding energy prices and societal costs.

On request of the EC DG Energy, as described in the Terms of Reference (TOR), only certain elements of task 7 of the MEErP methodology will be performed:

1. Type of possible requirements;
2. A rough estimate of the improvement potential attributable to the policy instruments recommended;
3. Sensitivity analysis for the improvement potential.

The structure as presented in the TOR will be followed in reporting on task 7.

5.2. TYPE OF POSSIBLE REQUIREMENTS

In this paragraph, the type (but not yet the precise content) of possible requirements relating to building thermal insulation products in the context of Ecodesign and/or energy labelling will be determined, taking into account any constraints inherent to the product group and the need to avoid duplicating existing legislation/standards mapped under paragraphs 4.3 and 4.4. Moreover, recommendations could be made to adapt or use different Ecodesign and/or labelling requirements, or even other policy instruments, if they are estimated to be more effective than the existing legislation/standards mapped in paragraphs 4.3 and 4.4.

Chapter 3 addressed the improvement potential, focussing on the energy-saving potential while using thermal insulation materials. The primary function of thermal insulation materials is to save energy. Also, it was concluded that the production and EOL contribution to the life-cycle impacts are small compared to the use phase. As the depth of analysis of the environmental aspects and of the feasibility of their improvement shall be proportionate to their significance, the differences
between production performance and EOL performance of the different insulation materials have been analysed in less detail.

Taking into account the full life-cycle of insulation materials, the following potential requirements have been identified for assessment:

- Potential requirements within the scope of the Labelling Directive;
- Potential Ecodesign requirements within the scope of the Ecodesign Directive, either specific or generic:
  - Ecodesign requirements on energy performance in the use phase;
  - Ecodesign requirements regarding environmental or energy performance in the production phase;
  - Ecodesign requirements regarding the emission of harmful substances from insulation materials during the use phase;
  - Ecodesign requirements regarding the release or leaching out of substances;
  - Ecodesign requirements relating to the EOL phase;
  - Ecodesign requirements for Design for Disassembly.

5.2.1. Potential requirements in the scope of the Labelling Directive

The Labelling Directive 2010/30/EU states:

Article 1
Scope
1. This Directive establishes a framework for the harmonisation of national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during use, and supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products.

2. This Directive shall apply to energy-related products which have a significant direct or indirect impact on the consumption of energy and, where relevant, on other essential resources during use.

Insulation products do not consume resources during use. However, as we discussed in CHAPTER 3, they clearly belong to the energy-related products which have a significant direct or indirect impact on the consumption of energy.

Labelling and standard product information on the consumption of energy during use of insulation materials is far from straightforward, as the energy saving contribution is not an intrinsic property of an insulation product, but depends on the context in which the insulation is used. Energy savings for an identical insulation product vary across the EU due to different climatic conditions. This is explicitly recognized by the Energy Performance of Buildings Directive (EPBD), which states in its Article 5.2 that “Member States shall calculate cost-optimal levels of minimum energy performance requirements [for buildings] using the comparative methodology framework ... and relevant parameters, such as climatic conditions and ...”

Moreover, energy savings are determined by different building practices for building envelopes, which also partially contribute to energy saving, alongside the insulation material itself. The overall insulation value of a building’s envelope is determined by the sum of all contributing elements in a building envelope, as we have extensively discussed in CHAPTER 3. The impossibility of labelling the energy performance of an insulation product is also reflected in the fact that, while renovating a building for better energy performance, the first addition of say 5 cm of insulation will reduce the
energy consumption by a certain absolute amount, but the next additional identical 5 cm will reduce the energy consumption with a lower absolute amount.

Taking into account the above limitations, thermal conductivity (\(\lambda\) [W/(m.K)]) could be considered as a standard product information relating to the consumption of energy during use, which could be used to enable end-users to choose more efficient products. However, the obligation for the manufacturers of insulation products to indicate thermal conductivity on their products is already regulated under the Construction Products Regulation (CPR). The CPR does not set a threshold value nor define performance classes. What is more, we have argued that it would be very difficult to define such a threshold value or performance classes, as these would be dependent on the climatic conditions and the building system in which the insulation material is used. By way of an example, different performance classes would be needed for mineral wool that is part of a wall system and mineral wool that is part of a roof system.

Conclusion:
The labelling of insulation materials is far from straightforward as the energy saving contribution is dependent on climatic conditions and is determined by differences in building practices. The possibility to obligate insulation material producers to indicate thermal conductivity on their products is already provided for under the Construction Products Regulation (CPR Art 60(a)). The appropriate level of product information on energy performance in the use phase that is intended for the end-user is at the level of the building envelope, in relation to which EPBD policy is in existence for new and existing buildings. (See also section on specific ecodesign requirements in the use phase (paragraph 5.2.2)).

5.2.2. Potential requirements in the scope of the Ecodesign Directive

Distinction is made between generic and specific Ecodesign requirements.

Generic Ecodesign requirements
According to Annex I of the Ecodesign Directive (referred to in Article 15(6)) generic Ecodesign requirements are intended to improve the environmental performance of products and focus on the significant environmental aspects of these, without setting limit values. The method referred to in this Annex must be applied when it is not appropriate to set limit values for the product group under examination. The Commission must, when preparing a draft implementing measure to be submitted to the Committee referred to in Article 19(1), identify significant environmental aspects which must be specified in the implementing measure. In practice, in the implementing measures adopted so far, generic Ecodesign requirements have been used to set product information requirements.

Specific Ecodesign requirements
According to Annex II of the Ecodesign Directive, specific Ecodesign requirements set out to improve a selected environmental aspect of the product. They may take the form of requirements for the reduced consumption of a given resource, such as a limit on the use of a resource in the various stages of a product’s life cycle.
Furthermore Annex II states:
Concerning energy consumption in use, the level of energy efficiency or consumption must be set at a level that takes into account the life-cycle cost minimum to end-users for representative product models, taking into account the consequences with regard to other environmental aspects.
Specific Ecodesign requirements on energy performance in the use phase

The same reasons that apply to measures arising by virtue of the Labelling Directive apply: the energy saving contribution is not an intrinsic property of an insulation product, but it depends on the context in which the insulation is used. The overall insulation value of a building’s envelope is determined by the sum of all contributing elements within that building envelope. The EPBD is an EU policy that is already in existence and is the most appropriate policy when it comes to setting targets at building level.

Annex II of the Ecodesign Directive states that the aim for specific measures regarding energy consumption should be the minimum life-cycle cost. As the same insulation solution provides different energy savings in the use phase across Member States and different cost savings in the use phase, an EU-wide specific measure is not appropriate. The optimum cost efficient level of insulation has to be determined in the context of local climatic conditions, local building practices, and when renovating also in the context of existing remaining building envelope.

Conclusion:
The imposition of a (specific) target with regard to energy performance of insulation products in the use phase is impossible. The appropriate level at which such a target could be imposed would be at the level of the building envelope. The Energy Performance of Buildings Directive appears to be the most appropriate policy tool to set performance requirements at the level of the building envelope. Requirements regarding the building envelope are handled by the implementation of EPBD in the Member States.

Generic Ecodesign requirements on energy performance in the use phase (product information requirements)

In the Quickscan (see CHAPTER 3), the high improvement potential for the use of insulating products in buildings has been demonstrated, but we must consider which Ecodesign requirements imposed on the manufacturers/importers could help realize this potential. For example, any support that will accelerate the renovation of the old stock of existing buildings lifting them to higher energy performance standards would prove to be a significant help when it comes to realizing the potential, but that measure does not lie within the scope of the Ecodesign Directive. The National Energy Efficiency Action Plans (NEEAP) provide an effective framework within which to realize the potential of energy savings by means of incentives for renovation of existing buildings. The existing EPBD already initiated national building codes that impose levels of performance for building elements. These levels of performance are differentiated across the Member States.

A potential generic implementing measure could address the issue of installation of insulation products. The EIP (PE NWE, 2012) study states “An incorrectly specified insulation, without the relevant performance characteristics in use, is not likely to deliver the required thermal performance, and may even cause greater problems in terms of cold bridging, moisture ingress, condensation or increased fire risk”. The design and installing of insulation is the main responsibility of the architect and the installers, which lies outside the scope of the Ecodesign Directive. However, manufacturers/importers have a role to play in providing information regarding performance and installation.

Information sharing on the performance of insulation materials is already included in the current CPR policy and associated standards.
The provision of information on correct installation of the insulation material is not yet included in current legislation or in the standards. The importance of correct installation of the different insulation products is however without doubt. There is an option to set Ecodesign implementing measures setting product information requirements for the installation of insulation materials. The content of the implementing measure can be developed together with the technical assessment bodies. Insulation materials can however be installed in a wide variety of applications, leading to a wide variety of correct installations. Stakeholders acknowledge the importance of correct installation, but they indicate that it is nigh on impossible to provide information on all possible applications. In addition, suppliers can never be responsible for the actual installation and or the possible uses made of products for which they are not intended. Stakeholders also indicate a need for harmonised EN standards for application of insulation products (see Annex C).

**Conclusion:**
A potential generic implementing measure could address the issue of installation of insulation products. Ecodesign requirements (generic) regarding information about the optimal installation of insulation products may provide help to architects and installers. Since information requirements are tackled within the CPR, Ecodesign could focus more on generic requirements, such as describing what information should be available in a manual. This potential measure can be considered if other more important opportunities for Ecodesign requirements are also to be found. Setting up an Ecodesign regulation for this possible measure alone is not advisable.

→ **Ecodesign requirements on environmental performance or energy performance in the production phase**

The benefits that insulation products provide during the use phase are an order of magnitude higher than the burden caused by the production of insulation products, according to current levels of insulation in buildings. The depth of the analysis should be proportional to that potential. The EIP study (PE NWE, 2012) provides an overview of differences regarding environmental production performance based on available public EPDs. The main conclusion from these graphs is that the environmental performance between insulation products with the same thermal performance can vary significantly, but that there is no overall winner in all of the impact categories taken into consideration. A “single number” approach involving weighting LCA Impact Assessment parameters, could help in the evaluation of these differences; however, it only assists in the decision-making process, and does not make the policy makers’ decision. It should be noted that the LCA community has long had misgivings about "single number" approaches, owing to the "black box" lack of transparency, and the over-simplicity of such approaches, especially in conveying the relevant improvement messages to stakeholders, in addition to higher level policy makers, or many non-technical policy makers.

Furthermore specific insulation products are required to fulfil additional functional parameters, such as trafficability when applied on top of flat roofs, leading to higher density and environmental performance during production of insulation products. Any specific target should not lead to a situation in which insulation products are not permitted to enter the market if those insulation products provide a valuable solution in a specific (renovation) context.

An important consideration is that insulation products are installed in both new and existing buildings. Concerning the renovation rates of the building stock, little consistent data is available about the number of renovations, their depth or developments over time. Most sources indicate a
renovation rate between 1% and 2% per year as an average for the EU, while some individual countries have reported higher rates often as a result of specific renovation programs in a given period (BPIE, 2011). The number of new buildings constructed per year is of the same order (1 to 1.5%). Especially for the renovation market a large number of constraints apply that are determined by the remaining parts of the building envelope, for which optimal reuse makes good economic and environmental sense. Sometimes intra-cavity insulation is possible, sometimes there is only space on the exterior side of the wall, sometimes there is only space on the interior side, the available thickness for insulation can vary etc. These very different contexts require different insulation products with different functional requirements regarding moisture resistance, compressive strength, vapour permeability, ability to be self-supporting, ease of installation etc. The architect is best placed to identify the optimal insulation solution. It is of paramount importance that sufficient insulation solutions exist in order to respond to the varying contexts encountered in renovation projects. Imposing an Ecodesign requirement on one specific impact category carries the risk of eliminating an insulation solution from the renovation market.

Nowadays, several manufacturers and importers voluntarily supply EPDs containing information on a broad range of environmental aspects. In the framework of TC 350 (and more specifically the EN 15804) these EPD’s should be evaluated at building envelope level. Only in case of identical application and equal performance can they be compared at the level of insulation products.

There is an option to make the declaration of environmental performances by means of EPDs mandatory through Ecodesign implementing measures or CPR delegated acts. This would allow the consumer to make a comparison between the different insulation materials (if the EPDs of the compared insulation materials are based on the same functional unit). In some Member States, the submission of EPDs is already obligatory. The CPR could make the submission of EPDs obligatory by a Delegated Act issued under Art 60 (a). From the moment Basic Work Requirement (BWR) 7 of CPR becomes mandatory, manufacturers will have to declare information on sustainable use of resources. Today only the first 6 Basic Work Requirements and REACH are mandatory. Paragraph 4.4.1 gives more information on the CPR and the different basic work requirements. Stakeholders are generally open to this suggestion, but indicate that they should be made mandatory for all construction products in that case, preferably supported by a public online database in order to increase transparency. This should all be in compliance with EN 15804 (see Annex C).

Conclusion:
The level of significance of Ecodesign requirements on environmental performance in the production phase is rather low and it is difficult to judge which impact category is the most important one. Moreover, there also exists a large variation in needs/constraints, especially during renovation projects, which requires a broad range of insulation solutions. Nowadays, by means of the voluntary EPD system, information on these differences is provided on dozens of different insulation products, although full coverage of the market has not been achieved. There is an option for the declaration of environmental performances by means of EPDs to be made mandatory through Ecodesign implementing measures or CPR delegated acts. This would allow the consumer to compare the different insulation materials (if the EPDs are based on the same functional unit and with the same framework assumption and assessed according to the same methodology). Stakeholders do not refuse mandatory EPDs, but claim that if they are introduced for insulation products, they should be also introduced for all other construction products. This would allow the assessment of the environmental profile of the entire building (see Annex C).
Ecodesign requirements on emissions of harmful substances from insulation materials in the use phase

The Construction Product Regulation, Annex I, Basic requirements for construction works #3 "Hygiene, health and the environment" of this regulation states: The construction works must be designed and built in such a way that they will, throughout their life cycle, not be a threat to the hygiene or health and safety of workers, occupants or neighbours, nor have an exceedingly high impact, over their entire life cycle, on the environmental quality or on the climate during their construction, use and demolition, in particular as a result of any of the following (follows a summation of several environmental aspects of products).

Standardisation work is being performed by CEN TC 351. Final general standards for the measurements of emissions to indoor air do not yet exist. However, as the work is already in progress, this should not be duplicated under the Ecodesign Directive. CEN TC 351 will not set emission limit values (ELVs) only the modus operandi of evaluation. Each Member State of the EU defines its specific requirements. In Belgium, for example, a draft regulation is in place in the form of the Royal Decree establishing threshold levels for the emissions to the indoor environment from construction products for certain indoor uses. The basis of the Belgian decree is the CPR. The placing of products on the market without the respective product emission files in accordance with the regulation will no longer be permitted from the quoted points of time. Insulation products are however not yet affected by the current draft, but the project team thinks that the CPR is the correct framework for the regulation of emissions in the use phase.

After receiving several complaints, ANSES (French Agency for Food, Environmental and Occupational Health Safety) in France is looking into ammonia emissions from cellulose insulation containing ammonium salts. This decision follows the French Decree of June 21, 2013, concerning the prohibition of placing on the market, importing, distributing and manufacturing cellulose insulation containing ammonium salts. In May 2013, the French Ministry of Ecology brought forward a draft proposal for the prohibition on placement on the market, importation, sale, distribution and manufacture of cellulose wadding insulation materials with ammonium salt additives (Arrêté du 21 juin 2013 relatif à l'interdiction de mise sur le marché d'importation, de vente et de distribution et de fabrication d'isolants à base de ouate de cellulose adjuvants de sel d'ammonium)). The EC agreed on an implementation of a prohibition, but this restriction should be covered under the REACH legislation (1907/2006) or under the REACH safeguard clause. This means the product should be prohibited on European scale. The prohibition of placing ammonium salts on the market has been granted by the EC for 21 months (provisional measure) (EC, 2013). The Commission is already working on a prohibition of the use of ammonium salts in cellulose insulation. It is therefore not necessary to address this issue by means of Ecodesign measures.

Moreover, indoor air quality is typically determined by the ambient air, by the building envelope (air tightness, building ventilation and ventilation system) and by indoor sources (such as heating, building materials, consumer products etc.). Indoor air quality should be measured at the applications level and not at the level of the insulation product. Member States currently set different requirements for indoor air quality. Compliance with any such requirement has to be ensured by the designer/installer of the particular buildings. Insulation products with more or less

http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000027650722&dateTexte=&categorieLien=id
emissions could be used to achieve the same IAQ requirement in different buildings, depending on the specific conditions.

Release or leaching out is also tackled in the Regulation 842/2006/EC on fluorinated gases, 1999/45/EC and 67/548/CEE and CLP Regulation (EC) 1272/2008 on carcinogenic, mutagenic etc. substances.

**Conclusion:**
Requirements for measuring emissions in the use phase are being developed by TC 351. Having a sound measurement method and measured emission data established on that basis forms a condition for further policy measures. Ecodesign requirements (generic) regarding information about emissions in the use phase may be of help to installers. Stakeholders indicate the need for harmonised EN standards and refer to mandate M/103 of the European Commission and the CPR (see Annex C).
Where CEN TC 351 only covers emissions in the use phase, some stakeholders indicate that an enlargement to the whole life-cycle is desirable.

EU Green Public Procurement (GPP) in general puts forward more ambitious levels for environmental criteria compared to a policy imposed to all products on the market. In the case of thermal insulation products the GPP criteria require appropriate evidence that the insulation product complies. GPP criteria do not impose higher levels of requirements regarding release or leaching out compared to the above mentioned Regulations.

→ **Ecodesign requirements on the EOL phase**

End of Life for insulation products installed in buildings today will usually after several decades after they are installed in a (renovated) building. Waste treatment options vary across different types of insulation and different Member States: some can be incinerated with energy recovery (if available), some can be recycled and some can be composted. In the literature, a consensus has been reached about the fact that the EOL stage has a small environmental impact compared to the benefits insulation provides during use. The EU Waste Framework Directive stipulates that 70% (by weight) of construction waste needs to be recycled or recovered by 2020. Insulation products are not contributing a lot to the weight of a building and consequently its waste, but in the long term with the nearly zero energy buildings target from the EPBD, the fraction of insulation waste may increase. Nowadays, waste is also generated during the installation of insulation into new and existing buildings. The actual environmental impact of the waste during installation is again an order of magnitude smaller than during the use phase, as this concerns approx. 5% of the amount of insulation product installed.

The basic question is what manufacturers/importers could additionally do to help realize the most resource efficient use of this waste. One could think of a generic implementing measure containing information about the most appropriate ways of handling this waste. Part of this requirement is already covered by the voluntary EPD scheme. There is an option to make the declaration of environmental performances by means of EPDs mandatory through Ecodesign implementing measures (see also the paragraph on Ecodesign requirements on environmental performance or energy performance in the production phase).

**Conclusion:**
We do not consider a generic implementing measure with information on best EOL options appropriate, unless maybe through mandatory EPDs (see also the paragraph on Ecodesign
requirements on environmental performance or energy performance in the production phase). The reason for this is the small significance of this life-cycle stage within the life-cycle of an insulation product. Moreover the group of insulation products makes up only a small percentage of building waste. We believe the most appropriate way to handle information sharing regarding the EOL of insulation materials is through EPDs and the existing EPD standards.

→ Ecodesign requirements for Design for Disassembly and life span

Paragraph 3.4.3 elaborates on the environmental significance of DfD for some representative building design cases – especially when frequent upgrades and multiple replacements have to be considered. The two examples given in paragraph 3.4.3 demonstrate that the improvement potential of DfD on the life-cycle impacts of a building may be different for each case: e.g. depending on the building application and the building (element) structure.

In paragraph 3.4.3 (classification on system level) the difficulty in finding consistent generic data on the lifespan of insulation products has been elaborated. There is, however, a common understanding that the energy efficiency related to most thermal insulation solutions degrade over the service life of the building (element). Therefore, the estimation of lifespan data should be carried out with care.

A lower-than-optimal lifespan for a thermal insulation product means that the building in which it is installed will have higher heating/cooling demand (with its associated environmental impacts) rather than an optimum one. The insulation will therefore need to be changed more frequently, also imposing cradle-to-gate and end-of-life impacts. Therefore, in principle minimum lifetime requirements for insulation products in a given category (interchangeable in the same location and circumstances) could make sense. Such requirements could be set for the reference service life tested under standard conditions (see below).

Unfortunately, insufficient information exists in order to judge whether sufficient disparities exist in typical categories of thermal insulation to set minimum lifespan requirements as a means of eliminating the worst performers. If (quantitative) information on the lifespan of thermal insulation is available, e.g. through the generic references given on p. 14 of this report, the range is quite broad. According to SBR (Dutch) (2012), this can be up to 20-100 years. BBSR (German) (2011) limits the range to 40-50 years.

Values of the SBR (2012) and BBSR (2011) are based on stochastic values, based on practical experience within the building sector. Both references give rounded values (so that the deviation is plus or minus 5). Among others, the ‘typical’ life expectancy of insulation products is dependent of the application (e.g. façade, roof, floor).

According to SBR (2012): e.g.

- for roofs cellulose (loosefill or plates) only lasts 20 years, while stone wool (blankets and plates) and cellular glass (plates) will last 75 years;
- for exterior walls cellulose lasts 30 years, stone wool (blankets and plates) 75 years and cellular glass (plates) 100 years and more;
- for floors cellulose plates lasts 30 years, stone wool (blankets and plates) and cellular glass (plates) last 100 years and more.

Based on these values (and others) the range of ‘typical’ lifespans of ‘typical’ insulation products is 20-100 years.
According to BBSR (2011): e.g.

- for exterior walls: cavity insulation products (such as mineral wool, PU, PS, blown-in glass) last 50 years and more, composite insulation systems (mineral wool, PU, PS, cork) do not last more than 40 years;
- For roofs: insulation between, on and under rafters (such as mineral wool, PS, PU, blown-in granulates, cellulose, cork) lasts 50 years and more

Based on these values (and others) the range of ‘typical’ lifespans of ‘typical’ insulation products is 40-50 years.

Due to the service life of buildings, SBR does not state longer lifespans than 100 years and BBSR does not state longer lifespans than 50 years.

The differences between these two highly respected references are not related as such to differences in studied insulation products (or a difference in culture), but are the result of (1) a lack of reliable and consistent data on the service life of construction products (often exceeding the human lifespan) and probably also (2) of differences in determining these values (e.g. stochastic or deterministic; taking into account internal and external conditions or merely a reference service life).

Before defining specific Ecodesign measures for specific thermal insulation products, one should accordingly have a better insight into the reference service life and the parameters affecting it. The ISO 15686 series help to make a scientific judgement on this (although one can only “guess”/“estimate” what the real service life of a construction product will be) by standardising (accelerated) testing conditions and standardising the way of estimating through the Factor Method.

To predict the service life of a (sub) component within a building, ideally, the internal and external conditions need to be known; the performance of the (sub) component under the specified climatic conditions should be accurately characterized by data from real life exposure in identical conditions, and the construction and maintenance regime for the building should be clearly specified and likely to be delivered in practice. It is, however, idealistic to expect this. In practice, service life prediction is based on judgement. The ISO 15686 series are devoted for the purpose of deriving data to support such judgments. Within this framework a distinction is made between:

- **Reference service life (RSL):** service life of a construction product which is known to be expected under a particular set, i.e., a reference set, of in-use conditions and which may form the basis of estimating the service life under other in-use conditions (EN 15804:2012)
- **Estimated service life (ESL):** service life based on the reference service life and in-use conditions

Since 2012, the content of an EPD has been standardised as well, thanks to the creation of the EN15804. According to this standard the RSL needs to be declared in an EPD. Furthermore, supplementary information can be added on the parameters influencing the service life. Here a direct link is made to the ISO 15686 series.

In addition, provision of reliable and accurate lifespan data would help building and product (system) designers and facility managers to improve building (element) solutions, for example by taking into account design for disassembly (DfD) measures, but also by having a more effective insight how environmental impacts and financial costs will evolve during the service life of the building (element) solution. ‘Service life’ is typically a sensitive parameter within LCA and LCC.
Based on the EN 15804 (2012) standard the reference service life (RSL) of construction products have to be declared from now on. RSL shall be related to the declared functional technical performance and to any maintenance or repair necessary to provide the declared performance during the declared RSL or provided ESL. The reference conditions for achieving the declared technical and functional performance and the declared reference service life shall include the reference service life data as described in Table 10 of EN 15804, where relevant.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit (expressed per functional unit or per declared unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Service Life</td>
<td>Years</td>
</tr>
<tr>
<td>Declared product properties (at the gate) and finishes, etc.</td>
<td>Units as appropriate</td>
</tr>
<tr>
<td>Design application parameters (if instructed by the manufacturer), including the references to the appropriate practices and application codes</td>
<td>Units as appropriate</td>
</tr>
<tr>
<td>An assumed quality of work, when installed in accordance with the manufacturer’s instructions</td>
<td>Units as appropriate</td>
</tr>
<tr>
<td>Outdoor environment (for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature</td>
<td>Units as appropriate</td>
</tr>
<tr>
<td>Indoor environment (for indoor applications), e.g. temperature, moisture, chemical exposure</td>
<td>Units as appropriate</td>
</tr>
<tr>
<td>Usage conditions, e.g. frequency of use, mechanical exposure</td>
<td>Units as appropriate</td>
</tr>
<tr>
<td>Maintenance e.g. required frequency, type and quality and replacement of components</td>
<td>Units as appropriate</td>
</tr>
</tbody>
</table>

**Figure 42: Reference service life data to be included according to the EN 15804**

**Conclusion:**
Reliable and accurate data on lifespan of thermal insulation is important in order to create a better design and assessment (LCA/LCC) of building solutions. Although data on the reference service life and internal and external parameters are often lacking, we believe the most appropriate way to share information regarding the lifespan of thermal insulation products is through EPDs and existing EPD standards.
Since EPDs (produced since 2012) already include this information, it is a matter of time to accrue sufficient data for thermal insulation products (through new EPDs) to have a better insight in the possible effect of the service life on life cycle environmental impacts, financial costs and comfort of the building. For this reason no implementing measure is proposed directly related to this issue.

To speed up data collection, EPDs for thermal insulation (and other construction) products could/should be made mandatory (see also the paragraph on Ecodesign requirements on environmental performance or energy performance in the production phase). As is the case for many other (environmental) issues related to this Ecodesign study, we would recommend making EPDs mandatory. Based on discussions during the stakeholder meeting, we know that most producers and federations would not be against such a measure (see Annex C).
5.2.3. **OTHER POLICY OPTIONS**

In this paragraph a list of other possible policy options, besides Ecodesign and Labelling Directive, are discussed, mainly based on examples implemented in Member States:

→ **Obligation to calculate GWP and ADP**

An obligation to calculate GWP and ADP might result in an accrual experience by carrying out calculations, even without threshold values. This is an obligation in the Netherlands since January 2013 the Dutch Building Decree was launched. By having these building requirements, the availability of EPDs has been boosted in the Netherlands. Furthermore, manufacturers are encouraged to improve emissions and being more resource efficient. This is true of all construction products, not only for insulation. Especially for the NZEB, insulation will become a more important material in the total of the building.

The Dutch Building Decree refers to the Dutch ‘Bepalingsmethode’, drafted before the CEN standards were available. However the method will gradually be adapted to the EN15978.

→ **Provision of an LCA database, containing EPDs**

Setting up an LCA database could boost the availability of EPDs. Manufacturers can be encouraged to improve emissions and to be more resource-efficient. This is not only valid for insulation products, but for all construction products. Regarding the introduction of NZEB regulation however, insulation will become more important, which will have an impact on the insulation products. EPDs will definitely become more important for sustainable designs of NZEB.

→ **Provision of online information systems**

Online information systems could foster energy and resource efficient buildings by providing essential information. There are examples of successful databases for building products, providing generic information for building materials, green tender specifications and LCA-tools. Such initiatives could bring more transparency into the market. Also online courses could be part of such information systems.

5.3. **ROUGH ESTIMATE OF THE IMPROVEMENT POTENTIAL ATTRIBUTABLE TO THE POLICY INSTRUMENTS RECOMMENDED**

Some possible policy instruments have been recommended in paragraph 5.1.1. The few policy options that we identified are more difficult to quantify than the usual minimum requirements in Ecodesign measures, therefore the improvement potential cannot be estimated in a meaningful way.

5.4. **SENSITIVITY ANALYSIS FOR THE IMPROVEMENT POTENTIAL**

Some possible policy instruments have been recommended in paragraph 5.1.1. As stated in paragraph 5.3, it is not possible to calculate the improvement potential in a meaningful way. This implies that it is also impossible to perform a sensitivity analysis of the improvement potential.
The main conclusions from this exploratory study with regard to Ecodesign and labelling requirements of thermal insulation in buildings are the following:

Although thermal insulation products for buildings are not easily defined or categorized, the Quickscan revealed strong indications that their economic and environmental importance is very significant. The volumes of sales and trades of this market are significant and exceed the 200 000 units threshold (based on annual sales data 2009 to 2011 according to the Prodcom categories). Furthermore, their environmental significance has also been established. The major environmental impacts of insulation lie in the environmental benefits it provides during the use phase of the building in which it is installed (i.e. reduction of energy use of the building). Compared to the reduction of energy use in the use phase of the building, embodied impacts related to the manufacturing and EOL of thermal insulation products are generally smaller. Furthermore, other building components often dominate the environmental profile of building elements and buildings.

Nevertheless, in light of the 2019-2021 EPBD targets and the increase in insulation waste released through demolition, the environmental impacts relating to manufacture, replacement and end-of-life will gain in importance. However, it would be counter-productive if attempts to reduce the embodied impact of thermal insulation solutions led to an increase in energy consumption and therefore extended the payback time.

For the time being, the environmental improvement potential related to thermal insulation products is generally defined by increasing the energy efficiency of buildings. However, in the near future, i.e. when near zero energy EPBD targets for new buildings and major renovations become a reality, improvement scenarios should be sought in the life-cycle phases relating to the prior and past use of the insulation product (for example production phase, replacement and repair, end-of-life phase…).

Furthermore the Quickscan resulted in the suggestion to exclude from further analysis building materials (or components) of which the material that is responsible for a thermal performance is the same material that also provides other primary functions. Also thermal insulation products intended to be used for the insulation of equipment and industrial installations have been excluded.

Finally, many of the issues addressed in the Quickscan, such as energy efficiency of buildings, environmental performance of building elements and indoor air quality, need to be addressed on a systemic level.

In the scoping many standards and legislation are listed. For insulation materials, a large number of (test) standards and legislation are already available that address primary and secondary functional performance parameters, the use of resources (energy and materials, incl. waste), emissions, other product-specific test procedures, etc.

An overview of existing mandatory and voluntary approaches with a relation to insulation products has been created. The EPBD and the CPR provide a mandatory common European framework with
freedom for Member States to provide targets, methodologies, develop building codes. There is a wide array of European standards relating to the technical performance of insulation products. With regard to environmental performance, a voluntary EPD scheme is quite successful in a number of countries although full market coverage is not yet achieved.

**Requirements in the scope of the Energy Labelling Directive**

The labelling of insulation materials is far from straightforward, as the energy saving contribution is dependent on climatic conditions and is determined by different building practices. The possibility to oblige insulation material producers to indicate thermal conductivity on their products is already provided for under the Construction Products Regulation (CPR Art 60(a)). The appropriate level of product information intended for the end-user on energy performance in the use phase is at the level of the building envelope, for which EPBD policy already exists for new and existing buildings. (See also section on specific ecodesign requirements in the use phase (paragraph 5.2.2)).

**Specific Ecodesign requirements in the scope of the Ecodesign Directive**

A specific target on energy performance in the use phase, imposed on insulation products, is impossible. The energy saving for the same (in terms of thermal performance) insulation product varies across Member States. The appropriate level at which a target could be imposed is at the level of the building envelope. Requirements regarding the building envelope are handled by the implementation of EPBD in the Member States.

**Generic Ecodesign requirements in the scope of the Ecodesign Directive**

The level of significance of Ecodesign requirements on environmental performance in the production phase is rather low and it is difficult to judge which impact category is the most important one. Moreover, a large variation in needs/constraints exists, especially during renovation projects, which requires a broad range of insulation solutions. Through the voluntary EPD system, information on these differences is nowadays provided on dozens of different insulation products, although full coverage of the market has not been achieved. There is an option to make the declaration of environmental performances by means of EPDs mandatory by means of Ecodesign implementing measures or CPR delegated acts. This would allow the consumer to compare between the different insulation materials (if the EPDs are based on the same functional unit and with the same framework assumption and assessed according to the same methodology). In some Member States, the submission of EPDs is already obligatory. The CPR could make the submission of EPDs obligatory by a Delegated Act issued under Art 60 (a). From the moment BWR 7 of CPR will become mandatory, manufacturers will have to declare information on sustainable use of resources. Today only the first 6 basic work requirements and REACH are mandatory. Stakeholders do not refuse mandatory EPDs, but claim that if they are introduced for insulation products, they should be also introduced for all other construction products. This would allow the assessment of the environmental profile of the entire building (see Annex C).

A potential generic implementing measure on energy performance in the use phase could address the issue of installation of insulation products. Ecodesign requirements (generic) regarding information about optimal installation of insulation products may provide help to architects and installers. Since information requirements are tackled within the CPR, Ecodesign could focus more on generic requirements, such as describing what information should be available in a manual. This potential measure can be considered if also other more important opportunities for Ecodesign requirements are to be found. Setting up an Ecodesign regulation only for this possible measure is not advisable.
Requirements for measuring emissions in the use phase are being developed by TC 351. Having a sound measurement method and measured emission data established on that basis forms a condition for further policy measures. Ecodesign requirements (generic) regarding information about emissions in the use phase may provide help to installers. Stakeholders indicate the need for harmonised EN standards and refer to mandate M/103 of the European Commission and the CPR (see Annex C). Where CEN TC 351 only covers emissions in the use phase, some stakeholders indicate that an enlargement to the whole life cycle is desirable.

We do not consider a generic implementing measure with information on best EOL options appropriate, unless maybe through EPDs. The reason for this is the small significance of this life-cycle stage in the life cycle of an insulation product. Moreover the group of insulation products contributes only for a small percentage to the waste of buildings. We believe the most appropriate way to handle information sharing on EOL of insulation materials is through EPDs and the existing EPD standards.

Implementing measures on design for disassembly and minimum life span requirements have been investigated as well. Reliable and accurate data on lifespan of thermal insulation is important to create a better design and assessment (LCA/LCC) of building solutions. Although data on the reference service life and internal and external parameters are often lacking, we believe the most appropriate way to share information on lifespan of thermal insulation products is through EPD’s and existing EPD standards. Since EPDs (produced more recently than 2012) already include this information, it is a matter of time to have enough data for thermal insulation products (through new EPDs) to have a more effective insight in the possible effect of the service life on life-cycle environmental impacts, financial costs and comfort of the building. For this reason no implementing measure is proposed directly related to this issue. To speed up data collection, EPDs for thermal insulation (and other construction) products could/should be made mandatory. As is stated in previous paragraphs, we would recommend making EPDs mandatory.
REFERENCES


CEN. 2012. EN 15804, Sustainability of construction works - Environmental product declarations – Core rules for the product category of construction products.


COM, 2008. Public procurement for a better environment. Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. 11p.


Kotzias et al, 2005. INDEX project. Critical appraisal of the setting and implementation of indoor exposure limits in the EU.


ANNEX A – MINUTES OF THE STAKEHOLDER MEETING

Minutes of stakeholder meeting on potential Ecodesign/Labelling Requirements for Thermal Building Insulation
Centre Albert Borschette, Brussels, Belgium, 01/10/2013

Present

European Commission
- DG Energy Andras Toth AT
- DG Energy Juan Moreno Acedo JMA
- DG Enterprise Georgios Katsarakis GK
- DG Energy Nina Pickl NP

Project Team
- VITO Arnoud Lust AL
- VITO Carolin Spirinckx CS
- VITO Wim Debacker WD
- VITO Karolien Peeters KP
- VITO Birgit Vandevelde BV

Stakeholders
- AFIPEB Eva Maraque EMa
- Agentschap NL Hans-Paul Siderius HPS
- BAM Judith Gieseler JG
- BASF Quentin de Hults QDH
- Belgian Ministry of Economy Bram Verckens BVe
- Belgian Ministry of Economy Guibert Crevecoeur GC
- Belgian Ministry of Economy Catherine Grimonpont CG
- BEUC/ANEC Alexei Pace AP
- BEUC/ANEC Angeliki Malizou AM
- CEN/CENELEC Gonçalo Ascensão GA
- CEN/CENELEC Alexandre Beltrao AB
- Confederation of Finnish Construction Industry Ari Ilomaki AI
- EAA Bernard Gilmont BG
- ECOS Stamatis Sivitos SS
- ECOS Christoforos Spiliotopoulos CSp
- EPF Isabelle Brose IB
- EUMEPS Edmar Meuwissen EMe
- Eurima Marc Bosmans MB
- Exiba Nadine Rauscher NR
- Federal Public Service: Health Bram Soenen BS
- Glass for Europe Vivien Fourcade VF
- Huntsman/EAIME Shpresa Kotaji SK
- JRC-IES Catia Baldassarri CB
- Knauf Insulation Vincent Briard VB
- KULeuven Departement ASRO Frank De Troyer FDT
- Le Relais Métisse Philippe Hugo PH
- Plastics Europe Eric Faes EF

2013/TEM/R/38
Objective of the meeting

Stakeholder consultation in the framework of an exploratory study with regard to Ecodesign of thermal insulation in buildings (Lot 36) accomplished under the authority of DG Energy of the European Commission (EC), under specific contract No ENER/C3/2012-418-Lot 1/02/SI2.652413, within the multiple framework service contract No ENER/C3/2012-418-Lot 1, preparatory studies and related technical assistance on specific product groups.

Discussion on the interim report, feedback on questions circulated by the PT.

Agenda

- Welcome by DG Energy;
- Quick ‘Tour de Table’;
- Introduction to the project;
- MEerP Task 0 – Quickscan;
- Lunch break;
- MEerP Task 1 – Scope;
- MEerP Task 7 – Scenarios;
- Final round.

Minutes

Welcome by DG Energy (AT)

In 2010 there was a revision of the Energy Labeling Directive, broadening the focus to energy related products. These products do not use energy but have an impact on the use of energy while they are being used. VITO is conducting an exploratory study, with quality review by Wuppertal Institute, on potential Ecodesign/Labelling requirements for thermal building insulation. It is an exploratory study, not a full preparatory study (only some tasks out the MEerP methodology (Methodology for Ecodesign for Energy-related Products) are considered). Also studies on windows and water related products are being conducted. For those products a full preparatory study is being carried out (all tasks defined by the MEerP methodology are carried out).

Quick ‘Tour de Table’ (all)

General introduction (CS)

This stakeholder meeting will present the interim results of the exploratory study with regard to Ecodesign of thermal insulation in buildings. VITO, the Flemish Institute for Technological research, conducted the study and also Wuppertal Institute from Germany is involved in the project and did a quality review for the study.

The VITO Project Team (PT) consists of:

- Arnoud Lust, Framework Contract Manager;
- Carolin Spirinckx, Project Manager Insulation Materials;
- Wim Debacker, Technical Expert Insulation Materials and Sustainability Assessments;
Introduction to the project (CS)

Background
Buildings are responsible for 40 to 50% of Europe’s energy use and the largest share of energy use in buildings is heating. EU legislation is driving towards an increased installation of insulation in buildings. Together with fluctuating energy prices, an increase in building activities (new-build and renovation), an increase in the awareness of insulation benefits and governmental grants this results in an increase in demands for insulation products.

In 2009 the Ecodesign Directive was released, setting a framework for the establishment of Ecodesign requirements and measures for energy-related products. Article 2 states that products are eligible for measures if they meet specific criteria. The Directive prescribes that in preparing a draft implementing measure, the Commission shall makes series of analyses and assessments, called preparatory studies. These MEErP studies should be in line with the stipulations that are made in the Ecodesign Directive.

In the Working Plan for 2012-2014 there is an indicative list of energy-related products that shall be considered in priority for the adoption of implementing measures and an indicative list of conditional energy-related products, including thermal insulation products for buildings. The aim of the exploratory study is to provide a view for the Commission to decide whether the conditions are met for thermal building insulation materials and to answer the question if they should be moved from the conditional to the priority list.

Work Methods
The MEErP methodology consists of 8 tasks, with the Quickscan (Task 0) not being mandatory. For thermal insulation of buildings an exploratory study is conducted which means that only a few tasks out of the MEErP methodology are conducted, unlike in a full preparatory study.

For thermal insulation of buildings only Task 0 (Quickscan), Task 1 (Scope) and Task 7 (Scenarios) are conducted. Task 0 is a quick screening of the environmental improvement potential, in task 1 the product group is defined and legislation and standards are mapped and task 7 is to answer the question if measures under Ecodesign and Energy Labelling directives can contribute to the improvement potential. Only certain elements of task 7 are performed in this framework.
MEErP Task 0 – Quickscan (WD)

The intention of the Quickscan is to provide a quick screening of environmental improvement potential of insulation materials. It is not a research project starting from scratch, but existing studies were examined on useful findings. Gaps were filled with VITO’s own expertise, which is mainly related to Belgium and its neighboring countries.

The most important part of the Ecodesign Directive for the Quickscan is article 15. Investigation is needed to see if the market of insulation materials has a significant volume, if insulation materials have a significant environmental impact and if there is significant improvement potential.

The Quickscan also sets out a definition for the product group of thermal building insulation. This definition is mainly adopted from ISO 9229.

“Thermal insulation products for buildings are factory made products in the form of rolls, bats, boards or slabs, with or without facings, or ‘in-situ’ applied materials, which have a primary function to reduce heat transfer through the structure against which, or in which, it is installed. Products covered by this definition may also be used in prefabricated thermal insulation systems and composite panels.”

This definition means that building materials or components that have another primary function, like a structural function, are not considered. The reason is that environmental scenarios cannot be pinpoint to the thermal or structural function. Also thermal insulation products intended for use in equipment and industrial installations are not considered, since these installations are topic of specific MEEuP (Methodology for Energy-using Products) studies. Thermal insulation for piping and
edges is considered. Reflective foils are not considered since they do not focus on transmission losses, but rather act as a heat absorption prevention. Reflective (foil) insulation is considered. For the required classification on product level matrixes have been created, with classification according origin and form. Also the manufacturing (on site or factory made) can be considered. On system level this becomes more difficult. Thermal insulation products however have an impact on building element and building level. So it is necessary to look at the system level, but with a broad view. 5 levels are considered in regard to the classification of thermal insulation solutions on system level:

1. building period;
2. building application;
3. element application;
4. relation to other components; and
5. thermal insulation product.

To see if insulation products represent a significant market, it is important to see what a unit of insulation materials is. In a study report of PE international they looked at a broader scale and considered the building skin as a unit. This unit definition resulted in the conclusion that there are more than 200000 units of insulation per year. So it can be stated that the market of insulation materials is fairly important.

Also the environmental significance is important, since it helps to reduce the energy use of the building, which is still the dominant element in the environmental performance of buildings. Studies show that the use phase is still the most important. Energy demand can however be easily reduced for new buildings, taking into account thermal insulation. Based on these findings we can conclude that the building use stage is dominant and that there are relatively large benefits through the use of insulation. The production and EOL\(^{78}\) have relatively small impacts. However, regarding to the near future with the implementation of the NZEB\(^{79}\) regulation, the relative importance of the use stage will decrease. Therefore other aspects like manufacturing and EOL will become more important. So the waste streams should be considered, together with the design for deconstruction to avoid unnecessary waste. Also further research is needed on the effect of possible SVOC\(^{80}\) and microbial emissions from specific insulation materials on the indoor air quality, but this requires harmonization of the measuring methods.

For the improvement potential, focus was on the use phase. For example an ETICS\(^{81}\) wall was studied: a version with no insulation and one with a U-value of 0.24 W/m²K. Results show that by insulating the wall, the overall impact of the wall is diminished. The impacts related to the insulation material are much smaller than the benefits gained by insulating. Also for a wall system with loadbearing brickwork with timber cladding insulated with PUR the same trend shows: the impact related to the manufacturing of the PUR is smaller than the benefits related to insulating. Also research studies investigating if there is an optimal insulation thickness from an environmental perspective were consulted. Different environmental indicators were looked at:

- the indicators directly taken from the EN 15804 (so-called CEN indicators in the research project);
- additional indicators like ecotoxicity, human toxicity, particulate matters, etc. which are not considered in the EN 15804 but which can be important for the building sector and for insulation materials in particular (so-called CEN+ indicators in the research project).

\(^{78}\) End of Life
\(^{79}\) Nearly Zero Energy Buildings
\(^{80}\) Semi Volatile Organic Compound
\(^{81}\) External Thermal Insulation Composite System
In that particular research project the different impacts were monetized (aggregation of the contribution to the different environmental impact categories into one single score). Through this single score, it is easier to understand the environmental impact for architects and policy makers. Results from this study show that the first centimeters of insulation applied in a wall will decrease the external environmental costs rapidly, but when a U-value of 0.19 W/m²K is reached, further insulation will increase the external environmental cost again. So it is important to apply insulation, but the entire life cycle cost should be considered.

MEErP Task 0 – Quickscan – Questions for stakeholders

QUESTION 1 – Functional Unit
The functional unit represents the quantified performance of a product system for use as a reference unit for an LCA study – or in this case the MEErP study. In the Quick scan (Chapter 3 of the interim report) the research team argues that assessing the environmental burdens and benefits, as well as determining improvement scenarios would require a system approach instead of a product approach. Such a system approach should take into account the relation of the thermal insulation product(s) with other building components in its built in context and the building (performance) itself.

Defining a European reference system on the building or building element level that takes into account different constructive solutions and is applicable in all European Member States is complex, time-consuming and necessarily controversial. For these reasons the research team recommends to define the functional unit on product level and communicate in a transparent way about the restrictions using a product approach.

Do you think it would make sense to examine the validity of using a functional unit at the system level, e.g. by describing the overall heating/cooling energy demand of the building in a unit of: \( \text{MJ} / \text{floor area} / \text{year} \)?
This would extend beyond the boundaries of thermal insulation products (and include windows, doors and ventilation systems, etc.), but the study could still make recommendations to look at higher level requirements, if they can be implemented in measures that are appropriate in the current policy context. See also the question on the next page of the document with questions that were sent to the stakeholders (Question 2).

What about the time aspect regarding the performance of the insulation? Presumably, there is a deterioration of the performance over time. Do you think initial estimates regarding performance over time could be incorporated at the product level?

Do you think it would make sense to perform practical inspections at the system level?

EC I would like to give some additional clarifications on the role of the Quickscan as a task in the MEErP structure: the Quickscan-element was introduced in the MEErP-methodology relatively late in the process and is intended for difficult/complex product groups, since they need a correct product definition group for the other tasks. It is intended to be a first run through the project to investigate how the product can best be defined and thus to avoid double work. This means that some of the topics discussed under task 0 may return in tasks 1 and 7.

EMe The discussion brought up is not trivial, since it will define which products are under an eventual Ecodesign measure and which aren’t. An unclear definition of the scope might result in difficulties. The primary function should be insulation products, but what about composite products? And where do you draw the line to determine if a product is a composite product or not? This can result in an unelevelled playing field. For example, what with insulating bricks? Also collecting statistics shows very difficult, since the definition used in the report shows no full overlap with the definition from CEN TC88. Whatever definition you will take, it will always results in possibilities to avoid the regulation by going to the other side of the definition
As a general remark, it is crucial to understand that one centimeter of insulation material applied is much more efficient if you apply it when there is no insulation yet than when you apply that same centimeter when there is already a lot of insulation. This is a crucial issue.

The purpose of Ecodesign criteria is to have criteria for more environmentally friendly products. This generates a problem for thermal insulation products. Thermal insulation products are intermediate products and cannot be installed as a stand-alone product in the building. So performance of thermal insulation products can only be considered in a building, since that is the end-use product. So this would result in Ecodesign criteria for the whole structure, not only the insulation product. It is unclear where this project is leading us, since there are already EPDs and EN 15804, giving information on the construction products. What is the purpose of this exercise?

The project team agrees that environmental improvement potential needs to be looked at the system level. The system level can be defined on the element level, but better is to look at the building level. A detailed analysis on building level is required. EN 15804 is a very important framework in this discussion. EPDs provide a way to communicate results about the environmental impacts of a building material, but EN 15804 is not the way to come to improvement potential.

There is no purpose to compare the performance of products at the product level, it should be done at the level of the building.

There is a preference for the building level, rather than the product level. A functional level on product level is easier, but would be more theoretical and not useful for consumers.

Concerning deterioration, there is a doubt that durability can be discussed on the Ecodesign level, since it is complex and application dependent.

The project team agrees that deterioration is application dependent. There are two ways to investigate durability of products: ageing tests and factor method. This factor method is more theoretical and can also take into account the application and is often used for sensitivity analysis.

The question on the functional unit is very interesting. At the building level it makes sense to look at the environmental performance. This means we should look at EPBD, since it operates on building level and can and will be improved in the future.

The starting point for the discussion should have been fitness for use in the given application. Figure 3 requires a distinction between situations in which the functional unit is a certain thickness (e.g. in case of renovation or cavity walls) or situations in which the functional unit is the U-value without this restriction. A functional unit on product level will result in many restrictions and Ecodesign wants to set requirements, but this cannot be done when there are restrictions, so you must make sure that you reflect the environmental performance of the products in their end use application, being the building level, or in some renovation cases the building element level.

We can resume that the building level should be considered, but is it possible?

When you go to system level, you are overlapping with installation rules, that are different in Member States. This cannot be neglected, since installation affects a lot. Do we want to regulate something at the product level that can be implemented differently at the construction level?

Each region indeed has a different construction practice, this will be discussed in the scenarios. Installation cannot be controlled on the product level. However, minimum requirements can be determined regarding durability of products. There are no rules on the limit value of the energy efficiency of these products. The products have great potential, both benefits for environment and human health.

EPDs provide data on the environmental performance and there is also a CEN standard for...
this. Maybe this standard should be examined regarding the definition of a functional unit.

PT  Both standards, on product (EN 15804) and building level (EN 15978), are known. These 
standards can be used to calculate the environmental profile, but the questions goes further: 
which measures will there be? Can we make them mandatory? Is this useful for all 
stakeholders?

AI  Each building is different and the conditions where it is built are different too. Technical and 
functional requirements should be included. A reference building can be used, but also varies 
from country to country. The only correct way is to look at the building level.

HPS  EPDs were brought in to the discussion, but are they mandatory?

PT  No, not at the moment.

HPS  Many comments state that we should look at the building level and the way the materials are 
installed, but Ecodesign requirements have been set for products. This is not impossible, 
taking into account that Ecodesign can set minimum standards for products. The more modest 
task here is to see if it is useful to have minimum requirements on insulation products that 
 improve the environmental performance, without restrict the choice for products. It should 
not be made to complicated, this might lead to discussions.

PT  Is there a need for new requirements on product level? Existing requirements will be discussed 
in the other tasks, and maybe they are sufficient.

HPS  When there are no requirements yet, it would be useful to see whether these can be set. The 
 process to set new requirements is part of the real preparatory study.

EMe  Different indicators were shown: CEN (from the EN 15804) and CEN+ (in addition to the EN 
15804). We should define environmental progress, but is this helped by defining additional 
indicators? Isn’t it better to have EPDs for the whole scope of construction products to cover 
the whole building instead of going in more depth for the materials already having an EPD.

AP  There is an increased production of composite products. Part of the system falls under the 
definition, but parts don’t? How will this be tackled?

PT  If you want to express environmental performance, clear definition should be made. Sandwich 
panels for example have more than one function (thermal insulation and construction). This 
makes it difficult to define which aspects will be affected by possible requirements. That is 
 why they were not taken into account. This does not mean that there should not be Ecodesign 
measures for composite materials, but this should not necessarily be considered in this study.

BS  What are the options for requirements? Can EPDs be made mandatory? Do we need to look at 
the building system? We should warn for complexity. Defining the functional unit could be a 
lot of work, so maybe another option is to have simple requirements on product level, not 
focusing on energy performance, but more on material performance, or on EOL for example.

BS  It is unclear what is included in the external environmental costs presented on slide 47.

PT  The environmental impacts are monetized (aggregated into one single environmental score, in 
this project a monetized value in euro). Only environmental costs are included in this graph, so 
no financials costs (e.g. production costs, investment costs, operational costs). The 
environmental cost of the use of energy is integrated in the graph.

SK  Despite what was mentioned in the comments, Ecodesign on construction product level is not 
yet in place.

SK  Concerning the discussion on composite panels, it should be considered that there are 
different types (focus on thermal performance or construction, with or without load-bearing 
functions). This illustrates the difficulties to assess what could be the best insulation product 
for a wall, since it also depends on the construction system. Therefore it cannot be defined 
which is the best material only considering the construction materials itself. Composites 
should not be neglected, since they are a part of the different construction techniques. There 
will be more and more composites on the market, since they are intrinsically providing 
benefits. Building practice is changing, so these techniques should not be excluded.
### Annex A – Minutes of the stakeholder meeting

| PT | There is a difference between composite materials and composite products. When a product has more than one function, it is best to look at the building level. In the Quickscan, the significance and the improvement potential are considered, not the question on what is the best insulation material. |
| SK | An LCA-process will probably drive you to an expansion of your system. The system will need to be expanded from the insulation product to the insulated wall structure. |
| CG | Insulation materials are the second construction product under the Ecodesign level (first: walk in cold rooms). There are many problems with the CPR: there is confusion with harmonized standards and it is also a problem who is taking responsibility for the CE market for in-situ installed items. |
| SS | Let’s not forget that the Energy Labeling and parts of the Ecodesign Directive are under review and will possibly be revised, which might result in the system level being tackled. Until then we should support requirements at the product level to not complicate the discussion. |
| AI | One should always consider the end use product when setting requirements, in this case the building. All functional and technical requirements for the end use should be considered. A so called simple approach is not appropriate here. |
| OL | Resource efficiency is often mentioned and is taken seriously by manufacturers. Insulation industry is the front runner in Europe for Environmental Product Declarations (EPDs). But only at the building level, you know how many of the products one needs to meet the requirements. Resource efficiency is important, but the assessment must take place at the building level. |
| BS | To come back to the previous suggestions there are two examples: you can use a system approach with mandatory EPDs or you can have a product approach with e.g. minimum 30% recycled material or with product identity cards with information on how to treat the waste insulation material later on at the EOL. Bot options could be investigated. |
| EC | The study is not obliged to focus only on Ecodesign and Labeling, recommendations can be made on where else to address specific issues. This is a theoretical exercise, where we try to see if a functional unit can be defined at the system or product level. In the next step we should see if this functional unit can be used at all for measures. |
| AM | Can potential measures also concern aspects on hazardous substances besides energy aspects? |
| PT | Yes |

### MEErP Task 1 – Scope (KP)

The aim of task one is to define product groups and product systems involved and to map the existing legislation and standards.

The product definition and product group has been discussed during the Quickscan. We will focus here on the existing standards and legislation.

Three types of legislation are considered:

1. Legislation and Agreements at European Union level;
2. Legislation at Member State Level;

A list of the legislation is presented in the slides and an overview is presented in a (preliminary) summary table on slide 67.
MEErP Task 1 – Scope – Questions for stakeholders

**QUESTION 4 – existing legislation on the environmental impact of insulation materials**

In the report, the following pieces of legislation having links with the insulation sector are mentioned, but their complementarity with Ecodesign is not elaborated in more detail. Based on prior consultation with CEN TC88 and EURIMA, these pieces of legislation are initially considered less important for this study:

- Directive on national emission ceilings for certain atmospheric pollutants (2001/81/EC);
- Directive on the landfill of waste (2000/76/EC);
- Directive on the incineration of waste (2000/76/EC);
- Regulation on shipments of waste ((EC) No 1013/2006);
- Directive on industrial emissions (integrated pollution prevention and control) (2010/75/EU);
- Regulation concerning the establishment of a European Pollutant Release and Transfer Register;
- Council Directive CAFE cleaner air for Europe (2008/50/EC);
- Forestry Strategy for the EU (1999/C 56/01).

**Are there any indications that some of the above legislation should be further analysed, because their mandatory requirements applicable to insulation products do not sufficiently cover the related environmental impacts, and there would be room for improvement under Ecodesign?**

<table>
<thead>
<tr>
<th>Country</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG</td>
<td>CPR applies for all construction products, harmonized and not-harmonized, but the CE-mark is only for products under harmonized standards. Products under not-harmonized standard can obtain a CE-mark with an ETA.</td>
</tr>
<tr>
<td>BG</td>
<td>Article 3, paragraph 3 states that the Commission has the opportunity to set minimum requirements.</td>
</tr>
<tr>
<td>GA</td>
<td>There are many harmonized standards for insulation materials. Since July 1st 2013 all these products need to have a declaration of performance (DoP). It is strange to say that there is no performance level.</td>
</tr>
<tr>
<td>PT</td>
<td>CPR does not set benchmarks or minimum requirements, it only requests a provision of information.</td>
</tr>
<tr>
<td>GA</td>
<td>The Member States are responsible for setting up the performance levels.</td>
</tr>
<tr>
<td>CG</td>
<td>DG Enterprise has an ongoing study for the needs on additional information on dangerous substances in the framework of the CPR.</td>
</tr>
<tr>
<td>IA</td>
<td>The Directives on landfill of waste and incineration of waste will be reconsidered in the future and this should also be considered. Also the reuse of products after EOL (first life) should be considered.</td>
</tr>
<tr>
<td>PT</td>
<td>Does the revision of these Directives comprise relevant aspects for this topic?</td>
</tr>
<tr>
<td>IA</td>
<td>There will be more restrictions for landfill for construction waste, but also for incineration.</td>
</tr>
<tr>
<td>AM</td>
<td>Did you look at the German Blue Angel Scheme related to hazardous substances?</td>
</tr>
<tr>
<td>PT</td>
<td>The Blue Angel Scheme is in the document, but will be elaborated in more detail in the final report.</td>
</tr>
<tr>
<td>IA</td>
<td>Why was the Belgian Royal Decree on the EPD not further elaborated?</td>
</tr>
<tr>
<td>PT</td>
<td>This decree is still a draft version.</td>
</tr>
<tr>
<td>BS</td>
<td>A colleague of BS is working on the decree and will provide written comments on the interim report. The decree is indeed still a draft proposal.</td>
</tr>
<tr>
<td>AS</td>
<td>In the Netherlands there is already a regulation in place where it is mandatory to calculate the...</td>
</tr>
</tbody>
</table>

environmental performance of building materials for global warming and depletion of resources. It is not mandatory but advisable to give EPD for products and the information of the EPD is used for the calculation. It is used to reduce the environmental impact of insulation materials.

PT  The project team would like to receive a reference to this regulation.

GB  Article 3, paragraph 3 of the CPR allows the commission to set threshold values.

GA  There are different statuses for the standards: they are all voluntary, but some are less voluntary than others; it is recommended to make a distinction in the report. Also distinction regarding the standards should be made considering if they are harmonized or not. E.g. CE-marking for ETICS is only possible through ETAs.

MEErP Task 7 – Scenarios (KP)

Task 7 – Scenarios

The aim of task 7 is to assess the extent to which measures under the Ecodesign and energy labeling directives could, if at all, contribute to the achievement of the improvement potential, taking into account the other existing policies. There are two main types of possible requirements:

1. In the scope of the Labeling Directive;
2. In the scope Ecodesign Directive:
   - Energy performance in the use phase;
   - Environmental performance or energy performance in the production phase;
   - Emission or leaching of harmful substances from insulation materials in the use phase;
   - EOL phase;
   - Design for disassembly.

Regarding the potential Ecodesign requirements on environmental performance in the scope of the Ecodesign Directive, the distinction between generic Ecodesign requirements and specific Ecodesign requirements should be made, with generic requirements not setting limit values.

A rough estimate of the improvement potential attributable to the policy instruments recommended is not calculated, since it requires results of tasks 3,4,5 and 6. This is also the case for the sensitivity analysis of the improvement potential. Task 7’s conclusion is that it seems that following Ecodesign measures can have potential:
- Design for deconstruction;
- Information on correct installation;
- Information on end-of-life;
- Emissions to indoor air in the use phase.

MEErP Task 7 – Scenarios – Questions for stakeholders

QUESTION 2 – LABELLING/ECODESIGN as a complement to the EPBD

Do you think the Ecodesign and/or the Energy Labelling schemes, which are based on requirements harmonized at EU level, could be applied to particular thermal insulation systems, to building envelopes (including windows/ventilation systems), or to buildings as a whole, or to the plans/designs of such particular elements, in order to usefully complement/improve the implementation of the Energy Performance of Buildings Directive? If yes, how?
Considering the following: the existing installers’ energy label for heaters (Commission Delegated Regulation (EU) No 811/2013), the provisions on technical building systems (including the building envelope) under EPBD (see interim report section 4.4.1), and the local conditions that have to be taken into account in the case of particular buildings when describing their energy performance or that of their building elements.

| IA  | The scope of the EPBD is purely on energy. EPDs are the appropriate tool to give information, but should be used at level of the building. |
| BS  | EPBD is all about energy and CPR makes it mandatory to declare the lambda-value, so there seems no added value for Ecodesign. But since there is an increased use of insulation materials, there will be more production and in the future more EOL of products, so maybe Ecodesign can focus those areas. |
| EC  | The question concerns also possible use of labelling. Could a label with classes on insulation systems or on the building envelope reinforce the EPBD? |
| OL  | EPBD focuses only on energy, but as indicated this is the single most important factor in buildings life cycle. However, after ten years of EPBD, EPCs are still not up and running in all Member States and there are no harmonized labels, showing the difficulties to implement such rules. Adding an energy label now to it, focusing on products/components/buildings would only add to the confusion. So first focus needs to be on getting EPCs up and running in all Member States and harmonizing them for comparability. Ecodesign or labeling probably could not complement here. |
| GC  | It is not likely that Ecodesign can complement EPBD, because the best options can only be based on specific use. |
| EMe | The reports by VITO shows that there is already a tremendous amount of regulation that affects the insulation sector. The customers already have a lot of confusion due to the amount of regulation. So Ecodesign measures are only desirable if they have an added value and measures cannot be fitted into existing legislation concerning the insulation and construction sector. |
| BG  | Member states can also set minimum requirements for energy efficiency of the building envelope in case of the EPBD, so in many Member States this is already the case. |
| EC  | There are already installer labels for heaters and water heaters. Also other technical building systems might benefit from this kind of labeling. |
| SK  | The difference with the water and space heaters is that there the whole system is considered. Here we are considering to look at insulation materials, separately from the building envelope in which they are used. If you would imply Ecodesign on the product level of insulation materials, you would become more prescriptive rather than performance driven. |
| EC  | It is not necessarily at the product level, also the building envelope could be considered. The EPBD also considers the installation, but the idea raised here is to provide a two separate labels: one for the heating system and one for the building envelope. |
| VB  | Would you suggest an Ecodesign of the insulation product or of a system or a building? Ecodesign of systems or of buildings could be a good complementation for the EPBD, but it is too restrictive if we only look at insulation products. |
| EC  | The concept was launched as a question, not a proposal. There could be obstacles and confusions might be created. Who is responsible? Who does the market surveillance of such a label? How would that overlap with EPBD? These relevant questions can undermine such a concept, so do you believe it is feasible? |
| GC  | It seems very difficult to make a label for such kind of products. Labels are focused on an end-user. However at the end the installer will combine different products and the result is his solution and there is no direct relationship between what is asked by the consumer, since the producer makes something he wants according to his knowledge. There is no relation between |
what the consumer wants and what is offered to him. Thus, market surveillance will become very difficult. For example: if a consumer wants all A+++ materials, the installer can still create a building envelope with bad thermal performance with these A+++ materials.

**PT**  
It can be the role of the architect to control this?

**GC**  
The variety of possibilities is such that good results can be obtained with different combinations. How will this be controlled? How will market surveillance work? I don’t think it is a good solution.

**MB**  
Resource efficiency is also important, next to energy efficiency. Ecodesign of a building could be a potential, because we can broaden it up from pure energy to other impacts. This can be calculated on the building level and would have implications also on the individual products brought together in the building.

**HPS**  
Ecodesign requirements for heaters and ventilation systems are OK. There is dependence of the product and the situation/building where it is used, but nevertheless requirements and labels for these products have been set. An important issue is that information is provided in a standardized way. If this is done by another Directive (e.g. CPR), this is fine, but then it must be made sure that it is mandatory for all materials covered by the scope. Ecodesign could be made mandatory for all insulation products. All products should have the same information. Also, other aspects than energy should be considered, since they will become more important. Besides information, communication is also important. A energy or environmental label could be considered in this context, to communicate in a simple way about the main characteristics. An energy label could be useful, since it does not prescribe a certain solution or a certain material. Nowadays, in practices, there are a lot of ‘invented’ labels to promote certain characteristics of a product.

**OL**  
Labeling the building envelope doesn’t seem to be a feasible option. The overall performance of a building is a trade-off between different measures and we cannot separate one from the other. If building insulation is considered, also ventilation should be discussed for example. Separating one system from the other is not a holistic approach and will not lead to the result we have in mind. Every product performs differently in different applications. It is not feasible to make labels for all end-use applications in each country, for all climate zones, etc. It is OK to make EPDs mandatory, including EOL scenarios. It cannot be limited to insulation products. All construction products must be considered, because we are aiming for a resource efficient building. The CPR (basic requirement 7) seems the appropriate tool. The same goes for VOCs and SVOCs: if it is made mandatory, than all construction products should be considered, not only thermal insulation materials.

**FDT**  
At this moment, only the energy performance of buildings is discussed, but this should be integrated with other aspects. So this discussion is part of a more global discussion. Regarding the energy performance of buildings, the end result can be considered including the shell and the heating and ventilation and maybe a cooling system. To include all the other aspects: EPDs should be made mandatory and made available in databases that are accessible for everyone.

**IA**  
We support the idea for a label of the building envelope from consumer point of view. However, there is already an indicator for that: average U-value.

**VF**  
An Ecodesign label of the building envelope has a much broader scope than the insulation materials considered in this study and would cover all building materials, including windows. As such, the option of developing Ecodesign requirement for the building envelope should be discussed with all stakeholders concerned. In the case of windows, both the average U-value and the g-value of glazing need to be considered to measure the energy performance. As such, using the average U-value as the only indicator to assess the energy performance of the building envelope is misleading, since the g-value of glazing also has an influence on the performance of the building envelope.

**BS**  
Not only the type of insulation materials is important, but also its thickness, which is
sometimes limited in renovation projects. Insulation materials depend on the type of
application they are used in, so this would result into different Ecodesign limits and different
labels. The whole building level should be considered, but this is already done by the EPBD.
First information should be harmonized.

QUESTION 3 – IMPROVEMENT OF EXISTING product information and measurement
methods

Environmental Product Declarations (EPDs)
Some standards (like EN 1580483) already include EPD (Environmental Product Declaration)
requirements and many products already have EPDs.

What would be the benefit(s) of reinforcing the EPD requirements by making them mandatory,
potentially complemented by mandatory information on proper installation of the product?
Is this a feasible measure for all thermal insulation producers with respect to available data and
financial resources?

Missing harmonised standards for measurement methods
For some product groups where missing standards delayed progress with requirements, the
Commission developed and published transitional methods of measurement in the Official Journal
to make it possible to apply the Ecodesign implementing measures, awaiting the publication of
standards by the ESOs (European Standardisation Organisations).

Could Ecodesign serve to speed up the development of missing harmonised standards providing
measurement methods for product information on biomass, reflective foil, cellulose, sheep wool,
etc.?

SK EPDs should be the same for all construction products, since the combination of products
results in the whole building performance. The methodology should be made very clear and
very robust. Now different software packages result in different EPDs for the same product and
the same scenario. The EPD profile should be the same independent on in which Member State
it is created.

OL Regarding the needs of SMEs, generic EPDs should be recognized when they reflect a good
average product on the market. It is not feasible for SMEs to create specific EPDs for the entire
product range.

PT The project team agrees. The Eco Platform is recently launched. The aim of this European
platform that brings together different national EPD program operators is to join their efforts to
come to an harmonized framework for Europe for the developing of EPDs and the exchange of
EPDs across the different EPD programs (mutual recognition). However, there always will be
differences between the Member States since there are always national scenarios (e.g. energy
mix, scenarios gate to grave).

NR We are not against the idea of mandatory EPDs, but there are precautions: associations EPDs
should be made possible, databases should be made available. Today it is a relatively costly and
it is a long exercise.

MB EURIMA supports the idea of mandatory EPDs, since it will increase the transparency on the
performance of the product and hopefully reduce the costs to make an EPD. Making EPDs
mandatory will also help to go to harmonization standards. The CPR is a powerful tool to have a
declaration of performance, but there is a need to have a technical standard or an ETA. There
should be ETAs at least for everybody and on the longer term technical standards for all
products.

83 Sustainability of Construction Works – Environmental product declarations – Core rules for the product
category of construction products
Today, there are many methodologies and many tools. It is recommended to choose one methodology.

If we focus on part 2 of the question: is there need to speed up development of missing harmonized standards?

The construction sector is very specific and a harmonized standard usually follows a mandate. In 1994 there was already a mandate from the Commission for insulation materials. If there are no harmonized standards today, it is because there are no barriers for trade or there is no interest from the industry. In principle, if there are regulations applicable for those products, they should be the same for the other family of products. They may vary a little bit, but in theory they should be the same. So there is no need for Ecodesign to have harmonized standards on those products. Usually the harmonized standard is considering all the regulatory aspects concerning the product. The information is already there in some cases.

**QUESTION 5 – Implementing measure setting product information requirements for the installation of insulation materials**

The provision of information on correct installation of the insulation material is not yet mandatory in current legislation or in the standards. There is an option to define Ecodesign implementing measures setting product information requirements for the installation of insulation materials. The content of the implementing measure can be developed together with the technical committees in ESOs and with EOTA. However, Insulation materials can be installed in a wide variety of applications, which could make it difficult to establish commonly applicable installation guidelines. On the other hand, the product information requirement could be as simple as a warning that the installation of the product should be done by professionals, and for an optimal result should be considered in the context of the refurbishment or design of the entire building.

Are implementing measures setting information requirements for the installation of insulation materials feasible and desirable?

How do you think proficient installation can be best addressed? (e.g. via Ecodesign information requirements, or via other means).

**QUESTION 6 – Implementing measure regarding information about use-phase emissions of harmful substances from thermal insulation materials**

Ecodesign requirements (generic) regarding information about use-phase emissions of harmful substances from thermal insulation materials may provide help to installers.

Are implementing measures on setting information requirements for the emissions in the use phase feasible?

**ADDITIONAL QUESTION – Implementing measure regarding EoL and DfD**

Are implementing measures on setting information requirements for the EOL phase feasible? Is it possible through EPDs?

Are implement measures on Design for Disassembly feasible?

Concerning question 5, the first three points are covered by the EN 15804. If Ecodesign could promote the use of EPDs, that would be useful.

Module D of the EN 15804 covers EOL, but is not mandatory. Should it be made mandatory?

If EPDs become mandatory, than it should be mandatory to cover all life cycle stages.

Regarding installation guidelines: airtightness is not an insulation product issue alone. Insulation can help as an air barrier, but is not the main aspect for airtightness, so certainly not the right level to address this. Building airtightness is very complex and not linked to products alone, but also their interaction. Thus, it cannot be addressed on product level. Blower door tests are desirable in principle, but again this is a building issue that will be tested.
<table>
<thead>
<tr>
<th>Annex A – Minutes of the stakeholder meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>There may be an issue with how manufacturers think the performance of their product is and the way it performs in real life in a given end-use application. There is a lot of company literature, e.g. installation guidelines, but these documentation would need to be adjusted to all markets, applications, climatic zones and other aspects.</strong></td>
</tr>
<tr>
<td><strong>FDT</strong> Installation is very important, but there are so many different situation that is not feasible to organize it at product level. Concerning emissions, the emissions are dependent on a lot of factors. The concentration is important for health regarding indoor air quality and there are a lot of other parameters that come into play (ventilation rate, geometry of spaces). If we look at health effects, exposure time, the concentration of different emissions and the combination of them become important. As a conclusion we can say that there are no simple rules on product level.</td>
</tr>
<tr>
<td><strong>EMe</strong> EUMEPS supports the use of EPDs. The overall picture that we have is that EU methodology and national responsibility to set requirements and make it mandatory or not should also apply for this field. It is better first to harmonize test methods than to make things mandatory, with a lot of resistance from the national level for this kind of European mandatory initiative.</td>
</tr>
<tr>
<td><strong>NR</strong> Installation guidelines are generally provided at supplier level, sometimes there are also installations guidelines at the level of the association, but this needs to be done country by country and language by language and these products are mostly sold to professionals, so they are probably more difficult for DIY. Today a lot of this literature is available on website, so a mandatory requirement would probably not help, except if there would be a big database of installation guidelines on the European level. Regarding emissions of dangerous substances, this is already covered in CPR. Measurement methods have been validated, will be made available soon. Some countries already have requirements (France, Germany). The issue at the EU level is how should we declare at the EU level, since there is no harmonized declaration way.</td>
</tr>
<tr>
<td><strong>MB</strong> Associations already have created guidelines for installation. There is an estimation that about 3000 applications need to be covered. It is very important, but it is a very big step to make it mandatory. Concerning emissions in use phase, these are very important. CPR basic work requirement 3 looks at which emissions should be covered, but not all insulation/construction products are covered by the mandate. This can create a quite bizarre situation.</td>
</tr>
<tr>
<td><strong>GA</strong> There are no installation rules in harmonized standards, since it is an impossible task. A standard can however state that a manufacturer must provide an installation guideline. DG enterprise should be consulted regarding the dangerous substances, since the sustainable construction unit is working on the topic for the last five year.</td>
</tr>
<tr>
<td><strong>SK</strong> The EN 15804 is being adapted to insulation products (TC 88). There is a difference between factory made and in-situ made. We try to cover the different elements, but we are not trying to harmonize and to make it mandatory to declare EOL and scenarios because these are country specific and product specific. About Design for Disassembly, the element must be considered. Energy use is the most important, but can be reduced by insulating. EOL had little impact on overall environmental performance, so there are solutions that are less easy to disassemble but can improve dramatically the energetic performance. Some insulation materials can be glued or mechanically fixed, then it is up to the architect to decide the best EOL approach.</td>
</tr>
<tr>
<td><strong>GA</strong> There are many European standards dealing with dangerous substances. There are few product families where the dangerous substances have been identified by the commission and were there are test methods, for example wood floorings. But this is very limited.</td>
</tr>
</tbody>
</table>
Final round

<table>
<thead>
<tr>
<th>EC</th>
<th>What about durability requirements? Diversity of different performances on the market in terms of durability is probably linked to the setting. Is there a possibility to eliminate some really bad materials from the market? Are there proper measurement methods to assess the durability of insulation materials. Is it possible to assess this before it comes on the market?</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA</td>
<td>On a case by case basis, the technical experts propose to the Commission which one of the series of characteristics (including the durability) they will address. In several harmonized standards, durability is already covered.</td>
</tr>
<tr>
<td>SS</td>
<td>If there is a test standard, it makes the potential setting of requirements easier and should be considered in this report.</td>
</tr>
<tr>
<td>OL</td>
<td>Durability is a complex issue, largely dependent on the end use. It is very difficult to give a real number on the durability of an insulation product. The life span of the insulation product can exceed the life span of the building (in commercial buildings for example), but it can also be affected by damages, so it is really difficult to assess this in a single number.</td>
</tr>
<tr>
<td>PT</td>
<td>We understand that is difficult to provide a single number, but provided good practice, is it possible for different insulation materials to put a range on it?</td>
</tr>
<tr>
<td>OL</td>
<td>There are a number of databases, for example in the Netherlands and Germany, where the life span of insulation products is specified, based on research results.</td>
</tr>
<tr>
<td>PT</td>
<td>The databases are scarce for insulation materials.</td>
</tr>
<tr>
<td>EC</td>
<td>Is there an issue? Are there insulation products on the market that cause problems and need to be phased out of the market to ensure that there are only quality products?</td>
</tr>
<tr>
<td>BS</td>
<td>Concerning durability criteria: is there a problem with certain isolation materials or certain building techniques that prevent combinations with one another?</td>
</tr>
<tr>
<td>PT</td>
<td>Each element system has its own way of construction, e.g. thermal insulation in a cavity wall versus an ETICS wall. The way that elements are constructed will also affect the dependence of other components. Since thermal insulation normally (regarding consulted databases) has a lower lifespan than construction elements, you may have unnecessary waste if you want to replace it.</td>
</tr>
<tr>
<td>BS</td>
<td>Are there compatibility issues for different insulation materials? For example is there a building element system that prevents the use of another insulation material?</td>
</tr>
<tr>
<td>SK</td>
<td>Documentation from different producers usually provide guidelines for applications that manufacturers think their product is fit for. There is a major role for the national building research institutes. They also recommend certain types of building structure. Also local building rules are important. Those elements should be taken into account by the architect who is building in a certain region. To this restriction the type of insulation that can be used will be limited. The information is there. Insulation manufacturers will not promote their product for an application that is not feasible for their product.</td>
</tr>
<tr>
<td>LDe</td>
<td>If insulation materials are installed in a proper manner, there is no problem with their service lifetime. However there is a difference on how the insulation materials react when there is an installation problem.</td>
</tr>
<tr>
<td>PT</td>
<td>Regarding the question of the EC, the project team has no official data available on the ageing of the different types of materials. Differences between traditional and renewable materials are not stated in official documents that the project team knows of.</td>
</tr>
<tr>
<td>EC</td>
<td>In certain cases, guidelines on the use of products may well represent a significant barrier to trade. They may be helpful for the engineer, but they might be used to close his eyes for other technical solutions. In some countries these guidelines are blind rules that have to be respected. This kind of approaches give problems to other materials that cannot be used, because nobody dares to use them. We request that the manufacturer will declare the</td>
</tr>
</tbody>
</table>
performance of his product concerning various aspects (water absorption capacity, bending strength, etc.) in line with what is required for a specific use in that Member State. Therefore the engineer is very well informed on the performance of the materials that he intends to use and he is expected to take his responsibilities in designing a work or specifying specific products for that work.

PT Could you give an example of how these guidelines could be a barrier to trade?
GK We are confronted with some national guidelines that are a barrier to trade, but the European ones will not be.
BS For example WTCB produces guidelines. If there is no guideline on a specific product system, architects will hesitate to use that solution, so that might be a barrier.
LDe We write guidelines, usually on element level, generally not on material level. We usually say that a range of materials can be used for that application and different combinations are shown.
FDT This meeting indicated that EPDs would help to design different solution if they were mandatory. There are still some harmonization problems, but this general conclusion is important.
The way forward (AT)

A final report will be provided to the Commission on December 15th, 2013. Stakeholders can provide comments until November 1st, 2013. After December 15th, the different Commission services involved (DG Energy, DG Enterprise, DG Environment) will sit together and discuss the way forward. This could include to go ahead with a full preparatory study (all MEerP tasks) that would be complementing with the existing exploratory study, by executing the missing tasks. This will only happen if the thermal insulation materials for buildings will be moved to the priority list.

If we have a full preparatory study, this will result in more detailed conclusions on what measures to recommend under Ecodesign or Labeling or potential other legislation. Afterwards the Commission would come forward with working documents that will be presented to the Ecodesign consultation forum. An impact assessment will be developed. Also there will be a finalization of legislation going for an inter service consultation within the Commission and notification to the WTO.

We are at the very beginning, so there is still a major decision ahead whether or not to start this adventure. We are not restricted to Ecodesign and Labeling, since there is also a close cooperation with the other services. The decision on whether or not to conduct a full study will be made in the first quarter of 2014.

Some of the discussions of this stakeholder meeting could also be useful for the preparatory study on windows as well. This study started in July 2013 and will last 18 months, so the final report is expected early 2015. VHK (the Netherlands), IF Rosenheim (Germany) and VITO (Belgium) are involved in that project. Two stakeholder meetings are scheduled, one in March 2014 and one in November 2014. Since this is a full preparatory study, the timing is different than for this exploratory study, since all tasks are conducted. There will be a close interaction between both studies regarding information sharing, since they are both under the same framework contract.

Further actions (CS)

Feedback remarks on the interim report is welcome until November 1st, 2013. The presentation (PPT), the minutes of this stakeholder meeting, and the feedback of the stakeholders will be added as an annex to the final report.

Thank you for your presence and your constructive feedback.
ANNEX B – QUESTIONS FOR STAKEHOLDERS

Introduction
VITO (the Flemish Institute for Technological Research) and WIKUE (Wuppertal Institute for Climate, Environment and Energy) have prepared an interim report (date: September 2013) in the framework of an exploratory study that they commonly carry out with regard to EcoDesign of thermal insulation in buildings, on behalf of the European Commission DG Energy.

The study analysed only parts of the so-called MEErP methodology (Methodology for Energy related Products):
1. Quickscan (task 0 of the MEErP methodology);
2. Scope (task 1 of the MEErP methodology);
3. Scenarios (task 7, only partly, of the MEErP methodology).

The framework of preparatory studies also requests the opinion and input of relevant stakeholders throughout the study. Therefore we have sent you an invitation for a stakeholder consultation meeting that is planned on the 1st of October 2013 in Brussels (European Commission - Centre Albert Borschette, Room 4C - Rue Froissart 36, B-1049 Brussels).

In order to be prepared for this stakeholder consultation meeting we have sent you an interim report (version September 2013). This present document is accompanying the interim report and turns some points into questions to you. These points will be addressed in full in the final report.

We would like to discuss your feedback/answers to these questions on the 1st of October 2013 (at the European Commission - Centre Albert Borschette, Room 4C - Rue Froissart 36, 1049 Brussels, Belgium, from 10 am to 4 pm). After the stakeholder consultation meeting, you will have one month time to submit your written comments (deadline: 01/11/2013).

Thank you in advance for reviewing the interim report and for considering the questions presented in this document. We are looking forward to a constructive stakeholder consultation meeting on the 1st of October 2013 in Brussels.

QUESTION 1 – Functional unit
The functional unit represents the quantified performance of a product system for use as a reference unit for an LCA study – or in this case the MEErP study. In the Quick scan (Chapter 3 of the interim report) the research team argues that assessing the environmental burdens and benefits, as well as determining improvement scenarios would require a system approach instead of a product approach. Such a system approach should take into account the relation of the thermal insulation product(s) with other building components in its built in context and the building (performance) itself.

Defining a European reference system on the building or building element level that takes into account different constructive solutions and is applicable in all European Member States is complex, time-consuming and necessarily controversial. For these reasons the research team recommends to define the functional unit on product level and communicate in a transparent way about the restrictions using a product approach.
Do you think it would make sense to examine the validity of using a functional unit at the system level, e.g. by describing the overall heating/cooling energy demand of the building in a unit of: MJ / floor area / year?
This would extend beyond the boundaries of thermal insulation products (and include windows, doors and ventilation systems, etc.), but the study could still make recommendations to look at higher level requirements, if they can be implemented in measures that are appropriate in the current policy context. See also the question on the next page (Question 2).

What about the time aspect regarding the performance of the insulation? Presumably, there is a deterioration of the performance over time.
Do you think initial estimates regarding performance over time could be incorporated at the product level?
Do you think it would make sense to perform practical inspections at the system level?

**QUESTION 2 – LABELLING/ECODESIGN as a complement to the EPBD**

Do you think the Ecodesign and/or the Energy Labelling schemes, which are based on requirements harmonized at EU level, could be applied to particular thermal insulation systems, to building envelopes (including windows/ventilation systems), or to buildings as a whole, or to the plans/designs of such particular elements, in order to usefully complement/improve the implementation of the Energy Performance of Buildings Directive? If yes, how?

Considering the following: the existing installers’ energy label for heaters (Commission Delegated Regulation (EU) No 811/2013), the provisions on technical building systems (including the building envelope) under EPBD (see report section 4.4.1), and the local conditions that have to be taken into account in the case of particular buildings when describing their energy performance or that of their building elements.

**QUESTION 3 – IMPROVEMENT OF EXISTING product information and measurement methods**

*Environmental Product Declarations (EPDs)*

Some standards (like EN 15804<sup>84</sup>) already include EPD (Environmental Product Declaration) requirements and many products already have EPDs.

What would be the benefit(s) of reinforcing the EPD requirements by making them mandatory, potentially complemented by mandatory information on proper installation of the product?
Is this a feasible measure for all thermal insulation producers with respect to available data and financial resources?

*Missing harmonised standards for measurement methods*

For some product groups where missing standards delayed progress with requirements, the Commission developed and published transitional methods of measurement in the Official Journal

---

<sup>84</sup> Sustainability of Construction Works – Environmental product declarations – Core rules for the product category of construction products

2013/TEM/R/38
to make it possible to apply the Ecodesign implementing measures, awaiting the publication of standards by the ESOs (European Standardisation Organisations).

Could Ecodesign serve to speed up the development of missing harmonised standards providing measurement methods for product information on biomass, reflective foil, cellulose, sheep wool, etc.?

**QUESTION 4 – existing legislation on the environmental impact of insulation materials**

In the report, the following pieces of legislation having links with the insulation sector are mentioned, but their complementarity with Ecodesign is not elaborated in more detail. Based on prior consultation with CEN TC88 and EURIMA, these pieces of legislation are initially considered less important for this study:

- Directive on national emission ceilings for certain atmospheric pollutants (2001/81/EC);
- Directive on the incineration of waste (2000/76/EC);
- Regulation on shipments of waste ((EC) No 1013/2006);
- Directive on industrial emissions (integrated pollution prevention and control) (2010/75/EU);
- Regulation concerning the establishment of a European Pollutant Release and Transfer Register; \(^{85}\)
- Council Directive CAFE cleaner air for Europe (2008/50/EC);
- Forestry Strategy for the EU (1999/C 56/01);

Are there any indications that some of the above legislation should be further analysed, because their mandatory requirements applicable to insulation products do not sufficiently cover the related environmental impacts, and there would be room for improvement under Ecodesign?

**QUESTION 5 – implementing measure setting product information requirements for the installation of insulation materials**

The provision of information on correct installation of the insulation material is not yet mandatory in current legislation or in the standards. There is an option to define Ecodesign implementing measures setting product information requirements for the installation of insulation materials. The content of the implementing measure can be developed together with the technical committees in ESOs and with EOTA. However, Insulation materials can be installed in a wide variety of applications, which could make it difficult to establish commonly applicable installation guidelines.

On the other hand, the product information requirement could be as simple as a warning that the installation of the product should be done by professionals, and for an optimal result should be considered in the context of the refurbishment or design of the entire building.

Are implementing measures setting information requirements for the installation of insulation materials feasible and desirable?

How do you think proficient installation can be best addressed? (e.g. via Ecodesign information requirements, or via other means).

**QUESTION 6 – implementing measure regarding information about use-phase emissions of harmful substances from thermal insulation materials**

Ecodesign requirements (generic) regarding information about use-phase emissions of harmful substances from thermal insulation materials may provide help to installers.

Are implementing measures on setting information requirements for the emissions in the use phase feasible?
## Annex C – Stakeholder comments

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andras TOTH</td>
<td>EC DG Energy</td>
<td>List of transitory measurement methods. These methods are supposed to be replaced by references to the harmonised standards containing the measurement methods, when the ESO's finish their harmonisation work.</td>
<td>&quot;Transitory measurement methods&quot; added to 4.3.1</td>
</tr>
<tr>
<td>Andras TOTH</td>
<td>EC DG Energy</td>
<td>Point out any updates resulting from these contacts with DG ENV.</td>
<td>General description added in 4.3.2.</td>
</tr>
<tr>
<td>Andras TOTH</td>
<td>EC DG Energy</td>
<td>Include information on the pilot on PEFCR for thermal insulation.</td>
<td>see above</td>
</tr>
<tr>
<td>Andras TOTH</td>
<td>EC DG Energy</td>
<td>Check if <a href="http://www.baubook.at">www.baubook.at</a> should be included in the study.</td>
<td>paragraph 5.2.3 added 'other policy options'</td>
</tr>
<tr>
<td>Andras TOTH</td>
<td>EC DG Energy</td>
<td>Check if the digital upload of “declarations of performance” should be included in the study.</td>
<td>added in 4.4.1. &gt; Construction Products Regulation (305/2011/EC)</td>
</tr>
<tr>
<td>Marc BOSMANS</td>
<td>Eurima</td>
<td>Eurima believes that the construction sector should benefit from a coherent legislative framework which provides a level-playing field in Europe. Regarding the own products, Eurima points at the gap between the full environmental potential benefit of insulation materials and the current implementation of legislations and standards. It should be avoided that there are conflictuous legislations at product and building level and that some materials are covered by more legislations than others.</td>
<td>added in 5.1: &quot;Also, it must be ensured that possible measures deal with all insulation materials in a similar way, so a level-playing field is created.&quot;</td>
</tr>
<tr>
<td>Agnes SCHUURMANS</td>
<td>Eurima/ROCKWOOL</td>
<td>Figure 12 refers to a wall type insulated with rock wool. Rock wool does not exist as a generic name and should be replaced by 'stone wool'.</td>
<td>adjusted</td>
</tr>
</tbody>
</table>
As of 1 January 2013 there is an obligation in the Dutch Building Decree to calculate the GWP and ADP for new residential and office buildings (article 5.9 Sustainable building): [http://www.bouwbesluitonline.nl/Inhoud/docs/wet/bb2012/hfd5/afd5-2/art5-9?tableid=docs/wet/bb2012/hfd5.html/afd5-2&articleid=5.9&fragid=art5.9#art5.9](http://www.bouwbesluitonline.nl/Inhoud/docs/wet/bb2012/hfd5/afd5-2/art5-9?tableid=docs/wet/bb2012/hfd5.html/afd5-2&articleid=5.9&fragid=art5.9#art5.9)

There is no norm yet for threshold values. The intention is to build up experience by doing the calculations, at least until 2016. The article refers to the Dutch Bepalingsmethode, drafted before the CEN standards were available. The method will gradually be adapted to the EN15978. The Bepalingsmethode refers to the Dutch national LCA database, maintained by SBK. This database contains EPDs according to MRPI and similar, as well as default values. The requirements for the EPDs are adapted to the EN15804, but a typical national requirement will remain: the obligation to use the nationalized version of EcoInvent for the background data in the LCA. Note that the article refers to the materials in the building only. Energy use and water use in the use stage are excluded; they are covered by separate articles and requirements in the Building Decree. It therefore specifically relates to emissions (GWP) and resources (ADP) of materials. A wish from the NGOs yesterday for ecodesign. How does this approach help for ecodesign? It is a fact that by having these building requirements, the availability of EPDs is boosted. Furthermore, manufacturers are encouraged to improve emissions and being more resource efficient. This is true for all construction products, not specifically for insulation. But especially for the NZEB, insulation will become a more important material in the total and this will certainly have an impact on the insulation products. EPDs will definitely become more important for sustainable designs of NZEB.

The SBK national LCA database makes use of default values to enable building modeling of the whole life cycle. One of the default values they use are service life data of products. You can find the SBR publication through [http://www.sbrcurnet.nl/producten/publicaties/catalogus-levensduur-bouwproducten-praktijkwaarden](http://www.sbrcurnet.nl/producten/publicaties/catalogus-levensduur-bouwproducten-praktijkwaarden). Default RSL for insulation materials [source: SBR Netherlands 2011] are provided. The values can have a huge impact on the environmental performance of a building. Fit for purpose seems the key word here too.
## Annex C – Stakeholder comments

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gonçalo ASCENSÃO</td>
<td>CEN/ CENELEC</td>
<td>At the CEN construction website <a href="http://www.cen.eu/cen/Sectors/Sectors/Construction/Pages/default.aspx">http://www.cen.eu/cen/Sectors/Sectors/Construction/Pages/default.aspx</a> you will find information about the standardization in the construction sector. In the bottom of the page there are some documents including the report on the general situation of European standardization <a href="">ftp://ftp.cen.eu/cen/Sectors/List/Construction/CENreport.pdf</a>. In this report you will see what are the standards already harmonised for thermal insulation material under M/103 (page 17-19) and those that have been finalised and are not yet cited and also those that are candidate to be harmonised and are in preparation. Also in page 47 it shows that for ETICS mandate 489 has been forwarded by the EC to CEN and that the candidate harmonised standard is in preparation. As informed during the meeting the EC mandate identifies a series of characteristics that are regulated at national in the different Member States of the EU. Also references to the list of harmonised standards and the EC data base of mandates is included. The information in paragraph 4.3 has been corrected according to the information in the provided document.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>The basic approach is flawed as the selection process of the right insulation product should start from “fitness for use” in a given application (see BWR of CPR). This eliminates a number of materials for each application. In the next step, durability should be checked, i.e. all performance claims should be based on harmonised test methods. Only in a third step, an environmental performance assessment in the end-use application should take place. Admittedly, this omits the most important selection criterion – the price. Information on fitness for use added to 3.2.2. &gt; Classification at system level.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>The Ecodesign directive states that products must have a significant environmental impact to be covered by implementing measures. The meaning is “environmental burden”. In the case of insulation, every LCA will show that it has significant benefits (graphs included). This confusion should be addressed in the report and the question asked whether this pre-condition is met at all. Will be checked with the Commission.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>Ecodesign leads to CE marking. It would not be acceptable that insulation products currently not CE marked (under the CPR) obtain a CE mark simply be issuing installation guidelines or other simple measures, whereas others have to go through a very costly certification process. Added in 5.1: &quot;Also, it must be ensured that possible measures deal with all insulation materials in a similar way, so a level-playing field is created.&quot;</td>
</tr>
</tbody>
</table>
Oliver LOEBEL  PU Europe  It would be difficult to accept if a new certification route was put in place through Ecodesign whilst the CPR provides all the tools to address environmental aspects and set European limit values. As building codes are national / regional (and the EU only provides the test methods), many of the measures proposed below may be in conflict with subsidiarity.

Oliver LOEBEL  PU Europe  The measures proposed below cannot be used for GPP / Ecolabel for insulation products, as they do not allow assessing product performance at the building level. In the case of GPP / Ecolabel criteria for buildings, TC350 provides the right tools. Any bans of product / substance families must be avoided unless there is clear scientific evidence for each of them.

Oliver LOEBEL  PU Europe  PU Europe provided a report on long-term performance of insulation products to VITO. Page 189 of the report gives some details on life times of products. The report shows the complexity of ‘durability’, the multitude of test methods and the impossibility of Ecodesigning this. Als the official table used by the authorities was provided bij PU Europe. More information on durability is available at http://www.pu-europe.eu/site/fileadmin/Reports_public/PU_10-139_Draft_Final_Desk_Research_on_Durability_of_insulation_product.zip Details can be found at http://www.nachhaltigesbauen.de/baustoff-und-gebaeudedaten/nutzungsdauern-von-bauteilen.html showing that the lifetime of the insulation layer is generally similar to that of other building materials in the same building component.
Annex C – Stakeholder comments

<table>
<thead>
<tr>
<th>Name</th>
<th>Company/Group</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>PU Europe has recently finalised a study on the environmental performance of insulation products in different end-use applications (see <a href="http://www.pu-europe.eu/site/fileadmin/PU_Europe_files_2013/PU_13-136_PWC_for_PU_Europe_-_Environmental_and_economic_analysis_of_insulation_products_in_low_energy_buildings__May_2013_.pdf">http://www.pu-europe.eu/site/fileadmin/PU_Europe_files_2013/PU_13-136_PWC_for_PU_Europe_-_Environmental_and_economic_analysis_of_insulation_products_in_low_energy_buildings__May_2013_.pdf</a>). The study clearly shows that the performance of different materials is quite similar at the building level. Note that wood fibre has a negative GWP based on German EPDs. This is not supported by many scientists and industry. The study also provides evidence how important it is to take a whole building prospective. For example, the flat roof steel structure needs to be stronger when a high density insulant is used. Similarly, if the functional unit of a building is the outer building footprint, then the available indoor surface varies significantly depending on the insulant. In this study, the difference was about 14sqm (for a total surface of 2,300sqm). If the inner surface is used as functional unit, the building footprint, and with it land-use, is impacted. This needs to be taken into account. Back in 2010, PU Europe had commissioned a study which shows the impact of insulation when U-values are fixed, but also when thickness is restricted (internal insulation, cavity wall insulation etc.). Again, this has an impact on the overall environmental performance (<a href="http://www.pu-europe.eu/site/fileadmin/Reports_public/LCA_LCC_PU_Europe.pdf">http://www.pu-europe.eu/site/fileadmin/Reports_public/LCA_LCC_PU_Europe.pdf</a>).</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>The study on WICRs (walk-in cold rooms) could be useful. No methodological difference were found.</td>
</tr>
<tr>
<td>Angeliki MALIZOU</td>
<td>BEUC/ ANEC</td>
<td>Thermal insulation raise serious environmental and health concerns associated to its hazardous content. We therefore consider crucial to explore under this study the possibility to set not only information requirements but also product specification requirements associated with the hazardous content of this materials(incl. outgassing during the use-phase). Information requirements are important when a product is first placed on the market as it would allow transparency and more comparability for consumers. Information requirements should also cover the assembly and installation aspects– especially if these can be carried out by the homeowner.</td>
</tr>
</tbody>
</table>
will not set emission limit values (ELVs) only the modus operandi of evaluation. Each member state of the EU defines its specific requirements. In Belgium for example a draft regulation is in place, the Royal Decree establishing threshold levels for the emissions to the indoor environment from construction products for certain indoor uses. The basis of the Belgian decree is the CPR.” The standards being developed by CEN TC 351 are listed in paragraph 4.3.2.

Angeliki MALIZOU  BEUC/ ANEC  To that extent we would also like to bring to your attention that ANSES (French Agency for Food, Environmental and Occupational Health Safety) after receiving several complaints is looking into ammonia emissions from cellulose insulation containing ammonium salts. This decision follows the French Decree of June 21, 2013, concerning the prohibition of placing on the market, importing, distributing and manufacturing cellulose insulation containing ammonium salts. This remark and a discussion has been added to paragraph 5.2.2 (section emissions in the use phase).
### Annex C – Stakeholder comments

| Angeliki MALIZOU | BEUC/ ANEC | We understand that installation and other parameters affect the performance of insulation material but this could also be the case for windows or lighting. Therefore, it would be useful to have a deep assessment of how the intrinsic insulating potential within each insulating category varies as it would help defining potential requirements on the energy efficiency of these materials. By this point we wanted to illustrate that we understand that the behaviour of insulation material depends to some extent on installation and on the building enclosing it. I am not able to remember by whom exactly, but I remember that the question of how the quality of the same kind of insulation material among different manufacturers varies. Our point intends to convey a similar simple message. Under this exercise, we would find it very useful to have an assessment of how the quality (in terms of insulation but also in terms of durability) varies among the available insulation products of the same type. Ecodesign requirements aim to phase out the worse performing products from the market. Understanding such quality variations of thermal insulation would help to determine whether this would be possible/feasible through mandatory requirements. I take the chance to reiterate that for us, this process is very important with regards to tackling the hazardous content of thermal insulation material. |
| The quality and durability of insulation materials is not always measured using the same method. The reported lambda values are not always directly comparable and there is a lack of information on durability of insulation products. This exercise requires an in depth study on the quality aspects (in terms of insulation, but also in terms of durability) of products available on the markets. This task requires and extensive inquiry of insulation producers, which was not possible given the limited time frame for provision of the draft final report of this exploratory study. |
| Angeliki MALIZOU | BEUC/ ANEC | Finally, the Ecodesign framework provide the opportunity not only for energy efficiency requirements but also other environmental parameters such as durability. Durability of thermal insulation is important both for reasons associated to cost as well as for reasons associated to the environment and public health. Besides, as the study confirms "in light of the 2019-2021 EPBD targets and the increase in insulation waste released through demolition, the environmental impacts related to manufacture, replacement and end-of-life will gain in importance". |
| "The application of building materials should always be assessed regarding their fitness for use. The technical characteristics, durability and financial aspects of building materials should all be considered given the application they will be used for." added in 3.2.2 |
| Martijn VAN ELBURG | Check if 'The BuildingGreen Guide to Insulation Products and Practices' has useful information for the study. | paragraph 5.2.3 added 'other policy options' |
Bram SOENEN  Federal Public Service: Health  

Belgium welcomes the Commission’s efforts on insulation materials and agrees with the conclusions of the VITO Exploratory study. Especially that impacts should be assessed at building level taking into account compactness, thermal mass, building type, heating system, orientation, envelope sandwich composition, refurbishment, inner/outer wall, .... This avoids double legislation and creating suboptimal or inconsistent requirements. We also agree with the general conclusion that Ecodesign requirements are inappropriate for evaluating indirect effects of insulation materials on energy consumption in buildings. However, we ask the Commission to continue the work done and commission a fully-fledged Preparatory study with the same product scope. We think all requirements in Article 15 of 2009/125/EC are fulfilled to do so.

Energy aspects of thermal insulation are covered more adequately by a combination of other legislation:• The Construction Products Regulation (CPR) has an information requirement for the $\lambda$-value (thermal conductivity).• The Energy Performance of Buildings Directive (EPBD) covers use phase energy efficiency for buildings. These oblige the manufacturers of these products to also declare their performance (thermal conductivity - $\lambda$-value). Ecodesign would be complicated to apply and would not yield any additional energy savings. Proper building codes will imply good envelope insulation taking into account other relevant aspects such as air-tightness, heating system, windows, envelope sandwich, .... A builder can make the most suited and cost-effective combination measuring air-tightness, selecting efficient heating systems, choosing double or triple glassed windows, looking at $\lambda$-values of envelope components, .... Basically you need a type of insulation material for your building solution (tiled roof, brick wall, wood skeleton wall, ...) and you achieve the required thermal resistance by applying a thick enough layer of insulation with a given $\lambda$-value. Different $\lambda$-value and different building solutions will mean different prices to be assessed in the budget of the whole building project and the local constraints. To create a level play field, the Commission should see to it that harmonised standards are drawn up under the CPR for cellulose, sheep wool and other -mainly renewable- insulation materials that currently don’t necessarily bare the CE marking.

2013/TEM/R/38
### Bram SOENEN  
**Federal Public Service: Health**

**Attention should be paid to on-site production (e.g. PUR foam) and application (e.g. loose glass wool). These materials should not be treated fundamentally differently than serial produced insulation (e.g. panels and blankets). Clear identification of the responsible for affixing the CE marking is needed (manufacturer spraying equipment, chemicals supplier, installer ?). An appropriate and adapted market surveillance procedure should be possible (e.g. chemicals test, equipment test, ...?). In a similar way standards for insulation of edges and piping should oblige the manufacturers to declare their λ-values.**

**Ecodesign Directive installation is out of scope of the**

### Bram SOENEN  
**Federal Public Service: Health**

**The focus of any Ecodesign requirements should be on non-energy related aspects of insulation materials. There is a huge incentive towards more insulation materials and reduced energy consumption during the use phase. Because of this the embodied energy of construction materials will be dominant for future nearly zero-energy buildings. Also non-energy impacts will increase due to increased material use and later more construction waste.**

**possible non-energy related requirements are discussed in 5.2.3**

### Bram SOENEN  
**Federal Public Service: Health**

**As for energy efficiency, embodied energy and non-energy related environmental impacts should best be addressed at building level. However an “Environmental Performance of Buildings Directive” does not yet exist. If it would, it would depend on standardised environmental impact information being available. This could be done using so called generic requirements in the current Ecodesign Directive. These provide for the disclosure and communication of the ecological profile representing significant environmental impacts over the life cycle of a product in physical values, without judging it or setting limits. For construction products this type of information is becoming available as Environmental Product Declarations (EPD). EPDs could contribute to enhance the environmental performance of construction products by obligatory B2C or B2B-communication on the basis of the LCA results. We ask the Commission to explore the untapped potential of these provisions. In the case of construction products ecological profiles could eventually be meaningfully added up at building level to assess its overall environmental performance. Benchmarking at building level should then be developed as a first step to requirements at building level, in analogy to the EPBD. CEN TC 350 does not provide that for the time being.**

**Ecodesign is not intended for information spreading**
<table>
<thead>
<tr>
<th>Bram SOENEN</th>
<th>Federal Public Service: Health</th>
<th>Another option is to check the suitability of PEF at building level. We think that the DG ENV Product Environmental Footprint initiative could also provide the necessary methodology and experience. One of the selected pilot tests is on thermal insulation.</th>
<th>General description of PEFCR pilot added in 4.3.2. &gt; Guidance on Environmental Footprints &gt; PEFCRs – Product Environmental Footprint Category Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>In any case it is key to have one harmonised methodology to avoid double work and market fragmentation (PEF+TC 350).</td>
<td>in 5.1: &quot;...assess the extent to which measures under the Ecodesign and Energy Labelling Directives could, if at all, contribute to the achievement of the improvement potential for insulation materials, taking into account other existing policies.&quot; Possible requirements discussed in chapter V mention existing legislation that is better suited to tackle the issue when available.</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>Alternative to more complex ecological profiles smart and simple material efficiency requirement could be developed. The Exploratory study concludes that Design for Demolition (DfD) could have beneficial effects. Insulation materials seem to be easily recoverable and recyclable unless prevented by their integration in the building (e.g. glued vs selfsupporting) and/or their composition (e.g. bulk material or laminated structure).</td>
<td>Comment. No action required.</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>Also it could be investigated if and how Ecodesign could tackle impacts associated with additives (RoHS only covers EEE) or the production process (if not covered by other legislation) for specific subcategories of insulation materials (e.g. blowing agents, flame retardants, biocides). These additives could be phased out if proper alternatives exist with a lower environmental impact.</td>
<td>Outside the scope of this study. DG Energy will inform DG Environment</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>As insulation materials could have a shorter functional life time than other building envelope components, aging requirements could be set. This would extend life time and probably reduce the impact of production. Also, the impacts associated with stripping and recladding a building to replace worn insulation would be avoided or postponed.</td>
<td>Ageing requirements and the influence of other building components is already discussed in the quickscan and the possible requirements regarding Design for Disassembly</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>Dangerous substances and emissions during installation should be covered in other available legislation (REACH, protection of employees).</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Only possible Ecodesign requirements on emissions of harmful substances from insulation materials in the use phase are discussed in 5.2.2. No reference is made to possible measures regarding emissions during installation.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bram SOENEN</th>
<th>Federal Public Service: Health</th>
<th>The impact of insulation on Indoor Air Quality is not clear and we fear opening this discussion would mean that discussions and decisions on other environmental quality indicators is delayed.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>The study advises not to tackle these issues by Ecodesign requirements, since they will be investigated within CEN TC 351</td>
</tr>
</tbody>
</table>
Do you think it would make sense to examine the validity of using a functional unit at the system level, e.g. by describing the overall heating/cooling energy demand of the building in a unit of: MJ / floor area / year?

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ines OEHME</td>
<td>Federal Environment Agency of Germany</td>
<td>We deem it (almost) impossible to define a useful functional unit of insulation material or insulation systems because of multifold interrelationships with the building. It may make sense to define a building (set in three climate zones as in the boiler or air conditioner label) in order to analyse some effects mentioned in the preliminary report: grey/embodied energy, energy consumption on construction site, dismantling and recycling of insulation material etc. Though it should be made clear that such an example may not be representative, but just indicative.</td>
</tr>
<tr>
<td>Isabelle BROSE</td>
<td>EPF</td>
<td>In principle, a functional unit at system level will be the best and most logical option. Although, practically, it is difficult as, so far, existing EPDs are often based on different functional units which could not be compared and do not allow comparing the products. Having a functional unit on system level would only make sense once based on product EPDs with the same functional unit. Harmonising the product specific functional units must be the first step.</td>
</tr>
<tr>
<td>Frank DE TROYER</td>
<td>KULeuven, ASRO</td>
<td>Analysis on building level is required and many parameters are independent of material, so labeling on material level in not interesting.</td>
</tr>
<tr>
<td>Philippe HUGO</td>
<td>Le Relais Métisse</td>
<td>Yes.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>Ecodesign wants to set minimum life cycle environmental requirements for products. In the case of insulation products, it would however be unable to assess the most important part of the product life cycle – its use phase. VITO stresses that a product approach would therefore be subject to many restrictions. It is unclear how these two elements could be combined. Therefore, PU Europe does not support the product level as functional unit. Instead of a functional unit, we could agree on a declared unit (as in EPDs based on EN 15804) that could easily be used to assess the performance at the building level. An LCA approach looking at the end-use application is the only scientifically sound way forward. However, this requires significant research work and requirements set per building type, location, climatic zones etc. It does not seem feasible within Ecodesign and even more generally at EU level.</td>
</tr>
<tr>
<td>Judith GIESELER</td>
<td>BAM</td>
<td>Further research is required in order to determine if it is feasible to evaluate insulation products rather at system level than only at product level. The system approach is more complex but could incorporate more parameters which are relevant for evaluating the performance of insulation. A regulation at product level seems feasible, but does not necessarily incorporate enough aspects in order to be really valuable. The setting of the system boundaries will be the key issue for this operation – this needs further research in order to determine if this is feasible. At this point, we think it should also be researched if the combination and further development of other existing mechanisms could help in assessing the effectiveness of thermal insulation.</td>
</tr>
</tbody>
</table>
Edmar MEUWISSEN  |  EUMEPS  
--- | ---  
No, such an approach would be complex to design and to implement. EUMEPS thinks it would be more appropriate to strive for implementation of building performance evaluation in line with the TC350 framework and the limited set of indicators developed there. There might be justification for some additional indicators (e.g. land use) but we should be very cautious in expanding the number of indicators. First priority should be to have data on current TC350 indicators for all materials in the building rather than having more information on a limited number of materials/products, so the overall calculation for the whole building remains difficult or impossible. Be aware that every additional indicator also increases the costs for drawing up the report. More helpful in the direction of enabling calculation on building level would be the support in alignment of software development and (electronic) data formats to make the LCA analysis at building level and improving the quality of the material data in LCA/EPD databases.
For a possible upcoming MEErP study, we agree a more pragmatic approach is necessary. The functional unit should take into account only the primary function of thermal resistance. Taking into account secondary functions would overcomplicate; this would open the scope beyond isolation materials. We agree with the project team’s proposal to define the functional unit at the product level and to communicate about the restrictions using a product approach. We support the functional unit being defined as 1 m² of a thermal insulation material with a thickness that gives a design thermal resistance of 1 (R = 1 m²K/W) and with a certain expected average reference service life for a specific application. We note that this approach is only interesting to examine the “Cradle-to-gate stage” without taking into account the actual application of the material in the building envelope. Practically this means that you can only directly compare between products of the same sub-group (e.g. only PUR in cavity walls). You wouldn’t know if another subcategory in another building envelope solution would perform better (e.g. Is it better to use cellulose or glass wool in a roof?).

For possible Ecological profiles as ‘generic requirements’ (see our accompanying comments), an approach is needed that would allow swift BtoB and BtoC communication, the structure should be taken into account to convey information that allows a potential customer to compare different building solutions. Then the functional unit should be set at least at the element level (cavity wall, exterior isolation, flat roof types, ...): 1 m² of a thermal insulation material with a thickness that gives a design thermal resistance of 1 (R = 1 m²K/W) and with a certain expected average reference service life, taking into account the contributions of the building envelope element it is applied in. This would take into account auxiliary materials and the secondary functions insulation can have (e.g. vapour screen, water screen).

Note: Ecological profiles can be calculated, representing significant environmental impacts over the life cycle of a product expressed in physical values (life cycle assessment: LCA). Calculations are done on the ‘functional unit’ from ‘cradle to grave’. If the precise function or the use, transport or EoL scenarios are not known a ‘declared unit’ can be used. LCA is done ‘Cradle to gate’. Environmental impacts of the ‘declared unit’ from ‘Cradle to gate’ are independent of lifetime or EoL, while those of the ‘functional unit’ from ‘cradle to grave’ aren’t. Results For more detail we refer to “LCA: Ten Insulation Materials – Final PCR” done by the VITO for Belgian Federal Public Service Health, Food chain Safety and Environment Directorate-general for Environment - Product policy (March 2013). Ecological profiles could contribute to enhance the environmental performance of construction products by obligatory B2C or B2B-communication on the basis of the LCA results.

---

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>For a possible upcoming MEErP study, we agree a more pragmatic approach is necessary. The functional unit should take into account only the primary function of thermal resistance. Taking into account secondary functions would overcomplicate; this would open the scope beyond isolation materials. We agree with the project team’s proposal to define the functional unit at the product level and to communicate about the restrictions using a product approach. We support the functional unit being defined as 1 m² of a thermal insulation material with a thickness that gives a design thermal resistance of 1 (R = 1 m²K/W) and with a certain expected average reference service life for a specific application. We note that this approach is only interesting to examine the “Cradle-to-gate stage” without taking into account the actual application of the material in the building envelope. Practically this means that you can only directly compare between products of the same sub-group (e.g. only PUR in cavity walls). You wouldn’t know if another subcategory in another building envelope solution would perform better (e.g. Is it better to use cellulose or glass wool in a roof?). For possible Ecological profiles as ‘generic requirements’ (see our accompanying comments), an approach is needed that would allow swift BtoB and BtoC communication, the structure should be taken into account to convey information that allows a potential customer to compare different building solutions. Then the functional unit should be set at least at the element level (cavity wall, exterior isolation, flat roof types, ...): 1 m² of a thermal insulation material with a thickness that gives a design thermal resistance of 1 (R = 1 m²K/W) and with a certain expected average reference service life, taking into account the contributions of the building envelope element it is applied in. This would take into account auxiliary materials and the secondary functions insulation can have (e.g. vapour screen, water screen). Note: Ecological profiles can be calculated, representing significant environmental impacts over the life cycle of a product expressed in physical values (life cycle assessment: LCA). Calculations are done on the ‘functional unit’ from ‘cradle to grave’. If the precise function or the use, transport or EoL scenarios are not known a ‘declared unit’ can be used. LCA is done ‘Cradle to gate’. Environmental impacts of the ‘declared unit’ from ‘Cradle to gate’ are independent of lifetime or EoL, while those of the ‘functional unit’ from ‘cradle to grave’ aren’t. Results For more detail we refer to “LCA: Ten Insulation Materials – Final PCR” done by the VITO for Belgian Federal Public Service Health, Food chain Safety and Environment Directorate-general for Environment - Product policy (March 2013). Ecological profiles could contribute to enhance the environmental performance of construction products by obligatory B2C or B2B-communication on the basis of the LCA results.</td>
</tr>
</tbody>
</table>
### Annex C – Stakeholder comments

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ines OEHME</td>
<td>Federal Environment Agency of Germany</td>
<td>Deterioration of performance over time results from water vapour diffusing through the construction. As far as we know, it is rather a matter of the planning and construction of the wall/ceiling etc. (water vapour permeability of the parts of the construction) than a property of insulation material. This may not be possible to regulate under ecodesign. Anyway, some literature research may be interesting.</td>
</tr>
<tr>
<td>Frank DE TROYER</td>
<td>KULeuven, ASRO</td>
<td>Information on “performance over time” is important but not available.</td>
</tr>
<tr>
<td>Philippe HUGO</td>
<td>Le Relais Métisse</td>
<td>Yes.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>Durability is an important, but complex issue. Long-term performance largely depends on applications, installation quality and use (mechanical pressure, humidity through leakage). As far as products under normal use conditions are concerned, these aspects are covered by the harmonised product standards and only long-term performance values are declared. The Construction Products Directive provides the legal basis for this and specific requirements are determined in the product mandate M/103 for thermal insulation products. Ecodesign cannot add value in this respect. PU Europe has transmitted to VITO details on product life spans. They clearly show that the life span of the insulation is usually similar to that of the building element.</td>
</tr>
<tr>
<td>Agnes SCHUURMANS</td>
<td>Eurima/ROCKWOOL</td>
<td>Canadien studies show that R-values changes over time.</td>
</tr>
<tr>
<td>Edmar MEUWISSEN</td>
<td>EUMEPS</td>
<td>Sustainability of construction products is a highly complex topic to deal with. Especially, data are difficult to collect at a large scale. Some product standards already include indications of this nature for some technical characteristics. Maybe assumed service life could be part of CE marking and the DoP.</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>We’re not sure if we understood the question correctly. But, aging, durability, stability etc should be examined. As they are part of the building envelope and difficult to take out during the use phase of the building, it is not acceptable that some manufacturers have no idea on the durability of their products. We acknowledge the difficulty of this issue, but it is a fundamental one. If the functional lifetime of insulation materials is the limiting factor in lifetime of the building envelope, this would extend life time and probably reduce environmental impact by ‘avoiding’ manufacturing and supply and reducing waste. Also, the impacts associated with stripping and replacing neighbouring components in a building to replace worn insulation would be avoided or postponed.</td>
</tr>
</tbody>
</table>

### Do you think it would make sense to perform practical inspections at the system level?

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ines OEHME  
Federal Environment Agency of Germany  
No.

Frank DE TROYER  
KU Leuven, ASRO  
No. There are too many parameters.

Philippe HUGO  
Le Relais Métisse  
Yes.

Oliver LOEBEL  
PU Europe  
In principle, this would be interesting but, in practice, this is complex and expensive. It would mean that you open a flat roof by cutting through the water barrier or tear down the outer façade of a cavity wall to get to the insulation layer. It is extremely difficult to find volunteers accepting such inspections. PU Europe has faced such problems when it wanted to conduct inspections and identified only two owners accepting the extraction of samples.

Bram SOENEN  
Federal Public Service: Health  
No it would be impossible to attribute performance to a specific building feature. Also what standard use conditions would apply? How could this be practically done? A blower door test for air-tightness is fast, but keeping a building in thermal equilibrium for testing energy consumption is impossible. Similarly laboratory tests of an insulation material applied in all possible building envelope systems seems burdensome for manufacturer.

Do you think the Ecodesign and/or the Energy Labelling schemes, which are based on requirements harmonized at EU level, could be applied to particular thermal insulation systems, to building envelopes (including windows/ventilation systems), or to buildings as a whole, or to the plans/designs of such particular elements, in order to usefully complement/improve the implementation of the Energy Performance of Buildings Directive? If yes, how?

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ines OEHME</td>
<td>Federal Environment Agency of</td>
<td>Energy consumption during use phase of buildings as a whole is sufficiently covered by the Environmental Performance of Buildings Directive and its national implementations. Thermal insulation material is just one side of insulation – especially for new buildings the thermal conductivity of the wall would have to be considered to give a sound picture. It doesn’t make sense to adress plans/designs, too, because plans/designs are done by architects or planners which are not the manufacturers of insulation material. Energy consumption in the whole life cycle may be more interesting to assess, including manufacturing and disassembling of insulation material.</td>
</tr>
</tbody>
</table>

2013/TEM/R/38
### Annex C – Stakeholder comments

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Isabelle BROSE        | EPF                   | A labelling/Ecodesign could complement/improve the EPBD although the approach should be stepwise:  
- Harmonised EPDs for insulation products  
- Harmonised EPDs for all other products in the system  
- Definition of the system to consider: insulation system, building envelope, and/or building itself  
- Labelling/Ecodesign of the whole system |
| Marc BOSMANS          | Eurima                | Construction products in general, and insulation products in particular, are covered by a number of rules and regulations. Amongst these, the Construction Products Regulation (CPR) is the center-piece. Ensuring that all products are covered by CPR, basis for the CE marking, through a harmonized standard is the most important single step that needs to happen. This is currently not the case for insulation products and a main consequence of this is that the declaration of thermal performance (as the most important parameter for tapping the environmental potential of insulation materials) is not regulated in a similar way for all materials. Durability aspects are part of this. Based on these (and other) facts and considerations VITO's intermediate report, in our view rightly, concludes that they see no reasons for supplementary legislation in the form of Ecodesign implementation measures for insulation materials. |
| Frank DE TROYER       | KULeuven, ASRO        | No.      |
| Philippe HUGO         | Le Relais Métisse      | The EPBD could be complemented with relevant information on the label, including thermal performance, heat capacity, fire resistance, hygroscopy, durability, COV labeling, toxicity, environmental footprint. |
| Eric Winnepenninckx   | CEN/TC 128            | Personally, I am hesitant about the usefulness of Ecodesign regulations for insulation products. The energy performance requirements already deal with imposing minimum thermal performance to be obtained by insulation products. Usually these requirements allow the designer to deal with the available tools, taking into account climate and design. However, insulating products are only one part of the bigger picture. The imposition of minimum performance for insulation materials seems an outdated approach. Imposing the determination of thermal performance based on the rules laid down by CEN/TC89 seems advisable, since not all products are sold on that basis. |
### Oliver LOEBEL  
**PU Europe**

What is an insulation system?

The Energy performance certificate introduced under the EPBD could be considered an Energy label at the building level and should not be duplicated. Developing Ecodesign requirements for buildings or, in the case of renovation, building elements could be a way forward, but requires very significant research work and adjustment to local conditions, building types and design solutions. Hence, in practice, it will be impossible and goes far beyond insulation. A label of the full building envelope (including windows) is not sensible. Many building codes are performance oriented and buildings must not exceed a certain energy demand per sqm and year. How this is achieved depends on the specific situation of each building and surrounding climatic conditions. For example, it might be more cost-effective to invest more in renewable sources of energy and less in the building envelope. For smaller renovation works, any labeling is likely to be too complex and costly. For major renovations (see EPBD), it might be an option, if the cost and resource implications and implementation are thoroughly researched and approved before proposing. If, for example, a pitched roof is renovated, you may just replace the tiles, or add / replace insulation, leave or replace rafters, leave or replace beams. All of this depends on the specific condition of each roof. How can a label be attached to this? Also, depending of the existing building structure, certain insulation materials can be more easily fitted than others. This cannot be identified at the level of the insulant but the building element to be renovated. Eco-design cannot contribute to the right selection.

### Edmar MEUWISSEN  
**EUMEPS**

The Ecodesign and Energy Labelling schemes are not relevant at thermal insulation systems level or at the envelope level. The challenges are at the building level. But climatic conditions and national construction practices must be considered. A building energy label is possible, but it should take into account national or regional climate characteristics. EUMEPS feels that additional regulation will only further confuse the market. Proper implementation of EPBD, already requiring energy labelling of buildings, and EED is already a major effort and offer sufficient tools. The non-willing countries will create and use loopholes in additional regulation as they can find them in EPBD and EED. This is rather a national political problem than a regulatory framework problem.
No, we also agree with the general conclusion that Ecodesign requirements and Energy labelling are inappropriate for evaluating indirect effects of insulation materials on energy consumption in buildings. Energy aspects of thermal insulation are covered more adequately by a combination of other legislation:

- The Construction Products Regulation (CPR) has an information requirement for the l-value (thermal conductivity).
- The Energy Performance of Building Directive (EPBD) covers use phase energy efficiency for buildings. These oblige the manufacturers of these products to also declare their performance (thermal conductivity - l-value). Ecodesign would be complicated to apply and would not yield any additional energy savings.

Proper building codes will imply good envelope insulation taking into account other relevant aspects such as air-tightness, heating system, windows, envelope sandwich, ... A builder can make the most suited and cost-effective combination measuring air-tightness, selecting efficient heating systems, choosing double or triple glassed windows, looking at l-values of envelope components, ... Basically you need a type of insulation material for you building solution (tiled roof, brick wall, wood skeleton wall, ...) and you achieve the required thermal resistance by applying a thick enough layer of insulation with a given l-value. Different l-value and different building solutions will mean different prices to be assessed in the budget of the whole building project and the local constraints.

To create a level play field, the Commission should see to it that harmonised standards are drawn up under the CPR for cellulose, sheep wool and other -mainly renewable- insulation materials that currently don’t necessarily bare the CE marking. Attention should be paid to on-site production (e.g. PUR foam) and application (e.g. loose glass wool). These materials should not be treated fundamentally differently than serial produced insulation (e.g. panels and blankets). Clear identification of the responsible for affixing the CE marking is needed (manufacturer spraying equipment, chemicals supplier, installer ?). An appropriate and adapted market surveillance procedure should be possible (e.g. chemicals test, equipment test, ...?). In a similar way standards for insulation of edges and piping should oblige the manufacturers to declare their l-values.

The label for heaters and water heaters is similar. It provides the same efficiency information (accompanied by limits) as the CPR would. EPBD methods should incorporate this information in calculations. The installer label for heaters does something similar at an intermediate system level. It was introduced for practical reasons, to allow evaluations of different products sold separately or alone, but which can also be combined. It was necessary to allow a flexible and fair Energy label.

What would be the benefit(s) of reinforcing the EPD requirements by making them mandatory, potentially complemented by mandatory information on proper installation of the product? Is this a feasible measure for all thermal insulation producers with respect to available data and financial resources?
<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ines OEHME</td>
<td>Federal Environment Agency of Germany</td>
<td>EPD for construction products are a helpful source for LCA data for assessing the environmental impact of buildings. They are less useful for an immediate comparison of construction products. For thermal insulation products, the declaration of general product properties such as thermal transmittance values, are already necessary for their marketing. If for those products the content and/or release of hazardous substances are provided elsewhere, an EPD would only have low additional benefit to achieve eco-design goals. We deem making EPD mandatory for solely insulation products (i.e. when not required for other building products at the same time to allow for an assessment of the entire building) not necessary.</td>
</tr>
<tr>
<td>Isabelle BROSE</td>
<td>EPF</td>
<td>If buildings have to be certified in the future, the need for mandatory EPD is obvious. One problem to be solved at EU level is that there is no (harmonised) EN standard for the application of insulation products (such as e.g. DIN 4108-1 to 10).</td>
</tr>
<tr>
<td>Marc BOSMANS</td>
<td>Eurima</td>
<td>Eurima believes mandatory EPD for all construction products will increase the transparency on the environmental performance of these products. This transparency will induce an increase in the environmental performance of construction products in their intended application. A level-playing field should be created by a mandatory CE-marking under the CPR through harmonized standards covering all relevant environmental issues. this would improve the environmental performance of insulation products.</td>
</tr>
<tr>
<td>Frank DE TROYER</td>
<td>KULeuven, ASRO</td>
<td>EPD should be made mandatory, a database accessible to the public and support to SME’s.</td>
</tr>
<tr>
<td>Philippe HUGO</td>
<td>Le Relais Métisse</td>
<td>Architects and builders must be given the tools to make the best choice in construction materials. As construction techniques are in continuous evolution, as much information as possible should be available for eventual new future building solutions. Producers have to know all properties of their product and how they react in different conditions. This information must be readily available.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>PU Europe supports the establishment of a formal link between EN 15804 and the Construction Products Regulation. Ecodesign measures are not required to do this and the limitation to insulation products would be pointless. PU Europe could support the mandatory provision of EPDs complying with EN 15804 (and product-specific PCRs based on EN 15804) provided generic EPDs (at association level) are accepted. Developing and updating EPDs is costly and time-consuming and requires sound LCA expertise. In particular small producers would not be able to provide EPDs for a wide range of products produced in small quantities. If EPDs were part of the CPR, the verification level would match the existing conformity assessment requirements and should not be more costly to the manufacturer than the procedure applied to declare other critical performance parameters such as lambda and other properties. As regards installation guidelines, see question 5.</td>
</tr>
</tbody>
</table>
### Annex C – Stakeholder comments

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>Concerning information or requirements on recycled content, this would not make sense in practice. Recyclates are not equally available across Europe. Real life stories tell you that, sometimes, there are more profitable applications for these recyclates and you cannot obtain them at all for your own production. Moreover, recycled content is not an aim in itself, as recycling is not a zero impact activity and uses also virgin resources. The best way to address this is through EPDs, as they can provide information on different raw material sources and end-of-life options. By using this information at the building level, EPDs also allow putting the weight of recycled content in the context of whole life performance.</td>
</tr>
<tr>
<td>Edmar MEUWISSEN</td>
<td>EUMEPS</td>
<td>The benefit of mandatory EN15804 standardized EPDs would be that the basic elements to compile a building assessment would be available to constructors and architects. Industry is waiting for the commission and the Member States to implement the TC350 framework (maybe aligned with PEF methodology) is being made mandatory as method to implement CPR BWR nr 7. Different methods private or national create a barrier to trade and confuse the communication around environmental performance of products and buildings and frustrate progress. Note that this requirement should be implemented for all (current) construction products. Only in that way the puzzle for drawing up the environmental profile for a building can be completed. Only doing it for insulation has little added value and will lead to comparison at product level: a way to sub-optimisation rather than a step forward. EUMEPS feels that in the near future quality of installation deserves more attention. Suppliers should provide proper information on the critical aspects of correct installation, however can never be made responsible for the actual installation. Somehow air tightness (blowerdoor tests) and realised insulation (IR-photo’s) could be made part of the standard delivery procedure of a new or refurbished building. Only having this kind of requirements for insulation has little added value and will lead to comparison at product level: a way to sub-optimisation rather than a step forward. EUMEPS thinks that providing information on proper installation is feasible. Experience learns that the installer is often creative in applying the material in other ways, for which a supplier can never be held responsible. Final testing of the end result at building level, often dependent of the quality of installing, might be feasible as well.</td>
</tr>
</tbody>
</table>
Energy aspects of thermal insulation are covered more adequately by a combination of other legislation (CPR + EPBD). So the focus of any Ecodesign requirements should be on non-energy related aspects of insulation materials. There is a huge incentive towards more insulation materials and reduced energy consumption during the use phase. Because of this the embodied energy of construction materials will be dominant for future nearly zero-energy buildings. Also non-energy impacts will increase due to increased material use and later more construction waste. As for energy efficiency, embodied energy and non-energy related environmental impacts should best be addressed at building level. However an “Environmental Performance of Buildings Directive” does not yet exist. If it would, it would depend on standardised environmental impact information being available. This could be done using so called generic requirements in the current Ecodesign Directive. These provide for the disclosure and communication of the ecological profile representing significant environmental impacts over the life cycle of a product in physical values, without judging it or setting limits. For construction products this type of information is becoming available as Environmental Product Declarations (EPD). EPDs could contribute to enhance the environmental performance of construction products by obligatory B2C or B2B-communication on the basis of the LCA results. We ask the Commission to explore the untapped potential of these provisions.

It is key to have a harmonised methodology to avoid double work and market fragmentation. We think that the DG ENV Product Environmental Footprint initiative could also provide the necessary methodology and experience. One of the selected pilot tests is on thermal insulation. In the case of construction products ecological profiles could eventually be meaningfully added up at building level to assess its overall environmental performance.

Could Ecodesign serve to speed up the development of missing harmonised standards providing measurement methods for product information on biomass, reflective foil, cellulose, sheep wool, etc.?

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isabelle BROSE</td>
<td>EPF</td>
<td>On the one hand, EPDs are expensive and not all producers, especially smaller ones (e.g. sheep wool), have money and enough data to develop EPDs. Funding from the EU side would be useful. On the other hand, Ecodesign could speed up the harmonisation of European labels, especially for products with small market shares. This could also help to avoid national stand-alone regulations which require huge effort from EU-wide distributors to meet the criteria from different national regulations.</td>
</tr>
<tr>
<td>Frank DE TROYER</td>
<td>KULeuven, ASRO</td>
<td>No.</td>
</tr>
<tr>
<td>Philippe HUGO</td>
<td>Le Relais Métisse</td>
<td>Yes.</td>
</tr>
<tr>
<td>2013/TEM/R/38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Annex C – Stakeholder comments

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>All thermal insulation materials should be covered by mandate M/103 relating to the CPR. All performance declarations should be based on harmonised test methods. In certain cases, it might be difficult to develop a standard, for example, if the sector is too small and not organised. For such cases, the CPR allows for CE marking based on a European Technical Approval. Putting in place a parallel certification system for these products next to the CPR would not be sensible or cost effective, and hence would not be acceptable.</td>
</tr>
<tr>
<td>Edmar MEUWISSEN</td>
<td>EUMEPS</td>
<td>No, EUMEPS feels that general applicable standards for insulation should be developed within TC88WG1 test methods for insulation products. Missing harmonised standards and even missing ETAGs/ EADs are a problem for the materials with low market share: essential information is often missing. Aim should be a level playing field, all materials declaring properties tested in a harmonised way as far as possible. Methods such as EN 15804 are adapted to bio-based products. For this kind of products, the lack of data should be more of interest. No alternative evaluation methods should be developed for bio-based products. Diverting from this approach will lead to apparently similar declarations but referring to different test methods and will therefore lead to confusion in the market.</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>No, it still are the ESOs that have to do the work. The Commission could identify their policy needs and issue an appropriate mandate to the ESOs. Ecodesign would not speed up things; it takes 4-5 years from tendering the study to publication of the final measure in the OJ.</td>
</tr>
</tbody>
</table>

### Are there any indications that some of the above legislation should be further analysed, because their mandatory requirements applicable to insulation products do not sufficiently cover the related environmental impacts, and there would be room for improvement under Ecodesign?

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isabelle BROSE</td>
<td>EPF</td>
<td>The following legislations should be further analysed: - Directive on the incineration of waste (2000/76/EC), - Council Directive CAFE cleaner air for Europe (2008/50/EC). Waste is a topic which will gain in importance in the forthcoming years. It will be also interesting to focus on the new EU Forest Strategy (COM(2013)659 final published on 20 September 2013.</td>
</tr>
<tr>
<td>Frank DE TROYER</td>
<td>KULeuven, ASRO</td>
<td>Energy-legislation is only partly covering environmental impacts Ecodesign can NOT improve EPD's</td>
</tr>
</tbody>
</table>


Yes. The fact that the question is raised is already an indication. There is confusion on the market about the environmental and health impact of insulation products. The mandatory requirements applicable to insulation products do not sufficiently cover the related environmental impacts and Ecodesign can bring improvements. Indication can be found in the divergent international legislation and reports about environmental and health impact of the insulation products.

We do not believe this is necessary. These are horizontal directives and cannot address individual products.

No, EUMEPS feels that there is little if any room for complementary improvement under Ecodesign related to mentioned legislation. Room for improvement, where possible or justified, should rather be sought for within the scope of existing pieces of regulation.

Not that we know.

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philippe HUGO</td>
<td>Le Relais Métisse</td>
<td>Yes. The fact that the question is raised is already an indication. There is confusion on the market about the environmental and health impact of insulation products. The mandatory requirements applicable to insulation products do not sufficiently cover the related environmental impacts and Ecodesign can bring improvements. Indication can be found in the divergent international legislation and reports about environmental and health impact of the insulation products.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>We do not believe this is necessary. These are horizontal directives and cannot address individual products.</td>
</tr>
<tr>
<td>Edmar MEUWISSEN</td>
<td>EUMEPS</td>
<td>No, EUMEPS feels that there is little if any room for complementary improvement under Ecodesign related to mentioned legislation. Room for improvement, where possible or justified, should rather be sought for within the scope of existing pieces of regulation.</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>Not that we know.</td>
</tr>
</tbody>
</table>

Are implementing measures setting information requirements for the installation of insulation materials feasible and desirable?

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isabelle BROSE</td>
<td>EPF</td>
<td>There is a need for an harmonised EN standard for application of installation products to cover all possible installations properly. The best way should be to develop hENs at CEN level with the availability of technical knowledge. Nevertheless the number of products and types of installation to cover is huge and it could be very difficult to cover all of them.</td>
</tr>
<tr>
<td>Frank DE TROYER</td>
<td>KULeuven, ASRO</td>
<td>Not feasible, context dependent</td>
</tr>
<tr>
<td>Philippe HUGO</td>
<td>Le Relais Métisse</td>
<td>Yes.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>Whilst we would fully support measures to ensure correct installation of insulation materials, we believe that banning DIY would not be acceptable to the public. The question is already stipulated in the CPR in article 11.6 for manufacturers, 13.4 for importers and 14.2 for distributors (“instructions and safety information in a language determined by the Member State concerned”). Art. 36.1c covers systems / kits (“precise instructions given by the provider of such a system or of a component thereof”). Hence, this is done at company level already and does not require duplicating legislation. Using Ecodesign to cover each possible application in each climatic zone while taking account of all national / regional building codes and additional local requirements would be a monster task with not real possibility to check compliance.</td>
</tr>
<tr>
<td>Edmar MEUWISSEN</td>
<td>EUMEPS</td>
<td>No, EUMEPS feels that the newly introduced mandatory DoP within the scope of the CPR should be sufficient. Further gaining of experience in the sector with this new tool is advisable rather than already now introducing something in addition.</td>
</tr>
</tbody>
</table>
### Annex C – Stakeholder comments

#### How do you think proficient installation can be best addressed? (e.g. via Ecodesign information requirements, or via other means).

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ines OEHME</td>
<td>Federal Environment Agency of Germany</td>
<td>We expect information requirements on the installation to bring only limited additional value because craftsmen tend not to consider lots of written information, and because very simple information is too basic to set a regulation. Proper education and continuing professional training of craftsmen and architects are more promising ways.</td>
</tr>
<tr>
<td>Frank DE TROYER</td>
<td>KULeuven, ASRO</td>
<td>Training of craftsmen</td>
</tr>
<tr>
<td>Philippe HUGO</td>
<td>Le Relais Métisse</td>
<td>Working through one channel will be less confusing. Ecodesign information requirements would be a good solution.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>Training of contractors and ensuring individual company product literature covers this.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>Information on disassembly is generally not a product, but a system / design issue. There may be applications, for which disassembly is easy. In other cases, the optimal life cycle performance of a product can only be guaranteed when it is somehow glued to the substrate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Floor insulation: the insulation layer is often placed between two concrete layers. This is difficult to remove at the end of the building life, but there is no real alternative from a design point of view.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Insulation boards glued to facades: If a façade (cavity wall, ETICS) is insulated, any air movement behind the insulation layer (convection) must be avoided in nearly zero energy buildings, as this would cause heat losses. Gluing insulation boards to the façade prevents convection and significantly reduces energy demand during the use phase. In other words, the easiness of disassembly must not jeopardize the functionality of building elements and the resource use during the use phase.</td>
</tr>
<tr>
<td>Edmar MEUWISSEN</td>
<td>EUMEPS</td>
<td>EUMEPS feels that IR-photo’s and air tightness tests (blower door) might be helpful to indicate quality of installation. It might be made part of an Ecolabel system at building level?</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>Starting an Ecodesign procedure just to set information requirements would be awkward. If other Ecodesign requirements are investigated, an information requirement could be included. Additionally, it would be at least as meaningful to address cold bridges and airtightness. Vocational training for architects and installers on this is something that could be better done within the framework of EPBD requirements (see recitals 28 &amp; 29 an Article 20 §3 of 2010/31/EU). Finally, manufacturers of insulation materials would benefit from information on how to use their insulation, and are best placed to explain this. So there is a responsibility here for manufacturers.</td>
</tr>
<tr>
<td>Name</td>
<td>Organization</td>
<td>Comment</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Ines OEHME   | Federal Environment Agency of Germany           | Yes, we consider such information requirements a good tool to achieve environmental policy goals. Such measures are especially important to reach the goal of good indoor air quality by 2020 as envisaged in the 7th Environmental Action Programme of the European Union. Please note that emission aspects have been partly mandated under the Construction Products Regulation (CPR). However, here a declaration of performance will only include VOC emissions, if these are already required in national provisions. This is so far the case for thermal insulation products only in France. Therefore the CPR rules will only lead to better information on the VOC performance of thermal insulation products in France, if the other Member States do not establish further requirements of their own. For establishing equal requirement on the single market the ecodesign directive would be a more transparent and efficient instrument than the CPR. A new horizontal test method for the VOC emission from building products, CEN/TS 16516, is available from October 2013. This method is suitable to assess all thermal insulation products used indoors without a vapour barrier. As a benchmark the so called R value can be recommended. The R value is based on comparison between the measured concentrations of individual VOCs with their lowest concentrations of interest (LCI). Harmonised European LCI values are not yet available, but could be made available on short notice, if supported by the European Commission (see e.g. chapter 4 in ECA report 27 http://bookshop.europa.eu/is-bin/INTERSHOP.enfinity/WFS/EU-Bookshop-Site/en_GB/-/EUR/ViewPublication-Start?PublicationKey=LBNA25276). In addition to information requirements on emissions of volatile organic compounds we support the following benchmarks for thermal insulation products: • No actively used substances that fulfil the criteria for classification as substances of very high concern (SVHC) under the REACH regulation • No propellants with a high global warming potential • Highlight external thermal insulation composite systems without biocides positively in comparison to systems that are based on biocide use • No use of biopersistent fibres With these benchmarks it is possible to ensure that thermal insulation products can be re-used, recycled or disposed of in an environmentally responsible manner after the use phase and do not have to be treated as hazardous waste. For currently used benchmarks in Germany please see: http://www.blauer-engel.de/en/products_brands/search_products/produkttyp.php?id=441 and http://www.blauer-engel.de/en/products_brands/search_products/produkttyp.php?id=604.
<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isabelle BROSE</td>
<td>EPF</td>
<td>Emissions from insulation products during the use phase are very difficult to measure and the emission level also depends on a number of other factors. Harmonised test methods for emission measurements must be defined and there is a need for an hEN standard for the application of insulation products. In a first step, basic measurement methods could be defined, then, as following steps, additional measurement methods could be developed to cover all insulation materials and types of installation on the same basis.</td>
</tr>
<tr>
<td>Marc BOSMANS</td>
<td>Eurima</td>
<td>The suggestion to look further to the emissions of dangerous substances is a valid demand. This is partially covered by standardization under mandate 103 of the EC, which will serve as an input in the Declaration of Performance under the CPR. In CEN/TC 351 only the emissions during the use phase are taken into account and not all emissions to declare are identical between product families. This should be enlarged to emissions of dangerous substances over the whole life cycle of the product and be identical for all construction products, including those materials that are currently not covered under the CPR. The diversity of labels in different Member States on these emissions shows that there is a need for harmonization between Member States and between product families. Products which do not have a harmonized standard are not under this mandate of the EC and do not have to declare their emissions of dangerous substances. This hampers improvements in some product families. A list of insulation product that have a harmonized standard is provided.</td>
</tr>
<tr>
<td>Frank DE TROYER</td>
<td>KULeuven, ASRO</td>
<td>Emissions depend on age of products and construction system (covering layers). Concentration depends on emission rate, ventilation rate and size of spaces and shape. Health effects depend on top of concentration on exposure time (use pattern) and combination of different emissions. Conclusion: emissions can NOT be handled on material level.</td>
</tr>
<tr>
<td>Philippe HUGO</td>
<td>Le Relais Métisse</td>
<td>Yes.</td>
</tr>
<tr>
<td>Oliver LOEBEL</td>
<td>PU Europe</td>
<td>BWR 3 of the CPR provides the legal framework to address this and DG ENTR mandated CEN to develop harmonised test methods. National building codes come under subsidiarity, i.e. Member States can set performance requirements or thresholds for certain substances, the emissions of which a determined through harmonised test methods. PU Europe would not oppose to the mandatory provision of emission data in the product use phase. As insulation products are usually covered by other construction products, it would not make sense to put such a requirement on one product group only. The CPR is already in place and comprises all construction products. The requirement should therefore be addressed in that regulation. It is difficult to see where Ecodesign could offer added value.</td>
</tr>
<tr>
<td>Name</td>
<td>Organization</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Edmar MEUWISSEN</td>
<td>EUMEPS</td>
<td>No, EUMEPS feels that the change of mandate M103, including declaration on emission of dangerous substances, according to TC351 developed methods is the best way forward on this topic. Insulation products in general are not significant contributors to the emissions to indoor air quality. Moreover, they are generally covered and not directly in contact with the indoor air. Therefore, there is no justification or reason to discriminate insulation products against other construction products. To do so could cast unfounded suspicion on this group of products.</td>
</tr>
<tr>
<td>Bram SOENEN</td>
<td>Federal Public Service: Health</td>
<td>Dangerous substances and emissions during installation should be covered in other available legislation (REACH, protection of employees). The impact of insulation on Indoor Air Quality is not clear and we fear opening this discussion would mean that discussions and decisions on other environmental quality indicators is delayed.</td>
</tr>
</tbody>
</table>