Excellence in insulation

Comments of BING
on the Technical Specifications for Green Public Procurement
- Thermal Insulation Background Report -

BING is the European association representing the rigid polyurethane insulation industry (PUR/PIR). Rigid polyurethane foam is a premium insulation material used in a wide variety of applications in buildings, district heating, cooling and refrigeration, and industrial systems.

The Commission has charged AEA (Harwell) with the development of the technical specifications for thermal insulation.

BING wishes to make the following comments on the draft reports

- BING fully supports green public procurement initiatives seeking to promote the development and construction of more sustainable, cost and energy efficient buildings and showing best practice;
- However, BING cannot support the development of “technical specifications” for the construction product / component level, especially for insulation materials. This contradicts existing European initiatives such as the Energy performance of buildings directive and the activities of CEN TC 350 "Sustainability of construction works - Framework for assessment of integrated building performance” which are mandated by DG Enterprise and fully supported by industry.
- This report should have been sent to all relevant European associations representing insulation material manufacturers. However, BING has never been officially contacted and received this report through third parties. This is not acceptable.
- The report focuses too much on the UK and some countries outside the EU which are unlikely to sell insulation products into the EU market. A more European approach would have provided the reader with more practical information. For example, it would have been more useful to refer to the existing activities of CEN TC 350 (sustainability of construction) and CEN TC 351 (harmonised standards on assessment of dangerous substances under the construction product directive) or other Member State activities.
- The future CEN TC 350 standards recognise the need to relate LCA information on construction materials to the end-product, which is the building, in order to be able to make informed choices. The product category rules and environmental product declarations developed by TC 350 should have been used as a basis for the GPP criteria.
  As will be explained later in this document, parameters relating to a weight unit (for example kg) of a construction product do not provide any relevant information on the environmental impact of the product installed in a larger system (building, roof etc.), as there are substantial differences between the various construction products in terms of efficiency, density and weight. This is particularly true with insulation materials, which are

not stand-alone products. They are used in combination with other construction materials (bricks, wood, metal etc.) in order to build walls, roofs and floor elements to a desired overall technical and thermal performance.

- The level to which an insulation material contributes to the overall building sustainability and energy performance highly depends on the building design and orientation, the quality of the works and the local climatic constraints. The insulation material of choice should first of all be fit for purpose, capable of fitting the building design details, ensure the desired level of thermal insulation during the entire use-period of the building and avoid emissions of dangerous substances to the indoor air.
- Insulation materials have a “negative energy balance”, in that they save much more energy over their lifetime than is required for their production. It is therefore essential that sustainability considerations look at the whole product life cycle and not only at the production phase. A material may have a higher primary energy requirement but may save more energy over its lifetime than other materials.

  If one took the focus on primary energy requirements to the extreme, one would have to conclude that no insulation is the most sustainable solution.
- On the other hand, looking at the sustainability of insulation materials from a building’s point of view corresponds to the interests of owners, users and society in general who want durable, efficient and non-hazardous buildings over their entire life cycle. Fixing additional requirements at component level is counterproductive, costly and confusing and hinders the development of integrated solutions using the most adequate insulation materials or components.
- The report does not take sufficient account of the Community legislation in the field of dangerous substances and proposes requirements on the chemicals used in the production that could not be met by any synthetic insulation material, and most probably not by any other insulation material either. The scientific basis of these requirements remains unclear. Although we support a life-cycle approach with respect to environmental performance, the arbitrary exclusion of chemicals used in the production of insulation materials based on their classification (R-phrases) needs to be firmly rejected. The report should refer to the Construction products directive (including TC 351), the REACH provisions as well as legislation for production and work safety. It would have been useful to refer to the recent letter from the CEFIC Director General to Mr. Verheugen regarding coherence between REACH and related "vertical" legislation (27th June 2008) and the cross-industry paper on scientific assessment in establishing ecolabel criteria.
- BING cannot see the added value of fixing extremely high requirements for the recycled content. Recycling for the sake of recycling may be harmful to the environment, energy intensive, expensive and may affect product quality. It is therefore not necessarily the most sustainable mode of production. The criterion should hence be removed.
- In the light of the above remarks, BING calls on the European Commission to launch a dialogue with industry to identify the most appropriate way to take the GPP initiative forward. The report as it stands now is not acceptable and does not allow public procurers to make informed choices.
- Finally, the report gives a certain ranking of insulation materials against some criteria, but not all. Figures are provided for a number of insulation materials, but the selection varies between the tables. Some tables omit to mention certain market-relevant

insulants. It is also unclear whether these figures were calculated using a comparable scientific methodology.

In the following, BING will comment in detail on a number of chapters to demonstrate the need for a dialogue between the Commission and industry on the principles of this report.

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Detailed comments of BING
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Section 3.2.2 Organic oil derived

PUR and PIR are used in many more applications than those mentioned in the document. Widely used applications include also floor insulation, pipe insulation, insulation of industrial installations, ships as well as cooling and refrigeration equipment. More details can be found on our website www.bing.org.

Section 3.2.4 Others (Foil products)

The claims of some multi-foil producers deviate more than 300 % from generally recognised efficiency levels. CEN/TC89 WG 12 AHG 2 has launched work on a standard on the determination of the declared value of reflective insulation products. This will include multifoil insulation, products with reflective surfaces and single layer foils or multiple layers in the form of pockets. The report should make reference to this activity.

Section 4 Key environmental impacts

The report quotes Hubermann and Pearlmutter (2008) saying that "*as operational energy use becomes lower, the role of embodied energy in minimizing overall consumption becomes increasingly prominent*". Whilst this statement is not wrong in itself, it omits to mention that even when the share of operational energy use becomes lower, the share of embodied energy of insulation materials will remain negligible.

Example:
During its in-use phase, a roof with a U-value of 0,19 W/(m².K) saves about 116 kWh/m² compared to a non-insulated roof with a U-value of 1,6 W/(m².K). This corresponds to annual savings of about 12 litres of heating oil per m^2. The savings can be estimated at 600 litres of heating oil per m^2 during a use phase of 50 years.
The primary energy requirement of the commonly used insulation materials amounts to 10 to 15 kWh/m², which is 10 to 15 litres of heating oil.[1]

With regard to manufacturing waste, it is not correct to say that "thermoset polymer products generate more manufacturing and installation waste, again due to the necessity for the product to be cut to size". The production process of most PUR/PIR insulation materials, such as insulation boards, sandwich panels and pre-insulated pipes causes very little waste (6 % according to a Danish study[2]), most of which is re-used or recycled. The application of in-situ spray foam should lead to even lower waste generation.

[1] IBW an der Universität Wuppertal: Vergleichende Studie Aufsparrendämmstoffe

[2] Kortlægning af affaldsprodukter med indhold af polyurethan, Berit Hallam og Simon Graasbøll Rambøll Danmark og Thomas Brønnum, Plastindustrien i Danmark, PUR-sektionen (chapter 3)

On the other hand, the share of production waste would indeed be higher for made-to-measure products cut out off block foam.
Looking at production waste without taking account of reuse would not provide relevant information.

Section 4.1 Summary of life cycle phases

Generally, it should be clearly pointed out, that the look at the energy use within the different life cycle phases makes only sense if it is compared to the total energy savings during the use phase in a specific end-use application.

Insulation manufacture:
It is incorrect to state that “The oil-derived materials have the largest impact in terms of energy consumption and air emissions due to the use of fossil fuels during the production process”.
Indeed, in a given building design, using a low density highly efficient insulation material (even oil-derived) may in fact use less energy to produce than a high density low thermal efficient material (see example below). Construction materials should only be compared at the building/overall element level taking into account the functional equivalence.

Transport to retail unit
It should be mentioned that the emissions stemming from transport are generally lower for lighter and more efficient (lower volume) insulation materials. Heavier insulation materials often have a 10 times higher weight than light materials for a given end-use application.

Installation
Again, it should be mentioned that the emissions stemming from transport are generally lower for lighter and more efficient (less volume) insulation materials. Furthermore, the installation process itself requires less equipment and less fixing devices.

Use and maintenance
The effectiveness of most natural and fibrous insulation materials is affected by damp or compression. PU has a closed cell structure and a very high compressive strength. Maintenance is therefore practically not required and the efficiency of the PU insulation will not significantly change in the case of a roof leakage.

Section 4.2.1 Manufacturing impacts – Energy and water use

As outlined above, BING is strongly opposed to a parameter calculating the embodied energy per kilogramme. This does not provide any useful information on the environmental impact of the insulation material as installed in the end-use application (building, roof, wall etc.). On the contrary, it causes confusion as insulation materials vary substantially in weight, density and thermal resistance. Sensible environmental information can only be obtained when looking at the embodied energy of insulation materials in a given end-use application.

Example:
A 100 m^2 roof is to be insulated guaranteeing a thermal resistance of 3.33 m^2K/W. What is the embodied energy of the insulation materials for this application?[3]

	Thermal conductibility	Thickness in mm	Weight in kg	Total embodied energy
Cork	0.040	133	1,733.33	12,220
EPS	0.035	117	291.67	28,933
PUR/PIR	0.024	80	264.00	33,317
Stone wool	0.038	127	1,520.00	33,622
Glass wool	0.037	123	1,295.00	44,807
XPS	0.036	120	420.00	46,284
Wood fibre	0.050	167	4,000.00	68,000

This overview does not take account of additional materials used for the building structure when heavy insulation products are used.

If at all being considered, BING calls on the European Commission to ensure that embodied energy always refers to end-use applications.

In addition, the far right column of table 2 gives figures with no real link to the global warming potential (GWP). It only compares CO_2 emissions per kg insulation material in correlation within the energy use in production". The table 2 also refers to a series of embodied energy values for which it is unclear whether they are based on comparable methodologies. The ISOPA eco-profile[4] estimates the embodied energy of PU at about 100 MJ/kg.

BING has also doubts about the source of the information relating to water use. The ISOPA eco-profile shows that 1 kg PU foam requires 74 kg of process water. This table shows data uncertainty.

Section 4.2.3 Hazardous materials

It is not understandable why the report puts so much emphasis on blowing agents in the context of hazardous materials. The use of pentane in PUR/PIR insulation foam reduces dramatically our dependence on fossil fuel and its related photochemical ozone emissions (POCP). On a life cycle basis, the use of pentane blown foam, including possible emissions and the impact on POCP, is dramatically outweighed by energy savings and related emission reductions.
Furthermore, the EU risk assessment of pentane has concluded that pentane use in PU foam is not of concern neither to health nor to the environment.

References to CFCs and HCFCs are useless, as their use as blowing agents is banned in the European Union.

The paragraph before the last one, referring to the Montreal Protocol should be deleted as the information given exclusively relates to obligations for refrigerants (virgin and recycled HCFCs) and their specific phase-out deadlines 2010 and 2015.

All references to CFCs in table 4 should also be deleted.

[3] ANPE (www.poliuretano.it) Poliuretano & Ambiente – Life Cycle Assessment (page 15)
[4] Ian Boustead, Eco-profiles of the European Plastics Industry: POLYURETHANE RIGID FOAM, 2005 http://www.isopa.org/htdocs/isopa_site/documents_ns/rigid%20foam%20LCI.pdf

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Section 4.2.4 End of life management

A line should be added to table 5 stating that PU can be recycled if not contaminated or its energy can be recovered.

Section 5 Cost considerations

Although costs are usually the major selection criteria in public procurement, BING doubts that this chapter can provide useful information to the reader. The prices for insulation materials depend on numerous product features (including the facing), differ significantly between Member States and are subject to fluctuations. The report will therefore never be able to provide accurate information and should therefore refrain from giving any guidance in this area.

Tools such Life Cycle Costing (LCC), which take into account the building life cycle (construction, use and end-of-life) are more adequate as they will compare the increased cost related to insulation and the cost savings achieved thanks to improved thermal performance of the building and reduced heating/cooling/hot water bills. Coupling LCC to the building design material requirements can help choosing optimal design solutions. It can also encourage efforts to go beyond the legal minimum efficiency requirements and justify much better insulated buildings.

It would have been useful, if the report had identified existing approaches and informed the public procurer of the current CEN TC 350 standardisation activities under sustainability of construction works – economical aspects.

Section 6.5. The Montreal Protocol on ODS

The reference to the Montreal Protocol is confusing and does not provide useful Information, as it is not relevant in the EU anymore.

Section 6.6. Ozone Depleting Substances (ODS) 2037/2000

This chapter does not provide relevant Information. The last paragraph is not relevant for insulation materials as the provisions are only valid for HCFCs used as refrigerants

Section 7.2.1 Product characteristics

Table 8 omits the fact that several insulation materials have a far lower thermal conductivity than those mentioned in the table. To be more complete, more values should be added. Also, the report does not mention the existing European CE marking process and relevant product standards that identify the various insulation material performance data.

Table 1. Required thermal insulation thicknesses for a given thermal conductivity.

Thermal conductivity (W/mK)	Required thickness (mm)
0.044	270
0.040	250
0.039	240
0.037	230
0.024	ca. 150

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Section 7.2.2.1 Recycled content

BING sees no way of achieving the 85% target for plastics or synthetic polymers. Furthermore, a high recycled content is not a guarantee for an improved environmental performance of the construction product and, even less so, of the building as a whole. Products with high recycled content tend to have lower thermal performance which means that constructions are thicker. This in turn means that extra virgin materials have to be used e.g. foundations will be wider, door frames will be wider, lintels will be wider, rafters will have to be longer and deeper etc. The net effect of higher recycled content could well turn out to be a greater use of virgin materials which is surely counterproductive.
Hence, recycled content should not be included in the material selection criteria. It is far more important to specify that insulation materials should show long-term thermal resistivity performance under various and extreme weather conditions, as this would add real value to the building and, hence, to the public procurer.

Section 8 Conclusions and summary (first paragraph)

It is not understandable why the report focuses so much on EU-wide recognised blowing agents when addressing hazardous substances. PUR/PIR is mainly blown with pentane or CO_2, both of which are considered as non-hazardous (see list of hazardous substances in chapter 4.2.3.). It is also recognised that pentane satisfies the requirements of the UK "Green Guide to Specification" and the Intergovernmental Panel on Climate Change (IPCC) with a Global Warming Potential (GWP) below 5. The WEEE directive does not impose any special recovery requirements for components containing gases with a GWP up to 15.
As outlined in section 4, the energy use during production and transport of the insulation material is negligible when compared to the energy savings over the material's life time. Hence, as soon as one applies an LCA approach, this phrase becomes meaningless.

Section 9 Proposal for core and comprehensive criteria

The table repeatedly refers to blowing agents as the most prominent hazardous substance used in insulation materials. As outline above, this may give rise to misinterpretation and should hence be modified.
The table recommends purchasing of insulation materials with a lower embodied energy. As explained above, embodied energy of insulation materials is not relevant. If considered at all, it should clearly refer to the embodied energy in the end-use application which defines the density and thickness, hence the weight of material to achieve the desire building performance.

The report should focus on the EU legislation relating to the use of ozone depleting substances (ODS), which is very different from the rules in Australia or Korea.
According to EU Regulation 2000/2037, ODS use in foam has already been totally banned since 2004. Such GPP criteria are therefore irrelevant and all reference to the Montreal Protocol and ODS use as blowing agents should be removed.
The third paragraph after the table is partly wrong as explained before (see phase-out dates for HCFCs).

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Detailed comments of BING on Thermal Insulation – Green Public Procurement Product Sheet

2. Key environmental impacts

In general, BING can support the proposal for three core criteria: hazardous substances, energy consumption and thermal resistance. Still, the chapter needs to be altered in two points:

- Again, the authors refer to blowing agents as the main source of hazardous substances. PUR/PIR is mainly blown with pentane or CO_2, both of which are considered as non-hazardous (see list of hazardous substances in chapter 4.2.3. of the background report).
- The table *Key Environmental Impacts* on page 2 once more refers to blowing agents as the most prominent hazardous substance used in insulation materials. As outline above, this may give rise to misinterpretation and should hence be modified.
  The table recommends purchasing of insulation materials with a lower embodied energy. Embodied energy is not a good indicator, and certainly not on a simple per weight or per thickness basis. Choices can only be made by expert judgement at the building level, i. e. by the architect/designer. He will choose the material that fits the intended use and design in the best possible way. If considered at all, embodied energy should refer to the embodied energy in the end-use application which defines the density and thickness, hence the weight of material to achieve the desired building performance requirements.

3.1 Core GPP criteria for thermal insulation - specifications

Generally, the references to green labelling systems outside the EU do not offer real added value as those products are very unlikely to be sold in Europe.

1. Thermal conductivity

BING believes that the criteria should not focus on the product's thermal conductivity but on targeting an ambitious U-value for the building envelop, leaving the design details and material choices to the architect/designer.

2. Hazardous substances

This part needs to be significantly reworked.

BING strongly opposes the requirement that certain substances must not be used at any stage in the production process. The proposed restrictions are completely arbitrary and unfounded. Indeed exposure to any substances used as intermediate in production processes are controlled under EU and national laws. For dangerous substances, exposure limits have been identified and implemented to ensure safe use. Their use in the process chain should not be a GPP criterion. Such criteria will by definition exclude every insulation product whether oil-derived or not. Indeed, any binder used with mineral fibres, any flame retardant used in cellulose or hemp, any fertilisers used in growing natural fibres or some of

the chemicals used in polymers production will include, at some stage of the production chain, the controlled use of classified substances.

Such recommendations must be based on scientific and objective criteria as a result of a life cycle evaluation (see related arguments in the BING letter on the GPP toolkit on construction materials). The references to ODS are confusing as they are already banned.

BING also opposes the requirement that certain substances should not be present in the final product. The presence of a substance in a construction product does not lead automatically to exposure risks or concerns for the health or environment. The provisions of the Construction products directive and, more specifically, the Essential requirement no. 3, require that buildings must not pose health threats to the occupants or environment. CEN/TC351 was mandated by DG ENTRE to develop methods to measure emissions to indoor air or leaching into ground water or soil, considering end-use applications and exposure risks. The GPP initiative must be consistent with this policy and not create additional unnecessary lists of substances.
Incidentally, the numbering of this paragraph is d), e) f)? Why does it not start with a)?

CFCs, HCFCs or HFCs: CFC and HCFC use in foam is clearly forbidden according to EU law. BING does not see the need to emphasize such a topic which is obviously an issue in Korea or Australia.
HFCs, which are a replacement to CFCs and HCFCs can be found in certain PUR/PIR applications and do not have an ozone depleting potential. Several LCA studies have demonstrated their positive impact in saving energy, despite the high global warming potential of some HFCs. Obviously, they save a far higher CO_2 equivalent than they emit. To be coherent with the life cycle approach, this must be taken into due account.
Given the inconsistencies of this chapter, we suggest the removal of all criteria relating to blowing agents.

Any substances or preparations:
See remarks under 3.2.

3. Blowing agents
EU rules clearly require blowing agents to have a zero ozone depleting potential (ODP). Hence, there is no need to specify this in the GPP criteria. The situation is obviously different in Korea and Australia.

5. Minimum levels of recycled content
See remarks under point 7.2.2.1 (Recycled content) of the background report.

Additional award criteria
Point 1: “The bidder can demonstrate that the material has been produced by a manufacturer which has in place effective policies and procedures to minimise:

a. Energy use during manufacture.
b. Water use during manufacture.
c. Waste produced during manufacture through waste reduction and recycling.”

BING believes that environmental management standards such as EMAS or ISO 14000 shows proper site management which does not necessarily ensure that materials will have a lower environmental impact as it will not influence whether or not such materials will be installed properly and for the right application. Correct product choice for the application and correct installation are much more relevant for achieving sustainable and energy efficient buildings.

Point 2: “The manufacturer provides a minimum of 20-year warranty against defects in workmanship and materials.”

BING supports such an approach. Indeed, the durability of the insulation material under increasingly extreme weather conditions is critical to reduce a building’s environmental impact during its lifetime. Insulation products are usually incorporated in the building envelop and therefore difficult to replace in the event they lose their thermal performance e.g. through settlement or water ingress. Long-term warranty on a building’s energy efficiency performance is hence critical.

3.2 Comprehensive GPP Criteria for Thermal Insulation

See comments under point 3.1. of this document.

4. Cost considerations

See comments in section 5 of the background report.

Brussels, 5 September 2008