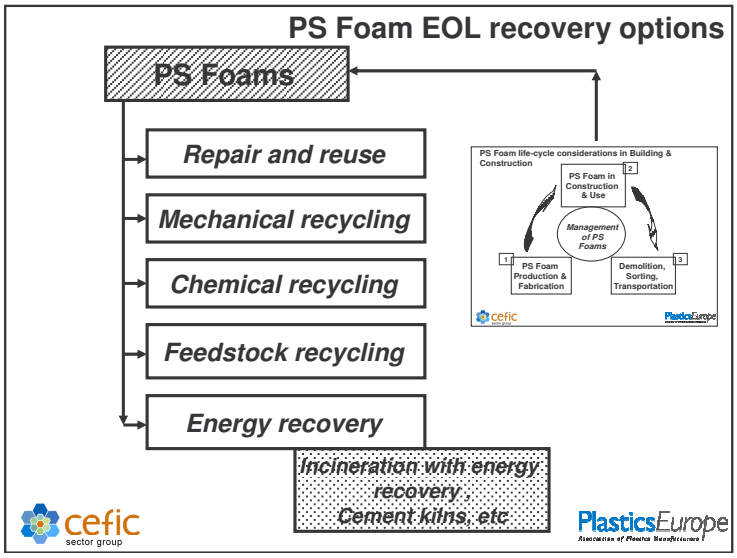
Best practice for the End-of-Life - EoL management of Polystyrene Foams in Building & Construction

Introduction

Industry is seeking to realize a balanced approach between resource efficiency and the elimination of hazardous substances over their life-cycle when EoL matters are considered. Whilst Polystyrene (PS) foams can be safely used and recovered, the selection of a particular EoL option at various stages of their life-cycle – production, construction and demolition phases – will vary according to a combination of criteria such as environmental sustainability, technical feasibility and economic viability. While HBCD is safely incorporated in the PS foam matrix, in order to satisfy existing and forthcoming regulatory demands, the incineration with energy recovery option is today the most efficient recovery route, all aspects considered.
Besides this requirement for a balanced approach on resource efficiency and the elimination of hazardous substances there are additional technical and economic constraints that require full attention before selecting the most appropriate EoL route. The phase-out of Hexabromocyclododecane (HBCD) from PS foams will directly influence the preferred selection of the recovery options with a tendency towards increased re-use and recycling. The various criteria and limiting factors are further illustrated in the document.

Industry's EoL Recovery Approach

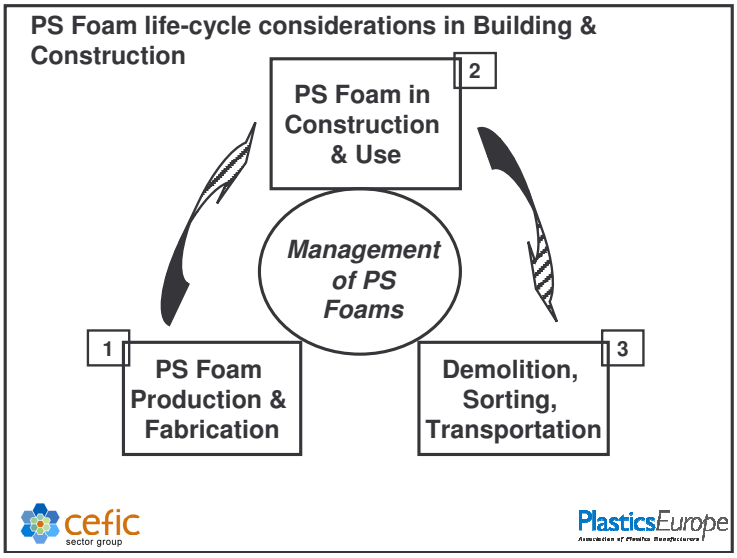
The approach displayed here has been promoted by the Plastics Industry for over 20 years and remains valid for the Polystyrene Foam sector and is in line with the EU waste hierarchy. The EoL recovery scheme is displayed in figure 1 below whereby the selection of preferred options follows the top-down approach.



Whilst re-use and recycling tend to be environmentally preferable, they require a regulatory framework, infrastructures and logistics in place that are capable to handle the flow of material in large quantities to the points of processing. Energy recovery in state of art municipal solid waste incinerators is able to cope efficiently and economically with decentralised waste occurrence, whilst at the same time valuable energy can be recovered and hazardous substance additives can be safely destroyed. The polystyrene foam industry and associated industries have undertaken a number of trials and studies to further the knowledge of all aspects of incineration with energy recovery of polystyrene foams. Tests included

emission measurements of co-combustion flame-retarded extruded polystyrene foams (XPS) in the TAMARA pilot Municipal Solid Waste Combustor (MSWC) plant several years ago. These tests were conducted among others on the assessment of hydrogen bromide (HBr) in the flue gas as well as the possible formation of brominated dibenzo-p-dioxins and dibenzofurans. The trials delivered scientific evidence that polystyrene foam waste can be incinerated safely within the municipal solid waste unit, even though it contains brominated flame retardants such as HBCD. Today industry is preparing for new large-scale Municipal Solid Waste Incinerator (MSWI) investigations designed to demonstrate the appropriate destruction of HBCD in the incinerator.
While the Plastics Industry as a whole considers landfilling the least preferred EoL option, it is still being practised in those EU member states lacking sufficient MSWI capacity. It is understood that this situation is likely to change with future EU waste regulations and related investments over the next decades to increase the EU capacities for MSWI.

Life-cycle Best Practice for Polystyrene Foams
The key PS Foam life-cycle considerations are displayed in figure 2



Specific considerations in relation to the PS foam waste recovery options are as follows:
1- Production recovery policy
Prevention of waste during the PS foams product manufacturing by internal recycling is a natural part of the process of the PS Foam industry. This "production waste" becomes a source of secondary material after shredding and is therefore not really considered as waste as it does not leave the production site.
Improved production planning and manufacturing techniques mean that production scrap is constantly being reduced. Recycling from other external sources (e.g. clean scrap from new construction sites, off cuts from intermediate fabrication stages) can also be used in the production process.
2- Construction recovery policy
Reducing, reusing and recycling waste can also be practised and help to reduce costs on construction projects. By asking for good practice from an early stage in the design and planning process, clients and contractors can secure savings and demonstrate corporate responsibility. Such commitment would also involve the training of the various people including operatives on material management, handling and waste reduction so as to raise

awareness before the start of construction. Equally contracting companies ought to be appropriately qualified to undertake the work. Recycling PS foams supports resource efficiency both from a material perspective and from the excellent property that these insulation products have in reducing energy consumption over their long service life.

3- Demolition recovery policy

PS foam products keep their initial properties, they don't deteriorate over time. These products, if in good shape can easily be reused. In case of renovating a leaking roof for instance the insulation is not affected by moisture and can remain in place when the roof is repaired. Equally the PS Foam industry offers products that are deconstructable and reusable at the end of their useful life.

Effective reuse and recovery is not achieved through material and construction properties alone. The necessary organisational structure must be in place in order to collect the material, rework the material to separate it from other materials that make up a finished product and to transport the clean material for recovery, preferably re-use or recycling.

In general, design for deconstruction and selective dismantling are encouraged and, if in good condition, the material can easily be reused.

When taking a building down it is advisable to identify the categories of foams beforehand, to remove the foams undestroyed, to prepare the foams for recovery and to organise the end-of-life options according to best practice. The recycling of demolition waste, including PS foams from building deconstruction is however complicated by the fact that these may be contaminated with concrete and other materials,

Therefore, since at present during deconstruction it is often not possible to separate the different categories of foams, incineration with MSW offers the only possibility to manage on a large scale the waste streams that arise from building demolition.

Since in today's market reality the composition of polystyrene foams obtained from building demolition is indeed usually unknown and, as long as these foams will contain HBCD, it is highly recommended that the foam should be transported to the nearest suitable municipal solid waste incinerator. At a time when PS foams will contain alternative flame retardants the reuse and recycling options are likely to gain in importance.

Incineration with energy recovery in state-of-art municipal solid waste incinerators is a realistic and environmentally responsible solution for the waste management of PS foams from the demolition of buildings. Energy recovery is a key process in the clean and sustainable waste management of post-consumer PS foams.

Summary

Polystyrene foams are energy efficient materials throughout their service life. When salvaged from the demolition of buildings, insulation foams are usually expected to have served more than 50 years and during this service life the foams will have saved at least 100 times more energy than the fossil fuel used to produce them in the first instance. It seems logical therefore to optimise the efficiency of these materials by applying best practice to the life-cycle management, including the choice of sustainable recovery options. Reuse and recovery would be the obvious choice for maximising resource efficiency when this is economically viable. However, the impact of environmental legislation, due to the HBCD content of PS foams, could result in incineration with energy recovery as an option of choice for a certain time period to come, despite evidence to suggest there is no risk from HBCD incorporated into foams. Options in practice will evolve as HBCD is eliminated in future PS foams. And as the future quantity of PS foams from building waste increases, a combination of EoL options will be required as no one option will be able to meet all requirements.