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ALF-CEMIND Project:
Supporting the use of alternative fuels in the cement industry
Specific Support Action

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An analysis of the legal & policy framework; policy recommendations for further exploitation of AF and AM in cement industry at EU level

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Introduction

The ALF CEMIND project focuses on alternative fuels and alternative raw materials for the cement industry. Now these aspects are also offering important interfaces with policy issues as energy efficiency, CO_2 emissions, waste handling and environmental policies in general.
Replacement of raw materials is less a subject for debate than the use of alternative fuels. But the difference between alternative raw materials and alternative fuels is – especially in the cement industry – often a thin line. The cement production process has the considerable advantage above other processes for energy conversion of waste, that most non-combustible components are in fact replacing raw materials.

Cement industry and other users of alternative fuels

Let's look briefly at other outlets for the alternative fuels. The most important are the energy conversion of biomass (and/or waste) for electric power and the incineration of waste. From the point of energy efficiency the co-combustion of rest fuels in (coal fired) power plants offers the highest electric efficiency ($\pm$ 40%). And electricity is a high quality form of energy – the value per kWhr being in the range of 2 tot 2,5 the value of (low/medium temperature) heat. Also the NO_x emissions are strongly regulated and comparatively low. Rest heat from the power plant can mostly be used to a modest extent at best as this requires the vicinity of heat demand from industry or residential area's. And these power plants are usually located far from city centres.
A disadvantage is the non-combustible content of the rest fuel. In electric power production the non-combustibles end up in the fly ash or bottom ash and are as such a source for a new stream of rest products (often going to the cement industry). The quality the further use of these rest products of coal/biomass fired power plants depends heavily on the homogeneity and the chemical composition of these ashes. In a (very) concise SWOT analysis this would argue for the use of high energy rest fuels with preferably low ash content and a chemical composition, which does not negatively affect the overall quality of the coal derived ashes. An example could be forestry rest products and fairly clean biomass streams in general.

Waste incineration – often combined with some electricity production – is the best equipped outlet for those rest streams which contain dangerous or harmful components. Installations can handle waste with enormous variety in composition – including elusive components as mercury. Waste incineration is obviously also a strongly regulated area and consequently NO_x emissions are fairly low. The electric efficiency is however much lower than power plants (22 – 25%) and the use of waste heat is usually also mostly very modest –for the same reasons as power plants. As the input of the waste is chemically less defined and variable, the quality of the ashes is much lower

and these ashes must either be land filled or used in lower end applications (road beds et cetera). This would argue for those rest streams which contain harmful or dangerous components.

When incinerated in the cement kiln by far the most positive point is the use as source of energy combined with replacement of raw material. Most non-combustibles are taken up in the cement matrix and simply result in less consumption of marl. There are simply no solid rest streams comparable to the ash and slag streams of the other processes (waste incineration and co-combustion of waste, digestion of waste). Looking at the energy conversion the high kiln temperatures assure a high combustion rate. Overall efficiency is therefore quite good and compares favourably with the alternatives of power production or waste incineration. The process does not produce electricity so the *exergy* of the application (thermal process heat) is less than electricity, but this is indeed offset by the replacement of raw materials. NO_x emissions are usually higher than the other processes but the process and the emissions to air are strictly regulated. The high temperatures and long residence times also result in the destruction of various harmful organic components. So the overall balance can be – and for quite some rest streams is – positive.

For the cement industry outlet this would argue for those rest streams which are composed of a larger content of non-combustibles (e.g. sewage sludge) and a chemical content which allows good blending in the cement matrix.
An important point is the economic aspect. Waste incineration always requires a substantial negative gate fee to be economically viable. When used as an alternative fuel in the cement kiln, the gate fee can be positive or negative – totally depending on the effects on the process (and market conditions).
These aspects induced a European Court of Justice ruling that using waste as a fuel in cement kilns should be classified as recovery, while burning municipal waste in dedicated incinerators, even with energy recovery, should be classified as disposal.

A second point is, that the alternative outlets (especially waste incineration) are not always available. This reduces the alternative options quite often to land filling.

Currently on-going policy developments

Against this background the cement industry is faced with a number of important EU regulations. When looking at the considerable variations – per country – in the percentage of alternative fuels, the impact of the EU and national regulations and policies becomes apparent. The most obvious example is perhaps the waste policy in e.g. Germany and The Netherlands, which prohibits the land filling of organic waste such as sewage sludge. The effect is – in this case - favourable for the use of alternative fuels in the

cement industry. The incineration alternative for sewage sludge – which contains substantial amounts of non-combustibles – is very costly.

EU Waste Framework, Incineration of Waste Directive and IPPC

Currently the EU Waste Framework directive is being discussed and reviewed. The same applies for the Incineration of Waste Directive and the IPPC. Important from the point of view of the cement industry in these negotiations is the classification of co-processing in cement plants as recovery. A point of concern is the issue of self sufficiency and proximity of waste handling. These concepts may - as a negative and possibly unintended side effect - prevent the efficient use of waste streams in cement kilns.

The overall effect of increasing regulations in waste management may well be favourable for the use of alternative fuels in the cement industry – as the German/Dutch example in the domain of land filling indicates. One of the findings of the ALF-CEMIND study was, that the national waste management policies (or the lack of enforcement of these policies) were often a main barrier for the application of alternative fuels in the cement industry.

ETS

The European targets for CO_2 emission reductions also both offers threats and opportunities. The fairly recent emerging of the ETS (Emission Trading Directive 2003) is an example. As biomass is declared to be CO_2 free, the use of biomass rest fuels is greatly encouraged. On the other hand the 'competition' for the available biomass streams becomes very much apparent. The specific CO_2 targets for electricity production and the targets for biomass use as automotive fuel strongly jeopardize the cement industry access to these alternative fuels. The markets for biomass products are increasingly affected by (national) green electricity grants as well as obligatory biomass shares in automotive fuels. As the margins for acceptable energy costs in the cement industry are modest (energy is a substantial cost factor in cement production), the overall effect of ETS on biomass use in the cement industry is less certain. EU Commission proposals for the revision of the ETS are expected in the beginning of 2008 and the cement industry and it's association CEMBUREAU are closely following the discussions.

A complicating aspect is that the views on the issue of biomass-to-energy conversion are strongly shifting. The earlier and perhaps too simple concepts (e.g. the biomass to energy conversion is carbon neutral axiom) are now openly criticised and replaced by more balanced & conditional views. So the ETS issue is – like the waste policies – a moving target.

Findings & Policy recommendations

One overall finding was at the end of the day, that technology was not really the most important issue or constraint in this domain. For one thing the ENCI cement kiln (Heidelberg Cement Group) was built in the sixties and is fuelled by more than 90% of alternative raw materials. More modern multi-stage kilns should be at least as capable of handling similar alternative fuel loads. Also in most investigated cases it is also not a lack of technical know how.

Most of the cement plants are subsidiaries of larger multinational concerns and are quite capable of implementing the technology. But as discussed before: more is not necessarily always better. For each larger stream of alternative fuels a careful and objective Life Cycle Analysis of the total process compared to the available alternative options would be useful. As the objectivity of these studies is served by independent funding, it is recommended that funding is made available to perform these LCA studies and, more important, to have the results in the public domain.

An obvious recommendation is to encourage faster introduction of sound waste management policies. The knowledge generated in the studies above could contribute to the development of these policies. But the issues and concerns of the cement industry – though important – are not and should not be the driving force. The driving force should be internationally accepted sound waste management strategies - and the cement industry might well benefit from this.

A separate item is perhaps the use of alternative raw materials in casu blast furnace slag. This option has few negative side effects and is generally considered to be recommendable. The effects on CO_2 are substantial. One ton of BF slag avoids roughly one ton of CO_2. In The Netherlands approximately one mln tons of CO_2 emissions are avoided – at basically zero cost to society. The product, blast furnace cement, is for some applications even to be preferred to the conventional Portland cement types. The transition to BF cement is however a long and difficult educational process in this predominantly conservative market of the building industry. It is recommended that the EU Commission reviews the options to assist the cement industry to adopt a higher percentage of blast furnace cement. This could be in the form of (modest) financial support for information sessions, knowledge transfer and especially initiatives to bring the steel and cement industries together. The BF option requires new or at least unusual cooperation between two fairly unrelated branches of industry and may not necessarily come by itself. The level of support could be modest, basically some funding of personnel (accelerators).

When looking at the major historical energy policy steps of the last 30 to 40 years one can see the following sequence. We – the then 12 member EU – started with energy conservation (efficiency) as a response to the oil crisis in the 70ties and 80ties. Major targets were the industry and the build environment. Heat was addressed more than electricity (and rightly so : energy consumption in the form of heat is an very important of overall energy consumption). Also : this – Heat and/or Industry - was (and still is) an area of comparatively quick wins. Pay back periods are way lower than other energy options.

Focus shifted in later years first to greening of electricity production. And after that the following trend was the shift towards green(er) automotive fuels. Carbon dioxide replaced the original driver of ‘independency and

security of supply'. Both 'heat' and 'energy efficiency in industry' suffered to some extent as policies (and funds) were increasingly targeted to those new domains. Nowadays we must face that these policies might be readjusted again. If the EU wants to reach the proposed Co_2 targets without (re)addressing Heat and/or Industry it is going to be very costly. Also the implicit disadvantages of green electricity (costs, storage, negative effects on grids) and green fuels (costs, competition for land, food, water, and last but not least the growing concerns for the true well to wheel CO_2 balance) are becoming more apparent every day.

Now the domains of Heat (both industry and other users – e.g. the build environment) still offers an enormous potential for energy efficiency, renewables and CO_2 reductions. And often at less costs per avoided ton of CO_2 – compared to green electricity and green fuels. So one obvious general policy recommendation would be to shift Heat again upwards on the agenda of ETS, ETAP (Environmental Technology Action Plan) and the Strategic Energy Technology Plan. We simply can not afford to focus. To leave this vast and relatively inexpensive potential untapped is costly and ineffective. The recommendation is therefore to better (re)integrate Sustainable Heat in these programmes.