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## Alternative fuels – history and outlook

At the beginning of the 1950s scrap tyres were used in Germany for the first time as a secondary energy source in the cement industry. Since then much has changed. Dirk Lechtenberg of MVW Lechtenberg, Germany, reports on the history of secondary fuel usage and gives a forecast on the future potential of secondary fuel utilisation in the cement industry.

Even today one sees in many cement plants in Germany the previously employed technology whereby tyres are fed into the kiln inlet by hand. Especially in the developing countries, simple technologies and processes are used today in order to lower costs.

In 1950 the oil price stood at around US\$2 per barrel. Fossil energy sources were cheaply available, so there was hardly a need to trade in order to use alternative fuels. At today's prices of around US\$100 per barrel it is understandable that alternative fuels are enjoying in-

pioneer was the Westphalian cement industry. This was a region with around 20 clinker producing plants at that time, which, in a radius of around 100km, were facing strong competition from each other. The BRAM concept comprised a preference for separating high-calorific value light foil and paper fractions from industrial and household waste by means of screens and separators. The thus separated fraction was comminuted by means of a most simple crusher and high-speed cutting mills and fed pneumatically to the rotary-kiln via the main burner.

It became quickly evident that the fuel extraction from mixed household waste was problematic. The household waste was collected in a mixed form and regularly suffered from greater contamination of lead and other heavy metals. A higher chlorine intake also led to production-specific problems.

At the end of the 1980s one company began to separately collect high calorific-value and uncontaminated production waste such as, for example, labels, films, waste from car production plants and use it as secondary fuels. The Westphalian cement industry was also a pioneer in this. High additional payments for acceptance of waste financed the formerly energy-intensive and technically complicated processing.

In 1986 around 5% of the thermal energy requirement in the Federal German cement industry was covered by alternative fuels. Through targeted technical and process technological optimisation, secondary fuel use was constantly optimised so that some plants in the meantime replace up to

100% of the thermal energy need through liquid and solid secondary fuels.

Secondary fuels in the meantime are used in many cement plants as 'standard fuel'. Through targeted, quality controlled measures and constant monitoring it can

**Table 1:** Consumption and average calorific value of alternative fuels in Germany in 2006

Alternative fuel	Consumption (1000t/a)	Calorific value (MJ/kg)
Tyres	265	27
Waste oil	69	27
Fractions of industrial and commercial waste:		
• Pulp, paper and cardboard	244	5
• Plastics	363	23
• Packaging	0	0
• Wastes from other textile industries	9	18
• Others	754	20
Meat and bone mean and animal fat	317	17
Mixed fractions of municipal waste	212	14
Scrap wood	14	14
Solvents	93	24
Fuller earth	4	8
Sewage sludge	238	4
Others, such as:		
• Oil mud	32	16
• Organic distillation residues		

creased popularity and the cement industry worldwide has an increasing need for this 'new' energy source.

At the end of the 1970s/beginning of the 1980s alternative fuels from waste – 'BRAM' – were used in the cement industry for the first time in Germany. The

be seen that, apart from the financial advantage, the environment especially is unburdened.

### Which preconditions do alternative fuels have to fulfil for the cement industry?

Waste materials can be used as alternative fuels provided that they do not contain harmful substances. In particular the presence of polychlorinated biphenyls (PCBs), chlorine, sulphur and heavy metals is either specifically precluded, or limited, in line with State or local regulations. Alternative fuels are only used in cement plants when their composition is in compliance with local regulations.

The basic principles for the use of RDF are as follows:

- The chemical quality of the fuel must meet regulatory standards, assuring environmental protection;
- The calorific value of the fuel must be stable enough to allow control of the supply of energy to the kiln, as the achievement of homogeneous clinker requires a well controlled combustion process;
- The physical form of the fuel must allow easy handling of the material for transportation and a controlled flow into the kiln;
- The fuels must not introduce chemical species into the clinker production process that might be deleterious to the stability of the process or the performance of the product.

Apart from alternative fuels, more and more alternative raw materials are used, e.g. as a calcium provider. This is how MVW Lechtenberg has already realised a few projects in which 'curious' raw materials are also used, such as egg shells from egg liquid production or mussel shells.

Alternative replacement materials are gaining ever more importance as additives, e.g. in nitrogen reduction, MVW Lechtenberg successfully used, as an example, poultry litter or biological waste materials from the pharmaceutical industry as a trial in the ce-

ment industry. Furthermore, fixer and developer from the photographic industry are used as a matter of course for denitrification in the cement industry.

Of special importance is the worldwide role of the cement industry as a reliable communal disposal partner. Since the recognition by the EU that the use of secondary fuels and raw materials in the cement industry is seen as 'recycling' and not as 'disposal', an international legal basis was created.

Ever since the climate change has become a main topic for discussion in the boardrooms of cement companies, the idea of sustainable development has become a hot topic. As a result, waste evaluation and CO<sub>2</sub> reduction have become everyday language in the cement industry.


Entire environmental departments have been established in the large cement concerns which concentrate exclusively on secondary fuel and raw material procurement. Just to name a few examples: Holcim has established, in the form of Geocycle, a company department of its own; Lafarge has created a trading instrument with the internationally active Resource Recovery Department which deals professionally with this subject area.

The Portuguese cement industry in general is also focusing more and more on the use of alternative fuels. At the end of 2007, MVW Lechtenberg was awarded a contract for the realisation of two secondary fuel production plants in Portugal using industrial wastes. The company SGR Sociedade Gestora De Residuos, SA, Seixal, was able, in conjunction with MVW Lechtenberg, to conclude a long-term contract to supply high quality alternative fuels to the portuguese cement group Secil Companhia Geral de Cal e Cimento.

MVW Lechtenberg takes on the design of the processing plants as well as the constant quality monitoring of the produced alternative fuels. The first plant is scheduled to go into production in April 2008 and to produce around 70,000t/y of alternative fuels.

### Summary

Key questions to ask in this discussion are: What influence do alternative fuels and raw materials have on the clinker production process? What legal and economical framework can the cement industry work within when using alternative fuels?

Using case-studies from cement plants from all over the world, Dirk Lechtenberg will present possibilities and framework conditions over the next few months in Global Fuels Magazine for secondary fuel usage in the cement industry. The series of articles begins in the next issue with a case study from Pakistan, where MVW Lechtenberg has realised a project in which household waste from Rawalpindi city is processed and used as a secondary fuel in a cement plant. In particular, the effects on clinker production as well as on the economic framework conditions will be highlighted. 

**Below:** Mussel shells as cement raw material

