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PRE-PROCESSING V CO-PROCESSING

When the first alternative fuels were used by German and Austrian cement plants in the 1970s, the materials were coarse and the feeding systems were unsophisticated by modern standards. The robustness of the clinker manufacturing process in rotary kilns permitted the introduction of lumpy particles that required long retention times for complete burn-out. Such fuels included whole tyres and tyre chips injected into the kiln inlet chamber where they could provide up to 20% of the thermal energy demand of making clinker.

It didn't take long before the economic benefits of using 'wastes' became more widely appreciated in the sector. This led to increased use of different types of refuse-derived fuels (RDF) such as pre-processed municipal waste and plastic fractions from industrial production residues.

However, the limits of the early approaches were soon reached. Plants could not cope with thermal substitution rates (TSRs) above 20% simply by feeding more coarse and lumpy fuels to the inlet chamber. If further increases in TSR - and the associated fuel cost savings - were to be realised, they would need to come through other approaches. First, producers mixed highly-calorific, small size RDF into the main burner fuel. Later on, as the pre-calcination process became increasingly widespread, injection of RDF into the calciner allowed overall TSRs above 40%, albeit with the introduction of chlorine bypasses to circumvent sticky agglomerations in the kiln inlet chamber and lower parts of the calciner.

KHD Humboldt Wedag's Matthias Mersmann discusses the fine balance between pre-processing and co-processing...

But... What is an alternative fuel?

Over time, the number of materials used as AFs increased. But what our sector refers to as 'alternative fuels' actually comprises a ***HUGE*** range of materials with differing physical and chemical properties. In truth there is only one commonality between them: They are made from materials that were not initially produced to serve as fuels.

By their very nature, the properties - particularly the particle size, chemical make-up and moisture content - of most potential AFs are not 'plant ready.' The clinker production process needs thermal energy to be released in precisely-designated areas of the sintering zone and in the calciner. Thus, AFs need to be pre-processed according to the plant's requirements in special pre-processing plants.

Pre-processing v Co-processing

The economical use of any kind of AF in a cement plant is a matter of finding an appropriate balance between pre-processing and co-processing. There is a simple play-off between the two: The more effort spent on pre-processing, the less complicated the co-processing process needs to be. This is intuitive, as finely ground and intensively dried AF particles will burn easily, for example in the main burner, without the need for complicated combustion technologies. In contrast, large, wet and only slightly pre-processed lumpy AF particles may need a special reactor to help them fully combust. Once this has been achieved, the co-processing in the cement plant can be carried out.

Co-processing technologies

In many developed countries the preferred approach tended towards higher pre-processing effort to produce plant-friendly AF that was easy to burn. Indeed, several attempts to 'standardise' RDF have been made in the hope of further streamlining the markets and technologies for its use. However, as the main motivation for AF use is reducing cost, each plant seeks out every opportunity to optimise the balance between its pre-processing and co-processing costs on its own terms. The balance is almost unique for each plant. What is deemed important by one producer may not be important to another.

This mismatch, combined with the inconsistent global availability of various types of AF and the varying technical capabilities of cement plants, means that attempts at RDF standardisation have not found enough support thus far.

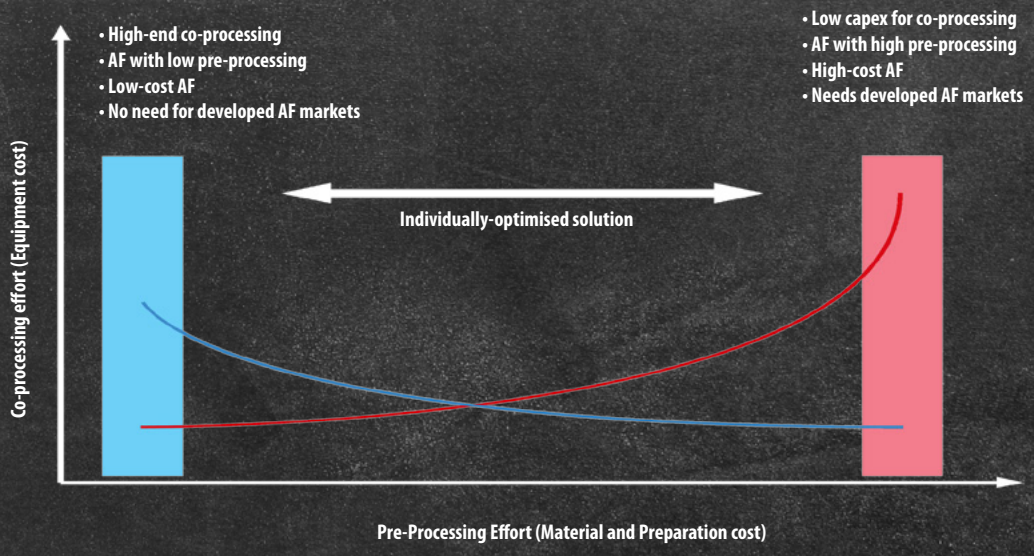
However...

Figure 1 shows the general interdependence of investment cost for pre-processing and co-processing of AF in cement plants with respect to AF quality. As the respective installations for receiving, storage, handling and dosing of AF have to be arranged regardless of the degree of AF pre-processing, this base investment forms a plateau for using AF of any quality. From this point onwards the pre-processing costs rise significantly with any further quality increment.

Going forward

The capital expenditure costs of installing equipment for highly-processed AF do not differ too much from those for low pre-processed AF. However, the cost benefits of using less heavily processed AF compared to a highly-processed AF represent a remarkably lower operating expenditure over time.

This, and the increasing urge to use a higher amount of mostly wet and hard to ignite biomass AF, leads to the trend that cement producers are increasingly looking for technologies that can handle any type or quality of AF. This provides flexibility to their AF procurement process and, at the same time, saves on pre-processing cost, regardless of whether the plant does that itself or has it delivered by an external supplier.



Left - Figure 1: General interdependency between pre-processing effort and co-processing effort.

Cost of Pre-Processing

Cost of Feeding Equipment