Global Fuels 2012 review

6th Global Fuels Conference 2012
5-6 March 2012

Image gallery for the 6th Global Fuels Conference 2012

The 6th Global CemFuels conference has successfully taken place, in Aachen in Germany, on 5-6 March 2012, attracting 150 delegates from 22 countries, including 25 presentations on alternative fuels in the cement and lime industry, an exhibition of 17 stands and including a field trip to HeidelbergCement's ENCI plant in the Netherlands.

Delegates from around the world assembled in Aachen, on the borders between Germany, Belgium and the Netherlands, to share information on the latest state-of-the-art in the use of alternative fuels (AF) in the cement and lime industries. The first speaker at the conference was Dr Jean-Marie Chandelle, secretary general of Cembureau, the European cement association. He pointed out that, while the cement industry is energy intensive, it has been successful in reducing its energy use to the point where, technically, only another 2% improvement in energy intensity is now achievable. He pointed out that forward energy prices are increasingly adding an impetus to use of alternative fuels, particularly biomass, which is carbon neutral. The European cement industry has to operate under a level of 766kg/t of CO_2, which is most easily achieved using alternative fuels. Europe leads the world in the proportion of alternative fuel used in its cement industry at 28%, and is seeing biomass increase quickly as a proportion of fuel used. Cembureau has successfully argued that the cement industry recovers the energy and minerals in waste streams, so that the cement path (rather than incineration) is now favoured throughout the continent, despite the fact that many states seem not to take waste disposal very seriously. There is still a great deal of potential in the supply side of waste-derived fuels in Europe. One area for potential growth might be the reclassification of specialised 'waste' streams as 'non-waste' which will make them easier to use, although there may be unexpected and unwelcome results of such a change, warned Dr Chandelle.

Jan Theulen, global waste co-processing manager for HeidelbergCement, stated straight away that the future position of the cement industry will be that we will be fighting for the best of the waste streams. He went on to speak about local case studies, including the ZA-oil waste produced from local sulphuric acid producer DSM. The waste is extremely well characterised and is first passed to a waste management company which then passes the material to a handling company which then supplies fuel to the ENCI Maastricht cement plant. From start to completion, the project for the use of ZA-oil took less than three years. In a second case study, HeidelbergCement used sewage sludge from a wastewater plant in the centre of Germany, which had a phosphorus content of 1.5% P_2O_5. A waste management company takes the sludge and reduces the water content from 75%, while lowering the smell and making it hygienic. The sludge is then passed to the cement plant. Phosphate is a valuable commodity in itself, at around $200/t, and a pilot plant is about to be launched to recover 30-40% of the compound via the P-Roc crystallisation process, which will give a final indication of the economics of the process. In a final case study, Jan spoke about Ragn-Sells, a waste handling company in Scandinavia and the Baltic states, with which HC has been working since 1994. The companies decided to work together to develop a waste collection and management project in Estonia, and to use the product stream in the Kunda

Nordic cement plant. Now the project supplies 80t/day of waste. A low-capex pilot plant established the original viability of the project.

Ed Verhamme of Alternate Resource Partners next spoke on the pricing factors for alternative fuels, pointing out at the start that most factors are local. He emphasised that the cement and waste businesses are completely different and that they come to the table with different expectations and outlooks (and legislative burdens). Making these two businesses agree - at least on a final price - is crucial, if sometimes difficult. There are costs that are associated with using AF, and the waste producer must recognise this. On the other hand, the waste producer has his own costs, including collection, processing, handling, storage and transport and the cement producer must recognise this too. Essentially, the strategy for each type of waste needs to be agreed between the partners, with transparency on both sides. The dynamics of the markets must be understood by both partners, and the benefits should be shared based on inputs and total cost of ownership. The cost of fuels may be influenced not only by the supply, but also by the availability of processing facilities. Supply agreements should include flexibility to adjust fuel prices, based on changes in the markets, if they are to be successful in the long term. “Nothing destroys an AFR programme faster than a safety or environmental accident: What you have taken five years to build can be destroyed in a day,” said Ed. In the end, AFR pricing is a moving target, because waste always flows to the ‘lowest point,’ that of the cheapest/most profitable processing/usage point.

Wim Heldens of IC&C next spoke about how to make money from AF, despite rising prices. He made the simple but effective point that the most profitable kiln would be one that used no fuels at all (implying that kiln efficiency is critical!). The price of cement in the USA is now at the same level as it was in 1900... So that cost reduction is critical. Coal prices per gigajoule have hardly changed in the last 20 years, whereas RDF and animal meal have increased in price substantially... if you can source them at all. Wim pointed out that ENCI uses 95% AF, with around 50% biomass, at a fuel cost of less than Euro2 per tonne of clinker, compared to a fuel cost per tonne of around Euro12/tonne at non-AF-using plants, while generating less than 700kg of CO2/t of clinker. He suggested that due to competition from other industries, the cement producers will have to start to use ‘alternative alternative’ fuels in the future! Wim mentioned a mercury adsorption system that has been developed, which is modular, can easily be switched on and off, and which reduces mercury emissions by around 25% per module, each of which costs around Euro30,000. Smells, dioxins and furans are also reduced by the system. Wim also gave details of a physical phase separator of liquids and solids, the Pulverised Air Dryer, distributed in Europe by Biovalor: no heat is required but the PAD will reduce water content from 90% down to 10%.

Stefan Laux from Praxair (returning to his own university town of Aachen), went on to speak about the benefits of using oxygen-enhanced combustion of alternative fuels. Fuel ignition and burnout can be improved, due to quicker heat-up, devolatisation, ignition and burnout, while heat transfer will increase, leading to higher heating rates and higher productivity. The kiln coating can be stabilised and the refractory life can be increased with oxygen. Higher combustion temperatures can be managed with flue gas recirculation, or with the higher moisture levels of alternative fuels. Oxygen also has the benefit of stabilising kiln operating conditions, which can in turn allow higher levels of AF usage. Liquid oxygen can be delivered by tanker, or oxygen can be generated on-site using vapour swing absorption equipment - the choice will depend on the amount needed and other factors. Injection of oxygen through the main burner is best combined with low quality fuels and this will lead to a significant improvement in flame stability. Optimised mixing will improve results still further, but Stefan pointed out that oxygen will not fix any ‘sins’ due to larger fuel particles that will tend to drop out of the flame in any case. Finally he concluded that cement producers can use 5-10% more AF when using oxygen-enhanced combustion, while substituting for the most expensive fossil fuels. Oxygen should be used carefully to optimise the profitability of the system.

Con Manias of FCT, fresh from a 30-hour flight from Adelaide, Australia, spoke about how to increase the amount of alternative fuel used in the process, through burner design, improvements to the position of fuel injection and optimisation of fuel and raw material flows in the pyro-processing system. FCT does this through Computational Fluid Dynamics (CFD), through using small scale cold models as well as, in some cases, small scale ‘hot’ models with mini-pyroprocessing systems. AF can be added to the system at a number of points, but Con suggested that lower quality fuel is best added to the back end or riser duct, while higher quality fuels can be added at the front or burner end of the kiln through the main burner. Con presented a case study from Akçansa Cement in Turkey which demonstrated the usefulness of the multi-model approach. He also mentioned FCT’s COSMA, a continuous real-time XRD instrument that can measure mineralogical trends in clinker, which can be vital when using alternative fuels.

John Carlill of UK-based lime producer Steetley Dolomite then spoke on increasing thermal substitution rates when producing dolomitic lime. The company’s kilns were designed to use low ash coal, but during the British miners’ strike in the 1980s, the plants switched to pet coke. In 1994, one of the plants started to trial liquid solvents, and up to 25% TSR was achieved, despite some regulatory uncertainty. Continuous emissions monitoring and obligatory public consultations were prerequisites for the trial. The cost of the liquid fuel has increased over the years, but there remain significant environmental benefits to using the fuel. On the other hand, environmental compliance and maintenance (due to the aggressive chemistry of the fuel) have added costs to the process. John mentioned that his company had had very positive experience with the use of oxygen-enhanced combustion. In 2009 the company started to trial the use of rubber crumbs, partly on the basis that it would consist of at least 30% biomass, as well as providing low sulphur and low chlorine. Rubber crumb is supplied ‘just in time’ by tanker, and the Thristlington plant can now use 3t/hour. The next stage for the project is to reduce transport costs by relocating the shredding plant to the lime plant site. The company now uses 37% solvent fuel, 32% rubber crumb and 30% petcoke/coal, for a thermal substitution rate (TSR) of around 60%. All of the company’s alternative

fuels projects - solvents, oxygen and rubber - have shown a payback period of less than one year. The plant is currently evaluating the possibility of using a waste heat recovery system.

Luca Sarandrea of Cimprogetti, the famous Italian lime equipment manufacturer, next spoke about the company's 'green' lime plants. There are three main types of lime plant: the rotary kiln, the single shaft kiln and the twin shaft regenerative kiln, the latter being the most efficient. Luca mentioned an example of a lime plant in India that uses non-traditional fuel, Corex gas, as well as the short reversal time (SRT) loading system, and an 'ultimate' limestone distribution system. The kiln's refractory system is simple, robust and capable of being built anywhere in the world, due to its pillarless design.

Tom Lowes of Cinar Ltd outlined strategies for achieving 90% TSR. One of his photos showed a white-hot process duct that urgently needed attention before it melted. Tom reiterated that stratification is the biggest problem for most kilns to overcome, which is usually due to insufficient burner momentum. He suggested that the best way to achieve good mixing is by 'jet mixing.' As Tom says, "the calciner is the biggest potential user of AF and is more forgiving than a kiln, but if the burner is no good, the AF potential of the calciner will be limited due to burnout issues due to kiln back-end stratification." Tom concluded with some general rules for using AF at higher than 90% TSR.

Matthias Mersmann of aixergee next spoke about how to master the difficult process of maximising secondary fuel burning. Critically, he asked - and sought to answer - the question of what it is that limits TSR. The fact is that there are many effects that will limit AF use: the systematic elimination of all of these effects will eventually allow the cement producer to increase TSR. Inadequate burn-out and heat release are the main effects that can cause problems, primarily due to time and space constraints in the process. He outlined an elegant CFD-based approach that can visualise the process in exquisite detail and which allows users to 'virtually' peer inside the process vessels to see what is happening. Innovation in the German cement industry will be driven by the Bundesimmissionsschutzverordnung 17 (BImSchV), the Ordinance for the Implementation of the Federal Immission Control Act.
Petr Tlamicha of Air Products and Chemicals, who spoke next, also covered the use of oxygen for the increase of TSR. He pointed out that the use of oxygen-enhanced combustion can produce a net reduction in costs, while at the same time generating CO_2 emissions credits via the use of biomass AF.

The final presentation of the day was given by Thomas Marx of ABB, who spoke on his company's control strategy for the maximisation of AF, using 'Expert Optimizer.' One of the modules in the software uses model predictive control: after an input into the process, the results are evaluated and a new input proposed and enacted. Constraints are considered, as well as safety, costs, fuel availability and characteristics, and desired (clinker) outputs. Other modules include a full economic analysis tool and a scheduling module for optimising the energy use of the cement plant. In this way, the process can be tailored to market and plant conditions as well as to unexpected internal and external events. The system can be retrofitted to any control system.

Gala Dinner and Global CemFuels Awards

Delegates travelled by coach from Aachen (in Germany) to Maastricht (in the Netherlands) to take a dining yacht along the River Maas, until it became the River Meuse (in Belgium), before finally returning to the Netherlands and finally back to Germany, for a multi-national night out.
During the evening, the Global CemFuels Awards were presented. The awards were based on on-line nominations and votes with hundreds of votes cast from all over the world. The winner of the 'Outstanding alternative fuel project' award was Continental Cement of Hannibal, Missouri, and its Green America Recycling company. Cemex won the 'AF-using company of the year' award, while the CBR/Sita Recyfuel joint-venture won the award for 'AF-supplying company of the year.' KHD won the award for 'Most innovative technology for AF use' for its KHD Combustion Chamber. Finally, Dirk Lechtenberg, the well-known and popular proselytising AF expert from MVW Lechtenberg, was awarded the Global CemFuels 'Personality of the year' award by the organisers of the conference, on the basis of his efforts to promote AF use worldwide.

Second day

After the revelries of the night before, a very impressive number of delegates turned out to see the first presentation of the day, that of Dirk Lechtenberg of MVW Lechtenberg. Dirk pointed out that the regulatory burden worldwide is increasing, making the use of AF even more challenging. For example, new regulations stipulate a NOx concentration of not more than 200mg/Nm3 for the cement industry, which is likely to increase costs by around Euro1/t of clinker. In the same way, mercury rules in the US are costing around US$400m/year in additional capex in order to move plants into compliance. This is all with a background of a drop in cement demand. Decreasing costs - including fuel costs - is crucial. Dirk pointed out that waste will always find the cheapest way: processing costs have increased in Ireland and the UK, so that waste is now being exported to countries with lower processing (or landfilling) costs. In common with several speakers, Dirk underlined the fact that pricing of alternative fuels should be based on the energy content of the material, to calculate a Euros per gigajoule price. If a fuel supplier provides shipments with a higher energy content, Dirk suggested that the user should pay a bonus: on the other hand, if chlorine (or moisture) levels are higher than a benchmark, then the supplier should pay a penalty. Contracts might also stipulate particle size ranges and other chemical constituents, including mercury. Sampling and analysis protocols are crucial so that the supplier and the user come to the same conclusions and can agree on prices.

John Tiernan of AFS Technology next spoke about skewer technology for tyre burning. Tyres contain around 8300kCal/kg energy and are around 30% biomass: they provide a consistent and reliable source of alternative energy for the cement process. However low oxygen levels and sulphur cycles can lead to build-ups. AFS has pioneered the suspension of tyres in the gas stream, which can help to avoid these symptoms. However, existing systems are constrained by their capacity, and can also suffer from the effect of the tyres lifting off the feeder in high gas stream velocities. John described the skewer method of tyre feeding, which will have a capacity of up to 4t/h. The skewer rods are made of centrifugally-spun 22H steel to withstand the high gas stream temperatures. Up to 11 tyres can be loaded onto the skewer using fully automatic loading systems. Two skewer systems are currently under construction for a cement plant in Texas. John suggested that the dual-skewer system at this Texan plant may lead to a fuel saving of up to US$7.6m per year, and a less than 12 month return on investment.

Wolfram Zschiesche of Vecoplan FuelTrack gave some details of his company's alternative fuels handling solutions, including a conveyor system in which a closed tube slides on an air cushion, thereby reducing operating costs compared to other conveyor types.
As a bonus presentation, Joule Unlimited then briefly presented the case for using genetically engineered micro-organisms, sunlight and the waste CO2 from the cement industry to produce ethanol and bio-diesel at costs that meet or beat fossil fuels. This seems not to be a 'flash-in-the-pan' project: the company has around US$100m of venture capital to back it up and is proceeding towards a large-scale pilot plant.

Next Thomas Jennewein of FLSmidth Pfister introduced the rotor weighfeeder, which is based on a horizontal rotary valve, suspended from a load cell - the rotation speed can be altered in order to vary the feeding rate. More than 200 units have been sold in 36 countries for the cement industry, in four standard sizes. The weighfeeder can cope with feed densities of 30kg to two tonnes per cubic metre, as well as fibrous, blocky, sticky and other difficult alternative fuels. Air jets in the weighfeeder help to clear the exit from the chamber, while a stirrer auto-reverse function can help to clear any blockage in the pre-weighfeeder homogenisation/feed hopper. Thomas also gave details of full AF handling and dosing systems provided by FLSmidth Pfister worldwide.

Richard Maslen of Fairport Engineering pointed out that solid recovered fuel (SRF) could provide a majority of the energy required by the global cement industry. However, the moisture and inerts content must be reduced before use. Fairport Engineering was involved in construction of the Huyton recycling and recovery centre near Liverpool, UK, which now takes in 50,000t of waste and can produce 25,000t of SRF per year. Problems with waste include abrasion, bridging, corrosion, dust, entanglement, fire risk, hygiene, odour, variability and other problems. Examples of problem constituents in waste include entangling plastic film, 'tramp' metals (such as a domestic radiator and even an engine block) and food slops. Incoming waste is passed through a trommel screen, shredded and homogenised, prior to a thermal processing step. Primary screening, fines separation and density separation provides fuels, aggregates and other product streams. The thermal processing line and biomass density separation machines at the facility are patented. The floc or fluff produced is in two forms, 'low carbon fuel' (70% biomass and higher CV) or 'renewable power fuel' (85% biomass but lower CV, to optimise the value of Renewable Obligation Certificates, ROCs), which can be formed into SRF pellets. With increased experience, the Huyton plant managed to increase the mean CV of its SRF over two years, as well as increasing the proportion of waste that can be transformed into SRF.

Vincent Grosskopf of Thorwesten GmbH next spoke about explosion prevention and mitigation in the alternative fuels industry. A source of heat, sufficient oxygen and the presence of a fuel are the prerequisites for any fire or explosion. Storage of fuels can lead to problems due to self ignition, smouldering and generation of potentially explosive CO, biodegradation and production of methane and the generation of an explosive dust atmosphere. With very few exceptions, all alternative fuels are fire and/or explosion hazards. Mixing alternative fuels with certain types of coal can increase the probability and violence of any explosion. Vincent pointed out that a proper venting system - such as could be supplied by his company - can reduce the maximum explosion pressure suffered by silos and other equipment. He showed one silo design which widened from top to bottom, to aid in material passage through the vessel.

Klaus-Martin Meier, on behalf of Cadence Environmental Energy, suggested that staged air combustion, which puts mixing energy and combustion air into a critical kiln area, addresses gas stratification and temperature imbalances. CO reduction, NOx reduction, higher AF rates (by 5-8%), better heat transfer and a reduction of excess air in the burning zone are all advantageous results. SNCR efficiencies can also be improved, with dramatically reduced operating costs. The equipment is added to the hot end of a kiln and, according to Klaus-Martin, is a relatively minor engineering feat to accomplish. Delegates were particularly interested in the potential NOx reducing possibilities of the system.

In the final afternoon's session on AF handling and dosing, Jurgen Bäumer of WTW Americas gave details of projects in Spain and Russia. He pointed out that AF is often an abrasive material to have to handle, and that even recycled wood chips could contain up to 10% of concrete: wear protection must be given special attention when dealing with AF.

Luc Rieffel of the Walter Materials/ATS Group detailed his company's AF handling solutions, including specialised systems for using whole tyres, utilising a front-end loader, a tyre singulator, tyre control conveyor, accumulating conveyors, doser roller conveyor and pneumatic or electrically-actuated double airlock valve. Holcim Gador used such a system to burn 5500t of whole tyres in 2009, increasing its TSR by a further 10% above previous levels. The company's combined hopper/dosing system/apron feeder is well-suited for use with alternative fuels, even with 'flowable' materials like rice husks.

Luigi Di Matteo of the Di Matteo Group, located in Beckum in Germany, spoke about handling, dosing and feeding of alternative fuels. The densification of AF must be considered, especially since it will increase over time. Compressibility also depends on the consistency and moisture content of the

material, as well as the storage height. In the case of problems, it is best to adhere to FIFO (first-in, first-out) principles, which can also help to reduce fire risks. The company can provide a wide range of AF handling equipment. Di Matteo offers gravimetric dosing with the innovative WeighTube weighfeeder. This consists of a screw feeder, part of which is mounted on load cells, offering fast response times, high short- and long-term accuracy, low energy consumption and easy maintenance.

The penultimate presentation was by authors from Schenck Process: the three golden rules that the company applies to AF projects are: to supply robust equipment despite the low density of the fuels; to avoid bottlenecks in order to avoid blockages and to allow for variations in bulk density and flowability. A number of case studies of handling and dosing were presented, including from Turkey, Romania and Switzerland. The company's Multidock AF reception equipment consists of inclined screw conveyors or a chain conveyor and is used with AF delivered by walking floor trucks. The MoveMaster chain conveyor is capable of conveying AF at an inclination of up to 75°. The MultiFlex screw weighfeeder has been especially developed for use with AF, and at Aslan Çimento in Turkey, a MultiFlex weighfeeder is coupled with an IDMS blow through valve. The weighfeeder can operate between 1-20t/h, and can handle AF particles up to 100mm. An 'inducer' has been developed to vertically feed AF using pressurised air into the calciner. Lukas Schwank from Holcim spoke about the operation of the MultiFlex and IDMS at the Eclépens plant, running at 4.8t/hour. He re-emphasised the fire-risk of AF, particularly with rather dry AF: if even water sprinklers on conveyors are not enough to prevent intermittent conflagrations, then further efforts must be taken.

Reiner Furthmann of Aumund concluded the presentation programme (of a total of 25 papers) by outlining his company's extensive capabilities in the alternative fuels handling sector for the cement industry. Reiner reminded delegates that sewage sludge contains a lot of silica (partly due to road run-off into waste-water treatment plants) and is unexpectedly abrasive: additional wear protection measures must be taken.

A lively expert panel session took place after the presentation programme, including panellists from Holcim, Italcementi and HeidelbergCement. The suggestion arose that one of the critical trends in the cement industry will be waste heat recovery and power generation (and the associated process changes that will be required to optimise the cement plant for the creation of electricity).

Farwell party

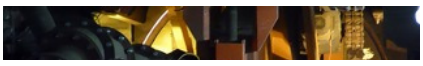
At the farewell party the awards for the best presentations were given out, based on delegate voting. In third place was Con Manias from FCT with his paper on how to maximise TSR with the use of CFD; in second place was Jan Theulen with his paper on HeidelbergCement's international use of AF, while in first place was Luigi Di Matteo, for his well-received paper on handling and dosing options for alternative fuels.

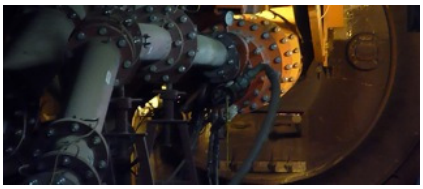
Field trip to ENCI

Download ENCI presentation pdf

A coach-full of delegates took the opportunity to visit the Maastricht cement plant of ENCI following the conference. ENCI was established in 1926, and produced 680,000t of clinker in 2011 and 1.1Mt of cement. The plant uses a single very long (200m) two-stage preheater dry kiln with satellite coolers, and is notable for using 92% AF, the highest in the HeidelbergCement Group. The clinker content of cement produced by ENCI is around 50%, the lowest in Europe, due to the amount of blast furnace slag and fly ash which is used, resulting in only 391kg of CO_2 per tonne of cement. The limestone feed has a moisture content of 15% so that a dryer is in place. "The kiln has a single drive, and when the drive is started, the coolers start to rotate later: the refractories suppliers like this 200m-long kiln," mentioned Frans Erens, the plant director at ENCI. The plant started using AF in 1968, burning high ash content shale via the main burner. The plant now uses or has used anode dust from the aluminium industry, fine coke, liquid recycled fuels, animal meal, sewage sludge, RDF, textile-based fuel and high-biomass RDF. There are continuing cost pressure on alternative fuel supplies, according to Frans Erens.

Sewage sludge is ground in a pair of Claudius Peters vertical 'biomills,' with a specific energy consumption of around 40kWh/t, with 17% retained on 90micron.High-chrome grinding balls are used rather than rolls, since the grinding capacity remains the same even though wear makes the balls progressively smaller. The Greco Flexiflame burner at the plant is equipped with multiple channels for AF use. Around 30% of the AF used is sewage sludge, and 36% anode dust, whereas 14% of the fuel used at the plant is ground lignite. The plant has a 'stop and go' philosophy, with a six week run and then a week's stop, to allow the restocking of AF in the silos.





Due to the encroaching city of Maastricht, clinker production at ENCI will end in 2018 and it will then become a clinker grinding station, with clinker sourced from elsewhere in the HeidelbergCement Group. Once the integrated cement plant is closed, the truly enormous limestone quarry will be turned over to a nature conservancy organisation and it will become a nature park. ENCI will be able to look back on a long history of cement production with pride.

Global CemFuels 2013

An on-line poll showed that the clear choice for the location of the next Global CemFuels Conference and Exhibition is for it to take place in Istanbul, Turkey. So, if you are involved in alternative fuels in the cement and lime industry (or would like to be), then you should attend the next Global CemFuels Conference in 2013: See you in Istanbul!

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