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# Di Matteo puts fire in the belly of Cemex with large-scale secondary-fuel installation

In 2007, one of the world's largest secondary-fuel installation for use in the rotary kiln cement production process was erected and commissioned at the Cemex Group's Rugby works and was designed to feed the calciner with up to 40t/h of secondary-fuel. The realisation of the installations was awarded to the company Di Matteo of Beckum, Germany, owing to its experience with unconventional material in a number of other secondary-fuel handling units. Di Matteo Beckum first developed the process technology and the control concept of the system as well as carrying out the manufacturing, supply and erection of all the machinery and system elements based on this concept. The successfully commissioned system is described in the following article.

As is well-known, the process of cement production demands a high level of energy. This energy intensity currently has the greatest influence on the production cost of cement. Owing to the tendency of ever-increasing energy costs, research has been carried out over an extended period into the required energy usage in cement manufacture and in particular, into its reduction. According to today's estimates, thermal energy within the cement calcining process can only be further reduced by 2% through technical measures. For this reason, special importance was previously attached to seeking favourably-priced replacement fuels.

Originally, primary fossil fuels such as oil, coal or gas were exclusively used in the cement calcining process. However, since the mid-1970s, these energy-bearing fuels have been replaced, at first partially, with heavy heating-oil and petcoke. But as these energy-bearing fuels were also available in limited volumes, utilisation of alternative raw materials in cement production practically coincided with the employment of alternative fuels (secondary fuels).

The secondary fuels which are currently suited to the cement production process are largely made up of the following residues of various origin:

- Production residues of wood, paper, textiles, plastics;
- Processed household waste fractions;
- Animal meal, animal fat;
- Used oil;
- Scrap tyres;
- Sewage sludge;
- Bio-mass.

That said, currently – and for some time to come – the lion's share of material stems from industry waste and it is processed from residues made of wood, paper, textiles and plastics, which can be designated as fluff or 'solid blowable fuels.' For this reason such a fuel is being employed as the energy-bearer in the new secondary-fuel system at Cemex's facility in Rugby. This material behaves a great deal differently from conventional bulk solids thanks to its mechanical properties and abrasiveness. It therefore also demands the appropriate experience for when developing a plant concept and for its material handling.

**Fig. 1 (right)**: Receival units for up 4 lorries.

## Delivery and storage

The secondary fuel is delivered by lorry in Rugby and is unloaded there into one of the two receiving units (Fig.1). At each receiving unit up to two lorries can unload simultaneously, so that up to four lorries in total can unload at the same time. The generous storage volume of the receival unit permits high-capacity unloading for the lorries, which takes just a few minutes, and offers storage capacity for several lorries. The receival units are each fitted with an ODM-MovingFloor, which gently

**Fig.2 (far left)**: ODM-MovingFloor for secondary fuels, during installation.

**Fig.3 (left)**: Magnetic separator, ODM-DiscSCREEN and mechanical conveying by means of ODM-trough chain conveyor into the preheater-tower

and reliably transports the secondary fuel into the intermediate storage. Both moving floors are hydraulically driven and operate, as in the intermediate storage, according to the 'Walking-floor' principle (Fig.2).

The secondary fuel is stored in an intermediate storage area which runs diagonally to the receival units. This intermediate storage has a width of 6m and a length of around 30m, which delivers a storage volume of up to around 1200m³. The secondary fuel has a tendency to cause bridge formation owing to its bulk material properties, which can lead to material flow problems, especially if stored too high. The ODM-MovingFloor has the great advantage of allowing the entire bulk material column is to be 'carried' gently to the discharge point without introducing additional – and for the secondary fuel, disadvantageous – mechanical forces into the bulk material. This way, the secondary fuel is not unnecessarily compacted and is of a better quality for the subsequent process. Furthermore, the moving floor systems created work on the first-in first-out (FIFO) principle. A reliable and even storage duration period is guaranteed as well as bulk material properties, which are as constant as possible. This is of significant importance when high substitute rates apply, as vacillating bulk material properties – such uneven moisture distribution resulting from varying storage periods – can negatively influence the burning process.


**Fig. 4 (left)**: Version of the employed TKF ODM-trough chain conveyor with solid, forged heavy-duty forged-link chain.

The reliable material discharge from the fuel storage is effected by a well-proven screw conveyor – the ODM-ScrewDOS®. The design of the screw systems is optimally matched to the secondary fuel in order to guarantee the material spread over the entire width of the intermediate storage. They rotate at variable rates so that their conveying volume can be matched to the required system capacity.

A trough chain conveyor transports the secondary fuel from the screw to a magnetic separator on which the magnetic constituents are separated and diverted away into a container. Following this, the secondary fuel is then fed onto an ODM-ScrewScreen SSM, in order to separate off larger foreign matter that could affect the upstream process. This foreign matter falls behind the screw-screen and into a separate container.

The material falls from the screw-screen, which is cleaned magnetically and mechanically, and led into the next mechanical conveying route to the heat exchanger (Fig. 3). This conveying unit was realised by means of two massive, heavy-duty ODM-trough chain conveyors, TKF. The total conveying length of both inclining trough chain conveyors is approximately 140m.

As the secondary fuel used is very abrasive, all ODM – TKF trough chain conveyors in the system were supplied and installed in a very robust heavy-duty version which would normally only be the case for clinker transport. Here for example, only solid forged heavy-duty forged link-chains were installed.

From the trough chain conveyor, the secondary fuels in the preheater tower reach an intermediate rectangular (for space retrictions) silo and has a volume of approximately 100m³. For even distribution of the secondary fuel in the silo and the subsequently better use of the storage capacity, a feed screw has been installed on the silo, which distributes the material evenly over the length of the silo. The discharge of the secondary fuel from the silo is effected with the help of a hydraulically-driven ODM-MovingFLOOR system, which also works according to the 'walking floor' principle. Here, as far as possible, identical modular elements to those in the moving-floor system in the storage area are used in order to simplify spare-part supply. Particularly with this intermediate silo the advantages of the employed moving floor system, FIFO-principle and mass flow (avoidance of dead zones), are of real significance for an uninterrupted, reliable and constant calciner feed.

The fuel falls from the moving-floor on to a special

**Fig. 4 (right)**: ODM – Injector gate IZS, for pneumatic feeding into the conveyor pipelines.

screw, the ODM-ScrewDOS®. Here the fuel stream is separated as desired in to two feed stages. The fuel discharge is controlled by the downstream belt weigh-feeders. The transport of the secondary fuels fed to the calciner of the rotary-kiln occurs pneumatically via a specially-developed IZS ODM injector-rotary vane gate, which reliably and constantly feeds the pneumatic conveyor lines (Fig.5). The air flow required for pneumatic conveying is generated via a lobed rotor compressor.

The blow-through rotary vane gates, which are normally employed for adding solids into a conveyed-air stream have a significant air leak rate thanks to the air over-pressure in the lower section of the rotary vane gate. In the process, part of the conveyed air flows into the material feed shaft of the gate. As the secondary fuel – with a bulk density of 100-300kg/m,³ – is very light, which leads to material clogging in the feed shaft. This causes a pulsating or a total interruption of the metered fuel stream. In the Di Matteo-developed IZS ODM-injector-rotary vane gate, an injector is fitted at the inlet of the conveyed air-stream into the blow-through rotary vane gate. With the latter, the static pressure in the blow-through chamber of the gate is reduced considerably, which also significantly reduces or even prevents the air-leak. The injector-rotary vane gate, for which Di Matteo Beckum has a patent pending, has proved itself in numerous plants for the pneumatic conveying of secondary-fuels.

The pneumatic conveyor pipelines for secondary fuels are subject to extraordinary wear, as experienced with the high degree of abrasiveness of the conveyed material. For this reason they were manufactured with a thick wall-lining and special attention was paid to the design of the pipe elbows. As far as the on-site conditions permitted, the elbows were arranged in a large bend radius. In addition, they received cast-basalt protection.

## Summary

The installation was commissioned in February 2008 without problems and the required process performance was achieved in the shortest of time. The installation has been running to the complete satisfaction of the client ever since and achieves the desired fuel savings. The satisfaction of the client has been expressed through the planned expansion of the system to install the second calciner feeder as well as to increase the storage volume by a further approximately 3200m³ – the contract for which has been awarded to Di Matteo.