CEMENT & BUILDING MATERIALS REVIEW

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40 Years
ARAB UNION FOR CEMENT AND BUILDING MATERIALS
هيئة عربية دولية

Cement and Building Materials Review

Arab Album | International News | New Products | Technical Articles | Diary Dates

Editor-in-Chief Eng. Ahmad Al-Rousan
Managing Editor Suha M. Canaan

CONTRIBUTIONS

- *The Magazine editorial staff welcome the contribution of experts to enrich the contents of the magazine .*
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Email: aucbm@scs-net.org / aucbm1977@gmail.com
Website : www.aucbm.org

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CORRESPONDENCE

Correspondence are to be addressed to the Editor-in-chief at the following address:

Syria, Damascus - P. O. Box 9015

Tel : (+963 11) 611 5412 - 6118598

Fax : (+963 11) 612 1731

Email: aucbm@scs-net.org / aucbm1977@gmail.com

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ARAB NEWS

ARAB NEWS

ALGERIA

Algeria issues concrete import licenses
The country is trying to deal with cement shortage

CemWeek: 11 /7

Gebr. Pfeiffer supplies MVR mill to Bechar cement plant
Gebr. Pfeiffer will supply an MVR 5000 R-4 mill for cement raw material grinding to GICA's Bechar cement plant near the border with Morocco.

Daily Cement

EGYPT

Big investment from Saudi Arabia could boost Egypt's South Valley Cement
The Saudi Arabian Al Sharbatly Group is reported to be looking to invest up to US$3bn in Egyptian interests, including setting up a second clinker line at its South Valley Cement plant.

Global Cement News

IRAQ

Iraq imposes 45% tariff on Iranian cement imports
While the country lifted the ban on imports of Iranian cement, it has maintained a 45% tariff on cement coming from Iran.

Daily Cement

JORDAN

Cement consumption in 1H17 reaches 2.3 million tonnes
Cement consumption in the Kingdom throughout the first 6 months of 2017 remained stable year-on-year, reaching 2.3 million tonnes.

Daily Cement

LEBANON

Cimenterie Nationale inaugurates new bag filter at Chekka cement plant
On June 23, 2017, Cimenterie Nationale has officially inaugurated a new bag filter at its Chekka cement plant. The new filter is expected to reduce dust, NOx and SO2 emissions by more than half. The filter has been in operation since late May 2017.

Global Cement News

MOROCCO

Tekcim cement plant project receives authorities' approval
The Regional Investment Commission of Casablanca-Settat has just approved several investment projects worth MAD 3.2 billion in the region.

Daily Cement: 2306/

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Contact Information

Headquarter
Address : 28 Tut Ankh Amoun St.,Smouha,Alexandria, Egypt
Telephone : +(203)425-7843, +(203)425-7223
Fax. : +(203)425-7151 Mobile: +(012)781-6404
Email : imc@intermaint.com.eg **Web site : www.intermaint.net**

INTERMAINT FABRICATION LTD.
Address : Kilo 35 Alex- Cairo Desert Road, Al-Nassereyah, - Alex. Egypt
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Saudi Intermaint Co. Ltd.
P.O. Box : 325591 Riyadh 11371 Saudi Arabia
Phone : +966 11 4762230
Fax. : +966 11 2916798
Mobile : +966 505194064
E-mail : hesham@intermaint.net

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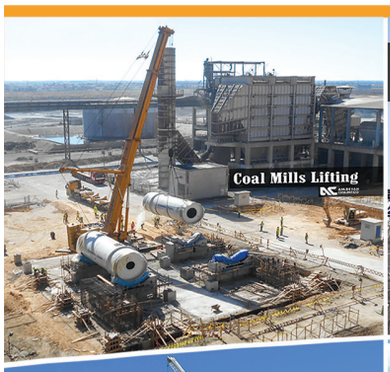

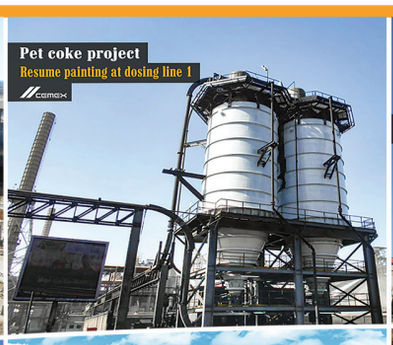

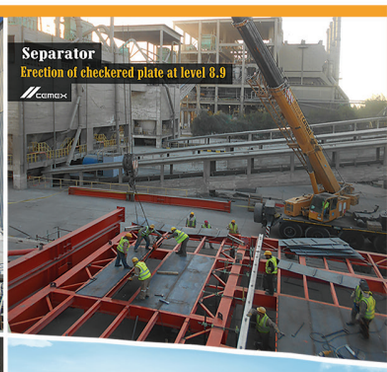

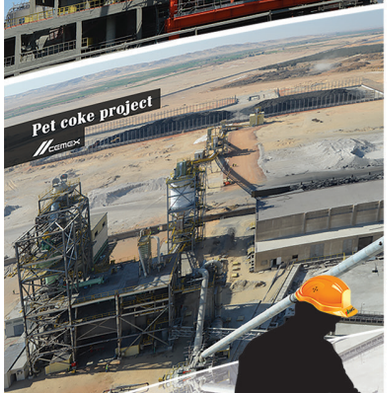

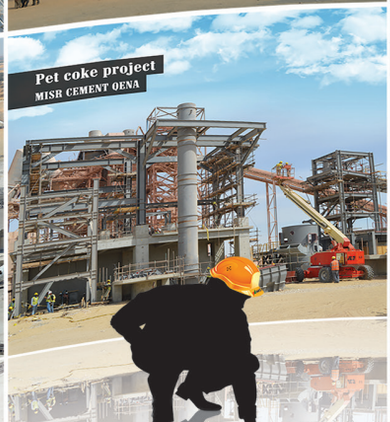

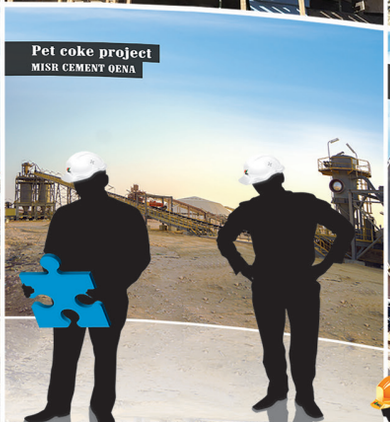

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THINKING FOR TOMORROW

Morocco aims to expand cement exports amid acceptance in ECOWAS

Local cement makers hope to capitalize on the country's acceptance in the Economic Community of West African States (ECOWAS) by increasing cement exports.

Daily Cement: 10/ 7

LafargeHolcim's grinding station in Laâyoune commissioned

LafargeHolcim says that its 0.2Mt/yr Laâyoune cement grinding plant is complete. The cement producer started production later in July 2017.

Cemengal supplied a Plug&Gring® XL modular and portable grinding station for the plant.

Daily Cement

LafargeHolcim starts construction works at Agadir cement plant

In a latest report, the Board of Directors of LafargeHolcim Maroc confirmed the start of construction works at its new cement plant in the Souss-Massa economic region. Thyssenkrupp Industrial Solutions has been contracted to build this project.

Daily Cement: 107/

LafargeHolcim Maroc Afrique announces 6 new cement plants

LafargeHolcim Maroc Afrique (LHMA), a subsidiary of LafargeHolcim and SNI (Morocco's National Investment Company), announced it will set up 6 cement manufacturing unit in sub-Saharan Africa in the next 2 years, with a combined production capacity of 3 million tonnes.

Daily Cement

OMAN

Oman government programme calls for coal power plants to support new cement plants

Tanfeedh, the National Programme for Enhancing Economic Diversification, is calling for captive coal power stations to be used to support new cement plants that are being planned for the Duqm special economic zone. The programme wants two Ordinary Portland Cement plants and a white cement plant to be built in the zone to reduce imports. It also wants investors to build one cement grinding plant in Duqm and one in Suhar. Tanfeedh says that the country used 9Mt of cement in 2015 but that only 44% came from local producers.

Global Cement

Oman Cement Company and Raysut Cement Company set joint venture

Al Wusta Cement, a joint venture between two major cement manufacturers from Oman, will operate a project in the Duqm Special Economic Zone.

The Company will be responsible for infrastructure requirements to set a project in Duqm, as well as exploring export markets in the Middle East, East Africa, and the Indian subcontinent.

The National Program for Enhancing Economic Diversification supports a cement manufacturing hub in Duqm, with plans for three cement plants in the region with the capacity to produce three million tons of gray cement and 300,000 tons of white cement per annum.

CemWeek

QATAR

Qatar ensures domestic cement supply

Qatar National Cement Company stressed it is capable

of providing the needs of the local market. Qatar is able to import all the necessary raw materials, like gypsum or iron oxide, from Oman. Paper bags for cement packaging are imported from Kuwait.

Qatar National Cement commissioned its kiln number five, adding 5,000 tons per day to the company's capacity. After that, Qatar National will have the capacity to produce 19,000 tons of clinker and 21,000 tons of cement per day.

CemWeek

SAUDI ARABIA

Government cuts cement export duties by half

On July 6, 2017, the Ministry of Trade and Investment announced cement export tariffs were slashed by 50%.

Daily Cement

Saudi cement sector with more positive outlook

Since 2014, when oil prices tumbled, bringing down with them the largest revenue source of the kingdom, the Saudi-Arabian cement sector has remained under great pressure, with clinker inventories mounting and profits falling.

However, looking at the current trends on public spending, construction market, and demographics, the National Commercial Bank gives an optimist outlook for the Saudi cement sector.

Major infrastructure projects will improve demand for cement.

CemWeek

Saudi clinker production falls by 10.9% to 29.3Mt in first seven months of 2017

Clinker production fell by 10.9% year-on-year to 29.3Mt in the first seven months of 2017. The Saudi Economic Review by the National Commercial Bank has attributed the slowdown in production to weak domestic demand, which fell by 9.8% in 2016, and 'record high' clinker inventory levels of 32.5Mt in July 2017. The local cement industry has also suffered from rising input costs due to higher energy and fuel prices following government policy changes.

Global Cement

Eastern Cement starts commercial operations of new cement mill

Eastern Province Cement Company (EPCCO) announced it has started commercial operations of the new cement mill installed at its Al Khursaniyah factory, about 70 km away from Jubail Industrial Port.

Daily Cement

Tabuk Cement has a new production line

Second production line entered commercial production

Daily Cement

TUNISIA

Carthage Cement's cement sales fall due to ban on exports to Algeria

Carthage Cement's cement sales have fallen due to a ban on sales to Algeria. Its clinker production volumes fell by 27% year-on-year to 0.57Mt in the first half of 2017 from 0.78Mt in the same period in 2016 and its cement production fell by 13% to 0.72Mt from 0.83Mt. Cement export sales fell by 79% and overall its sales fell by 18% to Euro 31.6m from Euro 38.7m. However, the cement producer said it increased its market share in the period.

Global Cement News

Votorantim Cimentos' Jbel Oust cement plant to gain access to national gas distribution grid soon

The Tunisian Company of Electricity and Gas (STEG) is currently carrying out a project to install pipelines and a distribution switching station for natural gas near the cement plant in Jbel Oust (or Djebel West), Zaghouan governorate.

Daily Cement

New cement plant to be set up in Tataouine Governorate

Construction work on a cement factory in the governorate of Tataouine will soon start.

Daily Cement

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AUMUND Group Field Service GmbH
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On 1st July 2017, a new company was incorporated under the umbrella of the AUMUND Group, and Erwin Last became its Managing Director. AUMUND Group Field Service GmbH has its registered office in Rheinberg, Germany, directly adjacent to the AUMUND headquarters.

The AUMUND Group Field Service team in the Rheinberg office (from left): Sybille Stonham, Frank Stefan, Erwin Last, Kamil Lewandowski, Martina Chervatin and Benjamin Pietta

The company's business is to carry out industrial installation services on behalf of the Group brands, AUMUND Fördertechnik GmbH, SCHADE Lagertechnik GmbH and SAMSON Materials Handling Ltd., but also for customers outside the AUMUND Group. In particular it will carry out and supervise installation and commissioning of machines as well as servicing, maintenance and repair work.
Through this merger the AUMUND Group will optimise the range of site installation, equipment start-up and inspection services.

About the AUMUND Group
The AUMUND Group is active worldwide. The conveying and storage specialists have special expertise at their disposal when dealing with bulk materials. With their high degree of individuality, both its technically sophisticated as well as innovative products have contributed to the AUMUND Group today being a market leader in many areas of conveying and storage technology. The manufacturing companies AUMUND Fördertechnik GmbH (Rheinberg, Germany), SCHADE Lagertechnik GmbH (Gelsenkirchen, Germany), SAMSON Materials Handling Ltd. (Ely, England), as well as AUMUND Group Field Service GmbH and AUMUND Logistic GmbH (Rheinberg, Germany) are consolidated under the umbrella of the AUMUND Group. In conjunction with the headquarters of the manufacturing companies, the global conveying and storage technology business is spearheaded through a total of ten locations in Asia, Europe, North and South America and a total of five warehouses in Germany, USA, Brazil, Hong Kong and Saudi Arabia.

Contact

AUMUND Group Field Service GmbH
Heydecker Strasse Str. 145
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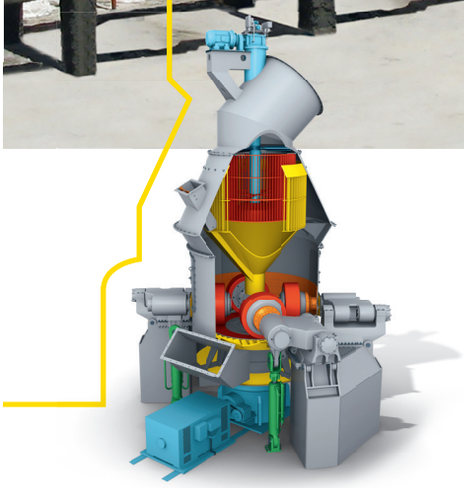

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Siwertell strengthens cement operations with repeat road-mobile unloader order

Siwertell, part of Cargotec, has received a repeat order from a company based in the Middle East region for a second 10 000 S Next Generation road-mobile unloader. The unit has been ordered in response to an expansion in white and grey cement operations and will support the company's existing road-mobile unloader. The order was booked in Cargotec's second quarter 2017 order intake.

The trailer-based, diesel-powered Siwertell 10 000 S Next Generation unit is fitted with dust filters and a double bellows discharge system, which allows for a rated unloading capacity of 300t/h; an increase in through-ship capacity of up to 30 percent compared to a single loading bellows system.

"In the cement bulk handling business Siwertell stands for reliability and therefore we believe that by choosing our units, the customer chooses the best tool in the business," says Jörgen Ojeda, Director, Siwertell Mobile Unloaders.

Siwertell's road-mobile unloaders are based on unique screw conveyor technology with totally-enclosed conveying lines for environmentally-friendly and cost-efficient operations. The unique screw conveying system ensures continuous high capacity operations and reduced unloading times. Siwertell's unloaders also achieve cost efficiency, consuming just 0.18 litres fuel/tonne during an average cement handling operation.

Available in three models - 5 000 S, 10 000 S and 15 000 S - the unloaders were originally developed to handle cement, though they can comfortably handle a wide variety of dry bulk materials including alumina, sulphur, grain, feedstuff, biomass and fertilisers.

For further information, please contact:

Jörgen Ojeda, Sales Director, Mobile unloaders, Siwertell,
tel. +46 703 685990
jorgen.ojeda@cargotec.com

Emily Brækhus Cueva, Marketing Manager, Siwertell,
tel. +46 706 858023
emily.cueva@cargotec.com

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Siwertell is part of Cargotec. Cargotec's (Nasdaq Helsinki: CGCBV) sales in 2016 totalled approximately EUR 3.5 billion and it employs over 11,000 people.
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CHRISTIAN PFEIFFER

Tüfentobel RopeCon®: Material is passed over to second system in mid-air for even more flexible discharge point

Since the year 2005, a RopeCon® system has been transporting inert material along a long-stretched valley at the Tüfentobel landfill site, which will eventually be backfilled. The belt is being extended in several stages. It discharges the material onto a debris cone directly where it is to be used. Finally in March 2016, a novel concept was implemented which has further increased the flexibility of RopeCon®.

Relocating the discharge point of Tüfentobel RopeCon® in various stages was part of the overall project plan from the very beginning. The idea was to discharge the material at all times as close as possible to the location where it was to be used. The discharge point has been relocated several times already since the installation went into operation so as to keep transport routes as short as possible for both the trucks supplying the material and the bulldozers spreading it from the discharge point. In March 2016 a second RopeCon® was finally installed directly into the rope span of the original system, which now discharges the material onto the new conveyor at a height of approximately 20m. The

new RopeCon® system can operate in both directions. This allows for two different discharge points which can be fed alternately. The second RopeCon® system requires no support structure of its own but rather uses the track ropes of the original system. The running wheels of the second installation return onto the track ropes on a set of rails. An important advantage of the extension concept was that even during the assembly work the original system could be kept in operation to the greatest extent possible. Long shut-down periods were thus avoided.

Contact:
Doppelmayr Transport Technology GmbH
Konrad-Doppelmayr-Strasse 1
6922 Wolfurt / Austria
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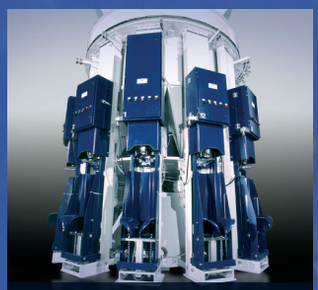
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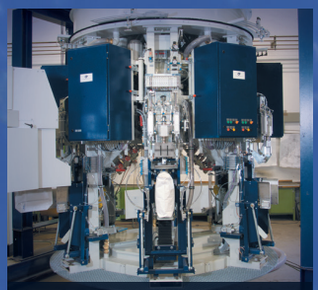
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Energy efficiency: Tunisian firm BMT chooses Sacmi Heavy Clay

Two new combustion systems supplied as part of the company's wider plant renewal and modernisation plan. SACMI thus wins a new customer on a strategic market.

A key player on the Tunisian market, with a growing number of customers and major projects, SACMI Heavy Clay has just completed the sale of two innovative combustion systems. These will soon be providing energy savings at the BMT – Briqueterie El Mostakbel facility.

Based in the city of Teboulba, the company produces B8 and B12 hollow bricks. As part of a drive towards greater energy efficiency on the two existing lines, BMT has commissioned SACMI to modernise the two kilns installed downstream from them: these kilns will be equipped with high-speed burners and combustion modulation systems.

This latest order reinforces the SACMI Group's position in the area and is, in fact, merely the first stage of a broader plant modernisation and renewal project on which the SACMI Heavy Clay team is working in concert with BMT staff. The goal? To reduce the company's energy consumption even further while enhancing product quality and overall plant efficiency.

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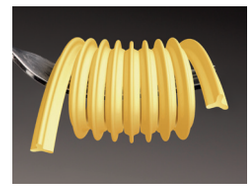

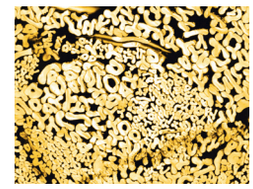

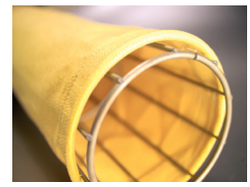

Evonik Fibres GmbH
Gewerbepark 4
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Austria
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POWER TO CREATE

SITI B&T supplies first complete Supera® line for large-size tiles in Iran

The Formigine-based SITI B&T Group has opened up the Iranian large-size tile market through an agreement to install the first complete Supera® line for the ceramic tile manufacturer Rock Sanat (MA Ceram), one of the country's leading producers and a longstanding SITI B&T customer.

Thanks to the 36,000 ton Supera® pressing system and an XXL single-channel kiln (with entrance width of 3850 mm), this new line will produce the largest porcelain panels and slabs ever made in Iran, in sizes up to 1600x3200 mm and thicknesses up to 25 mm.

The order from Rock Sanat also includes the entire raw materials preparation plant, equipped with latest-generation continuous modular mills to ensure the maximum stability and efficiency of production. Drying will be performed by a 5-layer single-channel dryer with high energy efficiency and maximum productivity, while the glazing and decoration department will consist of a fully digitalised line with G5 technology from Projecta Engineering. For handling and storage, SITI B&T Group will supply the BiBox loading and unloading machines, while for the end-of-line stage it will deliver an automatic palletisation system with Smartline sorting lines.

The agreement with Rock Sanat marks the continuation of SITI B&T Group's long-term R&D project as a global full provider of ceramic technology but with a special focus on the shaping and firing stages. Research carried out on Supera® has led to the development of an innovative pressing system with a number of advantages: it optimises productivity while using the same glazed porcelain tile bodies; it offers exceptional aesthetic versatility (up to 10 surface textures with depths of up to 4 mm) and flexibility in terms of sizes and thicknesses (very large and very small sizes and thicknesses up to 30 mm); and the use of a patented technology and the tensionless device avoids defects and rejects.

Given the enormous potential of the Iranian market and its strong inclination to invest in Italian technology, SITI B&T plans to open a local branch by the end of 2018.

REMOTE DIAGNOSTICS AND PROACTIVE MAINTENANCE FOR GRAVIMETRIC FEEDING SYSTEMS

Dr. Dominik Aufderheide*, Dr.-Ing. Luigi Di Matteo*

** DI MATTEO Group, 59269 Beckum, Germany*

Abstract

The cement industry is actually developing dramatically within a global act of consolidation and market shake-outs. In this context, efficiency and cost reduction have become the most important economic drivers for each and every plant in the world, in order to guarantee a long-term profitability. In this context the optimisation of energy resources and raw material supply are important factors, which are already considered by most plants. However, a simultaneous increase of machine availability and the reduction of maintenance costs are not less important, in order to utilise the full potential of those measures. This article provides an overview of typical concepts and methods for the usage of remote maintenance procedures and corresponding proactive services, by using the example of high-precision bulk-material dosing systems. The technical aspects for the realisation of remote access solutions are described against the background of heterogeneous IT-infrastructures in modern cement plants and actual IT security discussions. Furthermore, corresponding possibilities for a proactive service and maintenance concept are introduced. It can be shown that the reasonable implementation of such services leads to an enormous cost-reduction and a parallel increase of the plant availability.

1. Introduction

Today the daily work within the cement industry, both in headquarters and plant offices, is mainly determined by economic drivers, such as needs for increasing the production efficiency and capacity by a parallel reduction of costs for maintenance personnel and shorter return-on-investment (ROI) periods. These trends are the logical consequences of the actual act of global consolidation and market shake-outs within the whole industry, but especially in Europe after the financial crisis and the subsequent recession all over the south of Europe.

In this context the optimisation of energy resources and raw material supply are important factors, which are already considered by most plants. Thus the increased substitution of conventional fossil fuels by alternative energy resources is an ongoing process during the last decades and the utilisation of energy-from-waste concepts will speed up even more on a worldwide scale during the next years. This ongoing development was accompanied and driven by the introduction of the DI MATTEO Seven Stage Concept (SCC) for plants for the handling of alternative fuels (AFs). This concept, as depicted in Fig. 1, summarises the thermal utilisation of

AFs, e.g. within a cement plant, as a setup of machines from seven different stages, as described in detail in [1]:

1. ***Reception***

   e.g. plants for the reception of AFs from trailers, such as docking stations or from dumper trucks etc.

2. ***Preparation***

   machinery for the preparation of the received material prior to the combustion process, such as screening (ODM-DiscSCREEN), magnetic separation (ODM-MAS), deagglomeration, drying etc.

3. ***Storage***

   silo and bunker systems for the intermediate storage of AFs within the plant and their corresponding discharge systems, such as screw dischargers (ODM-ScrewDOS®), moving floors (ODM-MovingFLOOR), etc.

4. ***Transport***

   all types of conveyors for the transport of AFs in the plant, such as screw conveyors, drag chain conveyors, pipe conveyors, bucket elevators etc.

5. ***Metering***

   metering devices for the gravimetrical dosing of AFs for a precise control of the combustion process (e.g. the ODM-WeighTUBE® tubular weighing system, ODM-GraviSCALE belt weighers, etc.).

6. ***Feeding to the kiln process***

   e.g. the mechanical feeding of kiln inlets or calciners (e. g. by screw feeders, injectomizers etc.) or pneumatic feeding of main burners by injector rotary valves (ODM-IZS®) and the corresponding pneumatic transport lines.

7. ***Combustion***

   Successful and efficient combustion of the AF. It is essential to realize that the successful substitution of higher rates of fossil fuels by AF requires the right combination and implementation of the previous process steps [1].

This concept has proven its applicability in a wide range of application fields in numerous installations all over the world. However, a simultaneous increase of machine availability and the corresponding reduction of maintenance costs are not less important than the aforementioned increase in efficiency and optimisation of energy resources, in order to utilise the full potential of those measures.

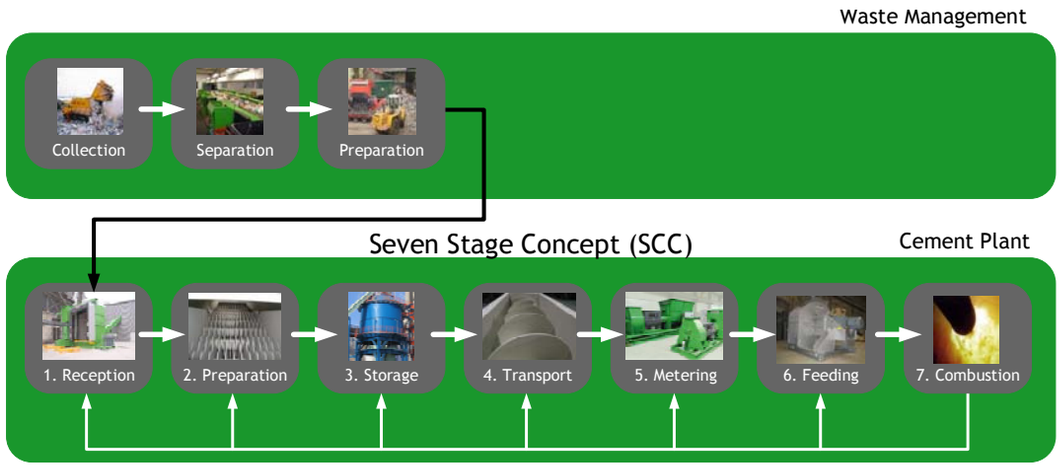


Figure 1- Seven Stage Concept (SCC) for the systematic classification of AF handling plants

DI MATTEO machines and installations are engineered and fabricated especially for the tough operational conditions in AF plants and therefore tailor-made for each customer by a former characterisation of the utilised fuels in terms of its thermal, physical and chemical properties. The corresponding wear resistant materials, which are partially developed within the companies own materials laboratory, guarantee a maximum life time.

Another important aspect which helps to increase the availability of AF feeding installations is the introduction of remote access and maintenance strategies during the conception of the automation system. This article provides an overview of typical concepts and methods for the usage of remote maintenance procedures and corresponding proactive services, by using the example of high-precision bulk-material dosing systems. The technical aspects for the realisation of remote access solutions are described against the background of heterogeneous IT-infrastructures in modern cement plants and actual IT security discussions. Furthermore, corresponding possibilities for a proactive service and maintenance concept are introduced. It can be shown that the reasonable implementation of such services leads to an enormous cost-reduction and a parallel increase of the plant availability.

The remainder of this article is organised as follows: chapter 2 provides a short overview of typical measures for the utilisation and reliability of technical installations. Subsequently chapter 3 contains an overview of typical systems accurate dosing and metering of AFs, while chapter 4 provides an introduction to modern remote access platforms and architectures and how those system can help to increase the availability of technical systems. In the fifth section a short case study for pro-active maintenance is carried out. Finally chapter six concludes the whole article.

2. Measures for the availability of technical systems

In everyday life different terms about the quality of a technical systems are often confused and used as synonyms. However there is a clear difference between the definition of terms such as availability, reliability and maintainability. In order to provide a clear understanding of measuring

the utilisation rate of a technical installation it is useful to introduce some standard definitions of the most important terms:

The *availability* of a technical system is often measured by using the definitions of the VDI 3423 [2] as released by the Association of German Engineers (VDI), where the availability of a technical system is generally defined as shown in the following relation:

$$Availability = \frac{Total\ working\ hours\ of\ evaluation\ period - Down\ time\ in\ evaluation\ period}{Total\ working\ hours\ of\ evaluation\ period} \quad (2.1)$$

However for a practical evaluation of the utilisation of AF feeding installations, the overall down time need to be separated in scheduled and unscheduled stops, since a scheduled down time, e.g. during a periodical maintenance period should not affect the measured availability.

Therefore if the two additional terms *reliability* and *maintainability* can be used in order to provide a clear difference between the different probabilities related to the term availability:

- **Reliability** defines the probability that a technical system will not fail.
- **Maintainability** defines the probability that a repairable technical system can be successfully restored after a failure.
- **Availability** consequentially defines a performance criterion for repairable technical systems that accounts for both the reliability and maintainability properties of the overall system.

The next table illustrates the functional relationship between reliability, maintainability and availability.

Table 1 - Relationships between reliability, maintainability and availability

Reliability	Maintainability	Availability
=	−	−
=	+	+
+	=	+
−	=	−
Explanation of symbols:		
+ Increase	= Constant	− Decrease

In most cases it is more relevant to consider the definition of the inherent availability (A_i), as proposed in [3], which can be considered as the steady-state availability after the initial commissioning process and the typical adaption period are successfully completed.

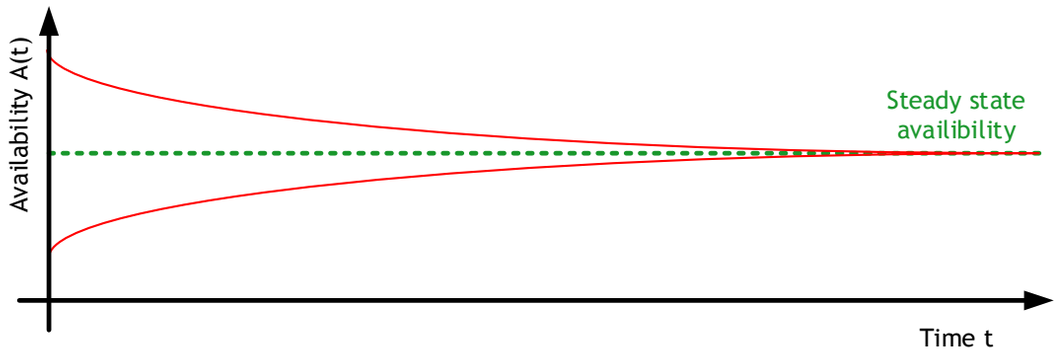


Figure 2- Steady State Availability

So if the availability is defined as a time-dependent function A(t) (often referred to as the instantaneous availability), as shown in Fig. 2, the steady-state availability (see [4]) can be defined as

$$A(\infty) = \lim_{t \to \infty} A(t) \tag{2.2}$$

As it is obvious, the exponential nature of A(t) after the initial commissioning process can contain either a negative or positive slope, since the negative effects of an initial instability during the adaption process and the benefits from a complete new installation can be combined in either directions.

However, since this definition is a quite difficult measure for practical considerations, in most cases the definition presented e.g. in [5] is more useful, since it describes the availability as a function of the mean-time-between-failures (MTBF) and the mean-time-to-repair (MTTR). The exact definition of the inherent availability A_i can be defined as

$$A_i = \frac{MTBF}{MTBF + MTTR} \tag{2.3}$$

In this context it should be mentioned, that the given definition is used for complex technical systems, where the availability cannot be defined based on a single component. For single components a definition based on the mean-time-to-failure (MTTF) is a more common representation.

This measure does not contain down times due to administrative, logistic or preventive maintenance reasons and is therefore a good measure to evaluate the overall systems reliability. So it can be concluded that the availability can be increased by either increasing the MTBF or decreasing the MTTR. While the MTBF depends mainly on adequate engineering decisions (e.g. usage of wear resistant materials or using of high quality technical entities) and reasonable pre-active service actions, the MTTR value is influenced by more complex factors, such as the training of the service personnel, the accessibility of the different system components or the usability of the software components. Thus, even if the definition from equation 2.3 is a quite simple relation, it need to be considered also here, that the MTTR and MTBF values should only be considered to

be constant, once the steady-state is reached. The following figure provides a visual representation of the different values and relations.

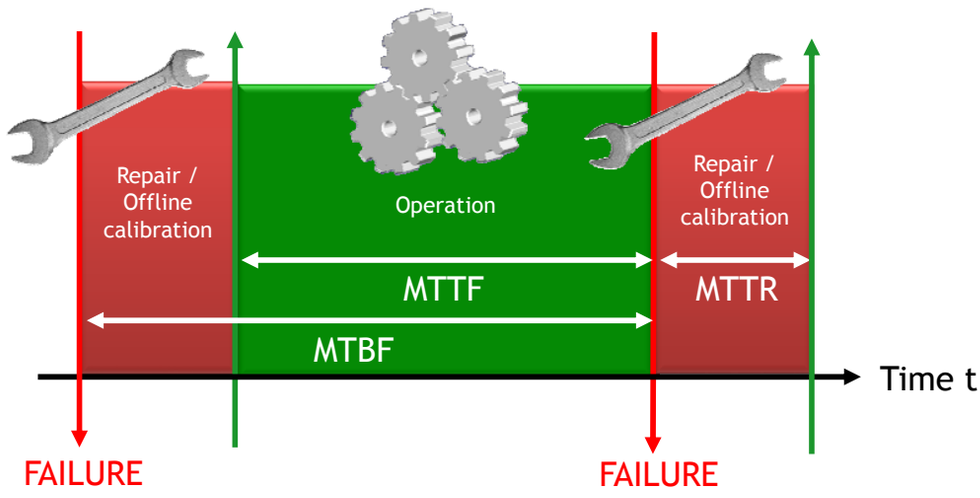


Figure 3- Availability as a value defined by the MTTF, MTTR and MTBF values of a dosing system

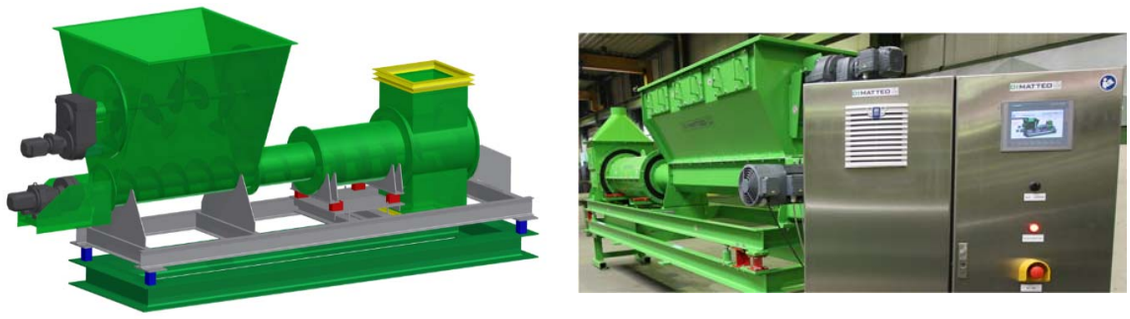
It can be found, that the smart usage of remote access and maintenance solutions can help to reduce the later value drastically. Typical solutions are described here based on metering devices for AFs, as introduced in the subsequent section.

3. High Precision Dosing Systems for Alternative Fuels

If the SCC concept is used as a guideline for typical AF feeding installations, it is quite obvious, that the metering device can be considered as one of the most critical one within the whole conveying line. Therefore the availability of the dosing unit is often crucial for the determination of the overall reliability of the installation. In this context it needs to be stated, that for a dosing system it is not just important that typical downtimes, where the installation is not in operation, can be avoided, but furthermore the dosing accuracy needs to be reliably within the given specification.

DI MATTEO offers three different kind of gravimetric dosing devices for their installations: differential dosing setups for discontinuous dosing setups (e.g. for silo discharge systems), classical belt weighers (ODM-GraviSCALE) and the innovative and award-winning tubular weigh feeder, the ODM-WeighTUBE®. Especially the introduction of the later in 2011 was an important step towards a long-term stable and high precision dosing system, due to its unique design as a completely closed system, where the weighing measurement systems (load cells) are completely separated from the bulk-material, as described in [6] and shown in Figure 4. From past experiences with installations for a great variety of applications, it can be concluded today that these engineering decisions help a lot to increase the MTBF measure if compared to classical metering devices.

In terms of increasing the availability of the overall system, the mechanical platform is only one aspect, which should be considered. This is specifically important since most conventional dosing systems are only available with dedicated controllers, which use in most cases proprietary hard- and software modules.



(a) *(b)*

Figure 4- ODM-WeighTUBE® – High precision tubular weigh feeder: (a) – 3D Model, (b) – Real machine (back) and control system (front)

Thus, for the service and maintenance personnel within the plants these controllers are black-boxes and in the case of a problem with the dosing accuracy or a general error it is very difficult to fully understand the inner reasons for the malfunction. As a logical consequence it is also difficult to resolve the problem without the help of a service technician from the manufacturer of the device, which is leading to much longer downtimes (MTTR increases).

For this reason the automation specialists at DI MATTEO developed a full modular hardware and software concept for the realisation of gravimetric dosing controllers, the ODM-GravitAS control system. This concept implements a modular hardware approach, which is only based on off-the-shelf products from widely accepted vendors of automation products. Furthermore the software implementation is based on common open standards for PLC languages, such as IEC 61131-3, or quasi-industrial PLC standard language sets (e.g. STEP7 from Siemens). The complete concept of the system is described in more detail in [7]. Due to the fact that service personnel can identify and resolve problems by using the tools and systems they are already used to, the MTTR can be drastically decreased. Today DI MATTEO is using the same controller concept for all its gravimetric machines and applications, as shown in Figure 4.

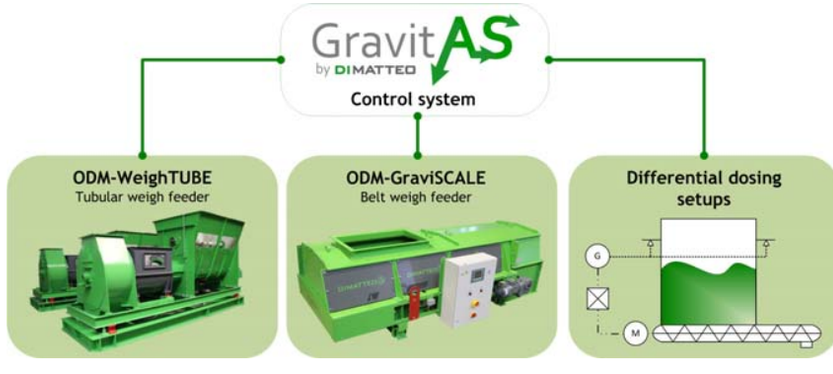


Figure 5- GravitAS control system for different dosing and feeding machines

Furthermore it is possible to include the remote access option (GravitAS-RA) to all installations in order to provide the possibility to immediately connect to the control system from any possible location in the world. Typical architectures and

4. Remote Access and Maintenance as a Tool for Increasing the Availability

As it was mentioned in section 2, the overall availability of the system can be increased if (i). MTBF can be increased, or (ii). the MTTR can be decreased or (iii). both effects can be achieved in parallel. Towards the realisation of these effects, the introduction of remote maintenance and access modules can play an important part.

DI MATTEO offers since years modular concepts for the integration of remote access solutions within their control and automation systems of complete installations. One prominent example is the GravitAS-RA remote access module, which is offered as an optional module within the modular GravitAS control system (see [8]) for gravimetric high precision dosing platforms, such as the ODM-WeighTUBE®. The ODM-GravitAS RA remote access and maintenance solution is based on the integration of a GravitAS-RA industrial router within the control cabinet of the dosing device. The router is responsible for the management of the connection to the local PLC. For this DI MATTEO offers units with various types of PLC interfaces (over 90 different drivers are included) in order to connect to all common PLC types and manufacturers. If the control system contains for example a Siemens S7-family PLC, the connection between GravitAS-RA and the PLC can be done by the multi-point interface (MPI), Profibus or ProfiNET, while for Allen-Bradley based control systems, a Ethernet-IP or DeviceNet communication would be more preferable, etc. The same variety of interfaces is also available for the connection of the module to the internet and be achieved by providing a fixed network interface or the included WAN modem by utilising an analogue or digital telephone line (analog, ISDN) or a mobile network (GSM, GPRS, EDGE, UMTS, LTE). In all cases the connection between the internet and the module is not continuously available, but will be only established by special control instructions (e.g. send by text messages) send by DI MATTEO automation technicians or by request from the plant. By this the costs for the connection can be reduced and furthermore a non-existing connection is the most efficient security guideline you can possibly follow.

However, speaking of security, it is important to mention, that the connection between the remote technician and the module will be achieved by using a secure virtual private network (VPN) connection and integrated firewalls and this even in a double sense, since within the DI MATTEO remote access architecture, there will never be a direct connection between a remote service PC and the PLC itself.

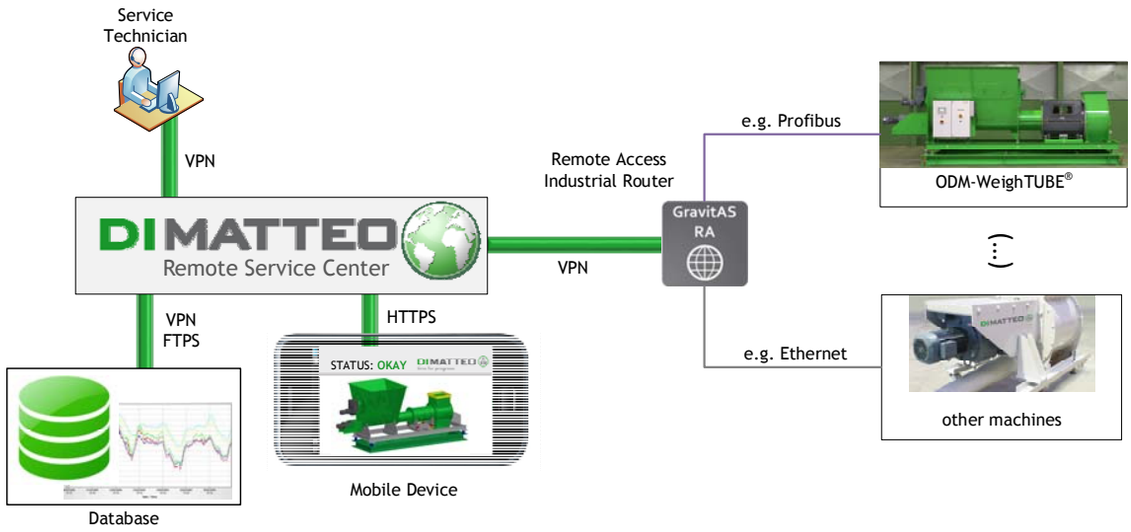


Figure 6 - Remote Service and Maintenance Architecture with dedicated DI MATTEO Remote Service Center

As it is shown in Fig. 6, a direct VPN connection between the GravitAS RA module in the plant and the final application will only be established from the DI MATTEO Remote Service Center, which is a dedicated server platform. All end user applications will only communicate with the remote service center and never directly with the PLC in order to guarantee a maximum security level.
The typical devices which communicate with the machines are also shown in Fig. 6, where the range of interactivity vary from full access of the program for service technicians, archiving for databases and only observation for visualisation. These three levels of access represent also the typical possibilities for the enhancement of the machines availability.

Let us assume the technical system is actually malfunctioning and for this reason not operational. For this reason a maintenance action needs to be executed. As defined in [9], those maintenance actions need to be associated with a certain amount of time which it takes to complete the necessary actions. This time shall be defined as the downtime (Td) and can be influenced by various different factors, such as the physical characteristics of the system, spare part availability, repair crew availability, human factors, environmental factors, etc. If this is considered t_d can be divided into two categories based on these factors:

- **Waiting Downtime (t_{dw})**

  This is the time during which the equipment is not in operation but also not yet undergoing any kind of repair or service. This could be due to the time it takes for replacement parts to be shipped, administrative processing time, etc.

- **Active Downtime (t_{da})**

  t_{da} is the time it actually takes to bring the machine back to a status where it is operational. So this value is the actual time, where service personnel are actively working on the machine.

By this the overall downtime can be defined as the sum of both components:

$$t_d = t_{dw} + t_{da} \tag{4.1}$$

If these times are measured for a number of interventions, the typical MTTR of an installation can be estimated by means of statistical modelling. The MTTR can then be interpreted as a measurement on how well an organisation can respond to a problem with a given machine.

By considering now the existence of a remote access module, it can be shown that both, the active and the waiting downtime can be immensely reduced if the platform is used in a reasonable manner. The most obvious time savings are clearly associated with the fact, that specialised personnel from either the supplier or a different plant do not need to travel, since the GravitAS-RA module gives a full control of the PLC and all problems related to software issues can easily been solved. Furthermore, even if a mechanical problem is the reason for the downtime, the waiting time can be reduced, because the system allows the technician to do an in-depth analysis of the problem by using current and archived process values. From the past experience of DI MATTEO this led in numerous occasions to a situation, where the service technicians in the plant were able to resolve the problem by their own based on detailed how-to-do descriptions delivered based on a prior analysis of data from the remote access module. However, even if a spare part is needed, it provides the possibility that the service technician can bring the correct parts directly with him as soon as it is decided that a visit is necessary. All of the aforementioned examples describe only the advantages during the *corrective maintenance*, which can be defined as all actions taken to restore a failed system back to its operational status. For an increased availability of the system, all factors which can be grouped under the term *preventive maintenance* need to be also considered. A short case study is shown in the next section.

5. Pro-active maintenance – A worthy glace in the crystal ball

Preventive maintenance can be defined as the practice of replacing components or subsystems of a technical installation before they fail in order to promote continuous system operation. By this it is possible to guarantee a higher availability of the technical system when it is important for production and typical repairs can be shifted to periodical maintenance intervals or times when the system is scheduled to be down.
In cement plants preventive maintenance is already used, especially for the continuous monitoring and pro-active replacement of mechanical elements. However, the determination of the system status from actual measurements and data analysis is not utilised to their full potential. A typical application of pro-active maintenance for a dosing application would contain e.g. the automatic analysis of the integrated weighing system based on a data analysis of historic data.

The ODM-GravitAS control system for the ODM-WeighTUBE® implements an automatic calibration routine, which provides the possibility to estimate properties of the dosed bulk material and

automatically adapt the controller parameters in such a way that the dosing accuracy remains stable over time. During this automatic calibration routine the intermediate buffer hopper of the ODM-WeighTUBE® is filled to a certain maximum in a first stage of operation. Within the second phase the buffer hopper is emptied by normal dosing operation (and parallel stopped feed of material to the buffer) up to a predefined minimum buffer weight. From the resulting difference in mass (Δm) and the corresponding expired time (Δt), the actual control parameters of the continuous dosing controller are automatically adapted. A typical calibration process, with its three phases, is shown in the following figure, where the actual buffer weight m_{plant} [kg] is visualised over time.

To avoid possible undesired influences, all controller parameters are checked for plausibility based on a probabilistic analysis of former calibration cycles, before they become active in the system. This statistical analysis can be used in order to provide an automatic notification of the plants maintenance department, that the weighing system of the dosing unit need to be checked next time when it is not operational.

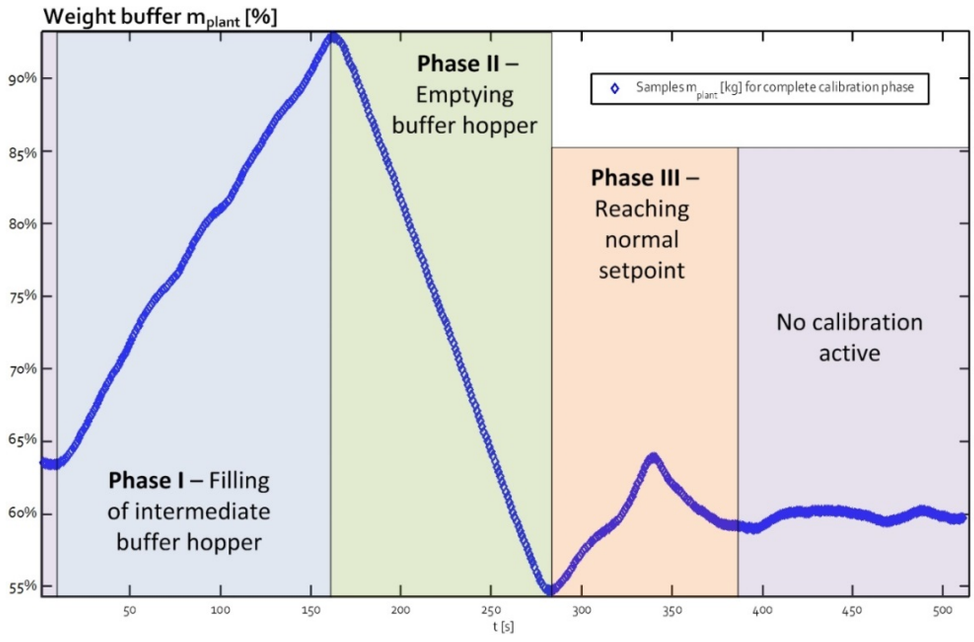


Figure 7 - Three phases of a calibration routine

This can be achieved by modelling the controller parameter based on a Gaussian probability density function. For this a control parameter α, which will be automatically adapted during a calibration cycle, shall be observed. Since α is slightly adapted during each calibration, it can be modelled as a set of n measurements [α_1 … α_n]. These measurements are assumed to follow the Gaussian (or normal) distribution, as defined by the following equation, where μ depicts the mean value of α and σ the corresponding standard deviation:

$$f(\alpha|\mu,\sigma) = \frac{1}{\sigma\sqrt{2\cdot\pi}} e^{-\frac{(\alpha-\mu)^2}{2\cdot\sigma^2}} \quad (4.1)$$

Due to the overall stability of the system the standard deviation of the Gaussian bell curve is typically quite small and can be interpreted as an indicator for a good condition of the weighing system. If the standard deviation is increasing from one point in time it can be automatically analysed in order to generate an indicator for the plant when the load cells shall be checked by the service personnel.

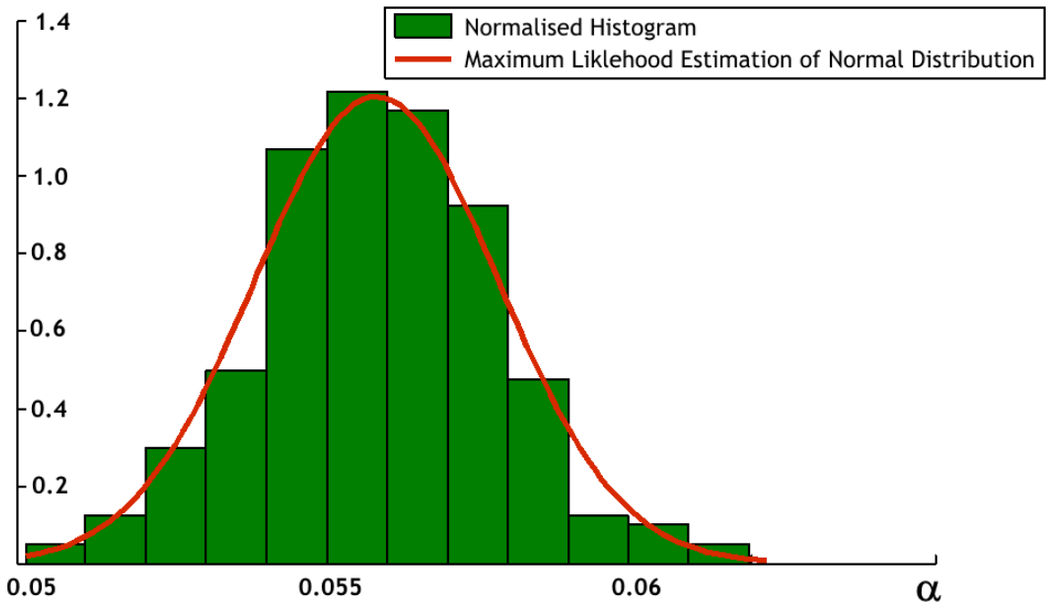


Figure 8 - Normalised histogram and estimated Gaussian distribution of controller parameter a

Fig. 8 shows a typical discrete normalised histogram of α and the corresponding Gaussian distribution as estimated by using the maximum-likelihood estimation (MLE) method, as described in [10]. It is clearly observable that the assumption of a Gaussian process is quite reasonable and furthermore the detection of abnormalities based on the estimated standard deviation is easy to be implemented by considering the sample variance s^2, based on n discrete measurements of α and the corresponding sample mean $\bar{\alpha}$:

$$s^2 = \frac{1}{n-1} \cdot \sum_{i=1}^{n} [\alpha_i - \bar{\alpha}]^2 \qquad (5.2)$$

The evaluation of these measurements can be realised within the PLC or the GravitAS RA e in the DIcemote access module and the actual condition can be visualised as a web based servir heirtATTEO Remote Access Center. By this service technicians can look at this data from M the orking places all over the world and/or by mobile devices used on site. Furthermorew essage tomystem is able to generate automated messages which are transferred by mail or text s ationmhe maintenance personnel in the plant. These messages can even include detail infort for theebout the pro-active actions which should be executed. Fig. 9 shows a typical exampla d in real-timeenteractive display of plant information on a mobile device. The information is loadi ntarom the DI MATTEO Remote Access Center by using HTTPS protocol, while the actual plf

updated by the server over a secure VPN connection to the GravitAS-RA remote access module mounted in the control cabinet in the plant.

Figure 9 – Mobile device used for actual condition monitoring

6. Conclusion

The implementation of a remote access module within actual installations for AF dosing and feeding provides numerous possibilities for increasing the overall availability of the installation. If the availability is defined as a function of the mean-time-between-failures (MTBF) and the mean-time-to-repair (MTTR), it was shown that both indicators can be positively influenced by the reasonable usage of the services included within a remote access module. For this, the example of the actual high precision AF dosing devices was used, where especially the innovative tubular weigh feeder ODM-WeighTUBE® was used as a case study. In this context a possible example for the integration of preventive maintenance measures was described. Due to modern connection architectures based on virtual private networks (VPNs) and the inclusion of the DI MATTEO Remote Service Center as a natural firewall between the end-user and the machine itself, security concerns are no longer justified.

The smart integration of a remote access strategy can help to increase the availability of an installation drastically and should be common sense for all planners of such machines. The relatively low integration costs are compensated in most cases during the first usage of the remote access due to the enormous savings in travel and personnel costs. In this context it should be mentioned that small scale solutions can be also easily integrated within existing installations.

DI MATTEO will further develop their actual applications in that field and preventive maintenance solutions for all parts of an installation are already available.

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Contact:

Dr.Dominik Aufderheide

dominik.aufderheide@dimatteo.de

www.dimatteo.de

Everything you need To maintain your Vertical Mill

By: Eng. Osama Aly Ahmed, Energy Efficiency Specialist

Introduction:

A vertical mill is being considered the most important equipment at the moment where it's due to the high their productivity. After has become represents one unit in the production line and therefore represents a bottleneck run for modern factories due to rising spare parts prices and their need to high technical level of the maintenance crew, but the major advantage in providing high energy efficiency and their high productivity As a result of the above, we are now fully aware of the importance that all engineers (erection, commissioning, maintenance, operators, and process) are fully aware of all mill troubles One of the most common problems are the vibrations that we tried to put mill user guidelines to find out the reasons and to reduce vibrations problems

When will operator feel for his mill condition?
In this article I try to describe mill mechanisms which vibration affect

What are the sources of vibrations?
How to predict for future troubleshooting which occurs?

How to improve vertical mill life cycle?
To answer all these questions we need to know all parameters which govern mill operation condition

At first it is fixed rule for all VRM that the root cause for vibrations is always unbalance of forces and tensions between rollers rotating and table rotating with material in so normal conditions.

A-Mechanical aspects:

Take certainty and check the following items

1- Check all screws tighten for roller jack (tensioning system) and drive units (Motor + Gearbox) as stated values
2- Control the height of dam ring (up or down) regard to main motor current.
3- Suitable substrate and control water injection.
4- Check accumulator pressure (bladder accumulator or piston accumulator) as stated values.
5- Check the surface of table and rollers spot pits can create vibrations
6- Mill surface completely clean Prevent source of oil contamination around the anchor bolts due to seals leaks of hydraulic cylinders.
7- a high N (nitrogen) pressure lower down the stiffness of your spring system therefore you can even go higher grinding working pressure
   If you have more volume of N to damper your high and low jump at the mill table. I would

suggest you to gradually increase your dam ring height, and get fixed your material size.
You will notice once you are confident on vibration level, that there will be potential to increase gradually working pressure, and producing at another level of efficiency.

8- If you pulled your gear unit out of mill first step checks your base plate elevation by total station device to avoid any inclination in concrete foundation.

B-Electrical aspects:

Make sure your power supply is steady and stable
Variation in voltage applied on the motor in some cases results a variation in the motor RPM which applies a positive or negative torque on the gearbox main shaft.
Also there is a friction force between the rollers and the table or material which is transferred to the gearbox.
Applying these two forces on the gearbox from the directions of input and output may results a negative dynamics appears in form of vibration.

C-Production and process aspects

At first
Please make sure your material (limestone) granulometry in function of the main rollers if are in range between 20002400-mm max Limestone size (100% passing) should be 100mm (in case rollers >2500mm you can have limestone chunks 100% passing 115mm)., if you have bigger chunk of limestone, you will have bigger vibration
Now we ready to check these points

1- Check your raw materials has anything changed recently Ensure correct feed size of incoming material (Neither too fine nor big size. avoid big size <3% anyway.
2- Do check that your raw mix is well mixed before feeding to mill
3- The air flow across a mill especially pressure differential value through mill so important point which responsible for carry on your material up.
4- Check good air flow in the classifier by opening guide vanes & good material seal on top.
5- Check the nozzles for moisture on the table clogged nozzles also give problems Apply good water spray nozzles between & directed to the compressing side of feed near roller crushing face. Avoid excess water spray.
6- By passing of heat air created this problem also
7- Analyzing your rejects closely to identify hard materials
8- Feed material size not very fine or coarse more than 1015- % so very fine material dose not form a good bed
9- Check the hydraulic motor for the separator for its consistency of speed - if there is a speed fault the mill will not clear the fines and this would result in vibrations
10- It is must be your fixed rule: must execute it periodically every month Check moisture on the bed if you stop the mill and the fan together and open the mill, the bed should be found to be well formed and moist around 3 -4 % moisture still there across the bed sample the top shall be almost 7 to 8 % moisture accordingly.
11- Closely log the cleaning of the metal detector and separator, and examine the material found in the metal separator. If the quantity is increasing, then some material is bypassing the separator and going to the mill. You will have to locate the entry point of these, and if that is a problem, increase the speed of the belt to reduce the belt material height you try these, and you shall certainly locate your problem.

12- Adjust mill Dp. for stable operation, before forcing the mill to maximum feed. Step by step ramp up of capacity is essential, keeping vibration in check.

D-Civil work Aspects

Abnormal conditions which related to civil and foundation unlikely conditions which considered as so bad conditions

1- Most mill foundations are multiple pours of concrete, which naturally gives rise to several cold joints. These cold joints do not allow the transfer of energy from one layer to the lower one, and thus the concrete is unable to perform its damping function properly. Oil contamination around the anchor bolts, which will eventually feed down into the cold joints only compound the problem. The other major problem is that the fastening of the gearbox and the mill stand itself is reliant on large steel structures embedded in the top pour of concrete. The interfaces between steel and concrete are vulnerable to oil penetration, and the overall stability is immediately compromised. Any steel-concrete interface should require the use of epoxy grout to maintain a consistent integrity to the foundation, and provide a long trouble-free life. Once the foundation issues have been resolved.
2- Chockfast layer is a new technology essential for large mill, it plays an important role to absorb mill vibration and maintains precise equipment alignment.

- Chockfast works in collaboration with the anchoring system to maintain the aligned "position" of the equipment critical to efficient performance.
- Resistance to downward and lateral acting loads on the foundation.

3- If there is a foundation problem which can be easily checked by checking the vibration levels from top of the mill down to the foundation (if the amplitude is reducing and the frequency is increasing as we go towards the foundation, and you have minimum amplitude and max frequency at the foundation bolts, then you have to attack the foundation. The best way is to stop the mill, and make holes around the foundation and pump epoxy cement into the foundation till it overflows. Allow to set as per the supplier recommendation and then start the mill. The foundation problem would be sorted out, unless it is the soil load taking capacity problem.

You can even try agencies who work at dams where pumping of concrete in foundations is normal.

4- Oil contamination is surely a big enemy for foundations. Also the steel must be oil free Single pour is a must for whole foundation. Engage trucks with similar mix (Very Important & responsibility for concrete engineer) for all side of foundation or take the corners & fill towards centre, rapidly disengaging the air entrained. The target is to make a MONOLITH structure in minimum time.

Foundation steel rods (Do not cut them to level) are normally twisted & tied around the base frame which is well leveled to best millimeter. Many times it is stress relieved before installation (In the workshop off course).

Based on the total machine load (Static + dynamic load), minimum about 600% or more is the foundation weight.

Other factor & protocols of locking, fasteners with torque & alignments make a great influence in vibration transmissions to foundation & its deception.

Body fasteners of mill body itself are sometime the source of vibrations.
Major issue found is mismatch of drill holes while assembly, therefore workshop assembly & match marking is must.
Proper type of Gaskets + Hardware is the best selection.

Then last is the equal Torque of all bolts& that too in selective sequence to avoid any deformations.

5- this last solution over here is to be evaluated by an expert in vibrations and civil engineering team which know very well the foundations but could be a solution, but need to be verified on site, is the option to put a bucket or moe buckets of balls (grinding balls) on top floor separator walkway in case this will increase the static mass on the top part of the mill help in reduce vibration by increasing mill rigidity.

At last how to improve vertical mill life cycle?

It went more companies to develop sensors to monitor the performance of drive unit through temperature measurements on journal bearings and the measurement pressures of oil and measuring torque on drive unit and thus achieve effective control to the operator to become fully aware of all what is happening inside drive unit and the impact of the different processes on drive unit.

Process monitoring system

The monitoring of torque vibration is vital that helps operators to understand drive unit reacting to the varied operating conditions.

Critical operations can be diagnosed and overloading of the machine can be avoided.

There are other records for main operating parameters of the system

As mill feed rate, inlet temperature, hydraulic pressure and water injection rate, pressure drop ... etc. also in relation to drive unit monitoring

These technologies applied effectively now by some companies to avoid big loss of machine stop.

This directly correlates critical process situations indicated by the torque sensor with the actual process parameters as a fuzzy system.

All parameters now are under control, Operations errors can also be analyzed and machine operations streamlined further enabling an increase in the life – time of the VRM

Eng. Osama Aly Ahmed, Energy Efficiency Specialist
Cemgate@gmail.com
Tel.: +201004466485 / +201064170712

Influence of the refractory lining on the cost efficiency of clinker production

By: P. Groger, H.-J. Klischat, S. Puntke - Refratechnik Cement GmbH, Germany

Summary

The sales of cement, lime, steel and aluminium continue to provide an indication of the wealth of society. Together with some other industries their production stands at the start of the value-added chain and, as energy-intensive industries, they are always trying to reduce the use of energy without compromising the properties and quality of the products. The characteristics variables here are essentially the CO_2 emissions, the carbon footprint and the energy efficiency. Numerous process engineering measures have been taken in the past to lower the energy usage. Moving the calcination of the limestone to the preheater, the use of a pre-calciner or the use of alternative, biogenic, raw materials and fuels can be mentioned here as examples. Efficiencies were achieved that are exemplary for thermal processes. Refractory products, which are located further along the value-added chain, are indispensable for the production of cement and lime [1]. The installation of thermally insulating refractory bricks in rotary kilns and the backing of brickwork with insulating materials have therefore also been known for a long time [2 to 4]. However, new developments offer further potential for lowering the use of energy and increasing the energy efficiency still further. Processes are coming increasingly to the fore that were formerly not considered because their energy-saving potential seemed low but will have to be taken into account in the future. This includes, for example, the heating procedure after a kiln stoppage. The examples of new developments in refractory technology that are described in this article are representative of the intensive interchange between customers and refractory developers and underline the potential for innovation.

(Translation by Robin B.C. Baker)

production of cement and lime. They not only protect the metal surfaces of the plant components (rotary kiln, preheater, calciner, cooler and burner lances) but also assist the formation of the reaction products through the interactions between the lining and the material being burnt (heat exchange processes, especially in rotary kilns). The costs of the refractory materials make up only 1 to 2 % of the total costs of cement production, while fuels, electrical power and raw materials contribute over 50 % to the costs (Fig. 1, [5, 6]).

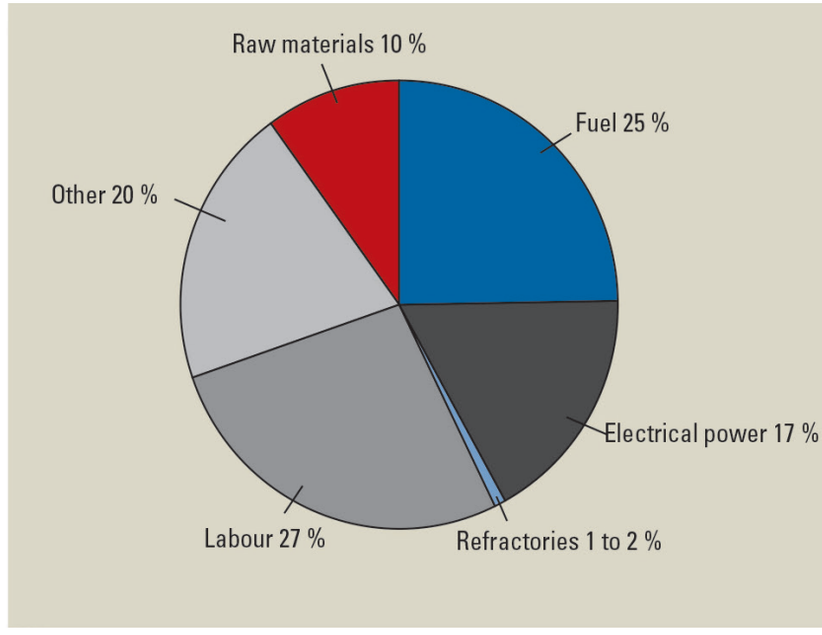


Figure 1: Breakdown of costs in cement production (Source: ICPA 2008)

1. The influence of the refractory lining on cement production costs

Refractory linings are essential process requirements for the

The choice of refractory lining, like changes to the parameters of the clinker burning process, sometimes has a substantial influence on the overall economic balance. Changes

in the coating behaviour, infiltration of fused salts, shifts in temperature profiles and too little or excessive coating formation as well as local or partial overheating or reducing conditions are examples of the consequences. Basically, it is necessary to recognize and evaluate the individual aspects and define the priorities appropriately. A higher grade refractory lining may also contribute to lowering the costs in the fuel and raw materials sector and it may be possible to reduce electricity consumption by lowering the weight of the brickwork.

Due to the nature of the process the refractory bricks are subject to wear, so determination of the respective causes of wear in the rotary kiln is of fundamental interest for the development of new products that are better able to withstand these stresses. According to the analysis by a leading cement group statistically 48 % are attributable to general refractory consumption, 27 % to changes in process conditions, 12 % are due to mechanical problems with the kiln (ovality, axial distortion, etc.), 5 % are due to wear resulting from the installation, in 7 % of the cases the wrong refractory material was chosen, and only 1 % is due to poor quality of the refractory material supplied (Fig. 2).

This affects all parts of the plant lined with refractory products but the main wear takes place in the rotary kiln itself. The chemical and thermal stresses and their combination occur here at the highest process temperatures. Possible ways of overcoming them are shown in Fig. 3.

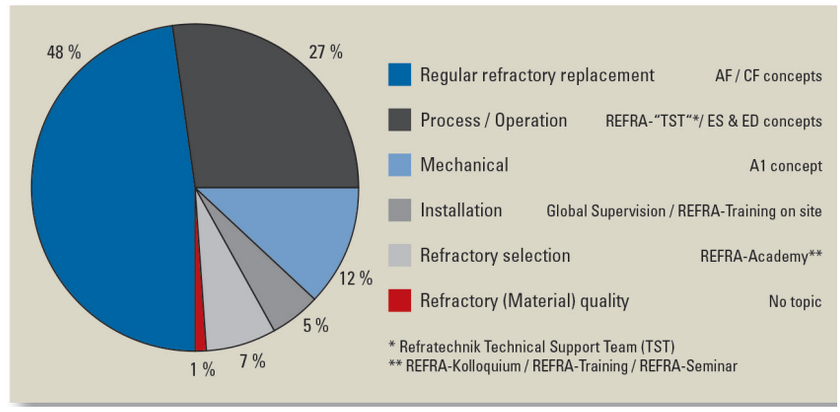


Figure 3: Refratechnik Cement countermeasures for reducing the causes of refractory wear

Product families that successfully meet the new and increased requirements have already been developed at Refratechnik Cement to lower the general consumption of refractories. These include the AF concept for kilns that are particularly affected by alternative fuels [7], the A1 concept and recently the CF concept for stress relief in kilns that are particularly subject to mechanical stresses [8, 9] (see Section 2.1). There is a similar situation with solutions to improve the process conditions. In this case linings made of ES concept bricks with low thermal conductivity (see Section 2.2) or of refractory concretes based on the ED concept that can significantly shorten the unproductive heating-up procedure (see Section 2.3) offer significant advantages in productivity and cost savings. Nor do these measures involve additional capital costs as the durability corresponds to, or even improves on, that of classical refractory materials.

With partnership-orientated refractory producers there are also competent discussion partners available who can assess the cement and lime burning processes from the process engineering aspect and give valuable advice on kiln operation (e.g. the Refratechnik Technical Support Team). Magnesia spinel bricks based on the highly elastic A1 concept can be installed where

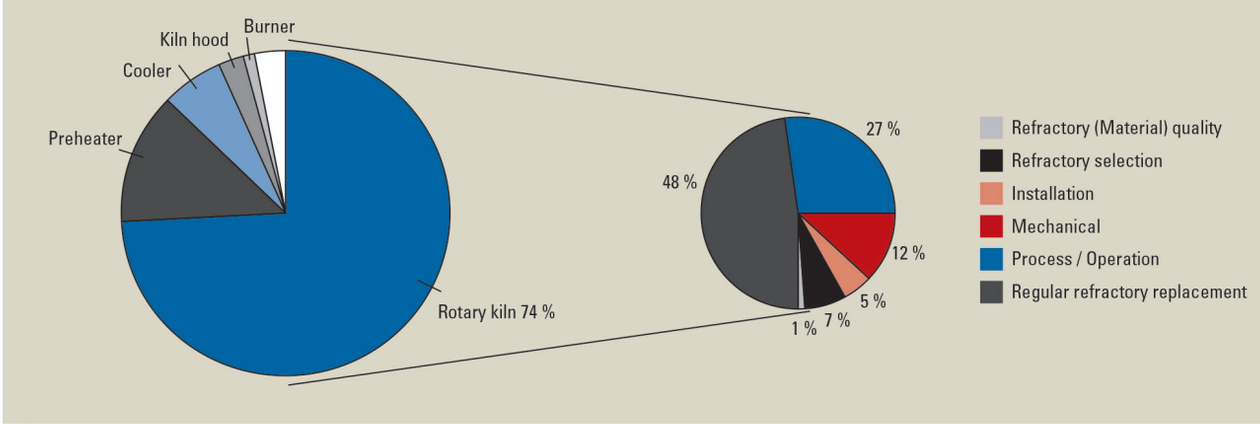


Figure 2: Statistical evaluation of the causes of refractory wear in a cement plant

there are mechanical kiln problems, e.g. due to ovality, axial distortion, manholes, etc. These bricks facilitate stress relief because of their low elastic modulus and high strength, and they extend the service life in those kilns with difficult operating conditions.

The quality of installation can be improved by profession monitoring (global supervision, foreman support) and also through special advanced training programmes for the plant personnel. It is possible to choose from different customized offers that range from on-site training (e.g. REFRA-Training on site) that can take account of the customer's specific circumstances worldwide to two-week training programmes with well-founded theoretical and practical components (REFRA Academy). They all have the objective of ensuring maximum service life of the refractory materials employed through the use of optimized linings. For better understanding of the optimum choice of refractories there are also events in which new problem solutions can be discussed with the cement plant operator, e.g. the REFRA-Kolloquium, the REFRA-Forum or the REFRA-Training.

2. Refractory solutions for the cement industry to reduce costs

Basically, the choice of refractory lining concept affects the cost of cement production as a whole. However, the economic and process engineering constraints must always also be taken into account as they have a crucial influence on the design of a lining. Alongside the production method, the age and condition of the plant and the type and proportions of the fuels or possible raw material peculiarities it is also necessary to bear in mind the utilization factor and the associated stoppage times. Only in this way is it possible to optimize the performance of the lining in the form, for example, of a longer running time (characterized by refractory consumption per t clinker), delay replacement of the lining and reduce costs. From the purely technologic aspect the use of different thermally insulating designs or the installation of suitable products can reduce the shell temperature and therefore lower the energy consumption and emissions.

2.1 CF concept

Classical magnesia spinel bricks based on MgO and $MgAl_2O_4$ form some of the standard linings for kiln plants in the cement and lime industries. They are characterized by high refractoriness and good compatibility with cement clinker. On the other hand, they contribute very little to the thermomechanical stress relief. In comparison, magnesia chromite bricks with an increased iron oxide content were technically advantageous because of their ability to relieve mechanical stresses thermoplastically without cracking, especially in older rotary kilns. The content of FeOx contributed to improved formation and adhesion of the coating that lessened the corrosive effects of alkalis, kiln atmosphere and temperature changes [10].

For environmental and, in particular, for industrial safety reasons magnesia chromite bricks have lost their importance because of the possible formation of alkali chromates. In order to retain the characteristic properties of this product group the development of refractory magnesia pleonastic and magnesia hercynite bricks containing iron has made a crucial contribution and their use has proved successful throughout the world [8, 11, 12].

Linings of magnesia hercynite bricks in rotary kilns and the corresponding laboratory measurements have shown that there is a disadvantage in the use of hercynite because of its comparatively low resistance to cement clinker under increased thermal loading. The formation of a certain quantity of dicalcium ferrite and tetracalcium aluminoferrite is definitely beneficial for assisting the formation of coating but with significant overheating, such as is observed increasingly with the use of replacement fuels, the stable coating becomes detached and there is increased corrosion of the bricks containing hercynite [13]. In this case there is intensified formation of a melt phase consisting of cement clinker and brick constituents, causing premature wear of the brick. It is therefore more advantageous to use products in which there is no hercynite but that contain a more corrosion-resistant pleonastic spinel with the composition $(Mg,Fe)(Al,Fe)_2O_4$.

Substrates of hercynite, pleonastic spinel and magnesium aluminium spinel (MA spinel) were corroded in direct contact with Portland cement clinker (OPC) in laboratory investigations with a hot stage microscope (Fig. 4).

The hercynite is almost completely corroded at temperatures of up to 1400 °C with the formation of melt phase, while pleonaste and MA spinel remain stable to far above 1400 °C. The corresponding corrosion temperatures are about 50 to 80 K higher for pleonaste and MA spinel because the MgO content in these elastifiers makes a drastic improvement in the corrosion resistance. This is confirmed in practice. Investigation of the microstructure in linings that have been removed show the severe corrosion of the hercynite by cement clinker while pleonastic spinel and also MA spinel exhibit only slight corrosion under comparable conditions (Fig. 5).

In-situ spinels are significantly less corrosion resistant than pre-synthesized spinels [13].

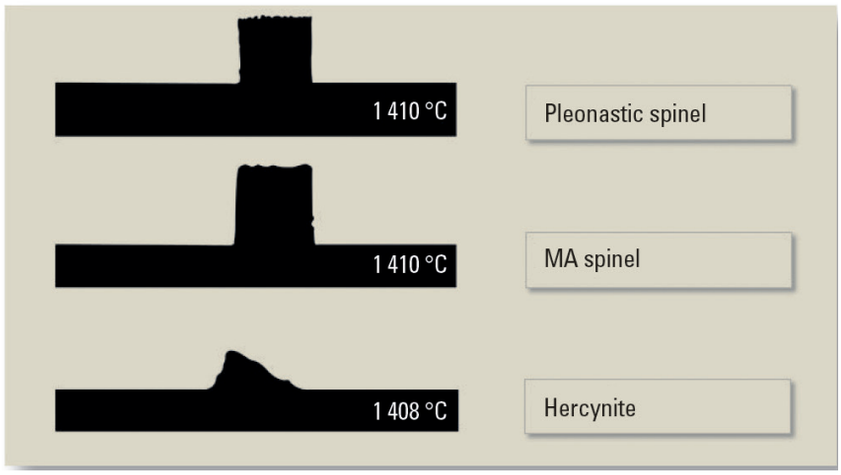
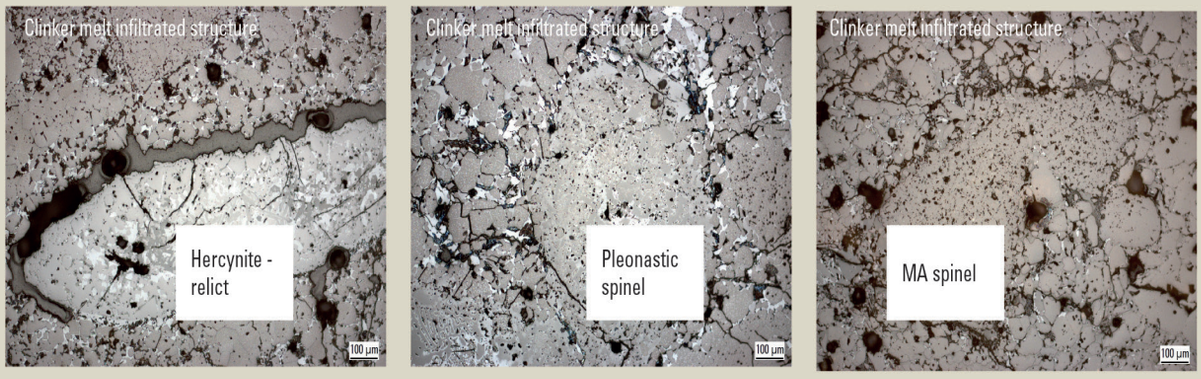


Figure 4: Corrosion behaviour of various spinel mineral substances in contact with ordinary Portland cement (OPC)

The use of these innovative elastifying materials in combination with the proven AF concept for refractory bricks with high resistance to infiltration led to the development of the CF products with high chemical resistance and optimized stress resistance combined with improved coating formation when compared with classical magnesia spinel bricks (Figs. 6 and 7). The products of the CF family with their deliberately economical design therefore form a logical bridge between the AF and A1 concepts. Their successful worldwide use in rotary kiln plants

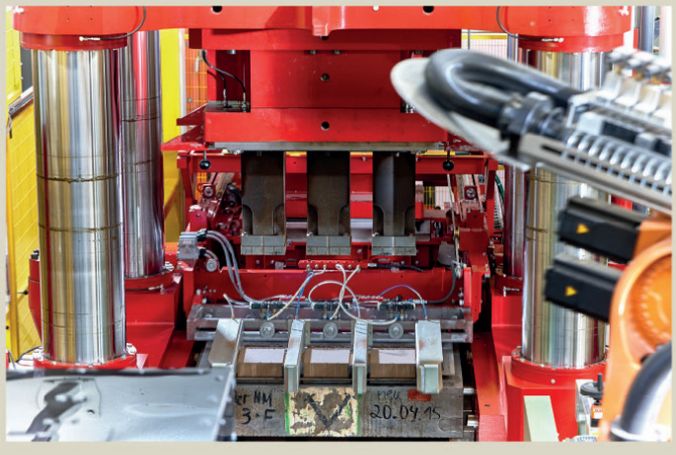


Corrosion of hercynite vs. clinker melt

Corrosion resistance of pleonastic spinel vs. clinker melt

Corrosion resistance of MA spinel vs. clinker melt

Figure 5: Resistance of different spinel types in basic bricks to corrosion by clinker melts



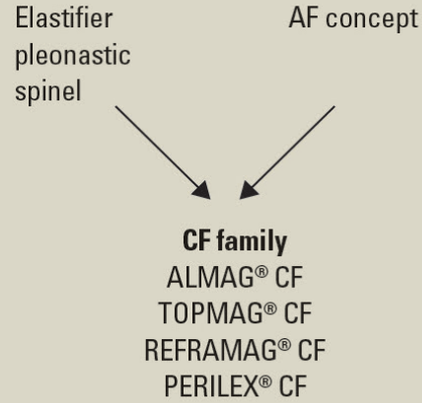
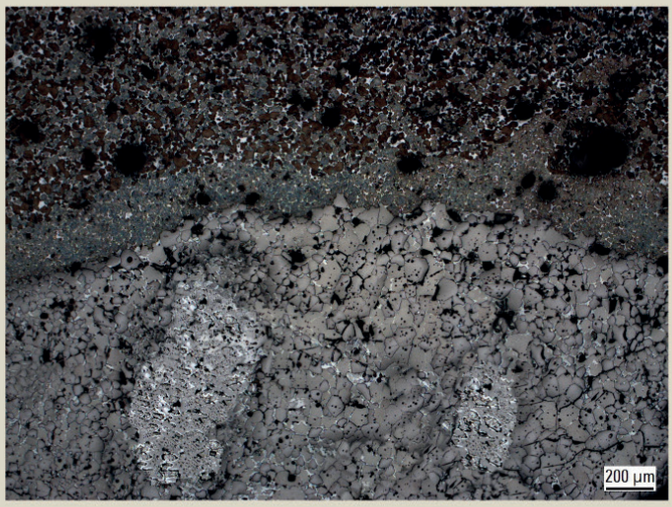


Figure 6: Pressing of innovative basic bricks (CF concept)



Improved coating adherence of cement clinker on a magnesia pleonaste brick due to the presence of FeO and Fe_2O_3 accompanied by high corrosion resistance

Energy-saving due to enhanced coating behaviour

Protection of refractory lining and kiln shell

Figure 7: Formation of cement clinker coating on a magnesia pleonaste brick

confirms that they have excellent resistance to the very varied process conditions that occur in practice.

The disadvantages that occur in bricks containing monophase elastifiers (also with hybrid-elastified bricks, e.g. with two separate elastifiers) are avoided by the combination of MgO, Al_2O_3 and FeO_x in a resilient elastifier. At the same time the thermoplastic resistance to mechanical stresses can be increased by the carefully controlled presence of FeOx not only in the elastifier but also in the magnesia matrix. The basis for this behaviour is the increased, crack-free, ductility of the refractory products due to the improved plasticity of the magnesia. This is exhibited clearly in the determination of the creep in compression as specified in DIN EN 993- 9:1997 (Fig. 8).

The ability to compensate for thermoplastic stresses rises with increasing content of FeOx from ALMAG® CF, TOPMAG® CF and REFRAMAG® CF to PERILEX® CF in which the refractoriness needed for cement burning is always maintained. The choice between these products must be made on the basis of the particular requirements of the specific rotary kiln to achieve the optimum cost-effectiveness for the operator.

2.2 ES concept

Analysis of the energy losses during clinker burning in the rotary kiln process shows that about half of the energy used is required for calcination and clinker phase formation and

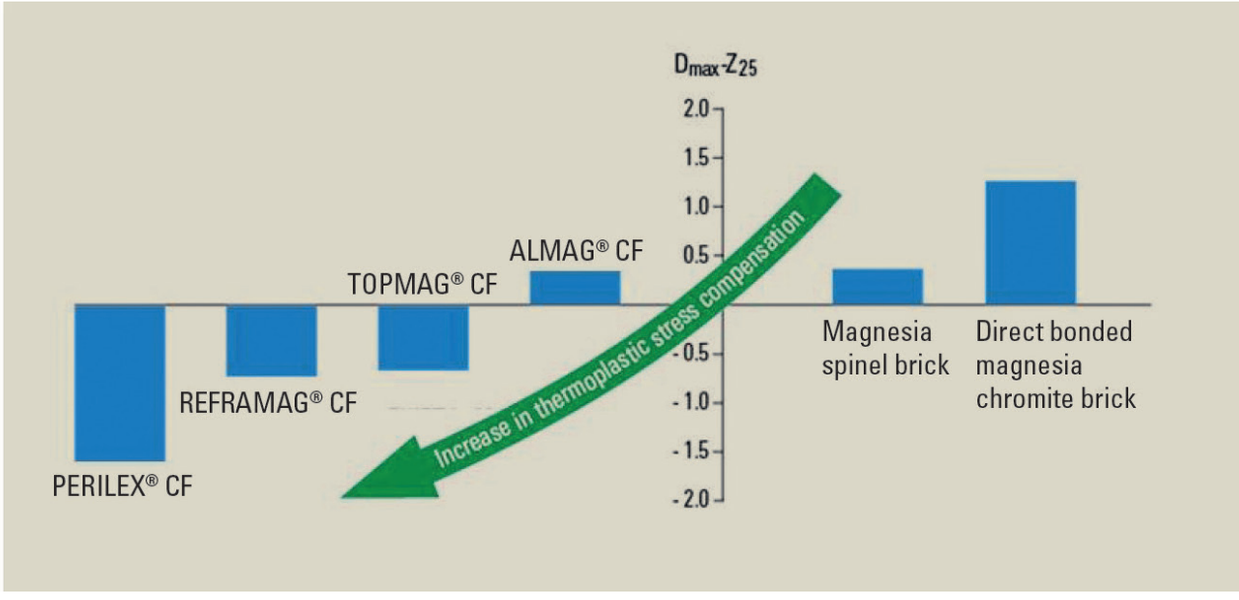


Figure 8: Thermoplastic stress relaxation by controlled creep under compression

21 % is available for other processes (predominantly drying and heating processes) but a quarter remains unused (Fig. 9).

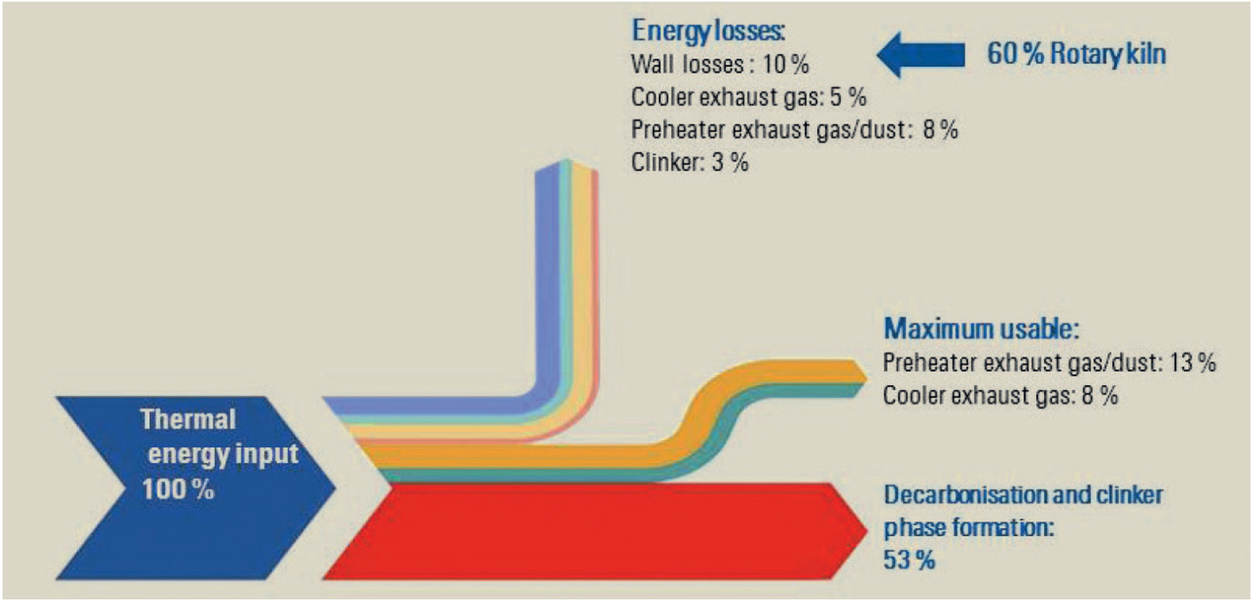


Figure 9: Energy losses in the cement clinker burning process (Source: VDZ)

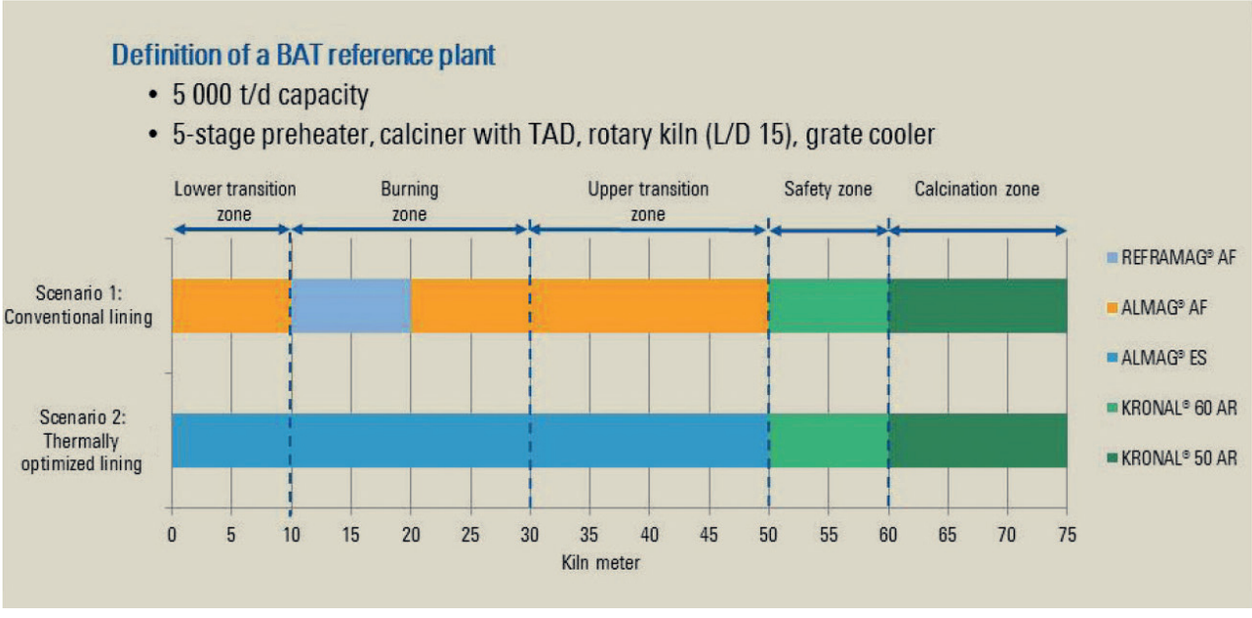


Figure 10: Refractory lining for a simulated case study of the reduction of heat losses in the cement clinker burning process (Source: VDZ)

Measures to utilize this energy, especially from radiation losses, 60 % of which are in turn due to the rotary kiln, have failed in most cases because the efficiency was far too low. A significantly more promising way of avoiding wall heat losses is therefore to reduce the flow of heat through the refractory lining without allowing the refractory properties and the chemical resistance to be affected by, for example, salt infiltration. The methods investigated in the past using two-layer brickwork or the so-called clog bricks in which the brickwork stood on small feet [14], were not always sufficiently stable for mechanical reasons.

However, there have recently been new developments

that take the previous experience into account and offer a solution to the problem that can avoid expensive capital investment for the cement plant operator. A basically classical refractory lining is used with standard formats. The underlying idea makes use of the fact that air is the best industrially available thermal insulator. There are plenty of examples of applications in both the refractories industry [2, 4] and in the binder industry, e.g. in the form of gas concrete or lightweight concrete. However, the use of porous basic products, specifically bricks for rotary kilns, is either unknown or has not yet been successfully implemented due to low strengths. The use of new process and burning technology has now made possible for the first time to produce magnesia spinel bricks with porosities of 22 to 25 % for lining kilns in the lime and cement industries with strength and refractory properties that match those of classical products [6, 15].

and KRONAL® 60 AR bricks.

The results of the simulation showed that the wall heat losses from the rotary kiln are reduced by about 16 % compared with the conventional lining. Relative to the areas with basic lining (coating-free) there is a reduction by as much as 30 %. This corresponds to a reduction of the specific thermal energy demand of the underlying BAT plant by 1.2 % or 35 kJ/kg clinker (8 kcal/kg clinker). This could reduce the coal usage by more that 2000 t/a with a corresponding drop in CO_2 emissions. Not included in the calculation is the simultaneous reduction in electrical power for driving the rotary kiln with its reduced weight and for the cooling fans that might be used for lowering the shell temperature.

Reductions in shell temperature by up to 60 K, and in one case even permanently by 90 K, have been measured in practice in the basic zone (Fig. 11).

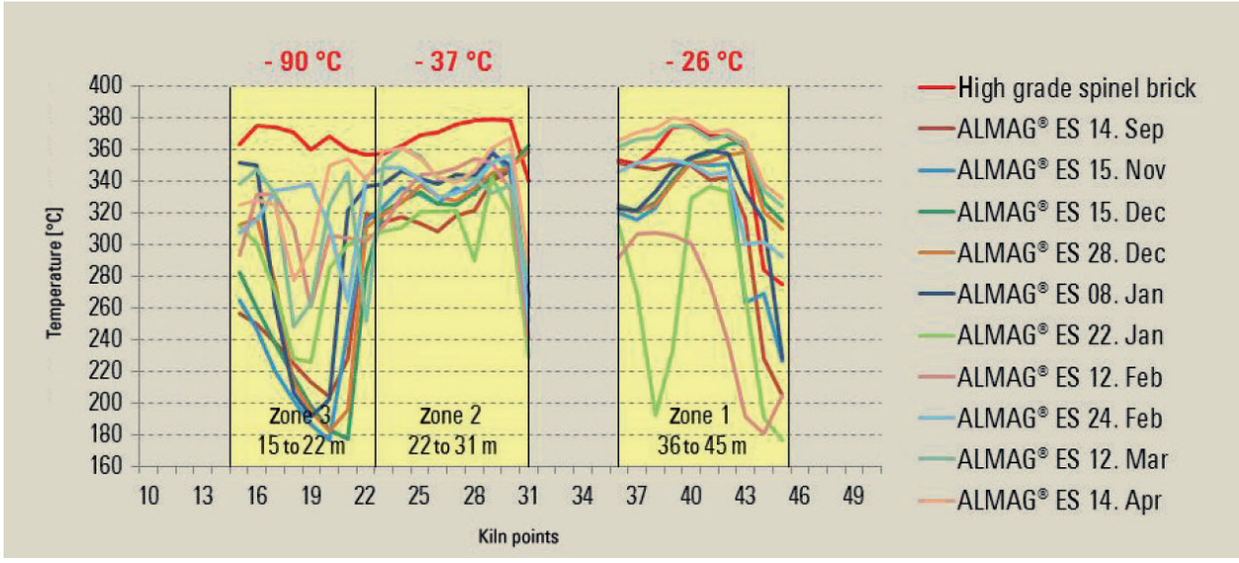


Figure 11: Measured reductions in kiln shell temperature by use of ALMAG® ES

The VDZ at Duesseldorf carried out a simulation study based on a mathematical model of the burning process [16] to evaluate the reduction in energy that can be expected from the use of a brick with a porosity of approximately 23 %. It considered a BAT plant with a production capacity of 5 000 t/d with a 5-stage preheater, calciner with tertiary air duct and a grate cooler. The kiln was 75 m long with an internal diameter of 5 m. The fuel used was 75 % pulverized bituminous coal and 25 % alternative fuels (fluff, animal meal, sewage sludge). The reference lining of the kiln consisted of a classical concept with ALMAG® AF and REFRAMAG® AF in the transition and burning zones. For comparison, the same plant was lined in the basic zone with ALMAG® ES bricks in accordance with an energy-saving approach, Fig. 10. In both cases the non-basic zone was lined with KRONAL® 50 AR

This means that the amount of unusable process waste heat (from cold clinker, wall heat, raw gas and cooler exhaust air) was reduced by about 4 % from 26 to 22 % by the installation of ALMAG® ES [16] – a significant contribution to energy efficiency without additional capital expenditure. The installation was also carried out in the same way as the classical concept with VDZ or ISO formats. There is no need for additional expensive work, such as with two-layer brickwork with thermal back-up insulation. When used in rotary kilns in the lime and cement industries but also in the dolomite and related industries the ES concept makes an active contribution in the balance sheet to cost reduction as well as to environmental protection (Fig. 12).

This means that a highly cost-effective brick is available that can be used universally and is mechanically

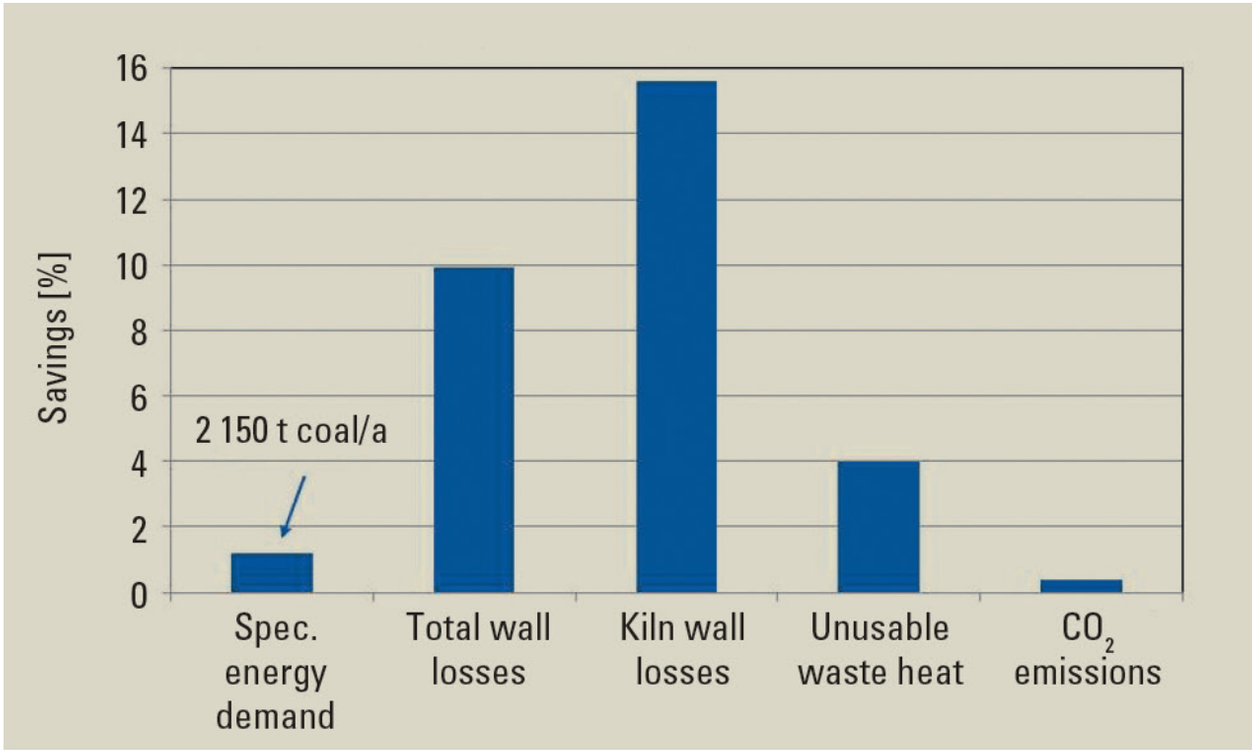


Figure 12: Saving potential ofthe lining using the innovative ES concept from Refratechnik (Source: VDZ)

highly dependable. Because of the reduced density the operator obtains a lining with significantly lower material requirement (about 10 %) [17].

2.3 ED concept

Bringing a rotary kiln plant back into operation after an inspection or re-lining is associated with major challenges and costs. Numerous factors and influences have to be borne in mind while the plant is being heated up and, under some circumstances, they can nullify the efforts of weeks or months. The heating phase after installation of refractory concretes, which are being used to an increasing extent instead of shaped products, is particularly sensitive [18]. In addition to design measures (adequate evaporation holes) the temperature has to be raised in steps to avoid spalling or explosion of components due to steam pressure. This causes further delays to the meal feed and the actual start of production. The slow heating required for decomposition of the calcium aluminium hydrate phases (principally $CaO{\bullet}Al_2O_3{\bullet}10H_2O$, $2CaO{\bullet}Al_2O_3{\bullet}8H_2O$, $3CaO{\bullet}Al_2O_3{\bullet}6H_2O$) also requires more fuel, which gives rise to costs and emissions. Ultimately, the de-watering has to take place in a controlled manner through the pores in the microstructure in the temperature range up to 1000 °C. If the heating is too rapid the abovementioned steam explosions can occur and destroy the lining, which then has to be installed again with additional costs and loss of time (Fig. 13, [19]).

Figure 13: Damage by steam explosions in refractory concrete linings containing cement

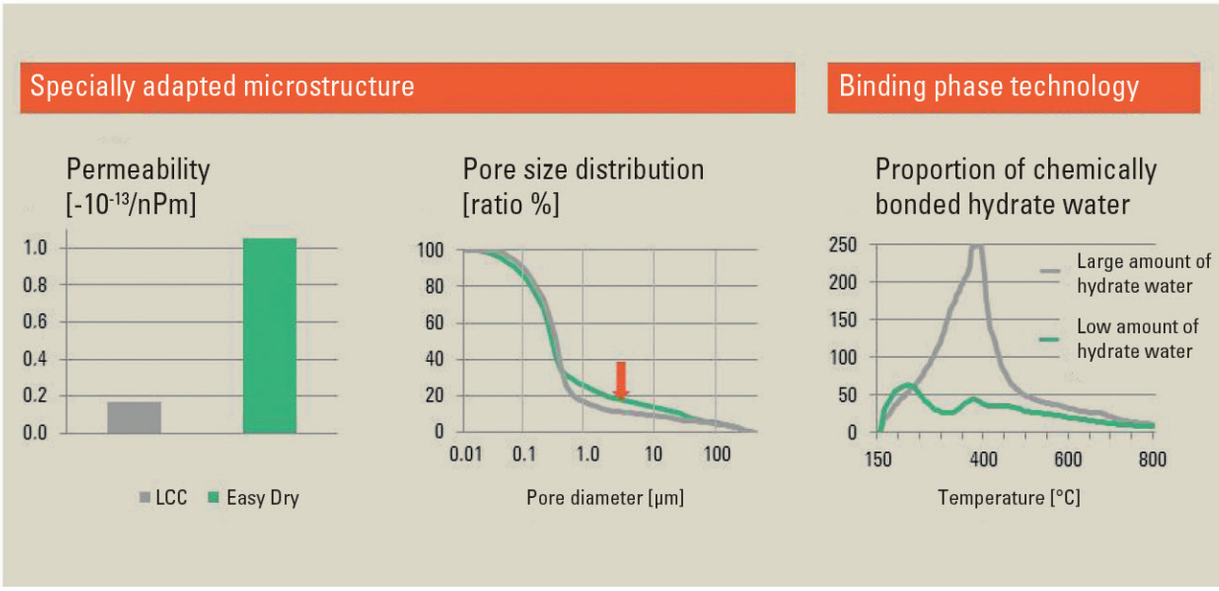


Figure 14: Optimized microstructure of Easy Dry (ED) refractory concretes for faster safe drying

The resulting, not inconsiderable, safety risks can also be counteracted. The sensitivity of refractory concretes during the heating has been significantly reduced by the development of the Easy Dry concept (ED) (Fig. 14).

The use of alumina cement is avoided in this product group, so a more permeable structure of the refractory concrete matrix is obtained. The internal specific surface area of the concrete is also increased by raising the proportion of pores with diameters between 0.1 and 10 µm so that water vapour can leave the microstructure more rapidly through these pores. Because alumina cement has been dispensed with there is also no decomposition of the hydrate phases. The new ED refractory concretes have a permeability that is one to seven times higher than in low-cement refractory concretes and at the same time they retain the high resistance to alkalis. Fig. 15 shows a comparison of the heating time for ED refractory concretes and cement-bonded concretes.

There is no dewatering of the calcium aluminate hydrate

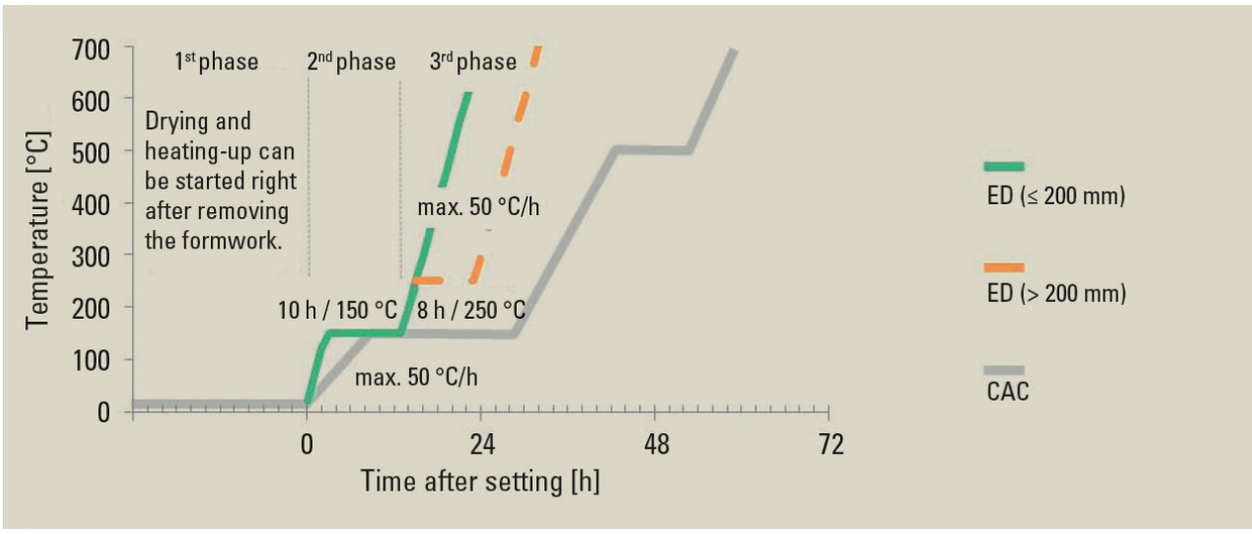


Figure 15: Recommended drying of no-cement (ED) refractory concretes compared to cement bonded concretes

water at about 500 °C so the heating procedure can be shortened by about 36 h (after the drying at 110 °C that is always necessary).

Not only the workability properties but also the performance characteristics are particularly outstanding. Thanks to their high strength combined with low elastic modulus the Easy Dry concretes are particularly insensitive to stresses and have low cracking potential (Fig. 16).

Figure 16: Comparison of binding phase technologies and use in refractory concretes for the cement industry

These outstanding properties mean that the advantages of the Easy Dry technology, which in part are also achieved by sol-gel concretes, over conventional refractory concretes (medium cement refractory concretes, low-cement refractory concretes (LCC) and ultra-low cement refractory concretes) are particularly apparent for cement and lime burning plants. This has been proved in installations such as nose rings, cooler inlets, inlet chambers, kiln hoods and even the tips of burner lances.

There are no restrictions on the supply and storage of cement-free Easy Dry products. A one-component system is involved so the processing with drinking water using standard equipment is just as uncomplicated as with conventional concretes. There is no warehousing of a sensitive second binder.

The use of Easy Dry refractory concretes is therefore another step towards cost reductions and economic efficiency thanks to a significantly shortened heating time and improved thermal and thermomechanical characteristics leading to an extended service life in the kiln plant and lower repair costs.

3.Summary of the possible ways of lowering costs in the cement burning process

Even in times when economic pressure or company guidelines may require the use of superficially "cheaper" products it is worth questioning existing concepts and methods and developing new approaches through intensive exchange of experience and joint innovations. The cooperation of plant operators and the suppliers of refractories is essential to ensure that these processes lead to successful products and ideas. Mutual understanding of the particular needs and system limits is a basic requirement for optimum results. The three above-mentioned examples, namely the ES, CF and ED concepts, show how this can be implemented successfully in practice.

Continuous advances in the application of new processes, raw materials and fuels require a corresponding foresight in the development of new products that will reliably meet future demands. Although they account for only 1 to 2 % of the total production costs of a cement plant, refractory products not only affect the plant availability (e.g. through stoppages) but also have a significant impact on fuel usage and the choice of raw materials. In many cases a suitable lining can facilitate the use of economically interesting alternative materials.

Truly innovative refractory concepts are not limited to on-schedule delivery of a product but include refractory training (also on site) and adaptation of the lining to the individual requirements as well as design engineering to take account of optimized lining times for shaped and unshaped products extending to fault-free installation. It is an entirely legitimate aim in the ideal situation to reduce the quantity of refractories required. However,

the direct impact on energy as a KPI factor by reducing the heat losses and/or the heating-up time, i.e. effective utilization of the plant availability, as well as, from the environmental point of view, a reduction of the CO_2

njoy an equally high priority (Fig. 17). This means that refractory materials with their direct influence on plant availability and efficiency should be rated far higher than their nominal percentage of the production costs

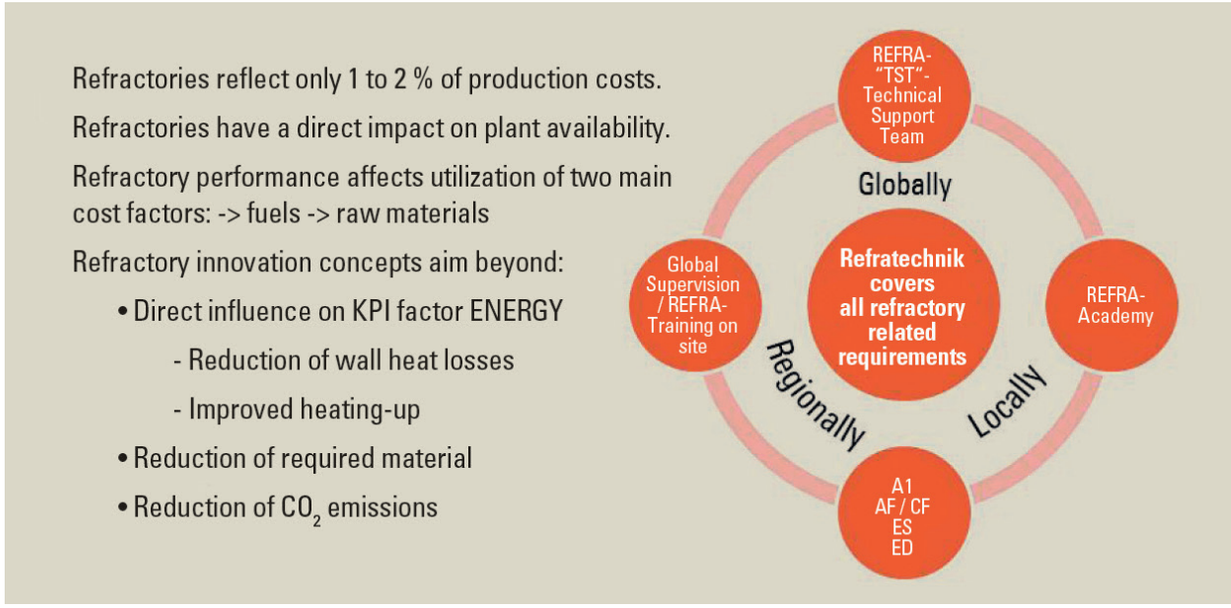


Figure 17: Refractory concepts for increasing the cost efficiency of clinker production

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Preparing for the future: National Cement Dubai now counts on reducing use of primary fuels

By: FLSmidth Pfister GmbH, Germany

There is probably no need to save for a rainy day in Dubai, UAE. But built upon that old saying, that is just what Mr. Mohammed A. Al-Ghurair (General Manager) is doing in clever foresight. As the owner of National Cement, he knows that even in regions where the resources mineral oil and natural gas are still available in abundance, prices will rise and availability may decrease. Regionally available alternative fuels are one of the answers to the rising energy hunger of rapidly growing economical sectors. Tobacco dust and carbon black dust now help to conserve fossil fuels at National Cement. The visionary Mr. Al-Ghurair pushes the use of alternative fuels and applies state-of-the-art FLSmidth Pfister dosing equipment in the process.

1. Mr. Mohammed A. Al-Ghurair, Owner and General Manager of National Cement Co. (left) and Engr. Radwan Mouakat (Head of Project Department) inspecting the latest Pfister dosing solution at the National Cement Dubai plant

2. National Cement Dubai site

To realize their first step in using alternative fuels, National Cement again hired the experts in handling the most diverse types of fuels used in the cement industry: FLSmidth Pfister engineered the shift from oil to coal in a previous project in the same environment, now they took on the installation of two new dosing systems for newly employed fuels and materials to fuel the four burners of the pre-calciner: One is a rotor weighfeeder Pfister® DRW for feeding carbon black dust, the other one is a rotor weighfeeder Pfister® TRW-D for dosing tobacco dust. National Cements Head of Project Department Engr. Radwan Mouakat remembers the initial trial phase with tobacco dust and carbon black dust before the FLSmidth Pfister experts came on board: “First we used belt conveyors for feeding the material. But we were not getting the appropriate results in calibration, which affected the process flow

National Cements Head of Project Department Engr. Radwan Mouakat:
„We chose the Pfister® rotor weighfeeders because we wanted a flexible and capsulated system with an extremely high feeding accuracy and constancy.“

3. Both new Pfister systems were installed in the pre-structure tower to feed the calciner

and created a lot of dust. That is why we decided to use the way more accurate, closed-circuit and gravimetric Pfister® system.“ “The major challenge in the installation was to route the pipelines through an obstructed area and to align the new equipment with the existing feeding system”, Robert Krist, Head of Sales at FLSmidth Pfister remembers the initial planning meetings.

New strategy: Secondary fuels in addition to fossil fuels

For the rough and abrasive tobacco dust, robust and flexible rotor weighfeeder Pfister® TRW-D is the perfect equipment. While the design differs to best meet individual operational areas, the weighing and dosing principle of all Pfister® weighfeeders is the same. Unlike the simple volumetric method of dosing materials merely by volume, Pfister® weighfeeders dose fuels gravimetrically by mass. That way, the often alternating density of bulk materials is considered in the dosing process. Material weight is the single most important factor in providing a highly accurate mass stream to the burner. As sturdy and simple as possible, as high-tech as necessary is the Pfister® philosophy. But not just tobacco dust, rotor weighfeeder Pfister® TRW-D can be used for dosing all kinds of secondary fuels such as wood chips, RDF, paper or plastic. Three-dimensional materials up to three cubic centimeters or flat, two-dimensional pieces up to 100 mm in length are sucked in, weighed for proper dosing and pneumatically pumped to the burner. The nominal

4. Rotor weighfeeder Pfister® TRW-D for alternative fuels is employed for feeding tobacco dust at National Cement, Dubai

density of the tobacco dust at National Cement is ≈ 0.3 t/m³ two dimensional sizes up to 5 x 5 mm and a moisture content of ≈ 10 %.

The second newly installed system at National Cement is a rotor weigh feeder Pfister® DRW for carbon black dust dosing. Studies showed that carbon black dust

FLSmidth Pfister Head of Sales, Robert Krist: „With a minimal number of functional parts and a very slow moving rotor, Pfister® rotor weighfeeders are low-maintenance and all measuring parts and drives are accessible from the outside."

mixed into fine coal used as primary fuel in the cement industry has no depreciating influence on the quality of the resulting clinker. Carbon black dust is pure elemental carbon and comes as a side-product in the aluminum production or in the recycling of old tires. It is chemically able to deliver very high temperatures, which makes it a perfect fuel for the energy-intensive calcining process in the cement industry. Along with its positive features comes one negative: it is highly abrasive. A dosing system especially designed to work under fierce conditions is the rotor weigh feeder Pfister® DRW. Carbon black dust at National Cement

5. Rotor weighfeeder Pfister® DRW which feeds carbon black dust after commisioning

6. These are the new pipelines in which trucks fill with carbon black dust and tobacco dust respectively

has a nominal density of ≈ 0.475 t/m³ with grain sizes of < 1 mm and a moisture content of 0.1 %.

"Planning the combination of existing equipment with new machinery is always a challenge", explains Robert Krist. In the installation at National Cement, detours proved to be the answer. Calculations of material flow and FLSmidth Pfister engineers' experience in tricky installations showed that the pipeline for the main fuel coal and the new lines for carbon black dust needed to be of the same length for optimum feeding quality. There was no room for a straight line parallel to the existing pipeline, but inventive thinking found an alternative route serving the purpose. The two pipelines

7. One of the challenges was to include the two new dosing systems into the existing calciner feeding lines. The existing and the new feeding line meet just before one of the calciner burners and then feed the burner with only one line:

now meet into one common line shortly before the calciner, where both materials are fed into one burner. For National cement the latest employment of these secondary fuels is an addition to oil and natural gas, as Engr. Radwan Mouakat explains: "We are planning to use the same percentage of primary fossil energy. Depending on the kiln operation condition the one or the other portion might increase."

8. National Cement decided to build a new second floor platform where both new Pfister® dosing systems were placed. Here, the pre-hopper of rotor weighfeeder Pfister® TRW-D is in mounting process.

Quick ROI in within only 3 years expected

For National Cement rotor weighfeeder Pfister® DRW was designed to feed from a minimum of 0.3 to a maximum of 2 tons of material per hour, rotor weighfeeder Pfister® TRW-D feeds 0.6 to 5 tons of material in the same time. In Dubai the special climatic conditions with ambient temperatures of up to +50 °C and air humidity of up to 85 % also have to be considered in implementing the installation: When both machines are in full operation, they save up to 0.5 tons of coal every hour at this time. In an average year, that amounts to an impressive 3,960 tons of valuable fossil fuel saved.

Calculated by National Cement is an amortization period as short as only three years until this plant upgrade and partially fuel extension pays off. The cement produced by National Cement with the help of this new fuel mix is of excellent quality. Engr. Radwan Mouakat: "Our cement is certified by Dubai Municipality with high quality. It is used in most of the main and important projects in Dubai like Jumeirah Palm Island, Dubai Airport, Dubai Water Canal, most of the residential towers, etc."

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The new business segment AFR systems at BEUMER group makes it possible for cement and lime plants to use alternative fuels

By: BEUMER Group GmbH, Germany

Reliable energy supplier

Cement manufacturing is particularly energy-intensive. In order to reduce the use of expensive primary fuels like coal and oil, cement plant operators focus increasingly on alternative fuels and raw materials (AFR). The use is generally focused on the fuels. Neither the manufacturing process, the end product, nor the emissions may be affected. Therefore, high-caloric wastes that cannot be further recycled, e.g. from plastic and packaging residues, paper, composite material or textiles, have to be treated beforehand to be ready for incineration.

In order to help customers efficiently convey, store and dose the treated fuels, BEUMER Group has established the new business segment AFR systems.

Germany, October 1973: For political reasons, Arab countries reduced their oil production, which caused oil prices to skyrocket. This was a very precarious situation, because crude oil was an important energy source, also for the cement industry to operate their rotary kilns. With this first oil crisis, plant operators started to shift towards using cost-effective fuels and raw materials.

Besides mineral waste that can be used as alternative raw material, the market primarily employs the use of fuel alternatives, because approximately 30 per cent of production costs are spent on energy. In addition to fluid alternative fuels, such as used oil or solvents, the majority of solid fuels consist of complete or shredded scrap tyres, scrap wood, or mixtures of plastic, paper, composite materials or textiles. After they have been treated and quality-controlled, they show calorific values similar to brown coal. The calorific value of scrap tyres is even comparable to that of stone coal. When producing cement, it is also necessary to ensure that the quality of the ash residues matches the quality of the end product. As all material components are completely incorporated into the clinker and mineralised. Their use makes for an economic production process. In addition, primary raw and fuel supplies are conserved and landfill volume is reduced.

Pre-treated secondary fuels are mostly supplied from external vendors, ready for incineration. BEUMER Group now offers tailor-made AFR systems to lime and cement plants for the safe transport and storage of solid materials. Based on wide-ranging experiences and the customer's requirements, the systems comprise the entire chain, from receiving and unloading the delivery vehicle, up to storing, sampling, conveying and dosing solid alternative fuels. BEUMER Group, provider of intralogistics, supplies its customers worldwide now with three systems, from one single source.

Picture 1: The alternative fuels are conveyed from the storage to the main burner, low in noise and dust-proof.

Tailored to every application

BEUMER Group's program includes the starter system that is used at the main burner. In the cement and limestone industry, primary fuels are usually ground to grain sizes of less than 100 micrometres and fed via the burner. At th e end of the rotary kiln, the burner heats up to 2000 °C, the temperature that is needed for limestone, sand, clay and ore to react and become clinker as an intermediate product. In order to use solid secondary fuels in the clinkering zone burner, they should deliver a calorific value that is at least similar to brown coal (ca. 22 ± 2 MJ/kg), have grain sizes of less than 30 millimetres and burn out while being fed.

The oven-ready material is usually delivered in moving-floor trailers. BEUMER Group provides a docking station that also serves as storage on site. Once the trailer is emptied, it is completely replaced or refilled in the large tent using a wheel loader. The material is metered volumetrically and conveyed to the clinkering zone burner. This solution is deliberately designed as a test system. This way, the operator can test their suppliers, the quality of the fuels and their furnace behaviour.

Picture 3: Fill level measuring probes and other measuring technology monitor the automated processes.

Picture 2: By using alternative fuels, the production process becomes more economical. Primary raw materials and fuels are conserved and landfill volume reduced.

Solution for the calciner

With the second system, the calciner can be fed with more coarse alternative fuels, such as tyre derived fuel or the fuels described above, but in a more coarse state. They are generally less processed, contain three-dimensional particles and therefore require more time to burn out than for example the more intensively processed, exclusively two-dimensional secondary fuels for the main burner.

The coarse calciner fuel is delivered in moving-floor trailers or tippers. The secondary fuels are quickly

unloaded and stored temporarily in a dust-proof way. Another storage serves as a flow buffer, which can hold the overall capacity of 900 cubic metres of the preceding bunker. From here, the Pipe Conveyor transports the material to the calciner in the preheater tower. Here, the secondary fuel is weighed and dosed. During the feed towards the hearth in the calciner, there is often the risk that the material or the conveying system can catch fire due to thermal radiation or pulsations. For this reason, the valveless special feed was developed, so the material can be safely fed to the calciner.

Picture 4: If suppliers encounter problems in regards to the quality of their processing, BEUMER AFR systems can be upgraded and are suitable for high substitution rates.

In order to ensure safe and automatic fuel supply after successful testing, BEUMER Group provides systems for permanent operation with high thermal substitution rates. The systems consist of the receiving area and a storage system, where the crane system can store material of different quality into different storage zones and boxes. Experiences so far have shown that you always have to calculate with disruptives or quality deficits in the fuel. This is why the entire storage and conveying technology in the hall can be provided with equipment that is able to separate metal, wet and three-dimensional disruptives from the fuel for the main burner and keep disrupting oversized grains from the calciner fuel.

Equipped with the necessary sensor technology, the operation runs automatically. The crane can be used independently for homogenisation, in order to minimise quality variations or feed the lines towards the main burner and the calciner.

Pipe Conveyor stands the test

Schwenk Zement AG's product diversity and production capacity make their plant in Bernburg one of the largest and most efficient cement plants in Germany.

In order to reduce energy costs, the cement plant is increasingly using secondary fuels that are engineered in external processing plants into high-quality fuels with defined product parameters.

Until now, the manufacturer had been using drag chain conveyors. After almost a decade of use and numerous modifications however, more and more maintenance was required. The fuel quality also improved over time, so that, due to its density of 0.2 t/m3, the existing technology was no longer sufficient to convey the required quantities towards the main burner. This created the need for a reliable, eco-friendly and low-maintenance solution. In addition, the new conveyor needed to be optimally adapted to the curved routing in the plant.

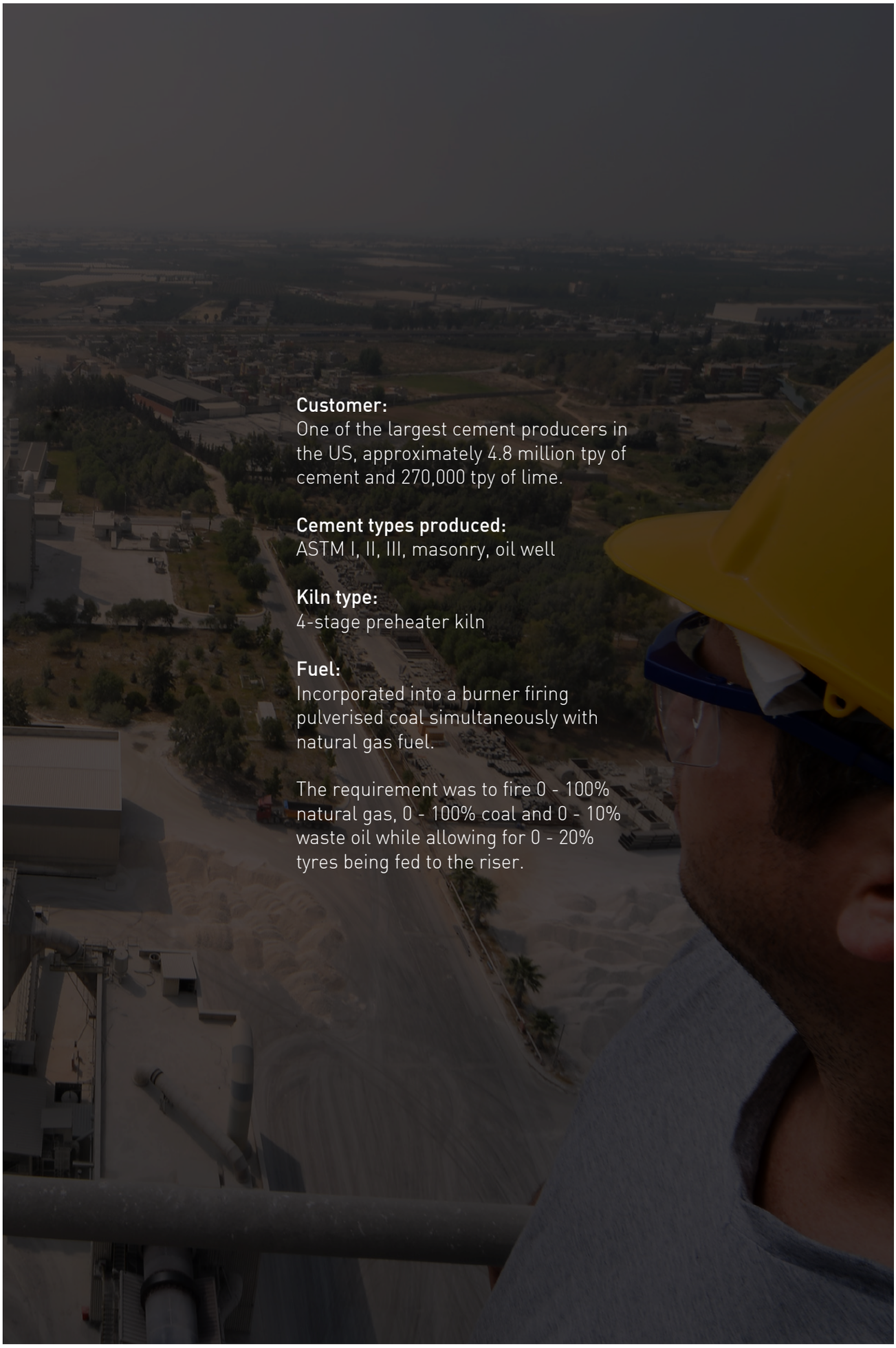
Schwenk Zement KG opted for the BEUMER AFR system with its Pipe Conveyor to feed the main burner with alternative fuels. The system works almost completely automatically, from receiving to the feeding system of the rotary kiln. Cranes pick up the engineered secondary fuels in the storehouse and fill them into the discharge bunkers with their discharge equipment. From there, a chain belt conveyor transports the fuel continuously towards the Pipe Conveyor, which conveys it to the weigh feeders before the main burner.

The curved Pipe Conveyor at the core of the system requires little maintenance and its enclosed design and quiet operation protect against emissions and the wind-blown dispersal of the fuel. It is able to connect long distances without interruption and navigate tight curve radii that adapt to the individual conditions of the plant.

The BEUMER Group is an international leader in the manufacture of intralogistics systems for conveying, loading, palletising, packaging, sortation and distribution. Together with Crisplant a/s and Enexco Teknologies India Limited, the BEUMER Group employs 4,000 people worldwide, and achieves an annual turnover of about 680 million EUR. With its subsidiaries and sales agencies, the BEUMER Group serves customers around the globe, across a wide range of industries. For further information **visit: www.beumergroup.com.**

Making production rise, while sending emissions crashing down

How the Gyro-Therm burner put kiln process control firmly into the hands of operators at one of America's largest cement companies.



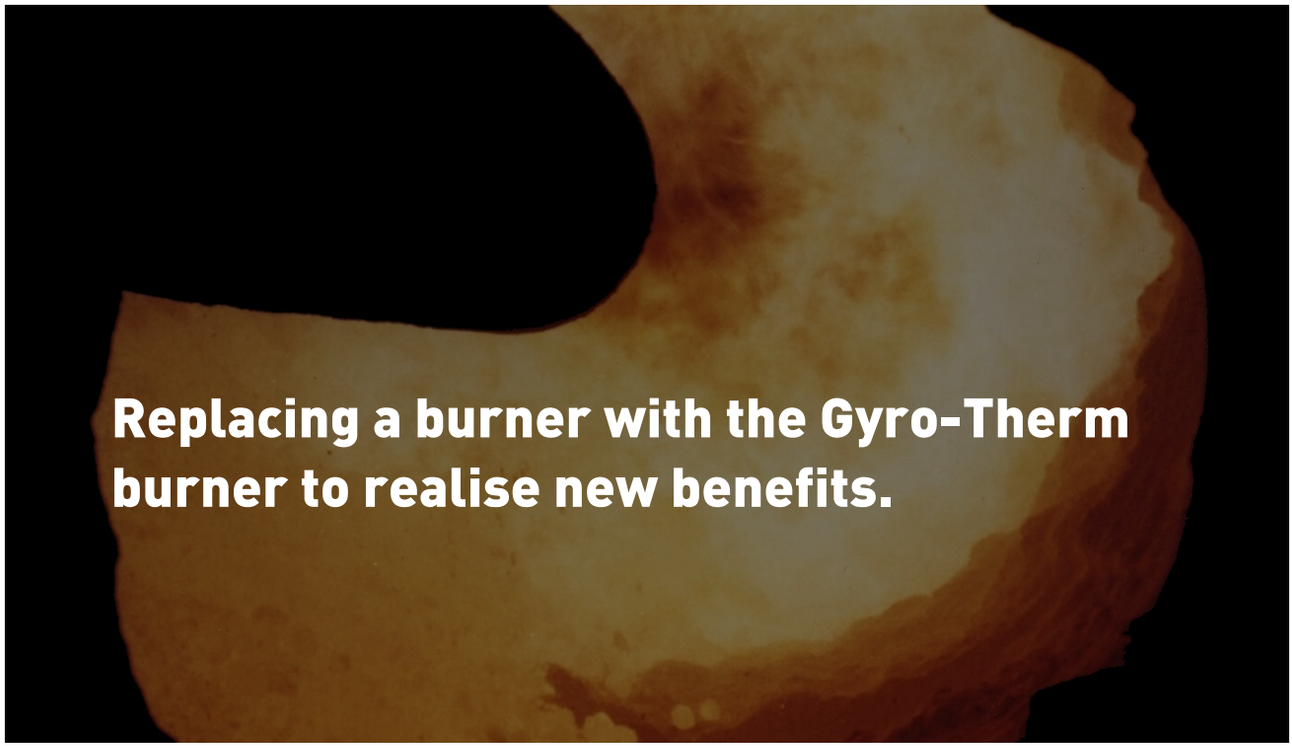
Customer:
One of the largest cement producers in the US, approximately 4.8 million tpy of cement and 270,000 tpy of lime.

Cement types produced:
ASTM I, II, III, masonry, oil well

Kiln type:
4-stage preheater kiln

Fuel:
Incorporated into a burner firing pulverised coal simultaneously with natural gas fuel.

The requirement was to fire 0 - 100% natural gas, 0 - 100% coal and 0 - 10% waste oil while allowing for 0 - 20% tyres being fed to the riser.



Replacing a burner with the Gyro-Therm burner to realise new benefits.

The 4-stage preheater kiln uses a range of fuels to maximise output and burns predominantly natural gas during summer and gas with coal during winter, as well as a quantity of tyres and waste oil.

The major incentive for the burner change was the opportunity to increase kiln output as the kiln was at maximum capacity in a sold out market. With the plant burning gas, coal, waste oil and tyres while producing two different types of clinker (type I & II), it was a difficult task to benchmark all conditions before and after the new burner's installation. As a result, the most detailed data was collected when firing with natural gas, the principal fuel.

It was decided to evaluate the burner by comparing the old and the new using the following operational parameters:

- Production in tph
- Fuel consumption in BTU/short
- Safety of the system
- Clinker quality
- Emissions
- Refractory life

As many of these parameters as possible were compared when producing type I and type II clinker. Once the operators became accustomed to the new heat flux profile, it was found that the kiln exit gas temperature was cooler, as was the gas exiting the top cyclone. This enabled a previously fan limited kiln to increase capacity and more feed to be put on.

Production increased by a staggering 11% when firing 100% gas. When firing natural gas with waste oil and tyres, the production increased between 6.0 and 9.9% (Figure 1 and Table 1).

It became immediately apparent that maximum output (now fan and feed limited) could be achieved by firing solely with natural gas where previously maximum output could only be achieved by the addition of tyres and waste oil. The benefit of this was a considerably more flexible operation and a steadier kiln. In addition to the short heat flux profile which reduces kiln exit gas temperatures and reduction in primary air, a 2.7 - 5.7% fuel saving resulted at the increased production levels (Figure 1 and Table 1).

Stack emission data was collected before and after the burner replacement principally while producing type II clinker. Data was collected under a 100% gas combustion scenario and under a gas, tyre and used oil combustion scenario. A 30% reduction in stack NOx corrected to 10% O2 was realised under the 100% gas scenario, while a 37% reduction in stack NOx was realised under the multi fuels scenario (Figure 2).

Regarding refractory life, it is observed that coating builds more readily in the burning zone and appears to be more stable. The kiln shell is cooler in the burning zone, as thicker coating is built. The coating formed is very even and no operational difficulties are observed.

Clinker samples taken before and after the burner installation were analysed under the microscope, and it was discovered that there were no significant changes in the microscopic characteristics of either clinker types as a result of the burner installation. The company was generally satisfied with the microscopic qualities of clinker and did not want to have to react to any change in clinker quality. A reduction of 3.9% in the cement mill Blaine set point (from 3850 to 3700) for type I cement has resulted after the burner installation.

The Gyro-Therm burner utilises a unique flow phenomenon known as a precessing jet (PJ) to achieve the air/gas mixing. A precessing jet is generated in a specifically designed nozzle. Precession is a term used to describe the gyroscopic rotation of a body about an axis other than its own centre line, similar to a spinning top that is leaning to one side. At any given moment, the jet is directed at an angle to the nozzle axis, about which it precesses. The precession creates a much larger scale of mixing than occurs in, a conventional jet, as well as increased spreading of and entrainment by the jet. The precessing motion is generated without any moving parts within the patented Gyro-Therm nozzle. The nozzle consists of an axi-symmetric chamber which has a large sudden expansion at its inlet and a small lip at its exit.

Figure 1.

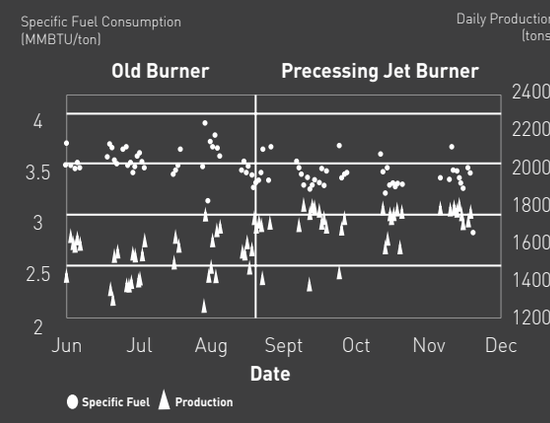
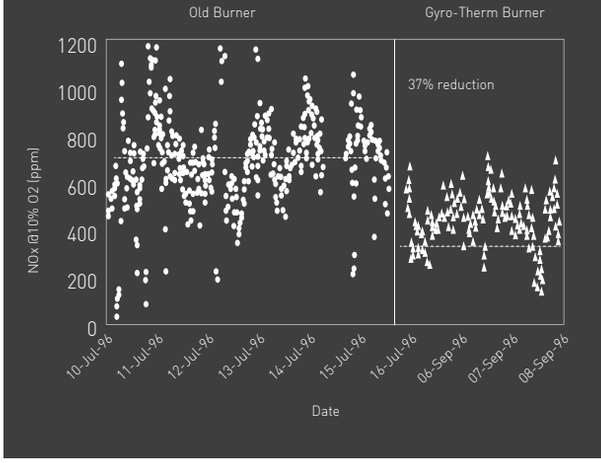


Table 1.

Fuel savings and output increases obtained with the precessing jet burner.

Clinker type	Fuels used	Fuel consumption (MMBTU/t)	Output (tph)
I	Gas, tyres, oil	-2.7% (3.67-3.57)	+6.4% (62.7-66.7)
II	Gas, tyres, oil	-3.4% (3.55-3.43)	+9.9% (63.2-69.5)
I	Gas, coal, tyres, oil	-2.5% (3.58-3.49)	Same
II	Gas, coal, tyres, oil	-5.7% (3.50-3.30)	+5.1% (68.5-72.0)
II	100% gas	-5.7% (3.53-3.33)	+11.0 (63.3-70.3)

Figure 2.



Achieving these results with the advanced Gyro-Therm burner design

As the gas jet enters the chamber, it reattaches asymmetrically to the inside of the chamber wall, generating strong local pressure gradients which deflect the jet out of the nozzle at a 45° angle. It is the strong azimuthal pressure gradients which cause it to precess about the nozzle axis.

These pressure gradients also draw a small quantity of air into the chamber which mixes with the jet before it leaves the nozzle. The flame itself does not precess.

The effect is to produce large-scale mixing, via the 'stirring' action of the jet, and a rapidly spreading flame. The highly luminous nature of the flame and the greatly reduced NOx emissions are a result of a naturally staged combustion process. The precessing jet engulfs air in such a way that stable combustion occurs close to the nozzle under fuel-rich conditions. This forms soot internally which is later burnt out in the more air rich sections at the extremities of the flame to achieve equivalent heat transfer to the process.

Although the flame spreads more extensively than that from a conventional single jet nozzle, the amount of spread is limited and can be controlled. This fact is important in cement kilns where direct impingement of a flame on the clinker could produce instability or reducing conditions which would be detrimental to product quality. A simple but extremely effective flame shaping technique is built into the burner.

The technique for flame shape adjustment is based on a high momentum gas jet injected at a critical point into the precessing jet flow field.

This jet (termed the centre body jet, CB) is expelled through the centre body of the precessing jet nozzle, modifying the pressure fields within the vicinity of the burner in such a way that the flame is directed more toward the kiln axis.

As the proportion of gas is increased through the centre body jet, the flame spread is reduced and the heat flux profile lengthened. An air channel is provided for cooling and for flame shaping during the warm-up phase. The coal channel was incorporated as an annulus around the PJ nozzle. The mixing generated by the precessing jet nozzle is produced directly by the gas stream, utilising the potential energy available in the high pressure gas supply rather than using a high momentum primary air stream. This means that a primary air fan can be reduced in size and effectively becomes a cooling fan.

In most rotary kiln applications, a Gyro-Therm burner would only use a small quantity of air, about 1 - 3% of the total air for cooling (in the event- of a kiln stoppage) and flame shaping during warm-up. Reducing the air reduces the operating and maintenance costs of the primary air fan and, more importantly, increases thermodynamic efficiency. The efficiency gains result when the volume of hot secondary air from the cooler increases due to the reduction of cold primary air.

To summarise, the precessing jet produces a very broad, bulbous, highly luminous flame compared to conventional burners, increasing radiation (heat transfer) to the product near the front of the kiln.

OVERVIEW OF PROJECT BENEFITS

REDUCES OPERATING AND MAITENANCE COSTS OF THE PRIMARY AIR FAN

MORE IMPORTANTLY, INCREASED THERMODYNAMIC EFFICIENCY

REDUCES SPECIFIC FUEL CONSUMPTION

INCREASES KILN OUTPUT

REDUCES NOx EMISSIONS

IMPROVES CLINKER QUALITY AS A RESULT OF BETTER HEAT PROFILES

GREATLY REDUCED PRIMARY AIR VOLUME DURING NORMAL OPERATION

IMPROVES FLAME TURNDOWN AND STABILITY

INCREASES FLAME STABILITY

USA
3874 SW 30th Av, Fort Lauderdale
FL - USA 33312
+1 954 866 0788
E: sales_US@fctinternational.com

BRAZIL
Rua Sete de Abril 235, 5 andar São Paulo
SP – Brasil 01043-000
+55 (11) 98346-3686
E: sales_US@fctinternational.com

EUROPE (Middle East)
M: +43 664 39 20 330
E: sales_EU@fctinternational.com

AUSTRALIA
20 Stirling St, Thebarton
SA - Australia 5031
Ph: +61 8 8352 9999
Fax: +61 8 8352 9988
E: sales_ALL@fctinternational.com

Municipal Solid Waste as Alternative Fuel resource

By: Dirk Lechtenberg - MVW Lechtenberg & Partner, Germany

When thinking about Alternative Fuels for the cement industry, we are always thinking about well specified, fine grinded, high calorific valuable and moisture free products. Indeed, when I first started to process (only industrial) waste into Refused Derived Fuels, the quality requirements (and involved costs for processing) were very high.

Thanks to new technical developments, this is not anymore needed!
Especially for countries in the Middle East, where usually no separate waste collection is done, this new technologies for using Municipal Solid Waste as Alternative Fuels offers chances for the cement industry to be a partner for municipalities to offer sustainable waste management solutions.

In the early days of Alternative Fuels for the cement industry, well defined waste sources mainly from the industry were collected and processed by further separation, shredding and grinding into a "fluffy" type of material with grain sizes below 20mm or 30 mm. These materials were pneumatically fed into the kiln burner of rotary cement kilns. With the development of precalciner kilns, Refuse Derived Fuels are fed in bigger particle sizes into the calciner burner. However, still a high calorific value and low moisture content is necessary, to avoid heat and energy losses. Similar, a low content of chlorine and other process and environmental relevant contents such as trace elements is necessary.

This results in a very high effort to process mixed waste into Refuse Derived Fuels (RDF). At the same time, the quantity of materials, which can be used as RDF when separated from e.g. Municipal Solid Waste is very low.

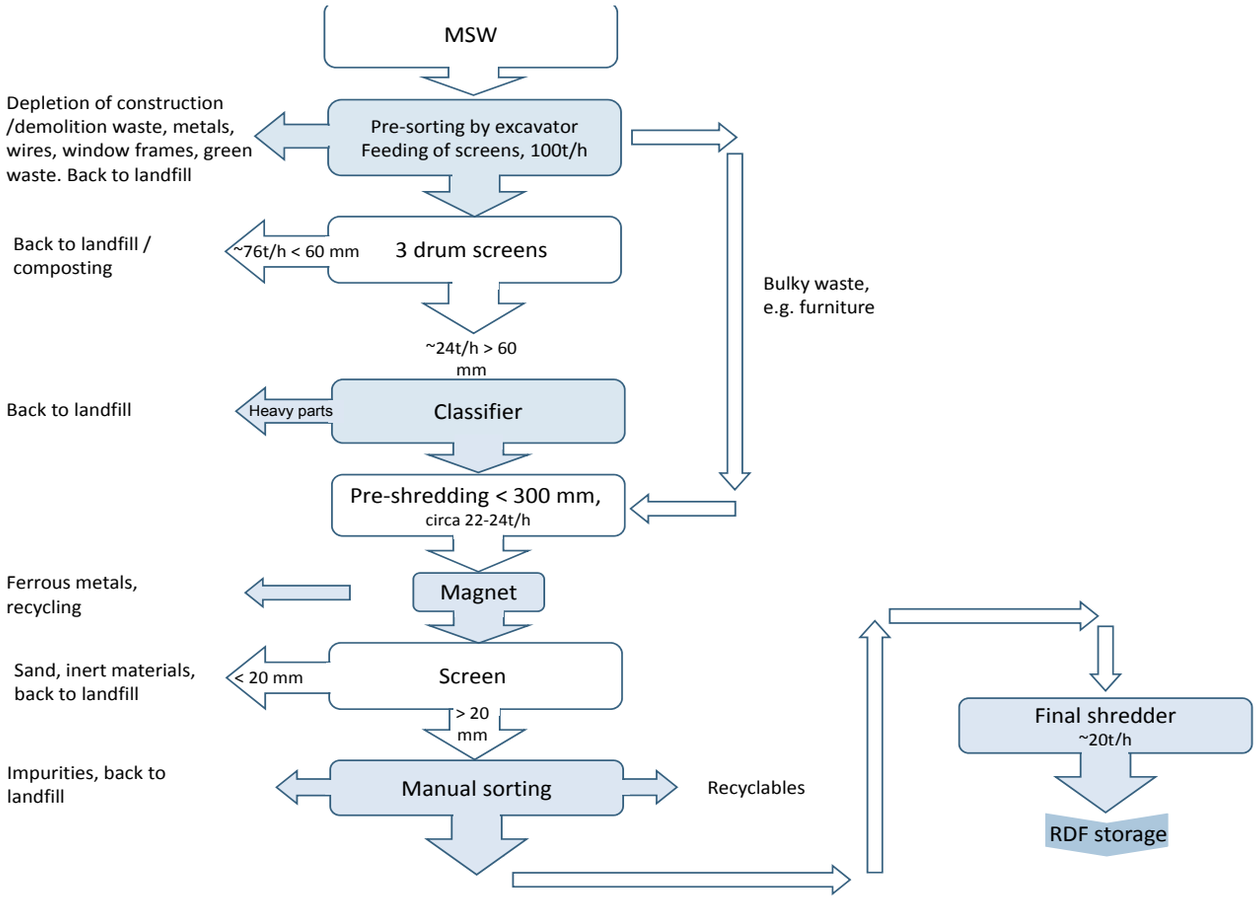


Figure 1: Typical process flow for processing MSW into RDF (Excerpt from Egypt, Source: MVW)

If you look at the typical waste composition of countries without a separate collection of Municipal Solid Waste such as Turkey or Australia, only 20% or maximum 30% of the mixed collected MSW can be used as RDF.
The following figure shows a typical composition of MSW in major cities of Turkey. This evaluation was carried out by MVW and its project partner in Turkey.

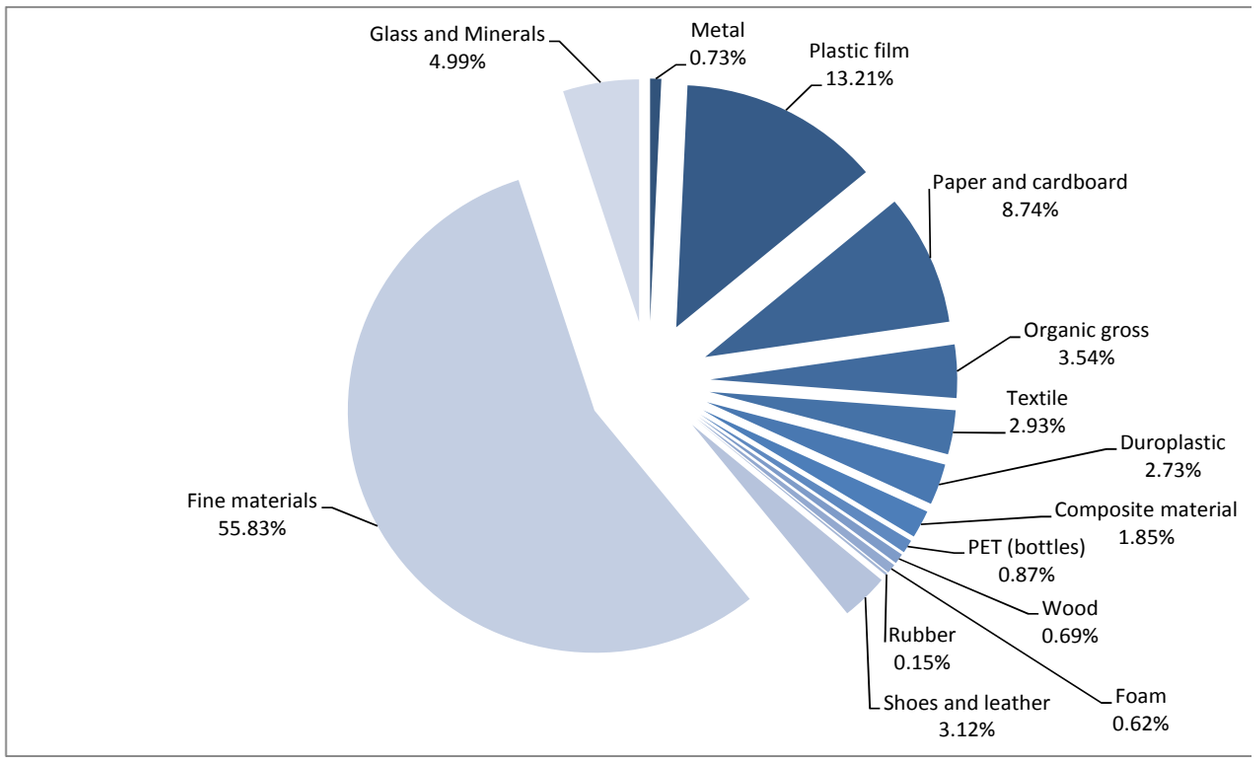


Figure 2: Composition of Municipal Solid Waste in Turkey (Source: MVW)

The analysis shows that the main component consists of fines, such as sand or soil. Also organic residues, derived from leftovers, are involved here. Combustible fractions, i.e. total plastics (around 18%), wood, textiles, shoes, paper and cardboard account for approximately 35% of the total waste.
The next example shows a typical waste composition in Pakistan, derived from research projects accomplished by MVW:

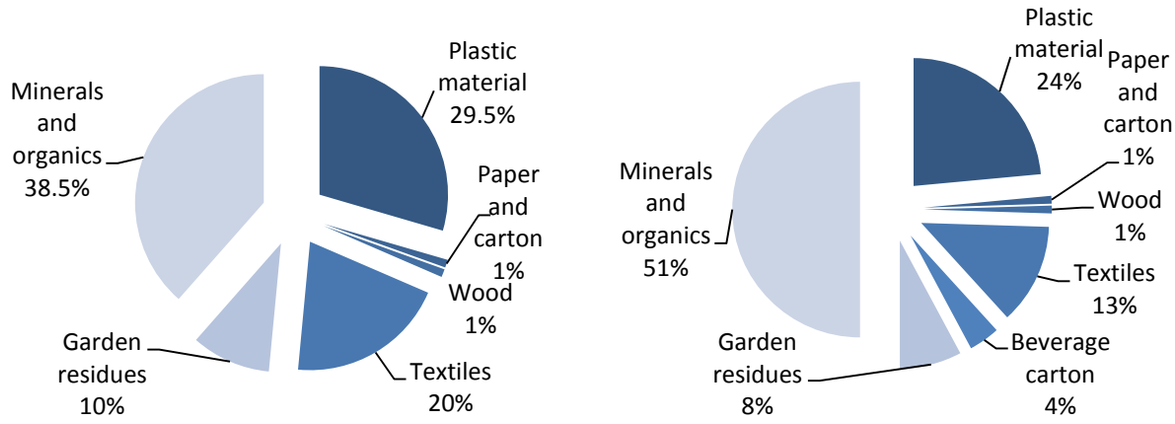


Figure 3: Composition of Municipal Solid Waste in Pakistan, province Punjab, from two landfills (Source: MVW)

In Figures 1 – 3 it is shown that, depending on the Municipal Solid Waste composition, only 20% - 25% of the incoming MSW can be used as specified RDF. At the same time, and also depending on the season, the moisture

content of the RDF can be up to 35%, which causes high additional energy consumption on fan capacities and to evaporate the water.

Throughout many projects for the development of Refuse Derived Fuel plants for municipalities, I was trying to convince the municipalities to sign long-term contracts with local cement plants to process the Municipal Solid Waste. Most of the Governors and Mayors of the municipalities were appreciating these efforts - however they always asked me what they should do with the remaining residues.

With new technical developments, this situation has changed dramatically, so that cement plants can offer now a turnkey - "zero waste" solution to municipalities.

New technical developments - either fine or coarse- but with high efficiency

Tow companies from the City of Beckum / Neubeckum, in the heart of the German cement industry, have looked at this problem with different views:

The company Voges, a family owned equipment manufacturer developed a mill, which is using exhaust gases from the clinker cooler to dry the pre-shredded waste in a grain size of up to 100mm and high moisture content of up to 45% down to < 10mm grain size and less than 10% moisture in the final RDF product. This mill is separating containing foreign particles (such as metals, glass etc.) in an airstream within the mill, so that the wearing is very low. A first plant, installed at Dyckerhoff Cement in Geseke, Germany, has shown that the wearing costs per ton are less than 0,10€ per ton of fine milled material. At the same time, the energy consumption is efficiently low with only 18Kwh/ton of fine milled material. Compared with a standard shredding process, this is just a third of typical energy needs.

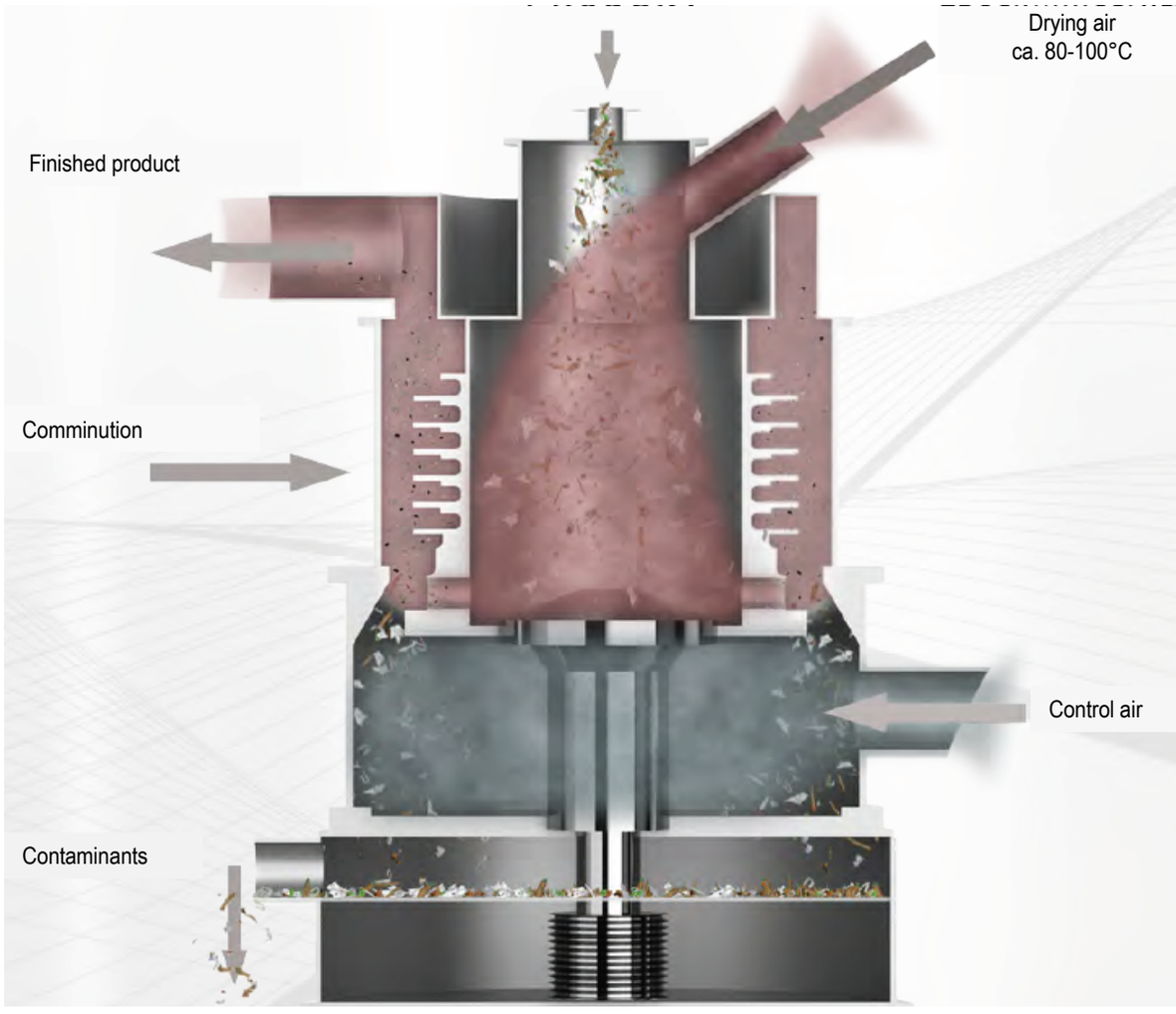


Figure 4: Working principle of the "V-Mill" (Source: Voges)

With such process, even mixed and wet MSW can be processed into a defined RDF directly for the calciner or even for the kiln burner, as long as needed minimum required CV of 4.000Kcal can be reached.

The company thyssenkrupp Industrial Solutions TKI (former Polysius) has developed a system for using coarse RDF at the calciner.

In a conventional calciner burner, RDF with a grain size of < 80mm in two dimensions can be used. This means, that the RDF have to be shredded twice - a pre-shredding step to < 300mm and then a final shredding to a grain size below 80mm.

In a first installation of TKI at Lägerdorf Cement, Germany, a PREPOL combustion system was installed, which is able to use coarse RDF in a grain size of up to 300mm in three dimensions - so no final shredding step needed!

The system is a separate combustion chamber which is drying and incinerating with long retention times of < 1000 seconds. MSW, which is only pretreated basically by means of screening, pre-shredding and separation of recyclables and big foreign particles such as concrete or hazardous materials can be used.

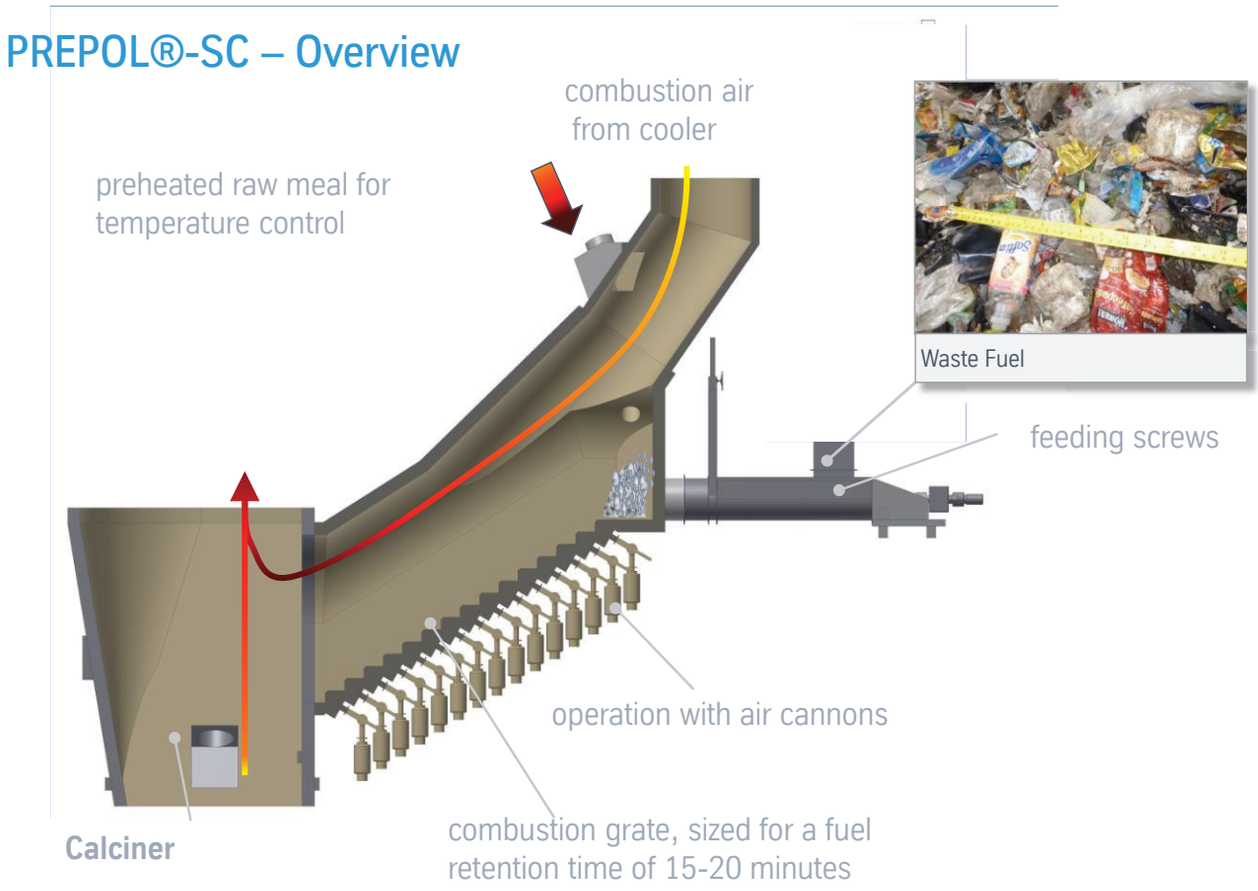


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Figure 5: Prepol SC (Source: thyssenkrupp)

The system has main advantages in processing mixed RDF. It is operating with high excess air level for a save operation and with low emissions. Due to a long residence time of 15 - 20 minutes, all types of coarse RDF can be completely burned safely. It is an astatic system, so that there are no moving parts in the combustion zone. With a permanent agitation of the RDF due to air cannons, a complete combustion is guaranteed. The first installation was started in November 2013 and has shown, that there is no negative impact on the clinker production. Even lower NOx emissions were recognized due to optimized staged combustion. The CO emission after preheater are stable and not affected by the PREPOL SC (0,08% +/-0,04%).

With almost 50MWth capacity, the system has shown the ability to use huge quantities of pretreated RDF.

Both systems - the Voges Mill for smaller capacities of up to 10tons/hour and the PREPOL SC for capacities of up to 20 - 25 tons coarse, basically treated RDF have proven itself and opens new horizons for the cement industry. Investment costs for both systems are similar and even lower than the investment for typical processing and feeding systems.

However - the operating costs are significantly lower comparable to existing standard solutions.

Organics

All MSW contain organic waste, such as food waste, garden trimmings and leaves etc. In some countries, especially in the Middle East, the organic content is up to 55%!

By adding processes for “bio drying” mixed MSW, such as the Herhof system, which has proven itself in many projects all over the world, almost 80% of mixed MSW can be turned now into Alternative Fuels.
The Herhof “Stabilat process” works in three phases:

1.Processing:

Extraneous matter and harmful substances are removed from the waste and the latter is then shredded to a maximum grain size of 250mm and then transported via a fully-automatic crane system into the Herhof “Bio Box”.

2.Stabilisation:

In the Herhof Bio Box, the waste is dewatered through biological means. This is the vital step to the subsequent pure source separated break down of the waste mixture into reusable material and energy as well as for the storability of the fuel generated.

3.Inert separation:

This means the removal of the mineral fraction (stones, glass, and ceramics), ferrous and non-ferrous metals are separated.

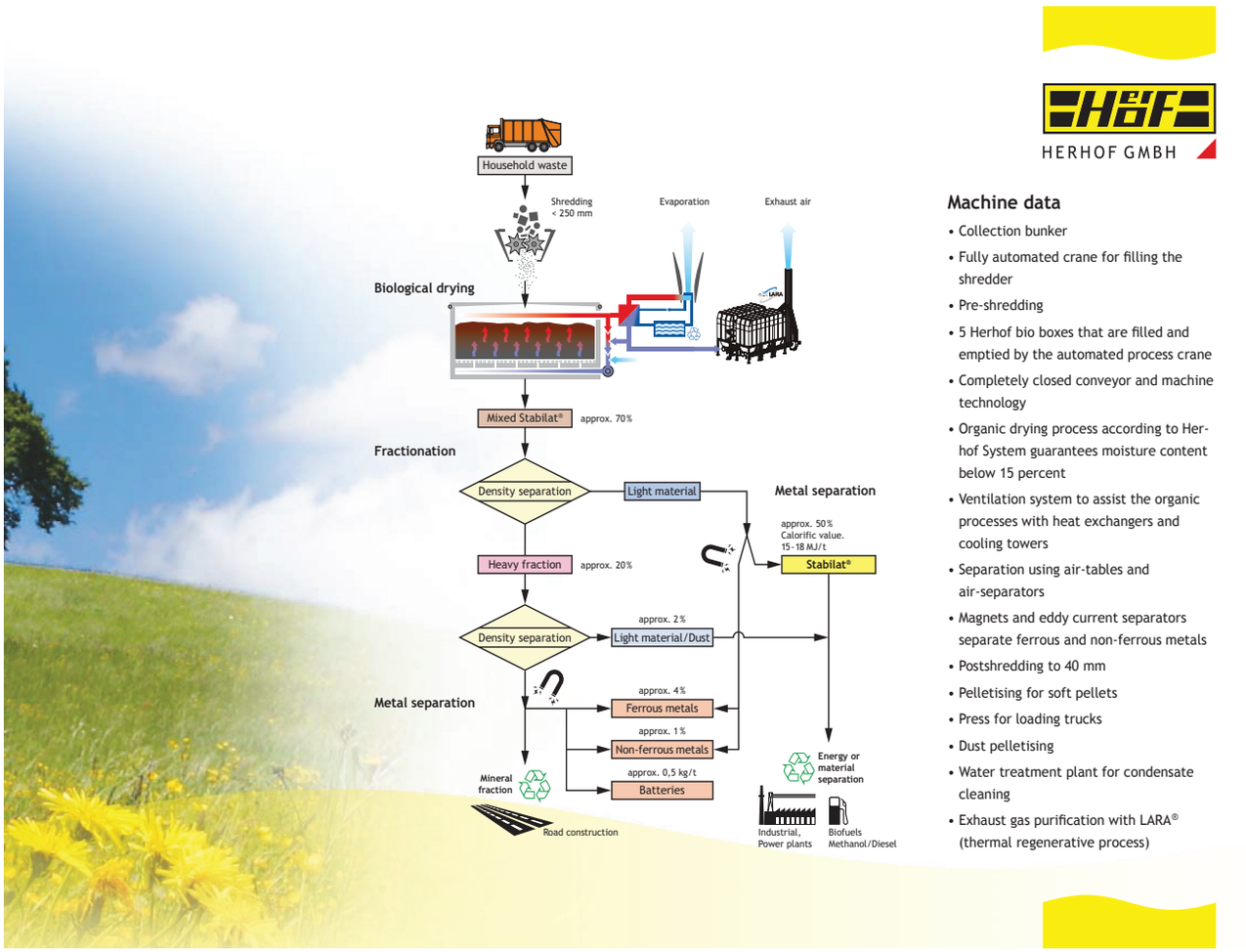


Figure 6: Complete Stabilat process (Source: Herhof)

By adding such basic bio drying process of Herhof, in combination with the new technologies of Voges and Thyssen Krupp, cement plants are now able to offer sustainable waste management solutions to municipalities all over the world.

An almost “zero waste solution” can be offered.
The “cherry picking” as it was called by many mayors is now history.

WHY USE HYDRAULIC DIRECT DRIVE SYSTEMS IN THE CEMENT INDUSTRY?

In a cement plant, the gigantic rotating kiln is the heart of production and has to work 24/7. This makes it a perfect application for hydraulic direct drive systems, which offer unbeatable reliability, exceptional uptime, high starting torque and great flexibility. Not only do they withstand vibrations, they also make it possible to start up the kiln without any overdimensioning of the drive system.

The number of hydraulic direct drive systems is steadily increasing, especially in applications such as kilns, crushers, feeders, mills and roll presses. Wherever variable speed, power sharing or high starting torque is required, and wherever shock loads occur frequently, hydraulic direct drives should be the first choice.

A Hägglunds hydraulic direct drive system from Bosch Rexroth allows a large kiln to be driven at variable speed, adapting rpm to the current production, while still offering the capacity to start up from standstill. It also balances the driving forces, thus eliminating the transfer of vibrations to the machine. The compact, low-weight Hägglunds motors are mounted directly on the drive shaft without gearboxes, foundations, special frames or complex attachments, which saves space, installation time and cost.

Redundancy and reliability

Hägglunds hydraulic direct drive systems have proven invulnerable to harsh environments and varying production with their unique ability to handle a starting torque of 3-4 times the running torque – without overdimensioning of the drive system. When multiple hydraulic motors are used, they provide a high level of redundancy and perfect load-sharing. Moreover, since the motors are connected hydraulically and share the load equally, they minimize wear.
A hydraulic direct drive system is used both for the main drive and for the auxiliary drive during maintenance and emergency stops. Unscheduled shutdowns are not acceptable for cement plants, not only because the kiln is the key to production, but also because a stop can easily deform

or break the kiln due to the extreme heat that arises inside during standstill.

Unbeatable flexibility

With a hydraulic direct drive system, a kiln can be dimensioned for all operating conditions and kept in continuous operation. The rotation speed can easily be adjusted as required – ranging from zero up to maximum speed with the same high degree of reliability.

"Flexible speed control not only lets you increase production, but also results in better quality, since you can experiment to find the optimal feed-speed ratio," says Per Åström, Industry Sector Manager, Mining and Material Handling & Cement, at Bosch Rexroth. "No matter how much or how little you feed in, you always end up with great-quality raw material for cement. In this way, future capacity increases or reductions can be achieved more efficiently and with greater flexibility."

Less installed power

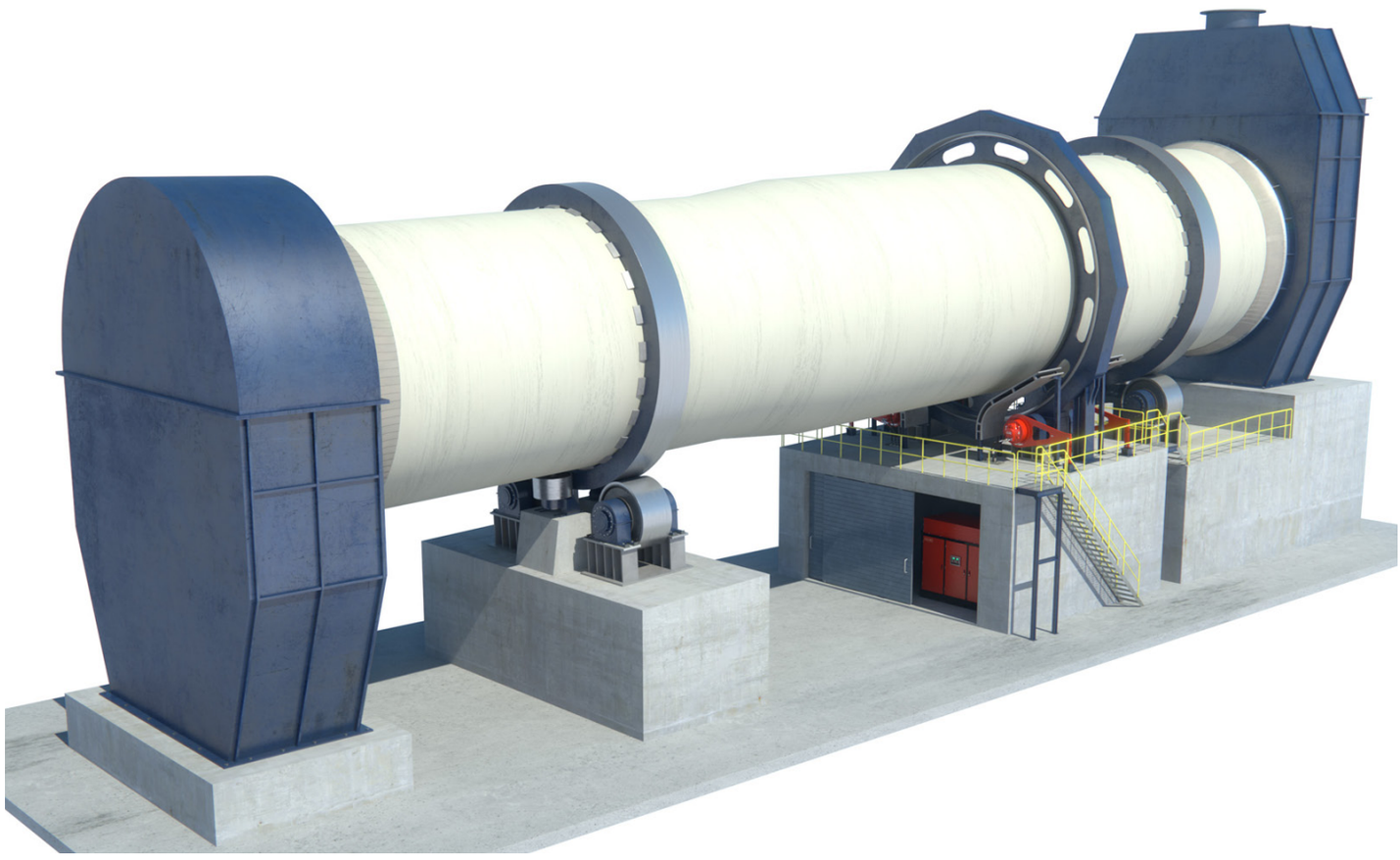
Bosch Rexroth offers a flexible drive system concept for kilns and drums that allows less power to be installed while achieving a more compact system with the same flexibility as before. This concept takes advantage of the possibility to use tandem Hägglunds motors, connecting two motors to each shaft. It also creates an adaptive system, where drive parameters can be changed during operation to maintain the 'sweet spot' and make the production more efficient. This is achieved through the built-in control system in the Hägglunds drive unit, which supplies the hydraulic motors with the necessary hydraulic power. The drive unit can be located anywhere convenient and communicates with the DCS via any interface.

"With this solution our customers can achieve higher productivity, flexibility and reliability, adapted to the actual production need," says Åström.

Low lifecycle cost

Hägglunds hydraulic direct drive systems from Bosch Rexroth offer an excellent solution for reliable and uninterrupted production, which is exactly what is demanded for tough applications like kiln drives. Complete retrofit kits for upgrading existing kilns are available and can easily be installed during a scheduled maintenance stop.

"I have customers who installed our drive systems five or ten years ago and haven't had a single unscheduled shutdown since. All in all, we offer a lower lifecycle cost, thanks to higher productivity coupled with less maintenance and downtime," concludes Åström.



CEM Drive: The ingenious and mechatronic drive system

By: Martin Baechler, Product Manager, FLSmidth MAAG GEAR, Switzerland

Introduction

Vertical roller mills are worldwide established in cement plants for the production of raw meal and the cement grinding process. Contrary to other comminution technologies the vertical roller mills have not yet reached their limits of throughput rates.

The constant increase in grinding capacity of VRM has defined the evolution of the required drive system. From the very beginning, conventional drive systems consisted of one stand-alone horizontal electrical motor, providing the necessary torque and a gearbox, reducing input speed to mill table speed and changing the rotation axis from horizontal into vertical direction. By the end of the past decade, the power increase reached the limits of the above mentioned conventional drive units. Mainly the bevel gear stage, responsible for changing the direction of rotation axis, reached physical dimensions where manufacturing is getting difficult and costly. Gear units with design power up to 9'000kW and gear ratio of 50 are still possible to build, but requires customized design for each application. The design is not only focused on the bevel gear stage but on the entire gearbox, its bearing arrangement and casing stiffness influencing the dynamic behaviour of the gearbox. Caused by the limitation of power transmission through the conventional gearboxes new drive systems have been developed.

While the majority of the gear suppliers implemented drive systems with multiple motor designs and blowing up the complexity, only FLSmidth MAAG Gear with the unique CEM Drive follows the way of reducing rotating parts and providing simplicity. The application range of this drive system is focused on medium to very high drive powers. Keeping this in mind from the very beginning of the design process, a smart modularization is realized to cover the power range from 4'000 kW to actually 14'000 kW.

CEM Drive

The CEM Drive is the real novelty in cement production. Contrary to modular drive system, the concept of CEM Drive is built to use only one main motor. This motor is vertical oriented, integrated in the gear casing and replaces the bevel gear stage. On top of the motor, a double planetary gear stage provides the required speed reduction and torque increase. Together with the hydraulic thrust bearing it is one by one the identical design as in conventional gearboxes. The motor is not only designed to fit into the gear casing, providing same outer dimension as conventional gearboxes, but it is also made for highest efficiency and optimum operation characteristics.

The result is a synchronous motor with permanent magnet exited rotor, including a space and energy saving single coil stator. The central element of this unique motor is the direct fluid cooled stator. Gear lubrication oil is used as cooling media, which is routed directly through the stator body to evacuate heat losses at the place of origin. The second source of losses, the rotor, is cooled by an internal airflow. The shaft mounted van generates an air current flowing along the gap between rotor and stator and cooling the magnets mounted on the rotor body. The hot air leaves the rotor at the top and is forced to flow along the back of the stator down to the bottom of the motor casing. As the stator is directly cooled by lubrication oil, is also severs as heat exchanger for the internal airflow. Once the cold air is arriving the bottom of the motor casing, the ventilator aspirate it again into the rotor for cooling.

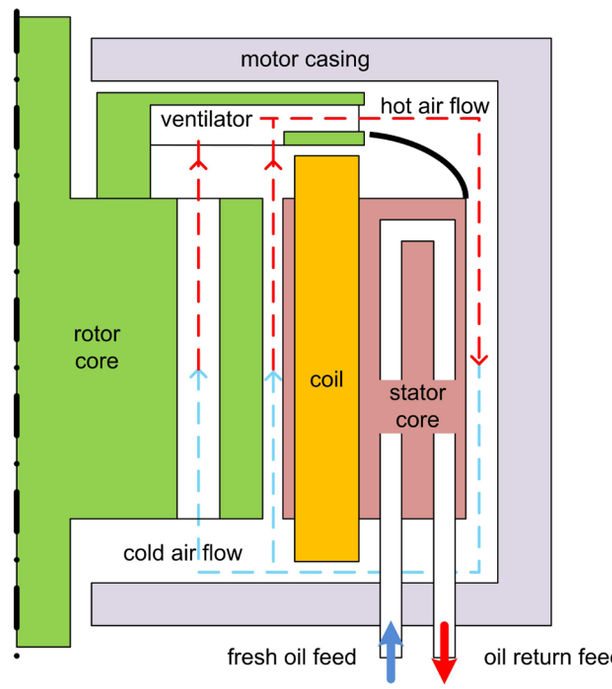


Figure 1: Schematic air flow inside motor

The variable frequency converter, feeding the motor, allows operating the mill at optimum process conditions. Especially when having several mills for raw material and cement grinding in similar dimensions and power ranges, the CEM Drive is able to operate each mill at the required speed without changing internal toothed

parts. It supports the effort of modularization of the equipment in cement production plant.

Designed to fit

The overall dimension of the CEM Drive follows strictly the size of conventional gear units where an overlap in drive power exists. The casing is always divided into two parts with a horizontal split line located at the top of the integrated motor. This makes the installation and access to the motor very easy. The gear design and the bearing system to support the grinding table is one by one the same as used in the well-known MAAG WPV gear units. The motor is equipped with hydrodynamic slide bearings which makes the shaft grounding device the only wear part in the entire drive system. This device is easily accessible from outside and can be exchanged within less than one hour. An advanced condition monitoring system allows supervising of operating behaviour of the drive system. Regular maintenance tasks and inspections can be done without removing the drive unit from the mill.

The consequent use of medium voltage for the frequency converter and the motor makes the installation extremely comfortable compared to other new drive systems for large power application. Those are using 3 to 8 motors, where each of them has to be connected to a local motor control centre and a separate circuit breaker. The recommendation of using low voltage motor design increases the power cable cross section compared to medium voltage design. These create high cost for cabling work and limit the accessibility underneath the mill.

The CEM Drive with its variable speed and the compact overall dimensions can replace nearly every conventional gear unit for vertical roller mills. Because of the integrated motor only an alignment to the mill table is necessary. It needs just three days of mill shut down to exchange an existing gear unit with the CEM Drive. The first prototype of this drive system is in operation under a raw mill. It operates with a drive torque of around 41'800 Nm in a very smooth and stable way.

Conclusion

Mechatronic units are already established in many industries and applications, in cement production the integrated motor concept of CEM Drive is still a novelty. From straightforward purchase process to small mill foundation until simple setup and commissioning, the potential of it is huge. The combination of proven gear technology with advanced motor development results in an extremely flexible drive system for VRM within same dimension as conventional gearboxes. This again allows cement producer standardizing mill drive units of new and existing plants. The high performance electrical motor, driven by a stat of the art frequency converter, drives any vertical roller mill up to the highest required power demands.

Figure 2: First installation of CEM Drive under a VRM for raw material grinding

BEDESCHI INCREASES ITS EXPERIENCE IN CLINKER AND CEMENT SHIPLOADING ACTIVITIES

Bedeschi Spa, historical supplier of crushing and handling machines for the cement mining industry, steel factories, coal and others industrial processes, in the latest 15 years added a new operative sector, the marine, producing a wide set of shiploaders for on-shore installations.
Important experiences of shiploaders for bulk cement and clinker are in operation while other are in the assembling phase.
In the shiploaders for melted cement and clinker sector, close to the classic technology with loading boom, rubber belt conveyor and telescopic chute , Bedeschi developed a new technology with complementary screw conveyor and telescopic chute as to obtain a close and sealed system, proof against dust.

THE ADVANTAGES OF USING A TELESCOPIC CHUTE WITH AN EXTRACTION SYSTEM

The telescopic chute is an ideal solution to prevent the problem of breaking particles and to minimize dust generation when loading bulk material that in this case is totally avoided thanks to the particular loading operation with vessel hatches cover completely closed, similar to the loading operation effectuated on a closed silo. The design of telescopic chute ensures that material particles are kept in mass flow form and at low velocity. In fact the internal lining of the module cones minimize the liberation of dust particles without affecting loading rates. The extraction system, represented by the top boom bag filter, guarantees a perfect vacuum atmosphere into the vessel hold, preventing any dust emission.
Due to the minimal free-fall and the low velocity that the material experiences, greatly reduced material degradation is evident when loading sized product.

Here below, some of our most important and recent case studies concerning the subject:

CASE STUDY OF YESILOVACIK PORT - TURKEY - EREN HOLDING

Bedeschi is in the process of assembling activities of the raw materials handling machines for the new Medcem Cement, a newly establishment manufacturing company within Eren Holding, located in Mersin. Bedeschi was also awarded by Eren Company the supply of two shiploaders, for clinker and cement and one ecohopper for receiving and delivering coal at a capacity of 1,200 t/h. The shiploaders are designed for loading at a rate up to 1,400 t/h vessels with a capacity up to 40,000 DWT. The shiploaders are slewing and travelling type. The machines will be installed in the new Yeşilovacik harbor terminal, located few kilometres away from the Medcem Cement factory and that will become the connection point for the raw materials and final products import/export operations. Commissioning of the Medcem Cement facility is planned for the end of 2014. Once fully operational, the plant will have a production capacity of 10 000t/h of clinker.

PROJECT DATA

Material	:	Cement	Clinker
Size	: (mm)	0 to 1 mm	0 to 30 mm
Design capacity	: t/h	1400	1400

Bedeschi shiploader in Yesilovacik Port

Bedeschi shiploader in Yesilovacik Port

CASE STUDY OF SONMEZ – TURKEY

Integrated cement plant has been founded in Adana Yumurtalık TAYSEP Free Zone under the mark of 'Sönmez Çimento' in accordance with decision taken by Sönmez Holding, Kutlucan Holding and Türkün Holding. Sönmez Çimento is the first cement plant which is allowed to be founded within the free zones in Turkey Thanks to the plant's closeness to the harbor, it is provided that vessels are loaded very fast. In April 2016 Bedeschi, awarded by Sönmez Cimento, a contract to realize a clinker and cement export terminal. The integrated cement plant is being founded in Adana Yumurtalık TAYSEP Free Zone (Turkey), on an advantageous area because of its closeness to land and sea transportation and raw material sources. The shiploader, slewing, luffing and travelling type, equipped with a telescopic chute, will be installed in this cement plant's port terminal. The slewing shiploader will perform efficient loading under heavy duty conditions for vessel up to 55.000 DW, beam 32.2. The nominal loading capacity of the machine is of 1.000 TPH with peak flow rate of 1.100 TPH. The equipment is fully in conformity with Current Environmental Legislation with high technology de-dusting systems such as filters, installed on board to reduce the dust pollution caused by material flow between subsequent belt conveyors. The plant protects its environmentalist features with using alternative fuels and renewable energy sources. Moreover, the belt conveyor installed on the shiploader was particularly designed, in order to reduce as much as possible the belt speed, the belt inclination and type. All these improvements and others have been applied in order to avoid any kind of spillage of conveyed material (clinker and cement) and to reduce dust generation at each belt conveyor transfer point." To this end, Bedeschi, thanks to its research and development in green technology, is able to design and produce eco-friendly bulk handling equipment, which incorporate sophisticated dust control measures, able to reach the highest environmental standards and emissions reduction.

Material	**:**	**Clinker**	**Cement**
Bulk density	**: t/m^3**	**1.35**	**1,05**
Grain size	**: mm**	**0 – 50**	**0 – 1**
Moisture	**: %**	**5**	**Dry**
Temperature	**: °C**	**110 max**	**Ambient**
Loading capacity	**: t/h**	**Clinker:1000** **Cement: 750**	

ANOTHER EXAMPLE OF BEDESCHI'S TECHNOLOGY:
VASSILIKO CLINKER EXPORT TERMINAL.

CONCLUSIONS

Some ports have the advantage of deep water and have extensive, flat surfaces for bulk materials handling and storage and the necessary machinery to handle the goods easily and quickly. However, most of them have limited space available and out-dated equipment that makes it hard to operate efficiently. In order to increase production new more performing shiploader are needed.

Bedeschi, with its wide set of machines is able to satisfy the modern need for flexible, efficient and eco-friendly solutions and last but not least cost cost-effective.
Bedeschi has many years of experience in supplying on-shore and off-shore material handling systems and extensive experience in the design of bulk material handling plants for continuous loading of dry bulk cargo onto ocean vessels up to capsize in deep water anchorage.

Each new project incorporates the feedback received from the on-going systems to continually improve the design of the machines.

The main characteristics of Bedeschi's equipment are:

- Telescopic chute with tiltable hopper for a better flow control.
- Very low environmental impact, suitable for dusty product.
- Special anti-dust systems.
- Complete control of dust emissions and dust products, as cement or similar in the passenger areas.

Bedeschi, thanks to its research and development in green technology, is able to design and produce machines, which incorporate sophisticated dust control measures, able to reach the highest environmental standards.

As supplier of a variety of equipment for Bulk Materials Handling such as cement, power, fertilizer, grain and food, the Company invests in R&D to offer the latest technology solutions with a reduced environmental impact.

Thanks to the presence of a BU specialized in the supply of purification and filtering systems, Bedeschi takes care to reduce the polluting agents produced by the production process.

Bedeschi, leader in engineering and manufacturing of onshore and offshore systems for loading and unloading bulk and containers, ensures modern technological solutions in order to avoid spillage of polluting materials into the sea, ensuring a sustainable approach in the working areas, complying with rules and regulations for the respect of the environment and operators, fundamental purposes to guarantee the improvement of the company performances and Customer satisfaction

Bedeschi aims to discover, develop and deliver innovative green technology and sustainable services for its suppliers and customers creating a better world taking care of environmental responsibility and social benefits.

Balancing the stocks

By: Mark Mutter – JAMCEM Consulting, UK

Introduction

The subject of maintenance and reliability is so broad that there is enough material to fill a whole magazine. Subjects such as the reliability strategy that should be adopted by a plant, the use of modern maintenance management techniques and the use of wear-resistant materials are often discussed in articles. The reliability of the plant has a direct impact on the profitability of the plant, especially when there is market pressure to maximise production. In addition to this, some of the known and often discussed effects of poor reliability are:

- Fuel and power consumption is increased in the pyro-processing system with the time that is spent heating up the kiln and building up the feed to the design output.
- Kiln stops also reduce the refractory life leading to potential unplanned stops and a shorter period between each planned maintenance stop.
- Power consumption for raw mills and cement mills increases with additional stops and motor and gearbox life is shortened.
- Higher downtime will limit the plants ability to run the equipment in off-peak tariff hours, increasing the cost of electricity to the plant.
- The size of the maintenance department must be larger to ensure that there are sufficient resources to repair the plant when it fails.
- Poor morale due to constant “fire-fighting”, often in anti-social hours.

These knock-on factors also affect the profit and loss of a company – the metric by which most companies are measured. However, a further knock-on effect of poor reliability, which does not show up on the profit and loss of the plant, is that plants that have poor reliability generally have a high stores stockholding of spare parts. In addition to this, cultures and practices develop within companies that lead to over-stocking of spare parts. This article covers some of the reasons companies end up with high stores stockholding, how the problem can be assessed and some of the solutions to addressing the issue.

Financial aspect of high stockholding

In the next section of the article, some of the causes of the high spare parts stockholding are explained. But it is important to first address the financial aspect of spare parts. When spare parts are purchased – regardless of whether they are OPEX of CAPEX spares - they are paid for in cash; so, the first financial aspect is that a higher stores stockholding increases the working capital/cashflow that a company requires. And it should be remembered that businesses mainly fail due to cashflow issues, not profit and loss.

As these spare parts are not used immediately, their value is put onto the balance sheet of the company and then their value is transferred to the operational budget as they are used. At the Section Engineer level of the plant, a high spare parts stockholding is not generally an issue; the Section Engineer only sees the spare parts hit his budget when he uses them, not when they are purchased and put into the stores.

The second financial aspect – which in many cases is a major issue for the Financial Director – is the issue of obsolete spares. These parts are those which can no longer be used – for example if electronics systems have been upgraded or old out of date equipment has been replaced. These parts are on the balance sheet at their full value but their actual value is much less than the purchase price and is normally either zero or the scrap value. However, in writing off these spare parts, a hit has to be taken on the profit and loss to make the balance sheet balance. And in the short term, profit-driven economy in which we live, this is not something that any Director feels motivated to do.

Assessing the scale of the problem

Putting to one side the financial treatment of the spare parts, it is necessary to examine whether a plant has a stockholding problem. Traditionally, the stores stockholding of the company is measured in financial terms i.e. the cost of the spare parts as they are purchased. JAMCEM has visited several plants where

the stores stockholding is in excess of $30 million dollars on a capacity of between 3 and 4 million tonnes per annum.

Whilst we can tell from the size of these figures that there is an issue, we need a better metric against which to measure the size of the problem. JAMCEM has addressed this issue by developing the concept of stores turnover i.e. the time that it takes for the value of the stores to be used. In this way, the current position of the plant can be compared to the target level to determine the size of the problem. This can be at the overall level i.e. for the total stores stockholding, as well as for specific areas such as refractories, cover belts etc. Clearly some adjustment to this target is required for factors such as location – so for example supplying large parts from a European supplier to a plant in Europe is going to be a lot quicker than to a plant in a landlocked country in Africa.

Causes of high stockholding

Once we have assessed the scale of the problem, it is essential to consider whether the issue is related to a high volume of spare parts or a high cost of the spare parts – or both. Taking each of these in turn, we have found the following:

A high volume of spare parts can be caused by the following factors:

- Fear of not having sufficient spare parts to fix the plant when it breaks down. This fear is made greater if the plant is suffering from frequent breakdowns. In some historic cases, this was due to the early O and M contracts whereby there was little control by the owner over spare parts purchase and the owner paying for all the spare parts, with only a fee being paid to the O and M contractor for tonnes of cement produced. In more recent times, this kind of over-ordering of parts comes from factors such as overly complicated purchasing processes, where too many sign-offs are required for parts leading to the order taking weeks to process. Excessively long delivery times to plants in more remote locations can also lead to over-ordering.
- A lack of control and structure in the purchasing department, whereby different departments are ordering the same spare part for their respective plant areas (so for example raw materials, raw mill, cement mill etc) without knowing what the other departments are ordering. We have found that this is made worse by the use of non-common descriptions of the spare parts in the purchasing system, so that the purchasing manager is ordering the same part for different plant areas simply due to the description of the part that is provided by the Engineers. Not only does this result in an excess of the same part, it means that the purchasing department has less bargaining power when ordering smaller batches of parts.
- A poor description of the spare part from the Engineers to the Procurement department which results in the purchasing process being slowed down - in some of the worst cases seen, the process to order a part takes 2 - 3 months. Faced with this, parts are over-ordered to cover the purchase process, the order placement and the time to deliver.
- A failure to have pre-defined maximum and minimum stocks of spare parts so the purchasing requests are simply executed without any real control over whether the part is required and needs to be re-ordered.
- A poor maintenance strategy when parts are replaced to early and there is no predictive maintenance leads to the plant carrying a higher stock level of parts being carried when there is no requirement.

A high financial value of a smaller number of spare parts can be caused by the following factors:

- A surplus of "production critical" spare parts have been purchased when the equipment has been initially installed. In some cases, the number of these critical spare parts are too high – or have been over purchased without considering the real impact of their failure and the time to re-order. In other cases, their classification as critical id not justified.

As mentioned in the previous section, one further case exists that inflates the value of the stores stockholding and that is the issue of obsolete spares. When spare parts are purchased, the cash leaves the company and the spare parts are put onto the balance sheet until they are used, at which point they become an operational cost and affect the profit and loss. The spare part generally carries the purchase value when on the balance sheet, but when it becomes obsolete – for example when equipment is scrapped or the electronics of control systems are upgraded – the value of the spare effectively becomes zero. This becomes an issue for the company and there needs to be a clear strategy for disposing of obsolete spares to ensure that the accounts are not presenting a false picture of the value of the assets and that any hit on profit from the write-off can

be spread over several years to avoid a significant "hit" in one year.

Corrective measures

It has to be said that solving the issues raised in this article are not simple nor are there any quick fixes. High spare parts stockholding situations tend to result from many years of poor spares management and are often a combination of many of the various reasons mentioned in the sections above. Assessing the causes that have led to this situation will require manpower – both internal and external – as well as serious thought from Senior Executives with regards to how the deal with the issue of writing off obsolete spare parts.
Whilst being a labour-intensive task, a full audit of the spare parts inventory is required and there is no avoiding this task if progress is to be made in reducing the spare parts inventory. Leading from this, if a standard naming system for parts can be developed in the stores, the financial rewards can be huge. The specific tasks of the inventory assessment are as follows:

- Review of the stores stockholding on an item by item basis to eliminate duplicate names for the same item within the stores and prevent over-ordering of the same part.
- Identify common items that can be used across multiple items of equipment which may be being ordered by different section heads of the plant.
- Assess the spare parts holding for common installations – for example where two raw mills of the same type are installed on a plant.

This assessment will identify what some of the core issues are; however, the build-up of spare parts is caused by humans and therefore the purchasing behaviour and processes need to fully analyse by reviewing the following areas:

- The procurement process from the initial purchase request through to the raising of the purchase order and placement of order with the supplier. Of importance are the number of signatories within the process/number of sing-offs, the use of the ERP system for authorisation and the time for the authorisation part of the process compared to the whole procurement process.

- Review of the supplier database and the number of suppliers of parts.
- The use of consignment stock and long-term supply agreements with different suppliers.
- Understand the purchasing strategy and how the lead time of spare parts from overseas suppliers are taken into consideration.
- The controls are in place to ensure that parts are not ordered by different departments/functions that serve the same purpose i.e. that multiple parts are not ordered which increase the stock levels.
- Relationship with OEM suppliers and recommended levels for stockholding.

Once the assessment – and in particular the stores stockholding review – has been completed, corrective actions can be put in place. This includes developing a common naming convention for spare parts, setting minimum and maximum stock levels for all parts, improving the use of the ERP, improving the checking of purchase requests from all the Engineers in one central department and discussing with suppliers how their supply times can be shortened. Longer term, a more systematic approach to stock-checking and identification and disposal of obsolete spares could also be considered.

Conclusion

Whilst the process of addressing high stores stockholding is time consuming and requires effort from the plant personnel, the gains can be significant and reach into the millions of dollars per annum in cashflow, even on a medium sized cement plant. This will be achieved by running down the stock levels to the target levels. Improvements in plant reliability strategy as a result of this study should also improve the profitability of the plant.

Once the plant is down to the target level of stores stockholding, the cashflow requirement for spare parts will be greatly improved and will free up cash for investment elsewhere in the company. In addition, once the thorny issue of obsolete stores write-offs has been addressed, Finance Directors can be sure that their financial statements are a true reflection of the value of the company assets.

Geopolitics and a Cement Strategy

*By: Mr. Terry Pavlopoulos – Managing Partner of Cement Business Advisory Ltd. (CBA)**

A lot of time has been spent discussing the recent financial crisis and its impact on the cement sector. It has been seen that the pre-crisis strategic drivers and behaviour of the sector have changed significantly in the post crisis era. In our view, the drivers and behaviour developed as follows:

Strategic drivers in the pre-crisis period:	Strategic drivers during the crisis (2009-2010)	Strategic drivers in the post crisis period
Additional capacity	Preservation of Free Cash Flow	Cyclical recovery
Excessive M&A	Revenue driven cost cutting initiatives	Continue addressing financial performance
Increased leverage	Reduce debt burden	Improve market structure and dynamics
		Effective cash management

But what has been happening in the last five years?

Geopolitical issues

As the financial crisis appeared to be ebbing away, the world has experienced some significant geopolitical events. This article is not intended to provide a definitive listing of all relevant events but to offer a flavour of what has happened and how the sector has been influenced by such events. Some significant events were:

The Arab Spring which led to significant changes to the status quo in many Arab countries. This has led to unsettling issues such as the Syria situation, Libya, Yemen and other related events in Egypt, Tunisia and other locations. These events may have been exacerbated by low oil prices which resulted in reduced revenues in many Gulf States and the influx of significant numbers of refugees to "safe havens" such as Lebanon, Jordan, Turkey and Europe. The uncertainty and retrospection in many countries in this region are now palpable.
The annexation of the Ukraine by Russia was another event that destabilised and unsettled the status quo. This was followed by sanctions from the Western world and the re-animation of a stand-off between Russia and "the rest" reminiscent of bygone eras.

In the meantime, Western economies have shown signs of tiredness and stagnation. The post-crisis period of 2010 to 2016 has left many western people questioning the benefits of globalisation motivated by stubbornly static economies (particularly in Europe) and increasing disparities between the so called "elite" and the rest. The EU GDP has grown at an average 1.2% per year from 2010 to 2016.

2016 proved to be an eventful year… First, came the UK vote to leave the European Union, sending waves of turbulence towards Europe and beyond. The unlikely (for many) victory of Donald Trump, and his propensity to topple a number of hitherto established understandings has topped the year. The terrorist atrocities in France, Belgium and Germany have unsettled many Western Europeans and as a result Europe found itself with closed borders and walls being erected between member states of the EU.

* 'Geopolitics and a cement strategy,' Terry Pavlopoulos, Cement Business Advisory Ltd, Global Cement Magazine, May 2017, pp 10 -12.

This is only a sample of events and issues that one can find in the post crisis era. Many other localised events have seen the light in numerous places around the world, increasing the level of uncertainty and confusion. Some examples of such events are: Turkey, Venezuela, Sub – Saharan Africa and many others.

Cement sector specific issues

In the wake of such a tumultuous geopolitical environment, the global cement sector has contributed its fair share to increasing the uncertainty and wariness of professionals operating in the industry.

The two mega mergers (Holcim – Lafarge and Heidelberg – Italcementi) were affected in the post crisis era by executing what was to that point unthinkable unions. The benefits and value of these two transactions are subject to numerous analytical comments and I will not indulge in my own views and opinions in this article, however the impact on the fibre of the industry is unmistaken. The supremacy of the major international players was under threat and the atmosphere in many cement companies was one of confusion and questioning.

One of the main arguments behind these mega-mergers was the further consolidation of the global cement sector. In fact, the opposite may be true. The notion that increased global capacity ownership by one or two players increases the sector consolidation is flawed. It is estimated that the top seven international producers held around 16% of global cement capacity in 2012 whereas currently the top seven hold below 15%. Not a meaningful impact here. At the same time, there were new entrants in many markets in MENA, Sub Saharan Africa, Central Asia and South East Asia. We would argue that despite the mega mergers more individual markets fragmented than consolidated between 2012 and today (particularly, in the developing regions). It could be argued that the structures of individual markets provide a more meaningful measure of sector consolidation.

On the other hand, the pre-crisis propensity to add new capacity has continued almost unabated. Although, most international players, either due to financial constraints or chosen strategy, did not participate in new capacity additions, many new entrants appeared in a number of countries/markets asserting their claim on what was perceived to be a lucrative sector of the economy. It is estimated that between 2010 and 2016 the sector globally added around 1.4 billion tonnes of new capacity whereas demand grew by around 1.0 billion tonnes.

Impact on the cement sector

The combined geopolitical events and sector specific issues have impacted the sector significantly.

In the period between 2008 and 2013 the sector experienced a significant cyclical recovery with cement demand growing at an annual rate of around 7%. Since 2013 however the global cement sector grew at around 2%. The cyclical recovery has therefore stalled perhaps due to the geopolitical events.

Because of this and the continuing capacity additions the sector is currently faced with an unattractive supply – demand balance globally. It is estimated that global capacity utilisation rates currently stand at around 70%.

In addition, the slowing of the Chinese economy and the perceived negative impact on many emerging economies of the "rejection" of globalisation does not bode well for the tightening of the supply-demand balance going forward. The Chinese economic deceleration is reflected in the cement consumption statistics (Between 2008 and 2013 cement demand grew in China by around 12% per annum whereas between 2013 and 2016 it only grew by around 1.5% per annum).

Added to this, increased climate change legislation and tighter environmental requirements have introduced an additional strain on the sector.

What is the sector to do?

It is nigh impossible to define a strategy for a whole sector. Strategy is developed and implemented by individual players within the sector. So, what could a committed cement player do in the face of such a challenging environment?

- Truly Consolidate

There are many markets globally that have an unsustainably high number of participants. In many, culture, legislation and funding are not yet in place to allow for meaningful consolidation initiatives. This can change but requires efforts from committed players.

- Move to a Sustainably Lower Cost Base

This may sound like stating the obvious but it is not. It is surprising how much improvement an average cement producer can achieve both at plant level but also in the rest of its operations. Our experience suggests that there isn't a cement plant in the world that cannot improve its cost structure further. I am sure, many would now think "…but our plant is new and very efficient…". Again, we would challenge this position and can prove that improvements are possible even in the newest of plants. Also, in recent years, low oil prices have impacted energy costs in the cement sector and supported attractive financial performances, perhaps leading the producers to a false sense of security. This could easily be reversed when oil prices begin to climb again.

Turning to Operations, it is also surprising to see that many cement producers rarely focus on improving their operational structure to improve costs and address the changing operating environment. The definition and development of an attractive distribution chain is one example in many developing markets where cement producers may miss opportunities to define a more robust business model. There are significant levels of introspection and complacency to be found across the world of cement. Moving to a sustainably lower cost base is fundamental for leading cement players to be able to cope with overcapacity and fragmentation.

- Optimise Investment Costs

This refers to both the cost and funding efficiency of all investment projects. It is baffling to see cement project costs escalating given the current situation. This reflects on both the cement producers' ability to manage their project efficiently, and the propensity of project suppliers (equipment manufacturers, construction companies, etc.) to present cement investments as special projects tantamount to "Rocket Science"! This view could be disputed.

Funding a cement related project is also an area where a more efficient approach may be taken. Cement manufacturers need to open up their funding sources to more than the local banks, and try to achieve the best possible financial outcome for their investment. The benefits that a local or regional cement producer could attain by approaching alternative funding institutions (to include Development Finance Institutions, Private Equity Houses, International Commercial Institutions, etc.) surpass the commercial terms of a loan or an equity stake.

- Address Capacity Utilisation Issues

When all is said and done, the unattractive supply – demand balance leads to lower capacity utilisation rates for cement plants. This is unwelcome news as the cost structure of a cement plant dictates the necessity for full capacity utilisation: the "Holy Grail" of cement economics. In situations like this, we have seen too many market share "fights" in domestic markets resulting in reduced prices and invariably insignificant changes in volumes. So, what other options are there for a cement producer to improve capacity utilisation rates?

o Exports

In the pre-crisis era when cement was scarce, many producers found it quite easy to export excess volumes to various deficit markets. This, sadly, is not the case anymore. We have argued on many occasions that opportunistic

exporting is all but defunct. We have also argued that developing and sustaining a long-term export strategy for many low capacity utilisation producers is a compelling strategic requirement.

Our thesis is that, an export strategy must include (beyond the standard aspects of relevant product, product licensing in destination markets, logistics expertise etc.) a commitment to the destination markets in terms of assets on the ground. These may include terminals, grinding stations, bagging plants and even Readymix concrete assets.

It is common to spot announcements in the trade press of new plants being erected with "exports in mind". It is less common to see a referral to an export strategy in these announcements. Even later, when the capacity comes on stream, we have seen frantic attempts of many plants to move product to deficit markets (which, by the way, disappear as we speak) on an opportunistic basis / spot pricing. As a result, competition in cement/clinker trading has intensified and FOB prices are very subdued.

It may be beyond anyone's financial expertise to be able to justify a US$ 250 million asset (say, 1.5 million tonnes of annual capacity) when FOB prices are in the region of US$ 30 – 40 per tonne, and the plant has been erected with "exports in mind". It is sometimes baffling to see new entrants (invariably from other sectors of the economy) to exhibit such inadequate understanding of the economics of cement.

- Vertical Integration (VI)

We have on many occasions in the past spoken about Vertical Integration, which is the idea of common ownership of cement and other downstream assets (Readymix concrete, Concrete Products etc.). Again, this requires diligent analysis and implementation strategy if the decision to go ahead with VI is taken.

There are many elements that need to be considered to decide that VI is a sound strategy. These elements differ significantly from one geography to another, and they require local knowledge and careful consideration. An understating of the trends and future development of the construction industry is essential. Our experience in this area is extensive, and it leads us to believe that there cannot be a universal VI strategy, as is the view of some international cement players. It would instead require a market by market approach.

- Removal of Capacity

Easier said than done? Perhaps, although there have recently been such moves in Western Europe. This is a more difficult concept for developing markets to grasp, and indeed it may not be appropriate for many such markets. However, even in the developing world, there are some markets that would benefit with some capacity removal, particularly if significant inefficient, high cost supply exists. China and Russia are two examples here. It is estimated that since the financial crisis only Western and Central Europe removed cement capacities whereas North America remained static. The rest of the world's regions have added capacity.

Removing capacity properly (not mothballing kilns but removing them completely) is not an easy task in many regions and requires careful planning with strict adherence to local legislation.

Conclusions

In conclusion, it appears that the global cement sector is influenced by both the turbulent geopolitical environment, and sector specific issues. Careful planning and implementation is required to address this environment for a cement company to survive and thrive. Here, we described some options that cement producers have to improve their current situation. Clearly, an overall strategy should include other growth initiatives such as potential entry into new markets and corporate development (acquisitions and disposals). We leave these aspects of strategy for a future article.

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A conspicuous place in the journal materials is given to the problems of plant development, capital movement, economic problems facing the cement industries of Russia and other countries.

The journal comes out once in two months and includes news, analytical materials and detailed abstracts of all the articles in English.

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Zvenigorodskaya Str., 22A, office 438
St.Petersburg, 191119, Russia

Tel./fax: +7(812) 242-11-24
+7(812) 712-36-83

E-mail: info@jcement.ru
Web: www.jcement.ru
www.petrocem.ru

Mondi Industrial Bags: The new generation of paper bags

In recent years, Mondi has made major efforts in innovation. That has led to more reliable industrial bags with reduced environmental impact and attractive added-value features, matching customer's requirements. One of the key drivers behind this continuous innovation process is the fact that Mondi is a fully integrated supplier. All steps involved in producing an improved paper bag can be handled in close collaboration between paper mills and bag converting plants.

Innovative. Every day.

Generally, the first step towards an improved industrial paper bag is to develop new or improved grades of sack kraft paper in combination with improved bag constructions and designs. As part of R&D activities at Mondi's R&D Innovation Centre in Frantschach, Austria, Mondi`s sack kraft paper and industrial bag team members analyse and assess existing and proposed materials, including kraft pulp, with a view to improving paper strength, de-aeration properties and mechanical qualities of paper and bags. These R&D activities are often oriented to achieving steady improvement, with the overall goal of taking sack kraft paper and industrial bag solutions to a whole new level. Claudio Fedalto, Sales and Marketing Director, Mondi Industrial Bags, points out the importance of co-operation between business segments within the Group: "Being in direct proximity to our sack kraft paper colleagues helps the bag development process, as we can work closely together on each project." The innovative Mondi Advantage Protect sack kraft paper, which offers both a water-repellent surface as well as high wet tensile strength, and our SPLASHBAG, a bag developed especially for the needs of the cement and building industry that shows a higher water-repellency than normal paper bags, is just the latest example of this close internal collaboration.

Performance driven. Every day.

The next stage of the development process involves rigorous testing. Application engineers at Mondi's Bag Application Centre (BAC) analyse bag strength, de-aeration properties and behaviour during filling and under different storage conditions. To test bag construction, simulations of specific situations are performed using advanced technology, e.g. a high-speed camera (1,000 images per second) for observing behaviour during drop tests, and a climate chamber for measuring performance under hot, humid or other demanding conditions. Since its opening in 2007 the Bag Application Centre performed drop tests for over 3000 bags, the water vapour transmission rate was assessed for around 2500 bags, and over 7000 Mega Gurley tests were performed.

Customer focused. Every day.

Collaborating with customers and listening to feedback is also important. In keeping with the Mondi initiative "IN TOUCH EVERY DAY", Mondi encourages customers with specific requirements – e.g. a bag needs to be developed or adapted – to collaborate closely during the development process. Various examples include collaborations with cement producers: the lightweight solutions ONE and ONE Plus and the world's first biodegradable industrial bag, the Terra Bag®.

Further progress in the evolution of industrial paper bags was the introduction of a bag that offers uncompromising weather protection and significantly extended shelf life of its contents. Combining the best of two worlds – paper and PE - the HYBRIDPRO bag is an excellent combination of the available options: the inner ply is made of 110

g/m^2 white or brown Mondi Advantage ONE sack kraft paper; the outer ply is a 40 µm-thick layer of high-density polyethylene (HDPE). The HYBRIDPRO bag allows high-speed filling, with de-aeration twice as fast as with a standard three-ply bag (35 m^3/h versus 18 m3/h tested on Mega Gurley equipment at Mondi's R&D centre BAC in Austria). Moreover, it is an eco-friendly solution as the total grammage of material used is less than with standard three-ply designs used for the same purpose. Since the bag can be filled on conventional paper bag filling systems, investment in FFS systems, which tend to be expensive, is not required. The HYBRIDPRO bag won the PART-Award at RosUpack 2016 and was shortlisted at the Eurosac Grand Prix 2015.

The benefits of filling expertise

Mondi also recognises the importance of having a filling equipment producer in house. It therefore owns Natro Tech, a company near Milan with a 90-year history of designing and building filling systems for granular and powder products. Natro Tech focuses mainly on filling equipment for industrial bags – valve bags as well as open mouth bags. This in-house filling equipment expertise is unique in the industrial bags market and is well received by customers, as Natro Tech's technicians visit fillers on site to provide input on how to optimise bag construction.

Sustainable. Every day.

Nowadays many companies have sustainability targets, either regulatory or voluntary. Suppliers such as Mondi which are fully integrated across the packaging and paper value chain - from managing forests and producing pulp, paper and compound plastics, to developing effective and innovative industrial and consumer packaging solutions – are well positioned to help their customers meet such targets. Accordingly, Mondi offers a comprehensive range of sustainable solutions, which are optimised to save natural resources and reduce waste and have internationally recognised sustainability certifications.

In addition to the above-mentioned innovative products, Mondi has developed a number of important industrial bag innovations suitable for the food industry over the years. Its current industrial bags portfolio includes the following solutions:

- The Easy Seal valve is an optional feature developed by Mondi that can be applied to any valve bag and adapted to specific customer requirements. Easy Seal employs thermo-media technology to ensure strong, fast and leak-proof valve closure. A special coating on the inside of the valve reacts to the heat and pressure generated by ultrasonic welding. Since the coating is non-adhesive, the valve cannot get blocked before the filling process. Therefore, bags with Easy Seal valves are ideal for high-speed filling processes, as filling and sealing can be carried out with minimum downtime.

- Mondi's Effusion Bag combines precise dosing with optimal protection of the filling good. Thanks to this innovation, end users can better dose the filled good via a funnel-formed effusion opening. With a few quick hand movements, the opening can easily be formed. The sturdy bag and a handle on the bottom of the bag additionally facilitate a convenient and controlled discharging of the bags' content. The paper bag itself is designed for best product protection and encloses the filling material tightly. By using a PE-free film as a second ply, further protection against humidity and an extended storage life of the filled bags can be achieved. Not only do customers benefit from this innovation, industry experts have also recognised its value in numerous product competitions.

About Mondi Industrial Bags

Mondi Industrial Bags, a business segment of Mondi Group, is the leading international producer of industrial paper bags1, selling around 5 billion bags per year. Thanks to its broad range of bag specifications, Mondi Industrial Bags serves major industries including cement and building materials, chemicals, food, feed and seed. The business segment operates a dense sales and service network, the specialised filling equipment department Natro Tech, as well as its Bag Application Centre, where researchers develop and test innovative packaging solutions.

[1] Based on sales volume. Source: Eurosac, Freedonia World Industrial Bags 2016 study prepared for Mondi and management estimates.

About Mondi Sack Kraft Paper

Mondi Sack Kraft Paper is a business segment of the business unit Packaging Paper and ranks among the leading European suppliers of both high-quality sack kraft papers and bleached and unbleached market pulp. It maintains

five production sites that are focused on producing sack kraft paper with excellent runnability and printability ensuring optimised converting machine productivity.

Customer focused. Every day.
With over 135 years of experience and a broad product portfolio consisting of top quality paper grades Mondi can serve its customers best. Mondi`s sack kraft paper is the main component of industrial bags used to pack a variety of products essential for e.g. the building, food, agricultural or chemical industry.

In addition, the sack kraft paper production benefits from a deep know-how enhanced through in-house expertise. Mondi's Sack Kraft Paper supports close collaboration with customers in order to drive product optimisation, every day.

Innovative. Every day.
Mondi Sack Kraft Paper fosters innovative research and cutting-edge technology. Its commitment is reflected in the work of its R&D and Bag Application Centres, the Print Competence Centre, where packaging and printing solutions are developed and tested in close cooperation with customers. In addition, the team of specialists at our Food Safety Laboratory develop optimised solutions that meet highest requirements for food contact and other sensitive applications.

We are Mondi: IN TOUCH EVERY DAY

Mondi is an international packaging and paper Group, employing around 25,000 people across more than 30 countries. Our key operations are located in central Europe, Russia, North America and South Africa. In 2016, Mondi had revenues of €6.7 billion and a return on capital employed of 20.3%.

We are fully integrated across the packaging and paper value chain - from managing forests and producing pulp, paper and compound plastics, to developing effective and innovative industrial and consumer packaging solutions. With over 100 products customised into more than 100,000 solutions, we offer more than you may expect.

Leading brands around the world rely on our innovative technologies and products across a variety of industries such as agriculture; automotive; building and construction; chemicals and dangerous goods; food and beverages; graphic and photographic; home and personal care; medical and pharmaceutical; office and professional printing; packaging and paper converting; pet care; retail and e-commerce; and shipping and transport.

We believe sustainable development makes good business sense. It's integral to our responsible and profitable growth, and embedded in everything we do, every day. We continue to look for ways to do more with less, promote the responsible management of ecosystems, develop and inspire our people, and enhance the value that our sustainable product solutions create.

Mondi has a dual listed company structure, with a primary listing on the JSE Limited for Mondi Limited under the ticker code MND and a premium listing on the London Stock Exchange for Mondi plc, under the ticker code MNDI. We have been included in the FTSE4Good Index Series since 2008 and the JSE's Socially Responsible Investment (SRI) Index since 2007.

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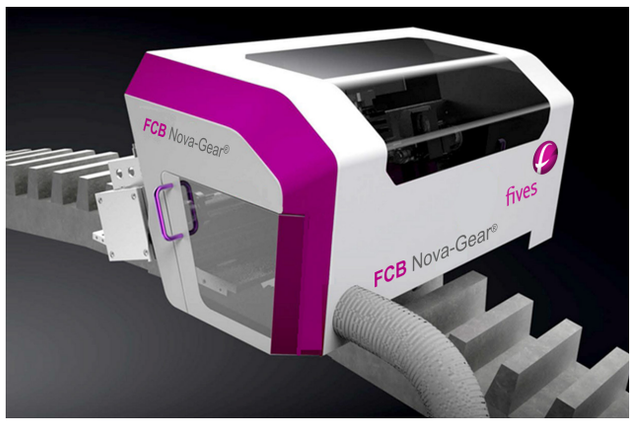

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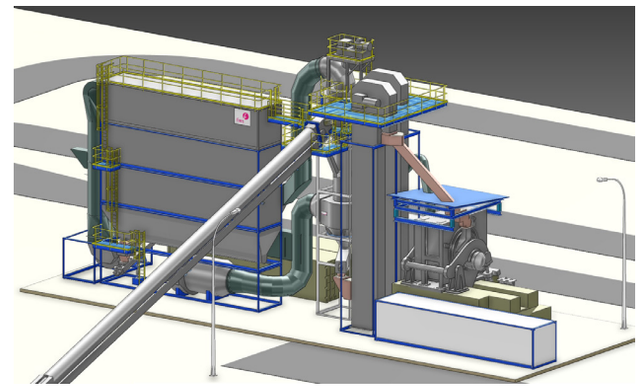
Fives FCB supplies a flexible and modular grinding plant designed for fast completion to enter new markets or adapt to market changes. This is the optimum combination of the best available technologies in grinding, drying and classification.
The FCB FLAG™ Station benefits from the FCB Horomill® grinding plant advantages such as: zero water injection, lowest electrical consumption and high flexibility to adapt to the production of any type of high quality cement and minerals. It meets cement producers' musts in terms of low Opex, low Capex and maximized production.
In addition, its modular configuration allows for a minimized and simplified erection leading to a quick delivery to market.



CHARACTERISTICS
- One single circuit with 3 separated process functions:
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- Fully automated operation
- Standard package with possible options
- Two sizes available:

FCB FLAG™ Station 2200 from 20 to 25 tph
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- Minimized CAPEX and OPEX
- Fast on the market

Contacts:
Fives FCB
50 rue de Ticléni
59666 Villeneuve d'Ascq
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fivesfcb@fivesgroup.com

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Mr. Christophe PRINGUET- christophe.pringuet@fivesgroup.com

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HYCONTROL'S SHIELD BRINGS A NEW LEVEL OF PROTECTION

Compact, budget-conscious new system is a game-changer for the field of silo pressure safety

Redditch, Worcestershire: After months of development and testing, silo protection experts Hycontrol Ltd. are proud to announce the launch of the **SHIELD Silo Protection System on Monday 17th July 2017**. The compact, all-in-one system comes after years of developing innovative technology to protect powder storage silos from pressure during tanker-fed deliveries. Utilising purpose-designed, state-of-the-art pressure monitoring and control equipment, SHIELD meets and exceeds best engineering practice and current guidance from the Mineral **Products Association**. The new SHIELD system has been re-designed from the ground up to offer customers the same comprehensive protection as Hycontrol's original, award-winning SPS, but with a raft of new and enhanced performance features and at a significantly more competitive price.

Powder storage silos are commonplace in many industries but are at risk of over-pressurisation during tanker deliveries, which can happen when the filter unit gets blocked or if the pressure blowing in during the fill is uncontrolled. Air pressure from as little as 1 or 2 psi can easily rupture a silo or blow its filter unit off the top. This poses a serious health and safety risk, which is why a comprehensive safety and alarm system is vital. SHIELD incorporates the essential high-accuracy silo safety components into a modular design that can be adjusted to suit site requirements. Maintenance has been made easier and the long-term cost of ownership is significantly lowered. Along with many new features, SHIELD incorporates Hycontrol's pioneering Ground Level Test technology enabling a one-button full-function test, and inbuilt system diagnostics aid preventative maintenance.

"Drawing on our years of industry experience, it is clear that there is still a widespread requirement for comprehensive silo safety systems," said Hycontrol Managing Director, **Nigel Allen**. "From now on, cost is no longer a valid excuse for ignoring safety. Hycontrol has led the silo protection field for over a decade through both innovation and product performance. We have added new features and improvements to the SHIELD system, whilst lowering the cost to meet the needs of the competitive end of the market, particularly in ready-mix and concrete."

He adds: "With this exciting new product, we are confident that we are now making truly comprehensive silo protection systems available to, and affordable for, all sites and businesses. Safety for staff, contractors and drivers is, quite rightly, the number one priority. With SHIELD, Hycontrol is making complete silo safety achievable and affordable for all sites, however restrictive their maintenance budget."

About Hycontrol: Hycontrol has been at the forefront of level control and silo protection technology for over thirty-five years. Hycontrol is acknowledged as a global knowledge leader in silo pressure safety. The company creates systems that are safer by design, in order to reduce risk, create a safer working environment and provide the best-engineered solution - without compromise.

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New mobile version of A TEC's Rocket Mill®

A TEC has successfully launched a mobile version of its grinding mill to demonstrate the benefits of A TEC's grinding technology.

The semi mobile version named A TEC Rocket Mill® 2.00 single is a compact version installed in a container. The mill consists of one grinding chamber with approx. 2m diameter and 315kW installed power at the main drive. This will give roughly the half capacity of the double chamber Rocket Mill 2.50. The throughput when producing RDF for the main burner (90% < 50mm) is about 1012- t/h.
Due to the compact equipment the required installation space is very small. This new development gives clients also the possibility to test their own product on side. Depending on existing situation only small connecting works to the existing equipment are necessary.

New product – same advantages

A TEC alternative fuel preparation technology offers the following primary benefits compared to conventional technologies:

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- Reduction of CO2 emissions
- Requires only two fuel preparation steps
- Separated FE and non-FE materials can be fed back to the recycling process
- Reduction of coal consumption

About the A TEC Group
A TEC Production & Service GmbH is an engineering and technology company located in Austria. It is focussed on the optimization and the efficiency improvement of cement plants. In total A TEC has successfully completed more than 450 cement plant optimization projects.
Part of a modern cement plant operation is the usage of alternative fuels. A TEC can offer the complete AF system for nearly any kind of solid and liquid waste materials including material handling, preparation, storage and feeding into the kiln.

Besides A TEC's core business of cement plant optimization, A TEC provides consultancy and overall project management and supervision for Greenfield and Brownfield projects (e.g. EPCM), including assistance in tendering process and assistance with environmental and other local norms and standards.

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premium combination for pre- and fine-grinding!

For powerful size reduction of very hard material with a feed size of 95 mm down to 0.05 mm final fineness in a single step!

Combination of Jaw Crusher PULVERISETTE 1 *premium line* with Disk Mill PULVERISETTE 13 *premium line*

For especially fast continuous *premium* pre- and fine-grinding of large quantities of coarse material, the combination of the Jaw Crusher PULVERISETTE 1 *premium line* and the Disk Mill PULVERISETTE 13 *premium line* is the ideal solution. Together, they form an efficient, heavy-duty, high-performance grinding instrument with integrated Riffle Sample Splitter. This gives you the full range of opportunities for optimal sample preparation with a feed size of up to 95 mm and final fineness of down to 0.05 mm – all in a single step.

***premium* combination for integrated pre- and fine-grinding**

- Powerful continuous pre- and fine-grinding
- Compact in a single instrument with integrated Riffle Sample Splitter
- High throughput for production of small amounts
- Maximum feed size 95 mm
- Minimum final fineness 0.05 mm

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After the comminution in the Jaw Crusher PULVERISETTE 1 *premium line*, the ground material falls directly into the Riffle Sample Splitter integrated in the collecting vessel and is automatically divided into representative samples. The division ratio can be set as desired, from 1:1 to 1:6.

Up-dated information on the whole FRITSCH range for efficient sample preparation with videos at www.fritsch.de.

There is also a Video available on the Jaw Crusher PULVERISETTE 1 *premium line* which can be viewed at http://www.youtube.com/embed/7lNr0KvrJag?rel=0. Please also view the video of the Disk Mill PULVERISETTE 13 *premium line* at http://www.youtube.com/embed/ZAD7WCZLIQU?rel=0.

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Schenck Process launches MULTIDOS® VDP-C apron weighfeeder

Schenck Process has announced the latest extension to its MULTIDOS® weighfeeder range. MULTIDOS® VDP-C is a new range of medium-sized and compact apron weighfeeders mainly suitable for raw material feeding, hot clinker feeding and similar applications.

"MULTIDOS® VDP-C leverages the proven technical features and component reliability of the existing MULTIDOS® weigh- and apron feeder designs while addressing specific application scenarios. In particular, it offers a perfect solution wherever a regular rubber belt weighfeeder would otherwise be chosen but cannot be installed because of the physical, chemical and performance limits of a rubber belt," according to Peter Groll, Managing Director Construction & Energy, Schenck Process EMEA.

"Moreover, because we have taken a 'designed straight for the job' approach, the cost is significantly lower than competitor apron weighfeeders," added Groll.

With a completely enclosed design the MULTIDOS® VDP-C enables a cleaner installation environment, with no extra cost, while also allowing quick access for inspection by means of easy-to-remove covers. Alternatively, an open design is possible for permanently visible material feed. The kit structure of MULTIDOS® VDP-C enables installation in a total of 48 possible geometrical configurations to suit plant requirements. It can be installed on the ground or suspended under

a bin. "Extremely high performance, component robustness, safety and the low cost of installation make this apron feeder stand out from the competition," said Groll. "It is also very compact. MULTIDOS® VDP-C has the lowest installation profile of any apron feeder on the market, and it is the shortest apron weighfeeder that is available with an integrated weighing section."

The chain used on the MULTIDOS® VDP-C is an enhanced version that can easily tolerate a drive torque four times higher than required. In addition, apron pans accept loads up to six times higher than the nominal load, for maximum robustness. So there are no compromises that need to be made when it comes to durability and reliability. Apron pans are available for fine grain material, and alternative designs for sticky and coarse material. The coarse material apron pans are made of HARDOX® steel for maximum strength and service life.

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For more information, visit us at: www.FLSmidthMaagGear.com

HANDLE HIGHLY ABRASIVE MATERIALS WITH AGGREGATE DIVERTERS

Handle sand, gravel, lime, flyash, slag, coal, grain, and other abrasive, difficult-to-convey materials more efficiently and economically with the Vortex Aggregate Diverter. The Vortex Aggregate Diverter features replaceable, abrasion-resistant wear liners and a removable access door.

Replaceable liners are present on the bucket's material contact surface, and are also commonly equipped along the internal walls of the diverter legs. Liners make a valve more durable, as they prevent damage and wear to the valve's cabin. If liners are regularly maintained, the useful life of an Aggregate Diverter can be significantly extended.

The diverter's removable access door allows for quicker, easier in-line inspection and maintenance. Unlike traditional bucket diverters that require valve removal from-line and system downtime for rebuilding or maintenance, the Vortex Diverter allows immediate access to the bucket, inlet, and special liners. The entire bucket, its complementing seals, abrasion-resistant liners, an optional dead pocket inlet, and the blade shaft deflector can all be removed and replaced through the side panel using basic tools, which reduces system downtime.

Ordinary diverters feature thin rubber seals. With regular actuation, these seals begin to wear and pull away from the valve. This lessens the positive seal across the closed leg, which allows material leakage to the opposite leg. The Vortex Aggregate Diverter utilises a thick, highly durable rubber sheet to provide a positive material shutoff and seal across the closed leg at the leading edges of the bucket. This prevents material waste, contamination, and process errors of materials intended for opposite legs.

Because the Aggregate Diverter's inlet is designed to redirect abrasive material flow away from the blade seals and the diverter's internal mechanisms, much of the valve is spared from abrasion, providing the system with durability and longevity.

In some applications, a "rock box" bucket design can be utilized to further resist mechanical abrasion. Similar in shape to a honeycomb, the rock box features a protruding grid design on the blade's material contact area, making square-shaped holding cells. As material flows from the diverter's inlet, material is trapped in the holding cells. Once each cell is filled, this creates a sheet of trapped material, allowing material flow to instead abrade against the trapped materials, rather than abrading the blade itself. This concept further reduces mechanical abrasion in the valve, reduces need for maintenance, and provides the valve's internal mechanisms with longevity.

All things considered, the Vortex Aggregate Diverter's abrasion-resistant features improve overall cost effectiveness by reducing maintenance necessity and allowing progressive part replacement, rather than continuous replacement of entire diverter valves.

Standard gate construction allows for 149° C service. Modifications can be made to handle temperatures up to 205° C. The Aggregate Diverter is intended to divert material from one source toward two destinations only. Inlet and outlet customizations are also available. Valve sizes range from 150 mm to 600 mm. Actuators, position indication switches, flanges, and wear liner options are also available.

About Vortex:
For 40 years, Vortex has provided quality slide gates, diverters, iris valves and loading spouts designed specifically for handling dry bulk solids in gravity, vacuum, dilute, or dense phase applications. Vortex valves and spouts are engineered for dependability, durability, easy maintenance, and offer proven solutions to material handling and process efficiency problems. With an in-house team of engineers, Vortex products can be completely customised for individual applications or special installations.

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DL1 1GY - United Kingdom
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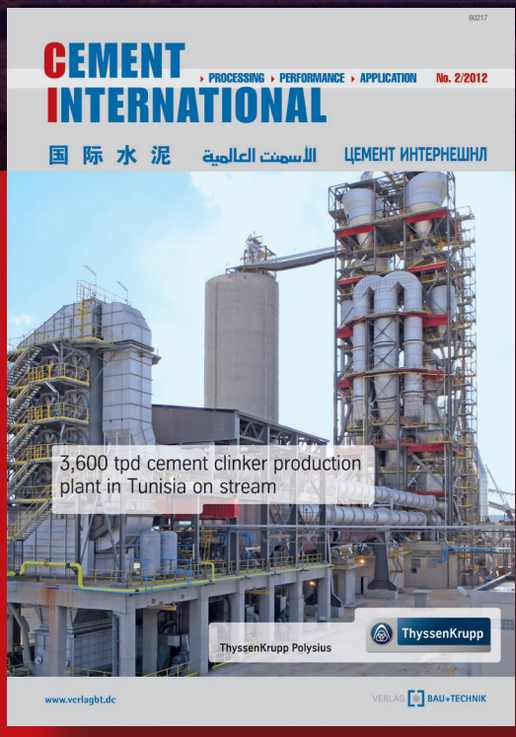

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Middle East outputs decrease YoY, while Asia-Pacific cement volumes edge up

Cement market volumes have dropped in the Mediterranean Basin and the Middle East in May 2017. However, the Asia Pacific region recorded a positive trend, according to CW Research's Cement Country Market Data reporting.

In the Mediterranean Basin, cement industry data shows the Moroccan market has been struggling with an unstable cement demand from the real estate sector. Domestic cement sales dropped eight percent on a yearly basis, having reached 1.2 million tons in May 2017. On the other hand, the Spanish construction market is currently benefitting from an increased demand from housing, while public infrastructure investment has remained slow. Cement consumption in Spain has been growing, reaching 1.1 million tons in May, a fifteen percent increase compared to the previous year. Year-to-date consumption was up eleven percent, comparing with 2016.

In the Middle East, cement manufacturers have been facing low construction activity in major markets. The geopolitical environment and low performing economies have led to a postponing of major private and public construction projects. According to Filipe Gouveia, analyst with CW Research: "cement manufacturers continue to face a deterioration in the Middle Eastern markets. Companies have been struggling to maintain revenues, as pricing competition is intensifying, and export revenue is decreasing."

In Saudi Arabia, cement production recovered one percent monthly, reaching 4.6 million tons in May. Despite a slight month-on-month improvement, on a yearly basis, cement output was eighteen percent lower. Another indicator of the Saudi Arabian market unfavorable environment was the halting of exports, which remained at zero tons since April 2017. In Jordan, 0.2 million tons of clinker were produced domestically from the start of the year until May, an eleven percent drop compared to the same period in 2016.

Cement volumes expand in Asia-Pacific

CW Research's monthly data shows cement industry statistics were positive in the Asia-Pacific region. Cement production registered an upward trend in China and Japan, sustained by a positive construction environment. In Japan, domestic cement sales in May rose nine percent year-on-year (YoY), reaching 3.2 million tons, while cement exports expanded six percent YoY. Chinese cement production grew three percent on a monthly basis, reaching 228.5 million tons in May 2017.

In Indonesia, cement consumption continued to expand on a yearly basis for the sixth month in a row, reaching 5.5 million tons in May. Domestic producers have been strengthening their position as clinker exporters, as year-to-date clinker exports were 37 percent higher than in the same period in the previous year.

For more information, placing an order, or interview inquiries, please contact Liviu Dinu, Market Services & Marketing Consultant, CW Group, by phone at: **+40 -744- 67- 44 -11, or e-mail at ld@cwgrp.com.**

About Cement Country Market Data

CW Research's Cement Country Market Data reporting, available on CW Group's CemWeek.com market reporting platform, covers monthly cement volume trends across the globe. The service provides data and statistics on monthly demand and supply volumes for the largest cement producing and consuming markets around the world. Presented in an objective, easy-to-understand format, the Cement Country Market Data is an indispensable tool for producers, suppliers, traders, investors and end-users that need to quickly understand developments in the world cement markets.

Additional coverage on country volume data can be found here: http://www.cwgrp.com/cemweek-marketdata/country-volume-data

About CW Group

The Greenwich, Connecticut, USA headquartered CW Group is a leading advisory, research and business intelligence boutique with a global presence and a multi-industry orientation. CW Group is particularly recognized for its sector expertise in heavy-side building materials (cement), light-side building materials, traditional and renewable power & energy, petrochemicals, metals & mining, industrial minerals, industrial manufacturing, bulk cargo & shipping, among others. We have a strong functional capability, grounded in our methodical and quantitative philosophy, including due diligence, sourcing intelligence, feasibility studies and commodity forecasting. www.cwgrp.com

White cement demand outlook driven by increasing purchasing power

Between 2017 and 2022, consumption of white cement is projected to increase by an average of three percent per year, according to CW Research's Global White Cement Market and Trade Report (2017 update). White cement consumption growth rate will outperform that of gray cement, which is projected to grow at an annual average of two percent. The popularity of the white building material, fueled by its diverse and specialized applications as well as a rising consumer purchasing power in developing economies, is laying the foundation for growth until 2022.

Raluca Cercel, Senior Consulting Analyst at CW Group, further illustrates the correlation between white cement consumption and buying power: "accounting for less than one percent of global cement demand, white cement is a premium product and priced accordingly. We anticipate white cement applications to continue to be in their majority of aesthetic nature and therefore contingent on disposable income."

Asia ex-China is forecasted to be the fastest-growing region in terms of white cement consumption. Within the region, India shows the strongest growth potential, with consumption projected to soar in the next five years. Mirroring the increasing trend in consumption, the Chinese booming construction sector and economy are also expected to contribute to a solid expansion in the white cement market, partly due to the sheer size of the Chinese market.

The worldwide white cement market today is somewhat shy of twenty million tons. The Mexican and American white cement markets showed strong growth over the past five years, expanding at an average annual rate of thirteen and eight percent, respectively. Considering the premium nature of the white-colored construction material, it is unsurprising that the surge in its consumption followed an increased consumer purchase power as well as a rebound in economic prospects in these two countries, respectively.

Masonry applications lead the way

At a global level, masonry applications, such as stucco, mortars, grouts, adhesives and flooring, account for 60 percent of white cement consumption. Other sectors, such as architectural precast and pool finishes, represent the balance. However, there are substantial geographic differences in the end-user demand profile. Not only do construction preferences dictate application needs, but also economic development.

As a relatively expensive building material product, large-scale applications in structural work, such as bridges and museums, limit such uses to developed markets. Looking forward, architectural precast will remain the main white cement segment in North America and Western Europe, while masonry will still account for most of the global white cement consumption.

Trade plays key role in global market

Out of the 130 white cement plants worldwide, over 50 percent are operated by the ten largest white cement producing groups. Capacity and production-wise, Cementir / Aalborg is the largest producer, followed by Cemex, LafargeHolcim, Cimsa, HeidelbergCement, JK Cement and RAK White Cement.

As opposed to ordinary Portland cement, white cement is not always consumed where it is produced. With its premium pricing and relative scarcity, white cement travels much farther than gray cement. In 2017, 93 percent of the total traded volume used seaborne routes.

Consequently, globally 28 percent of all white cement produced comes from a foreign country. Within the trade, United States absorbed 30 percent of the global imported volume in 2017. Most of the country's white cement imports come from Canada or Mexico. Turkey kept its place as the leading world white cement exporter in 2017, shipping 30 percent of its exports to the Middle East.

For more information, placing an order, or interview inquiries, please contact Liviu Dinu, Market Services & Marketing Consultant, CW Group, by phone at **+40 -744- 67- 44 , or e-mail at ld@cwgrp.com.**

About the Report

CW Research's Global White Cement Market and Trade Report (2017 update) examines the worldwide white cement industry and presents the latest market data which cover the 2007 – 2017 period, with a medium-term forecast until 2022. The comprehensive report includes cement consumption and production figures, import and export data, as well as pricing trends and white cement capacity developments. Additionally, this data-rich research product provides extensive quantitative information on consumption, usage segments, production, local prices, trade prices, type of handling, trading facilities and trade-flows, by region and major countries. Furthermore, the report analyzes region specific user segments by white cement type and their main consumption drivers as well as perspective for 2022.

More information about the report can be found here: http://www.cwgrp.com/research/research-products/product/200-Global-White-Cement-Market-and-Trade-Report-2017-update

Optimizing motion control software before the machine is commissioned

- New software version 5.1 for the high-end Simotion motion control system
- Simosim for simulating the user program in a virtual test environment – without connected hardware
- New elements for the object-oriented programming of modular machine concepts

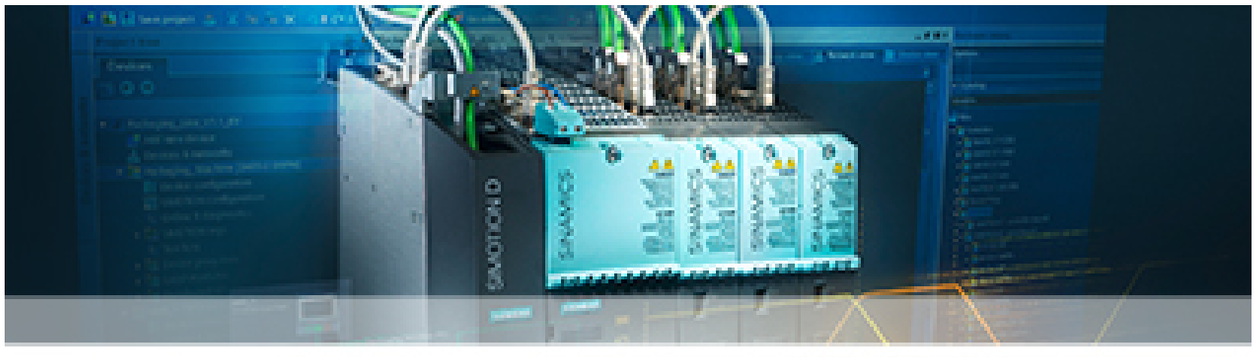
Siemens has released the new software version 5.1 for the high-end Simotion motion control system including a facility for simulating user programs. With the Simosim simulation integrated into the engineering, users can now test their software without connecting any hardware. Program parts are optimized at an early stage of the development phase, which shortens commissioning times later on. The functions of the object-oriented programming (OOP) have been expanded in software version 5.1 to make the creation of software more flexible. The new, highly modular Simotion software simplifies the implementation of motion control applications ahead of machine commissioning – in favor of a shorter time-to-market.

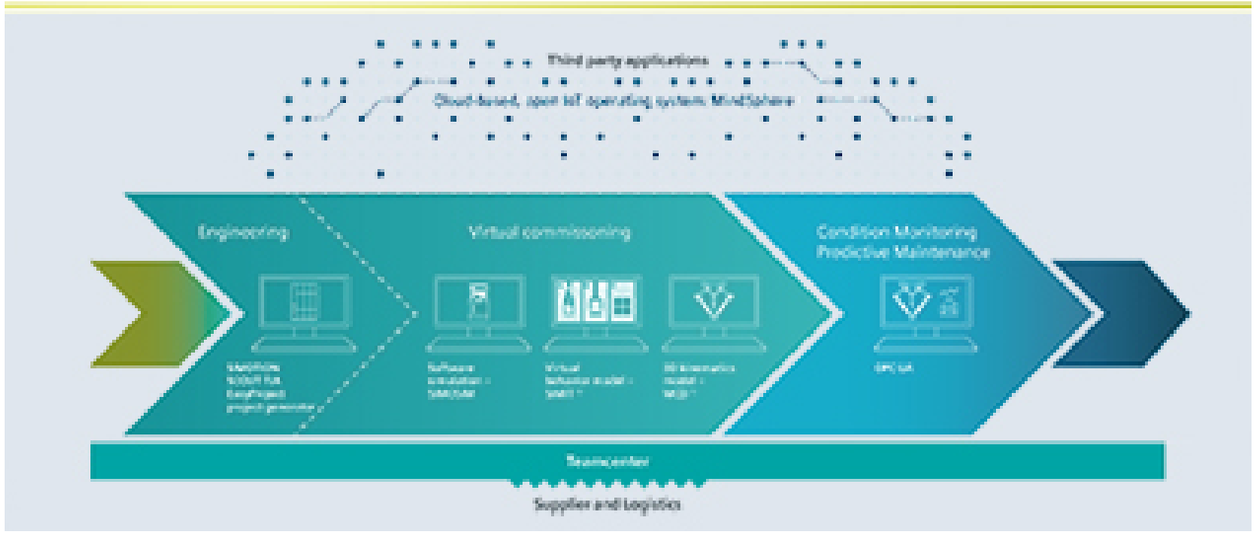
Simosim for simulation in the engineering enables online accesses and test functions to be executed just as if a real controller was connected. In addition to the debugging capabilities, such as the status program, breakpoints and traces, and including the complete web and OPC UA server functionality, even axes can be simulated. This considerably speeds up the start of production, as it reduces time-consuming troubleshooting and program adaptations on the actual machine. Simosim is also a key component in the end-to-end digital process chain, from the configuration to the cloud-based services.

In software version 5.1 for Simotion, Siemens has added OOPelements for the flexible, library-compatible software structuring of modular machine concepts: Mechanisms for the direct connection of I/O components in the program code or for grouping functionally associated software elements in libraries are now supported.

Siemens has released the new software version 5.1 for the high-end Simotion motion control system including a facility for simulating user programs. With the Simosim simulation integrated into the engineering, users can now test their software without connecting any hardware.

For further information, refer to:
www.siemens.com/simosim





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For more information please contact:
Mr. Mohammad Ahsan
Tel.: +44 203 141 0606
Email: mahsan@acieu.net

12th Global CemFuels Conference & Exhibition on alternative fuels for cement and lime 2018
Date : 20 - 21 February 2018
Venue: Berlin, Germany
For more information please visit:
cemfuels.com

1st Global Gypsupply
Date : 13 - 14 March 2018
Venue: Brussels, Belgium
For more information please visit:
gyp-supply.com

INTERCEM Dubai 2018
Date : 12 - 14 March 2018
Venue: Jumeirah Emirates Tower, Dubai, UAE
Email: info@intercem.co.uk
www.intercem.com

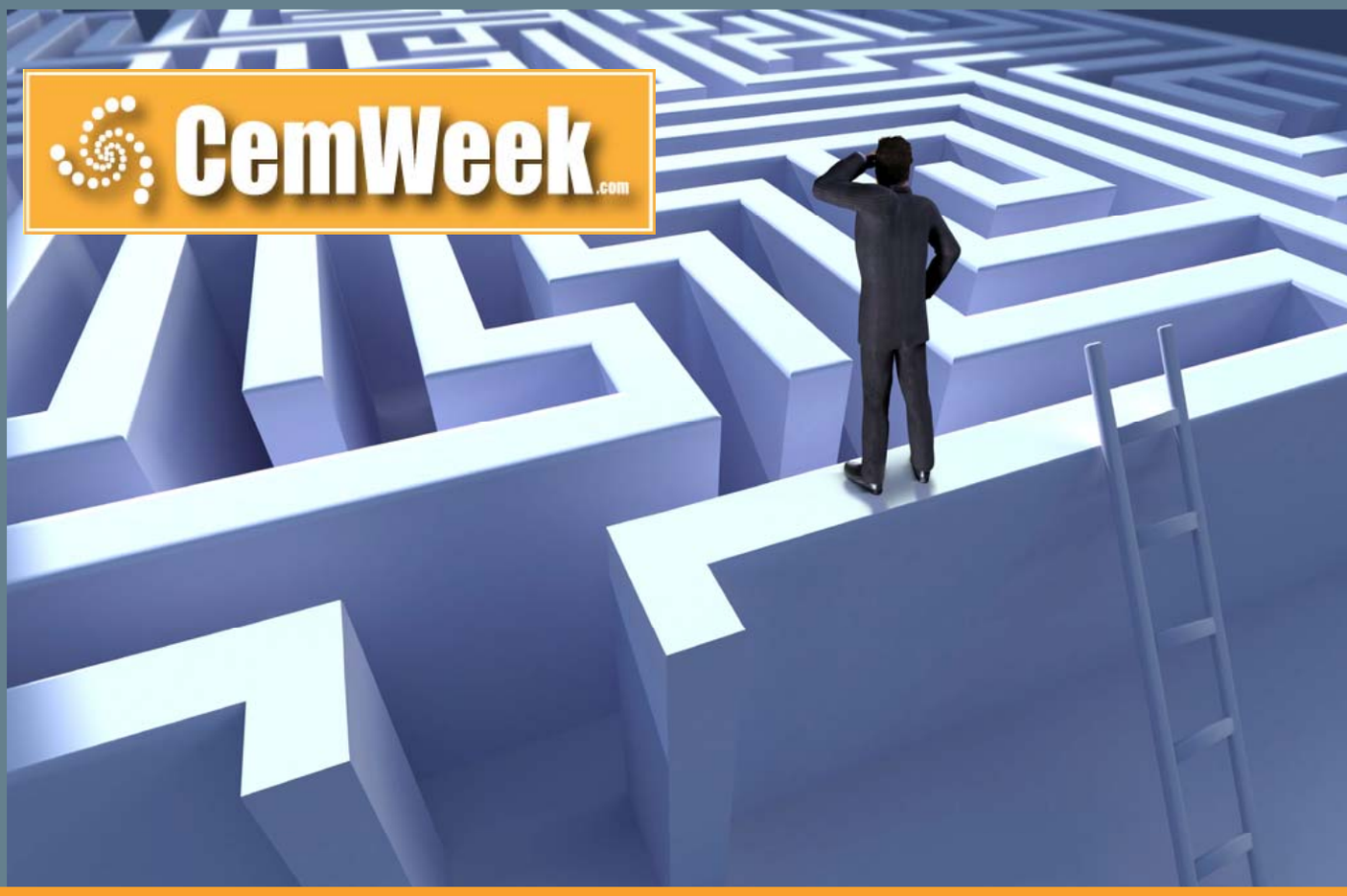
The 25th ASEAN Federation of Cement Manufactures (AFCM) Technical Symposium and Exhibition
Date : 04 - 06 April 2018
Venue: Trans Luxury Hotel, Bandung, Indonesia
For more information please contact:
Ms. Nurmala Sari
Indonesia Cement Association (ICA)
Tel.: +62 21 5705800 ext 555
Fax: +62 21 5705798
Mobile: +62815 1772 2465
Email: afcm2018@asi.or.id
http//: www.afcm2018indonesia.com

13th Global Slag
Date : 24 - 25 April 2018
Venue: Prague, Czech Republic
For more information please visit:
globalslag.com

2nd Global Cemprocess
Date : 23- 24 May 2018
Venue: London, UK
For more information please visit:
cemprocess.com

8th International VDZ Congress
Date : 26 - 28 September 2018
Venue: Maritim Hotel, Duesseldorf, Germany
For more information please contact:
Tel.: +49 211 4578 342
Email: info@vdz-congress.org
www.vdz-congress.org

15th International Congress on the Chemistry of Cement (ICCC 2019)
Date : 16 - 20 September 2019
Venue: Prague, Czech Republic
For more information please visit:
http://www.iccc2019.org



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DIARY DATES

DIARY DATES

GENERAL

2nd Annual Facilities Management
Date : 22 - 23 November 2017
Venue: Bangkok, Thailand
For more information please contact:
Trueventus
Mr. John Karras
Tel: +603 2775 0001
Email: johnk@trueventus.com

5th Global Geothermal Energy Summit
Date : 29 - 30 November 2017
Venue: Amsterdam, Holland
For more information please contact:
ACI EUROPE
Tel.: +48 616 467 022
Fax: +44 20 7593 0071
Email: rbaryah@acieu.co.uk

Cameroon Build Construction and Construction Materials Exhibition
Date : 30 November - 03 December 2017
Venue: Cameroon
For more information, please contact:
Ms. Burcu Uca / Sales Representative
Tel: +90 212 356 00 56 (Ext:1530)
Email: burcu.uca@expotim.com

India Energy Week 2017 (IEW 2017)
Date : 6 - 8 December 2017
Venue: New Delhi, India
For more details, please contact
Yuan Chang at yuanchang.yu@argusmedia.com

4th Arabiamold 2017
Date : 11 - 14 December 2017
Venue: Sharjah, UAE
Tel: +971 6 5770000
Fax: +971 6 5770111
Email: info@expo-centre.ae
For more information, please visit: www.arabiamold.com

SteelFab 2018
The Middle East premier trade show for the metal working, metal manufacturing and steel fabrication industry
Date : 15 - 18 January 2018
Venue: Expo Center Sharjah, UAE
E-mail: info@expo-centre.ae
For more information please visit: www.steelfabme.com

BlockChain
Date : 24 - 25 January 2018
Venue: Kuala Lumpur, Malaysia
For more information please contact:
Trueventus
Mr. John Karras
Tel: +603 2775 0001
Email: johnk@trueventus.com

Modern Method of Construction Conference
Date : 08 - 09 May 2018
Venue: Kuala Lumpur, Malaysia
Tel: +603- 2775 0067
Email: markw@willbeattending.com

4th Iraq Building Fair
Date : 10 - 13 May 2018
Venue: Baghdad, Iraq
Tel: +90 216 575 28 28
Email: info@pyramidsfair.com

12th fib International PhD Symposium in Civil Engineering
Date : 28 - 31 August 2018
Venue: Technical University, Prague, the Czech Republic
Tel: +90 216 575 28 28
Email: cbsbebton@cbsbeton.eu (Czech Concrete Society)
http//: http://www.phdsymp2018.eu.

8th International VDZ Congress 2018
Date : 26 - 28 September 2018
Venue: Duesseldorf, Germany
For more information, please visit:
www.vdz-congress.org.

Bauma China 2018
Date : 27 - 30 November 2018
Venue: Shanghai, China
For more information, please visit:
www.bauma-china.com

Bauma 2019
Date : 08 - 14 April 2019
Venue: Munich, Germany
For more information, please visit:
www.bauma.de

Global Cement & Gypsum Events 2018

For details, please visit each event's web site.

3rd global boards

22-23 January 2018,
London, UK
global-boards.com

The 3rd Global Boards Conference and Exhibition will take place in January 2018, looking at global market trends in cement-based boards, at advances in production technology and at how producers can add value to their products worldwide. In addition to equipping delegates with the latest information, news and developments, the networking opportunities will once again be excellent. ***If you are interested in cement-based boards, then you should attend!***

12th global cemfuels

20-21 February 2018,
Berlin, Germany
cemfuels.com

The popular Global CemFuels Conference and Exhibition will visit Berlin for the first time in 2018 and is expected to attract one of its largest-ever audiences from around the world. The event will showcase the state-of-the-art in handling, processing and firing all types of conventional and alternative fuels for cement (and lime) production. ***If you produce or use fuels and alternative fuels in the cement and lime industry, then you should attend!***

1st global gypsupply

13-14 March 2018,
Brussels, Belgium
gyp-supply.com

The inaugural Global Gypsupply Conference and Exhibition will look at the different supply sources of gypsum worldwide, including natural gypsum, synthetic gypsum and recycled gypsum, will examine transport and shipping options, and will match up miners, syngyp producers and recyclers with buyers and users of gypsum including cement producers, wallboard and plaster manufacturers, and agricultural users. ***If you use gypsum in your process, then you should attend!***

13th global slag

24-25 April 2018,
Prague, Czechia
globalslag.com

The 13th Global Slag Conference and Exhibition will take place in Prague, in the heart of Europe and central to many iron-, steel- and slag-producing areas. Slag producers and users are expected to attend from throughout Europe and from the rest of the world: Slag products have the potential to be profitable for both the iron and steel industry and also for the cement, concrete and construction products industries. ***If your business is in slag, then you should attend!***

2nd global cemprocess

23-24 May 2018,
London ,UK
cemprocess.com

The second Global CemProcess Conference and Exhibition on process optimisation, de-bottlenecking, production maximisation and troubleshooting in the cement industry will once again take place in London, including a confirmed full-day field trip to the Hope cement plant in Derbyshire, and a stunning Conference Dinner at a local stately home. ***If you would like to maximise cement production while decreasing costs, then you should attend!***