Siam City Cement Public Co Ltd modernised the raw meal grinding section at one of its Saraburi plants, leading to lower production costs

Saraburi's smart grinding

Siam City Cement Public Co Ltd (SCCC) has upgraded the raw material grinding unit at its Saraburi plant, Thailand, with a comflex® system, engineered and supplied by KHD. The project has enabled the cement producer to reduce its power consumption and improve the flexibility of its grinding operations.

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With a total clinker capacity of 13.5Mta, Siam City Cement Public Co Ltd (SCCC) is the second-largest cement producer in Thailand. Located approximately 135km northeast of Bangkok, its Saraburi site includes three independent cement plants. Each facility consists of two production lines with the following capacities:

- Plant 1: 4500 and 3500tpd
- Plant 2: 6100 and 5500tpd
- Plant 3: 10,000tpd x 2.

Plant 1 raw grinding modernisation

To operate more economically and to reduce electrical energy costs, SCCC has modernised the raw material grinding unit of the 4500tpd Line 1 at Saraburi's Plant 1 with a COMFLEX® grinding circuit by KHD Humboldt Wedag of Germany.

The basis for the project was an engineering and procurement (EP) contract. KHD also supervised the erection and commissioning of the new raw material roller press grinding circuit.

Thanks to KHD's engineering and equipment supply, SCCC is now able to produce sufficient raw meal with one roller press grinding circuit in finish mode instead of two ball mill circuits. At the same time, the cement producer is able to significantly reduce its energy consumption per tonne of ground raw meal. Furthermore, SCCC now runs a more flexible raw material grinding system.

Equipment description

KHD provided a new energy-efficient 350tph COMFLEX grinding circuit in finish mode to replace the line's existing two ball mill circuits. KHD's COMFLEX grinding units are always engineered around a roller press as core grinding mill in close circuit with static and dynamic separators.

Figure 1 and the equipment overview in Table 1 outline the new raw material grinding circuit in finish mode and the equipment chosen by SCCC and KHD.

The grinding unit for SCCC uses two static separators to minimise the energy consumption for the separation, as well as the energy demand of the system fan.

The fresh feed enters the grinding circuit through the VS 620 static separator. Here, the material is deagglomerated, dried and separated so that the coarse material is lifted mechanically back to the roller press via a bucket elevator and the finer particles are lifted pneumatically to the LS8600 static separator, which has adjustable guide blades to control the product fines.

Figure 1: Siam City Cement Public Co's modernised raw meal grinding system at Line 1 of Plant 1 at the Saraburi cement complex in Thailand

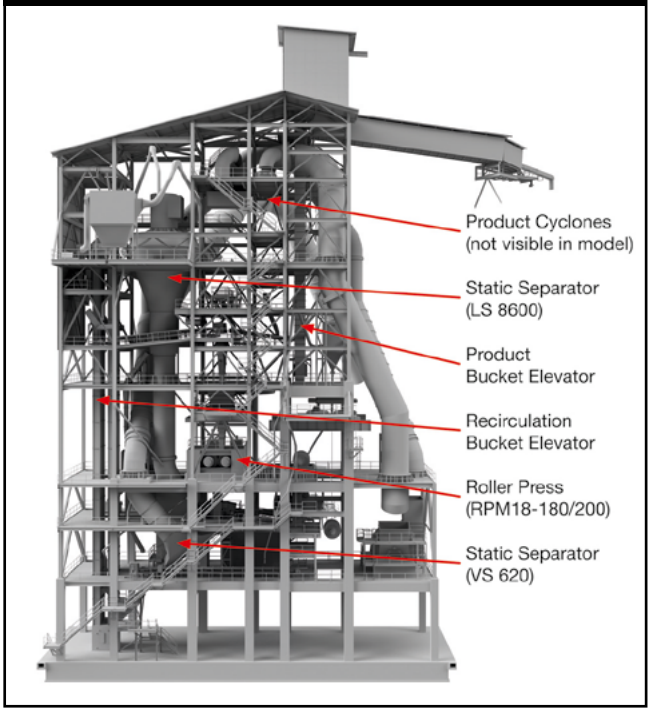

Table 1: proprietary equipment for the new raw material grinding circuit

Equipment	Type	Dimensions (mm)	Motor power (kW)
Roller press	RPM18-200/180	ϕ1800 x 2000	3700 (2 x 1850)
Static separator – coarse	VS 620	6000 x 2000	-
Static separator - fine	LS 8600	ϕ8600	-
Product collection	4 cyclones	ϕ3800	-
System fan	HKSK 236/346	ϕ2360/ϕ3460	1500
Bucket elevator	ZKBW 2200 x 451000	2200 x 45,100 CTC	400 (2 x 200)

Table 2: summary of performance guarantee test results of SCCC's Line 1 raw material grinding plant			
Parameter	**Guaranteed contract values**	**Performance guarantee test**	**Theoretical performance based on contract values**
Grindability (kWh/t)	15.00	15.86	15.00
Raw meal production (tph)	350	351	380
Product fineness (%R on 90µm)	15.00	14.06	15.00
Specific power consumption – at meters for equipment within battery limits (kWh/t raw meal)	13.30*	13.36*	12.30*
* roller press drives, system fan, recirculation bucket elevator drive, product bucket elevator drive			

The chosen layout aims for the lowest possible load on the circuit's bucket elevator, again to keep the energy consumption of the whole circuit as low as possible. After passing through the second static separator, the raw meal is collected in four cyclones, each with a 3.8m diameter.

Project completion and testing

The complete grinding circuit at SCCC was erected as a brownfield project in under nine months. The grinding circuit performance was measured during an uninterrupted 72h performance guarantee test. The new equipment achieved the performance values as agreed and guaranteed in the contract. The detailed results can be found in Table 2.

The grinding performance (grindability) is usually evaluated through a physical material analysis. Specifically tested is how much power (measured in kWh/t) is required to crack or grind the raw material. The grindability is measured once before contract signing, to get an evaluation for the available raw material. Based on this measurement the circuit layout and equipment are designed.

The initial grindability test for SCCC resulted in a value of 15.00kWh/t, which is within the normal range for raw material. The second test, conducted after installation and commissioning in the KHD test centre, resulted in a value of 15.86kWh/t. This means that the raw material is approximately six per cent harder to grind when compared with the assumed value in the project initiation phase.

Taking this into consideration, and the fact that KHD was able to achieve the agreed performance of 350tph with the harder raw material, the roller press circuit designed for SCCC would actually be able to produce above 370tph with the initially-tested raw material. When also taking into account the achieved product fineness of 14.06 per cent residues on 90µm (in contrast to the agreed 15.00 per cent residues), the previously-mentioned possible performance becomes even better. In total, with the preconditions that were agreed in the contract (residues of 15 per cent at 90µm and a grindability of 15.00kWh/t), the KHD COMFLEX circuit for SCCC would actually be able to produce more than 380tph at a specific power consumption of just 12.30kWh/t.

Production, electrical energy demand and overall cost

For SCCC the primary target for its investment was to reduce the energy demand when grinding raw material. This goal was fully achieved as the

KHD supplied VS 620 and LS 8600 separators for coarse and fine particle separation, respectively

A RP-M 18-200/180 roller press is the core of the raw grinding system

new grinding unit is now significantly more energy efficient. When comparing the same equipment in both systems (main grinding equipment, system fan and recirculation bucket elevator), the former ball mill circuits had a power consumption of 21.7kWh/t of raw meal. The new roller press circuit reduces this electricity consumption to 13.14kWh/t. This is a considerable reduction of more than 8.5kWh/t, which corresponds to energy savings of close to 40 per cent. When converting that into tangible cost, the new raw meal unit from KHD achieves savings of €1.5m annually. These numbers underline the fast return on investment of this project for SCCC.

Table 3 compares the production performance and energy demand of both systems – KHD COMFLEX with roller press in finish mode and the former ball mill circuits – in different states and gives a clear overview of the saving potential which was achieved through the modernisation.

Comparing the new circuit and its performance with a common alternative technology in the market, a vertical roller mill system (VRM), the KHD roller press circuit needs approximately 3-4kWh/t less power. To achieve the same results in terms of throughput, grindability and product fineness at given feed moisture, the VRM circuit needs a much bigger fan drive to achieve the same performance. Moreover, VRM-based grinding circuits also need constant water injection for grinding bed stabilisation. This is another positive energy-related evaluation for roller press-based systems.

Looking back on the overall project and the decision to award KHD the modernisation project, SCCC is absolutely satisfied with the outcome. The project went well, the equipment runs smoothly and Plant 1 is now able to produce sufficient raw meal with considerably less energy. Most importantly, SCCC has now reduced its specific production cost considerably. ■

The team at Saraburi Plant 1 is now able to produce sufficient raw material with a considerably-reduced energy requirement

Table 3: comparison of ball mill circuits to roller press circuit

Parameter	Single/double ball mill circuits (values from zero test)	Roller press (main equipment without product bucket elevator values from PGT)	Single/double ball mill circuits (zero test and roller press PGT values adapted to same fineness)	Roller press (main equipment without product bucket elevator)
Raw meal production (tph)	172/344	351	183/166	351
Product fineness (%R on 90µm)	11.80	14.06	14.06	14.06
Specific power consumption – at meters for equipment within battery limits (kWh/t raw meal)	21.70*	13.14*	20.30*	13.14*
Energy saving roller press circuit compared to ball mill circuits (%)	39		35	

*grinding equipment drives, system fan, recirculation bucket elevator drive