Società Impianti Calce S.r.l

SIC project at Egypt's Beshay Steel

The Beshay Steel Company is one of the primary steel producers in Egypt, with the domestic market share of 25%. In spite of the difficult social and political environment in country, Beshay Steel has completed the construction of one of the most ambitious iron and steel projects Egypt has ever seen. Italy's Società Impianti Calce S.r.l previously installed a lime kiln for Beshay in 2003-2005. Beshay Steel once again contracted SIC to provide captive lime capacity.

Above: The shaft of Beshay Steel's new DSR 500t/day lime kiln, supplied by SIC as part of a major steel plant upgrade.

Considering the performance achieved and the reliability provided by the first lime kiln that SIC provided to Beshay Steel, SIC was chosen as a supplier for the lime section for the second phase of the steel plant's enlargement. The first kiln, a 300t/day DSR lime kiln, has so far worked unceasingly for more than five years, without requiring significant maintenance.

Right: Expected and actual operating parameters for 300t/day DSR SIC lime kiln that was installed for Egypt's Beshay Steel in 2003-2005.

	Expected	Achieved
Max lime production (t/day)	300	315
Limestone size (mm)	40-80	40-80
Calorific consumption (kcal/kg)	<850	840
Power consumption (kiln) (kWh/t)	<35	32
Loss on ignition (%)	<2	1.5
Dust emission (mg/Nm^3)	<20	13
Reactivity (T_{60})	<1′	45″

Right: Expected operating parameters for 500t/day DSR SIC lime kiln installed as part of Beshay Steel's expansion project when fed with different sizes of limestone.

	40-80mm	25-50mm
Max lime production (t/day)	500	400
Calorific consumption (kcal/kg)	<850	<850
Power consumption (kiln) (kWh/t)	<35	<35
Loss on ignition (%)	<2	<2
Dust emission (mg/Nm^3)	<20	<20
Reactivity (T_{60})	<1′	<1′

The new kiln constructed by SIC for Beshay Steel, with its capacity of 500t/day of lime, represents probably the biggest single production unit constructed to date in Egypt.

Among the various technological options that SIC is able to offer to its clients, the option that was chosen for the steel plant expansion was a regenerative DSR 500t/day kiln - double-shaft, round section and peripheral channel for heat distribution. Each one has a cross-section of 12.6m^2 and natural gas combustion. Much technical experience, which was applied with success in the first kiln constructed for Beshay Steel has also been used for the new kiln.

The feeding of the new kiln is projected to be carried out both with limestone and dolomite or with a mixture of the two minerals, as is already carried out with success in the older DSR 300 at the plant.

The kiln will be fed with 40-80mm limestone and dolomite. However, the possibility of feeding the kiln with smaller (25–50m) material has been foreseen. In this case the expected capacity will be limited to 400t/day of lime.

Main considerations

The main problems that had to be taken into careful consideration during the project development phase, were: **1.** The heterogeneity of the material fed into the kiln, i.e.: the two different decarbonation temperatures for limestone and dolomite, and; **2.** The significant shaft cross-sections, which have diameters over 4m.

Right: The DSR 300t/day SIC lime kiln has operated at Beshay Steel's site in Egypt for five years without the need for major refurbishment and with a minimum of downtime.

The choice of regenerative double-shaft, round section DSR kiln is justified for this project because this shape of kiln, with a peripheral channel of the shaft, allows an homogeneous distribution of the heat all over the kiln section, avoiding heat concentration.

Besides avoiding the creation of points of overheating, the intake of heat that flows from the shaft in combustion phase to the shaft in heat regeneration phase (carried out in several points along the entire circumference of the kiln) also allows the minimum distance between the burners and the centre of the shaft's section in regeneration.

The homogeneous distribution of heat is a very important factor in this project because, in addition to the large kiln cross-section, the limestone and dolomite have to be decarbonated at the same time. Care must be taken not to over-burn the dolomite, which decarbonates at a lower temperature than limestone. This results in a less reactive dolomite, which in turn compromises steel quality.

Using the structural characteristics of the refractory bricks that are already used in the first kiln, some improvements have been made to the channel fluid dynamic profiles with the aim to minimise dust deposits and to improve the material flow towards the discharge, particularly when the kiln will be fed with material of smaller sizes.

Below: The DSR 500t/day SIC lime kiln being built by SIC at Beshay Steel's plant in Egypt.

Turntable feeder

In kilns with large shaft cross-sections the matter of size segregation of the materials fed into the kiln becomes very important. During the material handling phase it is possible for material to become unintentionally classified by size. If allowed to propogate into the kiln itself, this can cause uneven heat distribution because of different effective densities in different areas of the kiln. Because of this it has been decided that a turntable charging device should be used in the new kiln. This piece of equipment was already tested with success in the first kiln and guarantees a uniform feed.

The charging device is equipped with a round hopper, rotating with respect to its vertical axle and which receives, during rotation, the material feeding the kiln, weighed and dosed in the required quantity for a combustion cycle. The hopper rotating phase additionally mixes the limestone before its inlet into the kiln.

The kiln discharge has also received some important modifications to allow the amount of lime from different transversal sections of the kiln to be changed. This homogenises the lime and compensates for any eventual difference of material sliding speed inside the shaft.

Control

With regards to the supervision and control of the plant, SIC worked to two guidelines:

1. To make the day-to-day operation of the control programme as user-friendly as possible. This includes allowing all of the parts of the plant to be visible at once, without having to browse pages and making user-friendly graphics and calculation sheets available at the same time.

2. The supervision and control software has been realised using one of the best development programmes on the market that allows the plant's management team to autonomously implement the supervision system based on any new requirements of the plant, whenever required.