Engineering progress

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To help meet India's rising long-term cement demand, Reliance Cement Co Pvt Ltd is building its first integrated cement works in Madhya Pradesh as well as a 2.2Mta grinding facility in Uttar Pradesh. The cement producer called in the help of Holtec Consulting Pvt Ltd to contribute its engineering experience to the twin projects.

Reliance Cement installed its first integrated cement plant in Mahiar, Madhya Pradesh. The works has a cement capacity of 2.8Mta

With a per capita consumption of around 190kg, substantially lower than the world average, India's long-term cement demand is expected to rise. As the country develops its infrastructure and industrial activity on the back of economic growth, production is expected to climb to around 550Mt by FY20. To meet this higher demand, the country's current capacity of 365Mta will need to be expanded and new projects are emerging.

Reliance plant projects

Reliance Cement Co Pvt Ltd, part of the US$17bn Reliance Group, decided to install its first integrated cement unit with a 10,000tpd clinker capacity and a 2.8Mta cement capacity in Mahiar, Madhya Pradesh, along with a 2.2Mta grinding unit in Kundaganj, Uttar Pradesh.

The integrated works can produce ordinary Portland cement (OPC) and Portland pozzolana cement (PPC). The power demand for the project is about 49MVA, supplied from the state grid. A waste heat recovery (WHR) system is planned at the plant to utilise excess energy.

Holtec's role

Since the conception of the new cement works in March 2009, Holtec Consulting Pvt Ltd has been part of the project and its scope of services supplied have included:

- preparation of the techno-economic feasibility report for project financing
- assistance in statutory clearances for the plant
- procurement engineering and assistance in ordering for plant machinery and services
- project engineering services
- civil engineering services
- procurement assistance for the installation of a WHR system

The project in figures

The scale of the project can be gleaned from the tentative quantities of key materials needed to carry out the work required.

• Concrete:	142,000m³
• Reinforcement:	19,200t
• Structural steel:	19,000t
• Mechanical fabrication:	5500t
• Mechanical erection:	25,000t
• Refractory:	7000t
• Insulation:	60,000m²
• HT motors (>450kW)	26
• HT cable length	53km
• LT cable length	638km
• Control cable length	446km
• Instrumentation cable	106km

Table 1: main equipment supply

Equipment	*Supplier*
Raw grinding	ThyssenKrupp Industries India (TKII)
Pyroprocessing and clinker storage	TKIL
Coal grinding	FLSmidth
Clinker grinding	Loesche
Crushing systems	TKIL
Stacker reclaimer	NHI
Wagon tippler	Metso
Cement silo, packing and dispatch	FLS Ventomatic
Overland belt conveyor	FLSmidth
Fabrication erection	Hajee AP Bawa
Civil contract	Petron
HT motors	IJIN
E&I system	FLS Automation
Lab automation	ITECA

- procurement assistance and project engineering of the various systems for integration of railway siding with cement plant
- site supervision services.

Project activities

After receiving the mining licence, other statutory compliance and the techno-economic feasibility report – essential in arranging project funding, the main pre-project activities such as topographic survey, geo-technical investigation, basic plant sizing, tendering, ordering of main machinery and civil contractor, setting up of basic site infrastructure were planned and carried out.

Before the start of work on each building, site activities were planned in terms of resources required and volume of work to be carried out. This plan was monitored and updated regularly, enabling timely troubleshooting to meet the targets.

During the topographic survey and geo-technical investigation due care was taken to ensure site accessibility, locating the grid mark and bench marking, land rights and standing crops/trees. These data enabled accurate planning of the plant layout and formed the basis of the works' civil design and construction.

The technical concept for the project was formulated jointly between Reliance

and Holtec. After the basic engineering for major equipment sizing was carried out, the project was initiated with the issue of the five-part tender document, which detailed the requirements for:

- crushing system
- stacker and reclaimer
- grinding systems
- pyroprocessing and clinker storage
- cement storage, packing and dispatch.

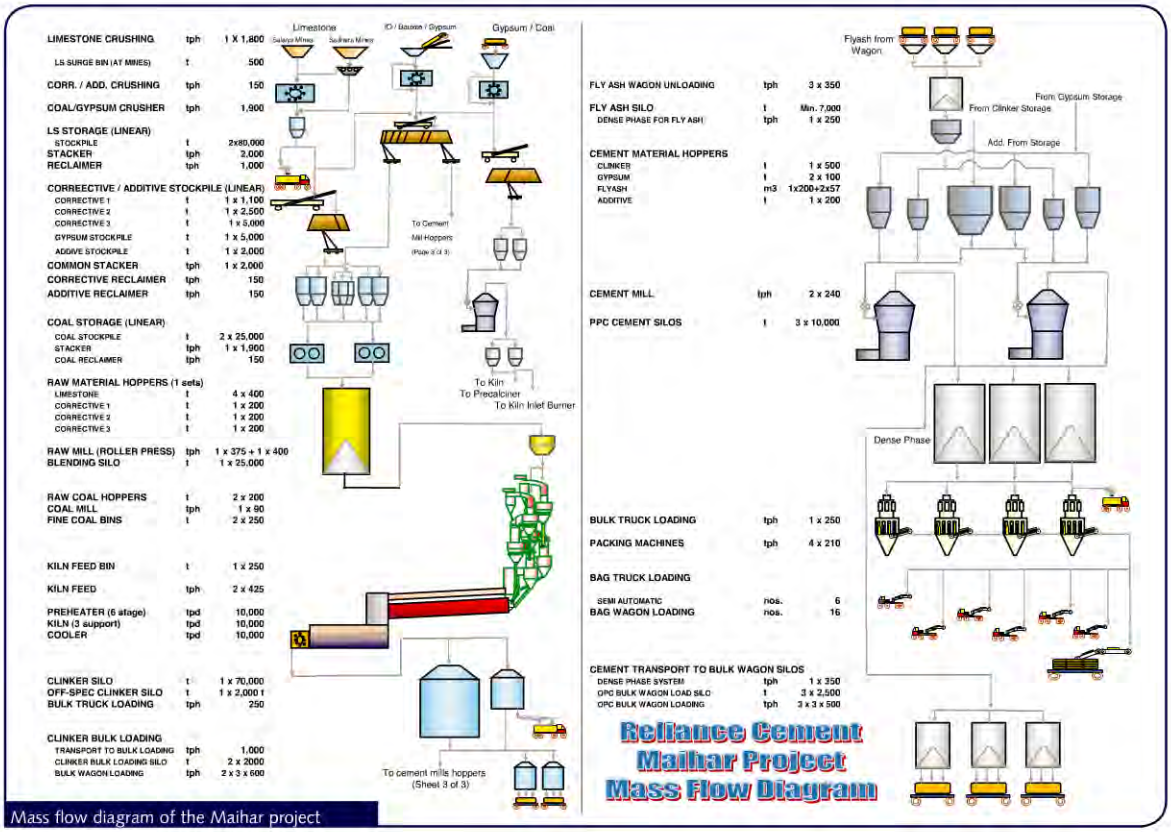
Enquiries for other, auxiliary equipment were made separately (see Table 1).

The ordering of the works' key equipment was the first step for the start of other project activities as well as tendering and ordering of the project's civil contractor. For civil works, tender requirements were floated with estimated bill of quantities (BOQ) based on the type of main machinery and plant structures required, design mix, topography and geo-technical investigation. The finalisation of the optimum design mix for construction activities is very critical as it affects the consumption of cement to a large extent. Hence these were also planned along with BOQ estimation.

The basic site infrastructure facilities such as site organisation, approach road,

Table 2: main equipment sizing and suppliers

Package/equipment	*Specifications*	*Supplier*
Limestone crushing system (tph)	1800	TKIL
Overland belt conveyor (tph) (from mines to plant)	1800	FLSmidth
Limestone stacker/reclaimer (tph)	2000/1000	NHI
Box feeder for corrective unloading (m^3)	35	Schenck Redler (Through TKIL)
Corrective/additive crusher (tph)	150	TKIL
Corrective/additive stacker (tph)	2000	NHI
Corrective/additive reclaimer (tph)	2 x 150	NHI
Wagon tippler – Rotaside (tips/h)	25	Metso
Coal/gypsum crusher (tph)	1900	TKIL
Coal stacker/reclaimer (tph)	1900 / 150	NHI
Coal mill (tph)	90	FLS
Raw mill (tph)	375 and 400	TKIL
Pyroprocessing (tpd)	10,000	TKIL
Clinker grinding (tph)	2 x 240 (PPC)	Loesche
Packing plant (tph)	4 x 210	FLS Ventomatic
Truck loaders (Nos)	6	FLS Ventomatic
Wagon loaders (Nos)	16	FLS Ventomatic
Cement bulk truck loading (tph)	250	FLS Ventomatic
Cement bulk wagon loading (tph)	3 x 3 x 500	FLS Ventomatic
Off-spec clinker bulk truck loading (tph)	250	TKIL
Clinker bulk wagon loading (tph)	2 x 3 x 600	FLS Ventomatic
Fly ash wagon unloading (tph)	3 x 350	FLS Ventomatic



Mass flow diagram of the Maihar project

Table 3: storage sizing and suppliers

Description	*Sizing (t)*	*Sizing (m)*
Limestone stockpile – linear with bridge reclaimer	2 x 80,000	
Corrective/additive stockpile – linear	1100 + 2500 + 5000	
Coal stockpile – linear with bridge reclaimer	2 x 25,000	
Blending silo	25,000	ϕ24 x 69.5
Clinker silo	70,000	ϕ56 x 40.25
Off-spec clinker silo	2000	ϕ10 x 35.6
Clinker bulk wagon loading silo	2 x 2000	ϕ10 x 35
Cement silo	3 x 10,000	ϕ18 x 50
Fly ash silo	7000	ϕ18 x 50
Cement bulk wagon loading silo	3 x 2500	ϕ10 x 40

site office, fencing and security, temporary storage and procurement of construction materials were planned before the main plant construction activities start.

A further important project requirement is engineering. Based on the orders for the main and auxiliary equipment, the data received from various suppliers were collated to finalise the general arrangement drawings and layout. The mechanical and electrical arrangement drawings with proper load data and fixing details formed the basis for the start of the civil design of the plant's buildings and structures.

Before the start of work on each building, site activities were planned in terms of resources required and volume of work to be carried out. This plan was monitored and updated regularly, enabling timely troubleshooting to meet targets.

Key project data

Important equipment highlights include:

- The limestone crusher is connected to the main plant by a 7km overland belt conveyor.
- A box feeder with truck tippler is used for receiving correctives and additives.
- A 1900tph reversible hammer mill is installed for coal crushing.
- The raw grinding system is a POLYCOM 20/12-8 roll press with a 375/400tph capacity in finish mode.
- Coal grinding is carried out by a 90tph ATOX 32.5 vertical roller mill.
- Pyroprocessing occurs in a ϕ6.2/5.8m x 88m kiln and a 13/4.0-0.25 POLYTRACK cooler.
- A clinker bulk wagon loading system that loads two wagons simultaneously is installed.
- The project includes the planning for fly ash and OPC bulk wagon loading systems.
- A 132kV gas-insulated switchyard (GIS) is installed for the first time in a cement plant in India. Benefits include high reliability, low losses, maintenance and spare part requirements.
- A process controller unit with 10 Siemens process controllers and comprising around 15,000 I/Os is included.
- A power distribution system consisting of 11 HT switchboards, eight LT switchboards and 29 numbers MCCs is installed.
- Quality control at the plant will be carried out by a Robo lab and a pneumatic sample conveying system is installed for quality control.

The sizing and suppliers of the project's main equipment and major storage facilities are outlined in Table 2 and Table 3, respectively.

The Reliance Cement project was the sixth 10,000tpd cement works in India for which Holtec Consulting has provided engineering and consultancy services

Learnings

For the construction of the main plant buildings, civil works will be shared equally (in terms of work load and contract value) between at least two contractors if the reinforced concrete volume exceeds 75,000m^3. For simple buildings such as electrical and non-plant structures and boundary walls, a further, less expensive contractor will be hired.

Conveyor gallery supports, cable gallery, electrical buildings, boundary walls will, where possible, be precast and standardised.

In addition, the preheater lift should be in working condition before plant commissioning and part of the fabrication work will be outsourced away from the site after identification.

Start-up

Clinker production at the plant started early 2014 after a two-year project execution period.

For Holtec Consulting, the Reliance project was its sixth 10,000tpd project to be commissioned in India and the eighth in the world for which it has delivered complete engineering services. A further three have since been commissioned.