



COROMANDEL CEMENTS LIMITED

Improved Drying of Coal through Insulation and Additional Hot Air Duct from the Coal Mill Furnace

SUMMARY OF THE OPTION

Coromandel Cements Ltd, a small cement manufacturing plant in South India made provision for additional hot air duct from coal furnace to the bottom of coal mill table feeder and the insulation of bare hot air duct. The unit plans to modify and expand their plant system and equipment capacities gradually in two phases. The first phase modification plans includes installation of Gas Conditioning Tower and Electro Static Precipitator, which would result in reduced power consumption. In the second phase, modification of Precalculator, Grate cooler, Cyclones and Cement mills would take the plant capacity up to 900 TPD. It was observed that grinding efficiency reduces with the increase in wetness thus affecting the flow of the coal. In addition, the coal mill performance is affected due to ingress of cold air. Options to resolve included the provision of additional hot flue gas duct to help dry coal while falling from the table feeder into the mill. It also helps create a higher pressure zone, as well as in reducing the opening at the table feeder, both of which help to minimize cold false air ingress into the coal mill, resulting in reduced fuel consumption in the kiln. Besides the above, the hot gas duct from the furnace to the coal mill was insulated by sheets of mineral wool leading to better coal furnace operation and reduction in furnace fuel consumption. This measure has resulted in 214×10^9 k Cal/year savings equivalent to 48 tons of coal annually worth Rs. 95,368 (US\$ 2,218). The entire modification was engineered with in-house resources and capabilities with no additional investment.

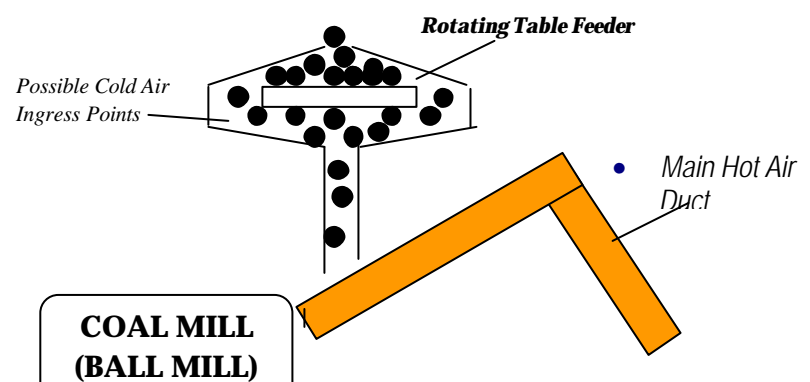
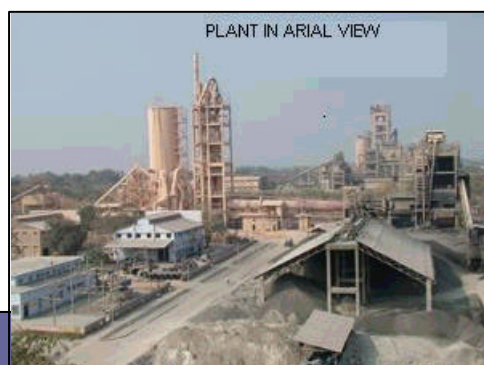
KEY WORDS

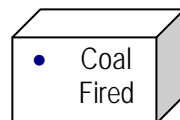
India, Cement, Furnaces and refractories, Coal mill, Insulation

OBSERVATIONS

Hot combustion air from the coal-fired furnace was supplied to the coal mill for drying the coal prior to grinding, which resulted in severe problem with the flow of the coal due to the wetness, especially during the rainy season. The coal mill performance was affected due to the cold air ingress occurring from the openings near the table feeder into the coal feed chute. The following observations were made:

- High Heat loss from bare duct carrying hot gases
- Frequent choking of coal mill inlet at table feeder due to wetness
- Cold air ingress into the coal mill through large gaps.

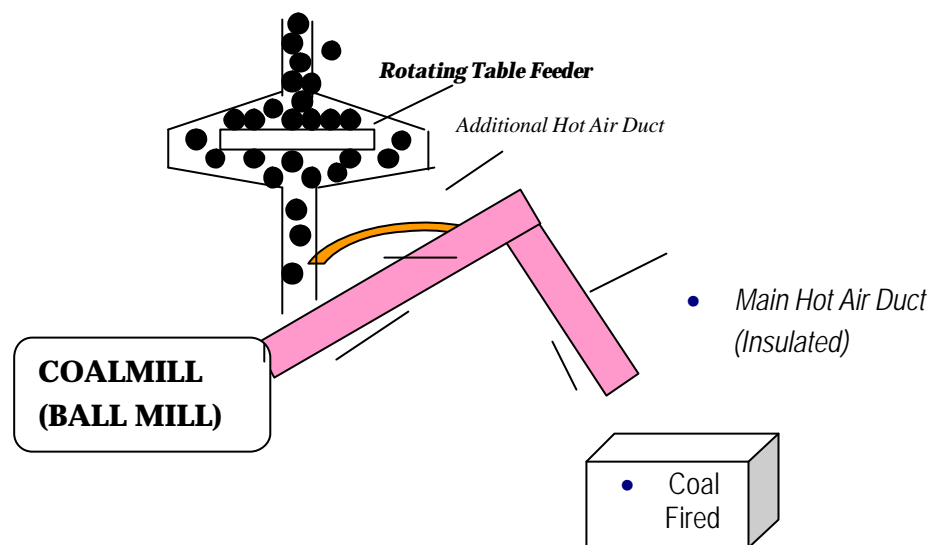




OPTIONS

Three options were implemented:

- Provision of additional hot flue gas duct from the coal fired furnace to dry coal while falling on to the table feeder
- Reduction of the openings to minimize cold ingress air into the coal mill has resulted in reduced fuel consumption in the kiln
- The hot gas duct from the furnace to the coal mill was insulated leading to better coal furnace operation and reduction in furnace fuel consumption



RESULTS

Total savings due to provision of additional hot air duct (option 1) and main duct insulation (option 2)

- Investment: none
- Annual coal savings: 47.684 tons of coal
- Annual cost savings: US\$ 2,218 (Rs.95,368)
- Annual GHG reduction: 73 tons of CO₂
- Payback period: Immediate

Option 1. PROVISION OF ADDITIONAL HOT AIR DUCT

Implementing the above options with Coal throughput at 7 Tons/hr and with the provision of the additional Hot Air Duct resulted in moisture percentage reduction by 0.2%, with total moisture reduction (7 Tons Coal/hr X (0.2/100)) at 14 kg/hr thus resulting in thermal energy saving (avoiding heat drawn from kiln for coal drying (14 kg/hr X 620 kCal/kg)) of 8680 k Cal/hr.

Financial benefits

- Investment: Nil
- Annual cost savings: Rs.15,400 (US\$ 358 @ Rs.43/ US\$)
(7.7 tons X Rs.2000/Ton of Coal)



Environmental benefits

- Annual energy savings at end use: 34.72 X 10⁶ kCal (= 4000 hrs/yr X 8680 kCal/hr)
- Annual coal savings: 7.7 tons (= 34.72 X 10⁶/4500 kCal/kg)
- Annual GHG reduction: 12 tons of CO₂, (= 7.7 tons X 1.53 kg CO₂/kg Coal)

Other benefits

Better reliability of coal mill output

Better heat release in the kiln due to moisture reduction in coal.

Option 2: INSULATION OF HOT AIR DUCT

The various parameters involved with the insulation of Hot Air Duct before and after the options used are given the following table:

Rationale:

Radiation loss (kCal/hr) = $(4.88 \times 10^{-8} \times (T_{\text{surface}}^4 - T_{\text{ambient}}^4) \times \text{surface area})$
Convection loss (kCal/hr) = $(80.33 \times ((T_{\text{surface}}^4 - T_{\text{ambient}}^4) / 2) \times (T_{\text{surface}} - T_{\text{ambient}})^{1.32} \times \text{surface area})$
Area in m²
Temperatures in deg. K

PARAMETER	BEFORE CPEE	AFTER CPEE
Clinker Production rate	440 tons/day	450 tons/day
Exposed surface area of hot duct (from furnace top to coal mill inlet)	21.03 m ²	23.81 m ²
Average exposed bare surface temperature	219 ⁰ C	123 ⁰ C
Ambient Temperature	30 ⁰ C	30 ⁰ C
Radiation loss	1.37 kCal/kg Clinker	0.50 kCal/kg Clinker
Convection loss	0.63 kCal/kg Clinker	0.31 kCal/kg Clinker
Total loss (Radiation + Convection)	2 kCal/kg Clinker	0.81 kCal/kg Clinker

Financial benefits

- Annual cost savings : Rs. 79,968 (US\$ 1,860 @Rs.43/ US \$)
(40 tons of Coal *Rs.2000/ton of Coal)

Environmental benefits

- Annual heat loss reduction: 179928 X 10³ kCal/yr (= 1.19 kCal/kg cl X 450 T cl/d X 1000 X 336 d/yr)
- Annual coal savings (@4500 kCal/kg): 39.984 tons
- Annual GHG reduction: 61 tons of CO₂ (= 40 Tons of Coal X 1.53 kg CO₂/kg Coal)
- Reduction of exposed surface temperature: 96⁰C
- Reduction of total heat loss: 1.19 kCal/kg clinker - 0.81 kcal/kg clinker)

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Disclaimer:

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