



LIME MASTER LIMITED

Installation of Bag Filters to Recover Lime Powder from Storage Silos and Reduce Dust Emissions

SUMMARY OF THE OPTION

Lime Master Co Ltd is located in Saraburi, Thailand and produces 99,000 tons of lime per year. There often is a dusty atmosphere at the plant and surrounding areas due to the dispersion of lime powder from loading and unloading of storage silos, and this contributed to an unfavorable opinion by the community of the plant. Excessive exposure to lime dust is also harmful to employees. A bag filter was installed to collect dust from silos, bottom of kilns and conveyors at the plant and collects 2 tons lime power dust per day, or approximately 730 tons per year.

Total costs were US\$ 54,591, consisting of the purchase and installation of the bag filter cost (US\$ 48,364), and annual electricity costs to operate the bag filter (US\$ 6,227). Each year, cost savings are US\$ 56,411, including additional income from 730 tons collected lime powder and the raw material, electricity, and fuel oil costs to produce this amount, as this would have been wasted money if lime powder would not have been recovered. The payback period was less than one year. Although electricity was saved through the recovery of lime, the bag filter runs on electricity and therefore this option resulted in a net increase in electricity consumption of 109176 kWh per year. Fuel oil savings from the recovered lime was 66,430 liters per year. Annual net reduction in greenhouse gas emissions was 176.4 ton CO₂ per year.

It is interesting to note that the company decided to install the bag filter to mitigate dust, and only realized after this decision was made that collected dust could be sold as product. Therefore this option initially looked like one that cost money, but turned out to be a very profitable option. Additional benefits are improved working conditions and improved reputation of the company because the air quality has improved significantly.

KEY WORDS

Cement, Thailand, Furnaces and Refractories, Bag Filters, Lime Powder, Dust Emissions, Product Recovery

OBSERVATIONS

Approximately 300 tons of high quality lime are produced by two vertical twin-shafts kilns, which is then conveyed and stored in silos. Newly produced lime is loaded into the silos from the top and lime sold to customers is taken from the bottom of the silos. Significant amounts of dust (i.e. fine lime powder) disperses in the air during the loading and unloading of silos. These very tiny particles of lime powder are spread over the vast area depending on the speed and direction of the wind. Suspended lime powders are considered to be hazardous air pollutant that can cause respiratory and lung diseases in humans, pets and cattle. In addition, lime powder reduces visibility, which could cause accidents at the work place or on the road. The dust this contributed to an unfavourable opinion by the community of the plant. The mitigation of dispersed lime powder from storage silos was therefore given a high priority since the beginning of the GERIAP project in 2003.



OPTIONS

The Team recommended installing a bag-filter system and company management approved this option, which was implemented in May 2004.

The bag-filter system installed at Lime Master consists of a 45 kW, 380 volts motor for driving a 30 ft³/min suction blower and 96 garment bags. The bag-filter system is similar to a huge vacuum cleaner with multiple suction heads/pipes that can be connected to any point of origin of dust/tiny particles in the production process. Suction heads/pipes were placed at the entrance and exit of storage silos, bottom of kilns (i.e. where the finished product is unloaded from the kiln after the burning cycle), and conveyors. Dust/tiny particle originating from the process are sucked under negative pressure via the suction heads/pipes into a bag. The selected bag-filter collected 2 tons lime powder per day, which equates to approximately 730 tons lime powder per year.

Although the bag filter would reduce dust dispersion significantly, there was still a point of concern. The bag-filter caused an increase in CO₂ emissions (i.e. via 138,376 kWh of electricity required per year to operate it). This is a case where the company had to choose between short-term (i.e. the mitigation of dispersed lime powder) and long-term (i.e. greenhouse gas emissions contributing to climate change) environmental impacts. The company considered the dust mitigation as a higher priority.

RESULTS

Financial benefits

- Investment: US\$ 48,364 (construction and installation of bag filter)
- Annual operating costs: US\$ 6,227 electricity costs per year (138,376 kWh X US\$ 0.045/kWh)
- Annual cost savings: US\$ 56,411, calculated as follows:
 - Annual revenue from recovered lime powder: US\$ 34,675 (730 tons X US\$ 47.5/ton)
 - Annual costs to produce 730 tons of lime powder (which also contribute to savings because without recovering this amount this money would need to be spent to produce an additional 730 tons of lime power)
 - Electricity cost savings: US\$1,314 (29,200 kWh X US\$ 0.045/kWh)
 - Fuel oil cost savings: US\$ 14,947 (66,430 liters oil X US\$ 0.225/liter)
 - Raw limestone cost savings: US\$ 5,475 (1,460 tons X US\$ 3.75/ton)
 - Total cost savings: 34,675 +1,314 + 14,947 + 5,475 = US\$ 56,411
- Payback period: less than one year

Environmental benefits

- Annual electricity savings: 109,176 kWh increase in consumption, calculated as follows:
 - Electricity savings from recovery of lime: 29,200 kWh/yr (730 tons recovered lime X 40 kWh/ton lime produced)
 - Electricity consumption by bag filter: 138,376 kWh/yr, calculated as follows:
 - Company's total annual products:46,060 ton/year
 - Production ratio, raw limestone: lime: 2:1
 - Equipment:
 - Blower capacity: 30 ft³/min
 - Motor size:45 kW (80% efficiency)
 - Voltage: 380 Volts
 - Current: 93 Amperes
 - Operating duration: 24 hours/day
 - System operation consumption: ($\sqrt{3}$ X380X0.8X30X24X365)/1000 = 138,376 kWh/year



LIME MASTER Ltd: Installation of bag filters to recover lime powder from storage silos

- Annual fuel oil consumption reduction via recovery of lime: 66,430 liters (730 tons recovered lime X 91 liters/ton lime produced)
- Annual GHG emission reduction: 176.4 ton CO₂ , calculated as follows:
 - CO₂ emission reduction via electricity savings: 8.05 ton CO₂/year (29,200 kWh X 0.000618 ton CO₂/kWh)
 - CO₂ emission reduction via fuel oil savings: 199.29 ton CO₂/year (66,430/1000 X 3)
 - CO₂ emission increase via electricity consumption of bag filter: 40.98 ton CO₂/year (138,376 kWh X 0.000618 ton CO₂/kWh)
 - Net CO₂ emission reductions: 18.05 +199.29- 40.98 = 176.4 tons CO₂

Other benefits

- Significant reduction of a hazy/dusty atmosphere at the plant and its surroundings
- Improved reputation with local community and local government
- Improved staff health and safety and staff morale due to reduced exposure to dust

It is interesting to note that the company decided to install the bag filter to mitigate dust, and only realized after this decision was made that collected dust could be sold as product. Therefore this option initially looked like one that cost money, but turned out to be a very profitable option.

FOR MORE INFORMATION

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