

Electrical Energy Conservation in Cement Plants in India



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India is the second largest cement producing country in the world with a distinction of operating plants with varying capacity and varying technologies. Some of the modern plants can be compared to the best plants in the world in terms of variety, quality and energy efficiency.

While the plant production Technologies are selected for achieving desired variety and quality, the commercial success depends on cost of production, which largely depends on cost of Energy, both Thermal or Fuel and Electrical. Energy costs accounts for 40 per cent of the total cost of production. In case of modern large Plants the Electrical Energy consumption is around 66kwh/MT, while for the older plants it is 75-100 kwh/MT. [Ref Article by Madhav Kamath and G Hari Kumar and IEEMA Journal, Energy Conservation Special issue]. BEE

has set the target at 67 kwh/MT.

These norms are for OPC 43 grade cement (Source: UNIDO)

Mines, Crusher and Stacking

In old plants, mostly with ball mills, two stage crushing is done. In such mills the energy consumption may be high up to 2.5 kwh/MT. However in single stage crushing (VRM or roll press-ball mill combination) the energy consumption will be 1.5 kwh/MT. Major part of the energy is consumed for the Crusher Main Drive.

Reclaimer, Grinding and Transport

The VRM (Vertical Roller Mill) is very efficient development over the conventional ball mill system saving about 30 to 35 per cent energy or power. In VRM the major energy

consumption of about 40 to 45 per cent is consumed by Main Drive followed by Vent and ESP Fans.

Kiln Feed, Kiln and Cooler

Pre-heater fans, ESP fans, Kiln Cooler fans consume about 60-65 per cent of total energy of this section. Only Feed and Coal conveying Drives consume some power.

Coal Mill

The Drives of Mill consume major power.

Cement Grinding and Transport

Majority of cement mills in India are open circuit ball mills. In some plants closed circuit or VRM are installed. Drives of Grinding Mills and Transport Conveyors consume major power.

Packing Plant

Drives of packing machines and transport conveyors consume major Electrical Energy, though small in volume compared to other sections of cement plants.

Lighting, Pumps and Services

Root Blowers, Compressors consume major power and Energy.

Overall most Electrical Energy is consumed in Gear Drives of

Major Energy Consuming Equipments in a Cement Plant

SI No	Energy Consuming Areas	Electrical Energy Consumed
1	Mines, Crusher and Stacking	1.5 kwh/MT
2	Reclaimer, Grinding and Transport	18.0 kwh/MT
3	Kiln feed, Kiln and Cooler	22.0 kwh/MT
4	Coal Mill	5.0 kwh/MT
5	Cement Grinding and Transport	23.0 kwh/MT
6	Packing Plant	1.5 kwh/MT
7	Lighting, Pumps, and Services	4.0 kwh/MT
Total		75.0 kwh/MT

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various machines and Conveyors, Compressors and Root Blowers. So far major attention of development was on processes and machines to improve Energy Efficiency. This has improved related Electrical Consumption from 120 kwh to 75 kwh.

Green Bio-lubricants – The easy solution to achieve energy saving and cost

The major subject of this article is to introduce 'Emerging Technology of Bio-based Lubricants' which can save Electrical Energy and also will protect Environment.

It will be surprising to many technical experts that, this new technology of bio-based lubricants can reduce the energy consumption in cement plants by 10 to 15 per cent. Thus the plant considered above, consuming 75 KWh/ton can reduce the consumption to almost 67 KWh/ton as desired by BEE (Bureau of Energy Efficiency). This changeover will not require any change in the plant machinery or any capex to improve the energy efficiency of various machines.

Most of the engineering experts are unaware that, present mineral oil based lubricants or even synthetic lubricants are not capable of reducing the frictional losses in gear boxes and moving components to appreciable level. The emerging technology of bio-based lubricants is the right lubricant which can provide all national objectives in respect of Energy and Environment.

This technology of bio-based lubricants was evolved in developed world to eliminate or reduce the hazards of mineral oil based or synthetic lubricants to environment. Most of these lubricants are not fully biodegradable and non toxic. Hence during their use or spent lubricants after use can cause great danger to the environment. This was first observed when the water depth in the 'Lake of Constance' in Switzerland has

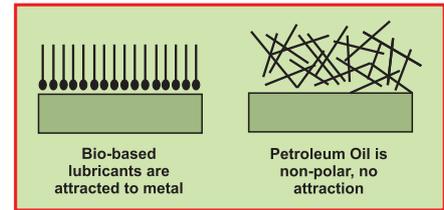
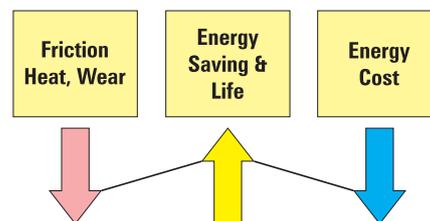
started reducing due to layer of spent lubricants delivered by motor boats, accumulated at the bottom. Soon laws were introduced in Switzerland and Germany to disallow any discharge of lubricants in the lake waters. This gave rise to the development of bio-based lubricants. The latest move in this direction is now from USA, allowing use of only environment friendly lubricants in US waters.

Intech Energy Systems Pvt Ltd, Pirangoot, Pune have pioneered this technology in India. It was noted from the exclusive properties of bio-lubricants that, besides being Green, these lubricants can save energy to the extent of 15 per cent in cases of gear boxes.

Bio-lubricants have following exclusive properties:-

a. Very High Lubricity - As per ASTM standards, lubricity is measured by four ball scar diameter test. Petro lubricants show the scar diameter of 0.5 to 0.7mm, synthetics show 0.4 to 0.6mm and bio-based are 0.3 to 0.5mm. The high lubricity means less friction and frictional energy loss as well as reduction in rise in temperature of gear oil and much longer life for the drives or machines.

The gear box manufacturers like Elecon Engineering Ltd, Premium Transmissions Ltd, Cyclo Transmissions Ltd etc have tested and certified such energy savings. There are international references also. This has also been proved in major industries. The lubricity is inherent natural property of base oils, while in case of mineral oil or synthetic base oils, it is provided by additives.



b. Polar Nature - Unlike petro or synthetic, bio-lubricants are polar. Thin film of these lubricants have adhesion with the substrate. Hence dry metal to metal contact is fully avoided. Moreover, it provides better boundary layer lubrication or EP properties.

c. High Viscosity Index - Mineral oil based lubricants have V.I. of 95 or 100, synthetics have 140 to 160 and bio-lubricants have V.I. of around 200. This means the rise in temperature has less effect on reduction in viscosity. Thus to get same viscosity in operation, bio-lubricants can have much less viscosity at room temperature. This allows easy flow of lubricant to all crevices of gear box. Moreover, the viscosity remains same in normal working temperature range.

d. High flash point and low evaporation rate - This helps in high temperature applications. It is safe and reduces the top-ups near furnaces or ovens.

e. Biodegradable and Non Toxic - The spent lubricants do not require ETP. They can be burnt with fuel like bio-diesel and can save fuel cost. Alternatively, it can be composted. No need of ETP. Even vapours do not cause any harm to environment.

Bio-lubricants are manufactured from edible or non edible vegetable oils. Thus they are having renewable source. Bio-lubricants can really meet all three major objectives - Energy Conservation, Environment Friendly and Renewable Source.

There are only two constraints in bio-lubricants. In a natural form, vegetable oils are not oxidatively and thermally stable. This constraint is being taken care of by chemically modifying base oils. The R&D in last two decades has

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solved this problem totally. Now bio-lubricants have same life like petro or synthetic.

The cost of bio-lubricants is almost 2 to 2.5 times higher than petro based lubricants and at par or less with energy efficient synthetic lubricants. It is proved in many industrial fields that, the total cost of bio-lubricants gets paid off in 30 to 90 days out of cost of energy saved. For the rest of the life, the user gets cost benefit of three to 10 times the cost of lubricants depending on sump capacity, kw or hp and type of gear box. Thus this is also no more any constraint.

Dirghayu bio-lubricants from **Intech Energy Systems Pvt Ltd** were tested and approved by many industries like Textile, Sugar, Engineering, Chemical etc.

The use of them is started in cement factories in USA and now it is a turn of India to gain from this emerging technology.

International References:

1. Industrial Lubrication and Tribology by Cliff Lea
2. Biobased Lubricants: A Viability Study - Adam Ing
3. Efficiency Tests of a Transfer Gearbox: Biodegradable Non-Toxic Ester Vs

Mineral Oil - T Oliveira1, R Martins2, J Seabra2, Ch Seyfert3, A Igartua1

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Technical Specifications:

Hole Diameter: 4-1/2 in. to 7 in. (115 mm to 178 mm)

Max Depth : 138 ft (42 m)

Compressor : 900 ft³ per min (25.4 m³ per min) upto
500 psi (34.5 bar)

Engine : 530 hp (395kW)

Advantages:

- Low owning and operating cost.
- Single man operation.
- External control for easy and safe maneuverability.
- Better serviceability.

REL is a pioneer and have over three decades of experience in manufacturing Blast Hole Drilling Rigs for Open Cast Mining and Quarry Applications, Heavy Duty Water Well Drilling Rigs for Deep Drilling in all formations, HFU for rejuvenating Dry Wells, allied products and accessories for all drilling applications.

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