VISAKHAPATNAM STEEL PLANT – RASHTRIYA ISPAT NIGAM LIMITED

Optimum Utilization of Field Current in Rolling Mills to Reduce Electricity

SUMMARY OF THE OPTION

Rashtriya Ispat Nigam Limited (RINL) is the corporate entity of Visakhapatnam Steel Plant. The steel plant is located 26 km south of Visakhapatnam city. The plant has a capacity to produce 2.656 MT (million tons) annually of saleable steel of which 2.410 MT is finished steel. The product profile of the plant comprises of wire rods, reinforcement bars (rebars), angles, channels, beams, squares, billets and blooms. The product profile also includes basic grade pig iron, granulated slag, coal chemicals and other by products. The plant also exports power to AP Transmission company from its captive power plant. The monetary value of the total energy consumption of main inputs averages Rs. 13,913 million (US$ 323 million) which accounts for 40 percent of the manufacturing cost. The specific energy consumption during this period was 6.26 Gcal/ ton of Crude Steel. The commitment to energy conservation is reflected in the energy policy of RINL where in it is committed to reduce specific energy consumption by 1 percent per year up to 2010 AD.

Medium Merchant & Structural Mill (MMSM) of VSP has been a large consumer of electrical energy with an annual consumption of about 91 Million kWh. The rolling of blooms is essentially done by the Main Drive (DC) motors. These DC motors are of separately excited type. In total there are 20 DC motors with armature ratings of 600kW, 1000kW, and 1700 kW respectively. These are further divided into two groups on the basis of the current required for charging/excitation the field. The group 1 consists of 9 motors with field parameter of 112 amps, 150 V and 1.34 ohm. The group 2 consists of 11 motors with field parameters of 202 amps, 150 V and 0.7425 ohm. Because of varying customer demands from the mill (daily changes in section and profile), the rolling period is limited to 16 to 18 hrs a day.

As a standard design feature of any DC motor/ drive regulation, field of the motor is charged 100 percent throughout the time and the armature is powered only when motor is required to run. This manifests as charging of armature of the motors for 16 to 18 hrs a day, where as the field coils are powered for all the 24 hrs. The problem obviously is the wastage of electrical energy in the field of the main drive motors during 8 to 6 hrs a day. It was decided to optimize the field current by limiting the field current to 25 percent during the non-rolling hours thereby affecting annual electrical energy savings at end use of the order of 796 MWh worth Rs. 15.92 lakhs annually (US$ 37,023). The associated reduction in annual GHG emissions amounted to 710 tons of CO_2 per year.

KEY WORDS

India, Iron and Steel, Electric motors, Rolling Mills

OBSERVATIONS

The observations made in the process of reduction of energy consumption in Rolling Mills by optimum utilisation of field current are as follows:

- Total Power consumption in MMSM is 303 MWhr/ day.
- Total Power consumption by Main drive motor is approx. 120 MWhr/ day.
- The average Rolling time is 16 to 18 hrs a day, and the remaining 6 to 8 hrs non rolling

- time is staggered in the 24 hrs.
- The field coils are powered through out the day , where as the armature coils are powered only during rolling period.
- Frequent switching On / Off of the Field during non rolling hrs.
- Improper co-ordination among all agencies.
- Production stoppages / breakdowns
- Reduced life of the equipment
- Energy wastage in field coils during non rolling time for all 20 motors amounts to 3.5 MWhr/day

OPTIONS

In order to consume field energy optimally, the field regulation hardware and its thyristorised power circuit was redesigned so that during non-rolling time, the field current would be limited to 25 percent (instead of 100 percent) and would go to the requisite value during rolling period. Field current was limited to 25 percent keeping in view that the field loss setting is designed to be activated at 15 percent field current which would stop the motor- an undesirable feature. The 'STOP' of rolling command is chosen for taking over the activation of the modified circuit and 'START' of rolling command will override to the original drive regulation circuit.

This optimization philosophy has considerably reduced the energy consumption of the mill apart from the stress on the field circuit.

RESULTS

Assumptions and calculations behind the results are :

- Field parameters of Group – 1 motors: 112 amps, 150 Volts, 1.34 ohms (Stand 1,2,3,4,5,6,7,17,19)
- Field parameters of Group – 2 motors:202 amps, 150 Volts, 0.7425 ohms (Stand 8,9,10,11,12,13,14,15,16,18,20)
- Rolling time:16 hrs
- Non – rolling time: 8 hrs
- Reduction of field current: 75 percent of rated current

Electrical power saving in Group -1

- Reduction of current in one drive: 84 amps
- Electrical power saving for 9 motors: 85.1 kW (I^2R X no. of motors = 84^2 X 1.34 X 9)

Electrical power saving in Group -2

- Reduction of current in one drive: 151 amps
- Electrical power saving for 11 motors: 188 kW (I^2R X no. of motors = 151^2 X 0.75 X 11)
- Total power saving: 272 kW (85.1 + 188)

Financial benefits

- Investment: negligible
- Annual operating cost: none
- Annual cost savings: Rs. 15.92 lakhs (US$ 37,023) (796 MWh X 2 Rs./kWh)
- Payback period: immediate

Environment benefits

- Annual electricity saving (at end use): 796 MWh (= 272 kW X 8hrs/day X 365 days/yr)
- Annual GHG emission reduction: 710 tons of CO_2 (= 796 X 1000 kWh X 0.000893 tons of CO_2/kWh) [1]

Other benefits

- Longer life of the motors

[1] – Sourced from UNEP GHG Calculator. Value specific to India.

FOR MORE INFORMATION

GERIAP National Focal Point in India
Mr. A. K. Asthana
Group Head Energy Management
Mr. P. K. Gupta, Director, NCPC-India
National Productivity Council,
5-6, Institutional Area, Lodi Road, New Delhi - 110003
Tel: +91 – 11 – 24697446
Fax: +91 – 11 - 24698138
E-mail: ak.asthana@npcindia.org / ncpc@del2.vsnl.net.in

GERIAP Company in India
Mr. Y. S. S. Rao, Company Chairman and Managing Director
E-mail: cmd@vizagsteel.com
Mr. K.K. Rao, Director – Operations,
Mr. C.S. Gupta, Addl. GM (Energy and Environment and Designated Energy Manager)
E-mail: gupta.cs@rediffmail.com
Rashtriya Ispat Nigam Ltd.
Visakhapatnam Steel Plant
Visakhapatnam, Andhra Pradesh, India
Tel: +91-0891- 2518444/2518301
Fax: +91-0891- 2518237/2518631