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Technological Developments in Pulverized Coal Fired Steel Re-rolling Mills for Energy Efficiency

Status of Environment & Related Issues
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EDITORIAL

Steel Re-rolling mills (SRRMs) constitute an important link in the overall supply chain of steel in the country, supplying 60% of India's long steel products. There are around 300 Re-rolling mills in the State of Punjab. These mills use pulverized coal (fuel) for heating of raw materials like ingots, billets, blooms or scrap. Along with energy losses, these mills also contribute towards air pollution in Mandi Gobindgarh - Khanna area. The energy-use in this sector includes heating fuels (furnace oil and coal) and electrical energy. The energy cost in these SRRMs is estimated at 25%-30% of overall production cost. This is a significant proportion, and a result of continued reliance on obsolete technology by the SRRM sector. It has thus become imperative for the SRRMs to tread the energy-efficient path. The SRRM sector can achieve globally comparable business and product performance standards only by moving towards reliable, sustainable, and affordable supplies of energy, along with adoption of modern commercially viable and available technologies, and developing new indigenous technologies through research on native requirements and parameters.

To achieve the desired set goals, Punjab State Council for Science and Technology (PSCST) adopted following and approach to demonstrate of energy conservation & pollution control measures in Mandi Gobindgarh cluster, carry out capacity building and skill development of workers & owners through formal offsite / onsite programmes, implement commercially viable energy efficient technology packages both in furnace as well as rolling section.

PSCST demonstrated pollution mitigation system for the re-rolling mills in 2004. The technology comprises of cyclone followed by impingement type wet scrubber which has been adopted by around 200 rolling mills. To tackle the problem of heat loss in exhaust gasses, a shell and shell type waste heat recovery system was demonstrated for pulverized coal fired mills for the first time in the country in 2009. This has resulted in 8-10% fuel savings with average financial savings of Rs. 10.0 lacs/annum (payback period as only 3-4 months). Over 50 mills have availed the benefit of this technology. Further, one rolling mill from Nepal also approached the Council for consultancy services which were duly provided. It was observed by the industry and Punjab Pollution Control Board (PPCB) that though the pollution and energy loss problems had been resolved to a great extent, but the problem of black smoke in the morning still persisted. The declaration of Mandi Gobindgarh as a critically polluted area was a matter of serious concern to the government and public. In order to find the solution a detailed analysis of the project cycle was taken up and results revealed that the answer was available in simple solutions like proper raw material feeding, fuel firing & furnace operating practices. To understand and address the concern of the industry, the Council has been in regular touch with All India Steel Re-Rollers Association & Punjab Pollution Control Board. The three agencies have jointly come forward not only to address this problem but also for the skill development of owners and workers.

Capacity building exercise has been taken up in 2012 to ensure that the benefits of the technology and energy conservation measures reach to the beneficiaries. In the skill development programmes, 27 formal off-site and on-site training programmes for 172 mills have been conducted. These efforts have not only resulted in decrease in visible smoke in ambient air but the whole industry was benefitted due to reduction in scale loss and fuel consumption. With the intervention of Council, around 50% of participating mills have achieved reduction in scale loss by about 0.5% (amounting to savings of approx. Rs. 15-20 lacs/annum) besides energy efficiency improvement by 8% to 12% fuel reduction leading to coal savings.

Recognizing the expertise of the Council in this area, UNDP has also awarded a project for implementing these Energy Conservation Measures (ECMs) in 65 units in Mandi Gobindgarh. 40 units have already established ECMs whereas the remaining 25 units are in the process of implementation. In UNDP project Council intervened in the rolling section as well as experimented a few advancements in furnace section. This has resulted in reduction in electrical energy as well.

To expedite the implementation of energy efficient technologies in other clusters in the Country, UNDP generally conducts exposure visits of cluster members to the best performing clusters. Realizing the success of Mandi Gobindgarh cluster, a group of rolling mill owners from Bhavnagar (Gujarat) and Jalna (Maharashtra) visited Mandi Gobindgarh to study the benefits from adoption of better feeding, firing and furnace operating practices as well as implementation of energy conservation measures. The Council is in constant touch with these units and hopes to replicate the Mandi Gobindgarh model in Gujarat.

We hope industries across the country will benefit from Mandi Gobindgarh model involving owners and workforce through formal classroom and onsite capacity building programmes in the years ahead as it offers a Win-Win opportunity to both, the industry and the environment.

— Editors

Background

Mandi Gobindgarh, often referred as the "Steel Town" blessed by the sixth sikh Guru Shri Hargobind Sahib ji, falls in Fatehgarh Sahib district of Punjab. The steel industry in the town of Mandi Gobindgarh has about 300 steel re-rolling mills, employing over five lakh people. The cluster is over 50 years old, and had been constantly growing since its inception. Today this small city caters to 25 % of the total steel requirement of the country. Steel Re-rolling mills constitute an important link in the overall supply chain of steel in the country, supplying 60% of India's steel products. About 1200 small scale steel re-rolling mills are operating in India, out of which 300 mills are in the State of Punjab. These mills use pulverized coal (fuel) for heating of raw materials like ingots, billets, blooms or scrap. These rolling mills operate at a poor thermal efficiency of 20-30%, resulting in wastage of precious heat energy and also contribute considerably towards air pollution especially in the Mandi Gobindgarh - Khanna area.

The Council observed that about 40 lakh tonnes of steel is being rolled per annum in about 300 re-rolling mills. These mills consume 2.50 lakh tonnes of coal worth Rs.341 crore per annum. Combustion/ flue gases are generated from the combustion of pulverized coal in these rolling mills which are emitted at very high temperatures (400-650°C) along with high concentration of suspended ash particles. These mills emit 12 tonnes/day of fine particulate matter (3600 tonnes/annum) and 6.7 lakh tonnes of CO_2 per annum. The Council demonstrated two stage air pollution control technology (involving cyclone followed by scrubbing system) to control high concentration of suspended ash particles. To tackle the problem of wastage of heat in exhaust flue gasses, a shell and shell type waste heat recovery system has been demonstrated for pulverized coal fired mills first time in the country. This has resulted in 8-10% fuel savings with average financial savings of Rs. 10.0 lakh/annum (payback period as only 3-4 months).

The industry and Punjab Pollution Control Board (PPCB) observed that though the pollution problem had been solved to a great extent, but black smoke in the morning still persisted. The declaration of Mandi Gobindgarh as a critically polluted area was a matter of serious concern to the government and public. However detailed analysis of the project cycle was taken up and it was found that the answer was available in simple solutions like proper raw material feeding, fuel firing & furnace operating practices. Council, All India Steel Re-Rollers Association & Punjab Pollution Control Board have joined hands to address the problem of black smoke and skill development of owners and workers through capacity building exercise has been taken up to ensure that benefits of the technology and energy conservation measures reach to the beneficiaries.

Punjab ENVIS Centre also published a study on ***"Sustaining the Re-Rolling Sector through Energy Conservation Measures and Better Operating & Firing Practices"*** in its newsletter Vol. 10, No. 4, 2012-13; (*softcopy* available on website www.punenvis.nic.in) covered the following aspects :

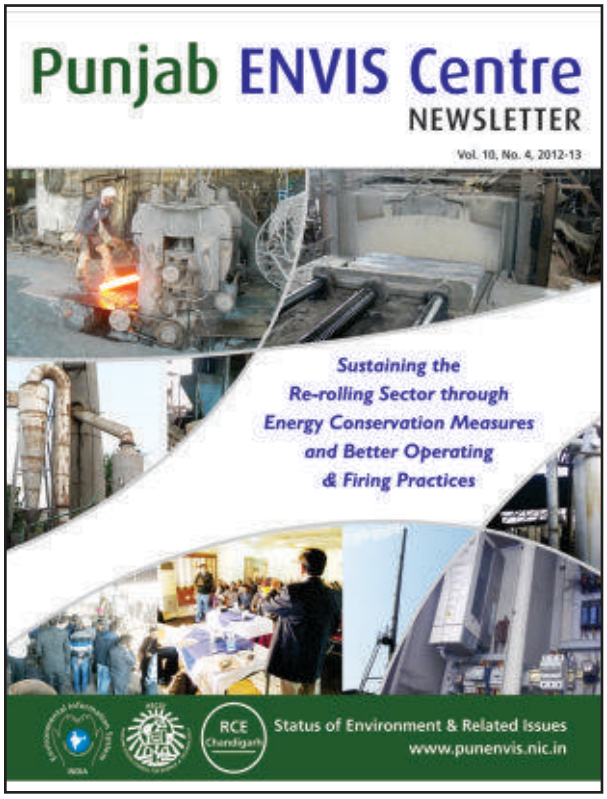
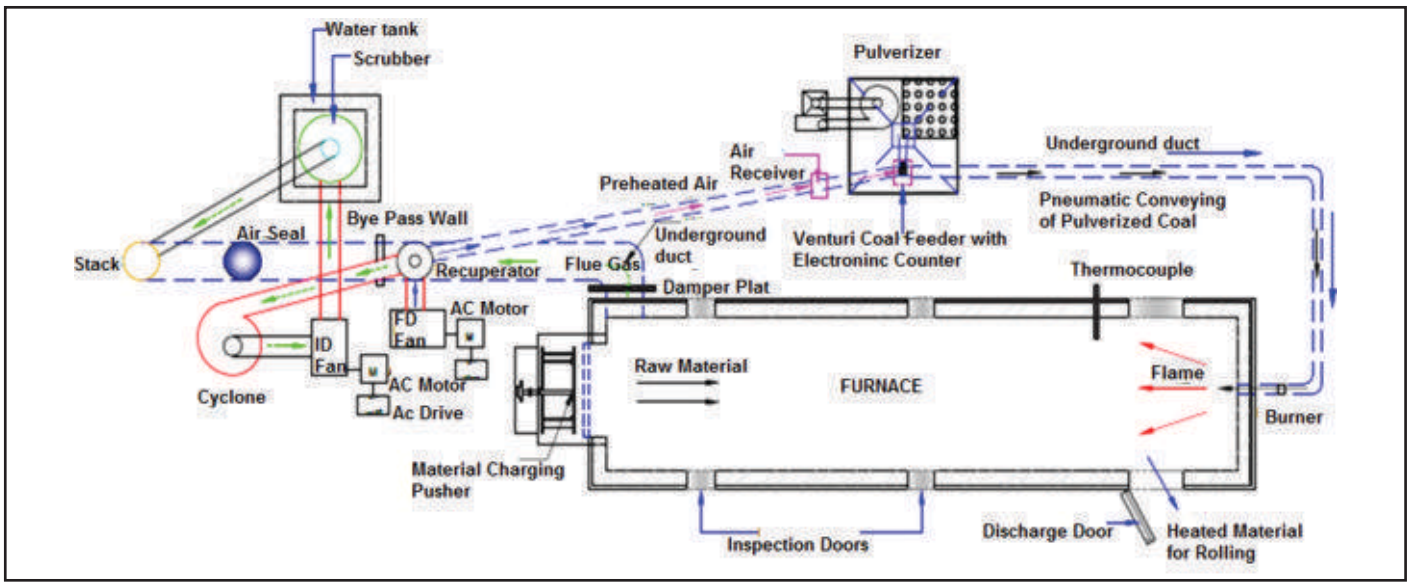


Fig. 1. Process Diagram of Re-Heating Furnace



❖ Basic principles and functioning of an energy efficient reheating furnace indicating energy conservation measures as shown in Fig. 1.

❖ Key problematic areas with regard to air pollution, thermal energy loss & scale loss and their solution being reproduced as summarized in Table 1.

Table 1. Key Problems & Solutions in Re-rolling Mills Structural Design

Related Component	Problem	Solution
Furnace	High skin and flue gas loss (skin temp. 70-350°C & flue gas temp. 400-650°C)	Insulation in form of low thermal mass, low conductivity ceramic material.
Pulverizer	Poor pulverization (90% pulverized coal less than 200 mesh)	Hammers & liners with improved metallurgy (Mn alloy) for wear resistant grinding operation. Proper size and location of classifier blades.
Conventional U-tube cross flow recuperators installed underground & designed for oil fired reheating furnace	Choking problem in conventional recuperators due to feeding of pulverized coal in the furnace.	Shell & Shell type recuperator specially designed for dust laden flue gas. It does not have tubes, but only multiple shells.
Instrumentation	No instrumentation to monitor air fuel feeding during product change over, lunch & tea break.	Thermocouple, electronic counter, VFD, test sieve, flue gas analyzer are basic instruments to analyze the health of a furnace and better control on fuel firing operation
Air Pollution Control Device (APCD)	Unscientific local made APCD & ID/ FD fan mostly in scrap based mills	Scientifically designed APCD in form of cyclone followed by scrubber solved the problem of SPM emissions.

Black Smoke from Re-rolling Mill causing Air Pollution

- Need for capacity building programmes to minimize the black smoke during the start-up period in the morning as well as to minimize the fuel consumption and scale loss.
- Concept and objectives of capacity building programmes for firemen and owners of the mills - a unique initiative by All India Steel Rerollers' Association (AISRA) by formally engaging Punjab State Council for Science & Technology as Consultant for this purpose.

Capacity Building Programmes (On-site & Off-site)

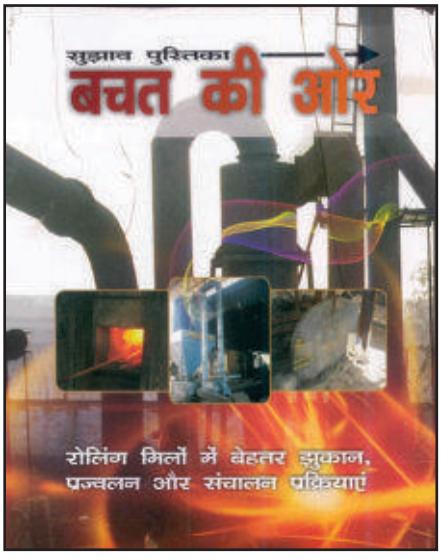
In the skill development programmes, 27 formal off-site and on-site training programmes for 172

Participants in Feedback Programme at Khanna

On-site Training to Firemen & Industrial Owners at Mandi Gobindgarh

mills have been conducted besides three feedback workshops where following activities have been carried out:

- Diagnostic studies of each unit.
- Formal off-site classroom training in the evenings for a group of 8-10 owners and their workers.
- On-site training from the above group next early morning in an operational mill.
- Interactive Feedback Programs for the participants of previous 4-5 Capacity Building Training Programmes (CBTPs).
- Distribution of Knowledge Kit to each participant comprising of the following IEC material.
- Manual in Hindi - "Sujhav Pustika - Bachat Ki Aur - Rolling Millon Mein Behtar Jhukan, Prajavalan Aur Sanchalan Prikirayien".



- Posters in Hindi - 7 Nos. covering all critical issues leading to Pollution.
- Control, reduction in the scale losses and energy conservation.
- Video Film in Hindi "Bachat Ki Aur - Rolling Millon Mein Behtar Karya Vidhi".

During CBTPs, rolling mills were sensitized about raw-material feeding practices, proper size of air seal, use of burner block plate, besides the likely benefits to be accrued by implementing energy conservation measures and better feeding firing and operating practices.

The above initiatives has not only led to decrease in visible smoke in ambient air but the industry stands benefitted doubly due to reduction in scale loss and fuel consumption. With the intervention of Council, mill owners have reported to achieve reduction in scale loss by about 0.5% (amounting to savings of approx. Rs. 15-20 lacs/annum) besides energy efficiency improvement by 8-12% fuel reduction leading to coal savings. Feedback received on phone/ through written feedback forms reveals that around 50% of the participating mills i.e. minimum 80 mills have adopted either one or more energy conservation measures. Assuming average production capacity mill as 40 TPD, financial savings to the tune of Rs. 22 crore per annum besides reduction in flyash, CO_2 and black smoke have been worked out with details as shown in Table 2.

Besides above, almost all the mills have adopted following suggested operational parameters and slight modifications in their furnaces, which helps in retaining furnace temperature in the morning, ultimately reducing the coal consumption meaning thereby lesser cold start-up time as well as visible reduction in black smoke in the morning:

- Proper size of air seal at the right location.
- Proper thickness and location of the damper plate.
- Cleaning of flue draft once in a month.
- Proper start-up and shut-down procedure.
- Operation & Maintenance and upkeep of Air Pollution Control Device (APCD).

Table 2. Suggested Operational Parameters for Energy Conservation and Monetary Savings

Parameters for Energy Conservation	Monetary Savings
Average production of 80 mills	3200 TPD
Coal Saving *(3200 TPD x 7kg x 250 days x Rs.14000/T)*	Rs. 7.84 crore / annum
Saving on account of scale loss reduction *(3200 TPD x 0.5% x 250 days x Rs.35000/T)*	Rs. 14 crores / annum
Reduction in hazardous waste generation	560 TPA
CO_2 emission reduction *(Coal saving 5600 TPA x 2.67)*	14950 TPA
Reduction in cold start-up time	15-30 minutes after the adoption of energy conservation measures and adoption of proper start up and shut down procedure, resulting in visible black smoke reduction in the morning.
Savings	Rs.21.84 crore/annum (Say Rs. 22 crore) besides reduction in flyash, CO , black smoke.

APCD before Chimney

UNDP Steel Upscaling Project

Recognizing the expertise of the Council in energy efficiency area, the United Nations Development Program (UNDP) has selected PSCST as Cluster Level Agency (CLA) for Mandi Gobindgarh cluster to support energy efficient production in small scale steel industry in India in April 2014 with the following aims :

- ❖ Up-scaling Energy Efficient interventions in about 300 SRRMs in India.
- ❖ Piloting EETs in other steel sub-sectors such as Induction furnaces.
- ❖ Trialling second generation of technology packages in SRRM.

The scope of work of the UNDP assignment :

- ❖ Generation of Expression of Interest (EOIs) for 80 units in Mandi Gobindgarh cluster.
- ❖ Intervention plan for implementing energy efficiency measures in selected units.
- ❖ Coordination for baseline measurement, actual implementation, post commissioning measurements and other related activities.
- ❖ Submission of Reports.

Council generated EOIs from all the targeted 80 units in 2 ½ months which could be possible by one-to-one personal meetings and orientation seminars. Afterwards, the baseline measurement studies in beneficiary units were conducted by National Productivity Council (NPC) in Energy Consumption Pattern Project as shown in Table 3.

Table 3. Energy Consumption Pattern Baseline Studies - Mandi Gobindgarh

(Showing impact of Capacity Building Programmes)

Energy Consumption (MJ/t)	No of Mills	Percentage contribution	Average MJ/t
2000-2500	9	12%	3136
2500-3500	50	65%	
3500-4500	12	16%	
4500-5500	3	4%	
5500-6500	2	3%	

Country	Energy Consumption MJ/t
Japan	1900 – 2000
Europe	2000 – 2500
India	3500 – 6500

To facilitate and expedite the implementation of energy conservation measures, Council in active association with AISRA and UNDP conducted following activities since April 2014:

- ❖ Group meetings
- ❖ Vendor's meets
- ❖ Interactive meets
- ❖ Cluster level meetings
- ❖ National Vendors meet
- ❖ Exposure visits

Beneficiary Vendors Meet at Khanna

Table 4. Implemented EE Technologies in Steel Re-rolling Mills in Punjab (till March 2015)

EE Technology	Beneficiary Units (No.)
Shell & Shell WHRS	12
EE pulverizer	22
VVVFD	20
Insulation	25
Antifriction roller bearing stands	4
Revamping of furnace	4
Y-roller table/tilting table	4
PID temperature control system	3

The various Meets & Exposure Visits have resulted in implementation of EE technologies in 40 steel re-rolling mills till March 2015 (Table 4) whereas implementation in remaining 25 units are likely to be completed by 30.06.2015.

After implementation of EE technologies post commissioning study is being conducted by North India Technical Consultancy Organization Limited (NITCON) so as to evaluate and ascertain the benefits in terms of thermal and electrical energy to specific mill. The results of study revealed the energy savings in the range of 10-20% with significant reduction in scale loss. The investment is ₹ 3-15 lacs per unit with payback period of 4-12 months.

Under the Project, a reference manual "Rolling in Profits" on EE technologies and one DVD titled as "More Steel with Less Energy - A Success Story" has also been developed by UNDP, wherein, Council's team shared their field experiences. IEC material developed UNDP has been provided to each participating unit so that they get far-reaching benefits in short time.

The objective of UNDP Project is to implement EE technologies in 12 clusters of the country with total number of project units as 300. To expedite the implementation, Project Management Unit-UNDP conducts exposure visits of the cluster members to the best performing clusters. A group of rolling mill owners from Bhavnagar (Gujarat) and Jalna (Maharashtra) visited Mandi Gobindgarh to study the benefits from adoption of better feeding, firing and furnace operating practices as well as implementation of energy conservation measures. The Council is in constant touch with these units and hopes to replicate the Mandi Gobindgarh model in Gujarat.

Participants during Beneficiary Vendor Meet at Khanna

During Capacity Building Programmes and execution of UNDP Project, the mill owners & firemen asked very searching questions based on their observations while running the mills. The Frequently Asked Questions during this programmes are tabulated in the Annexure after the article.

Technological Developments

As brought out in the previous ENVIS Newsletter issue (Vol.10, No. 4) and above, the Council sensitized the mill owners about the likely benefits of implementation of energy conservation measures in the **"Furnace Section"** only during Capacity Building assignment. Whereas, in UNDP Project, the Council intervened in the **"Rolling Section"** and experimented a few advancements in Furnace Section also, as mentioned below :

Temperature based PID Control System

- Implementation of PID based furnace temperature control system.
- Demonstration of Shell & Shell Recuperator in a mill with production capacity 20 TPH.
- Adoption of antifriction roller bearings in place of conventional gunmetal/ brass cotters.
- Replacement of wobblers couplings with Universal couplings and spindles.

A) Furnace Section

- **PID based furnace temperature control system:** As brought out in the previous text, the mill owners were sensitized about the benefits of basic instrumentation like electronic counter and Variable Frequency Drive etc. during Capacity Building Assignment and most mills have even realized the benefits. Under the UNDP Project, the Council demonstrated Proportional Integral Derivative (PID) based furnace temperature control system in three mills (2 scrap based and 1 ingot based mill).

Controller system with microprocessor based (Proportional Integral Derivative) is used in reheating furnace for controlling and regulating air-fuel (pulverized coal/oil/PNG) which has direct impact on specific fuel consumption and scale loss. The components of automation comprises of VFD (Variable Frequency Drive), R-type thermocouple, control panel, cables etc. This type of automation helps to control the air flow automatically in a very convenient and energy efficient manner. It helps to regulate the air flow for corresponding fuel feeding rate. This helps in reducing the flue gas loss in the furnace and improves the furnace efficiency. Cost of PID system varies between Rs. 1.5 - 3.0 lakh depending upon the heating capacity of furnace. The system is functioning successfully for the last 4-5 months with payback period less than 3 months meaning thereby all the three mills have already recovered the initial investment.

PID based furnace control system for pulverized coal fired furnace is also being demonstrated in one mill operating with two burners. Performance analysis and trials of the automation system are being carried out.

Shell & Shell Type Recuperator

- **Shell & Shell Recuperator for Mill with 18 TPH Capacity:** Earlier Council was providing consultancy services for designing Recuperators for mills with production capacity upto 10-12 TPH, In the recent past, Council has successfully demonstrated the technology of Shell & Shell Recuperator for mill with capacity as 18 TPH in M/s. Bhartam Ispat Udyog, Mandi Gobindgarh. This mill has reported a saving of about 350 tonnes per annum of pulverized coal worth Rs. 49.00 lakh i.e. payback as 2-3 months only.

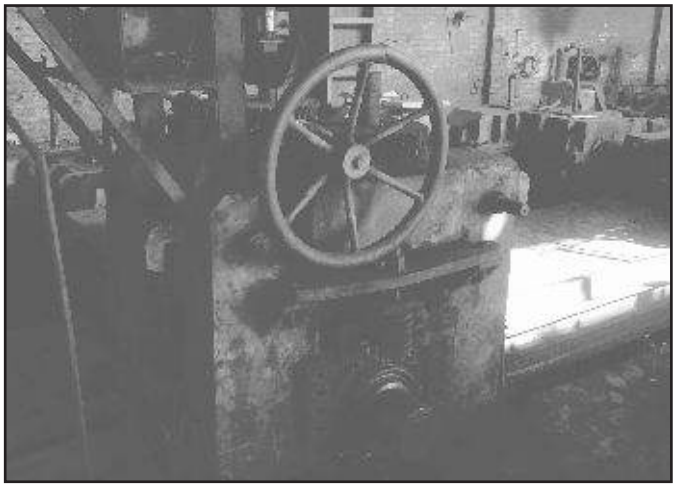
As described in earlier issue of ENVIS Newsletter (Vol. 10, No. 4, 2012-13), Shell & Shell Recuperator is specifically designed for dust laden flue gas having advantage of non-chocking and easy installation and operation. The main advantages of recuperator are :

- ❖ It is able to reduce the consumption of pulverized coal by 8-10%.
- ❖ It will help in raising the temperature of flame. This would help in reducing the initial heating time of the furnace.
- ❖ Reduction in amount of excess air required for combustion which further reduces the fuel consumption and scale/burning losses.

Performance evaluation of Recuperators installed under the guidance of Council's team reveals that the combustion air gets preheated up to 200-250°C for pneumatic conveying of pulverized coal thereby resulting in drying of pulverized coal during pneumatic conveying and swirl type burner facilitates better combustion efficiency.

B) Rolling Section

❖ **Anti Friction Roller Bearings:** Most of the mills at Mandi Gobindgarh/Khanna are using gunmetal/ brass cotter to support and guide rotating machine parts. These materials have high friction value resulting in more specific power consumption at rolling stands. Moreover, these conventional cotters need to be replaced frequently due to early wear out. Antifriction roller bearings are, therefore, good substitute to gun metal/brass cotters as these offer lesser friction and reduced lubrication requirement. Benefits of antifriction bearing rollers include reduced specific power consumption by 3-5% besides improvement in mill utilization by 5%.



Anti Friction Roller Bearings

In UNDP Project, 5 rolling mills manufacturing patra (strip) and TMT steel have already switched over to anti-friction bearing stands, thus replacing conventional intermediate and finishing stands. In these high speed mills, initial investment has been reported as Rs. 2 to 6 Lakhs per stand depending upon capacity of the mill.

Universal Couplings Spindles

❖ **Universal Couplings & Spindles:** Wobblers are the most commonly used couplers in steel re-rolling mill units to drive rolling mill rolls. These wobblers couplings are of cast iron and used in un-machined condition. The roughness and improper mating due to non-machining of wobbler couplings gives rise to low metal-to-metal contact, which, in turn, phenomenally increases wear & tear as well as noise levels.

As an alternative to wobbler couplings, the use of universal coupling has significantly increased in rolling mills. The most unique feature of universal couplings is their high misalignment capacity that ranges from 3° to 10°. This is manifolds higher than the misalignment capacity of wobbler couplings,

Y Roller Table

which is restricted to a range of 1° to 2°. The design of universal coupling allows them to resist lubrication loss and contamination due to the harsh environment. This unique feature reduces the friction and makes them stable choice even for high speed mills. Simplicity & ease of maintenance further reduces the down-time. These shafts have negligible backlash and radial clearance, thus improving the surface finish and overall product quality. Improvement in transmission mechanism like installation of universal couplings shall help to increase the efficiency of transmission from motor to mill stands, which results in specific power consumption saving by 5-8%.

In the UNDP Project, all the five mills who have switched over to anti-friction roller bearing stands are functioning with universal couplings and spindles. The initial investment for universal coupling and spindles has been reported as Rs. 20,000/- to 25,000/- per set of universal coupling with spindle depending upon size of the mill with likely payback period less than one year.

- **Installation of Tilting /Y roller table for 3 Hi Mill Stands**

In general Re-rolling sector in India has 3-Hi mill stands in roughing mill train. The metal is being fed to various passes manually by hooks and tongs.

Installation of tilting table towards the entry side and delivery sided of passes between top-roll and middle rolls ensures smooth guided entry of metal to the passes and also eliminates the manual lifting, feeding of the rolling stock. This increases mill-utilization by 5-10% and likely savings in specific power consumption by 6-8%. This installation further ensures the constant temperatures for all the various bars.

In the UNDP Project, 6 ingot based mills have installed Y-roller/tilting table. Mill owners have reported the cost of installation of one table as Rs.6-10 lakh depending upon the size of the mill. Further, they have reported 2-3 manpower reduction in each stand.

Way Forward

- PID control in mills operating with two or multiple burners.
- Fuel handling, storage and preparation system.
- Capacity building programmes for remaining around 125 mills so as to make the city clean & green.
- Hand-holding for implementation of energy conservation measures in remaining around 200 units.
- Design optimization of flywheel.
- Raw coal drying system.

Conclusion

PSCST is in constant touch with remaining steel re-rolling mills in Mandi Gobindgarh/ Khanna Cluster and making efforts to upgrade the conventional mills in technical and skill development aspects. Energy conservation measures and skill development of mill workforce are the need of rolling sector and these two facts offered a win-win opportunity to both the industry and the environment and much stronger foundation for rolling sector is anticipated in the years ahead.

Further, industries across the country will benefit from Mandi Gobindgarh model involving owners and workforce through formal classroom and onsite capacity building programmes in the years ahead as it offers a Win-Win opportunity to both, the industry and the environment.

Frequently Asked Questions (FAQ's)

Q. No.	Questions	Answers	
1.	How to work out the heating capacity of furnace?	Thumb rule: Multiply effective hearth area with hearth load as 125-150 kg/m^2/hr for scrap & as 200-225 kg/m^2/hr for ingot based furnace.	
2.	Desirable mesh size of pulverized coal for its optimum combustion?	200 mesh (65-80% pulverized coal passing through sieve having 40000 holes in one square inch)	
3.	Benchmark for specific pulverized coal consumption?	50-55 kg/T (RM: 4" thick Ingot) 45-50 kg/T (RM scrap thickness 10-35mm)	May vary as per GCV of Coal
4.	Benchmark for Scale loss?	1.0-1.5% (Ingots) 2.5-3% (Scrap)	
5.	How to reduce coal consumption & scale loss?	i. Heat the raw material inside furnace as per the heating capacity of furnace ii. Insulate the furnace & its inspection doors iii. Do not allow flame to touch the raw material. iv. Coal must be pulverized to 200 mesh v. Shift to hot air combustion by providing well designed recuperator. vi. Provide variable frequency drive with induction motor on FD fan and pulverizer as proper air fuel ratio would be maintained during lunch/tea break, change over of product and before shut down when fuel requirement used to be less. vii. Provide instrumentation like temperature gauge, thermocouples, butterfly valve, heat spy, electronic counter, flue gas analyzer etc to optimize the air fuel ratio & furnace temperature control viii. Install well designed APCD with proper specifications ix. Install ID & FD fan as per specifications and manufactured by reputed fan suppliers. x. Provide proper size of air seal & damper plate at proper location. xi. Operate the furnace with completely closed bypass	
6.	From where we can get the specifications of ID & FD fan?	PSCST or from consultant who has designed APCD for specific mill.	

Q. No.	Questions	Answers
7.	Can we fabricate APCD, recuperator & Burner in our mill, ourselves?	No. Only reputed machinery manufactures/ fabrication house having sophisticated fabrication facilities in terms of machinery & skilled workmanship can fabricate these equipments.
8.	How to stop the flue gas being emitted from furnace & maintain the proper suction or draft inside furnace?	Emissions from doors and other openings are due to positive pressure inside the furnace which is not at all desirable as it is the main cause for higher scale loss. To overcome this, FD & ID fan must be of adequate capacity in terms of its flow rate, pressure and power. Slight adjustment of pressure inside the furnace is achieved by regulating damper position placed in the flue duct.
9.	What should be the Oxygen percent in flue gas?	2-4% or 10-20% excess air
10.	Size of air seal & its importance?	Air seal should be slightly bigger than the uniform diameter of chimney. Absence of air seal drops the furnace temperature during shut down period.
11.	Location of air seal?	Preferably in between base of chimney & bypass wall or otherwise just before APCD.
12.	Use of damper plate?	In case of large deviation in the size of raw material (TMT, Scrap, Bone etc), damper plate helps in maintaining the desired pressure in the furnace. It also restricts the heat loss during shut down. It should be at least 3 inch thick and preferably gear operated.
13.	How to select the AC drives?	AC drives to be installed should be as per the specified rating of Induction motors. RPM must be displayed on AC drive panel.
14.	What should be the horse power at induction motor placed with ID fan?	Remember! Horse power at ID fan will always be more than FD fan for proper suction of flue gas during cold start up. The specification of motor are to be provided by APCD consultant which is to be worked out on the basis of required flow rate, total pressure (including pressure of cold flue gas) and temperature of flue gas at ID fan during normal raw material heating process.
15.	How to check the pulverized coal consumption?	By installing electronic counter. Calibration of counter should be done after change in quality of coal.
16.	What is the payback period for hardware cost for implementations of energy conservation & air pollution control?	5-6 months for conventional mills.

Q. No.	Questions	Answers
17.	APCD constitutes of what components?	Cyclone with rotary valve, scrubber with water seal in case of self-induced scrubber, well designed ID fan with rated power & compartmentalized sedimentation tank of proper size.
18.	How to reduce the acidic nature of scrubbing water?	Add caustic soda in the last compartment of sedimentation tank from where scrubbed water is being pumped to water distribution system. Adjust the pH between 5-7 which can be checked by pH paper.
19.	Is it necessary to operate the rotary valve continuously?	Yes. Otherwise efficiency of cyclone will reduce.
20	How much air is required for 1 kg of coal?	8-12 kg depending on quality of coal
21.	How to check the static pressure of FD fan?	U-tube manometer
22.	How to attain the 200 mesh standard in pulverizer?	Pulverizer should be equipped with: ❖ Hammer with high manganese or carbon steel. ❖ EN-9 or 31 liner ❖ Classifier: Properly designed at specific locations ❖ Shaft rpm : As suggested by pulverizer manufacturer
23.	How to check mesh size?	Mesh size of coal can be checked by analytical test sieve (200 mesh, BIS mark) & can be purchased from New Delhi or Ambala.
24.	What parameters are required to check for quality of coal & from where parameters can be checked?	Coal quality can be ascertained by: i. Proximate analysis which determines Ash, Moisture, Fixed Carbon & Volatile matter ii. Ultimate analysis which determines Carbon, hydrogen, Nitrogen, Sulfur & oxygen. Ultimate analysis also helps in calculating the volume of air required for optimum combustion of pulverized coal. iii. GCV (kcal/kg) : Heating value of pulverized coal highlighting its energy contents. These parameters can be got analyzed from fuel analysis laboratories. Number of addresses is available on internet otherwise Council can be consulted.

Q. No.	Questions	Answers
25.	What are the likely reasons that most of the rolling mills have not adopted energy conservation measures (ECM)?	Main reasons for not implementing ECM are: i. Lack of genuine technical guidance. ii. Casual culture of only depending on foreman/ traditional system iii. Financial constraints iv. Absences of ECM guidelines as none of the govt. departments have thought over its implementation.
26.	What are the benefits of newly designed shell & shell waste heat recovery system - Recuperator?	❖ Conventional Shell and Tube recuperator replaced with "Shell and Shell" type recuperator. ❖ Recuperator installed above ground with easy access for maintenance. ❖ Duly insulated to reduce the heat losses. ❖ Designed preheated temperature (250°C) ❖ Hot air conveying of pulverized coal to the burner.
27.	Working principle & mechanism of coal pulverizer	Rolling mills usually use Hammer Mill for pulverization of coal which uses principle of "impaction". Hammers, liner, classifier & inbuilt blower are the components of impact coal pulverizer. Well designed Classifier is the main component which allows the required mesh size of coal particle to pass on to storage bin (hopper).
28.	Significance of particle size	For complete combustion of pulverized coal, it must be pulverized to 200 mesh. Pulverized coal of 200 mesh burns like a gas and during combustion of coal, maximum of dust (ash particles) floats out of furnace with flue gas. Proper meshing of coal reduces the requirement of excess air required for combustion which will also reduce scale loss.
29.	Principles of efficient combustion and significance of burners.	**Time, Temperature & Turbulence** are three parameters that take part in combustion mechanism of fuel. These parameters may be achieved by providing a well designed burner. **Excess Air :** Extra volume of air required (in addition to theoretical air calculated from ultimate analysis of coal) for complete combustion of coal. About 10-20% excess air is required in case of pulverized coal. **Static Pressure :** Pressure of blower required to create a negative pressure in venturi so that pulverized coal may be sucked into coal conveying pipe. Pressure is also to be adjusted for combustion of coal at burner. **Primary air :** Air used to convey pulverized coal **Secondary air:** Air used to mix at burner with primary air.

Government proposes to hike peak rate of customs duty on steel products

The government proposes to hike peak rate of customs duty on steel products from 10 to 15%. This will help it raise customs duty upto 15% in a move that is likely to help stem the flood of cheap imports from Russia and China. While this was part of recommen-dations made by finance minister Arun Jaitley in his budget speech, the timing of the decision will depend on the government notification after the budget is approved by Parliament. It is more in the nature of an enabling provision and clearly sets out the government's intent, a ministry official said.

Domestic steelmakers who have been urging the government to raise customs duty on steel in the wake of huge surge imports this year, were keeping their fingers crossed. "For finished and semi-finished products of steel sector, tariff rate limit has been enhanced from 10 % to 15 %. This has created possibility of increase in import duty in the interest of domestic steel industry," steel & mines minister Narendra Singh Tomar said.

Between April 2014 and January 2015, volume of steel imports had gone up by 58% to 8.1 million tonne (mt). Out of this the imports from China amounted to 2.9 mt, according to the steel ministry data.

Rajiv Rajvanshi, senior VP- Corporate Strategy, Jindal Stainless Limited. "Finance Minister has proposed peak rate of custom duty on iron & steel from 10% to 15%, which would allow government to increase custom duty upto 15%. No immediate relief has been provided to the sector which is reeling under huge surge in imports mainly from China. We had hoped that keeping in view the large scale dumping taking place, basic custom duty on finished stainless steel products would have been increased and duty on input material like stainless steel scrap and nickel would have been done away with." A senior official of one of India's largest private sector steel companies said the budget sets out a roadmap and the government's intention to earmark a part of its public spending on infrastructure is encouraging. "However, we hope the government takes some tariff measures and the effective customs duty on steel is raised and those on iron ore and coke are reduced. This is an area of concern for the industry. The increase in clean energy cess on coal will raise our cost of production," Jayant Acharya, director (commercial & marketing), JSW Steel said.

The long term impact of the budget measures on the steel sector would be moderately positive, according to Jayanta Roy, senior VP, Co-head corporate sector ratings ICRA. "Increased tariff rate on iron and steel from 10% to 15% is expected to discourage imports. Additionally, the emphasis on housing as well as other infrastructure areas like roads and railways is also a positive. Secondary steel producers would also benefit from the reduction in special additional duty (SAD) on steel scrap imports," he said.

Analysts, also pointed out that the increase in clean energy cess on coal will have a negative impact on costs of steel and aluminium companies by 4-5%. "The hike in clean energy cess on imported coal from Rs 100 to Rs 200 per tonne will have a 4-5% impact on costs across the steel and aluminium industry, both of which are coal/energy intensive. However, the duty hike on met coke from 2.5% to 5% will have a marginal impact on cost of production since steelmakers use imported/domestic coking coal to produce coke indigenously inside coke oven batteries," Abhisar Jain, research analyst at Centrum Broking said. Achal Chawla, Director (Tax & Regulatory Services) E&Y said: "Clean energy cess is a downside for metal industry while reduction in SAD for metal scrap of iron & steel, copper brass and aluminum from 4% to 2% is an upside." ICRA's Roy also felt coal cost of steel players would increase due to an increase in clean energy cess on coal, while the higher import duty on coke would impact blast furnace players importing coke.

Source : The Economic Times, 28th Feb., 2015

Railway Budget offers a mixed bag for struggling steel industry

The Railway budget offers a mixed bag for the struggling domestic steel industry. Cost of steel production will go up due to 0.8 per cent freight hike on iron ore and steel and a 6.3 per cent increase on coal movement. However, with domestic steel demand yet to pick up, and a very real threat of imports most major companies are likely to absorb the hike.

On the other hand, the Indian Railways' massive Rs 8.5 lakh crore investment over the next five years in new capacity and lines presents a huge growth opportunity for steel industry. In FY 16 alone, Railways is supposed to invest an whopping Rs 96,000 crore. However, budget's freight hike on coal movement is expected to hit aluminium players like Hindalco and Vedanta hard, just after aggressive coal block auctions.

Amod Khanorkar, General Manager, Ratings at CARE said, "Companies will have to absorb the hike. Steel companies will face pressure on profit margins because they can't pass the hike to consumers. They already are facing competition from cheap imports. In particular, auto ancillary industry will suffer as they consume pig iron, secondary steel industries will suffer as they use steel scrap. Aluminium and power companies will take the biggest hit as these companies consume coal in high quantity."

The Railways plan to invest Rs 8.5 lakh crore over next five years was a positive for the steel industry, according to SAIL chairman CS Verma. "The budget has laid down a road map for next five years with an investment of 8.5 lakh crore. Thrust on capacity augmentation for Indian railways including up-gradation of network, increasing of track capacity, gauge conversion and track doubling and tripling would lead to improved steel consumption," Verma said.

However, SV Sukumar, Partner (Strategy & Operations) KPMG in India felt the budget has not addressed the main concern of "Logistics cost" for the India Inc. and that will continue to remain high. "Unfortunately, this is not going to help our 'Make in India' campaign", he said.

Aluminium and power companies are already facing high cost of captive coal after aggressive bidding in the first phase of coal mine auctions. A sharp hike in coal transportation costs will add to their cost woes. Aluminium is an energy intensive metal. Six to seven tonnes of coal is required to produce one tonne of aluminium. Hindalco Industries and Vedanta Resources will be at the receiving end as they both have undertaken massive expansion but domestic demand has not kept pace and prices remain weak globally.

Source : The Economic Times, 26th Feb., 2015

Private firms to set up solar projects worth Rs 13,500 cr

New and Renewable Energy Minister Bikram Singh Majithia signed MoUs with private companies to set up five solar projects worth Rs 13,500 crore and establish five bio-ethanol-based refineries here today.

The agreements between the state government and the companies were reached during the ongoing Renewable Energy Global Investors Meet and Expo-2015.

The Punjab government said the companies and related projects include an investment of Rs 4,000 crore by a California-based 8-Minute Energy. The company will reportedly set up 500 MW ground-based power plants. The UK-based OTV Energy company will also undertake a Rs 4,000 crore venture.

The others proposed projects are 300 MW canal-based solar power plants with an investment of Rs 2,400 crore by a UK-based Lightsource Renewable Development Ltd; Rs 900 crore Solar/biomass complex by Mohali-based Spray Engineers; 100 MW projects with an investment of Rs 800 by Italy-based Progetika-SRC; and a 200 MW power project with an investment

UPCOMING PROJECTS IN MARCH

Company	Capacity	Location
Essel Renewable Energy	10 MW	Mansa
Essel Clean Energy	20 MW	Mansa
Punj Lloyd Surya Urja	20 MW	Mansa
Omega Solar Energy	10 MW	Sangrur
Welspun Solar Punjab	32 MW	Bathinda

PROJECTS COMMISSIONED SO FAR

Company	Capacity	Location
Azure Urja Pvt. Ltd.	34 MW	Muktsar
Madhav Solar Pvt. Ltd.	04 MW	Mansa
International Switchgears	01 MW	Amritsar

19 New Projects in March

19 new projects likely to be commissioned in March. The projects will generate 215 MW of solar power.

Currently, the state produces 57 MW of solar photovoltaic power. Of this, private players contribute 39 MW while the remaining comes from Punjab Energy Development Agency projects.

of Rs 1,400 crore by PLG Energy Systems. Besides, the minister signed an agreement with Italy-based CVC Infrastructure for establishing five bio-ethanol-based refineries that will be based on paddy straw, napier grass and cotton stalks.

During his interaction with investors, Majithia pitched for floating of solar panels on 22,000 acres reservoir of the Ranjit Sagar Dam. He said the project had the potential of 2,000 MW of solar power.

At a session of the Renewable Energy Global Investors Meet and Expo, the Minister emphasised the need to focus on biomass power. He urged the Centre to revise tariff for biomass projects to enable the farmers to earn additional income.

Source : The Tribune, 17th February, 2015

Sun power: 215 MW solar boost for Punjab by March

Solar power is on the rise in Punjab. Known for heavily relying on thermal generation, the state now produces 57 MW of solar photovoltaic power.

This figure is likely to jump manifold next month with the commissioning of 19 new projects that will generate 215 MW of solar power.

"The target is 4120 MW generation by 2020," says Punjab's Non-Conventional Energy Minister Bikram Singh Majithia. The state government's nodal authority for solar power generation, Punjab Energy Development Agency (PEDA), has received a thumping response from private players to its bids for setting up new solar projects. The state government wants to produce 250 MW of solar power in its second phase of renewable energy generation. It has, however, received proposals that will help in producing 378 MW of solar power. Of these, projects worth 337 MW have been found to be viable, said sources.

Majithia says after commissioning of these projects, Punjab will be amongst handful of states that will follow the new legislation of the Union Government that focuses on generating at least 10% of power in states from renewable energy sources.

"We have received proposals worth Rs 2,000 crore. Many other companies have evinced interest in setting up projects in Punjab," he says.

Vijay Singh, general manager, Azure Power, that has set up three units of solar power plant, having a generation capacity of 34 MW, says companies are enthused by the support being received from the government.

"Our projects were commissioned in October last year. It's been a smooth run for us and we are planning to increase our generation capacity to 500 MW with new projects in the coming years," he said.

The biggest hurdle being faced by solar power companies in Punjab is getting land for the project. "The cost of the land is high and it is difficult to get a contiguous piece of land for a project. So the companies have decided to take land on lease for 30 years from farmers. We are giving a higher lease amount to farmers, with an annual appreciation of almost five per cent, says Luv Chabbra, director (corporate affairs), Punj Lloyd.

The company is setting up 20 MW solar power project in Mansa, which is expected to be commissioned by March.

The companies generating power have a purchase agreement with Punjab State Power Corporation Limited, which buys solar power at rates varying between Rs 7.20 and Rs 8.75 per unit.

In 2013, Punjab had awarded projects with 250 MW capacity to 26 developers across the state. These projects have either been commissioned before time or likely to be commissioned by March this year.

The solar power projects were awarded in two categories - projects which have a capacity of 1 to 4 MW and others between 5 and 30 MW.

Among the companies which have been awarded the projects are Lanco Solar Energy, Punj Lloyd Infrastructure, Moser Baer Clean Energy, Essel Infra Projects, Welspun Solar Punjab and Azure Urja.

Source : The Tribune17th February, 2015

State bags award in renewable energy sector

Prime Minister Narendra Modi here today awarded the 'Best Performing State Award' in renewable energy capacity building to Punjab for its innovative and result-oriented solar mission. The award was received by Punjab New and Renewable Energy Minister Bikram Singh Majithia.

Congratulating Punjab on its outstanding performance in promoting renewable energy in a big way at the 'Investors Meet and Expo' held at Vigyan Bhawan, the Prime Minister emphasised on using solar power to better the life of the common man.

He stressed on manufacturing equipment needed to create solar power in the country to generate jobs, besides the need to go in for technology upgrade in league with nations that possessed expertise in the field.

During an interaction with investors, Majithia said Punjab had achieved much in the renewable energy sector in a short period due to "political will and innovative ideas". He exhorted the entrepreneurs to invest in Punjab as the state was committed to extending every possible support to them to set up their projects.

Pointing that Punjab had formulated a policy to allot projects within 60 days by using single window project clearance system, he said as the minister in charge he himself monitored day-to-day developments, besides involving the district administration to address local issues on the spot.

Highlighting the advantages for renewable power projects in Punjab, Majithia said the state possessed the country's best power transmission and distribution system with 66 KVA sub-stations at every 10 km.

He said it also had the country's first ever 400 KVA ring main system covering the entire state, besides excellent road network, healthcare facilities, airports, availability of skilled manpower and above all 'Invest Punjab', a single point project approval facility.

The minister said Punjab also facilitated investors to take up village common land on lease basis as it reduced costs and also supplemented the income of panchayats.

Listing the government's achievements on the solar power front, the minister said Punjab had touched 250 MW solar power figure from 9 MW in a mere two years and was all set to bid out 250 MW solar power projects with investment potential of $430 million.

Majithia said with the Centre's in principle approval to a 1,000 MW mega solar power park, Punjab would soon offer this project also to the industry. He said the state was offering power purchase agreement for 25 years with the state power utility, which made solar projects a viable investment. Punjab had floated India's largest tender of 100 MW grid connected roof top solar power projects after identifying the required roof tops throughout the state.

He claimed Punjab had the world's single largest roof-top solar power project of 7.5 MW in Beas (Amritsar) and 28 MW more were being added there itself. Similarly, Punjab had notified its net metering policy and was committed to set up 200 MW power projects on 1 lakh houses in next three years with the motive of encouraging people to produce their own power, as per a statement issued by the government.

Urging investors to set up biomass power projects, the minister said the state had huge potential of 21 million tonnes of agriculture residue availability.

Source : The Tribune, 16th February, 2015

IMPORTANT WEB LINKS

www.beeindia.in
Bureau of Energy Efficiency (BEE) - India

www.dae.nic.in
Department of Atomic Energy | Atoms in Service of the Nation

www.in.undp.org
Energy Efficiency in Steel Re-rolling Mills, United Nations Development Programme

www.ireda.gov.in
Indian Renewable Energy Development Agency Ltd.

www.mnre.gov.in
Ministry of New and Renewable Energy. Govt. of India

www.nire.res.in
Sardar Swaran Singh National Institute of Renewable Energy

www.nisst.org
National Institute of Secondary Steel Technology

www.peda.gov.in
Punjab Energy Development Agency (PEDA)

www.seci.gov.in
Solar Energy Corporation of India (SECI)

www.steel.nic.in
Ministry of Steels, Govt. of India

www.srma.co.in
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