**Unit Profile**

Tata Steel Group is among the top global steel companies with an annual crude steel capacity of nearly 29.55 MTPA as on March 31, 2016. It is now the world’s second-most geographically-diversified steel producer, with operations in 26 countries and a commercial presence in over 50 countries. The Tata Steel Group recorded a turnover of US $17.69 billion in FY16. Tata Steel Group has over 76000 employees across five continents and is a Fortune 500 company.

Established in 1907, Tata Steel founded and developed India’s first industrial city, now Jamshedpur, where the company established one of Asia’s first integrated steel plants. The Jamshedpur works currently comprises a 9.7 MTPA crude steel production facility and a variety of finishing mills. Tata Steel has a significant presence in allied and downstream areas through its various Strategic Business Units, namely the Tubes Division, Wire Division, Bearings Division, Ferro Alloys and Minerals Division, Industrial By-Products Management Division, Agrico Division and Tata Growth Shop. The company also possesses and operates captive iron ore, coking coal and chrome ore mines.

The Company dedicated the first phase (3 MTPA) of the 6 MTPA greenfield steel project at Kalinganagar to the State of Odisha on November 18, 2015. Tata Steel is also examining further capacity enhancement through greenfield projects in Jharkhand, Karnataka, etc. The Company also possesses and operates captive iron ore, coal and chrome ore mines.
Specific Energy Consumption

The major energy parameters affecting Specific Energy Consumption have been achieved as below:

Long term plan of Energy Conservation:

Tata Steel is committed to bring down the plant specific energy consumption to a level of 5.200 (FY’21) Gcal/tcs from its current level of 5.767 Gcal/tcs (FY16).
Energy conservation measures implemented in 2015-16

<table>
<thead>
<tr>
<th>Years of Commissioning of the projects 2015-16</th>
<th>Project Description</th>
<th>Achievements of Annual Energy Savings in 2015-16</th>
<th>Investment incurred on the project (Rs. lakhs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Elect. (Lakhs Kwh)</td>
<td>Coal (tonne)</td>
</tr>
<tr>
<td>Repairing and modification of West plant LP steam line network to reduce the energy/steam loss.</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Replacement of HP nitrogen consumption by MP nitrogen at Y' Blast furnace</td>
<td></td>
<td>85</td>
<td>-</td>
</tr>
<tr>
<td>Increase in power generation by optimizing cold blast blowing to blast furnaces through Turbo-blower</td>
<td></td>
<td>300</td>
<td>-</td>
</tr>
<tr>
<td>Reduction in Ball Mill RPM at D&amp;G area of Pellet plant</td>
<td></td>
<td>66</td>
<td>-</td>
</tr>
<tr>
<td>Reduction in steam and condensate loss by improving steam trap management</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reduction in power consumption and compressed air loss at HSM compressor House</td>
<td></td>
<td>41</td>
<td>-</td>
</tr>
<tr>
<td>Improving in pulvrised coal injection at Blast Furnaces.</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>492</td>
<td>-</td>
</tr>
</tbody>
</table>

Description of the energy conservation measures:

**Project 1 - Repairing and modification of West plant LP steam line network to reduce the energy/steam loss.**

**Problem Statement:** The steam generated in Power House # 4 & 5 is classified into two categories i.e. HP steam and LP steam. The HP steam is used for power generation through turbines and running of HP steam blowers whereas LP steam is supplied to entire Tata Steel network for various process applications.

Over a period of time, many new facilities have come and steam lines were modified at the departmental levels. It was felt that in order to have better reliability and lowering the energy loss, LP steam network at the West plant needs modification taking the holistic view at the company level. Further, this old network had very limited provision for isolation and back facilities. Several leakages developed in LP steam network could not be attended due to difficulty in isolating these lines. This has resulted in considerable loss of useful energy in addition to unsafe working conditions with high noise at the west plant high line area.

Approximate steam loss was estimated around 15 TPH LP steam due to leakages and other losses. Hence repairing and modification of LP steam line found be essential.

**Solution Statement:** A comprehensive mapping of LP steam network of Tata Steel works was done, the network was studied and analyzed. Based on the analysis, a framework of solutions involving a set of robust action plan was developed and implemented.
After carrying out this repair and modification job, the leakages in LP steam network has been almost eliminated. There was a significant reduction in steam consumption observed. Reliability of network and flexibility in carrying out the maintenance job has also been enhanced. Alternate source of supply to the critical consumers like G, H, & I Blast furnaces etc. was also provided.

Result: The above modification has resulted an annual saving of Rs. 247 lakhs

Project-2 Replacement of HP nitrogen consumption by MP nitrogen at 'H' Blast furnace

The Failure of the HP Nitrogen Compressor Motor of oxygen plant (700 tpd) resulted in HP Nitrogen shortage of 15000 Nm3/hr (450 tpd). Since many of the major operating plants consuming HP Nitrogen were on shutdown it was managed by liquid pumping to maintain the Network Pressure.

However in view of depleting liquid stock at the suppliers end it was decided to lower PCI injection of both H and G Blast Furnaces from the present level of greater than 200 kg/thm to 150 kg/thm by stopping one of the new PCI mills as it consumes very high amount of HP Nitrogen.

It was decided to take trial by MP Nitrogen which is at 4.5 kg/cm$^2$ by laying out line from our central MP Nitrogen network to downstream of control valves of PRS.

After completion of the job, the system was put in service. The PCI mill was given in operation along with the HBF team and it did not get hampered. This resulted in saving of 5000 Nm3/hr of HP Nitrogen. It also helped in reduction of liquid pumping in the HP Nitrogen by 150 tpd.

Similar exercise was done for the Old PCI mill. This resulted in another reduction of 5000 Nm$^3$/hr and zero liquid pumping of HP nitrogen.

Result: The above modification has resulted an annual saving : Rs.324 lakhs

Project-3 Increase in power generation by optimizing cold blast blowing to blast furnaces through Turbo-blower

Problem Statement: Both Demag and Axial blower at Blower House # 3 & 4 respectively are turbo-blower and are connected to ‘F’ Blast Furnace. Demag blower is HP steam driven and Axial blower is LP steam driven. However, Axial blower is much efficient compared to Demag blower. Since two (2) Demag blowers are connected parallel to the header for Blast Furnace blowing, even if one trips, Blast Furnace does not suffer much. Hence there is a tendency to operate Demag
blower more keeping the axial blower as standby. Statistics says that Axial blower is much reliable and had much less number of failures as compacted to Demag blower. There is an increasing trend of blowing cost in FY’16. It was also noticed that 30 MW BPTG at Power House # 5 is under loaded and there is a significant margin available in condensing TGs at Power House # 4.

**Solution Statement**: Modification of blowing strategy to increase the loading of Axial blower and for better utilization of in-house power stations. The idea is to supply cold blast to F blast furnace from Axial blower and supply to C & D Blast Furnace from GHH blower. Both the blowers being LP steam driven will enhance the power generation at Power House # 5. This would further improve generation from condensing TGs at Power House #4.

Result: The above modification has resulted an annual saving of Rs.1140 lakhs

**Project - 4 Reduction in Ball Mill RPM at D&G area of Pellet plant**

**Problem/Opportunity Statement/Current Practice:**
Currently Ball Mill at Pellet plant Grinding runs at 900 rpm. There is an opportunity to save power by running at lower rpm

**Solution statement:**

Run Ball mill at 800 rpm instead of 900 rpm. This will have no impact on rate of production and quality of production at pellet plant. No impact on Pellet plant production was observed after implementation of this idea.

Result: Actual audited saving was Rs. 252 lakhs

**Project -5 Reduction in steam and condensate loss by improving steam trap management**

Steam is lost from the distribution system through flash steam and leaking steam traps. Flash steam occurs when the condensate from a steam trap is above the boiling point. Without a flash recovery system in place, the flash steam will be lost. Leaking steam traps are a major source of energy and condensate losses in most distribution systems. Plant conducted a steam trap survey of LP Steam. The field investigation and computer analysis reveals that 44.4% of the in-service traps were found to be defective.
Recommendations:

Install drip trap with proper sizing for efficient condensate removal
1) At all low points in piping.
2) At elevation changes such riser and expansion loops
3) At an interval of 20-30m on horizontal runs
4) Dead end of mains
5) Upstream of pressure and temperature control valve or meters

Result: The above modification has resulted in an annual saving of Rs.104 lakhs

Project -6 Reduction in power consumption and compressed air loss at HSM compressor House

Compressed air is mainly generated in Tata Steel works at Centac Compressor House and at HSM Compressor House. At present total required quantity is 62000 Nm$^3$/hr at 6 kg/cm$^2$ pressure. 75% of the compressed air requirements are met by HSM compressor house. HSM compressor house is a very old system. Its efficiency as compared to new compressors installed in the current phases of Tata Steel expansions is very low.

Goal: Improvement in efficiency of HSM compressor house by 2%.

Main cause of high pressure rate:
- Compressed Air loss in network
- Compressed Air press. drop across flow meters.
- Compressed Air pres. drop across dryer’s & demand controller for instrument air to HSM & Slab Caster
- Blowing off of centrifugal compressors due to improper function of controller.

Solution:

1. Reduce the pressure of the network from 5.7 Bar to 5.4 Bar
2. Replace all the orifice type flow meters with vortex type flow meter.
3. Backwashing the dryer periodically to take out any obstruction in the air heat exchanger which may come from receivers and piping erosions.
4. Install a peer to peer communication system in which compressors communicate with each other about their IGV opening & try to maintain the same inlet of IGV for each compressor.
Result: The above modification has resulted an annual saving of Rs.163 lakhs

**Project -7 Improvement in pulverised coal injection at Blast Furnaces**

Coke rate with increase of coal injection by process improvements with the available system.

Major enablers required to increase coal injection rate from a level of ~ 140 kg/thm to 200 kg/thm at bigger Blast Furnaces ie. G, H & I were identified. These enablers are

1. Increasing oxygen enrichment
2. Optimization of bosh gas volume
3. Higher coke strength
4. Availability of fine coal for injection – Commissioning of PCI Mill # 2 at H Blast Furnace

Cross functional teams were formed to work upon each enabler & came out with detailed action plan.

The study covered the present operating regime and its requirement with new regime of operation. After compilation of the entire studies action plan was developed to take controlled trial in one of the Blast Furnace to establish the process with higher coal injection. I Blast Furnace was selected for this.

The trial was successful and the learning’s of I Blast Furnace was translated in G & H Blast Furnaces.

After implementation of this initiative the monthly coal injection rate of > 200 kg/thm was achieved which is a global benchmark with coke ash of > 16% and alumina input > 55 kg/thm.
Result: In terms of cost reduction the total impact of this initiative is more than Rs 14000 lakhs p.a.
JSW STEEL LTD
Bellary (Karnataka)

Unit Profile

The flagship company of the over $11 billion JSW Group, JSW Steel is testament to decades of experience and a dynamic culture that have culminated in the company becoming the leading manufacturer of value added and high end steel in India. With state-of-the-art manufacturing facilities located in Karnataka, Tamil Nadu and Maharashtra, it is recognized for its innovation and quality. Company strategy of always staying on the leading edge of technical advancement has led to partnerships with global sector leaders such as JFE Steel, Marubeni Itochu Steel, Praxair and Severfield Rowen Plc. This technological edge has helped plants rank among the lowest-cost steel producers in the world and differentiated them from their competitors. With state-of-the-art manufacturing facilities located in Karnataka, Tamil Nadu and Maharashtra, it is recognized for its innovation and quality.
Energy Saving Initiatives undertaken

1. LPG Reduction by N2 injection:

The Vaporized LPG is used in steel plant for pilot burner operation, heating and as a preheating fuel for oxy-fuel cutting of steel. The LPG usage was brought down without disturbing to process by injection of N2 in LPG.

Risk: Injection of inert gas like N2 into LPG will reduce the CV, which is vital for combustion and Adiabatic flame temperature, which is important for Oxy-fuel cutting operation. Increased amount of N2 beyond optimum volume percentage will cause flame failure and hence production delay. Challenge to ensure uniform mixture.

LPG Savings in FY 2015-16: 10.6 Tons per day
Savings in FY 2015-16 (Rs): 4.2 Lakhs per day
Investment: Nil (Developed Inhouse)
2. Improvement in LD Gas Recovery through Corex Gasholder:

With present LD#1 & 2 gas holder capacity of 30 KNm3 & 50KNm3 the Specific LD gas recovery is in the range of 76~78 Nm3/TLS, scope available for recovery is 90~92 Nm3/TLS.

With commissioning of DRI all the HP corex gas supplied to DRI for producing DRI. Hence Utilization of existing ruptured seal of Corex gasholder by revamping it and by inter connecting LD2 gasline with DN2500 Corex gasline by taking shutdown and isolating from mixed gas network the project got commissioned in Sept 2015. The Corex gasholder is utilized to recover excess LD gas for process requirement.

Advantages:

1) Increase in Specific LD gas recovery, LD#1 11.62 & LD #2 9.1 Nm3/TLS
2) Avoided investment in new gasholder.
3) Reduced pressure & CV variations in mixed gas network.

Savings : Oct 2015 to March 2016: LD 1: 3.5 Crores & LD 2: 4.7 Crores
Investment : Rs 13.4 Crores

3. Blast Furnace 1 modernisation:

Capacity of Blast furnace 1 was enhanced. w.e.f Feb-2016 by rebuilding its working volume to 2000 Cu.m from 1107 Cu.m (enhancement of capacity from 0.9 to 1.90 Mtpa)

Accordingly, BF gas pipe line erection done to utilize the excess BF gas generated due to capacity enhancement of BF1 into the network to reduce BF gas flaring.

Pipeline Investment (Rs) : 17.4 Crores
Excess BF Gas Utilisation : 120 KNm3/hr
4. **Reduction in oxygen venting through strategic decision & optimization of pressure:**

I. Optimisation of HP oxygen pressure settings & implementation of buffer operation through logic control at different oxygen plants located at different geographical locations within the plant boundary.

II. Strategy to optimize supply and demand post commissioning of PIPL2: After PIPL2 commissioning a strategic decision was taken to stop a compressor at JPOPL to reduce the venting & save power consumption.

![Graph showing reduction in O2 venting](chart.png)

**Energy Efficiency through Operational Improvements for FY 16:**

- Increased TRT power generation form 19.3 MW to 22.2 MW by improving the furnace availability.
- Installed VVVF drive at pellet plant 2 for Updraft drying fan for 3.75 MW motor, resulted in 0.455 MW power saving.
- Reduction of energy consumption in HSM 2 through modification of Descaling system nozzles by low flow high impact type of nozzles. Power saving 2.3 MW.
- Installed 2 X 60 KNm3/hr capacity of Atlas Capco booster to cater high pressure requirement of LCP & Pellet Plant. Improved lime quality due to consistent pressure supply.
- Increased Pulverized coal injection in to Blast furnace by 7.6%
- Reduced solid fuel rate in Sinter plant by 5%
- Minimising the suction losses in sinter machine of SP 1 by reducing the gap between car body and front plate there by reducing the waste gas fan rpm & reduced power consumption by 2160 units per day.
- Reduced HSM heat rate by 10% due to higher hot charging & by optimized air to fuel ratio.
- Total 80 six sigma projects were completed & 2071 kaizen's were implemented which has benefited the organisation.
Energy Policy

We, at JSW Steel committed for energy conservation and resource optimization through continuous monitoring of energy parameters and strive to optimize its utilization in a cost effective manner by

- Continuously working for energy efficiency in the shops by surpassing the targets.
- Adopting best of the best innovative energy efficient technologies in utilization of energy.
- Capturing waste heat to the last of calories and recycling all the calories of the process waste.
- Working towards achieving lowest specific energy consumption among Integrated Steel Plants.
- State of art energy centre to ensure real time control of energy parameters for un interrupted plant operation and safety.
- Effective energy management to neutralize the impact of continuously increasing energy input cost.

JSW is poised to take the lead in the fight against climate change and its impact by achieving world benchmark in CO₂ emission per ton of crude steel.

Date: 14th Dec 2010

Dr Vinood Noural
Director & Chief Executive Officer

Steel Limited, Vijayanagar Works
Unit Profile

India’s steel and power consumption is expected to rise significantly as the economy creates more opportunities across the social pyramid. Value added materials and solutions for construction are also expected to enjoy considerable market traction. At JSPL, company believe that the Government’s Make in India initiative was a timely response to galvanise the manufacturing sector into action; and to elevate the country’s manufacturing expertise to match global standards. The unit is investing in new capabilities, technologies and innovation to create bespoke, value-accretive products that enjoy high demand in domestic and international markets. The initiatives also help strengthen the country’s export sector. Their manufacturing mettle in India and Oman, benefits the nation and the world.
DISPATCHED INDIA’S LONGEST EVER 260 METRE RAILS

JSPL is India’s first and only private sector steelmaker manufacturing Rails. JSPL produced the world’s longest single piece Rail of 121 metre length. During FY2015-16, JSPL dispatched India’s longest ever rails, measuring 260 metres to the Dedicated Freight Corridor Corporation of India Limited (DFCCIL). The 260-metre long rails will be used for the construction of eastern corridor of the landmark 350 kilometre dedicated freight railway network in India.

Energy Consumption

![Energy Consumption Chart]

Process Route: DRI (Coal Based)-BF-EAF-Power plant

Major Energy Conservation initiatives taken in FY 2015-16

<table>
<thead>
<tr>
<th>Projects</th>
<th>Electricity Lakh kWh</th>
<th>Coal (Ton)</th>
<th>Coal in (MTOE)</th>
<th>Total saving in Rs. Lakhs</th>
<th>Investment (Rs. Lakhs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric arc furnace (EAF-1) converted into New Oxygen Furnace (NOF)</td>
<td>2894</td>
<td>7236</td>
<td>12000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of Timer for total 588 nos. 400W Shed &amp; Flood Lights in Eight Different Bays in MLM</td>
<td>1.693</td>
<td>4.23</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of LV VPD in 1D Fan 3A and 3B (AFBC # 3) in Power plant -2</td>
<td>7.440</td>
<td>18.6</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic Start/Stop of Dilution Fan in MLM</td>
<td>0.324</td>
<td>0.81</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Furnace Charging Hydraulic Automatic Pump Stoppage in MLM</td>
<td>0.741</td>
<td>1.85</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Better quality coal in AFBC boiler in power plant-2</td>
<td>66173</td>
<td>16232</td>
<td>398</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of 15 KW PV Solar Power Panel in DCPP</td>
<td>0.124</td>
<td>0.36</td>
<td>12.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replacement of Cooling Tower Fan Blades from GRP to FRP in DCPP</td>
<td>7.844</td>
<td>22.2</td>
<td>12.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of control valve in Instrument Air header for diverting air to AHP</td>
<td>22.826</td>
<td>64.6</td>
<td>1.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2935</strong></td>
<td><strong>66173</strong></td>
<td><strong>16232</strong></td>
<td><strong>7747</strong></td>
<td><strong>1204</strong></td>
</tr>
</tbody>
</table>
ENERGY CONSERVATION ACHIEVEMENTS

Electric arc furnace, EAF -1 has been converted from Electric Arc Furnace to New Oxygen Furnace, now there is no arcing required therefore the electrical energy which was required earlier (342kWh/t) has now been saved. Specific Energy consumption of SMS has reduced from 1.515 Gcal/tcs in FY 2014-15 to 1.241 Gcal/tcs in FY 2015-16. This technology is basically a retrofit to existing Electric Arc Furnace (EAF) and is being used for the first time in the world as it was specially developed for JSPL. Even after the modification this furnace can also be used as Electric Arc furnace (EAF) since it already have stand by Electrode system for Electrical operation.

About NOF:

- Record Average Tap to Tap Time of 34 mins.
- Benchmarking production of 42 heats in a day
- Excellent figures with Yield (LM) of 87.0 – 87.5 %.
- Record Commissioning Time of 10 days only.

There are total 588 nos. of 400W Shed & Flood Lights are installed in Eight Different Bays of MLSM. Previously no timer control is available for Switching ON/OFF of these lights and as a result of which there is extra energy consumption of 14112 units per month and as a result of which there is Loss of Rs.41630 Per Month & Rs 499564 Per Year. But after installation of timers for switching of these lights at various locations, there is energy saving of 14112 units per month and 169344 units per Year.

To reduce the power consumption of ID Fan, new motors equipped with Variable frequency drive is introduced in ID Fan 3A and 3B (AFBC # 3)

Av. Power consumption 2 fans before: 132 kW
Av. Power consumption 2 fans after: 85 kW

In power plant, DCPP 15KW solar power panel installed in Stores building and supplying power from non-conventional source instead of normal supply.
ENERGY CONSERVATION PLANS & TARGETS

<table>
<thead>
<tr>
<th>ENERGY CONSERVATION PLANS</th>
<th>Completion year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitors to be installed in BF-1, LDP, PGP-2, PGP-3, Plate mill, power plant-2, Sinter plant, SMS_2, SMS-3 to improve power factor</td>
<td>2016-17</td>
</tr>
<tr>
<td>Optimise size of pumps in SMS</td>
<td>2016-17</td>
</tr>
<tr>
<td>Installing VFD in Descaling Pumps, CA fan in plate mill, PA fan PP-2</td>
<td>2016-17</td>
</tr>
<tr>
<td>Fuel saving by improving insulation in RH furnace of Plate Mill</td>
<td>2016-17</td>
</tr>
<tr>
<td>Replacement of steam traps in all location</td>
<td>2016-17</td>
</tr>
<tr>
<td>Waste Heat Recovery from 1. Sinter cooler 2. EAF- 3</td>
<td>208-19</td>
</tr>
<tr>
<td>Hot stove waste heat recovery in BF-2</td>
<td>2017-18</td>
</tr>
<tr>
<td>Modification of RH furnace with regenerative burner in rolling mill</td>
<td>2018-19</td>
</tr>
</tbody>
</table>

Energy Policy

Due to adoption of energy saving products/measures, better capacity utilization, waste utilization, fuel substitution, etc., overall specific energy consumption of the plant from FY’2007-08 to 2015-16 has been reduced by 16% in total.