Annexure 'A' to the Directors' Report:

PARTICULARS REQUIRED UNDER THE COMPANIES (DISCLOSURE OF PARTICULARS IN THE REPORT OF THE BOARD OF DIRECTORS) RULES, 1988:

Conservation of Energy

a. Energy Conservation measures taken:

i. Commissioning of TRT at 'I' Blast Furnace.

ii. Higher steam generation through CDQ of battery # 5, 6 and 7.

iii. Enhanced use of lean gas for heating and reheating purposes.

iv. Use of Pellets at Blast Furnaces to reduce coke rate.

v. Mixing of propane (in-house designed) in CO gas main to enhance the calorific value, thereby building capability to use more LD gas.

vi. Efficient use of by-product gases for Power Generation – Highest ever in-house power generation through by-product gases.

b. Additional investments and proposal for reduction of consumption of energy:

i. Commissioning and operation of new LD Gas holder and its export system so as to recover LD Gas from all the three (3) steel melting shops at a benchmark level of 80 Nm^3/tcs.

ii. Recovery of sensible heat of coke by installation of Coke Dry Quenching system in battery 10 and 11 at Coke Plant.

iii. Replacement of one boiler of higher efficiency at Power House # 4.

iv. Energy Audit.

c. Impact of the above Measures:

Energy Conservation measures during the Financial Year 2012-13 has resulted in achieving:

i. Plant specific energy consumption – 6.083 Gcal/tcs.

ii. Highest ever LD Gas recovery – 58,893 Nm^3/hr.

iii. Highest ever combine boiler efficiency – 85.55%.

iv. Lowest ever fuel rate at New Bar Mill – 0.207 Gcal/t.

Form - A

Form for disclosure of particulars with respect to Conservation of energy: 2012-13

Particulars	2012-13	2011-12	Difference	Reasons for variation
A. POWER & FUEL CONSUMPTION				
1. Electricity				
(a) Purchased				
Units (M. KWH)	**3,348.18**	*2,545.63*	802.55	Increase in consumption due to commissioning of
Total Amount (₹ Lakhs) #	**133,144.51**	*98,653.43*	34,491.08	new facilities under 3 mtpa project.
Average Rate/Unit (₹/KWH)	**3.98**	*3.88*	0.10	
(b) Own Generation				
(i) Through Diesel Generator				
Units (M. KWH)	**5.08**	*4.09*	0.99	
Units per litre of Diesel Oil (KWH)	**3.59**	*3.73*	(0.14)	
Average Cost/Unit (₹/KWH)	**39.13**	*37.49*	1.65	Increase in Diesel price.
(ii) Through Steam Turbine/Generator				
Units (M. KWH)	**1,021.50**	*995.83*	25.67	In house generation increased due to increase
Units per tonne of Coal (KWH)	**8,509**	*9,107*	(597.95)	in demand.
Average Cost/Unit (₹/KWH)	**2.52**	*2.41*	0.12	
(* This includes generation of PH4 in M KWH which is operated on by-product gases upto 95%)	**324.64**	*242.62*		
(iii) Through TRT				
Units (M. KWH)	**129.23**	*105.24*	23.99	Power generation started through Top recovery
Average Cost/Unit (₹/KWH)	**2.00**	*2.00*	(0.00)	turbine of 'I' Blast Furnace.
2. Coal				
(i) Coking Coal & Cokeries				
Quantity (Million Tonnes)	**5.57**	*5.39*	0.18	Increase in coke production.
Total cost (₹ Lakhs)	**448,487.37**	*469,866.54*	(21,379.17)	
Average Rate (₹/Tonnes)	**8,057.72**	*8,721.82*	(664.10)	
(ii) Blast Furnace Injection Coal				
Quantity (Million Tonnes)	**0.95**	*0.87*	0.08	
Total cost (₹ Lakhs)	**107,439.33**	*116,867.14*	(9,427.81)	
Average Rate (₹/Tonnes)	**11,303.04**	*13,412.19*	(2,109.15)	Decrease in imported Coal price.
(iii) Middling Coal and ROM				
Quantity (Million Tonnes)	**0.11**	*0.10*	0.01	
Total cost (₹ Lakhs)	**1,990.41**	*1,679.89*	310.52	
Average Rate (₹/Tonne)	**1,732.00**	*1,602.43*	129.57	Increase in middling cost at West Bokaro.
3. Furnace Oil				
Quantity (Kilo Litres)	**13,063.84**	*15,424.23*	(2,360.39)	
Total Amount (₹ Lakhs)	**5,492.49**	*5,637.40*	(144.91)	
Average Rate (₹/KL)	**42,043.44**	*36,548.98*	5,494.47	
4. Others				
L.D.O.				
Quantity (Kilo Litres)	**2,618.95**	*2,390.15*	228.80	Higher generation of power through DG.
Total cost (₹ Lakhs)	**1,527.46**	*1,264.22*	263.24	
Average Rate (₹/KL)	**58,323.51**	*52,892.98*	5,430.53	Increase in Diesel price.
5. Others				
L.P.G.				
Quantity (Tonnes)	**7,644.60**	*7,623.76*	20.84	
Total cost (₹ Lakhs)	**4,627.98**	*3,933.98*	694.00	
Average Rate (₹/Tonnes)	**60,539.20**	*51,601.57*	8,937.63	
6. Others				
HSD. Oil				
Quantity (Kilo Litres)	**44.86**	*49.69*	(4.83)	
Total cost (₹ Lakhs)	**21.44**	*22.40*	(0.96)	
Average Rate (₹/Tonnes)	**47,793.13**	*45,079.49*	2,713.64	

Excludes electricity duty paid on purchases.

B. CONSUMPTION PER UNIT OF PRODUCTION

Particulars	Steel (per tonne)	Tubes (per tonne)	Bearings (per no.)	F.A.M.D. (per tonne)	Growth Shop (per tonne)	CRC West (per tonne)	Wire Div. (per tonne)
Electricity (KWH)	**416.00** *(351.00)*	**107.00** *(105.00)*	**0.38** *(0.33)*	**3,580.59** *(3,728.05)*	**537.68** *(531.67)*	**84.03** *(81.88)*	**209.22** *(216.14)*
Furnace Oil (Litres)					**13.59** *(10.09)*	**3.61** *(4.55)*	**21.10** *(25.50)*
Coking Coal (Tonnes)*	**0.55** *(0.59)*						
Others:							
Light Diesel Oil (Litres)	**0.27** *(0.26)*						**1.66** *2.04*
High Speed Diesel Oil (Litres)		**0.21** *(0.20)*					
L.P.G. (kg)						**9.61** *(9.99)*	**19.46** *(20.01)*

* Coal consumed in HMC for producing Coke has not been considered for this calculation.

Form - B

Form for disclosure of particulars with respect of Technology Absorption 2012-13.

Research and Development

1. **Specific Areas in which R&D was carried out by the Company:**
   - Raw Materials
   - Cost and productivity
   - Market and new products
   - Energy and Environment
2. **Benefits derived**
   - Coal leaching technology has been demonstrated successfully at pilot scale for producing 8% ash clean coal from washery tailings. Regeneration of the chemicals and reduction of energy cost are the remaining challenges for commercial exploitation of the technology.
   - Promising results obtained for extracting low ash (4%) coal with reasonable coking properties from some non-coking coals through organo-refining process. Energy reduction and technology up-scaling are the remaining challenges going forward.
   - Successful pilot scale demonstration made for recovering concentrate with <2.5% alumina from iron ore ultra-fines rejects (<25 micron). The process has been included in the iron ore total beneficiation scheme.
   - Remarkable improvement in pellet strength and RDI has been achieved by adopting a new flux combination (Pyroxenite & Limestone). Future challenges include decreasing the dust generation during pellet making and pellet handling.
   - R&D studies have helped in eliminating inconsistency in liquid steel chemistry prior to continuous casting for welding electrode steels at LD1.
   - Implementation of new SEN designs developed by R&D for reducing slivers in coils, process improvement has been recorded at LD2, product testing is under way.
   - NEST IN Brand has been developed jointly with M&S FP. Response is good – price optimisation in process.
   - Thin organic coating (TOC) for GI tubes (Tata Pipes) developed by R&D for the first time in India, process facility commissioned in Tubes Division, optimisation is the challenge ahead.
   - Successful commercialisation trials of Fire Resistant Steel for Structura Tubes completed.
   - Application of laser-cladded rolls has resulted in significant life enhancement of LD2 foot rolls.
   - Major EVI carried out with M&S FP for Tata Motors, TVS and Bajaj. Cost savings have been reported by M&S. VAVE workshop hold with Volkswagen globally for the first time.
3. **Future plan of action**

In order to maximise value creation and create stake holder delight by world class differentiating research R&D shall continue to improve the competitive position of Tata Steel by carrying out research related to Tata Steel's present operations as well as its future business needs. Being a corporate function, R&D aligns itself to the objectives and strategies outlined in the Corporate Vision. Financial Year 2013-14 shall continue with the objectives of process and product innovations, improving existing production processes, support new product development and building world class R&D to sustain and excel.

4. **Expenditure on R&D** (₹ in crores)

(a)	Capital	3.96
(b)	Recurring	55.77
(c)	Total	59.73
(d)	Total R&D expenditure as a % of Total Turnover	0.15%

Technology Absorption, Adaptation and Innovation

Efforts made on the process front:

Product:

- Improvement in surface quality with respect to rolled in scale resulted in increase of skin panel yield.
- Reduction in strip breakages at PLTCM through Process Control measures.
- Development of Chemistry and rolling parameters in TSCR for grades such as Yst-38, SAPH 540, API-60 etc. All these grades have shown consistency in mechanical properties through this development. This is a positive trend towards TSCR stabilisation.

- Development of suitable passivation for PLASMA coated rebar and stabilisation of the pilot line at Nagpur for the production of coated rebars.
- Development of air cooled rebars with high UTS/YS ratio (above 1.25) for the applications requiring earthquake resistance.

Pellets:

- Improvement in CCS by addition of flux (lime stone), which resulted in better slag bonding. Utilisation of pellet in bigger iron making furnaces improved.

Sinter:

- Reduction in RDI sinter through magnesium chloride coating.

Nut coke:

- Improvement in reactivity of coke through iron oxide coating. Charging of nut coke and sinter together improved the reactivity of nut coke and thereby the consumption of nut coke could be increased to 200 kg/t HM in E furnace.

Waste to wealth

- Projects to do with
  1. Development of iron ore slime briquettes as a replacement of iron ore lump in LD converter.
  2. Production of DRI from slime and waste coal.
  3. Development of smelting process for the production of hot metal from waste materials such as Iron oxide slime and Jhama Coal. In the process strong briquettes containing iron ore slime and Jhama coal have been developed. The melting will be done in low shaft furnace. The whole process development will result in generation of several patents.
  4. Production of pavement bricks and sewer covers from steelmaking slag.

Patents and Technical papers

- NML-TSL initiative has taken off well. Many good projects were completed. Quite a few of them have resulted in International publication and generation of patents.

Biodiesel

- A detailed project report has been made for the production of Diesel from Jatropha.

Tubes Division:

- New Straightener installed in Precision Tube Mills to increase the contribution from Telescopic Front Fork (TFF) Production.
- Thin Organic Coating (TOC) line installed in Standard Tube Mills to improve the quality of Plumbing Tubes.
- New Welding Machine installed in 3" PT Mill.
- Development of Online Zinc Coating mechanism on welded seams at EPAs.
- Stabilisation of Cold Saw Technology in Precision Tube Mills to get burr free ends.
- Development of low cost high strength Cold Rolled Coils for Precision Tubes.
- Development of 300x200 mm tubes for structural application.
- Development of value added components like Strut, Keel and Rib for AREVA Solar.
- Development of Ultra Thin Galvanised Tubes for Structural Application.
- Development of Thin Organic Coated Pipes for Plumbing segment. Commercialisation underway.

Bearings Division:

- HUB Bearings manufacturing facility has been installed. Imported grinding machines from IZUMI and assembly machines from R&S successfully installed. Following HUB bearings manufactured through this HUB bearing line.
- Design and development done by using Advanced software ROMAX TECHNOLOGIES, U.K.
- 3D-Modelling software SOLID WORKS installed for DEVELOPING mistake proof Drawings.
- The product and process know how & why has been absorbed form IZUMI and R&S fully automatic HUB Bearings.
- Component design parameters have been benchmarked from customers, suppliers from abroad and India.

FORM B - PARTICULARS OF TECHNOLOGY IMPORTED DURING LAST FIVE YEARS

	Steel Division	Absorption	Status of Implementation
a)	Electric Blowers for 'H' Blast Furnace	2009	Commissioned
b)	Top Gas Recovery Turbine for 'H' Blast Furnace	2009	Commissioned
c)	Flat Cast House Design for 'H' Blast Furnace	2009	Commissioned
d)	Internal Stoves for 'H' Blast Furnace	2009	Commissioned
e)	Use of mixed gas in place for CO gas, for firing in 7th Lime Kiln	2009	Commissioned
f)	New Billet Caster having all the latest facilities and having 9 m casting radius installed in an existing building suitable for 6 m casting radius, by going underground and taking the pass line to (-)3.3 m level	2009	Commissioned
g)	Use of hydraulic mould occilator and hydraulically operated turn over cooling bed at CC 3 at LD Shop 1	2009	Commissioned
h)	Robotised Sample Testing Laboratory at LD Shop No. 1	2009	Commissioned
i)	Top Gas Recovery Turbine for 'G' Blast Furnace	2010	Commissioned
j)	4th Stove for 'G' Blast Furnace to facilitate relining of other stoves, without hampering hot metal production	2010	Commissioned
k)	Continuous Emission Monitoring stations at 4 locations inside Tata Steel Works	2010	Commissioned
l)	Installation of Roll Coating & Drying System at Continuous Galvanising Line at Cold Rolling Mill	2011	Commissioned
m)	Use of Blast Furnace Gas at New Reheating Furnace using regenerative burners at Hot Strip Mill	2011	Commissioned
n)	Installation of Chiller system for maintaining temperature of cooling medium for 'H' Bl. Fce Blower Drives at Blower House No. 5	2011	Commissioned
o)	Installation of 6.0 mtpa Pellet Plant for making pellets using iron ore fines, for use in Blast Furnaces	2012	Commissioned
p)	Installation of New Steel Melting Shop (LD3), and one strand of Thin Slab Casting & Rolling (TSCR) facility	2012	Commissioned
q)	Pipe Conveyor in the Lime handling circuit	2012	Commissioned
r)	Rapid Loading Station at Dispatch Yard of Noamundi Iron Ore Mines, including Extromat Silo Extractor in the fines circuit	2012	Commissioned
s)	Barrel Reclaimer at Noamundi Iron Mines	2012	Commissioned
t)	Installation of 0.25 mtpa FHCR (Full Hard Cold Rolling) Mill at Bara in Jamshedpur	2012	Commissioned
u)	Installation of Coke Dry Quenching facilities at Coke Oven Battery Nos. 5, 6 & 7	2012	Commissioned
v)	Installation of Compactor at Wire Rod Mill	2012	Commissioned
w)	Installation of 0.7 mtpa capacity 5 metres tall Stamp Charge Coke Oven Battery No. 10 with pushing, charging and quenching emission control systems	2013	Commissioned
x)	2 Nos. of 600 tpd capacity, suspended cylinder Lime Kilns	2013	Commissioned
y)	Installation of second strand of TSCR	2013	Commissioned
z)	Online continuous emission monitoring system for stack emissions and ambient air quality	2013	Commissioned
aa)	Coromax Technology for Power Saving in ESP at Sinter Plant No. 3	2013	Commissioned
ab)	Composting Plant for Canteen waste	2013	Commissioned