Energy Saving Proposals being Pursued

1) Energy Source Change for Ladle Pre-heating (Furnace Oil to Electricity)

2) Better Returns from Steel slag

3) Fan-less cooling Tower

4) Heat Recovery from Off gases of EAF

1.Ladle Pre-heating – Energy Source change

- Ladle Pre-heating – Electrical heating Instead of Furnace Oil
- Ladle has to be heated to ~ 1100 Deg.C for receiving liquid metal (to avoid thermal cracking / stress)
- Proposed heater arrangement – 216 KW (18 nos.* 12 KW capacity heaters) placed in a header unit with trolley (For Horizontal unit) & Slider unit for vertical unit)

1.Ladle Pre-heating – Energy Source change

- Measured Data –

- Pre-heated Ladle Temperature – Refractory -1100 +/- 20 Deg.C , Steel Shell (i.e Outside)~ 200 DC , resp.
  New / Repaired Ladle – Temp. of Refractory / shell – 30 DC – Rise in Temp.~ 1070 & 170 DC
  resp.
  B) Ladle In circulation –Incoming temp. ~ 950 DC , Shell - 450 DC , Rise ~ 150 DC & 50 DC
  resp.
  Instruments used – Infrared Pyrometer

1.Ladle Pre-heating – Energy Source change

- Supporting Data –

- Ladle tare weight ~(11.5 + 6.5) ~17 Tons

  Furnace Oil Consumption Data- From Issue Record In 1 ¾ months.

  No. of Ladles heated – 27 repaired (10 working lining new , 9 – 1st repair , 9 – 2nd repair).

  Nos.of re-circulation – 636 nos.

  Typical time required – New / Repaired – up-to 27 to 29 Hours ,1st / 2nd repaired – upto 12 hours , Re-circulation – 2 to 4 hours

1.Ladle Pre-heating – Energy Source change

Ladles are pre-heated when new / repaired or when in Circulation & need different heat input in both the routes.

Total nos. heated = 27 + 636 = 663 in ~ 1.75 months--- Shop Log-book

1.**Ladle Pre-heating – Energy Source change**

Theoretical heat required (based on sp. Heat of refractory & shell & temp. rise)

A) Repaired ladle - 12437600 Kcal / Ladle , F.Oil required = (1243.8 kg = 1351.9 liters ,

B) Ladle in circulation - 1764000 Kcal / Ladle , F.Oil required = 176.4 kg =191.8 liters

1.Ladle Pre-heating – Energy Source change

Theoretical F.Oil required for 27 Repaired ladles & 636 re-circulated ladles in 1 ¾ month

= 27(1.352)+ 636(0.192) = 158.61 KL

ACTUAL CONSUMPTION = 359.18 KL

Gross Thermal Efficiency =

158.61*100/359.18 = 44.2 %

Expenses @ Rs. 28150 / Ton of FO -- Rs. 1,01,10,917 / - for 1 ¾ months

1.Ladle Pre-heating – Energy Source change

For electrical heating system , expected efficiency is 85 to 90% (87.5%).

With this , Kwh / Repaired ladle = (12437600/(0.875*860) = 16528 --- @ Rs. 4.81 / unit = Rs. 79501 / ladle

Kwh / Ladle in circulation = 1764000/(0.875*860) = 2344 Kwh –Rs. 11276 / ladle

For 27 repaired ladle & 636 in circulation ;

Total expected expenses = Rs. 9317779 / -

1.Ladle Pre-heating – Energy Source change

Savings for a period of 1 ¾ months = Rs. 10110917 – 9317779 = Rs. 793138 / -

Annual savings = 793138 *12/1.75 = Rs. 5438661 / -

Investment = Rs. 60 Lacs

Simple Pay back period = 13.2 months = 1.1 YEAR

2.Better returns from EAF Steel Slag

- **Steel slag** – An essential by-product / waste of steel making process(Iron +Lime +1640 Deg.C -Steel Slag) **Typical composition of Tapping slag** is : CaO2 – 28 to 40 % , SiO2 – 10 to 16 % , MgO – 6 to 10 % , FeO – 18 to 32 % , Al2O3 – 4 to 6% , rest – traces.
  Slag Composition & quantity - depends upon type of furnace, charge mix composition, steel grade produced, melting practices, etc.
  Steel slag production~ 4.5 to 5 Tons / Heat of 50 Tons

- **Current Use** – Cutting & Tumbler Processing - **Recovery** ~ 0.07 to 0.1 Ton / Ton of slag AS a metal to be put in Charge Mix

2.Better returns from EAF Steel Slag

- Support data / Lab report – EAF Tapping slag Chemical analysis (XRF M/c).
- Quantity data – Averaged from shop information (Charged qty. – LMT) & stores feedback reg. weigh-ment of metal recovery. Observations of recovery process.
- Improved Option Data – Technical literature, AREA Brochures, etc.

2.Better returns from EAF Steel Slag

- The remains (Non-metallic portion) is used as a land fill , internal road leveling or lies idle.
- **Proposed Use –** The remaining part to be used as - A) **Slag Cement ingredient** – a handsome & compatible source for cement makers due to saving in their energy requirement , CO_2 foot print reduction.
  B) **Usable for Asphalting of roads**.
  C) Sale it as **Rail-road ballast** due to it's unique properties

2.Better returns from EAF Steel Slag

- D) To develop the slag as a Cement Pre-fab Blocks using scrap Silica Bricks of Furnace refractories & cement by crushing –sieving – Molding. This is a construction product & can be processed in plant complex with the help of an outside contractor.

  Existing value recovered ~ Rs. 1300 to 1500 / Heat.

  Proposed Recovery~ Rs. 2000 to 3000 / Heat

2.Better returns from EAF Steel Slag

Improved Benefication– Rs.1000 /Heat

Investment - Nil

Annual addl. Gain = 5000 Heats * 1000 = **Rs. 50 Lacs**

3.Fan-less cooling Tower

- CT2B (DCW -Direct Cooling Water) tower is the one where above proposal is applicable.
- Specifications – Water Flow – 1210 m3/ Hour , Water Inlet , Outlet Temp : =45 & 34 Deg.C resp. WBT – 27
  DC
  Motor of fans – 37 KW * 2 Nos., Opn. – **Continuous**.
- Measured Data – Temperature : Ti & To – 45 & 35 DC
- Flow rate – Steady process – from meters / design flow rate

3.Fan-less cooling Tower

Existing Expenses – (Based on 355 days, 22 hours / day @ Rs. 4.81 / KWh rate : Rs. 2779891 / - year --- Will be saved

Proposal – Fan-less C.Tower

It can handle required range & approach parameters

Investment for C. Tower + Civil Work = 16.99 +0.45 +3 = 20.44 lacs.

Simple Pay back period- 9 months

4. Heat Recovery from Off gases of EAF

- **A) Existing Method** – Hot off gases leaving 4th roof/moving duct , Post combustion, cooled via. ICW loop & then sent to bag house

  ESP Proposal – Recovery of heat from off gases to generate Superheated steam & off-set the Boiler Operation saving Furnace Oil.

  B) Measured Data – Temp. of off gases at Moving duct (Infrared Pyrometer) – Temp. ~ 1350 to 1400 Deg.C , Post Combustion~ 1000 DC ,Required near bag-house inlet -130 Deg.C & **Volume & Composition** – Based on **established research on HR** from M/S. Stahl & SMS DEMAG & other agencies. EAF Cycle (Heat Melting) – Process observations

  D) Heat content

  ~ 170 kwh / Ton of LMT equiv. heat

4.Heat Recovery from Off gases of EAF

Sensible heat of gases,to be used to generate **Superheated steam required for VD Opn.)**

Projected annual savings -Rs. 46809820 / - by dispensing with Boiler Operation (Furnace Oil & O & M Saving) = (@ 3333 M.Tons of steam / month * 12) = 3333*15.792*Rs.28190 * 12/432.5) **+ b) Boiler O & M expenses: Rs.4098120 (AUXILLARY) +540000(Manpower)+10,00,000 (spares,etc.) = 4,68,06,392 / year. Investment** ~ Rs. 17.10 crores (Est.2.5 to3 M. Euro)

PB Period – 3.65 Years (System life ~ 12 to 15 years minimum).

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5.Improved Melting / Foamy Slag Practices

- Though, there is a std. Op. Procedure at EAF , LRF, nevertheless , furnace operation still is influenced sizeably by MELTERS' SKILLS, inter-alia other parameters.
- Adopting best practices based on linking Melter's views & statistical analysis of EAF process data, viz; Grade , Charge mix, Units consumed , Oxygen through lance (OLM) & co-jet (O2 & LPG), coke used - based on line of best fit / regression analysis. Expected saving~ 3 to 4 % w.r.t current scenerio

Other Initiatives (being explored)

- 1) Billet / Scrap Warming using Hot Bloom / off gas
- 2)Developing Energy Awareness + Energy PLACARD
- 3) Additional metering points of various utility items,
- 4) Emphasis on Energy MIS – AT ALL LEVELS OF MANAGEMENT
- 5) Exploring avenues of : Energy Plantation”