

Innovative Approach Towards Energy Efficiency

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Abstract: *As Indian manufacturers face an increasingly competitive environment, they seek out opportunities to reduce production costs without negatively affecting the yield or the quality of their finished products. The volatility of energy prices in today's marketplace can also negatively affect predictable earnings. The challenge of maintaining high product quality while simultaneously reducing production costs can often be met through investments in energy efficiency, which can include the purchase of energy efficient technologies and the implementation of plant-wide energy efficiency practices. Energy efficient technologies can often offer additional benefits, such as quality improvement, increased production, and increased process efficiency, all of which can lead to productivity gains. Energy efficiency is also an important component of a company's overall environmental strategy, because energy efficiency improvements can lead to reductions in emissions of greenhouse gases and other important air pollutants. Investments in energy efficiency are therefore a sound business strategy in today's manufacturing environment.*

Key words: Paper Industry, Energy Efficiency, Innovative Approach

Introduction

Century Pulp and Paper (CPP) is a division of Century Textile and Industries Ltd (CTIL) and is one of the largest producers of Writing & Printing paper, Board and Kraft paper, Tissue paper (speciality grade paper) and Rayon Grade Pulp (RGP). The manufacturing facility of Century Pulp and Paper (CPP) was established in 1984 at Lalkua Dist. Nainital in Uttarakhand. The first expansion during year 1995, added bagasse based manufacturing located adjacent to the existing pulp and paper plant at Lalkua. Subsequently, the plant has added board and prime-grade tissue paper plant at Lalkua.

Power requirements of paper plant are catered through a total installed capacity of 86.8 MW (1 x 6.8 MW, 1 x 16 MW, 1 x 21 MW and 1 x 43 MW) of captive power generation. Apart from this, the plant also sources electricity from Uttarakhand Power Corporation Limited (UPCL) through 132 kV HT feeder with a contract demand of 11 MVA. The steam requirement of the captive power plants and pulp & paper manufacturing process is met through solid fuel fired (CFB) and recovery boilers.

Methodology

The correlation between efficiency values and energy consumption is particularly visible in electricity/steam consumption. The papermaking process includes many devices that run at constant power regardless of the production speed. Near the design point of the machine, their share of electricity consumption is lowest, and also generally, as production increases, specific electricity consumption decreases. As a result, for the sake of energy efficiency, it is best to run the machine at maximum speed.

The number of breaks and unplanned shutdowns should be minimized. During breaks, electricity consumption often increases as the broke systems and tail threading equipment are on with the machine running at production speed. During shutdowns, only the most essential equipment should be kept running.

However apart of above Century Pulp & Paper has the following approach for ENCON Initiatives:

1. Thermal Audit(Mill Wide)
 - Audit by Forbes Marshal
2. Electrical Audit (Mill Wide)
 - Audit by TERI
3. Steam & Condensate (WPP, RGP & PM3)
 - Audit by Forbes Marshal
4. Compressor (Compressor House, Tissue & Board)
 - Audit by Systel
5. Vacuum Pumps (Mill Wide)
 - Audit by Kakati
6. Water Conservation & Recycling (Mill Wide)
 - Internal Audits

Back Ground

• **Goal and objectives of the energy management programme:**

Integrated Mill wide Power: From 1212 KWH/MT to 1185 KWH/MT

Integrated Specific Steam Consumption (Including TG condensing): from 8.31 to 8.20T/T

• **Major challenge and goals for the upcoming year**

To achieve the specific power consumption of final product up to 1,185 kWh per tonne of product and specific steam consumption (Including TG condensing): up to 8.20 tonne per tonne of product

• **Major activities to meet challenges and goal**

The activities includes,

- Prioritization of recommended energy conservation measures identified in energy audits
- Selection of competitive technology/service providers
- Monitoring and verification of the saving achieved through implementation and reporting

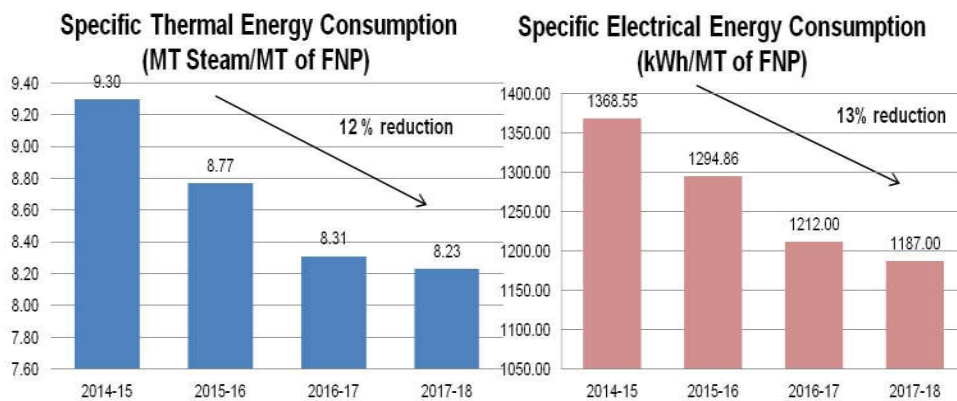
| Parameters | Indian Pulp & Paper Mills | CII Godrej GBC | International Mills | SE : Century Pulp & Paper 17-18 (up to Feb 18) | SEC Target for FY Year 17-18 |
|---------------------------------------|---------------------------|----------------|---------------------|--|------------------------------|
| Electrical SEC (kWh / MT of FNP) | 1094-2082 | 1130 | 900-950 | 1187 | 1185 |
| Thermal SEC (MT of Steam / MT of FNP) | 6.7-15.3 | 7 | 6.5-7.0 | 8.23* | 8.20* |

- Note: CPP SEC includes TG condensing.

Results:

Based on the methodology, M/S CPP is continuous working on energy efficiency practices to compete the market requirement. In last 3 years CPP implemented 193 no of Energy saving schemes including 29 no of thermal saving schemes, which results a reduction of 12% thermal SEC & 13% reduction of Electrical SEC, refer fig.

| Parameters | | 2014 - 2015 | 2015 - 2016 | 2016- 2017 | 2017- 2018 (up to feb'18) |
|---|--------------------|-------------|-------------|------------|---------------------------|
| Specific Electrical Energy Consumption (kWh/MT of FNP) | kWh/MT of FNP | 1368.55 | 1294.86 | 1212.00 | 1187.00 |
| Specific Thermal Energy Consumption (MT Steam/MT of FNP) -Including TG condensing | MT Steam/MT of FNP | 9.30 | 8.77 | 8.31 | 8.23 |

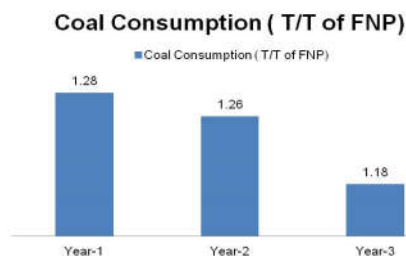


Apart from this CPP implemented 14 no of water saving schemes, which results a reduction of 4.88% specific water consumption

• **Replication arising out of best practices in Green supply chain**

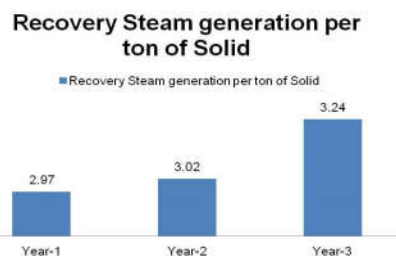
Decrease in Coal Consumption:

Coal Consumption per ton of finished product has been decreased from 1.28 to 1.18 Ton per ton of finish product



Increase in Recovery Steam Economy:

Recovery Steam Ratio has been increased from 2.97 to 3.24 Ton per ton of Solid

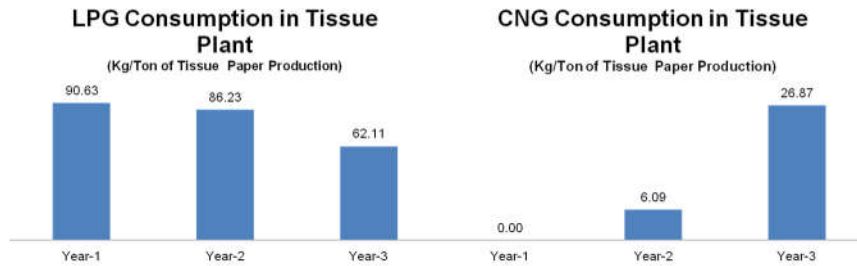


Decrease in LPG Consumption:

LPG Consumption per ton of Tissue paper production has been decreased from 90.63 to 62.11 Kg per ton of Tissue Paper Production

Increase in CMG Consumption:

CMG Consumption per ton of Tissue paper production has been increased from 0 to 26.87 Kg per ton of Tissue Paper Production

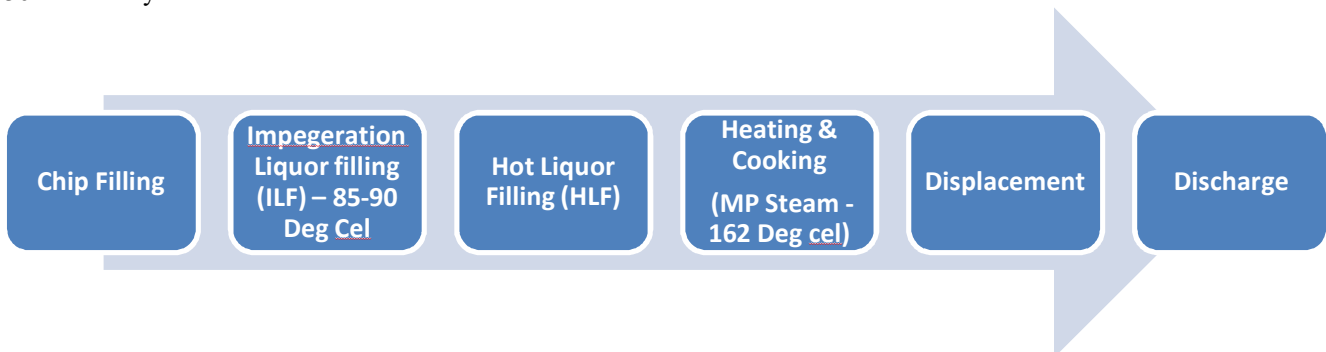


Major ENCON Initiatives:

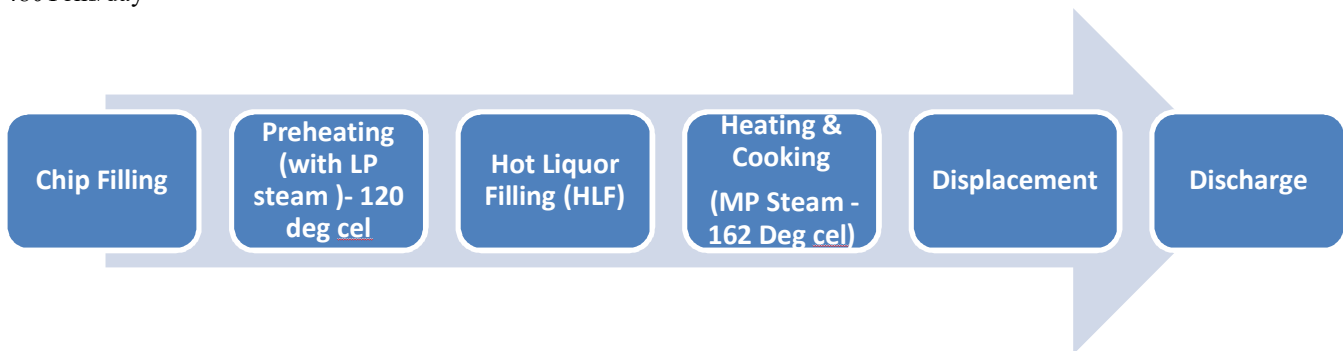
1. Fiber Line: Opti-batch Adoption:

It is the first time in India where super batch is modified into Opti-batch.

Earlier ILF (Impegeration Liquor Filling) technology was used. Total Digester discharge 12-13 @ 27-28 Tons/ Digester – 364 Tons/Day



After Optibatch Model-C technology adopted. Now Total digester discharge are 13-15 @ 30Tons per Digester – 480Tons/day



Advantages

- Gain of Steam due to low cooking temp – 0.05 Tons /Ton of Pulp
- Power saving of 2KWH/ Ton of Pulp.
- Cooking yield improved due to low reject level.
- Improved capability of cooking plant on sustainable basis.
- Elimination of channeling problem in the digester.
- 2 Ton/ Digester pulp increased
- 2 no Digester Discharge increase
- MP steam replaced by LP steam resulted gain of 14 Ton steam/ day

2. Increase in TG power generation by 1.23MW

Earlier:

- 43 MW, 21 MW & 6.8 MW TG were running.
- ABL Boiler (62 Bar) was stopped & BHEL Boiler (46 Bar) was running
- 3 MW generation through 6.8MW @ 13.33Tons Steam/MW

After:

- Retrofitting of ABL Boiler & Started.
- 6.8 MW TG Stopped

- 16MW TG Started along with 43MW & 21MW TG to fullfill the power & process steam demand.
- ABL 62 Bar steam added to HP Header & Steam Consumption Reduced 5Ton/MW
- Extra Aux power consumption of 375KW

Advantages:

- 1.23MW extra power generation with same steam.
- Coal Saving of 1.2T/Hr.
- Minimize the grid load.

3. Power House:- PRDS Reduction 18 Bars

Earlier:

Tissue 18 bar steam (Approx 4-5 TPH) requirement taken through 62 bar to 18 bar PRDS

After:

18 bar steam taken through 43MW TG 1st uncontrolled extraction, by installation of a PRDS from 30 bar to 18 bar



Advantages:

Generation of additional power approx. 60 KWH per ton of steam hence reduction in condensing.

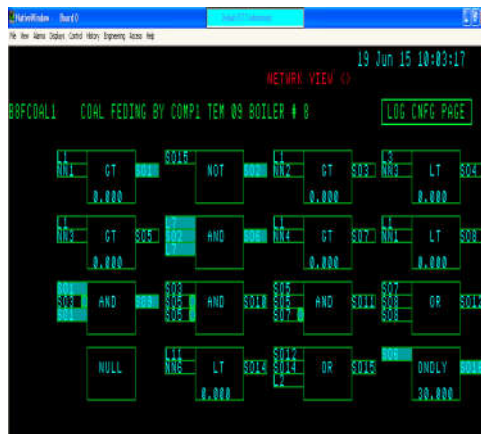
4. Boiler Optimization

Earlier:

- As boiler load decreased compartment shut completely.

After:

- As Boiler load decreases compartment, does not shut down completely.
- Air & coal feeding reduces in all compartment equally wrt O₂ at economizer outlet & individually compartment temp



Advantages:

- Less Coal unburnt.
- Fine controlling over coal feeding according to bed temp.
- Fine controlling over air.
- Reduction in Aux power consumption
- Less clinker formation
- Boiler run ability increased.
- 12T/hr more steam generation & 550KWh Aux power saving.

5. Steam Condensate

Before:



- PM-1 & 2 Steam & Condensate System was highly inefficient resulting in excess consumption of steam per tonne of paper

After:



- Modified by cascade system to reduce steam consumption

Advantage:

Reduction in steam consumption by 0.3 T per ton of paper at both Machines

6. Line Loss Reduction

Earlier:

- Power factor was 0.95 in ETP, DIP & Power house
- Lightning energy was fed from mill wide distribution transformer
- Long Length cables

After:

- Installation of power capacitor, PF 0.99
- Installation of lightning transformer (Dedicated for lightning circuit).
- Route altered of long length cables & increase no. of runs

Advantages:

- KVAH reduction by 4% (Advantage in grid billing)
- Lightning energy saving of 240 KWH
- Reduction in I²R Losses.

7. Technology Up gradation

Before:





- Reciprocating compressor.
- Old energy in-efficient vacuum pump
- Old KVM LC Pump at WPP & Bagasse Pulp Mill.
- Conventional Lights
- Root blower for air circulation in aeration tank

After:

- Installation of IR Compressor
- Energy efficient vacuum pump installed
-
- New sulzur make LC pump installed
- LED Light installed
- Turbo blowers with variable pressure & flow

Advantages:

- Compressor power saving 200KWH
- Vacuum Pump Power Saving 90KWh.
- Sulzur pump power saving 45KWh
- LED Light saving of 287 KWh
- Turbo Blower saving of 150KWh

8. *Heat Recovery From Effluent*

Earlier:

-
- The filtrate of press no 4, 5 & 6 is being drained and going to ETP Plant.
- The temp. of filtrate is around 80-85 Degree C

After:

- Installation a heat exchanger for heat recovery from effluent to heat DM Water.
- The heated DM water is pumping to DAT tank at power house. As the make up water is entering at higher temp the addition of live steam shall be reduced.

Advantage:

- Live steam reduction. (1.36T/hr)



9. *Optimization of Boiler feed water Pump*

Earlier:

- For each boiler separate feed water pump was running (Total- 6 No).
- All pumps was in manual operation (Excluding Enmas Feed pump).

- Pumps was running on 105Bar pressure
- Earlier Running load 2125 KW

After:

- Common Boiler Feed water Header.
- Auto Operation.
- Now 3 no feed water pumps are running
- Pressure Optimization of feed water (from 105 Bar to 86 Bar)
- Now running load is 1515 KW

Advantages:

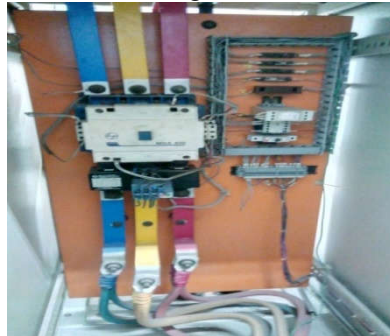
- 610 KW saving
- System reliability increase by adding them in auto mode



VFD Installed on MC pumps

Earlier:

At Fiber MC Pump (11 No) flow was controlled through control valve & flow tube.



After:

VFD Installed & control valve is open 100% & flow is controlled through variable frequency drive (Saving of 259KW)

Advantage:

Saving of 259KWh

10. Renewable Energy Sources/ Waste Utilization

- 2 dedicated turbine i.e. 21MW TG & 6.8MW for using waste heat recovery through 3 no. Recovery Boilers.
- Fuel used is Black Liquor which is a declared Bio-mass product from MNRE.
- Waste Utilization by converting it into Bio-Gas

| UTILIZATION OF WASTE AS FUEL (ALTERNATIVE FUEL UTILIZATION) | | | | | | | | | |
|---|-----------------------------|--------------------------------|------------------|-----------------------------|--------------------------------|------------------|-----------------------------|--------------------------------|--------------------------------------|
| 2014- 2015 | | | 2015 - 2016 | | | 2016- 2017 | | | Waste Fuel as % of total energy used |
| Name of the Fuel | Quantity of waste Fuel used | Heat Value (million kcal/year) | Name of the Fuel | Quantity of waste Fuel used | Heat Value (million kcal/year) | Name of the Fuel | Quantity of waste Fuel used | Heat Value (million kcal/year) | |
| Pith/waste | 162716 | 276617.2 | Pith/waste | 123909 | 210645.3 | Pith/waste | 110972 | 188652.4 | 6.63 |
| Black Liquor | 355584 | 1155648 | Black Liquor | 425368.79 | 1382448.568 | Black Liquor | 385206 | 1251919.5 | 37.16 |

Conclusions:

1. Implemented various innovative approach year to year and thus reduced specific electrical power consumption from 1368 KWh/MT in 2014-15 to 1187 KWh/MT of finished production in 2017-18 (up to Feb'18). It has resulted from 193 energy saving schemes.
2. Through focused innovative technology adoption, specific steam consumption reduced from 9.3 MT in 2014-15 to 8.23 MT of finished production in 2017-18 (up to Feb'18). Total 29 thermal saving schemes implemented including opti-batch at fiber line.
3. Coal consumption reduced from 1.28 MT in 2014-15 to 1.12 MT of finished production in 2017-18 (up to Feb'18). Other than thermal energy saving initiatives, one of the major contributor recovery steam generation increased from 2.97 MT to 3.24 per ton of black liquor solids.
4. Innovative state of art "Compressed Methane Gas Plant (CMG)" plant contributed in reduction of LPG consumption from 90.6 kg to 62.1 kg/MT of tissue through the use of 26.8 kg/MT CMG in tissue Plant.

Acknowledgement:

The Authors express their gratitude to Shri.JP Narain-CEO, Century pulp & paper for granting permission to present the article. The Author express thanks to Mr.P.K.Mittal (Head –Process) has contributed their valuable information to prepare this paper.