



ITC LIMITED

Lighting improvements: Fluorescent Lights with Electric chokes, Metal halide lamps, Automatic timers, Lighting transformers

SUMMARY OF THE OPTION

M/s ITC Limited–Paperboards and Specialty Paper Division (ITC–PSPD), Bhadrachalam unit commenced its commercial production in October 1979. It is the largest and one of the best performing integrated pulp and paper plants in India with a design manufacturing capacity of 200,000 tons per annum (TPA) of paper and paper boards and was actually producing around 238,000 – 240,000 TPA. Notwithstanding, the unit, plans for an immediate expansion with the addition of another Paper Machine, thus taking the manufacturing capacity to 2, 85,000 TPA. The products range from Printing and writing paper of various grades, Poster paper, Uncoated paper board and Coated paper board. The annual electricity consumption is of the order of 242 million kWh and the thermal energy consumption totals 914913 million kCals/annum. The energy cost accounts for 5.12 per cent of the manufacturing cost. The specific electricity consumption is 971 kWh/Ton and the specific thermal energy average is 3.87 million kCal/ton.

KEY WORDS

India, Pulp and Paper, Lighting, Fluorescent lights, Metal halide lamps, Automatic timers, Lighting transformers

OBSERVATIONS

- The plant had a large number of Fluorescent Tube Lights (FTL) with conventional ballasts (High wattage choke).
- Some of the shop floor locations the lighting requirement was catered to by older genre 400 Watts (W) Mercury Vapor lamps which are less efficient.
- Due to lack of controls lamps in these rooms are kept burning all through the day in some of plant areas which do not require lights all through the day (for instance, MCC rooms do not require continuous lighting, except when some measurements, repair and maintenance is to be undertaken).
- In most of the lighting feeders the single phase supply voltage was higher than required (235 – 220 Volts).

OPTIONS

Based on the study the following four options were implemented resulting in lighting energy savings;

1. Replacing 2025 FTL's at various locations within the plant with 36 W FTL's equipped with electronic chokes.
2. Replacing 100 inefficient 400 W Mercury Vapor lamps in the high bays of paper machine 1 & 4 with more efficient 250 W Metal Halide lamps (one to one replacement).



3. Installing automatic timers at various MCC's to optimize on lighting usage. *(These timers when switched ON will activate lamps for a period of half an hour and then automatically switches OFF. If light is required for a further period of time, the push button is activated once again for another half hour of illumination).*
4. Installing dedicated lighting transformers to facilitate reduction in lighting voltage levels. *(Purely lighting loads can accommodate lower voltages by simply changing the transformer secondary tap setting to a lower voltage thereby resulting in lower lighting power consumption.)*

RESULTS

The results are presented for four options below.

1) Replacement of Old Inefficient FTL sets with New Efficient FTL sets at various locations in the plant.

Before Replacement

Number of Old FTL's + Conventional choke sets: 2025

Power Consumption: 196.6 kW

Light Intensity: 114 Lux

After Replacement

Number of Slim 36 Watt FTL's + Electronic Choke: 2025

Power Consumption: 88.28 kW

Light Intensity: 143 Lux (Max – 235, Min – 92)

Impact

Reduction in Power Consumption: 108 kW

Annual Electrical Energy Savings: 395,368 kWh (108 X 10hrs/day X 350 days)

Investment (Cost + Commissioning charges): Rs. 1,192 lakhs (US \$ 27,721)

2) Replacement of Old Inefficient Mercury Vapor Lamp sets with New Efficient Metal Halide Lamp sets a High Bays' of Paper machines 1 & 4

Before Replacement

Number of Old 400 W Mercury Vapor Lamp sets: 100

Power Consumption (100 X 400 W) + (100*37.5W): 43.8 kW

Light Intensity: 60 Lux (Max – 77, Min – 54)

After Replacement

Number of New Metal Halide 250 W lamps: 100

Power Consumption (100 X 250 W) + (100 X 16.5 W): 26.6 kW

Light Intensity: 75 Lux (Max – 84, Min – 63)

Impact

Reduction in Power Consumption: 17.2 kW

Annual Electrical Energy Savings: 62780 kWh (17.2 X 10hrs/day X 350 days)

Investment (Cost + Commissioning charges): Rs. 1.91 lakhs (US \$ 4,442)

3) Installation automatic timers to switch OFF lamps at MCC rooms

Before Installation

Total lighting Load at various MCC locations : 2 kW

Hours of Operation due to absence of timers: 24 Hrs/day

Total Energy Consumption by these lights: 100800 kWh 12Kw X hrs/day X 350 days/yr)



After Installation

Total lighting Load at various MCC locations: 12 kW Hours of Operation with timers (Avg.): 1 Hrs/day

Total Energy Consumption by these lights: 4200 kWh (12kW X 1 hr/day X 350 days/yr)

Impact

Annual Reduction in Hours of usage: 8050 hrs/yr

Annual Electrical Energy Savings: 96600 kWh

Investment (cost, installation and commissioning): Rs. 16,200 (US \$ 377)

6 timers placed at 6 MCC's(Rs.2700/pc. X 6 Pcs.)

4) Installation of dedicated lighting transformer to facilitate reduction in lighting load levels

The lighting loads across the plants are not always powered through dedicated lighting transformers and these transformers often contain other mixed loads. Hence any opportunity for voltage reduction in lighting systems cannot be affected, as it would hamper the operation of the other loads. However there exist some transformers with dedicated lighting loads and it is possible in such cases to reduce supply voltage and thereby lighting power consumption without affecting lux levels appreciatively.

In SFT street C a 45 kVA lighting transformer was specially installed catering only to lighting loads of this area. The lighting transformers their ratings and actual loading is given below.

Sl.No	Lighting Transformer Ref.	Rating (kVA)	Nos.	Sec'ry Voltage (V)	P. F	Actual Load (kVA)	Annual Lighting Power Consn. (kWH)	Comments
1.	SRB - 3	100	2	235	0.98	52 (on 2 trafos)	448560	Voltage high can be toned down to 220 V
2.	SFT Street C	45	1	235	0.76		91560	Voltage high can be toned down to 220 V
3.	Paper Machine Nos.4 and 5	100	2	235	0.7		416640	Voltage high can be toned down to 220 V
4.	New Fibre Line	100	1	235	0.76		257880	Voltage high can be toned down to 220 V
Total							12,14,640	

Annual electrical energy consumption by lighting through the above transformers: 1214640 kWh per cent voltage reduction (from 235 to 220 V): 6.4 per cent lighting Energy consumption with reduced voltage: 1136903 kWh

Impact

Annual reduction in electrical energy consumption: 77737 kWh

Investment (Spare available transformer was used): Nil



Results: (Total of Options 1, 2, 3 and 4)

Item	OPTION 1	OPTION 2	OPTION 3	OPTION 4	TOTAL
Energy Reduction	395368	62780	96600	77737	632485
One –Off investment	27721	4442	337	0	32500
Savings	15355	2438	3752	3019	24564
Simple Pay Back Period(Months)	22	22	1	0	16
Other Benefits	Greater Light Intensity	Greater Light Intensity, Longer life	Longer life	Low burn out of fittings due to high voltage	

Financial benefits

- Investment: Rs.13.99 lakhs (US\$ 32,540)
- Annual cost savings : Rs.10.56 lakhs (US\$ 24,564) (= 632485 kWh X Rs.1.67/kWh @ Rs.43/ US\$)
- Payback period: 16 Months

Environmental benefits

- Annual electricity savings: 632485 kWh
- Annual GHG emission reduction: 565 tons CO₂ (= 632485 kWh X 0.000893 tons of CO₂/kWh) [1]

Note: Installation and commissioning charges vary between 3 to 10 per cent depending upon the complexity of the implementation project.

[1] – Sourced from UNEP GHG Calculator – Specific to India

FOR MORE INFORMATION

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