Improvement in Energy Efficiency and Energy Conservation Initiatives at Khanna Paper Mills Limited

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Energy use in paper industry

Thermal (~ 70%)

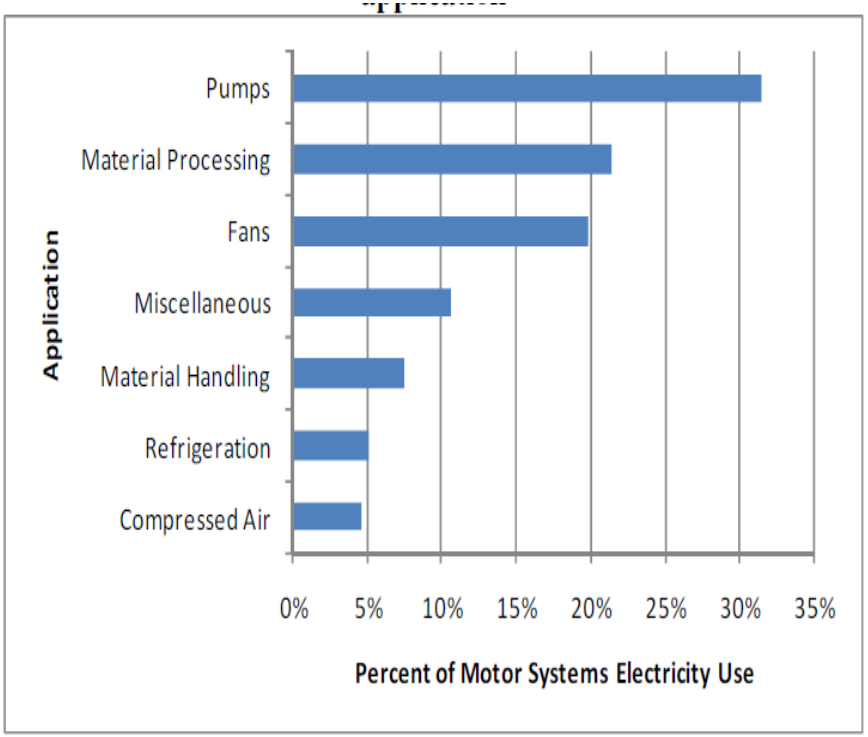
Breakup of power and steam consumption

Section	Power Consumption, kWh/ton of paper	Steam Consumption, ton/ton of paper
Pulp Mill (including Raw material cleaning, Digester, screening & washing and bleach plant)	300-325	1.2-2.5
Recovery Section	250-300	3.0-3.5
Stock Preparation & Paper Machine	350-450	2.5-4.0
Effluent Treatment Plant	75-100	-
Power Generation Plant (12 MW)	150-200	6.0-6.5
Others (including ClO_2, O_2 plant, office, street light)	100-125	-
Total	**1,225-1500**	**12.7- 16.5**

Electrical (~30%)

Breakup of motor-system electricity use

Pumps, fans, and materials processing equipment account for over 70%) electricity use



Source: U.S. DOE (2002a)

KPM - Where do we Stand

1. Unique : Scale of Operation

Companies > 35,000 MT p.m. Capacity	Only 7, KPM in Top 7
Single Site : 35,000 MT p.m. Capacity	Only 3, KPM in Top 3
Manufacturer With 3 Biggest Segment	Only 1, That's KPM
Largest Recycled Based Mill	KPM - No.1

KPM - Where do we Stand

2. Technical & Product Range : Superiority and Leadership

Mills with 750 MT DIP Facility	Only KPM
Mills With SFT Plant	KPM in Top 3
>6Mtr Deckle,1000 mpm	Only Few
Paper Machine >10,000 MT p.m.	Only 10
Leader in Duplex Board	Among Top 2
Leader in Newsprint	KPM - No.1
Paper & Board - Virgin & Recycled	Among Top 2

PRODUCT PORTFOLIO

PACKAGING BOARD

- VIRGIN
- RECYCLED

Capacity – 1.60 Lakhs TPA

APPLICATION

FMCG, Pharmaceutical, F&B, E-Commerce and Liquor Carton

PAPER

- W&P
  - VIRGIN
  - RECYCLED
- COPIER

Capacity – 1.20 Lakhs TPA

APPLICATION

Publications, Notebooks, Stationery and Commercial Printing

NEWSPRINT

- STANDARD

Capacity – 1.40 Lakhs TPA

APPLICATION

Newspaper, Magazines, Advertisement and Brochures

PRODUCT PARTNERS

State Energy Conservation Award-2022-2023

(Department of New and Renewable Energy, Government of Punjab)

Completed Projects at KPML

Project	Proposed Benefits	Estimated Saving (Lacs/annum)
14 MW STG Overhauling	Increased Power Generation by 700 kWh	653
Replacement of old inefficient APH with Efficient APH	Better boiler efficiency	120
	Energy saving in terms of fuel	
	Reduction in aux power consumption	
Replacement of Standard Efficiency IE1 with Premium Efficiency IE3 Motors	Less electrical energy consumption	6.48 Lac kWh resulting in savings of INR 43.0 Lacs annually

14 MW Overhauling Improvement Sheet

Parameter	UOM	Before Overhauling	After Overhauling
Turbine load	MWH	12.5	14
Specific Steam consumption	MT/MW	5.8	5.4
Saving in Specific steam consumption	MT/MW	0.4	
Saving in steam consumption for total power generation	MT	5.6	
Power Generation benefit due to lower Specific steam consumption	MW/Hr	1.0	
Saving due to less steam consumption @ Rs.7.5/- per Unit	Lacs/day	1.9	
Overhauling expenses	Lacs	119.9	
Payback Period	Days	64	
	Month	2.1	
Annual cost saving	Lacs/Ann.	653	

Replacement of old inefficient Air Preheater with Efficient Air Pre-heater system

- **Description**
  - Air Preheater on 100 TPH Boiler
  - Tubes in top & bottom modules developed cracks
  - Short circuiting of flue gas and air to the boiler
  - Loss of essential heat
  - Increased power consumption in Auxiliary equipment
- **Improvement**
  - Short circuiting of flue gas and air to the boiler was stopped
  - No loss of essential heat
  - Reduction in O2% from 7 to 4.5%
  - Increased Boiler efficiency by 1.5%
  - Reduction in power consumption of Auxiliary equipment

Replacement of Standard Efficiency IE1 / Re-wound Motors with Premium Efficiency IE3 Motors

❖ Description

- "Critical motor replacement study"
- Standard Efficiency IE1 Motors
- Motors rewound more than 3 times identified
- Low efficiency
- High electrical energy consumption

❖ Improvement

- Replaced with Premium Efficiency IE3 motors.
- More energy efficient
- Low electrical energy consumption

❖ Benefits

The above proposal resulted in annual savings of **6.48 Lac kWh** resulting in savings of **INR 43.0 Lacs** annually and required an initial investment of **INR 94.0 Lacs.**

Replacement of Standard Efficiency IE1 / Re-wound Motors with Premium Efficiency IE3 Motors

Area	EQUIPMENT NAME	Motor KW	Motor RPM	Application	Eff.Old %	IE 3 Eff %
PM 1	Fan Pump No. 5	45	1,500	Pump	91.5	94.2
PM 1	Fan Pump No. 7	37	1,500	Pump	91.5	93.9
PM 1	Fan Pump No. 8	37	1,500	Pump	91.5	93.9
PM 1	Pressure Screen no.1	37	1,500	Screen	91.5	93.9
PM 1	Mould Blower No.2	55	1,500	Blower	92	94.7
PM 1	Coating Blower No. 1	75	1,500	Blower	92.5	95
PM 1	Broke Pulper	75	1,000	PULPER	92	94.6
PM 1	Pope reel	75	1,500	SECTIONAL DRIVE	92.5	95
PM 1	Broke Tower pump	45	1,500	Pump	91.5	94.6
PM 2	Broke pulper agitator	45	1,000	PULPER	91.5	93.7
PM 2	Old T/C Coating Blower 4	45	1,500	Blower	91.5	94.6
PM 2	Trim Blower for rewinder	30	3,000	Blower	89	93.8
PM 2	Chest Pump No. 7	30	3,000	Pump	89	93.8
PM 2	UTM Pit No.2 Agitator	75	960	PULPER	91.6	94.6
FILLER PLANT	F/L T.D.R 24"	260	1,000	REFINER	92	96
FILLER PLANT	P/L. Mixing Chest No. 4 Pump stand by Top Plant	37	1,500	Pump	91.5	93.9
FILLER PLANT	Chest Pump No.1	30	1,500	Pump	91	93.8
SFT	Intensa Maxx Drive	75	1,500	Pump	92.5	95
SFT	Contaminax Drive	75	1,500	Pump	92.5	95
SFT	Stock preparation dilution pump	75	1,500	Pump	92.5	95
SFT	Pulper dilution pump	75	1,500	Pump	92.5	95
SFT	DF shower pump	75	3,000	Pump	92	94.7
BOTTOM PLANT	Krofta Feed Pump No.1	30	1,500	Pump	91	93.8
utility-1	High Pressure Desuper he	55	2,975	Pump	92	94.3
utility-1	Desuper Heating Pump-2	55	2,900	Pump	92	94.3
utility-1	Cooling Tower Fan -1	37	1,500	Fan	91.5	93.7
utility-1	Cooling Tower Fan- 3	37	1,500	Fan	91.5	93.7
utility-1	Cooling Tower Fan-4	37	1,500	Fan	91.5	93.7

List of Replaced Motors

On-going projects at KPML

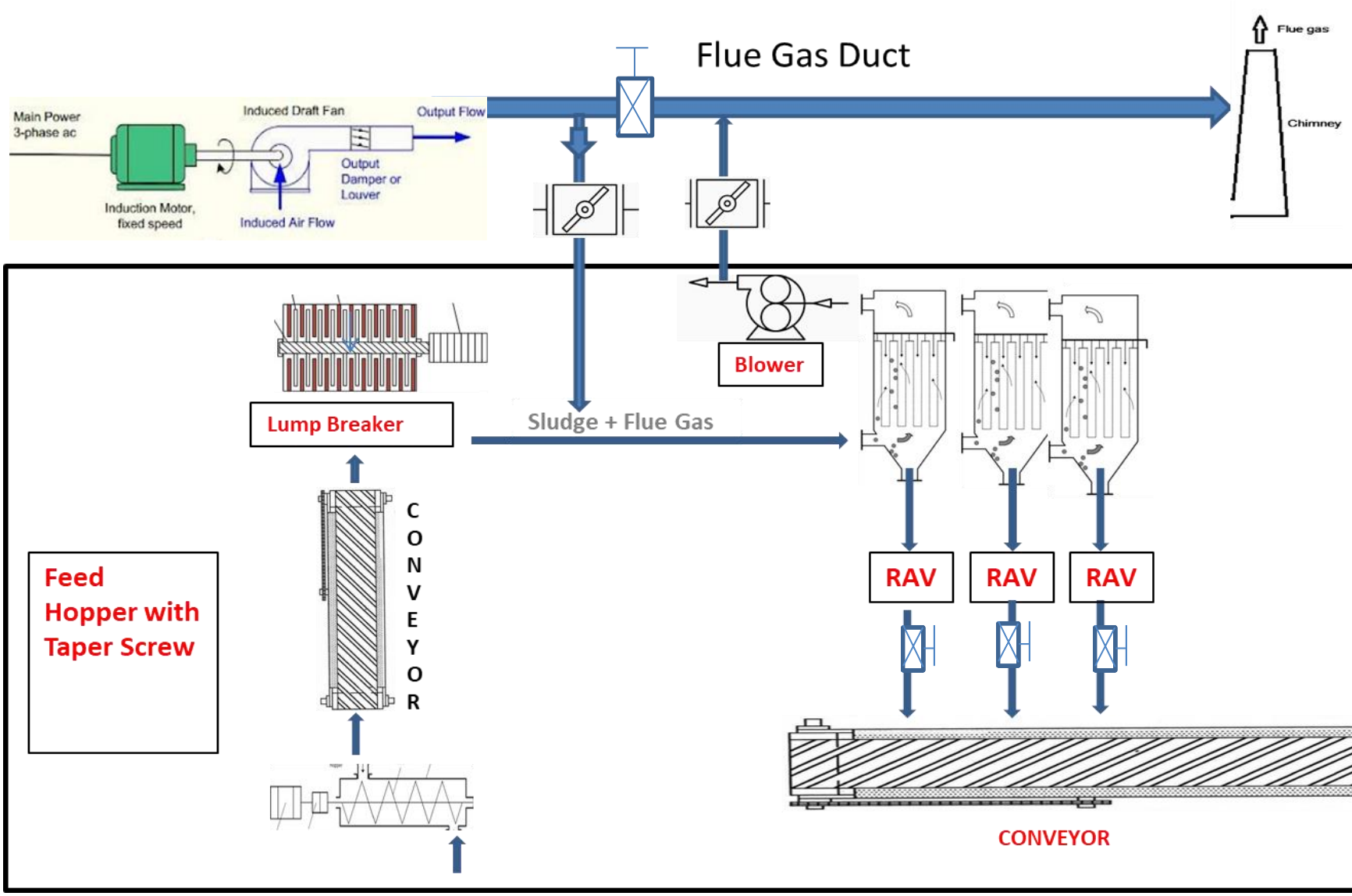
Project	Proposed Benefits	Estimated Saving (Lacs/annum)	Target Date/Status
Replacement of 17.5 MW STG with 23.3 MW.	Increased power generation with improved efficient Turbine	2523 (collaborative saving)	April 2024
Sludge Dryer Followed By Incinerator	Waste Valorization		Sludge Dryer in April 24 followed by Incinerator
100 TPH Boiler Pressure Part Replacement	Sustainability		April 2024
100 TPH ESP Up-gradation	Increased plant reliability		April 2024
New Cooling Tower 6000m3	To cater new 23.3 MW and 6.5 MW STG		April 2024
100 TPH Bed plate with nozzle replacement	Better Fluidization	79.5	April 2024
70 TPH CHP Up-gradation	Reduction in fugitive dust emission	Plant reliability	March 2024

Sludge Dryer

Description:

1. To increase the dryness of paper waste sludge from 50% to 75% to consume in the boilers as a fuel.
2. To generate energy by using sludge as a fuel for boilers after mixing it with coal.
3. To consume waste paper sludge received from ETP.
4. **Investment: 509 Lacs (approx.)**
5. **Estimated Saving: 990 Lacs/annum.**

SLUDGE DRYER SYSTEM



Incinerator: Waste to Energy Boiler

Description

- To generate energy from waste plastic.
- To consume plastic waste produced by KPML which is 120-130 TPD.
- To safely disposing the plastic waste and getting gains from it by producing energy.

Present Status

Technical Finalization in Progress

Replacement of 17.5 MW STG with 23.3 MW

Description

- To enhance power generation with improved efficient Turbine.
- To increase efficiency of STG with less steam consumption in comparison to existing 17.5 MW.
- Existing turbine is having defects such as wear out of HP gland fins and inter-stage fins, steam leakage from parting plates, pitting on LP blades.
- **Investment: 3900 Lacs (approx.)**
- **Saving: 2523 Lacs/annum (Considering per unit rate 7.5)**

Grid Islanding Project

Description

- All plant loads connected on the same network
- Separate load on the grid was not possible due to constraint of the distribution network.
- TG and Grid running in parallel mode
- Any disturbances in the Grid network resulted in disturbances in the TGs
- Loss of production amounting to huge financial loss

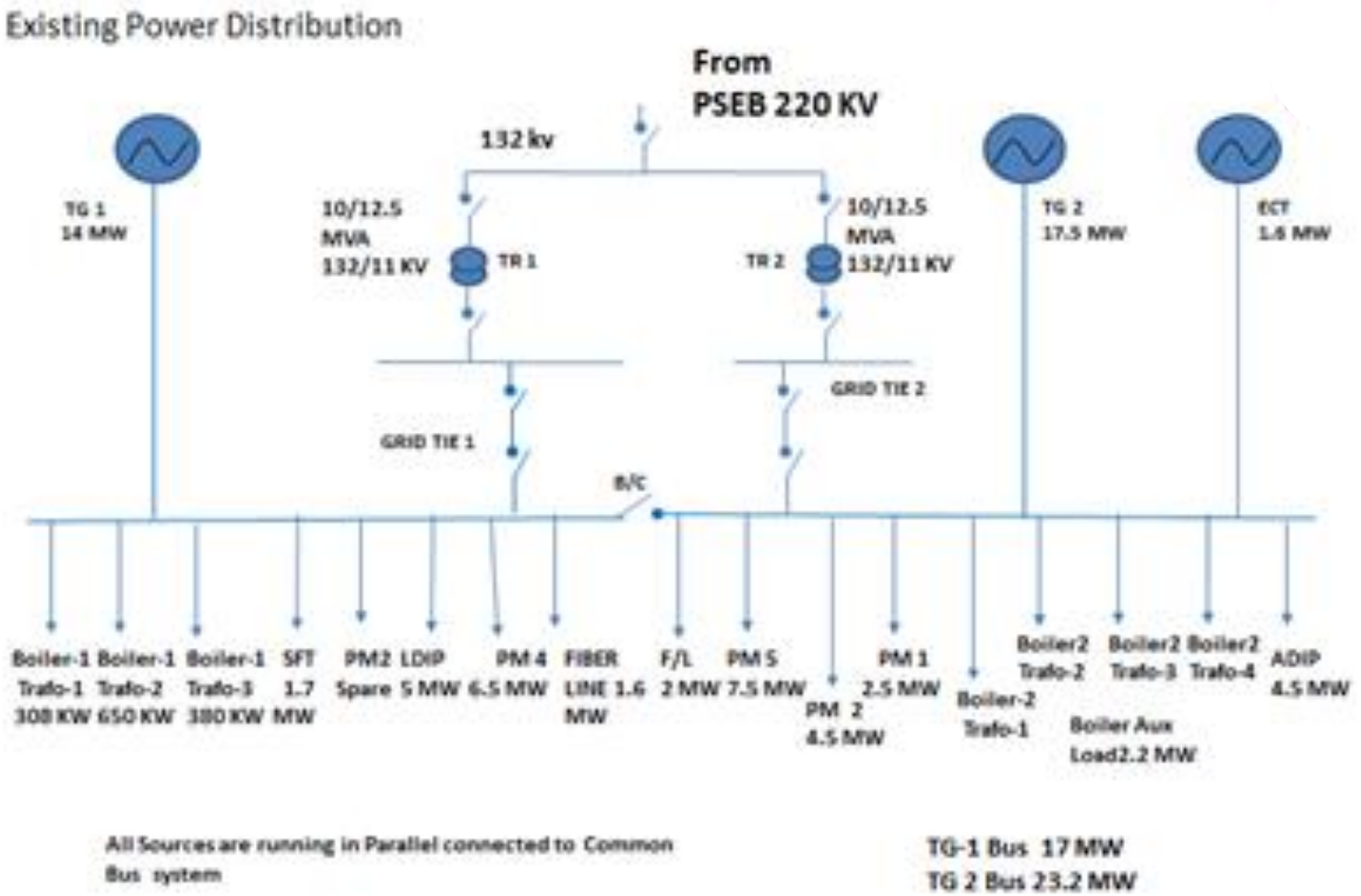
Improvement

- Grid Islanding and protection systems
- Isolate the in-house generator in case of fluctuations happened on the grid side.
- Prevent blackouts, production and financial loss.
- Energy saving as the TG run at lower frequency
- Reduction of fault levels in the system
- Increased life of the switchgear.

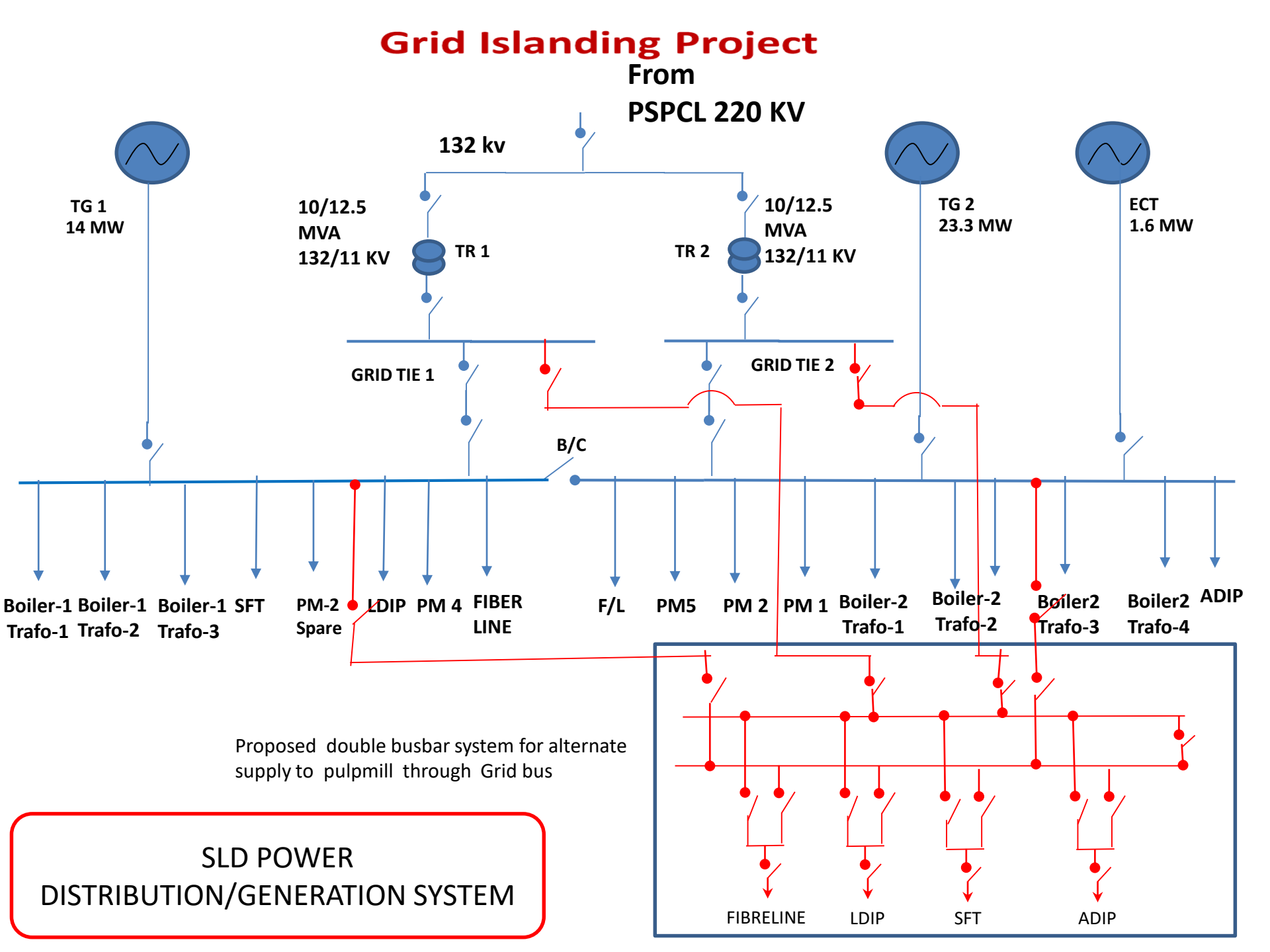
TG-1 run in parallel with Grid and TG-2 run in island mode

Saving considering grid charges 7.5 Rs/Unit = 518 lacs Production and quality loss due to black out situation - 50 lacs Electronic card and drive failure spare cost due to Grid fluctuation- 50 lacs Total saving- 618 lacs

Grid Islanding Project



Grid Islanding Project



Proposed double busbar system for alternate supply to pulpmill through Grid bus

SLD POWER
DISTRIBUTION/GENERATION SYSTEM

Replacement of liquid Ring Vacuum Pumps With Energy Efficient Turbo Blowers

Vacuum Pumps	Energy Efficient Turbo Blowers
Existing power consumption 1275Kwh	Revised power consumption 1110Kwh
Vacuum pump exhaust from seal pit is open to atmosphere	Turbo blower exhaust high temperature dry air for heating in PV Blower system, 0.045Ton of steam savings /Ton of Paper
Existing efficiency 70%	Turbo blower 85% efficiency
High sealing water consumption	No sealing water consumption.
Antiscaling chemical required	No antiscaling chemical required
High inventory of consumables	Low inventory
Complex piping design prone to more failure	Simple piping design & less piping
Life maximum 10 years	Turboblower vacuum pumps is upto 20 years

- Annual Power savings : INR 103 Lacs
- Annual Steam Savings: 4455 MT amounting to INR 55.7 Lacs*
- Increased production with 0.5%efficiency increase in machine : INR 74.25 Lacs

Other Energy Efficiency Initiatives (Completed)

Project Description	Rated kW	Savings (kW)	Monetary Savings (Lacs)
Installation of VFD in 1100 Drum Pulper Dilution Pump	110	20.5	9.35
Installation of VFD in Dilution Pump ADIP (Andritz De-Inking Plant)	55	12.0	5.4
Installation of VFD in stock feed to clear filtrate at LDIP (Lamort De Inking Plant)	55	16.0	7.29
Installation of VFD in NP02 Prime Cell Floatation feed pump	200	37.3	17.5
Installation of VFD in SPE 15 Screen Feed Pump	200	36.0	16.41
Installation of VFD in Fractor Feed Pump in ADIP (Andritz De-Inking Plant)	250	45.8	20.92
Installation of Drive Compressors for Ash Handling System	2 nos. of Compressors - 160 kW each	35	15.96
Installation of VFD at 100 TPH ID Fan	200	22	10.03

Other Energy Efficiency Initiatives (Completed)

Project Description	Savings (kW)	Monetary (Lacs)	Fuel Savings	Investment (Lacs)
Installation of efficient Coal Crusher at 100 TPH Boiler	36.0	21.0	-	19.0
Efficiency Improvement of 14 MW Turbine by overhauling	600	378.0	-	120.0
Replacement of Air Pre Heater modules of 100 TPH Boiler	-	230.0	2100 MT/annum	120.0
Installation of Compressor and replacing inefficient ETP Blowers	40.0	23.0	-	45.0

Conclusion

- Energy consumption pattern should be Monitored closely and regularly, and efficient control systems should be implemented
- Collaboration with external agencies for identification and implementation of the recommendations for achieving energy efficiency and cost reduction drive
- Energy-efficient technologies to be implemented in a phase wise manner to achieve the energy efficiency targets and subsequent GHG reduction

KHANNA

Thank You

…….. For Patient Listening