ITC Limited

Paperboards & Specialty Papers Division

Unit : Bhadrachalam

Core Competencies

Unit - Bhadrachalam

- 7.4 Lakh TPA Paper and Paper Board Production Capacity
- 1 Lakh TPA Bleached Chemi Thermo Mechanical Pulp (BCTMP) Pulp Capacity
- 100% Self Sufficiency in Power through in-house Co-Generation Power Plant
- Green Covered area so far 8 Lakh acres through Social and Farm Forestry
- **47.9% of total energy in 2021-22 is from RENEWABLE SOURCES**
- **Carbon Positive for 16 Consecutive years**
- **Water Positive for 19 years in a row**
- **Solid Waste Recycling Positive for the last 14 years**
- **Green Co Platinum Plus Certified by CII-GBC**
- TPM Methodology for manufacturing excellence
- Adopting I 4.0, IOT Based predictive models for energy & process optimization

Process at Unit Bhadrachalam

High Speed Chippers

Super Batch Digesters
SP. Steam Cons < by 30%

Ozone Bleaching *India's First*

Plant Consent Capacity is 114 MW

Plant Operating Load is 83.7 MW

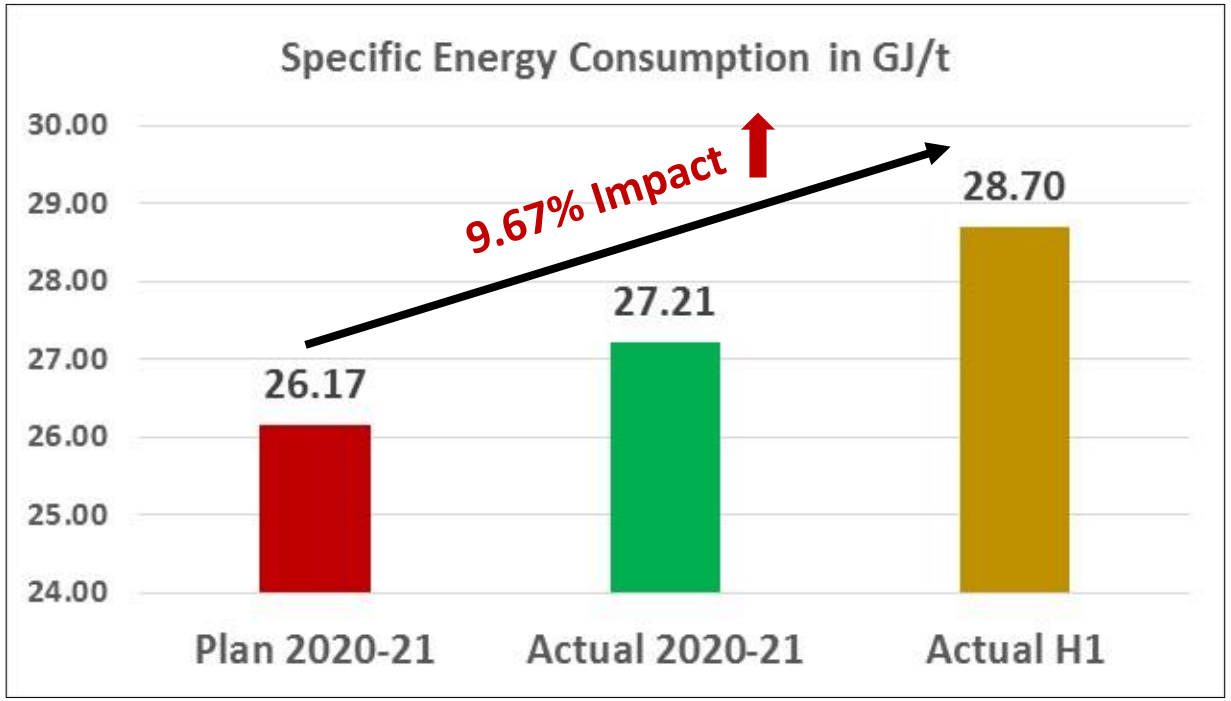
Wood + Bamboo → Chipping → Cooking & Bleaching → Paper Making → Paper Finishing → Paper to Market

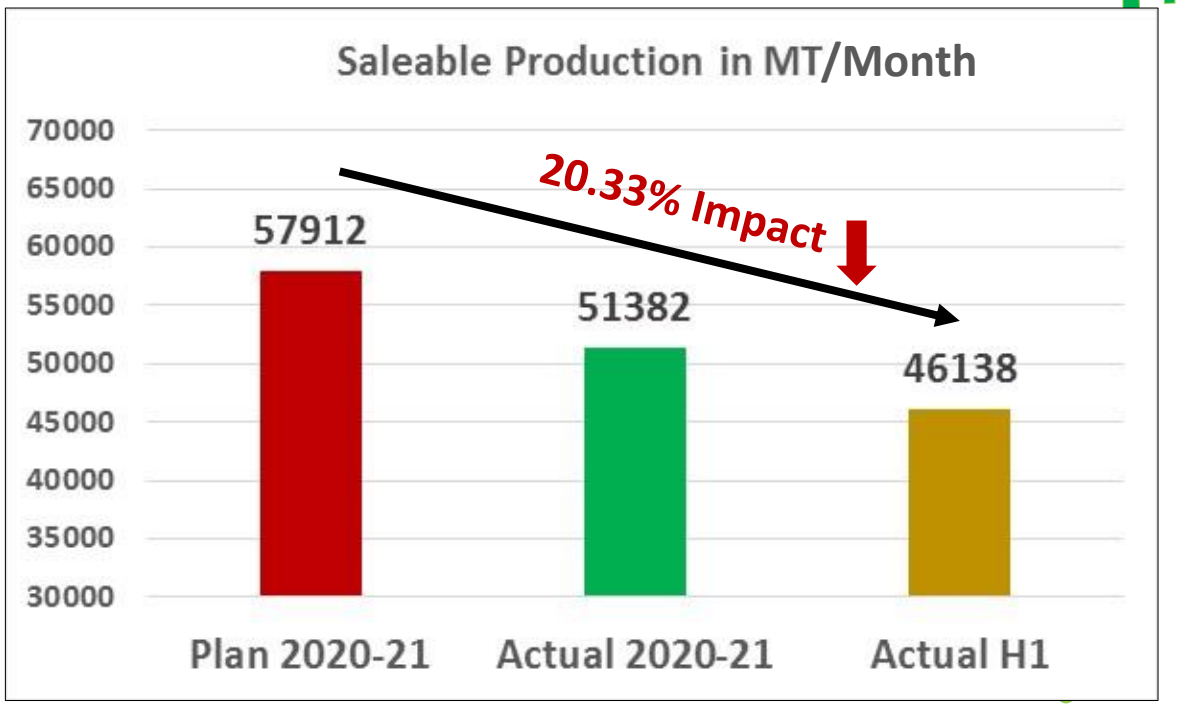
State of Art Paper / Board machines & Rewinders

High Speed Sheeters

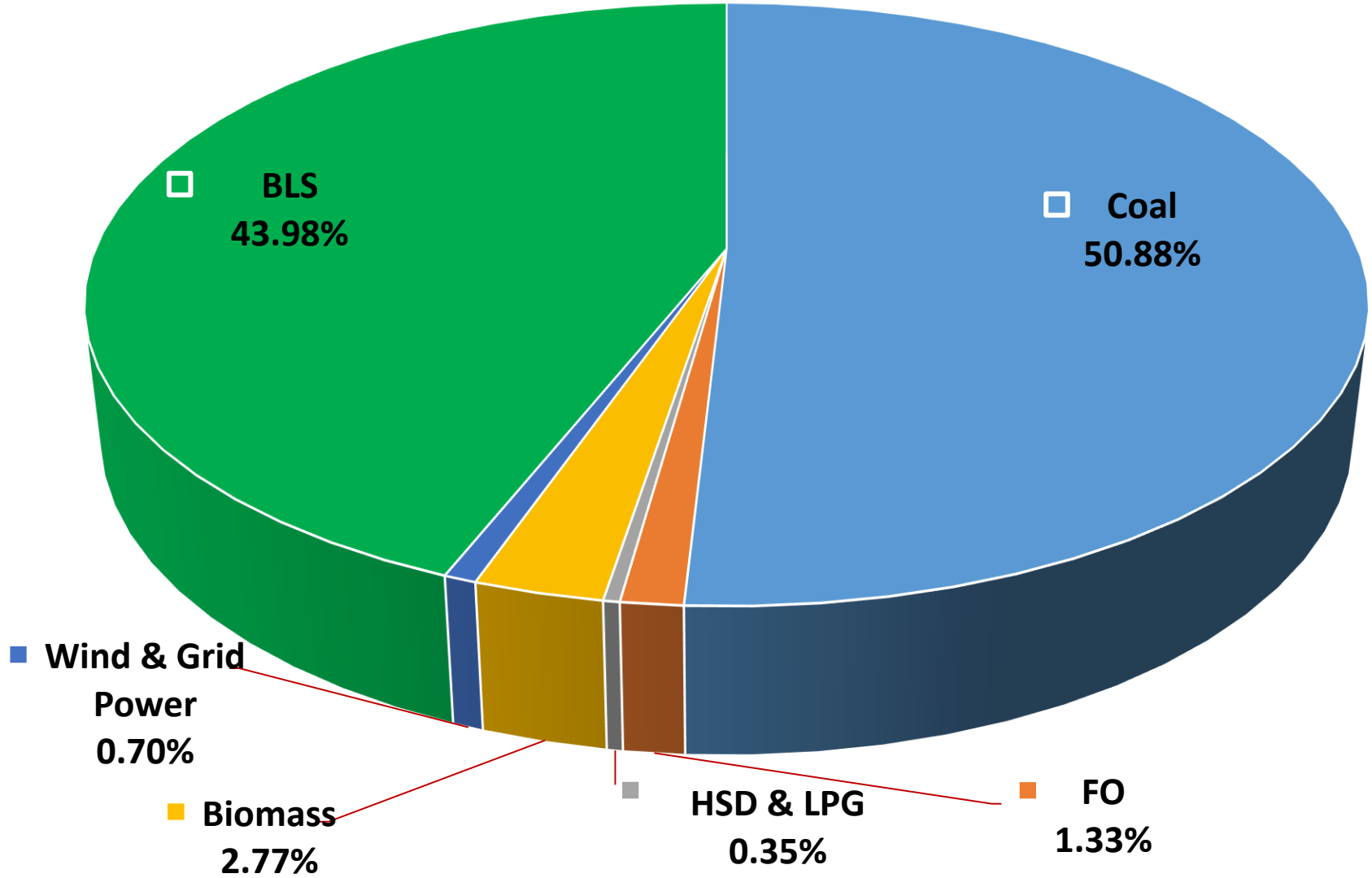
Automatic Storage & Retrieval Facility Warehouse

Impact of COVID-19



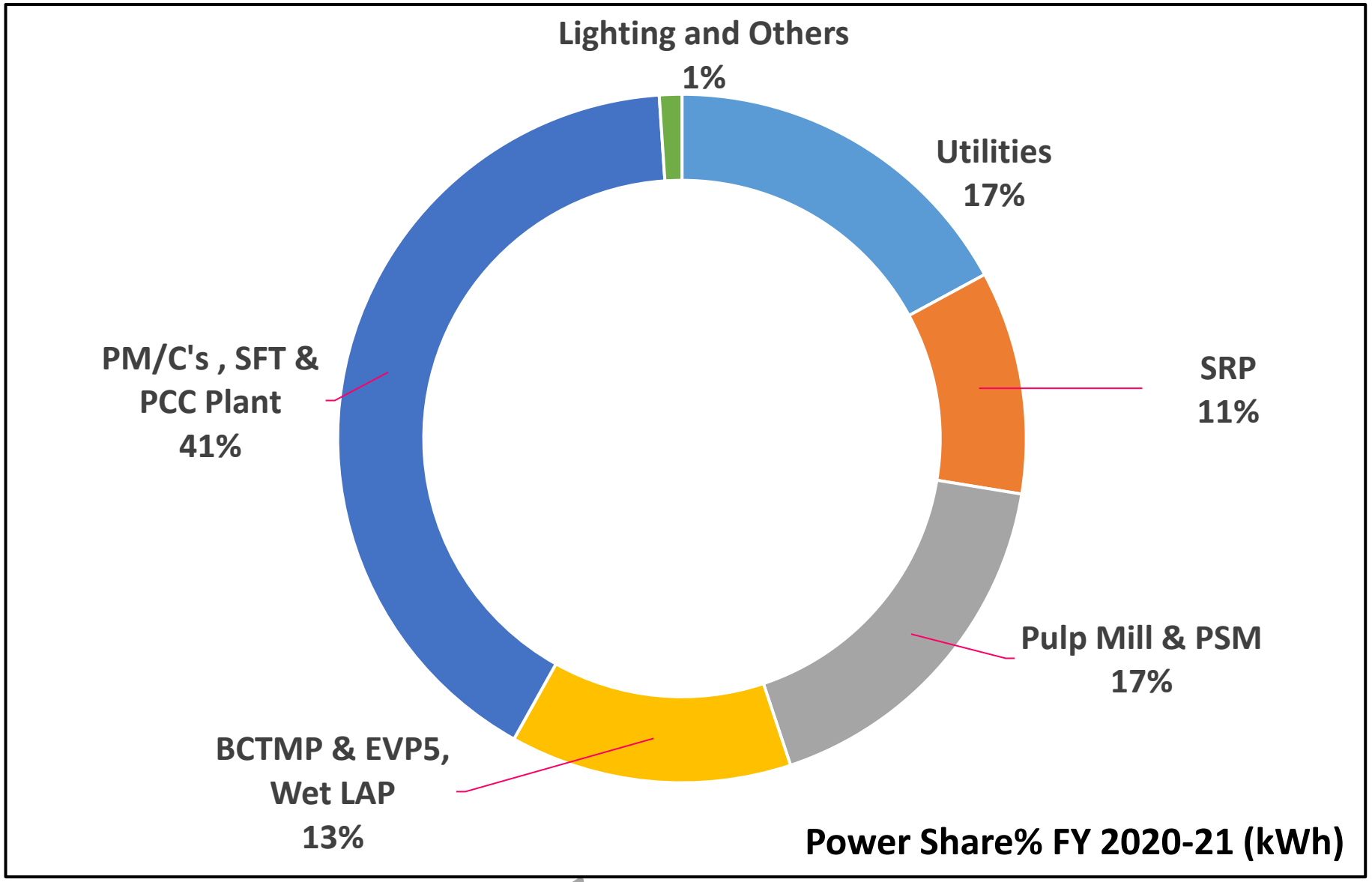


Energy Consumption Overview

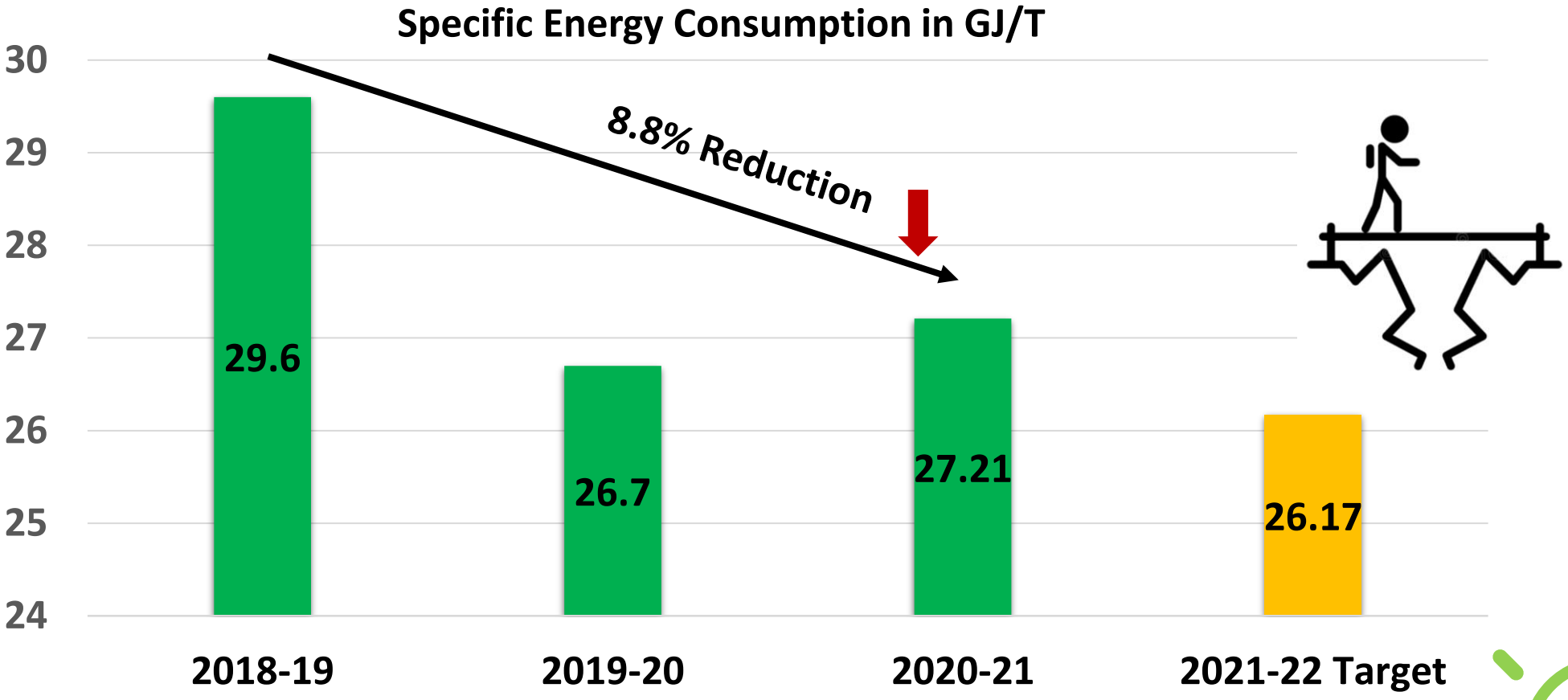


Primary Energy Distribution % FY 2020-21 (Mkcal)

Energy Consumption Overview

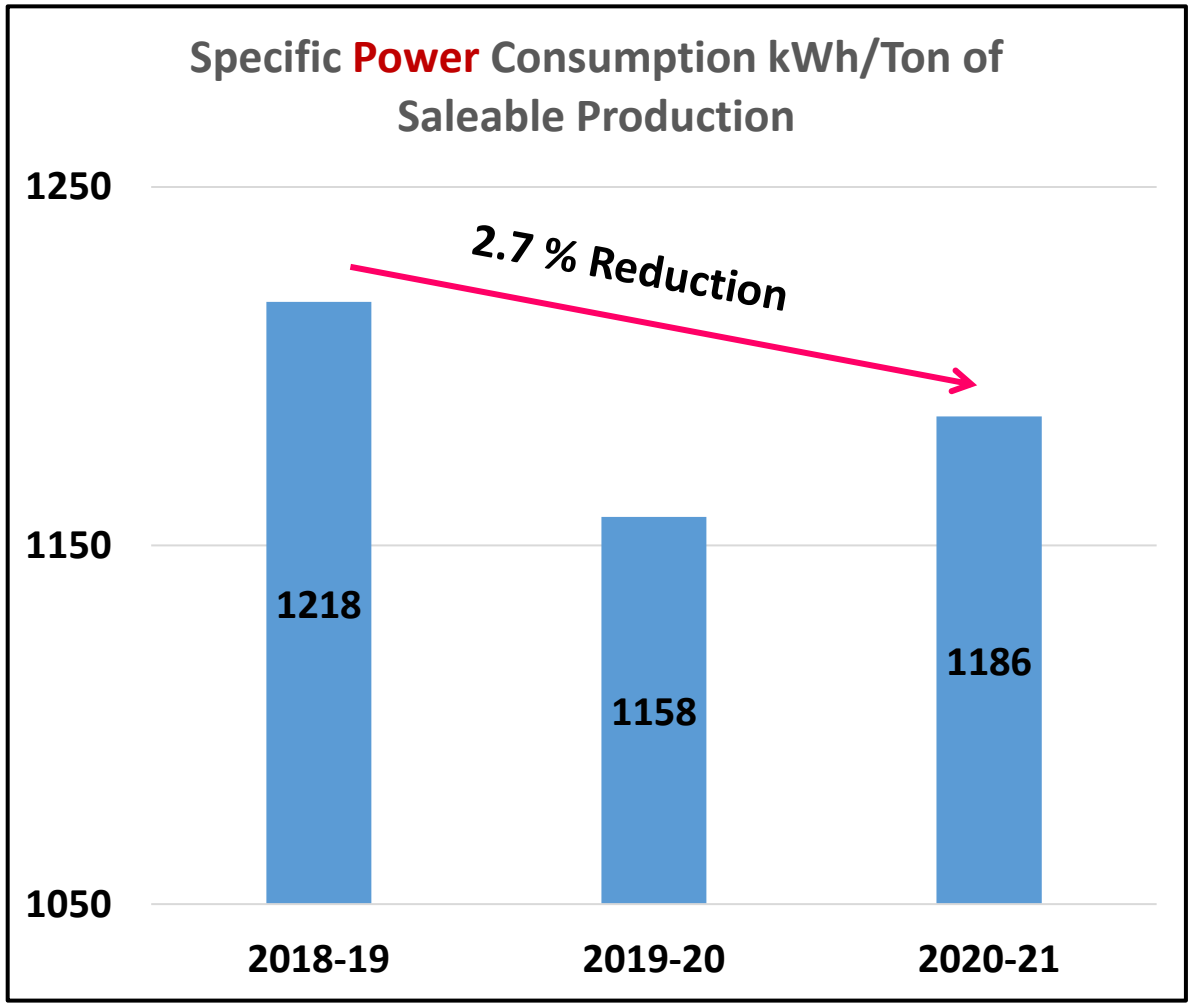


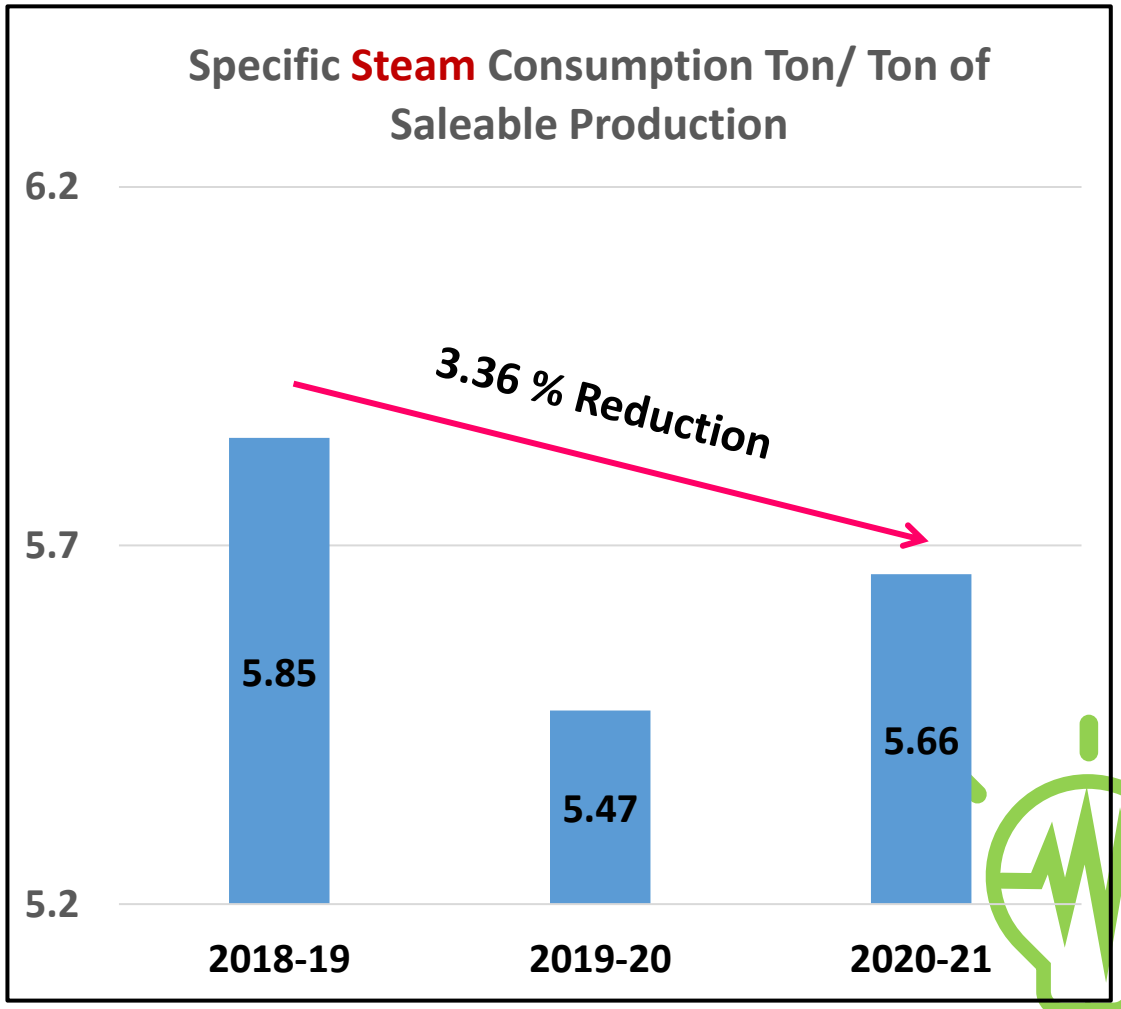
Specific Energy Consumption Reduction FY 2018-21



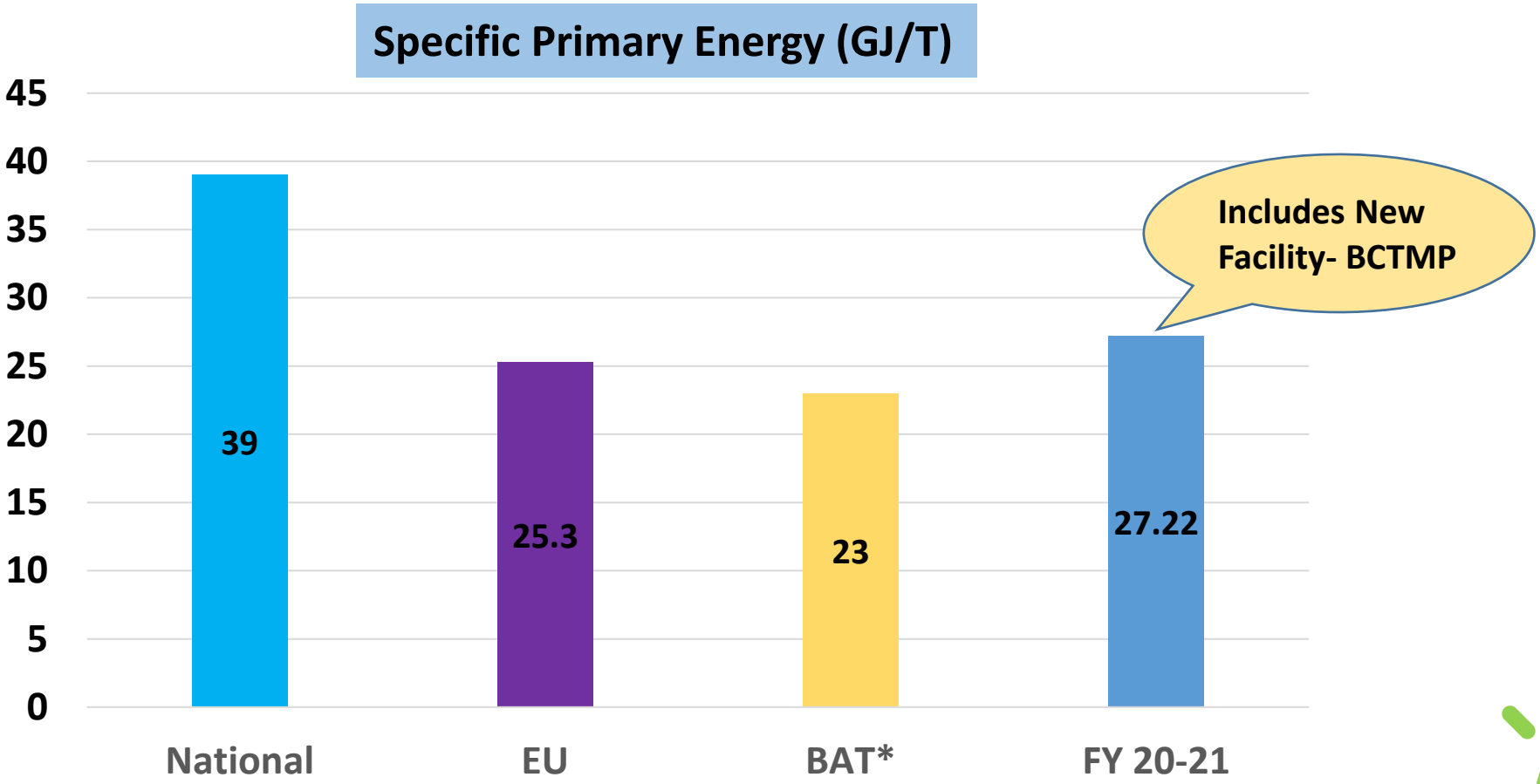
Reduction in Specific Energy Consumption Achieved by 8.78 % in Last 3 Years

Specific Power and Steam Consumption Reduction FY 2018-21





Benchmarking with World Class Performance



Benchmark Reference:
Centre for Science & Environment study published in 2010 for Pulp & Paper sector

***Best Achievable Technology (Without BCTMP)**

Global & National Benchmarking

BENCHMARKING – GLOBAL & NATIONAL

Industry Group	Particulars	Units	Global Avg.	India Avg.	ITC BCM
Wood Based Mills	Specific Electrical Energy Consumption	kWh/tonne of paper	1000-1100	1400-1500	1186
	Specific Steam Consumption	Tonne of steam/ tonne of paper	7.0-9.0	12.0-13.0	5.66

Reference: CPPRI 2018

Energy Conservation Plan 2021-22

S.No	Description	UOM	Saving Potential
1	Centrifugal Chillers at Pulp Mill	kW/Hr	800
2	Centac-1 Upgradation	kW/Hr	196
3	Intelligent Liquid Ring Vacuum Pump at PM2	kW/Hr	120
4	Godrej IFC for Compressed Air Network	kW/Hr	120
5	Energy Efficient Pumps for PM6	kW/Hr	100
6	Refiners Power Optimization	kW/Hr	90
7	VFD for GB FD Fan	kW/Hr	85
8	LED lighting for Balance Areas	kW/Hr	80
9	VFDs for Mill	kW/Hr	80
10	Vacuum Pump Optimization at PM4	kW/Hr	80
11	IE3 Motors Replacement Phase-1 (50 No's)	kW/Hr	70
12	PM4 Compressed Airline Filters Upgrdation	kW/Hr	70
13	Intelligent Liquid Ring Vacuum Pump at Evp-4	kW/Hr	40
14	New thermocompressor and existing TC Retrofit for dryers	TPH	24
15	De Superheating Shifting to User End	TPH	20
16	Hood & PV Heat Recovery PM6	TPH	13

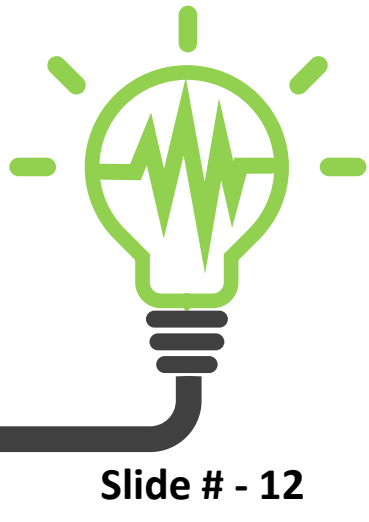
Energy Conservation Projects Implemented FY 2018-21

ENCON Projects with "ZERO" Investment (2018-21)

Year	No. of Zero Investment Projects	Annual Energy Saved (Million kWh)	Annual Thermal Energy Saved (T Steam)	Savings (Rs. Million)
2018-19	8	3.31	1675	34.63
2019-20	9	2.34	-	9.21
2020-21	14	7.96	35973	68.77
Total	**31**	**14**	**37648**	**112.61**

Total 31 Projects with ZERO Investments implemented in las 3 years resulted saving of Rs. 112.61 Millions

ZERO investment projects are coming from shop floor / TPM where Every employee irrespective of level contributing in Energy & Resource Conservation.



Energy Conservation Projects Implemented FY 2018-21

ENCON Projects with "ZERO" Investment (2020-21)

Sl. No.	Title of project implemented	Annual Savings	
		Electrical (kWh)	Monetary (Rs. Million)
1	CFBC Ash Handling Compressors Power Optimization	485267.0	2.13
2	ESP Field Power Optimization	187206.7	0.82
3	Impeller Trimming for ETP Secondary Sludge Pump	106080.0	0.47
4	Drive Logic for ETP Disposal Pump	358305.6	1.57
5	Impeller Trimming for TG-7 CT Pump-1	658234.6	2.89
6	Compressor Power Optimization Through Service Air Modifications	2251402.6	9.88
7	GB FWP Pressure Logic Modification	79619.8	0.35
8	Inst. Air Pressure Reduction from 5.9 to 5.8 bar	625985.3	2.75
9	MC Pumps Power Optimization Through VFD tuning	170517.6	0.75
10	Optimization of Power at HC & LC Refiner Through Selection of Low Intensity Plates at HC Refiner.	1557761.0	6.84
11	Power Saving Through Bypassing of Broke Refiner During Tetra Pac	474122.9	2.08
12	Refiners Power Optimization Through Fine Bar Tackles.	216881.3	0.95
13	Optimization of EVP-4 CT Pump-1 by Providing VFD.	798505.0	3.51
	Total	**7969889.28**	**34.99**

Energy Conservation Projects Implemented FY 2018-21

ENCON Projects with "ZERO" Investment (2020-21)

Sl. No.	Title of project implemented	Annual Savings	
		Thermal (Ton)	Monetary (Rs. Million)
1	HP Steam Saving Through Specific Power Generation improvement Project	35973.42	33.78
	Total	**35973.42**	**33.78**

Energy Conservation Projects Implemented FY 2018-21

ENCON Projects with Investment (2018-21)

Year	No of Projects	Annual Electrical savings achieved		Annual thermal Savings			Total Annual savings		Investment made
		Unit Million kWh	Rs Million	Tons of coal	Unit Million kWh	Rs Million	Unit Million kWh	Rs Million	Rs Millions
2018-19	5	4.27	20.30	-	-	-	4.27	20.30	42.50
2019-20	5	4.99	23.56	-	-	-	4.99	23.56	30.32
2020-21	6	8.70	38.21	-	-	-	8.70	38.21	44.08
Total	**16**	**17.96**	**82.07**	**0**	**0.00**	**0.00**	**17.96**	**82.07**	**116.90**

Total 16 Encon Projects with investments implemented in past 3 years resulted saving of Rs. 82.07 Millions

Total 42 Encon Projects with & with out investments implemented in past 3 years resulted saving of Rs. 194.68 Millions

Energy Conservation Projects Implemented FY 2018-21

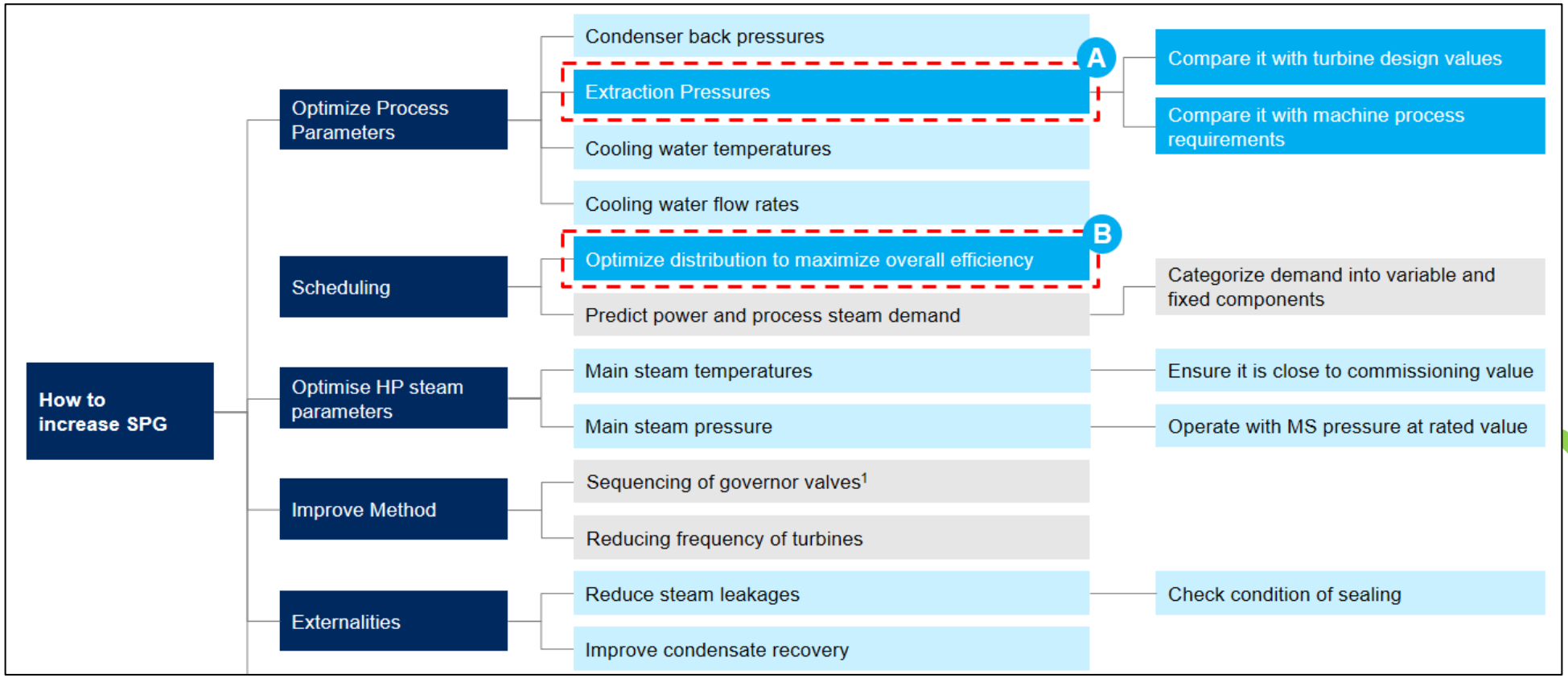
ENCON Projects with Investment 2020-21)

S.No	Title of project implemented	Annual Savings		Investment (Rs Million)	Payback period (Months)
		Electrical (kWh)	Monetary (Rs Million)		
1	Energy Efficient LED Lighting Mill Wide – Phase 2	1922820.0	8.44	16.837	1.99
2	Energy Efficient Centrifugal Chiller for Clo2 - Pulp Mill	3506335.7	15.39	12.3351	0.80
3	Energy Efficient Screw Chiller for PM6	1458518.4	6.4	4.335	0.68
4	Energy Efficient Screw Chiller for PM4	1286048.6	5.65	7.1432	1.26
5	Energy Efficient Primary Sludge Pumps for ETP Area	447285.6	1.96	2.724	1.39
6	Zero Air Loss Moisture Removal Traps for Centac-5	84008.4	0.37	0.7038	1.90
	Total	**8705016.72**	**38.2**	**44.08**	

Innovative Project-1: Improved Specific Power Generation by Intelligent Turbine Scheduling

Problem Case:

Multiple Boilers and Turbines with different loading capacities and efficiencies are loaded through manually which is effecting the specific power generation of turbines. (SPG)



Innovative Project-1: Improved Specific Power Generation by Intelligent Turbine Scheduling

B We built an optimizer to distribute process steam and power demands across turbines in order to maximize specific power consumption at overall level

Constraints and objective function have been laid out

Maximize

by varying -

$$SPG = \frac{\Sigma\ Power_i}{\Sigma\ HP_i}$$

Lp_i, Mp_i, $Power_i$

Such that - *Where $_i$ is for all turbines*

1 Demand constraints

$\Sigma\ LP_i$ = LP demand

$\Sigma\ MP_i$ = MP demand

$\Sigma\ Power_i$ = Network 1

$\Sigma\ Power_i$ = Network 2

$\Sigma\ HP_i$ > HP_{SRB} + 50 (CFB7) +70 (GB)

2 Mass balance

HP_i = LP_i + MP_i + $condensate_i$

3 Machine constraint

HP_i, MP_i, LP_i < Individual machine capacities

4 Power equation

$Power_i = f(HP_i, LP_i, MP_i)$

Relationship of individual turbine's power with process steam and HP steam

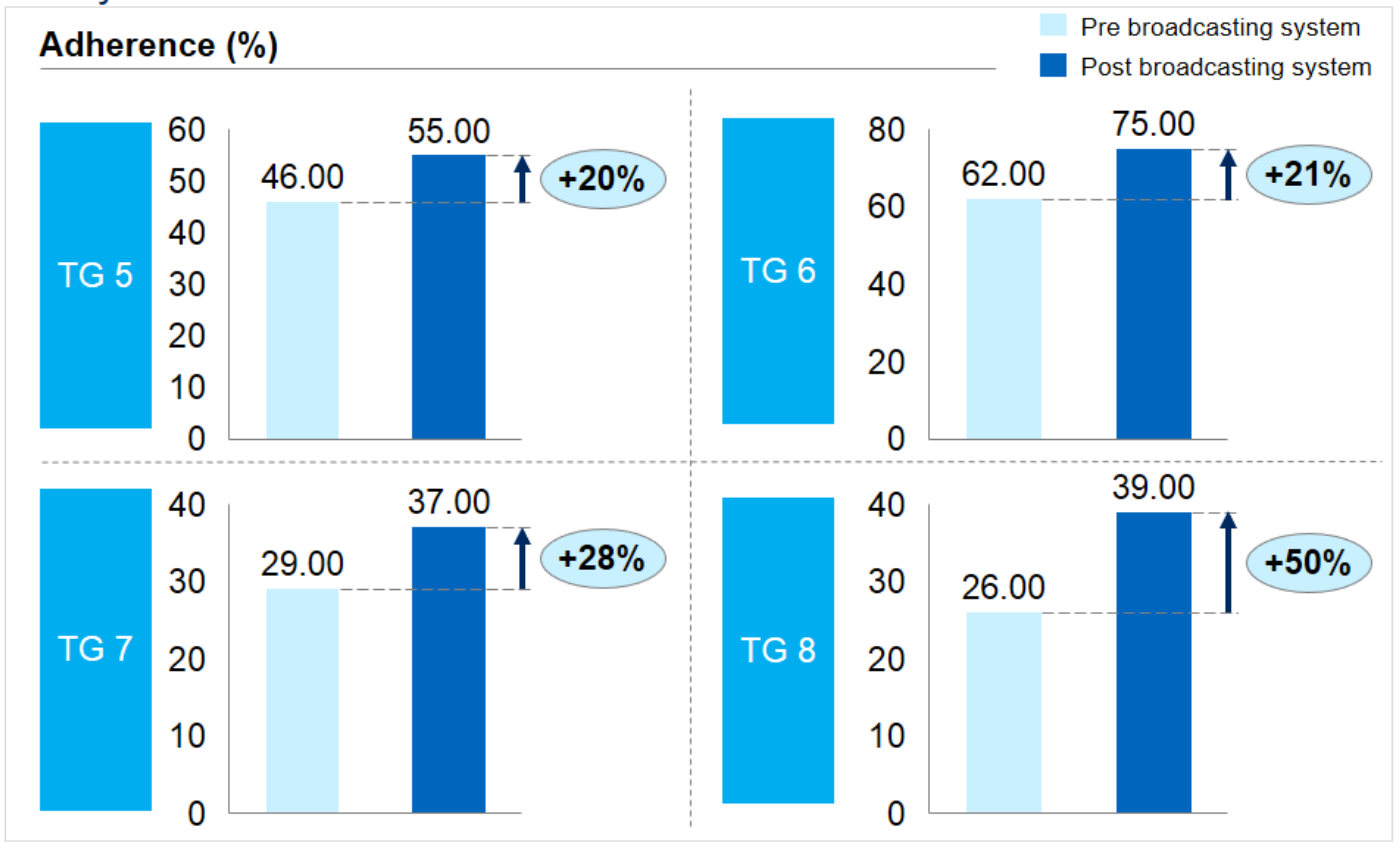
4

- **Granular minute level data has been considered for the analysis**
- **Linear relationships of power with corresponding HP, MP, and LP has been made for all 5 turbines**
- **Most equations have a R^2 of around 90%**

Turbine	Power equation	R sq.
TG 3	Power = 0.27 X HP steam - 2.12	91%
TG 5	Power = 0.25 X HP steam - 0.19 X MP steam - 0.13 X LP steam - 2.62	95%
TG 6	Power = 0.18 X HP Steam - 4.36	69%
TG 7	Power = 0.28 X HP steam - 0.14 X LP steam - 2.53	92%
TG 8	Power = 0.198 X HP steam - 0.05 X MP steam - 7.08	99%

Innovative Project-1: Improved Specific Power Generation by Intelligent Turbine Scheduling

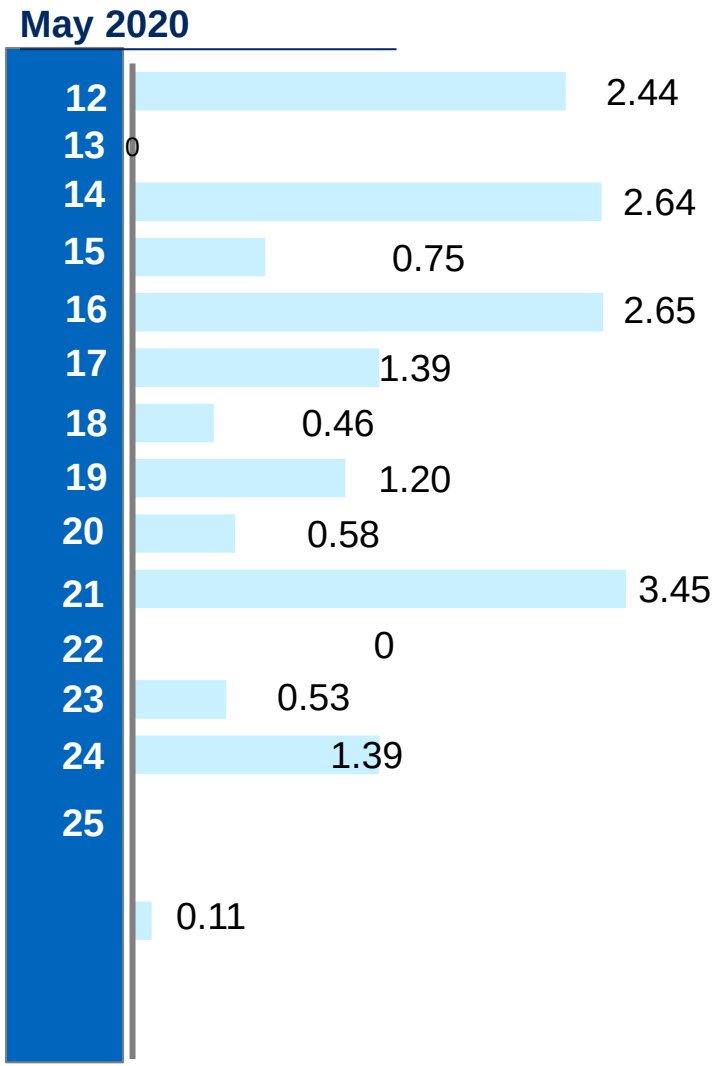
B Adherence of the optimizer recommendations has slightly improved after establishing broadcasting system of the recommendations – low adherence observed in TG7 and TG8



- Adherence is calculated by checking how close the TG parameters are to optimization recommendations after 5 minutes
- TG 7 has low adherence due to lack of direct flow control of LP
- TG 8 has seen low adherence due to issues with CFBC
- Operator discipline also should be increased in order to improve adherence

Adherence shall be tracked on a daily level to help identify issues and improve adherence

Innovative Project-2: Improved Specific Power Generation by Intelligent Turbine Scheduling



Total SPG impact 1.46

Optimizer – Built for intelligent turbine loading and steam distribution

E:/Industry 4.0/Wave 2/Utilities/Optimizer_Code/shinytest/shinytest/App1 - Shiny

http://127.0.0.1:3111 | Open in Browser | Republish

Constraints	Demand
LP Demand	200
MP Demand	84.54
Network1(TG5 & TG6)	31.35
efforts	43.34
Network2(TG7 & TG8)	10.8
Network(TG3)	273.35000000000002
HP Header Pressure	62.73
GB Biomass Running	Yes

Description	Time
Datalogger time stamp	3/20/2020 16:36
Adherence calc time	3/20/2020 16:36
Last run time	2020-07-08T13:44:45.943Z

Variables	OptimisedValues	ActualValues	Direction	Difference
TG3 C	61.35	61.35	-	0
TG3 P	10.8	10.8	-	0
TG5 MP	12.18	12.18	-	0
TG5 LP	83.96	83.96	-	0
TG5 C	32.04	32.04	-	0
TG5 P	16.71	16.71	-	0
TG6 P	14.65	14.65	-	0
TG8 LP	104.24	104.24	-	0
TG7 LP	14.6	14.6	-	0
TG7 C	74.34	74.34	-	0
TG7 P	19.33	19.33	-	0
TG8 MP	71.12	71.12	-	0
TG8 LP	103.9	103.9	-	0
TG8 P	24.01	24.01	-	0
Total HP	559.15	559.15	-	0
Total P	85.49	85.49	-	0
SPG	160.06	160.06	-	0

Refresh

TG	Adherence
TG5	82%
TG6	60%
TG7	92%
TG8	80%

Innovative Project-2: Improved Specific Power Generation by Intelligent Turbine Scheduling

Benefits:

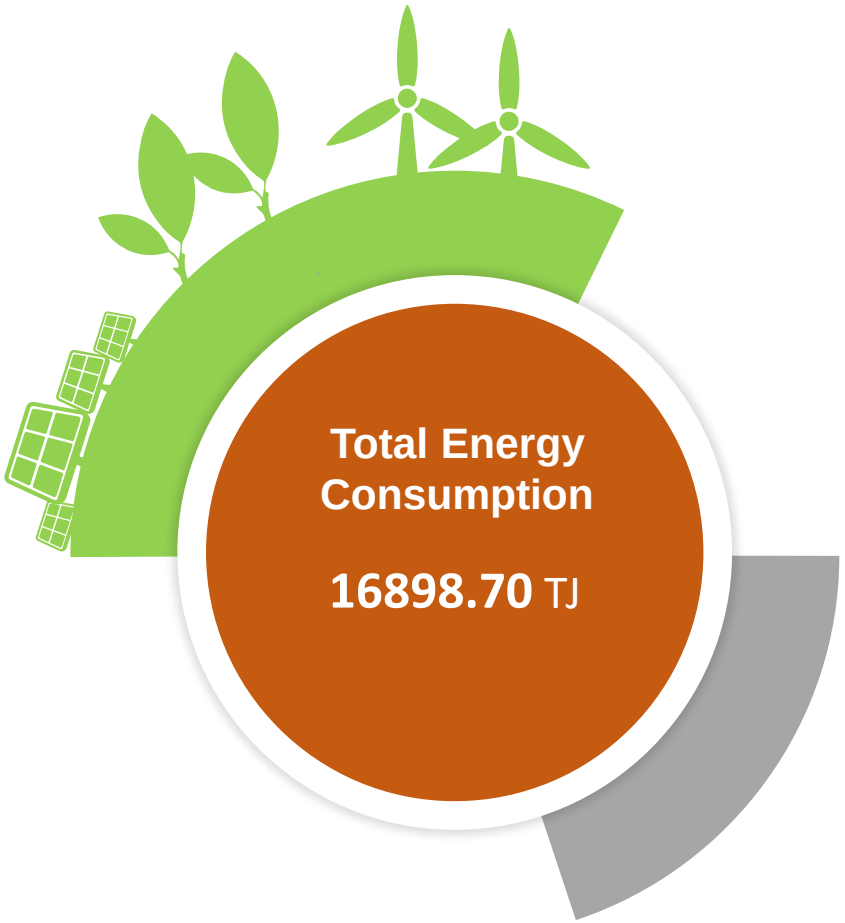
1. Turbines Specific Power Generation improved by **1.03%.**

2. Reduction in Coal consumption is **7200 MT/Annum.**

3. Reduction in Cooling tower make up water consumption is **52000 m3/annum.**

4. Overall monetary savings are **Rs. 425 Lacs.**

Utilisation of Renewable Energy Sources



47.9%

Renewable sources

Black Liquor (43.98%)
Biomass & Biogas (2.77%)
Wind & Solar (0.7%)

52.1%

Fossil sources

Indian Coal (50.88%)
Furnace Oil (1.33 %)
HSD & LPG (0.35%)

FY 2020-21

Utilisation of Renewable Energy Sources

On-Site Renewable Energy Generation

- **Solar PV – Lakshmipuram**
  - 80 kWp Rooftop Solar PV plant
- **FY 2020-21**
  - Energy Generation 79407 kWh
  - 72 tCO2eq of GHG Emissions avoided

- **Solar Light Pipes**
  - Total Installed – 126 no's
  - Annual Energy savings – 1.35 lac kWh
  - GHG Emissions – 124 tCo2eq

Utilisation of Renewable Energy Sources

Off-Site Renewable Energy Generation

- **Energy Wind Energy**
  - 46 MW wind farm in Andhra Pradesh
  - Average Energy Generation – 11 X 10^7 kWh
  - Substitutes electrical energy generated from coal.

- **FY 2019-20**
  - Wind Power Utilized at BCM - 332,74,644 kWh
  - Coal savings – 50258 tons
  - GHG Emissions –30279 tCo2 eq

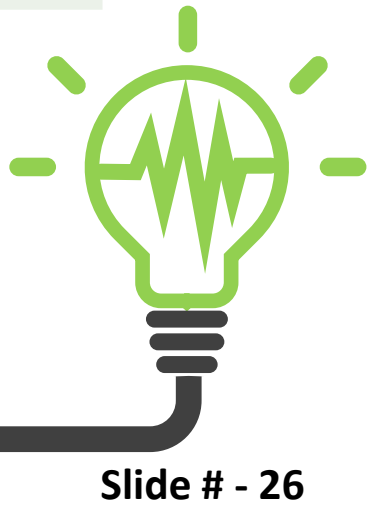
Waste Utilisation and Management

- **100% solid waste utilization/ recycling in Bhadrachalam unit.**
- **Chipper dust & bark** used in Green Boiler for steam generation (Also contributing in renewable energy generation)
- 100 % **Fly ash** utilization by way of manufacture of Fly Ash Bricks and in cement industries.
- **Lime sludge recycled with Lime Kiln**.
- Andritz Press **sludge** is utilized by external agency for card Board manufacturing & Egg tray manufacturing
- **Effluent Treated discharge for irrigation / plantations**.

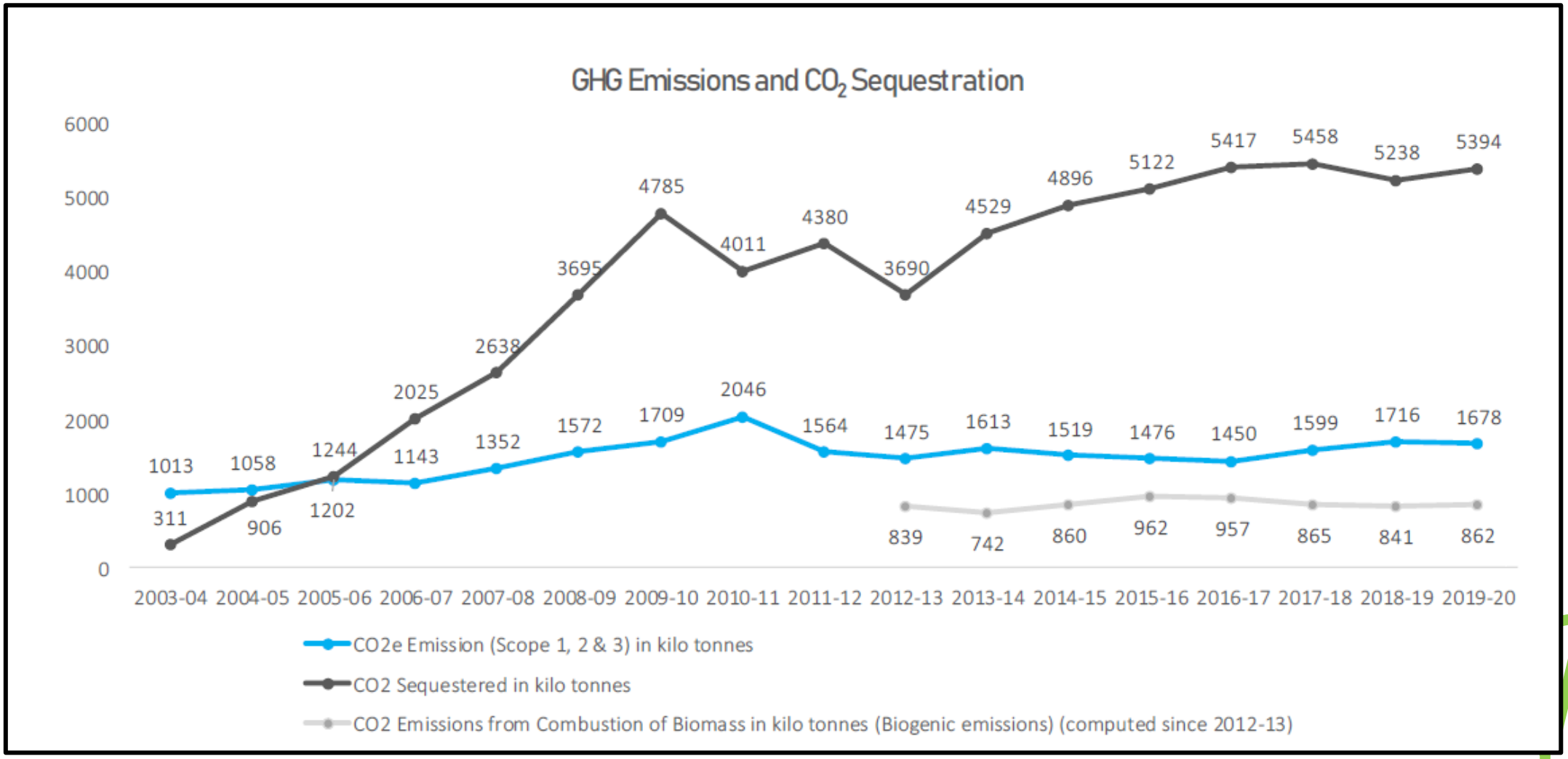
Waste Utilisation and Management

Utilization of Waste in FY 2018-21

Type of Fuel	Year	Qty in MT	GCV of fuel (kCal/kg)	Heat Value (million kcal/year)	Waste as percentage of total fuel
Chip dust & Biomass	2018-19	32652.25	3296.91	107651.42	2.363%
Bio Gas equivalent to LPG	2018-19	3.60	11892.01	42.76	0.001%
Chip dust & Biomass	2019-20	29416.13	3235.25	95168.53	2.717%
Bio Gas equivalent to LPG	2019-20	0.65	11892.01	7.70	0.000%
Chip dust & Biomass	2020-21	40009.654	3105.85	124263.98	2.932%
Bio Gas equivalent to LPG	2020-21	2.53	11892.011	30.13	0.001%



GHG Inventorisation



Source : ITC Sustainability Report 2020

GHG Inventorisation

Long Term Goals

Proposals	Responsibility	Targets
Increase in Renewable energy share by installation of Energy efficient recovery boiler with higher BL Solids firing (2700TPD).	Head(Proj.) & Head(Pulp& recovery)	Long Term Mar,2023
Reduce coal consumption by 1.30LTPA by installation of Energy efficient recovery boiler .	Head(Proj.)	Long Term Mar,2023
Reduction in imports by in-house BCTMP production enhancement from the exiting production 1.0 LTPA to 1.20 LTPA.	Head(Proj.) & Head(Pulp& recovery)	Long Term Mar,2023
Reduction in imports(Bleached HW Pulp) by in- house HW pulp production enhancement from 3.5LTPA to 4.0 LTPA	Head(Proj.) & Head(Pulp& recovery)	Long Term Mar,2023
Explore possibility of ETP Sludge utilization in the boilers to reduce disposal to agencies for reduction in CO2 emissions	Head(Utilities)& Head(Mtrls)	Long Term Mar,2023

Green Supply Chain Management

Green Purchasing Policy:

March 1, 2019

GREEN POLICY

We at Unit Bhadrachalam of the Paperboards and Specialty Papers Division of ITC engaged in the development and manufacture of Pulp, paper, paperboard and specialty papers, are committed to monitor, continuously innovate and improve our score against set targets on the various parameters listed below while building capabilities in our employees and vendors in order to achieve international benchmarks in an environmentally sustainable manner.

Energy Efficiency

Water Conservation

Renewable Energy

GHG Emission Reduction

Material Conservation, Recycling & Recyclables

Waste Management

Green Supply Chain

Life cycle Aspects and Product Stewardship

Occupational Health & Safety

PAPERBOARDS AND SPECIALTY PAPERS DIVISION

B MAKARAND
UNIT HEAD

S.No	
1	Procure maximum from Vendors/Service Providers who have robust Management Systems like ISO 9000& 14000 or equivalent
2	Procure energy efficient equipment.
3	Source maximum from the nearest market.
4	Motivate Vendors to conserve natural resources, minimize waste generation, emissions by adopting energy efficient processes
5	Ensure Suppliers & Service Providers to comply with applicable legal requirements w.r.t. EHS

Green Supply Chain Management

Green Chain Management Plan - External

S.No	Strategy	Action Plan	2021- 2022	2022 - 2023
1	Awareness creation and Training.	To create awareness and train all the critical vendors on green practices	Efficiency improvement and reduction in GHG and Logistic Optimization.	Bring in more Vendors in to the purview of Awareness Creation.
1(a)	For Chemical Vendors	Create awareness to reduce emissions, toxicity, water conservation and increased usage of environmental friendly chemicals	Set targets for additional 30% critical vendors and provide necessary inputs to achieve targets. Monitor closely by regular audits	Sets targets for additional 40% of the critical vendors and provide necessary inputs to achieve targets. Monitor closely by regular audits
1(b)	For Packing Vendors	Create awareness to reduce wastage, improve recycling, conserve power and water	Reduction of energy 2%, waste and water by 2% from a baseline year of 2019-20	Reduction of energy 1%, waste and water by 1% from a baseline year of 2020-21
1(c)	For Engineering Local Service Providers(Vendors)	Make 5 local vendors to reduce wastage, packing material, and get certifications.	Make 5 local vendors to go for import substitution, certifications by providing guidance , monitoring and regular audits	Make all the 5 local vendors reach the goals set and define new targets for next 3 years.
2	Efficiency Improvement	To improve productivity and quality, to reduce defects and rework	Encourage 5% of critical suppliers to go for process improvement through SOPs and by following best industrial practises	Encourage 10% of critical suppliers to go for process improvement through SOPs and by following best industrial practises
3	Environmental Certifications	To encourage vendors to move towards Environmental Certifications	To motivate 4 more vendors to go for Environmental Certifications	To motivate 7 more vendors to go for Environmental Certifications

Green Supply Chain Management

Projects Implemented

Imported Material Procurement:

- Reduction in import of BCTMP.
- Transfer of Hardwood Pulp to Tribeni Mill thereby reducing procurement of Imported HW Pulp for TribeniUnit
- Stopped Import of Stretch film and Kraft Wrapper and sourcing being done from domestic market.
- Usage of Imported Sizing agent(Hiphase) replaced by Domestic Source.

Material reduction :

- GSM reduction of wrapper and Side Discs.

Green Supply Chain Management

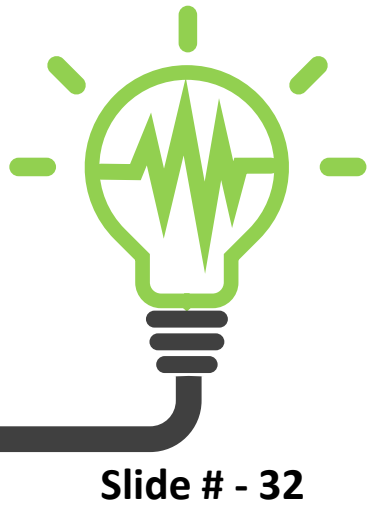
Projects Implemented

Recycling:

- Core Plug and Side Disc Recycling.

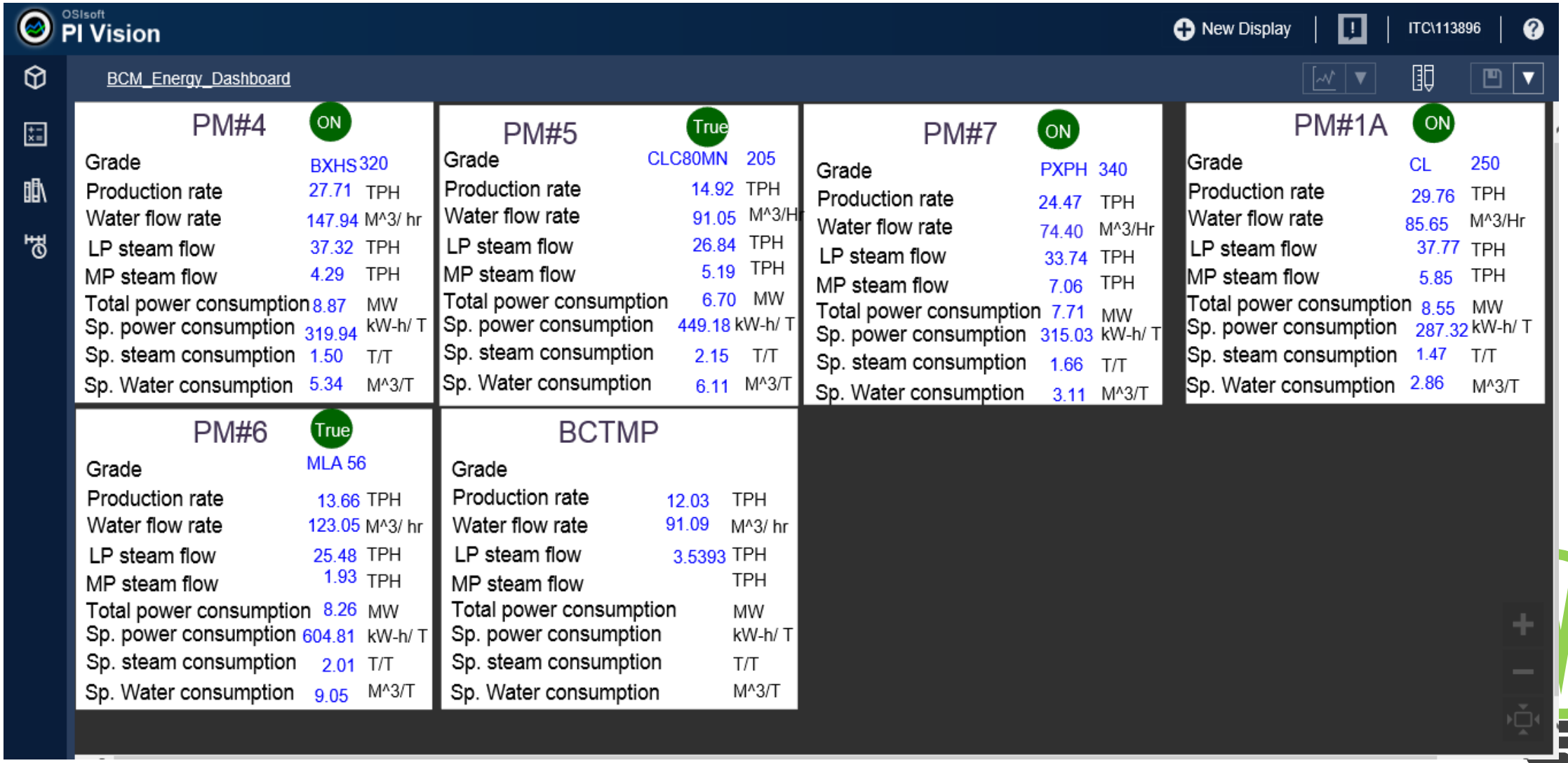
Logistics Reduction :

- Procurement of Coal from nearby Mines.
- Procurement of Wrapper from WG district instead of Pune.
- Procurement of Chemicals from Vijayanagaram and Kurnool instead of Harihar and Bombay.
- 100% procurement of Stretch film from domestic market instead of part import from Sweden.



Team Work, Employee Involvement & Monitoring

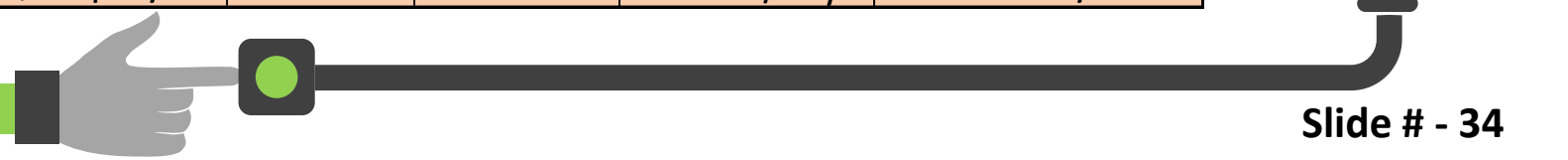
Continuous Energy Monitoring by using IOT



Team Work, Employee Involvement & Monitoring

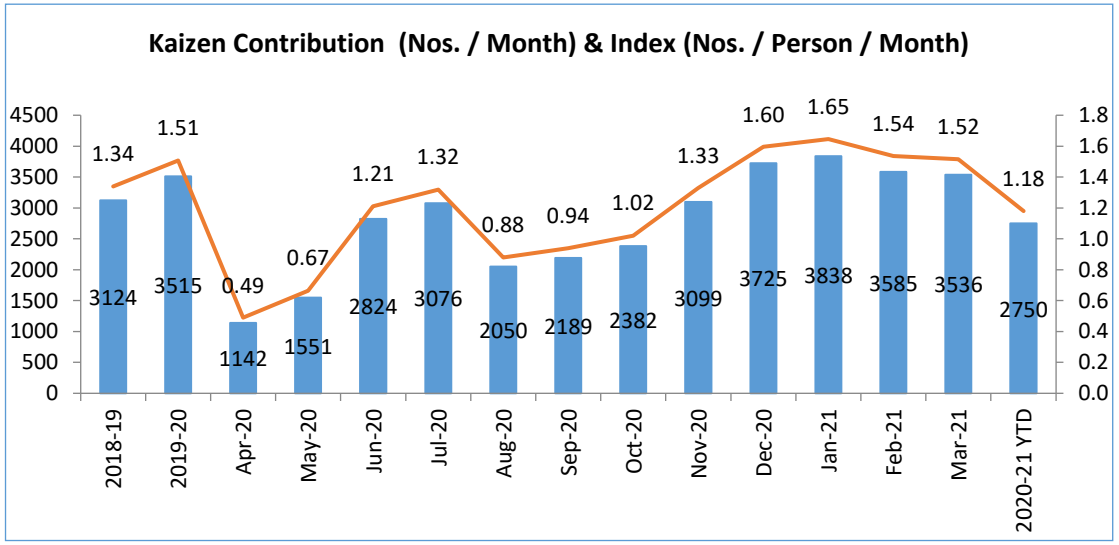
Encon Reward and Recognition Scheme

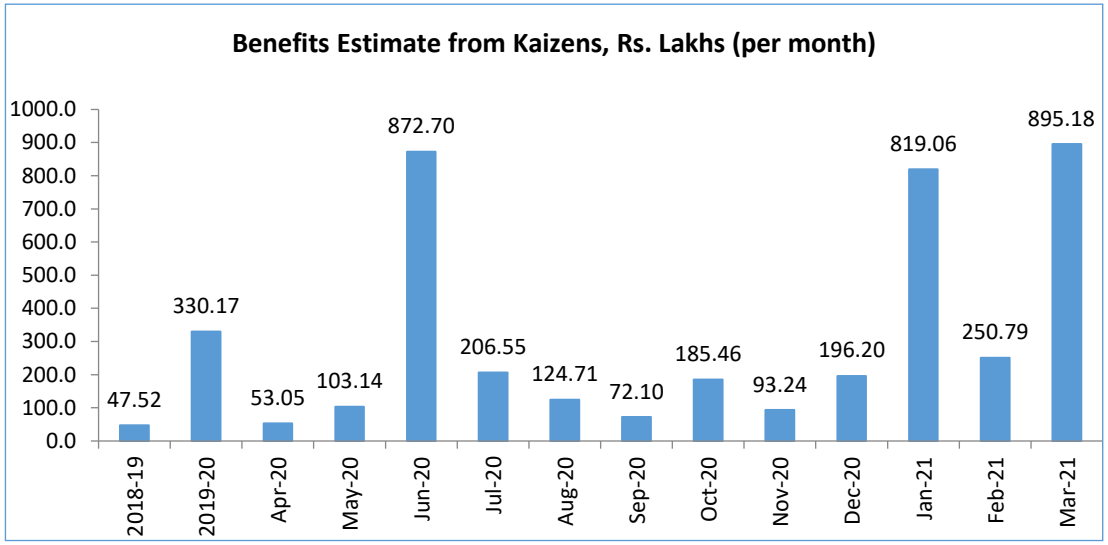
S.No	Award	Target Group	Parameter	Min. Target Reduction	Criteria
1	BCM Energy & Water Efficient Leader	DMT	All		Criteria 2, 3 & 4
2	Excellent Power Efficient DMT	DMT	Power	3%	CAPEX/FIP/Kaizen
3	Excellent Steam Efficient DMT	DMT	Steam	2 TPH	CAPEX/FIP/Kaizen
4	Excellent Water Efficient DMT	DMT	Water	200 M^3 /day	CAPEX/FIP/Kaizen
5	Power Efficient DMT	DMT	Power	2%	CAPEX/FIP/Kaizen
6	Steam Efficient DMT	DMT	Steam	1 TPH	CAPEX/FIP/Kaizen
7	Water Efficient DMT	DMT	Water	100 M^3 /day	CAPEX/FIP/Kaizen
8	Excellent Power Efficient JH	JH	Power	50 kw	FIP / Kaizens only
9	Excellent Steam Efficient JH	JH	Steam	6 TPD	FIP / Kaizens only
10	Excellent Water Efficient JH	JH	Water	50 M^3 /day	FIP / Kaizens only
11	Best Power saving Manager/Employee	Individual	Power	10 kw	Kaizens only
12	Best Steam saving Manager/Employee	Individual	Steam	2 TPD	Kaizens only
13	Best Water saving Manager /Employee	Individual	Water	10 M^3 /day	Kaizens only

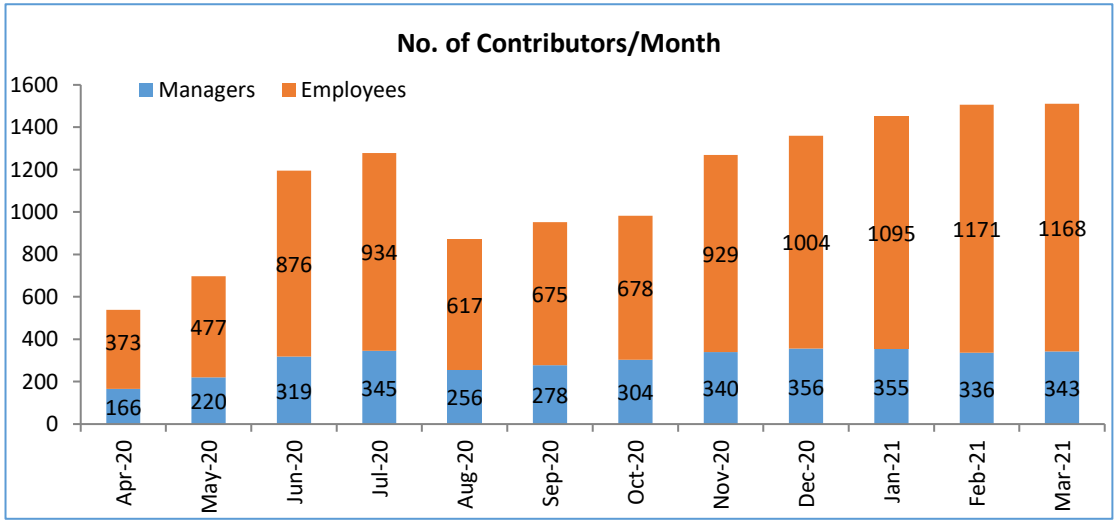


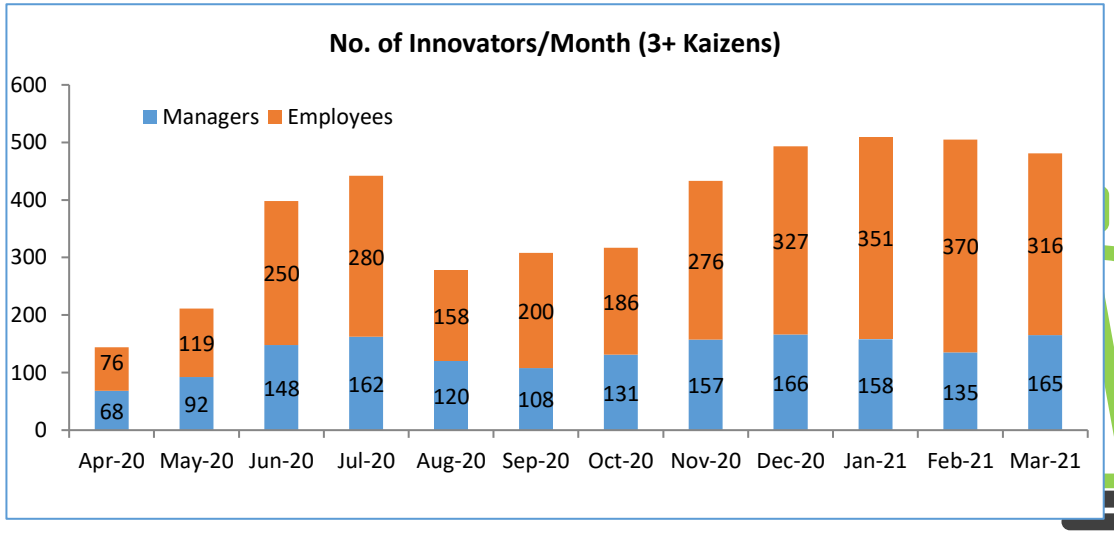
Team Work, Employee Involvement & Monitoring

TPM









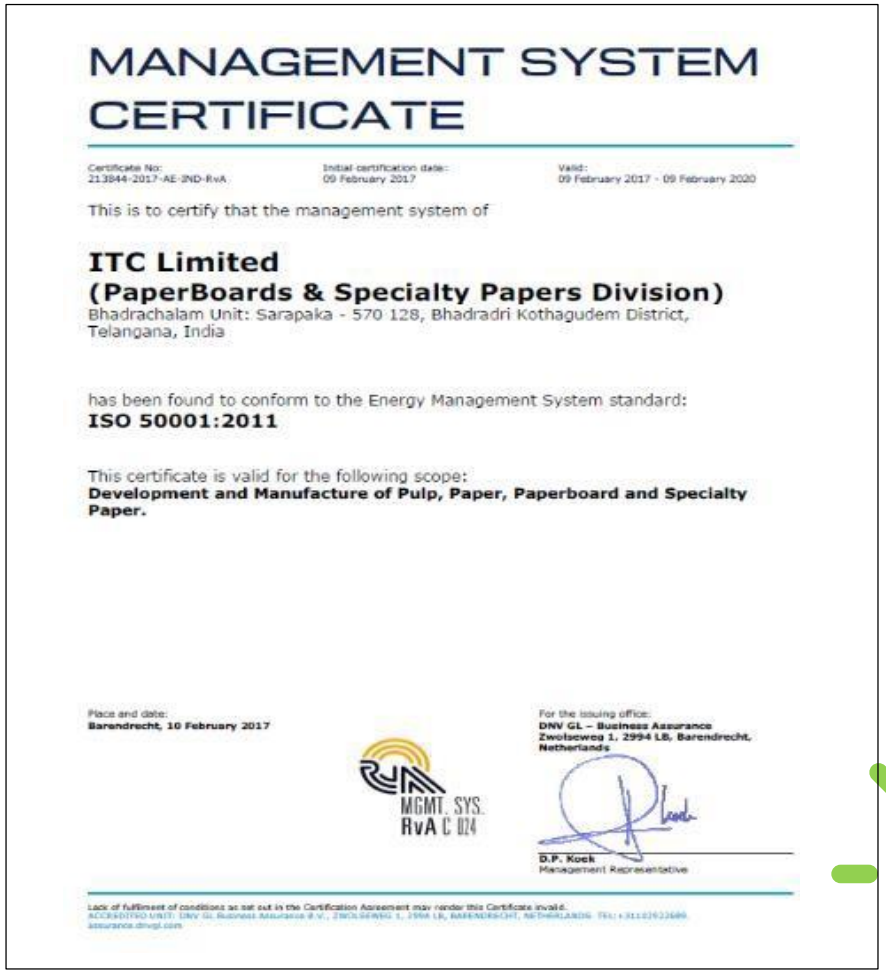
Team Work, Employee Involvement & Monitoring

Particulars (<5 Lakh not considered)	2020-21	
	No. of Ideas	Value, Rs. Lakhs Annualized
(A1) Onetime Saving Ideas	58	1762
(A2) Recurring Savings	50	1360
Total	**108**	**3132**
(B1) Fixed Cost Saving	7	107
(B2) Variable Cost Saving	89	2618
(B3) Capex Saving (spend avoided)	12	407
Total	**108**	**3132**
(C1) Reduction in Current Cost established through KPIs (will flow into P&L)	17	377
(C2) Reduction in Current Cost - potential/estimated (will flow in next year plan, once established)	72	2227
(C3) Saving in potential additional spend (or) Spend avoided	19	528
Total	**108**	**3132**

Implementation of ISO 50001:2011 (EnMS)

Continual improvement of energy performance by complying with the requirements of ISO 50001:2011 Energy Management System (EnMS) standards. **(The PDCA approach)**

- Formulation of Energy Policy
- Initial Energy Review, Baseline establishment
- Identification of EnPIs
- Identification of objectives, targets & management programs
- Operational Controls, Documentation
- Internal auditor Training
- Internal audit
- Audit findings closing
- Management Review
- Certification Audit Stage-1
- Certification Audit Stage-2



MANAGEMENT SYSTEM CERTIFICATE

Certificate No: 213844-2017-AE-IND-RvA
Initial certification date: 09 February 2017
Valid: 09 February 2017 - 09 February 2020

This is to certify that the management system of

ITC Limited
(PaperBoards & Specialty Papers Division)
Bhadrachalam Unit: Sarapaka - 570 128, Bhadradri Kothagudem District, Telangana, India

has been found to conform to the Energy Management System standard:
ISO 50001:2011

This certificate is valid for the following scope:
Development and Manufacture of Pulp, Paper, Paperboard and Specialty Paper.

Place and date:
Barendrecht, 10 February 2017

MGMT. SYS. RvA C 024

For the issuing office:
DNV GL – Business Assurance
Zwolseweg 1, 2994 LB, Barendrecht, Netherlands

D.P. Koek
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

ISO 50001:2018 Upgradation In Progress Target is Mar'22

GreenCo Certification

ITC PSPD, Unit: Bhadrachalam becomes the 1st Pulp & Paper Plant in India to achieve Greenco Platinum+ (Plus) Rating (July'2020)

Thank You