ISSN: 0379-5462
IPPTA: Quarterly Journal of Indian Pulp and Paper Technical Association
Vol. 36, E1, 2024, p. 88-93

FOSTERING THE FUTURE OF ENERGY AND ENVIRONMENT IN SESHASAYEE PAPER AND BOARDS LTD, UNIT: ERODE

Ganesh Bhadti*

D. Radhakrishnan*

T. Iswarya*

**Seshasayee Paper & Boards Limited, Tamil Nadu*

Abstract:

In the pursuit of a sustainable future, a delicate balance between energy and the environment has become a focal point for innovation and change in our era. As the world tussles with the challenges of climate change and resource depletion, industries are under enormous pressure to adopt environmental-friendly processes. Industries, long considered as a significant contributor to environmental degradation, are undergoing a transformation towards sustainability.

This article delves into the acute importance of striking a balance between environmental preservation and meeting the ever-growing demand for energy, emphasizing the need for sustainable practices and innovative solutions. In SPB, we have increased our green energy share by 6% and enhanced our pulp production from 380 to 430 TPD through innovation in the Digestor modification project. Our constant look to offset the fossil fuel requirement has triggered us to implement a solar sludge dryer for handling MLSS as biomass in the power boiler. In addition, the burning of Bio-Methanation gas in the Rotary Lime Kiln along with the furnace oil. This resulted in a reduction of furnace oil consumption by 3.5 to 4.0 TPD for lime production. We partially replaced fossil fuels with biomass in the power boiler by modifying bio mass feeder arrangements. Our in-house team carried out modifications to the power boiler, which helped us reduce coal consumption by 79 TPD and increase green energy by 7.46%. In total, we have increased our renewable energy share from 55 to 68%. The above projects can be applied horizontally in other mills where similar system are in use. Priority to renewable energy, efficiency enhancement measures, technological innovations, and fostering a global commitment to sustainability are navigating us towards a future where carbon neutrality is not just an ambitious goal but a collective reality.

To sum up, the nexus of energy, the environment, and GHG emissions reduction represents both a challenge and an opportunity. Through technology and teamwork, at SPB we are molding a path toward a more sustainable and resilient future - one where energy meets our needs without compromising the health of the planet.

Keyword: Sustainability, Energy, Environment, GHG emissions

I. Introduction

1.1 About us:

Seshasayee Paper & Boards Limited, established in 1960, is a wood and agro-based integrated pulp and paper industry with an installed capacity of 20000 TPA and continuously upgraded to the present capacity of 165000 TPA. SPB's branded products have been carefully formulated to match the specific needs of various consumer segments. SPB has always been committed to manufacturing quality papers by using environmentally benign raw materials and technology.

Not only with the capacity expansion of the pulp mill, chemical recovery plant, and paper and board machines, we have increased marginally the mill capacity by debottlenecking, resulting in the generation of additional black liquor and putting additional load on the existing chemical recovery plant, thereby increasing the mill's renewable energy share up to 61%.

2. Energy and Environment:

The evolving relationship between energy and the environment is akin to a symphony in progress. The decisions we make today—the energy sources we choose, the policies we enact, and the innovations we pursue—are the notes that will shape the melody of our collective future. It is our responsibility to conduct it with care, wisdom, and a deep appreciation for the interconnectedness of all life on Earth.

The pulp & paper industry is continuously adopting the latest technologies for energy conservation. Energy efficiency in the Indian pulp & paper industry is already high but still there is a scope for improvement in this area, by providing the continued use of energy efficient technologies. Many industries adopt on usage of renewable energy sources and recycling technology thereby cutting down the manufacturing cost for virgin raw materials

Paper and paper board output increased by 0.3 % per year, demonstrating a decoupling of growth in energy consumption from growth in production. The World & National energy scenario is represented in Figure 2 to understand the importance of energy benchmarking.

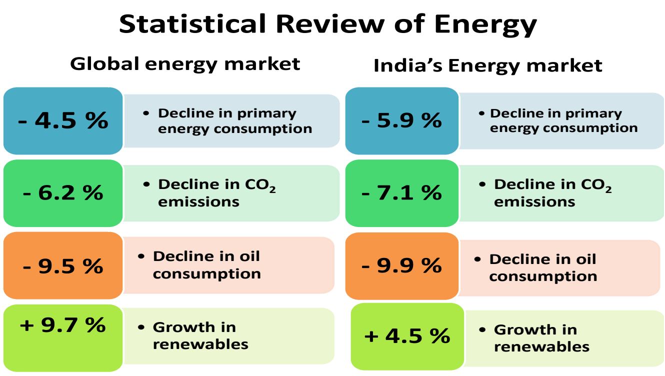


Figure 2 : Global & National energy scenario

3. SPB Contribution in the Energy sector

We are pioneers in the concept of the circular economy and are working toward the sustainability of raw materials and energy. We are participating and discussing with policymakers like BEE, IPPTA, and CII for the benefit of industry and development. In this article, we share the best practices followed by us with all PEERS in the industry. We are aligned with energy conservation and committed to the National energy goal. We are the National leader in Energy and regularly conduct training for energy auditors / energy managers as per BEE.

4. Case Study 1 - Digester Modification - "An innovative approach to increase the Pulp Production"

In the face of escalating environmental challenges and a growing global population, the need for enhancing green energy has become more critical. As we stand at the crossroads of climate change, resource depletion, and a burgeoning demand for green energy, the imperative to transition towards sustainable and renewable sources becomes apparent. Digestor modification helps us reduce the dependency on imported pulp, which reduces significant transportation, leading to a reduced carbon footprint. This innovative approach offers several advantages, ranging from cost savings to environmental sustainability. This project's results reveal the multifaceted reasons why enhancing green energy is not just an option but an absolute necessity for a resilient and sustainable future.

4.1 Introduction

Recent major modifications to paper machines have pushed up the need for pulp even more. Moreover, the necessity of generating more green power is the need of the hour. The digestor was enhanced with the assistance of the internal team, resulting in an increase in pulp production from 380 to 430 tpd. With minimal expenditure, all of the changes were completed in phases over a six-month period. This shows our paths towards strengthening our sustainability practices. Initially, four digesters were installed in SPB after a retrofit of the same from M/s SAPPI in 2006–07. They were functioning under a pressure discharge system. The conical construction provided by the OEM was not giving trouble-free operation, such as no channeling and complete evacuation during pump outs. However, during the time of erection in our system, it was converted to a dilution blow system to avoid damage to the fiber and also to have steam reduction, i.e., from the conventional batch process to the RDH system.

After the conversion to RDH, with the conical construction, we were experiencing channeling, in which the temperature distribution was not uniform across the digesters. This resulted in the non-uniform cooking of pulp in the digester. Also, we observed pulp stagnation in the bottom conical area, forcing us to repeat the flushing cycle for clean pumpouts. This not only contributes to an extended cycle time but also means that the discharge tank gets diluted during each pumpout.

To overcome the issues, a detailed analysis was done.

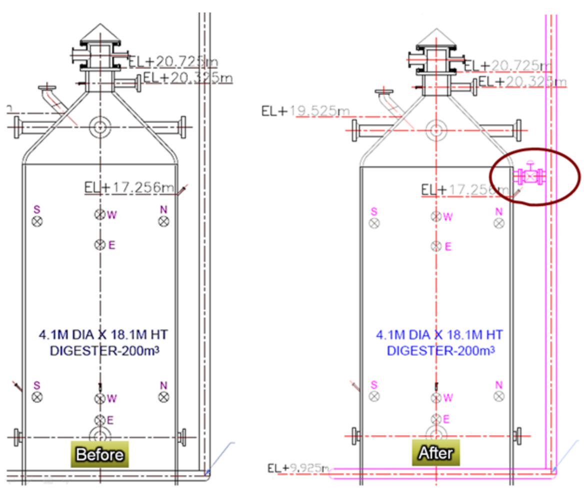
The conical nozzle outlet size is 300 mm dia. It was decided to enlarge the discharge cone nozzle size to 500 mm towards the approach to the dish end profile. The pump-out inlet header sizing of 500 mm is also concluded to have that sizing. Accordingly, modifications were carried out in one digester, and the results were appreciable.

Added to the above modifications, the suction ring header for the RC pump of the same digester from the middle strainer sizing was enlarged to increase the circulation rate during the TAT operation. Header sizing increased the circulation rate from 300 mm to 400 mm in diameter. With this modification, the electrical load of RC pumps increased by 15 amps, indicating a better circulation effect. Results show the attainment of H-factor and uniform temperature during the TAT cycle has resulted in a cycle time reduction of 20 minutes.

To continue, we have introduced the top air evacuation system along with the existing middle air evacuation system during chip filling to have better chip packing.

4.2 Modification – 1 : Chip fill Sequence

- To have top air evacuation in one digester with dual logic with the existing system (With middle and top valve openings) and Investment cost was Rs. 24.51 Lacs



Pic 4.2 Schematic diagram of before and after modifications of chip fill sequence

Benefits Achieved

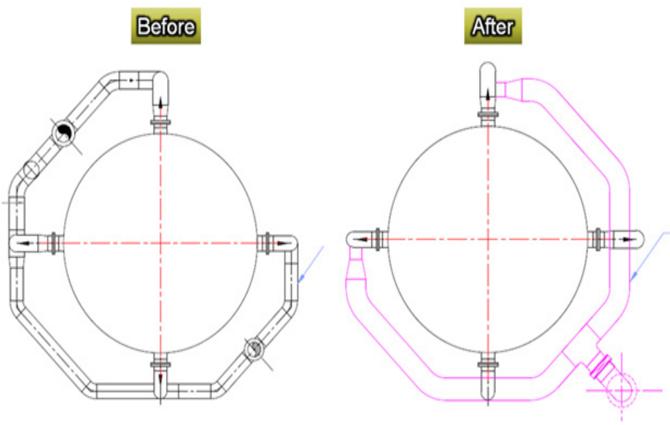
- Chip fill quantity in digester increased by 1.5 Tons / digester
- Chip fill time reduction achieved is by 7 minutes minimum (from 32 minutes to 25 minutes)

4.3 Modification – 2 : TTT Sequence

- The middle header's control valve in a single digester with self-draining capability was enlarged from 12 to 16 inches in diameter, at an investment cost of Rs. 34.07 lacs.

Benefits Achieved:

- Circulation volume increased from 130 LPS to 180 LPS.
- TTT time cycle reduced by 15 mins / cycle.
- Uniform Temperature profile achieved.



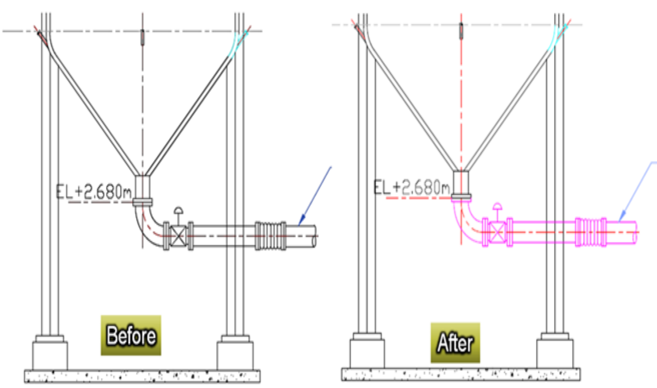
Pic 4.3 Schematic diagram of before and after modifications of TTT sequence

4.4 Modification – 3 : Pump out Sequence

By changing the discharge valve, the discharge line nozzle's diameter can be increased from 300 to 500 mm. The cost of the investment was 101.52 lacs.

Benefits Achieved:

- Clean pump out in one stroke
- Cycle time reduction from 310 minutes to 290 minutes / pump out
- Displacement liquor entry under low velocity.



Pic 4.4 Schematic diagram of before and after modifications of Pump out sequence

4.5 Outcome Achieved by the project:

Table 4.5 Outcome achieved by digestor modification

Description	UOM	Values
Increase in Pulp Production	TPD	380 to 430
Increase in Green Energy	%	6
Investment	Rs. Lacs	148
Savings	Rs. Crores	8.15

5. Case Study 2 - Solar Sludge Dryer -Novel Approach in handling of MLSS

We at SPB are constantly looking for ways to offset the fossil fuel requirement. Utilizing waste water to produce bio energy is an economical and sustainable approach that promotes us towards environmental sustainability.We implemented a project—a solar sludge dryer—for the handling of MLSS. Mixed liquor suspended solids (MLSS) is the concentration of suspended solids in an aeration tank during the activated sludge process, which occurs during the treatment of waste water. It consists mostly of microorganisms and non-biodegradable suspended matter, which has a high calorific value ranging from 3260 to 3460 kJ/kg fuel.

5.1 Methods :

In this innovative project, Solar sludge dryer was installed in 2000 square feet, and It consists of sludge-drying beds (Direct sunlight), the rotary drum vacuum filter, the centrifuge, and the belt filter press. Solar sludge drying is a sustainable and cost-effective method for treating sludge generated in Effluent Treatment Plants (ETPs).In the activated sludge procedure, MLSS was isolated from the treated water by settling in a settling tank. The excess sludge has to be removed from the system through the Decanter Centrifuge. Polymer Chemicals are added to the liquid sludge to coagulate solids and improve drainability. Dewatered sludge still contains a significant amount of water—often as much as 70 percent - but, even with that moisture content, sludge no longer behaves as a liquid and can be handled as a solid material. In Aeration basin the MLSS maintains in the range of 5500 to 6000 mg/l. Solar drying utilizes the energy from the sun to remove moisture from the sludge, resulting in the reduction of its volume and weight. Earlier, it was used as fertilizer and currently dried MLSS is being used in power boiler as biomass.

Pic 5.1: Outside view of Solar sludge

The in-house trail was taken with 200 kg of MLSS material, and the investment cost is Rs. 17.5 lakhs. The present system can handle 20% of the requirement, and 6 tons of such MLSS are being dried per batch in a cycle of six days (dried from 15% to 70%). The solar dryer operation temperature is 34° C (min) and 50 °C (max) during the summer section. It is in operation to date. We are planning a second cut to increase the production capacity.

Pic 5.1.1: Final product of solar sludge dryer

Table 5.2 : Outcome of solar sludge dryer

S. No	Description	UOM	Value
1	Coal savings	TPA	30
2	Annualized cost savings	Rs. in Lacs	4.10

6. Case study 3 - Bio gas firing in Rotary limekiln :

Anaerobic digestion (AD) provides several benefits in wastewater treatment, such as the reduction of organic matter, reduced energy consumption and the production of methane as a renewable energy carrier. However, kraft pulping (a chemical pulping process) makes up 80% of the world production of virgin wood pulp, thus, the wastewater from this sector represents a large unused potential for methane production. There are three main types of substrates available for AD at pulp and paper mills:

I. wastewaters generated at the different process steps (e.g. pulping, bleaching, papermaking)

II. Primary sludge / fibre sludge generated at the primary clarification step

III. Waste activated sludge, which is the residual sludge produced at the aerated biological treatment step.

There are several challenges related to AD treatment of these streams, such as the presence of inhibiting compounds or low degradability of the organic matter. By following the 3R principles to reduce the furnace oil, we introduced a new organic bio-culture product for addition in the anaerobic lagoon to improve methane gas generation.

6.1 Treatment of foul condensate from SRP evaporators :

The waste water generated from various sections of the mill are collected in an equalization tank and treated in primary clarification, vacuum filtration, aeration system by activated sludge process followed by secondary clarification. The treated final effluent confirming to inland surface water discharge standards is sent from the factory and used by the farming community in the neighborhood. The quality of waste waters various in organic load in different streams. To assess the organic load for effective treatment the environmental cell analysed the various parameters to minimize the load to ETP at source. Based on the study it is found that the waste water from bagasse pulp mill and foul condensate from SRP are in the top list. To counter act this, a scheme was formulated to reduce the organic load before entering ETP.

Pic 6.1: Anaerobic digestion lagoon

6.2 Details of the Project :

An anaerobic lagoon was installed early in 1984 to treat the high BOD effluent from the bagasse plant. The biogas generated was released into the atmosphere without any collection devices. A suitable supplier was identified to make a balloon cover above the anaerobic lagoon to collect the biogas and was pumped by a blower to the power boilers to a tune of 2000 Nm3/day. Meanwhile we have odor nuisance in the surrounding the SRP evaporator area. To mitigate the odor, a system was formulated to collect the foul condensate and pump it to the anaerobic lagoon to convert the organic matter into a valuable biogas, one of the unique features in the pulp and paper industry sector. The biogas collected was analyzed for the quality of methane content, which was found to be 65%. Adequate care was taken to avoid the impact of sulphide in the anaerobic digestion by the regular addition of ferric chloride. Regular supplementation of nitrogen and phosphate is done for biological activity, addition of micronutrients for enhancing methogenic activity. Regular testing of the performance of the anaerobic system is monitored by the laboratory for the percentage reduction in BOD, COD, and VFA ratio.

A separate line was laid to the rotary lime kiln and burnt in the lime kiln as a supplementary fuel. All safety measures were included like flame back arrestor, moisture traps with control systems. The system is in operation and the biogas is burnt as fuel since 2.8.2018. An amount of 7000 - 8500 Nm3 of bio gas is collected on daily basis.

6.3 Outcome and achieved by Project Implementation :

- Reduction of furnace oil in the rotary lime kiln to a level of 3 - 3.5 kl/day
- Mitigation of biogas to the atmosphere.
- Elimination of odor nuisance
- Reduced organic load to ETP and improved performance of the treated waste water.
- Reduced energy and nutrient consumption in the aeration system.

7. Case study 4 - Firing of Bio fuels in Boiler 10 over and above the designed Capacity of 10%, through underfeeding:

7.1 Trigger for the project :

To increase and sustain green energy in the mill operation and, in parallel, to explore alternative usage of green fuel, thereby reducing the environmental impact.

7.2 Introduction of the project:

The original CPP AFBC boiler, when commissioned in 2005, was designed to handle the fuel mix of imported coal (60% by underfeeding), raw lignite (30% by underfeeding), and bagasse pith (10% by overfeeding). But it has not been incorporated into the system since commissioning. We used imported Indonesian coal as the primary fuel. With coal becoming critical in terms of availability and hike in prices, from the beginning of 2021 onwards, prices have started increasing from a low of Rs 5,000 per ton to a double. The increase in energy costs due to coal costs directly had an impact on the overall final product cost.

As a part of the green energy initiative to reduce GHG emissions, conserve coal, and explore the usage of alternate biofuels within the existing system, it was decided to take steps to reduce the requirement for imported coal without affecting plant production and use the readily available chipper dust. During the use of chipper dust as a fuel, various boiler parameters were closely monitored. No deviation was observed in boiler parameters and flue gas temperatures.

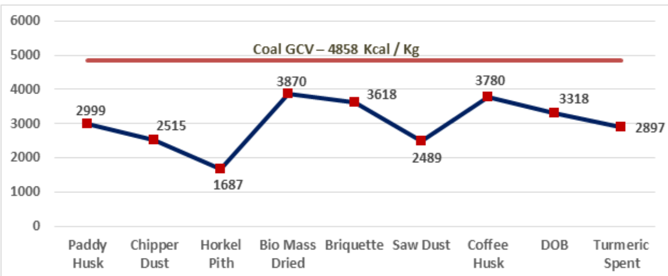
Initially, around 50 to 60 T of paddy husk was mixed with coal along with chipper dust fed through underfeed. During this operation, no change in the boiler parameters was observed except for the increase in fly ash generation. This has increased the operation of the ash conveying system from 6 to 7 hours daily to around 24 hours daily. Due to the increase in demand for paddy husk by other consumers, its availability has been reduced, and other bio fuels like coffee husk, turmeric spent, hortal pith, DOB, briquettes, and biomass dried were explored. Firing of biofuels in the boiler was developed with the help of an in-house team and utilizing the existing facilities. By doing so, we have reduced coal consumption by 79 TPD and increased green energy by 7.46 %.

Coffee husk GCV – 3780 Kcal/Kg is better than the Paddy Husk - 2999 Kcal/Kg and Saw Dust 2489 Kcal/Kg. From Februay’22 onwards we have started consuming Coffee Husk mixed with coal & other bio fuels and feeding through underfeeding. Since ash softening temperature is low around 800*C, its use is restricted to around 30 TPD.

Pic 7.2 : Varieties of Biofuels

Challenges Faced :

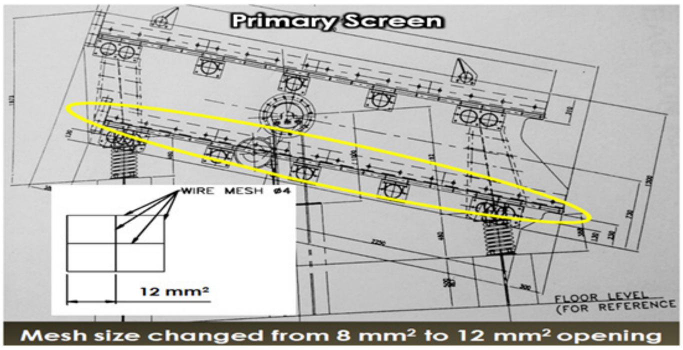
1. Coal screening become bottleneck to handle more biofuels.
2. Almost all the drag chain coal feeders runs at full RPM and we are unable to push more Biofuel.



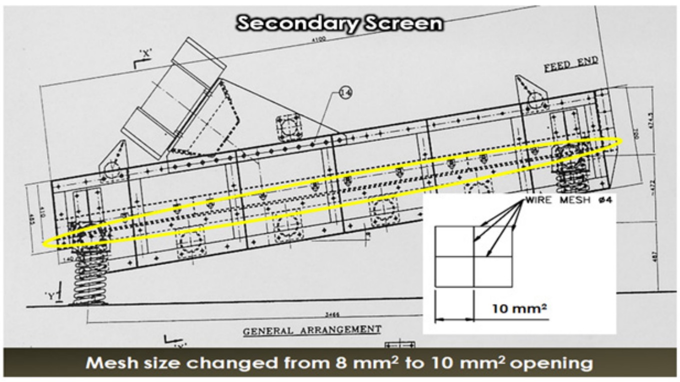
Pic 7.2:1 Biofuel GCV details

7.3 Modifications of Boiler:

A. Modifications carried out in the existing system – Primary & Secondary Screen



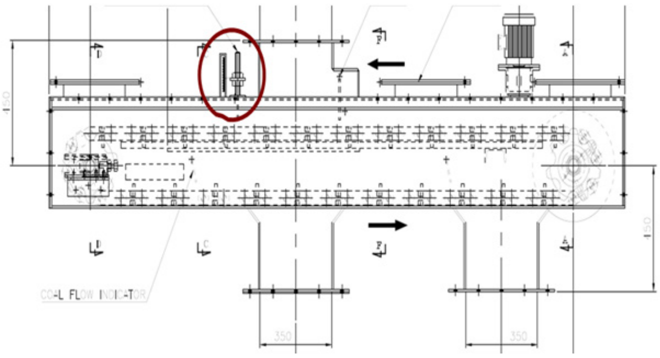
Pic 7.3.1 : Modifications carried out in the existing system –Primary Screen



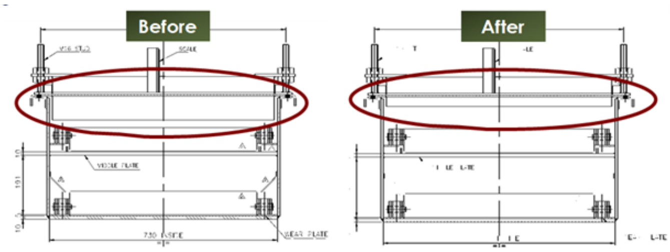
Pic 7.3.2 : Modifications carried out in the existing system –Secondary Screen

B. Modifications carried out in the existing system – Drag Chain Coal Feeders

All the flow adjusting gates were lifted to maximum and now fuel feeding was achieved.



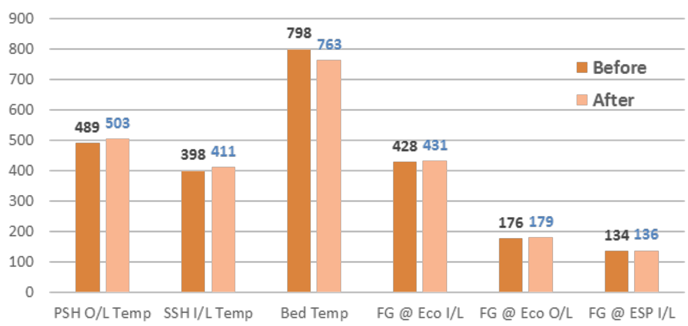
Pic 7.3.3: Modifications carried out in the existing system –Drag Chain Coal Feeders



Pic 7.3.4: Modifications carried out in the existing system – Drag Chain Coal Feeders

7.4 Operational & Control Parameters :

For Boiler steam: Flow, Pressure & Temperature – 76 TPH / 103 KSC / 507 °C



7.5 Outcome achieved by the project:

Table 7.5: Outcome achieved by the project

S. No	Description	UOM	Value
1	Coal savings	TPA	27650
2	Increase in Green Energy	%	7.46
3	Annualized cost savings	Rs. in Lacs	1123

8. Renewable Energy Sources:

The pulp and paper industries have great potential and prospects for renewable energy resources. These resources are generated at almost all stages of the pulp and paper manufacturing process. Energy-rich biomass in pulp mills includes bark, sawdust, wood waste, pins, fines, knots, black liquor, wet pith, lime sludge, and lime grits, as well as fly ash.

The pulp and paper sector was responsible for about 190 metric tons of CO_2 emissions in 2021, about 2% of all emissions from industry and a historic high. As paper production is projected to increase to 2030, significant efforts must be made to reduce the emissions intensity of production. This can be accomplished primarily by moving away from fossil fuels as an energy source and encouraging innovation in technologies that reduce the amount of heat needed for pulp and paper drying. We are enhancing pulp production to cater need for the paper machines of both units in MDP- IV , thereby increasing our green energy share.

9. Conclusion:

In conclusion, fostering the future of energy and the environment is imperative for the well-being of our planet and future generations. As we face the challenges of climate change and resource depletion, it is clear that a transition to sustainable and renewable energy sources is not just desirable but necessary. Mahatma Gandhi was absolutely right when he said, "The earth provides enough to satisfy every man's needs but not every man's greed." All the best practices can be applied horizontally to other mills where similar systems are in use. The article highlights the importance of investing in innovative technologies, promoting energy efficiency, and adopting policies that encourage environmental stewardship. SPB takes pride in achieving consistent and stable financial performance over the years due to the adaptation of best practices and green practices. We thank the SPB Management for allowing us to share the best pratices followed by us with the Peers in the industry.

References:

1. *https://en.wikipedia.org/wiki/Mixed_liquor_suspended_solids*
2. *https://www.diva-portal.org/smash/get/diva2:1313936/FULLTEXT01.pdf*
3. *https://ippta.co/past-journals/2022*