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Bureau of Energy Efficiency
Ministry of Power, Government of India

ASPIRE Programme

Accelerating Smart Power & Renewable Energy in India

SUMMARY REPORT
DOMESTIC STUDY TRIP OF

KHANNA PAPER MILLS LIMITED

14th February 2024

Hosted by:
Khanna Paper Mills Limited, Amritsar, Punjab, India

iDeeksha

Industrial Decarbonisation and Energy Efficiency
Knowledge Sharing Platform

Contents

Abbreviations

ASPIRE	Accelerating Smart Power and Renewable Energy in India
BEE	Bureau of Energy Efficiency
CPCB	Central Pollution Control Board
DIP	De - Inked Pulp
FCDO	Foreign Commonwealth and Development Office
GESI	Gender Equality Social Inclusion
GET	Graduate Engineer Trainee
Hi-Con	High Consistency
IEED	Industrial Energy Efficiency and Decarbonisation
KPM	Khanna Paper Mill
MW	Mega Watt
MCC	Motor Control Centre
PAT	Perform Achieve and Trade
SAARC	South Asian Association for Regional Cooperation

BACKGROUND

Indian paper industry accounts for **~5%** of global production, with annual revenue of **~ INR 800 billion** (~GBP **7.9 Bn**) in 2023. The sector employs over half a million people directly and around one and a half million indirectly. The paper industry is broadly classified into three segments namely writing & printing (W&P), newsprint and paperboard and industrial packaging (paperboard). Paperboard segment leads the domestic paper demand, accounting for **45%** of demand, followed by writing & printing (W&P), at **35%**, and newsprint, at **20%**. paper mills utilise various raw materials, including wood, bamboo, recycled fibre, bagasse, wheat straw, rice husk, etc. Presently, within the overall production, wastepaper-based mills account for **~72%** of the overall production followed by wood-based mills accounting for **~20%**, and agro-based mills account at **~8%**.

Energy consumption per tonne of paper production in India is nearly double than the North American and Scandinavian standards, averaging about **34.3** gigajoules/Ton (GJ/ton) paper. Key factors affecting energy consumption include capacity utilisation, paper quality, machinery efficiency, downtime, and co-generation levels. Energy consumption and greenhouse gas emissions are expected to rise significantly by 2030, to **~1,702** petajoules (PJ) per annum and contributing **~164 million tonnes** of carbon dioxide (tCO_2) per annum, respectively.

Indian pulp & paper sector consists of about **550** facilities, producing wood-based, agro-based, and recycled fibres. These plants are spread across the country and are segmented into large, small, and medium-sized enterprises. Approximately **30%** of the sector, in terms of both capacity and production, is represented by the **48** plants or designated consumers (DC) included under the BEE's flagship Perform Achieve and Trade (PAT) scheme. However, many of these paper plants are smaller in scale, falling into the SME category or utilising biomass as fuel, and they do not exceed the threshold limit of **7,500** metric tonne of oil equivalent (MToE) per annum for pulp and paper industries to be notified as DCs under PAT Scheme.

In view of the above, a study trip to Khanna Paper Mills, Amritsar, Punjab was organised on 14th February 2024 under the Accelerating Smart Power and Renewable Energy in India (ASPIRE) programme[1]. The study trip was jointly organised by the Foreign, Commonwealth and Development Office (FCDO), Government of UK and the Bureau of Energy Efficiency (BEE), Government of India with the support of Khanna Paper Mills Limited. The purpose of the study trip was to demonstrate and disseminate the various best practices and innovative industrial energy efficiency and decarbonisation (IEED) technologies adopted by Khanna Paper Mills Ltd. to enhance its energy efficiency and enable decarbonise of its operations.

Objective of the Study Trip

To demonstrate new and innovative IEED technologies implemented by Khanna Paper Mills Limited

To enable other industries in pulp & paper sector, to reduce their overall specific energy consumption and adhere to the compliance requirements under BEE's PAT scheme

To foster an ambitious, mutually beneficial, and outcome-focused relationship between industry stakeholders

Highlights

Active participation from **~40 (**including ~17% women participants**) stakeholders including senior officials and executives** from central and state government agencies, industrial organisations, research institutions, and technology providers

Visit to key areas of the plant to understand various IEED measures implemented:

- Recovered paper sorting area
- Drum pulper section
- Paper recycling process section
- De-inking process section

1 Accelerating Smart Power and Renewable Energy (ASPIRE) is a bilateral technical assistance programme being implemented by the Foreign, Commonwealth and Development Office (FCDO), Government of UK in association with the Ministry of Power and Ministry of New and Renewable Energy, Government of India. KPMG is the implementation advisor to FCDO in relation to the ASPIRE programme.

OVERVIEW OF KHANNA PAPER MILLS LIMITED

Khanna Paper Mills (KPM), headquartered in Amritsar (India), is a leading manufacturer and supplier of writing and printing papers, newsprint papers, and paperboards. Established in 1985, KPM is the largest single-location plant in India, spread over **80 acres**, utilising recyclable paper waste. With an annual production capacity of half a million tons, the facility has four paper machines, de-inking plants, and an in-house **30 MW** captive power plant.

KPM holds the distinction of being the first paper mill in the country to produce writing and printing paper from de-inked pulp. Their products are exported to South Asian Association for Regional Cooperation (SAARC) countries, Africa, and the Middle East with exports contributing **15%** to the total production.

KPM's primary objective revolves around the development of recycled, eco-friendly, and innovative papers, ensuring unparalleled quality and performance for their clients. Predominantly, their paper and related products are crafted from recycled fibres, aligning with sustainable practices.

Currently, KPM has an installed capacity of **1,200 tonnes** per day. The company holds significant market shares across various segments: **11%** in the copier segment, **20%** in writing and printing paper, **48%** in packaging and board, and **30%** in newsprint. produces **10,000 million tons** of writing printing paper, newsprint, and paperboard, utilising approximately **15,000 million tons** of recycled fibre. The company pioneers the production of high-quality writing and printing board from **100%** deinked woodfree recovered paper. The unit produces **~10,000 million tons** of writing printing paper, newsprint, and paperboard, utilising **~15,000 million tons** of recycled fibre. The company pioneers the production of high-quality writing and printing board from **100%** de-inked woodfree recovered paper.

In terms of infrastructure, KPM's extensive campus encompasses two board plants with a daily capacity of **400 tons** each, a newsprint plant with a daily capacity of **400 tons**, and a writing and printing paper plant with a daily capacity of **400 tons**. Additionally, two pulp plants with a daily production capacity of **350 tons** each contribute to its operations.

Dedicated to environmental stewardship, KPM emphasises efficient power consumption, utilising in-house power generation. Certified with ISO 9001 and recognised as an export house by the Directorate-General of Foreign Trade, KPM is the third-largest single-location plant and the largest user of wastepaper in India.

STUDY TRIP OF KHANNA PAPER MILLS LIMITED

Khanna Paper Mills Limited holds the distinction of being the pioneer among Indian paper mills in manufacturing top-tier writing and printing paper exclusively from 100% deinked woodfree recovered paper.

Product Portfolio:

PACKAGING BOARD

VIRGIN RECYCLED

Capacity - 1.60 Lakhs TPA
APPLICATION

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

PAPER

W&P COPIER

VIRGIN RECYCLED

Capacity - 1.20 Lakhs TPA
APPLICATION

Publications, Notebooks, Stationery
and Commercial Printing

PACKAGING BOARD

STANDARD

Capacity - 1.40 Lakhs TPA
APPLICATION

Newspaper, Magazines, Advertisement
and Brochures

During the study trip, participants had the opportunity to explore various sections of the plant, providing an opportunity to gain insights on the production process. Key sections of the plant included the following:

- Recovered paper sorting area
- Drum pulper section
- Paper recycling process section
- De-inking process section

Sorting Process:

At Khanna Paper Mill, a robust system is in place to handle both domestic and imported bales of wastepaper. This material undergoes meticulous sorting at a dedicated station, aiming to achieve the following objectives efficiently - sorting of materials, separating out throws and isolating prohibitive materials.

The sorting section encompasses various machines and processes, including the following:

- **Bale Breaker Drum:** Large rotating drum, equipped with various mechanisms, effectively breaks compacted bales of paper waste by loosening and separating paper sheets and materials within the bales.
- **Sorting Station:** The mill consists of a designated area for sorting wherein workers manage the process of segregation and categorisation of different types of paper waste and materials.

Post sorting, the outfeed conveyor transports sorted paper waste materials to subsequent recycling stages, which may involve further processing, cleaning, or baling. The goal of this process is to efficiently sort and separate different types of paper waste, facilitating their transformation into recycled paper products, which is an environmentally friendly practice that reduces the demand for new pulp and minimises the environmental impact of paper production.

Bale Breaking & Sorting Capacity of KPML across locations					
S.No.	**Location**	**Bale Breaking capacity (TPD)**	**Sorting Capacity (TPD)**	**RPM**	**Dimensions (DXL) in mtr**
1	Newsprint Line	800	150	11-12	3.5X10
2	Writing & Printing Line	400	100	10-11	3.5X07
2	Mix Waste Line	400	150	10-11	3.5X07
4	Under Top Layer Line	100	50	8-10	3,0X05

Drum Pulper Machine:

Khanna Paper Mills has an innovative drum pulper in their newsprint line. This robust machine has redefined the approach to handling recovered paper, making substantial contributions to sustainability objectives.

Key Components and Stages:

- **The Mixing Chamber:** Dominated by large rotating drums equipped with precision blades or teeth, the mixing chamber serves a crucial role. Its function is to meticulously break down baled or compacted paper, operating with surgical precision to strike a delicate balance between efficiency and the preservation of paper fibres.
- **The Pulping Chamber:** This stage immerses recovered paper in water, initiating the pulping process. Through a softening and disintegration mechanism, it achieves the separation of paper fibres while efficiently removing contaminants, ensuring high-quality output.
- **Screening Stage:** A distinctive feature of drum pulpers lies in their gentle treatment of paper fibres. Unlike more aggressive methods, this stage minimises fibre damage and retains a significant portion of the original fibre length. Such meticulous handling contributes significantly to the production of premium-quality paper.

Paper Recycling:

Deinking is the transformative process of turning used paper into pristine pulp, tailored to produce premium-grade paper products.

Key Objectives and Processes:

- **Objective:** Primarily aimed at creating pulp suitable to produce high-quality paper products, deinking involves meticulous steps to rejuvenate recycled paper.
- **Processes:** Central to deinking is the removal of ink, adhesives, and other contaminants from recycled paper, ensuring the purity and integrity of the final product.

Advanced Equipment in Deinking:

- **Primary Flotation Cells:** Serving as the initial line of defence in the deinking process, primary flotation cells play a pivotal role. They efficiently extract impurities from the recycled pulp, setting the stage for further refinement.
- **Secondary Flotation Cells:** These specialised cells are instrumental in elevating the quality of pulp in the later stages of deinking. Their precise function optimises the purity and consistency of the pulp, facilitating the creation of top-tier paper products.

Stickie's Removal in the Paper Industry:

Stickies, comprising adhesives, labels, and coatings, pose persistent challenges in the deinking process. Their stubborn nature resists separation from fibres, resulting in detrimental effects on paper quality, heightened downtime, and costly production interruptions. Traditional methods frequently struggle to effectively eliminate these resilient contaminants, perpetuating the struggle against stickies. Their persistence necessitates innovative solutions to uphold production standards and efficiency. Amidst these challenges, the fiber wall fine screening system emerges as a revolutionary game-changer. Its innovative design and functionality significantly enhance deinking efficiency while simultaneously reducing environmental impact.

Key Takeaways

Khanna Paper Mills Limited has realised significant cost benefits through strategic process optimisation initiatives, exemplifying their commitment to efficiency and sustainability:

- **Bale Breaker Optimisation:** Through the innovative utilisation of the bale breaker, Khanna Paper Mills transformed low-grade raw materials into high-grade counterparts, yielding a remarkable annual cost saving of INR 2.8 crore (GBP **0.26** million).
- **Drum Pulper Implementation:** Embracing the efficiency of drum pulpers over high consistency (Hi-Con) pulpers in the deinked pulp (DIP) process, the mill achieved a notable reduction in pulping energy consumption by **25** kWh/T, resulting in an annual saving of INR 2.0 crore (GBP **0.19** million).

- **Foam Recovery Cell Integration:** The installation of foam recovery cells in loop-2 marked a significant milestone, enhancing yield by **1%.** This improvement translated into an impressive annual net saving of INR 5.0 crore (GBP **0.47** million).

- **Fiber Wall Screen Innovation:** Through the adoption of fibre wall screens in fine screening operations, Khanna Paper Mills effectively curbed fibre loss by **0.3%.** This optimisation contributed to an annual net saving of INR 1.5 crore (GBP **0.14** million).

FEEDBACK FROM THE PARTICIPANTS

- 75% of the participants were more than satisfied with the outcomes of the study trip (*provided a 7+ rating on a scale of 10*).
- 75% of the participants rated the quality and content of the delivery as more than satisfactory (*provided a 7+ rating on a scale of 10*).
- The participants suggested the following subjects for future study trips:
    - **Optimising Fossil Fuel Use**: Explore efficient methods to maximise fossil fuel utilisation.
    - **Energy and Water Conservation**: Learn about practical strategies for conserving energy and water resources.
    - **Energy-Efficient Equipment**: Discover advancements in energy-efficient motors, switchgears, and motor control centre (MCC) panels.

"Overall study trip was very good"

- Mr. P V Krishna Kumar, Co Founder & Chief Marketing Officer
Supreme Energy Solutions

"The study trip was very informative and we would appreciate it if can be part of other study trips as well in the future"

- Mr. Aviral Soni, EA to ED, Energy Conservation Cell Member
Khanna Paper Mills Ltd.

CONCLUSION

Group photograph of Participants

The response to the study trip has been positive with significant participation from senior officials from BEE, executive leadership of leading Indian pulp & paper industries, and technology providers from India. The study trip seems to have achieved its goal of providing national organisations a stage to witness the operations of new and innovative IEED measures implemented and the challenges faced in the implementation of the same. The study trip successfully promoted gender equality and social inclusion (GESI) through the participation of women employees from Khanna Paper Mills Limited. It is expected that this study trip would have a demonstrable and long-lasting on-field impact in due course of time.

Further, to keep up the momentum, the following activities are envisaged under the ASPIRE Programme to enable wider adoption of IEED measures and technologies by Indian pulp & paper industries to achieve their net-zero targets.

- Provide support including B2B interactions/webinars to large energy-intensive industries (including pulp & paper sector) to support in identifying technologies & solutions, and technology suppliers for enhanced adoption of IEED interventions.

- Create more discussion forums to facilitate the exchange of knowledge and information.

Annexure – Attendance Sheet

S. No	Name	Designation	Organisation
1	Dr. Sanjay Tyagi	Scientist E-II	Central Pulp & Paper Research Institute (CPPRI)
2	Mr. Aviral Soni	EA to ED	Khanna Paper Mill
3	Dr. Bipin Thapliyal	Secretary General	Indian Agro and Recycled Paper Mills Association
4	Mr. Jayaprakash T	Joint Secretary	Indian Agro and Recycled Paper Mills Association
5	Mr. Arpan Gupta	Dy. Manager	Century Pulp & Paper
6	Mr. Ajay Kumar	Manager	Century Pulp & Paper
7	Mr. Rajesh. P	Manager (Electrical)	Tamil Nadu Newsprint and Papers Limited
8	Mr. Senthil Arunachalam. A. K	Manager (Mechanical)	Tamilnadu Newsprint and Papers Limited
9	Mr. Balamurugan. M.P. N	Senior Manager (Pulp)	Tamil Nadu Newsprint and Papers Limited
10	Mr. Shivkumar	Senior Manager (Paper machine)	Tamil Nadu Newsprint and Papers Limited
11	Mr. Arijit Kanti Swain	Chief Manager (Electrical)	JK Paper Mill, Rayagada, Odisha
12	Mr. Sudeep Kumar Panda	Deputy Manager (Power Block)	JK Paper Mill, Rayagada, Odisha
13	Mr. Inderjit Singh	Sr Engineer Electrical	Satia Industries Ltd
14	Mr. Sarabjit Singh	AM Utility -power plant	Satia Industries Ltd
15	Mr. P.T. Sampath	SR. GM. Utility	Bindals Papers Mills Limited
16	Mr. Balawant Joshi	Managing Director	Idam Infra (ASPIRE Team)
17	Mr. Sunil K. Khandare	Director	Bureau of Energy Efficiency
18	Mr. Naveen Kumar	Sr. Sector Expert – Pulp & Paper	Bureau of Energy Efficiency
19	Mr. K. K. Chakarvarti	Sr. Advisor, IDEEKSHA	Idam Infra (ASPIRE Team)
20	Mr. Anurag Sirola	Manager	KPMG India (ASPIRE Team)
21	Mr. Dipak Khandare	Associate Director – Industrial Decarbonisation	Idam Infra (ASPIRE Team)
22	Ms. Dhaarna Rawat	Consultant	Idam Infra (ASPIRE Team)

S. No	Name	Designation	Organisation
23	Ms. Sonam Vyas	Consultant	KPMG India (ASPIRE Team)
24	Mr. Amit Sharma	Director & CEO	Venus Energy and Consultants Private Limited
25	Mr. Sukhdev Sandhu	Security Officer	Khanna Paper Mills
26	Mr. Puneet Ujjal	Paper Plant – DGM	Khanna Paper Mills
27	Mr. Honey Arora	Funt. Expert Electrical	Trident Limited, Barnala
28	Mr. Sukhpreet	Shift Manager Recovery	Trident Limited, Barnala
29	Mr. P V Krishna Kumar	Co-Founder & Chief Marketing Officer	Supreme Energy Solutions, Tiruchirappalli, Tamil Nadu
30	Dr. M.K. Gupta	Director	Central Pulp & Paper Research Institute
31	Mr. Alok Sharma	Director Technology	Zenex Impex Pvt. Ltd.
32	Mr. Suneel Sehgal	Head Utility	Khanna Paper Mills
33	Ms. Sujata Verma	Graduate Engineer Trainee (GET)	Khanna Paper Mills
34	Ms. Sonali Rattan	GET	Khanna Paper Mills
35	Ms. Sunita Singh	Associate	Khanna Paper Mills
36	Ms. Aimon	Associate	Khanna Paper Mills
37	Ms. Ranjana	Associate	Khanna Paper Mills

FOR MORE INFORMATION PLEASE CONTACT

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