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BUREAU OF ENERGY EFFICIENCY
Government of India, Ministry of Power

GOVERNMENT OF INDIA
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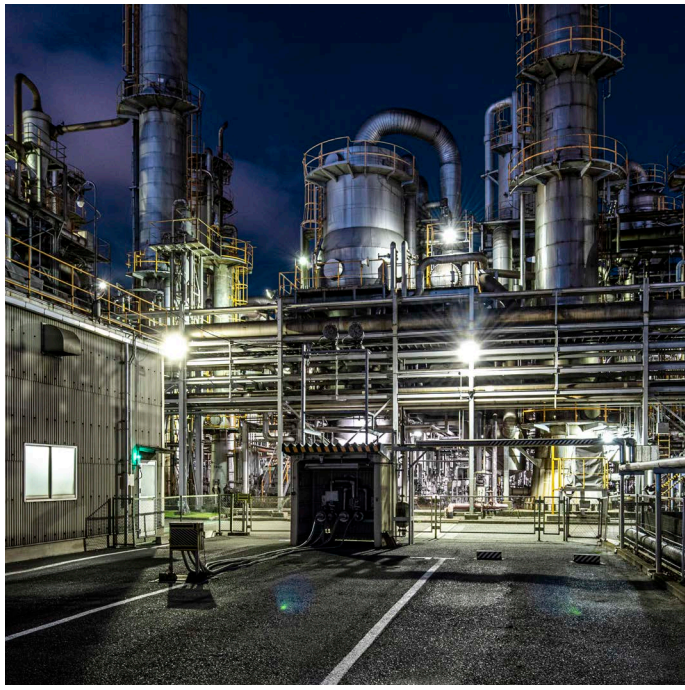
ASPIRE
Programme

Accelerating Smart Power & Renewable Energy in India

IDEEKSHA NEWSLETTER

INDUSTRIAL ENERGY EFFICIENCY/ DECARBONISATION OUTLOOK



CASE STUDIES ON SELECT GLOBAL TECHNOLOGIES AND BEST PRACTICES

JULY 2024

iDeeksha

Industrial Decarbonisation and
Energy Efficiency
Knowledge Sharing Platform

CONTENTS

Message from Mr. Srikant Nagulapalli, IAS

Director General, Bureau of Energy Efficiency

As our nation's economy flourishes, the energy demand has surged significantly. However, the increased energy intensity in specific sectors raises concerns about sustainability. In this context, the efficient use of energy resources and their conservation becomes crucial for curbing wasteful consumption and ensuring sustainable development. Recognising that efficient energy use and conservation are the most cost-effective solutions to address the escalating energy demand, the Bureau of Energy Efficiency (BEE) has introduced the Perform, Achieve, and Trade (PAT) scheme, now in its eighth cycle.

Recently, as we celebrated BEE's 22nd Foundation Day, we placed more emphasis on the pivotal role of conducive state-specific EV policies. We also proposed collaboration between government agencies for the development of a Model EV policy for nationwide adoption. Moreover, we recognise the importance of carbon market, affordable electricity, offering financial incentives for EV users and policy support for manufacturers.

To support industries in their journey towards decarbonisation, we introduced the IDEEKSHA platform, launched by the Hon'ble Cabinet Minister for Power and New and Renewable Energy, at the 21st Foundation Day of BEE and a Decade of PAT Scheme event on March 01, 2023. The platform has been developed by the Accelerating Smart Power and Renewable Energy in India (ASPIRE) program in collaboration with the Bureau of Energy Efficiency (BEE). ASPIRE is a bilateral program implemented by the Foreign, Commonwealth and Development Office, Government of UK, and Ministry of Power, Government of India.

The IDEEKSHA platform serves as a central hub for knowledge exchange and collaboration between industries and technology suppliers across eight challenging sectors, all covered under BEE's Perform Achieve and Trade (PAT) scheme. It provides comprehensive support to these sectors, fostering access to a global database of Industrial Energy Efficiency & Decarbonisation (IEED) technologies, newsletters, capacity-building workshops, study tours, and more. As part of our commitment to continuous improvement, we are now extending technical assistance support through the IDEEKSHA platform to four new industrial sectors: Pulp & Paper, Chlor-Alkali, Sugar (yet to be covered under the PAT/CCTS scheme), and Tyre Manufacturers (yet to be covered under the PAT/CCTS scheme).

As we embark on this extension, I am delighted to announce the launch of the sixth newsletter by the IDEEKSHA Platform. This edition showcases national and international case studies on IEED technologies.

I trust that the information presented will prove invaluable to our stakeholders, contributing to the continued success and sustainability of our endeavours.

Message from Lindy Cameron

British High Commissioner to the Republic of India

Climate change is an existential challenge for our race and planet. Increasing numbers of extreme weather events around the world show the risks to our livelihoods, jobs and the natural environment.

So we need to act together if we are avert the worst impacts of climate change. Prime Minister Modi proposed ambitious new targets for 2030, and pledged India would have net zero emissions by 2070. At G20 New Delhi, India encouraged the global leaders for tripling of renewable energy capacity and doubling of energy efficiency by 2030. The UK being a global leader in the fight against climate change, supported this initiative along with other world leaders.

To go further down the path of decarbonisation requires renewed focus on the industrial sector. Industries are one of the most significant contributors to emissions in India - around 25% of total emissions, second only to power generation. India's Long-Term Strategy, submitted to UNFCCC during COP27, sets out how it might develop an efficient and innovative low-emission industrial system. It highlights the opportunities to improve energy and resource efficiency, material efficiency and recycling, to strengthen the circular economy and to promote emerging technologies such as green hydrogen and carbon capture and storage technologies.

The UK is acting as well – we are committed to delivering clean power by 2030 and accelerating to net zero. The UK government has committed £3.9 billion in financial year 2025-26 for the first carbon capture utilisation and storage (CCUS) clusters in the UK to decarbonise industry, support flexible power generation and capitalise on the UK's geographic and technical strengths. We have also launched the Great British Energy to invest in home-grown, clean energy, and are establishing a new National Wealth Fund to supercharge growth in clean energy industries.

The UK and India are also working together on the green transition and industrial energy efficiency. In October 2021, we launched a new UK-India bilateral programme: "Accelerating Smart Power and Renewable Energy" (ASPIRE) which aims to work with India to reach India's 2030 targets.

Under ASPIRE, the 'IDEEKSHA: Industrial Decarbonisation and Energy Efficiency Knowledge Sharing Platform' has been developed in collaboration with the Bureau of Energy Efficiency (BEE), Ministry of Power. The IDEEKSHA platform has shared best practices and Industrial Energy Efficiency and Decarbonisation (IEED) technologies among energy intensive industries. The newsletter provides case studies on new and emerging low-carbon technologies and industry best practices. I hope that the information in it will help industries in reducing their energy and carbon consumption, contributing to India's efforts to achieve its climate goals.

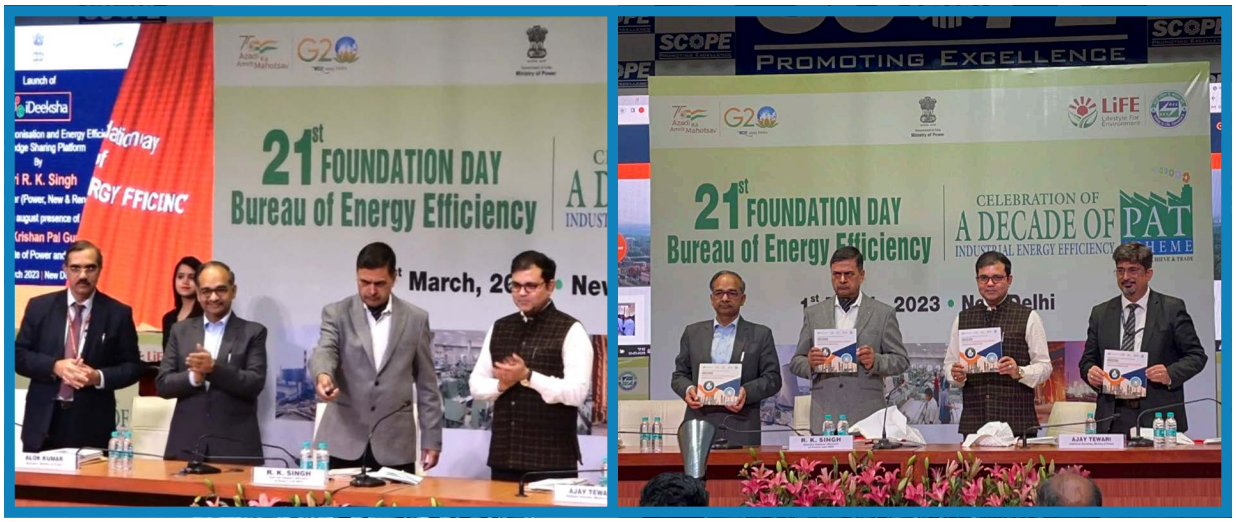
Introduction

About ASPIRE Programme

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 (GOI). Key objective of the ASPIRE programme is to facilitate India's transition towards a sustainable, low carbon energy ecosystem to fulfill its net-zero commitments.

About IDEEKSHA Platform

The Industrial Decarbonisation and Energy Efficiency Knowledge Sharing (IDEEKSHA) Platform has been developed under the ASPIRE Programme in collaboration with the BEE to promote and share best practices and energy-efficient technologies among large-scale industries. The IDEEKSHA platform was launched by Mr. R.K. Singh, Hon'ble Cabinet Minister for Power and New and Renewable Energy, Government of India during the 21st Foundation Day Event of BEE on 1st March 2023, in Delhi.



Snapshots from IDEEKSHA Platform and Newsletter launch during BEE's 21st Foundation Day Event on 1st March'23 in Delhi

The IDEEKSHA platform is a one-stop shop for all energy efficiency/ decarbonisation needs of large industries covered/ expected to be covered under BEE's Perform Achieve and Trade (PAT) Scheme. The IDEEKSHA platform would thus facilitate:

- Exchange of knowledge and information to enhance peer to peer learning.
- Designated Consumers (DCs) in adoption of new and emerging IEED tools & technologies by facilitating access to Indian and global (including from the UK) technology suppliers.
- Access to a database of financial institutions.
- Access to IEED tools, technologies & technology providers available in India and globally.
- Access to data sources and knowledge repositories to support knowledge translation.

Sector/ industry specific workshops/ seminars to enhance EE measures.

Knowledge and commercial partnerships.

The IDEEKSHA platform facilitates knowledge exchange and partnerships among industry and technology suppliers for 8 hard-to-abate industrial sectors (cement, aluminium, iron & steel and textile, fertiliser, chlor-alkali, pulp & paper, and refinery) which are also covered under BEE's PAT scheme. Under the IDEEKSHA Platform, support was extended to four (4) energy-intensive industrial sectors (Cement, Aluminium, Iron & Steel and Textile) in terms of providing access to database of global industrial energy efficiency & decarbonisation (IEED) technologies, organising capacity building workshops and study trips, etc. Four sectoral workshops and study trips were organised in 2022 and 2023, each focusing on key industries: Aluminium, Textile, Cement, and Iron & Steel. These events are aimed at understanding industry-specific challenges, opportunities, and identifying strategies for sustainable development. The details of the events, including background notes, presentations, event summary reports, etc., can be accessed through the IDEEKSHA Platform (https://www.ideeksha.in/) under 'Past Events' tab.

Now, the ASPIRE Programme in consultation with the Bureau of Energy Efficiency is extending the technical assistance support through IDEEKSHA platform to four (4) new industrial sectors namely, Pulp & Paper, Chlor-Alkali, Tyre manufacturers and Sugar. As part of the support, ASPIRE Programme team is organising workshops and industry study trips for the above 4 new focus sectors to enhance energy efficiency measures and enable decarbonisation in the industrial sectors. In February and March 2024, 3 capacity building workshops and industry study trips focussed on pulp & paper, chlor-alkali and sugar sectors were organised. The platform would also host a technology compendium encompassing IEED technologies available in India and globally (including from the UK) along with newsletters showcasing case studies on leading IEED best Practices practices adopted by the Indian and international players (including from the UK). Further, the platform would also provide energy intensive Indian industries access to innovative low-carbon technologies/ solutions and their suppliers tailored for the above sectors.

This is the sixth of a series of newsletters that are being developed under the above initiative of ASPIRE programme for the 'IDEEKSHA Platform" and the Bureau of Energy Efficiency.

Section 1

Case Studies on International IEED Technologies

1.1 Utilisation of ENCORE® Retread Tyres by Michelin Tyres for Enhancing Efficiency, Safety and Sustainability in Tyre Sector

Introduction

Tyre retreading, also known as tyre remoulding or recapping, has been a practice for over a century. Initially developed in the early 20th century, retreading gained popularity during World War II when rubber shortages prompted the need to maximise tyre lifespan. Since then, tyre retreading has become an integral part of the tyre industry, offering a cost-effective and environmentally sustainable solution for extending the life of tyres. With advancements in technology and quality control measures, retreaded tyres are able to offer performance and safety comparable to new tyres, making them a preferred choice for businesses and consumers aiming to reduce costs and minimise environmental footprint.

Michelin is a tyre manufacturer renowned for its innovative products and commitment to sustainability. The company produces a wide range of tyres for vehicles, including cars, trucks, motorcycles, bicycles, and aircraft. In addition to tyres, Michelin is involved in providing mobility solutions, such as tyre retreading, digital mobility applications, and road safety initiatives[1]. Notably, Michelin's ENCORE® Retread Tyres[2], crafted in the UK, adhere to rigorous quality standards, including ISO 14001 for environmental management, ISO/TS 16949 for quality management, and compliance with REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulations governing chemical usage. Employing advanced casing verification methodologies, Michelin ensures the production of premium-grade retreaded tyres, underscored by unwavering commitment to excellence.

About the technology[3]

Michelin provides customers with two distinct retreading options, each tailored to address specific preferences and priorities:

- **Hot retreading:** Involves encasing the entire prepared casing with uncured rubber, encompassing both crown and sidewalls. This assembly is then placed within a mould to impart the final profile to the retreaded tyre. Vulcanisation occurs within a heated curing press, maintained at a ~160°C for approximately one hour, akin to the manufacturing process of a new tyre. The benefits of hot retreading include the ability for customers to fully leverage the performance potential of original casings, enhanced dimensional uniformity leading to a consistent wear, appearance which is comparable to new treads, featuring recut sidewalls and marked diagrams, thereby elevating the vehicle's appearance.
- **Cold retreading:** Involves affixing a pre-moulded tread band, complete with its final tread pattern, onto the prepared casing. Vulcanisation takes place within an autoclave, heated to ~115°C for about three hours, ensuring cohesion of the entire product. This method offers advantages such as expedited return times due to streamlined retreading processes and increased flexibility in tread pattern changes.

Process description

Michelin has installed high-quality machines in their certified shops, specially designed to meet rigorous quality and performance standards. Their process of retreading is as follows:[4]

- **Initial inspection-** A comprehensive examination commences with a 100% thorough inspection utilising an automated inspection machine featuring an integrated lighting system. This step ensures meticulous scrutiny and detection of imperfections.

1 Homepage | Tyres | Michelin Tyres United Kingdom Official
2 ckd5wi0gv008w01koj1j3gqlk-2020-encore-final.pdf (azureedge.net)
3 ckag9ds2l00j101nv7e8pj4pv-white-paper-2015.pdf (azureedge.net)
4 Retread tyre Technologies | MICHELIN Commercial tyres India

- **Buffing-** Automated precision is the hallmark of the buffing phase, facilitated by a radius buffer equipped with electronic measuring sensors. This setup guarantees uniformity and consistency, setting the stage for optimal retreading outcomes.
- **Skiving and repair-** Leveraging insights gained from Michelin's five decades of radial casing retreading experience, this phase incorporates enhanced specifications tailored for superior performance and longevity.
- **Tread preparation and building-** Tyre tread preparation and building are executed with special attention to detail, ensuring seamless tread pattern continuity, centring, and balance. This approach guarantees optimal traction and stability.
- **Filling-** Utilising automatic extruder guns, the filling process is streamlined for efficiency and precision, ensuring uniform distribution of materials and optimal tyre performance.
- **Enveloping-** Precision is paramount during enveloping, facilitated by pneumatically operated spreaders that ensure perfect uniformity, setting the stage for flawless retreading outcomes.
- **Curing-** At this stage, a fully automatic curing chamber, equipped with automatic differential pressure control is utilised to ensure uniform heat distribution and precise curing, critical for achieving optimal tyre performance and longevity.
- **Final inspection-** The process ends with a rigorous 100% thorough inspection by utilising the automated inspection machine equipped with integrated lighting. This final assessment ensures that every retreaded tyre meets Michelin's quality and performance standards.

Outcomes and benefits[5]

Choosing to retread tyres instead of purchasing new ones yields numerous benefits for both end-users and the environment:

For end users:

- **Cost Savings:** Retreaded tyres are priced **40%** lower when compared to new tyres. This translates to significant monetary savings for consumers without compromising on quality or performance.
- **Extended Lifespan:** Opting for retreading allows consumers to achieve **twice** as many miles from their tyres compared to purchasing new ones. With the potential for multiple retreading cycles, tyres can be utilised to their fullest extent, maximising mileage and durability.
- **Enhanced Customisation:** Consumers can select from a vast array of up to **350** combinations of casings and tread options, tailoring their choices to meet specific performance requirements and preferences.

For Environment:

- **Reduction of GHG emissions:** Retreading **100** tyres results in the conservation of **5** tonnes of materials and prevents the emission of over **6** tonnes of CO_2 into the atmosphere. This significant reduction in greenhouse gas emissions helps mitigate climate change and enhance sustainability.
- **Conservation of Resources:** Tyre retreading consumes significantly lesser raw materials compared to the production of new tyres. Each retreading operation saves ~**50** kilos of raw materials, representing a **70%** reduction compared to newly manufactured tyres. This conservation of resources helps alleviate pressure on natural ecosystems and finite resources.
- **Waste Reduction:** Opting for tyre retreading leads to a substantial reduction in waste generation, with approximately **300** kilos less waste produced for a three-axle trailer. Retreading six tyres for three axles results in six lesser tyres requiring recycling, further minimising the environmental impact of tyre disposal and recycling processes.

Opportunity for Indian Industrial sectors

Michelin's ENCORE® Retread Tyres offer a sustainable alternative in the tyre industry, driving cost-efficiency and environmental stewardship. For Indian tyre manufacturers, facing increasing pressure to adopt sustainable practices and reduce waste generation, the adoption of rethreading technologies presents an opportunity for transformative change.

5 Retread tyre Technologies | MICHELIN Commercial tyres United Kingdom

1.2 Utilisation of Heat Recovery System - 'EasiHeat' by Spirax Sarco for Enhancing Energy Efficiency in Sugar Sector

Introduction

The sugar industry relies heavily on energy-intensive processes, particularly evaporation and drying, which require significant heat input. To address this challenge and promote sustainable practices, the **heat recovery system** (HRS) emerges as a game-changer. This innovative technology effectively captures waste heat generated from various sources within the sugar production process, such as evaporators, dryers, and boilers. The recovered heat is then re-utilised for preheating boiler feedwater, boiler combustion air, or other process streams, significantly reducing the need for fresh steam generation. By harnessing the power of waste heat, HRS empowers sugar manufacturers to achieve substantial energy savings.

[6]Spirax Sarco UK is a provider of steam and thermal energy solutions, specialising in innovative products and services that enhance the efficiency and performance of steam systems. Among their extensive offerings, Spirax Sarco places a significant emphasis on heat recovery systems, which are designed to capture and reuse waste heat from various industrial processes. This not only improves energy efficiency but also reduces operational costs and environmental impact.

About the technology

Spirax Sarco's **EasiHeat Packaged Heat Recovery System** offers a comprehensive and compact solution for steam-to-water heat transfer, delivering exceptional energy efficiency for applications with stable load conditions such as closed-circuit heating. These pre-assembled and pressure-tested systems are available for heating duties ranging from **70** kilo-watt (kW) to **3** mega-watt (MW), ensuring a perfect fit for the industry's needs. By utilising Spirax EasiHeat, heat recovery system, industries such as the sugar can significantly lower operational costs and contribute to a more sustainable future.[7]

Some advantages and features of Spirax Sarco's 'EasiHeat' packaged heat recovery system include the following:

- Compact heat transfer.
- Cloud-based energy monitoring and reporting.
- Safe start-up and shutdown sequencing.
- Precisely engineered system and components that provides accurate temperature control during sudden load fluctuations.
- Integrity test, fouling detection and intelligent diagnostics.
- Options to suit all applications.

Technology deployment/ installation

The EasiHeat system is designed for ease of installation and operation. It can be integrated into existing sugar production facilities with minimal disruption to ongoing processes. The system requires minimal maintenance, ensuring long-term reliability and cost-effectiveness. It comprises of three main components[8]:

6 EasiHeat (spiraxsarco.com)
7 Packaged Heat Exchanger System (spiraxsarco.com)
8 Easiheat (spiraxsarco.com)

- **Heat Exchanger**: This is the core component where the heat transfer between the waste heat source and the preheated stream takes place. Spirax Sarco offers a range of heat exchanger options, including shell-and-tube, plate-and-frame, and scraped surface heat exchangers, depending on the specific application and process requirements.
- **Control System**: The EasiHeat system is equipped with an advanced control system that monitors and regulates the heat transfer process. This ensures optimal efficiency and prevents overheating and other potential issues.
- **Pumps and Piping:** A network of pumps and piping is used to circulate the waste heat and preheated streams within the system. Spirax Sarco provides expert design and installation services to ensure proper flow rates and pressure control.

Project Demonstration

Tate & Lyle, a sugar manufacturer in the UK, was confronted with increased production demands, and required a solution to enhance the efficiency and reliability of their process heating systems. The manufacturer was experiencing difficulties maintaining consistent steam pressure and temperature control, which impacted their overall production capacity. To meet rising market demands, the sugar manufacturer needed to upgrade their existing steam systems. Additionally, the solution needed to integrate seamlessly with their existing infrastructure without causing significant downtime or disruption to ongoing operations. Hence, Tate & Lyle partnered with Spirax Sarco to implement the EasiHeat® steam-to-hot-water system. The EasiHeat® system was chosen for its ability to provide accurate temperature control, improved energy efficiency, and reduced maintenance requirements. Spirax Sarco's team worked closely with the manufacturer to design a solution tailored to their specific needs, ensuring a smooth integration with minimal operational disruption.[9]

Benefits

The implementation of the EasiHeat® system yielded significant benefits for the sugar manufacturer:

- **Increased Efficiency**: The EasiHeat® system delivered consistent steam quality and accurate temperature control, leading to improved production efficiency.
- **Energy Savings:** The system's enhanced energy efficiency resulted in notable energy savings, reducing operational costs.
- **Reduced Maintenance:** The robust design and reliable performance of the EasiHeat® system decreased the need for frequent maintenance, further lowering downtime and maintenance expenses.
- **Scalability:** The modular design of the EasiHeat® system provided the manufacturer with the flexibility to scale operations as demand continued to grow.

Opportunities for Indian Industrial sectors

Adopting heat recovery systems can significantly benefit Indian sugar mills by reducing energy consumption, improving product quality, and lowering maintenance costs, thus enhancing efficiency and profitability. Given that energy costs constitute a substantial portion of operational expenses in sugar production, the implementation of heat recovery technologies presents opportunities for cost savings and reduced environmental impact. Energy audits provide valuable insights into the potential benefits and feasibility of such systems, allowing Indian sugar mills to identify energy-saving opportunities, quantify potential cost savings, and prioritise investments based on economic and environmental considerations. Collaboration with technology providers like Spirax Sarco ensures that heat recovery solutions are customized to meet the specific requirements and constraints of Indian sugar mills, optimising performance, reliability, and compatibility with existing infrastructure.

9 Tate & Lyle | Case Study | Spirax Sarco

Section 2

Case Studies on International IEED Best Practices

2.1 Utilisation of variable-speed drives (VSDs) in pulp and paper industry

Introduction

VSDs adjust the speed of an electric motor, based on the application requirements. In the pulp and paper industry, different processes (such as pulping, papermaking, and finishing) have distinct speed requirements. VSDs enable efficient operation by adjusting motor speed accordingly. Without this control, the paper production system simply brakes when less force is required, expelling the wasted energy as heat. Additionally, consistent motor speed enhances product quality by maintaining uniform paper properties.[10]

Implementing a VSD in paper production instead of just using a fixed speed motor allows companies to account for varying process load and rapidly respond to changes in demand. VSDs regulate motor speed by adjusting the frequency of the electrical supply, ensuring optimal performance.

About the technology

VSDs are essential tools in the paper manufacturing industries, enabling precise motor control, energy savings, process optimisation, smooth starts/stops, synchronisation, and enhanced diagnostic capabilities. By utilising VSDs, manufacturers can achieve higher productivity, improved product quality, and enhanced energy efficiency.[11] Several companies across the globe (including from the UK) are developing and supplying novel VSDs such as ABB Group, Siemens and Danfoss (Distributed by J J Loughorn and Hydrastore in UK), etc.

The cost of utilising VSDs varies based on factors such as the size of the mill, the number of motors, and the level of automation. Major cost components include VSD equipment cost (including drives, controllers, and sensors), labour costs for installation and setup, training & development expenses for training existing staff on VSD operation, regular maintenance costs and troubleshooting expenses.[12]

Expected benefits of the technology

- **Enhanced energy efficiency:** VSDs improve the efficiency of the papermaking process by regulating the speed of the electric motors that power the papermaking machines. This adjustment reduces energy waste when the machines operate below full capacity.
- **Improved product quality:** VSDs contribute to higher quality paper by controlling the speed of the electric motors. This ensures the paper is produced at optimal speed and tension, maintaining consistency and precision in the final product.
- **Reduced maintenance costs:** VSDs decrease maintenance expenses by minimising wear and tear on the electric motors. This leads to a longer lifespan for the motors and reduces the frequency and cost of repairs.

Project demonstration

ABB upgraded a paper machine at DS Smith Packaging Contoire-Hamel in France, installing 24 international efficiency class 5 (IE5) SynRM motors, ACS 880 multi-drives (VSDs), and advanced controllers. This first-of-its-kind implementation in France significantly enhanced energy efficiency and production speed while reducing operational noise and maintenance costs. The integration under a Profinet protocol streamlined

10 ABB launches UK-wide variable speed drives hire fleet - PITA - Paper Industry Technical Association
11 G120P variable speed drive - Siemens United Kingdom
12 Making the case for VSD control - HOIST magazine

communication and control, supporting DS Smith's sustainability goal of reducing carbon emissions by **46%** by 2030.[13]

Opportunity for Indian Industries

VSDs present a significant opportunity for the Indian pulp and paper industry to enhance efficiency and reduce costs. By controlling the speed of electric motors to match actual process requirements, VSDs can significantly reduce energy consumption, achieving savings of up to 30%.[14] This improved control can enhance product quality, reduces downtime, and increases productivity. Furthermore, VSDs protect electric motors from damage caused by sudden starts and stops, reducing mechanical stress and extending the lifespan of equipment, which in turn lowers maintenance costs.

The cost of production in the Indian paper industry remains a significant challenge. Factors such as raw material costs, power expenses, and maintenance contribute to the overall production cost[15]. VSDs allow precise control of motor speed, optimising energy consumption. By adjusting motor speed based on process requirements, mills can reduce energy costs and enhance overall efficiency. They can be easily integrated into existing systems and applied to a wide range of electric motors, regardless of size or power rating, leading to improved performance.

In summary, the adoption of VSDs in the Indian pulp and paper sector can substantially impact energy consumption, process efficiency, and overall productivity. By reducing energy waste, improving process control, and lowering maintenance costs, VSDs can contribute to the long-term sustainability and competitiveness of the industry.

13 ABB upgrades paper machine at French DS Smith mill using award-winning SynRM motors technology
14 Applications of variable speed drive (VSD) in electrical motors energy savings - ScienceDirect
15 Indian Pulp and Paper Industry | Paper Production & Manufacturing (pulpandpaper-technology.com)

2.2 Integration of heat exchangers and evaporation systems in chlor-alkali industry

Introduction

Adoption of heat integration techniques is crucial for enhancing energy efficiency within the chlor-alkali industry. These techniques involve the systematic recovery and reuse of waste heat generated during the electrolysis process. By capturing this waste heat, the industry can repurpose it for various applications, thereby significantly reducing overall energy consumption.

One primary application of recovered heat is the preheating of the brine solution, which is a crucial step in the chlor-alkali production process. Preheating the brine solution reduces the amount of external energy required to bring the solution to the necessary temperature for electrolysis, leading to considerable energy savings.

Additionally, the waste heat can be utilised to generate steam, which can then be employed in various stages of the production process or for other ancillary operations within the plant. The generation of steam from recovered heat not only curtails the energy costs but also enhances the overall thermal efficiency of the facility.[16]

About Alfa Laval's heat exchangers and evaporation systems

Alfa Laval is a provider of heat transfer, separation and fluid handling technologies. They provide products and solutions to enhance productivity and sustainability in various industries such as energy, environment, food, and marine. Their core offerings include heat exchangers, separators, pumps, and valves. The company aims to optimise customer processes, improve energy efficiency, and reduce environmental impact. They operate in over 100 countries (including India), supporting customers with sales, services, and spare parts through a widespread global network. The company produces wide range of high-performance gasketed, semi-welded, and welded heat exchangers that can be integrated into various heat transfer positions along all electrolysis process lines. These heat exchangers are suitable for tasks such as brine pre-treatment, wet chlorine gas cooling, hydrogen gas cooling, and electrolyte heating and cooling.

Expected benefits of the technology

Some of the key benefits of utilising heat exchangers and evaporation systems are as follows:

- **Energy efficiency:** the heat exchangers are designed to maximise energy efficiency, which helps reduce operational costs and environmental impact. They recover and reuse heat, minimising energy consumption.
- **High performance**: the systems have high thermal efficiency and ability to handle a wide range of temperatures and pressures, leading to improved process performance and reliability.
- **Compact design**: the systems have a compact design, which is particularly beneficial in industries where space is at a premium.
- **Cost savings:** the efficiency and durability of these systems lead to significant cost savings over time. Reduced energy consumption, lower maintenance needs, and longer equipment lifespan contribute to overall cost-effectiveness.
- **Versatility:** A variety of heat exchangers and evaporation systems are suitable for diverse applications, including chemical manufacturing, food and beverage processing, oil refining etc. This versatility allows for tailored solutions that meet specific industry requirements.

16 Chlor-alkali production | Alfa Laval

- **Ease of maintenance**: Designed for easy cleaning and maintenance, these systems reduce downtime and maintenance costs.
- **Environmental Impact**: by improving energy efficiency and enabling waste heat recovery, these systems help reduce greenhouse gas emissions and overall environmental footprint, aligning with sustainability goals.

Project demonstration

AGC's Chiba Plant (Japan) significantly enhanced its caustic soda concentration process by replacing an outdated evaporator and heat exchangers with advanced gasketed plate heat exchangers and a specially designed evaporator. The new system, featuring HeatSeal™ gaskets made from Aflas 600X fluoroelastomer, resulted in **10%** reduction in steam consumption, contributing to sustainability and cost savings. This upgrade also decreased maintenance costs due to improved gasket durability, reduced electricity consumption through smaller pumps, and saved space with its compact design. AGC plans to implement these innovations in other facilities, promoting sustainable and efficient manufacturing.[17]

Opportunity for Indian Industries

The chlor-alkali sector in India faces several challenges, including high energy consumption (during production), environmental concerns, and increased production costs.[18] Many chlor-alkali plants in India have relatively small production capacities compared to global standards which limits their ability to achieve economies of scale and compete effectively[19]. However, there are notable opportunities for enhancing energy efficiency by adoption of advanced technologies such as heat exchangers and evaporation systems. These innovations offer substantial benefits by significantly reducing energy consumption through the recovery of waste heat, thereby enhancing operational efficiency, reducing costs, and improving control over critical production parameters such as temperature and concentration. Additionally, evaporation systems contribute to sustainable water management by recycling and reusing water within production processes, particularly advantageous in water-scarce regions. These technologies are adaptable and scalable, making them suitable for integration into chlor-alkali plants of varying sizes. Their adoption promises significant sustainability gains by minimising energy waste, optimising processes, conserving water resources, and lowering greenhouse gas emissions, thereby supporting the long-term competitiveness and environmental responsibility of the chlor-alkali industry.

17 Sustainable soda ash manufacturing | Alfa Laval | Heat exchanger | Alfa Laval
18 India Chlor Alkali Market [2029] By Size, Trends, Forecast | TechSci Research
19 Chlor-alkali-industry-in-India-status.pdf (ama-india.org)

Section 3

Case Studies on National IEED Technologies

3.1 Performance Optimisation in Sugar Mills through Predictive Modelling

Mr. Antoine Setti & Mr. Daniel Werner, Veolia ÖKOTEC
Mr. K. Srikant & Mr. Rohan Kadamb, DESL

Introduction

The production of sugar involves highly energy-intensive operations, including cane preparation, milling, and evaporation, which require significant electricity and steam consumption. Predictive modelling plays a crucial role within these facilities to significantly enhance efficiency and performance optimisation. It enables sugar mills to effectively identify inefficiencies and streamline their operations by systematic monitoring of energy flows, visualisation of consumption patterns, and real-time evaluation of operational data.

The technology from sugar mills perspective

- **Equipment level monitoring - Shredders, Mill drives:**

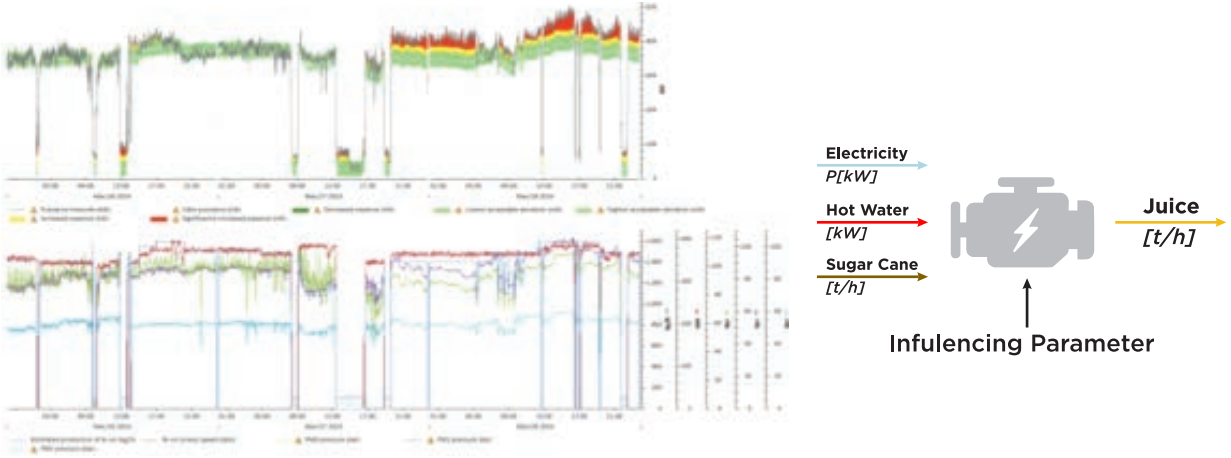


Figure 2: Monitoring of top power consumers in a typical sugar mill by a predictive analytics software

Cane preparation and milling can account for up to **40%** or more of the total power demand in a typical sugar mill.

Figure 2 depicts the comparison between present electrical parameters with the statistical best values from the historical best values. The graph's green hues mark instances where equipment operates within the defined best operating point, based on historical data. Yellow signals minor threshold breaches, while red indicates severe deviations, promptly triggering alarms for corrective intervention. Furthermore, leveraging predictive modelling allows for accurate forecasts of motor electricity consumption by analysing influential parameters affecting equipment power usage which enables the identification of inefficiencies and the implementation of predictive maintenance strategies. A review of potential energy savings from analogous systems and past projects, equipment monitoring, predictive maintenance strategies, and early warning systems of a predictive analytics software can yield energy savings ranging from **2% to 5%.**

- **Equipment level monitoring - Multiple Effect Evaporators (MEEs):**

The evaporation process is one of the largest steam consumers in a sugar mill, accounting for over **90%** of the overall low pressure (LP) steam consumption on the process side. Even small improvements in the MEE's steam economy can lead to significant savings. The following case study demonstrates how the monitoring capabilities of predictive analytics software can provide real-time insights into the performance and efficiency levels of MEEs.

Case study: Zero Liquid Discharge Plant in Gujarat, India

A predictive analytics software was integrated into the operations of a Zero Liquid Discharge Plant in Ankleshwar, Gujarat. Specific Key Performance Indicators (KPIs) were tailored for both the Multi Effect Evaporator (MEE) and the stripper unit. This solution streamlined data collection from various plant sections, including the boiler, MEE, and stripper, meticulously monitoring over 250 data points. This allowed the plant to track critical influencing parameters of energy such as pressures, temperatures, flows and condensate recovery rates, providing invaluable real-time insights into the plant's performance and efficiency levels.

To empower dynamic decision-making, intuitive dashboards (as shown in figure 3) along with detailed daily and weekly reports were developed, ensuring a comprehensive oversight. While still in its nascent stages, this project holds promise for substantial enhancements in operational efficiency and performance.

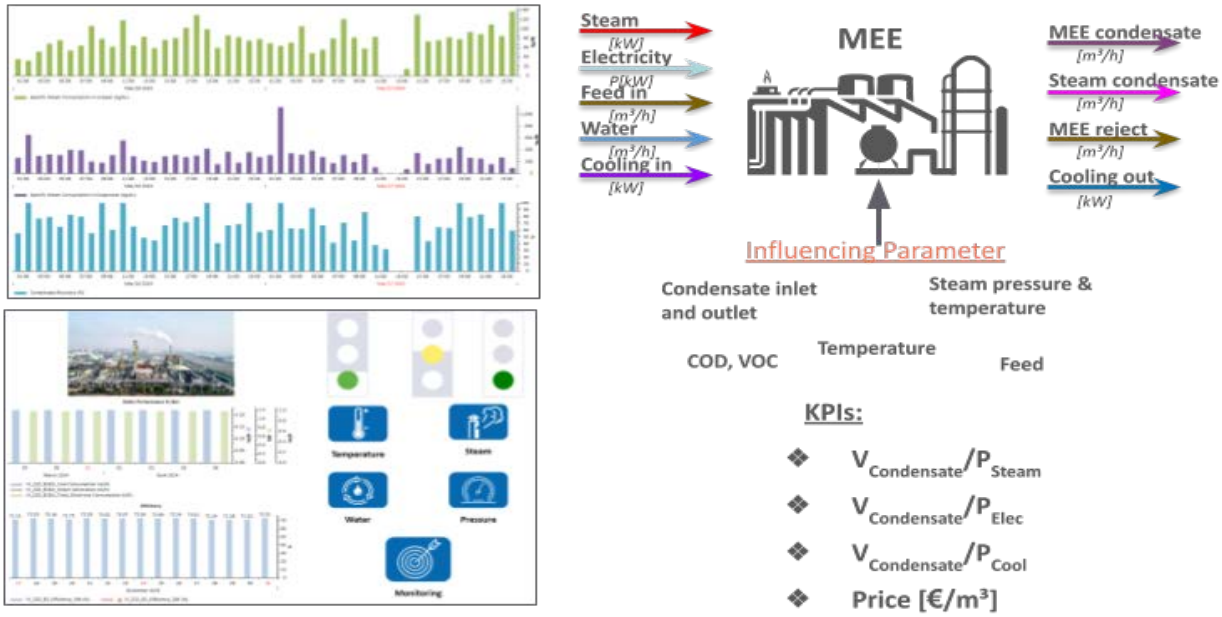


Figure 3: Intuitive dashboards and KPIs for MEE monitoring

- **System level monitoring - Combined Heat and Power (CHP):**

System flexibility refers to the ability of a Combined Heat and Power (CHP) plant to adapt and respond efficiently to changes in operational conditions, demand, or external factors. Sugar mills in India face seasonal variations in sugarcane availability and processing requirements. System flexibility allows the mills to optimise their operations based on the availability of feedstock, energy demand, and market conditions. For example, during peak sugarcane crushing seasons, mills can adjust their CHP operations to optimise their electricity generation while efficiently utilising bagasse for heat and power generation and maximising the bagasse surplus for direct sale.

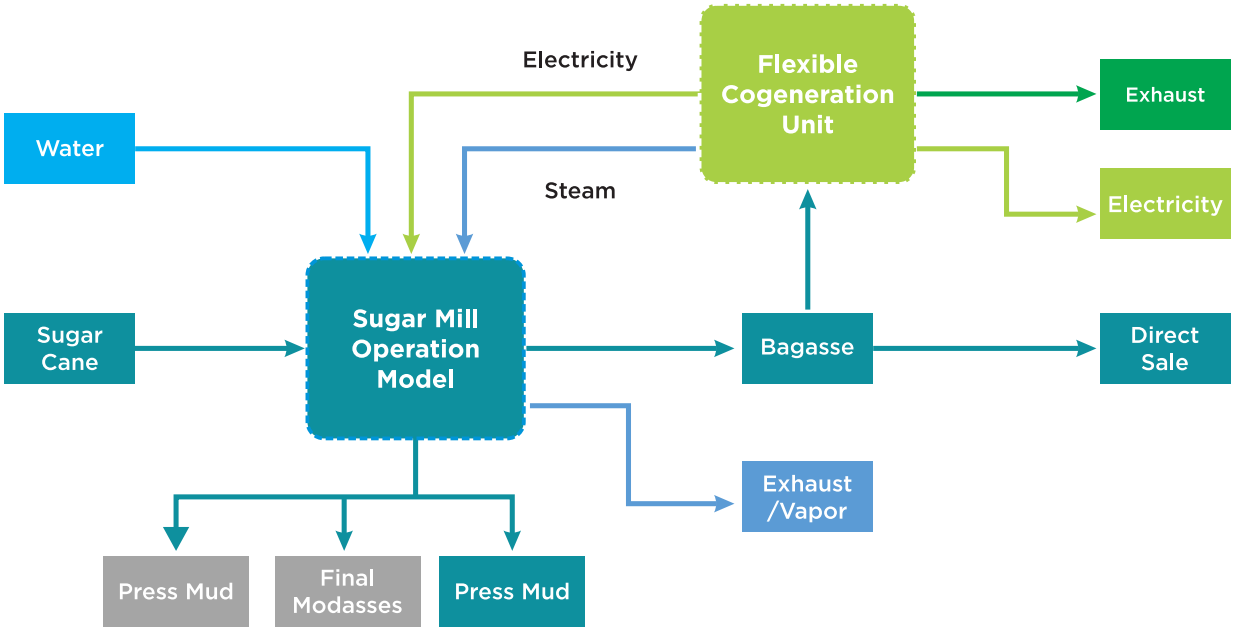


Figure 4: Illustrative diagram of a sugar mill with flexible co-gen operation

Predictive modelling software can not only support the sugar mills in enhancing system flexibility and efficiency but also address unique challenges such as forecasting steam demand with high accuracy and optimise boiler operations. This can enable the sugar mills to plan and reduce inefficiencies in the CHP systems, consequently maximising revenue from surplus bagasse.

Furthermore, through comprehensive system-wide monitoring, the sugar mills can promptly identify deviations from optimal modes and ensure immediate corrective actions. By mathematically delineating operational flexibility, predictive modelling enables dynamic adjustments in electricity and heat generation mix, finely tuned to real-time demand fluctuations. Estimated savings[20] from bagasse through flexibility improvements and boiler monitoring ranges from **5,500** to **10,000** tonnes of cane/year and **6,200** to **12,500** tonnes of cane/year respectively.

About the predictive modelling software - EnEffCo®

The EnEffCo® predictive analytics software is developed by industry practitioners in Veolia ÖKOTEC, Germany. The Veolia group has a strong presence in India through its group company, Development Environergy Services Limited (DESL). Since its inception EnEffCo® has been implemented in over 1,500 facilities (including over 100 industrial units).

20 Savings are estimated for a 12,500 tonnes of cane per day (TCD) plant.

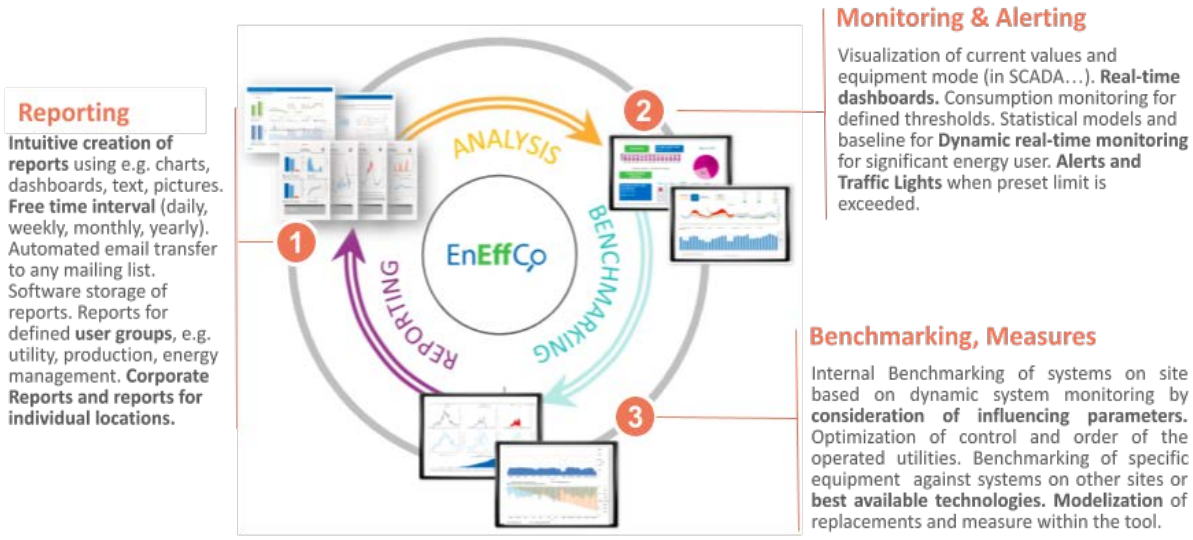


Figure 5: Illustrative diagram: Sugar mill with flexible cogen operation

Figure 5 showcases the three functionalities of the tool which provides a single solution that consolidates all data sources, minimising capture, and processing efforts, while offering a variety of interfaces and protocols for easy access and ensuring high availability of data whenever needed.

3.2 Decarbonisation through Bagasse Dryer in Captive Cogeneration Power Plants in Sugar Mills

Mr. Rajesh Verma, CEO, Enviropol Engineers Pvt. Ltd.

Background

Bagasse, a byproduct of sugar production, serves as the primary fuel for boilers in sugar mills, where it undergoes combustion to produce steam and electricity. However, due to its high moisture content, a significant amount of thermal energy in the form of waste flue gas escapes through the boiler stack into the environment.

Daurala Sugar Works (DSW) currently operates a set of high-pressure boilers fuelled by wet bagasse, resulting in substantial heat losses through the boiler stack. Recognising the impact of moisture and resulting dry gas on these losses, reduction in stack flue gas temperature, achieved by minimising moisture content in bagasse, is expected to result in enhanced steam-to-fuel economy.

In its pursuit of enhancing boiler efficiency, DSW has identified stack heat losses as a critical area for improvement. Additionally, the concentration of particulates in the flue gas leaving the boiler stack remains a concern, highlighting the need for efficient **'Advanced Process Control'** at the boiler's backend.

In response to these challenges, Environpol Engineers has developed an innovative solution known as the ***Hybrid Flash Dryer*** - **Wet Electrostatic Precipitator (WESP)**. This solution not only aims to reduce energy consumption but also promotes environmental sustainability by improving energy efficiency and reducing emissions.

Hybrid Flash Bagasse Dryer-WESP [Patented] Scheme

Sugar mills utilise bagasse from freshly crushed cane as fuel in boilers to generate high-pressure (HP) steam, which in turn produces power and steam via integrated steam turbogenerators.

In this process, the highly moist bagasse is fed into the flash bagasse dryer unit (illustrated in Figure 6), where it is effectively dried by flue gas flowing in a concurrent mode. The dried, hot bagasse then exits the unit and is directed to the boiler's combustion chamber.

Subsequently, the partially cleaned and cooled flue gas is routed to a WESP for final cleaning. The cleaned flue gas is then discharged into the atmosphere through the stack by an induced draft (ID) fan.

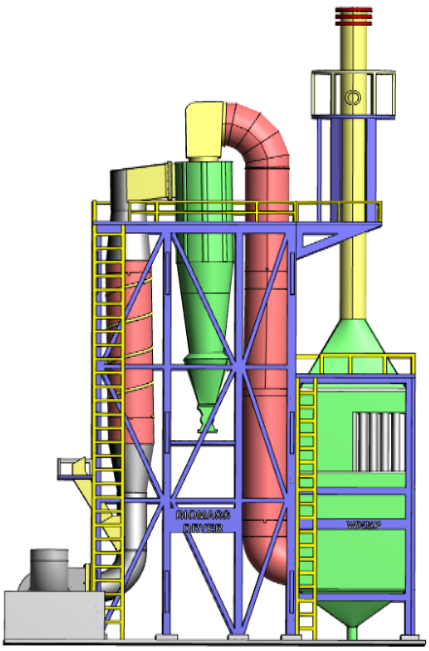


Figure 6: Hybrid Flash Bagasse Dryer

Case Study – Daurala Sugar Works- HP Co-gen Boiler

Boiler Description

Steaming conditions of co-gen high-pressure (HP) boiler and other related parameters are elicited in Table -1.

Table-1 Steaming conditions of Cogen HP Boiler - DSW

Parameter	Design Value
Fuel	Bagasse
Moisture in mill bagasse (%)	50
Steam evaporation rate (Tons per hour)	90
Steam outlet pressure (Kilogram per square centime-tre)	67
Steam outlet temperature (°C)	505
Feed water temperature from boiler deaerator to economiser (°C)	104
Draught system	Balanced- Forced draft (FD) & ID fans
Back-end Equipment	Economiser & Air Preheaters (APH)
Super heater steam temperature control	Attemperator between primary superheater (PSH) & primary superheater (SSH)
Flue gas temperature at APH outlet (°C)	140
Air pollution control device	FBD integrated with WESP

The hot and dusty flue gas from the air heater is first passed through a flash dryer, where it directly mixes with wet bagasse. During this drying process, dust particles become entrapped in the dried bagasse. The partially cleaned flue gas, with a remaining dust load of about 200 mg/Nm^3, is then routed through an integrated low-pressure drop WESP for further cleaning, reducing the dust load to well below 50 mg/Nm^3 (milligram/cubic nanometre) in compliance with current environmental regulations. The Hybrid Flash Bagasse Dryer at DSW is designed to handle 100% of the flue gas exiting at 140°C after the air preheater from a 90 TPH boiler (refer Figure 7). This system achieves a **10%** reduction in bagasse moisture content while maintaining outlet emissions below **50** mg/Nm^3. Performance data for the hybrid flash bagasse

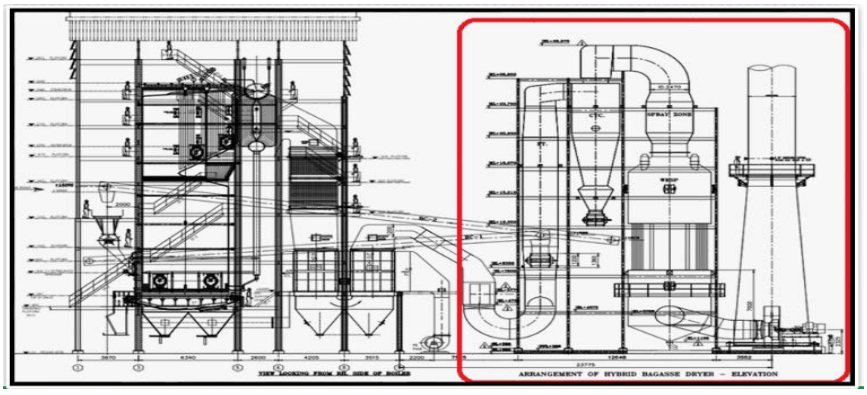


Figure 7: G.A. Drawing of Bagasse Fired HP Boiler integrated with Hybrid Dryer

dryer are provided in Table 2. .

Table-2 Performance data for hybrid flash bagasse dryer with WESP

Particulars	Unit	APH Outlet – Dryer Inlet	Dryer Outlet - WESP Inlet	WESP Outlet – Stack
Flue gas temperature	° C	140	71	68
Bagasse moisture	%	50	40*	-
SPM in flue gas	mg/Nm^3	4000	195	35
Flue gas draught	Milimetres Water Column (mmwc)	130	260	280

Performance Results

Waste Heat Recovery – Energy Conservation

Through scrubbing warm flue gas over the incoming wet bagasse at ambient temperature, heat is directly transferred, reducing the flue gas temperature and achieving a **20%** reduction (from 50% to 40%) in the moisture content of the incoming wet bagasse. An illustrative photo of milled wet bagasse and dried bagasse exiting the Flash bagasse dryer is presented in Figure 8. This process has increased the thermal efficiency of the boiler by ~**9 to 10%**.

Figure 8: Mill Wet Bagasse & Dried Bagasse

Cleaner Stack- Environment Control

To meet stringent air pollution norms under the forthcoming Clean Air Act, the WESP installed at the boiler's back end has achieved average stack particulate emissions of less than **40** mg/Nm^3, as shown in Table 3. Although this installation necessitates an additional draft of **~25-30** mmwc for the WESP, leading to a slight increase in overall station power consumption, this is offset by the reduction in power consumption of the ID and FD fans due to decreased flue gas and combustion air flow requirements.

Overall, the implementation of the flash bagasse dryer with WESP system results in a **35%** reduction in absolute emissions of all stack pollutants, through increased boiler thermal efficiency, the WESP, and reduced fuel consumption in the boiler. Performance data supporting these improvements are detailed in Table 3.

Table-3 Absolute Stack Particulate Emission Reduction

Parameter	Units	Standard Unit without bagasse dryer	Hybrid WESP with bagasse dryer
Flue gas Volume	Nm^3/hr	1,40,000	1,26,000
SPM in flue gas at air pollution control devices (APCD)	mg/Nm^3	4,000	4,000
Particulates loading in flue gas	kg/hr	560	506

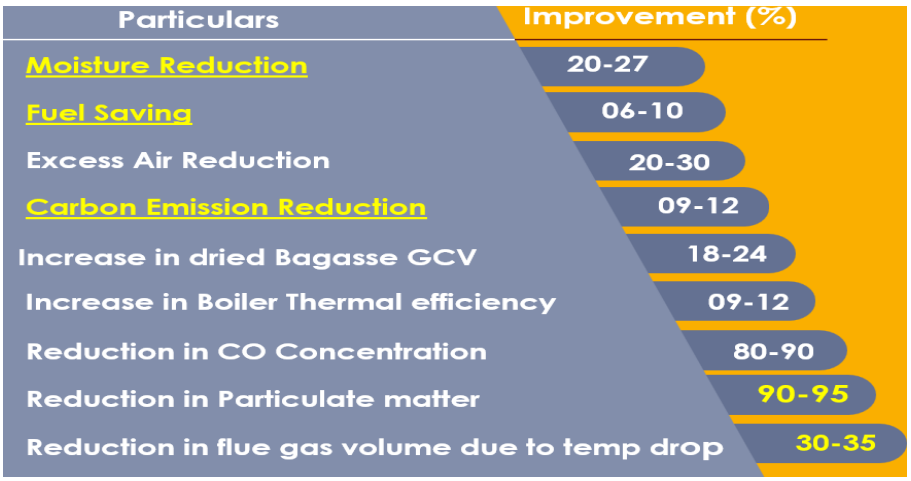
Parameter	Units	Standard Unit without bagasse dryer	Hybrid WESP with bagasse dryer
SPM in flue gas at BD out	mg/Nm^3	NA	190
SPM in flue gas to stack	mg/Nm^3	50	35
Absolute Particulate discharge through Stack	kg/hr	**7**	**4.5**
Absolute Gaseous pollutants discharge reduction	%	Base	10%

Expected benefits

- Offers bagasse drying & flue gas drying in a single process
- Increases revenue through the generation of additional green power
- Ensures a significant reduction in particulate matter in flue gas post-WESP installation.
- Anticipates a **~20%** reduction in nitrogen oxides (NOx) emissions due to lowered excess air, staged air combustion, and the use of preheated, dried fuel.
- Provides substantial control over gaseous pollutants.
- Features a smaller footprint and a compact layout.
- Contributes to the reduction of greenhouse gas emissions.
- Improves overall productivity.

Performance analysis for decarbonisation

- Bagasse Flexibility: allows for the saved bagasse to be sold or stored for later use in the HP boiler, particularly during periods of lower cane crushing, ensuring continuous power export to the grid.
- Enhanced Combustion Temperature: The combustion temperature in the furnace is expected to be higher due to the lower moisture content and higher gross calorific value (GCV) of the dried fuel. This improvement reduces N_2O (nitrous oxide) emissions (a potent greenhouse gas), contributing to overall GHG emission reductions.
- Enhanced Energy Efficiency: Specific energy gains are achieved through improved steam economy (specific steam evaporation). This leads to a reduction in GHG emissions by offsetting fossil energy use with the improved heat content of the dried fuel and increased thermal efficiency of the boiler with the bagasse dryer in place. The estimated reduction is approximately ~1250 tCO_2e (tonnes of carbon dioxide equivalent) per month during the crushing season.



Summary of improvement in key parameters by utilisation of hybrid flash bagasse dryers with WESP

Opportunity for Indian Industries

In Indian sugar mills, decarbonisation through bagasse dryers in captive cogeneration power plants can offer significant environmental and economic benefits. By reducing moisture content, bagasse dryers enhance combustion temperature and energy efficiency, improving bagasse flexibility and overall plant performance. This approach not only reduces carbon emissions but also optimizes resource utilization. Simultaneously, predictive modeling techniques can help in performance optimization in the sugar industry. By leveraging advanced reporting, monitoring, and alerting systems, sugar mills can proactively identify potential issues, optimize processes, and improve overall efficiency. These models analyze real-time data to predict equipment failures, optimize maintenance schedules, and enhance production yields. Benchmarking efforts further support continuous improvement by comparing performance metrics across the industry. The integration of decarbonisation strategies and predictive modeling in Indian sugar mills represents a step towards sustainable and efficient operations, aligning with global environmental goals while boosting productivity and profitability in the sector.

Section 4

Case Studies on National IEED Best Practices

4.1 Enhancing Energy Efficiency and Green Practices deployed in Tyre Sector

Mr. S K Satpathy, Assistant Vice President (Manufacturing)
Cavendish Industries Limited (A Unit of JK Tyres)

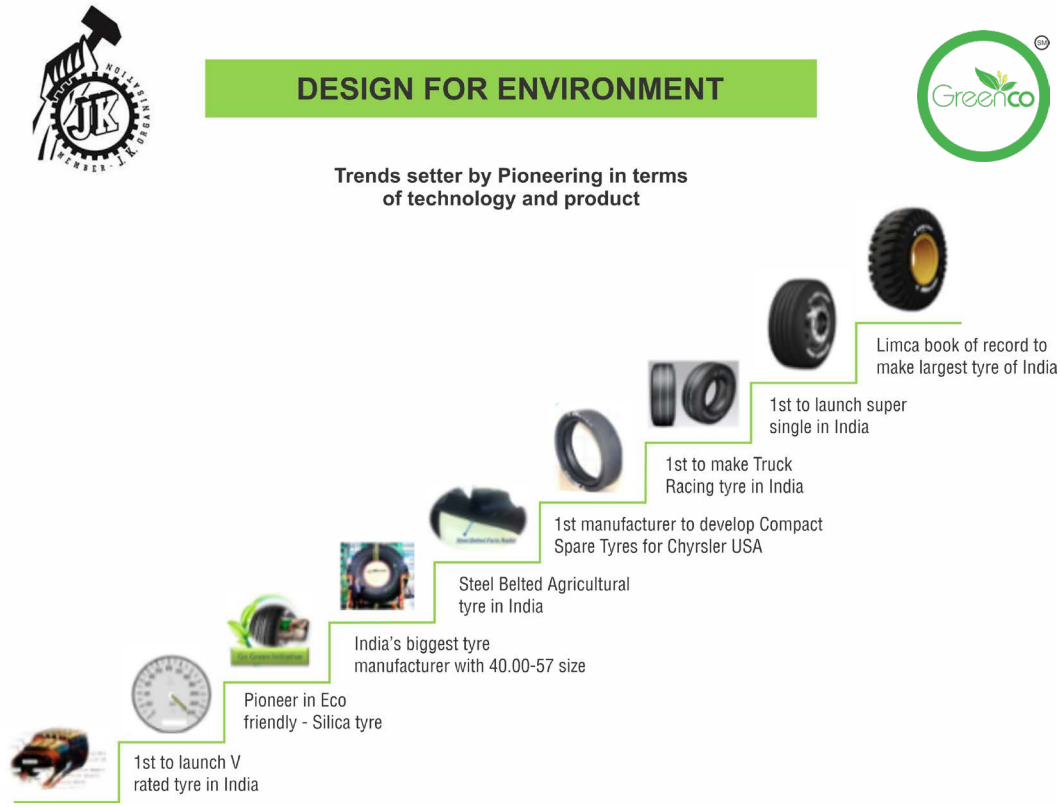


Figure 9: Technology & Products

Introduction

JK Tyre, the flagship company of the JK organisation, is recognised as one of the leading manufacturer of tyres both in India and globally. The company is dedicated to driving and leading change in technology, society, and the environment. JK Tyre is a pioneer of radial technology in India and they have achieved advancements in water conservation and energy efficiency.

The force behind JK Tyre's sustainability journey

Over the past decade, JK Tyre has focused on evaluating green alternatives, primarily centred around recycled materials, renewable resources, bio-based or bio-attributed materials, and regenerated materials. The company has focused on the development of a green and sustainable product line. By embracing green product innovation, it addresses environmental concerns and improving the reliability on the road.

Focus on green product to reduce carbon footprint

JK Tyre's efforts are directed across all aspects of its operations to enhance energy efficiency and reduce the overall carbon footprint. This involves a simultaneous focus on:

- Developing environmentally friendly and sustainable products.
- Designing products with low rolling resistance and efficient designs to enhance vehicle fuel efficiency, thereby contributing to the optimisation of natural resources.
- Implementing highly efficient process engineering and controls to conserve fuel, power, water, and other natural resources.
- Pioneering the transition from traditional tyre curing methods using steam to nitrogen.
- Implementing engineering controls to minimise process waste.

Initiatives undertaken for enhancing sustainability

- ***Lower rolling resistance tyres:*** designing tyres with lower rolling resistance enables the vehicles to move with less energy, thereby consuming less fuel. This, in turn, leads to a reduction in carbon dioxide (CO_2) emissions from the vehicle, as burning less fuel results in lower CO_2 output. The company has implemented specialised green polymer integrated with hyper bonding silica technology, which has resulted in **20%** reduction in rolling resistance in tyres over past 3 years.

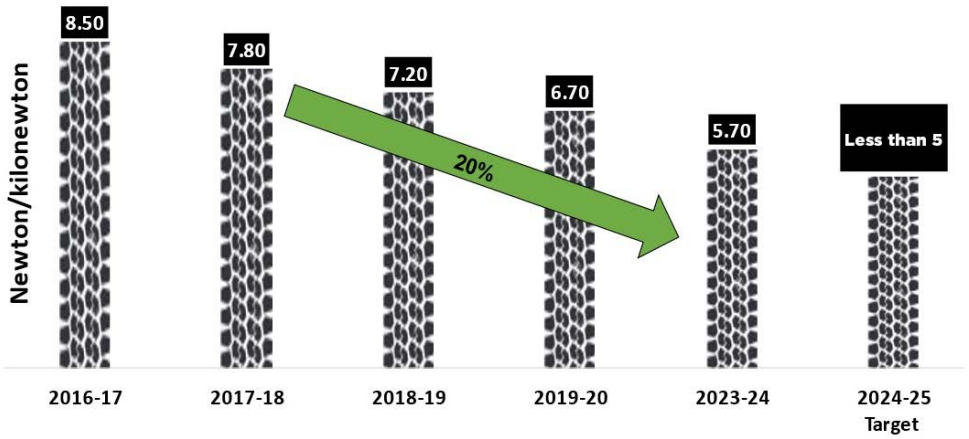


Figure 10: Rolling resistance over the years

Utilisation of renewable energy: 55% of power requirements of the company are addressed by in - house renewable sources such as solar and wind

- ***Replacement of Aromatic Oils*:** aromatic oils with high levels of polycyclic content have been fully replaced with low poly cyclic aromatic (PCA) oil and naphthenic oil.
- ***Replacement of carbon black:*** Partial replacement of carbon black with silica in truck, bus, and radial tyres (TBR) formulations, ranging from 2-12 parts per hundred rubber (phr). High silica content compounds are currently used and in development.
- ***Innovative Formulations:*** Introduction of oil-free formulations in TBR compounds, completely eliminating the use of petroleum-based aromatic oils.
- ***Recycled Rubber Usage:*** Incorporation of recycled or reprocessed rubbers such as crumb rubber, superfine reclaim, butyl reclaim, and SMR, accounting for approximately 15% of total rubber consumption.
- ***Synthetic Rubber Usage***: utilisation of around 2% petroleum-based synthetic rubbers in its total rubber consumption.
- ***Compliance with REACH certification:*** raw materials used in JK Tyre's products meet stringent safety and environmental standards set under REACH regulation.[21]

21 REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals) is a European Union regulation that aims to ensure a high level of protection for human health and the environment from the risks posed by chemicals.

Tyre retreading

Retreading involves refurbishing worn-out tyres by replacing the tread, thereby extending the tyre's lifecycle and reducing the need for new raw materials. This practice not only offers significant economic benefits to customers by lowering the operational cost per kilometre, but also contributes to environmental sustainability by minimising waste and resource consumption. JK Tyre has been in the tyre retreading business for over **10** years, achieving approximately **30%** year-over-year growth in 2023. They employ advanced retreading technologies and adheres to stringent quality standards, ensuring that retreaded tyres deliver performance and reliability comparable to new ones. They have **69** retread centres across India equipped with ultra-modern retreading machinery and JK Tyre-recommended repair and retread procedures.[22]

Initiatives undertaken for enhancing energy efficiency

- Enhancing the performance of air ventilation fans by substituting belt-driven centrifugal fans with high-efficiency direct-coupled axial fans.
- Introducing a 20% substitution of Coal with biomass
- Improving the performance of air ventilation fans by replacing belt-driven, low-efficiency centrifugal fans with high-efficiency direct-coupled axial fans.
- Decreasing compressor energy consumption by incorporating intelligent flow controllers alongside VFD controls.
- Introducing nitrogen tyre curing as an alternative to hot water tyre curing, thereby eliminating the hot water generation system entirely.
- Converting all plant lighting to LED lights.
- Executing various projects aimed at steam and condensate recovery, boiler efficiency enhancement, trap management, and coal conservation.

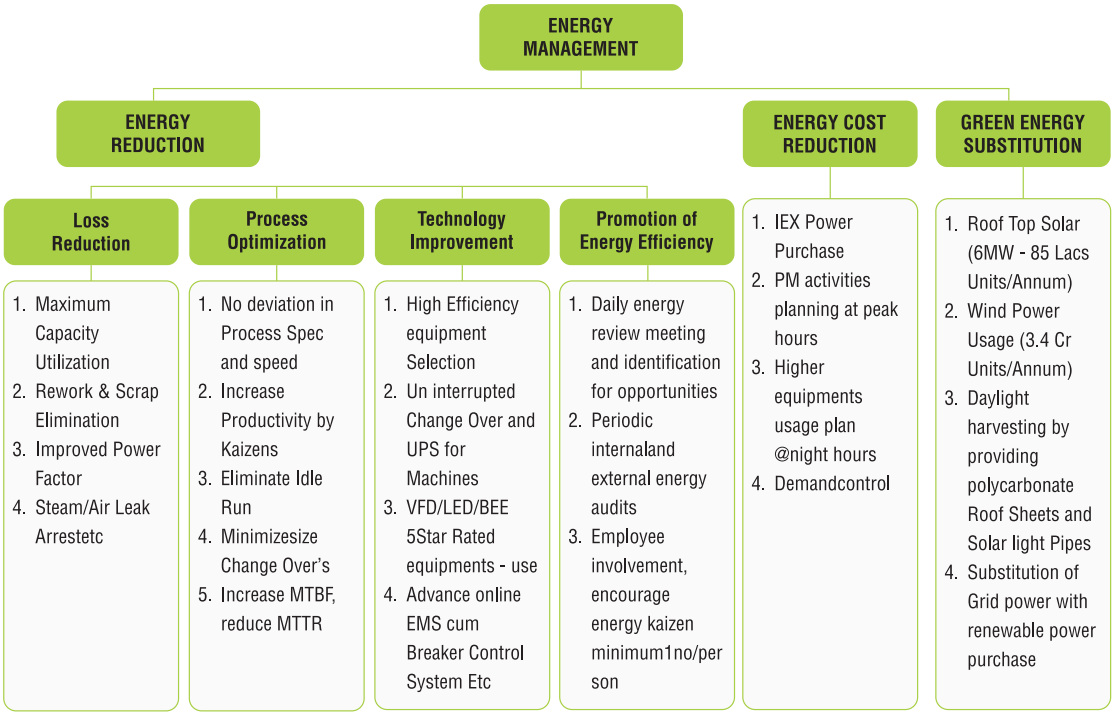


Figure 11: Energy management strategies by JK Tyre

22 JK Tyre Annual Report (FY' 2022-23).

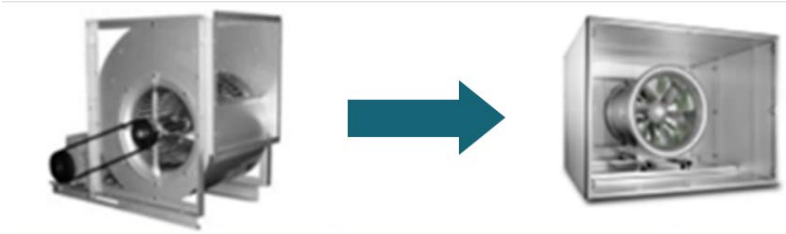
Project: Substituting Centrifugal Type Ventilation Fans with Next Generation High-Efficiency Axial Fans:

Fresh air ventilation systems typically employ centrifugal fans to meet higher air volume demands, with fan efficiency ranging from 60-75%. The Company has conducted global research into alternative technologies to achieve higher air volume output with reduced power consumption. The Organisation has identified a high-efficiency axial fan ventilation system capable of meeting these requirements and retrofitted existing units, resulting in significant savings of 48% in the past.

Air Handling Unit Fixed Power Cost Reduction

High power consuming centrifugal fan can be replaced with axial fan

Centrifugal Fan	Axial Fan
Belt Driven	Direct driven
Conventional Starter	VFD control for step-less load control



Parameters/Fan Name	Unit	Centrifugal Fan (Before Retrofit)	Axial Fan ()After Retrofit)
Velocity	m/s	6.2	6.2
Efficiency	%	55.8	89.8
Flow	**CFM**	**23,735**	**23,777**
Measured Power	**kw**	**14.4**	**4.5**

Cost Saving - 5.54 Lacs / Annum (Investment - 6.49 Lacs, ROI - 1.2 Years)

Water management

Since its inception, the company has implemented a methodical approach to identify all potential avenues for water recovery, recycling, and reuse. Some key projects include:

- Substituting Hot Water with Nitrogen Curing, saving large quantity of energy used for generating high pressure hot water system.
- Optimising Cooling Towers in the VAM Chiller System.
- Implementing Zero Liquid Discharge in the Effluent Treatment Plant (ETP).
- Recycling RO Rejects in the Water Treatment Plant (WTP) using Ultrafiltration (UF) technology.
- Recycling Sewage Treatment Plant (STP) water for process use.
- Implementing a Condensate Recovery System.
- Introducing a Flash Steam Recovery System.
- Implementing a Main Drain Recovery System

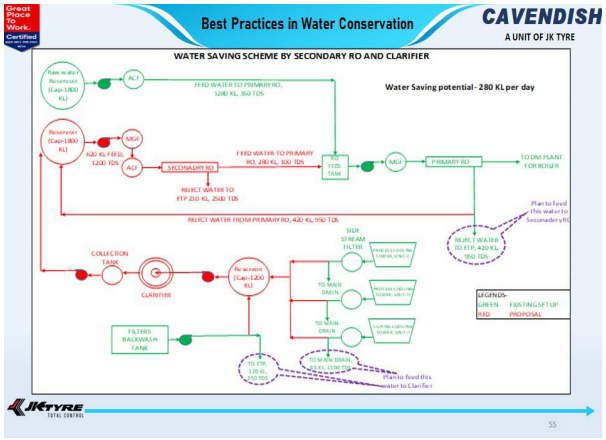


Figure 12: Water management at JK tyre

The company has implemented well-designed Rainwater Harvesting (RWH) Systems to collect runoff water generated during rainy seasons, with stormwater drains connected directly to RWH ponds within the factory premises.

As a result of these initiatives, the company has achieved a significant 50-60% reduction in water consumption over the last three years, positioning itself as one of the world's lowest consumers of water per ton of tyres manufactured.

Figure 13: Energy Training

Figure 14: Plant Training Centre

Best Practices for energy conservation

To maximise operational efficiency and minimise energy wastage, the following best practices are implemented:

- Adaption of pull model of product planning reducing the inventory carrying cost.
- Conducting daily efficiency monitoring for boilers.
- Ensuring precise control of process temperatures.
- Maintaining optimal steam pressures.
- Repairing damaged insulation on hot/cold surfaces.

- Maintaining a high-power factor and correct voltage levels.
- Regular cleaning of screens, filters, and fan blades in ventilation/blower systems.
- Adjusting pump operation to the best efficiency point and flow requirements.
- Lowering air compressor discharge pressure to the lowest acceptable level.
- Minimising idle running time of compressors.
- Adjusting chilled water temperature set points to the maximum acceptable level.

Conclusion

JK Tyre is enhancing its energy efficiency and sustainability practices by setting ambitious goals, such as reducing its carbon intensity by 50% by 2030. JK Tyre sources over half of its energy from renewables and plans to increase this to 75% in the next five years. Further, they aim to reduce environmental impact and promote energy-efficient technologies in their production processes.

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