ISSN: 0379-5462
IPPTA: Quarterly Journal of Indian Pulp and Paper Technical Association
Vol. 36, E2, 2024, p. 80-83

Enhancing Energy Effciency and Performance Through Electrical Systems In SPB


*S. S. Nandha kumar**
GM (Electrical)


*R I Ambalavanan**
Head (Electrical)


*S. Suresh kumar**
AM (Electrical)


*V. Udhayasree**
Officer (Electrical)


*T. Iswarya**
Electrical Engineer

* *Seshasayee Paper & Boards Limited*

Abstract:

In an era characterized by rapid technological advancements and growing resource constraints, optimizing efficiency has become a strategic imperative. Enhancing efficiency in electrical systems yields multifaceted benefits. Firstly, it directly contributes to energy conservation and mitigates environmental impact by reducing GHG emissions associated with electricity generation. Moreover, efficient electrical systems translate into lower operating costs for industries, driving economic competitiveness and affordability. This paper delves into how SPB enhances efficiency through advanced electrical systems and technologies.

As an energy leader and a trend setter, SPB's relentless commitment to pursuing excellence in energy performance drives us to continually engage in efficiency improvement activities. Our key initiatives encompass a comprehensive approach to enhancing the efficiency and resilience of our power infrastructure. With the successful implementation of a Distributed Control System (DCS) for real-time monitoring and controlling, our operational efficiency has experienced significant enhancement, ensuring immediate responsiveness to system changes. Additionally, leveraging the capabilities of an online Energy Monitoring System (EMS) for real-time power monitoring empowers us to make data-driven decisions and optimize energy usage effectively. Detailed insights into power consumption patterns provided by the EMS enabled us to identify areas for improvement and reduce energy costs.

By implementing the Grid Islanding project, self-sufficiency is not only ensured but also the power system frequency can be reduced, which in turn reduces overall power consumption. Furthermore, SPB actively undertaking the elimination of the 22 kV supply system, a pivotal step aimed at eliminating the power losses and mitigating potential business risks associated with outdated infrastructure. These initiatives, combined with other complementary strategies, emphasize our unwavering commitment to sustainability and operational efficiency in energy management.

Energy efficiency is not merely a goal but rather a mindset, driving organizational excellence and adaptability in an ever-evolving landscape.

Keywords: *Efficiency, Energy Monitoring System, Grid islanding, Business risk.*

Introduction

Seshasayee Paper & Boards Limited, established in 1960, a wood and agro-based integrated pulp and paper industry, started with the paper production of just 20,000 TPA and continuously upgraded to the present capacity of 1,65,000 TPA.

SPB focused on enhancing efficiency in the Electrical systems, while expanding the capacity of the pulp mill, chemical recovery plant, paper and board machines. By utilizing a Distributed Control System (DCS) in our operations, we reaped a multitude of benefits that significantly enhanced the efficiency and reliability of our processes. For better monitoring capabilities, the system was upgraded by incorporating an energy monitoring system. This integration allowed SPB to identify numerous potential energy-saving opportunities, which led to significant improvements.

2. Energy efficiency Methodologies

2.1. Distributed Control Systems:

Efficiency improvement in equipment operation:

Distributed Control Systems (DCS) offer significant benefits to Electrical systems by enhancing their efficiency, reliability, and overall performance. The optimization of operation is ensured by monitoring the parameters such as speed and load of the equipment. If there is any deviation from the set points, the alarm system of DCS plays its role, prior to tripping. Hence the overload and under load tripping are avoided. The DCS incorporates safety interlocks to prevent the motor from running in the wrong direction, as it is crucial.

Providing the DCS control with level controller in the suitable pumps and agitators causes energy saving, as the pump starts when the level drops below 30% and stops when the level exceeds 80%, automatically. The digital output channel is configured to send start/stop signals to the equipment, potentially using relays for interface. This setup is integrated with the HMI/SCADA system, allowing for monitoring, displaying level measurements, set points, and equipment status, with which operators able to adjust set points if needed.

Efficiency and safety improvement in conveyor operation:

Conveyors equipped with a Zero Speed Switch (ZSS), Pull Cord Switch, and Belt Sway Switch are connected with DCS to prioritize men and machine safety and prevent accidents. These devices monitors conveyor belt speed, promptly detects any stops or belt misalignments to prevent accidents. By proactively addressing safety concerns through DCS, we can minimize the downtime and enhance the equipment life span also.

Efficiency improvement through VFD:

The pump / fan operated with VFD, controlled by DCS, based on pressure / damper set point, offers several benefits. The speed of the motor is controlled by the VFD dynamically in response to changes in pressure / damper set points monitored by the DCS. This setup ensures precise control and optimization of the system operation. The energy savings is directly achieved when the motor operates in the required speed.

Apart from Energy savings, the stress over the pipelines and the pump's gland packing gets reduced, consecutively the mechanical maintenance cost gets reduced.

Energy Recorder in DCS

In DCS, the totalizer is used to accumulate and display the total power consumption over time. Setting up a totalizer involves configuring the DCS to integrate the power consumption data (usually measured in kW or MW) to provide a cumulative value (typically in kWh or MWh).

The downside of energy recording in DCS is the vast space needed in the hard disk, for storing multiple trends, which slowdowns the process control operations, as it is the ultimate purpose of the DCS. Thus, this led us the pathway to Energy Monitoring Systems

2.2. Energy Monitoring Systems (EMS)

Energy monitoring system plays a crucial role in enhancing the efficiency of Electrical systems by providing real-time insights into energy consumption patterns. These systems enable precise tracking of energy use across various devices and processes, allowing for the identification of inefficiencies and the implementation of targeted improvements.

Adoption of EMS to significant cost savings, improved operational efficiency, and enhanced environmental performance, making them an essential tool for any organization looking to optimize its energy use and contribute to a more sustainable future.

EMS in Paper machine 5:

Energy monitoring systems installed in Paper Machine -5, offer substantial benefits, enhancing both operational efficiency and sustainability. The EMS is an excellent tool which widens the extent of Energy savings. By continuously tracking energy consumption of various critical equipments, even the obtained Energy savings are verified and deployed horizontally.

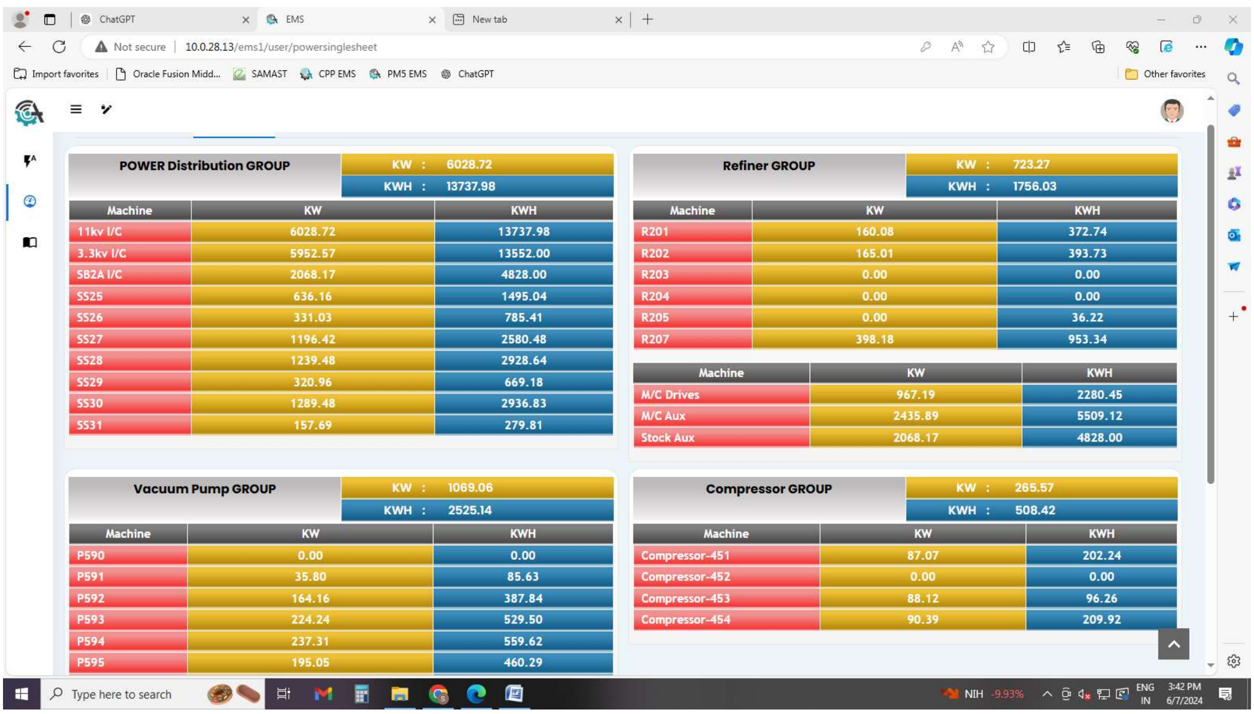

Fig 2.2.1 Paper machine 5 Power distribution dash board

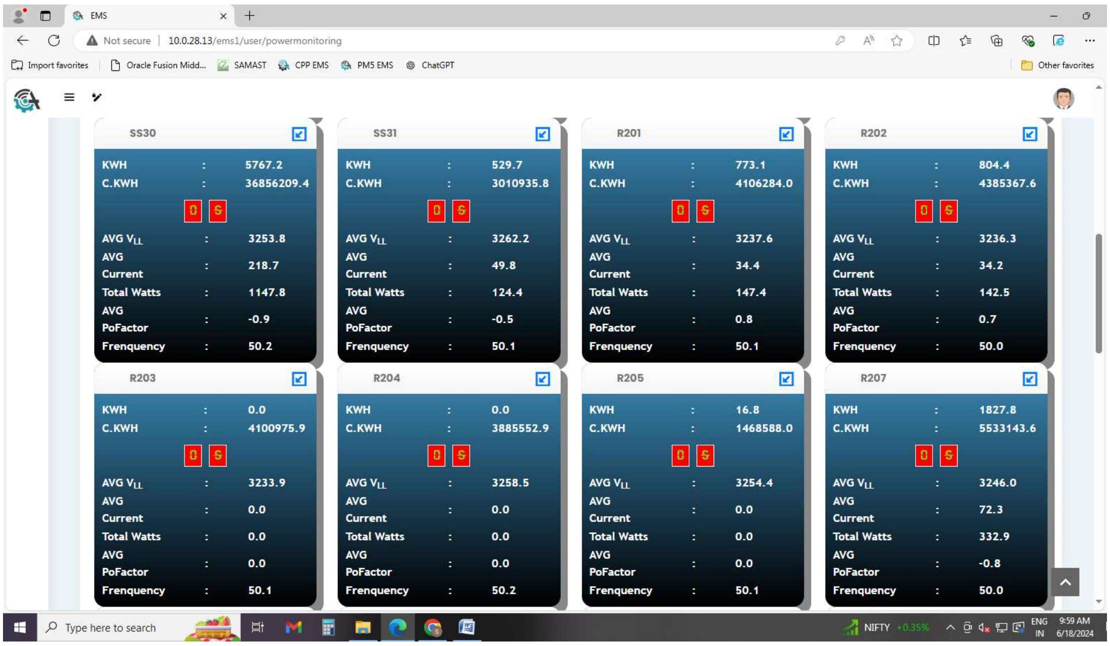

Fig 2.2.2 Paper machine 5 Refiner power dashboard

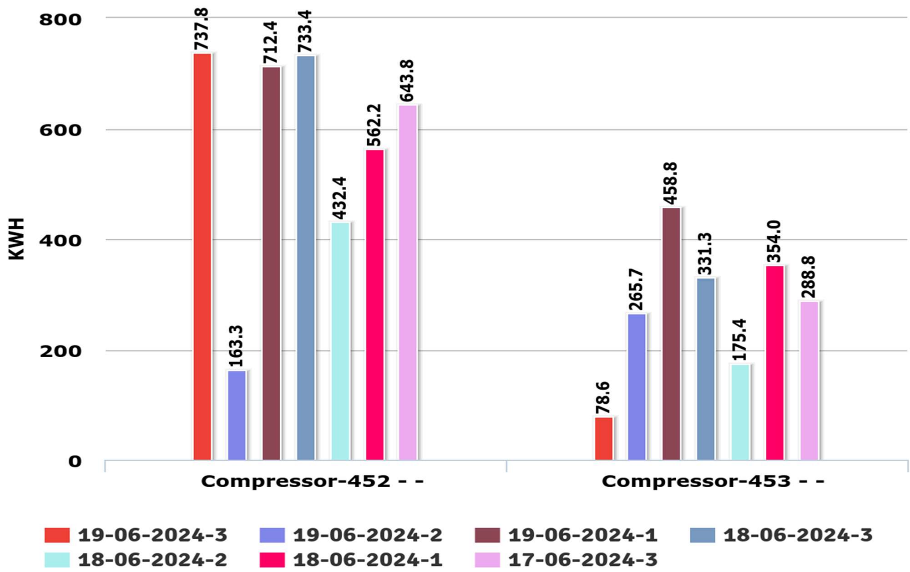

Fig 2.2.3 Load analysis graph for compressors

EMS in Captive Power Plant:

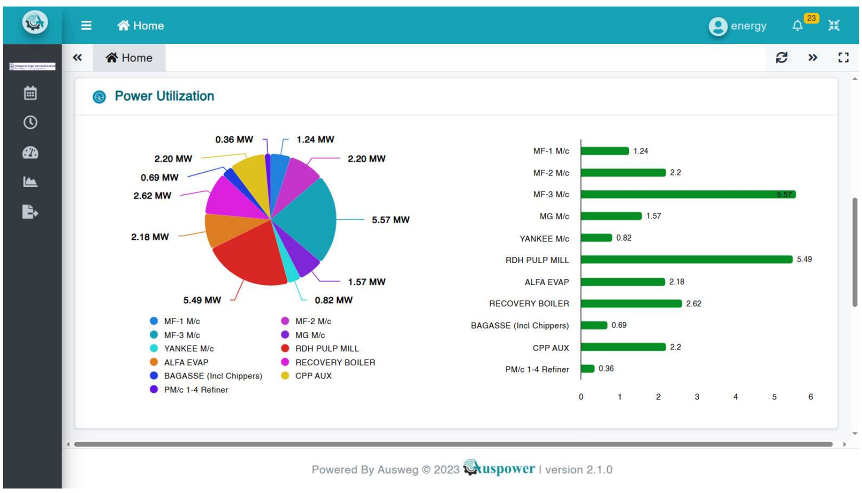

Fig 2.2.4 Power utilization dash board

The online EMS installed in CPP is handy for the real time comparison of instantaneous power consumption among various plants. EMS is the enrichment of the DCS, as the every connected equipment can be compared in a graphical manner with one another. Moreover, the EMS overcomes the difficulty in retrieving the trend data for the last 3 months, unlike the DCS where it can retrieve only the last one month data.

With the help of EMS in CPP, we found that there is a scope of Energy saving in the 22 kV Power system.

2.3.Elimination of 22kV system:

In the early 1960s, the Power system available from TNEB Grid at SPB is 22kV System. The 22kV power is stepped down to 3.3kV and again to 415 volts to run the equipments. This Power distribution system remained in the service for many years.

Later, in the year 1985, 110 kV systems were introduced by TNEB. To minimise the plant stoppage during switch over from 22kV voltage to 110 kV voltage systems, it was planned to install 110kV/22kV Power Transformers and connected the existing 22kV system without affecting the existing Power distribution arrangement. 21 MW STG & 16 MW STG were installed with the 11kV generation, in the year 2004 & 2007 respectively.

The integration of the TNEB Grid power involved the parallel operation with the 21MW and 16MW TGs through a single vital component, viz., a 15 MVA coupling Power Transformer, capable of converting power between 22 kV and 11 kV and vice versa.

However, it's noteworthy that in the event of any disruption or blackout in the mill, there was no alternative route available to start the 21MW / 16MW TGs, even when the Grid supply is available. Consequently, ensuring the reliability and resilience of this single route becomes paramount in maintaining uninterrupted power supply to our facility.

Hence, we have planned to phase out the current 22kV supply system to avoid the unwanted power losses experienced in the existing 22 kV power system.

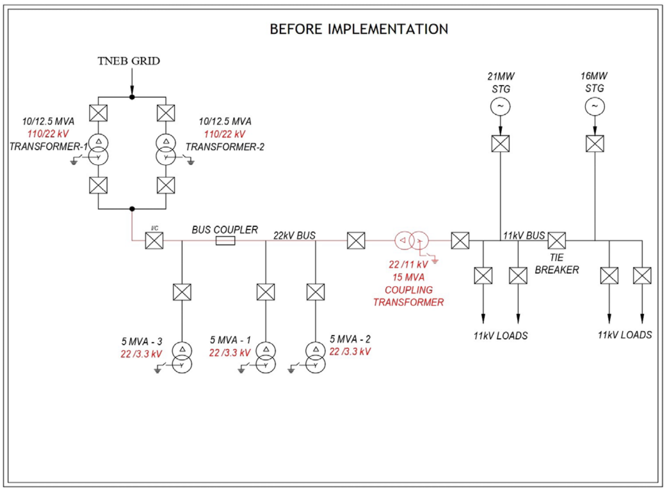

Fig 2.2.5 Single Line Diagram of Power System before implementing the project

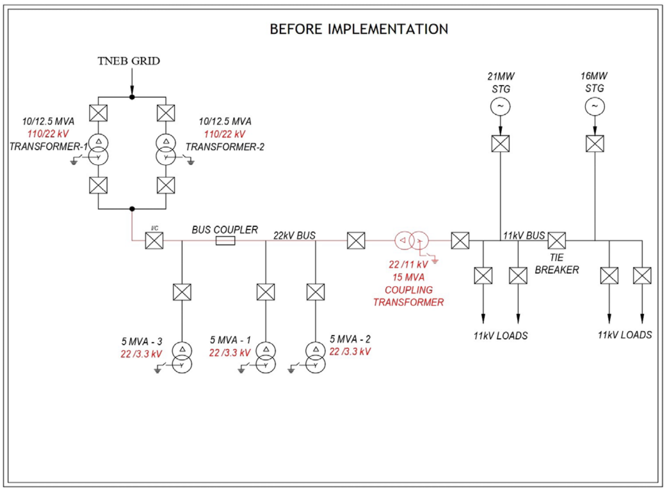

Fig 2.2.6 Single Line Diagram of Power System after implementing the project

Benefits:

- Ensuring the availability of TG start-up power from the TNEB grid, after a black-out, effectively mitigates Business risk.
- Isolating the 15 MVA (22 kV/11 kV) coupling power transformer results in a power saving of 960 kWh per day by eliminating no-load loss.
- The availability of spare 11 kV feeders is ensured to accommodate future projects.

2.4. Grid Island / Grid Zero:

By eliminating the 22kV from our System, it is possible to isolate a part load connecting the Grid system. The boon of isolation of grid is the Frequency reduction in the power system. The operating frequency of our TGs alone is around 49.2 Hz, which is sufficient for our operation, whereas when connected with Grid the frequency would be around 50 Hz. This reduction in frequency plays a significant role in power reduction, as the overall speed of each connected motor gets reduced.

We evidently found 0.8 MW reduction in the instantaneous power and average power reduction of 19,000 units per day, when we did the Grid zero / Islanding operation.

Conclusion:

SPB's branded products are meticulously crafted to cater to the precise needs of diverse consumer segments. Our unwavering commitment lies in producing premium quality papers, utilizing eco-friendly raw materials and advanced technology. Energy efficiency plays a supreme role in the overall improvement. Through SPB's countless hours of team work, we've overcome challenges and achieved a major milestone. Our endless efforts will continue for the years to come.