Industrial Visit Report

Steam Power Plant and Electrical Systems at Nira Bhima Sahakari Sakhar Karkhana, Shahaji Nagar

Institute Name: S.B Patil College Of Engineering [Polytechnic]

Department: Diploma in Electrical Engineering

Date of Visit: 10th September 2025

Location: NiraBhima Sahakari Sakhar Karkhana, Indapur

Report Prepared by: Batch 25-26

Introduction

Industrial visits provide diploma students with essential practical exposure that links classroom theory to real industrial processes. The visit to Nira Bhima Sahakari Sakhar Karkhana Ltd., located at Shahaji Nagar near Bavada in Maharashtra, offered valuable insights into an integrated sugar factory with cogeneration technology.

Established in 2002, the karkhana has a cane crushing capacity of about 3500 metric tons per day. It efficiently produces sugar and electricity simultaneously using bagasse-fired boilers and back-pressure steam turbines. The plant's cogeneration system optimizes energy use by generating power for in-house consumption and supplementing the grid while utilizing exhaust steam for sugar processing.

This visit allowed students to observe the steam power plant's electrical components, control systems, and operational challenges, enriching their understanding of practical electrical engineering applications in industry.

Company Overview

Nira Bhima Sahakari Sakhar Karkhana Ltd. (NBSSKL) is a cooperative sugar factory located in Shahaji Nagar, Indapur Taluka, Pune district, Maharashtra. Established in 2002, the karkhana processes around 3500 metric tons of sugarcane daily during the crushing season.

The factory integrates modern sugar processing with an 18 MW cogeneration steam power plant that uses bagasse as fuel to produce electricity and steam for factory operations. This sustainable cogeneration system supplies power internally and exports surplus electricity to the grid.

NBSSKL also operates a 30 KLPD molasses-based distillery, diversifying products and enhancing profitability. The karkhana supports local agriculture and economy by providing employment and promoting cooperative values among regional farmers.

Visit Details

Date: 10th September 2025

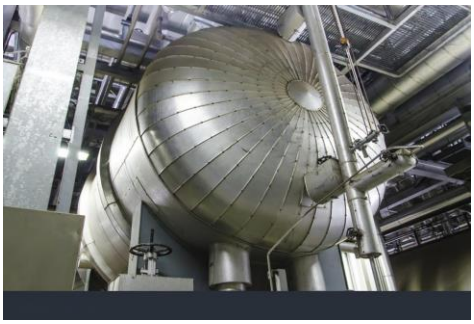
Participants: Diploma Electrical Engineering Students

Focus Areas: Steam Power Plant components, Control Panel, etc.

Guidance: Factory Technical Staff

Steam Power Plant Components Observed

1. Boiler

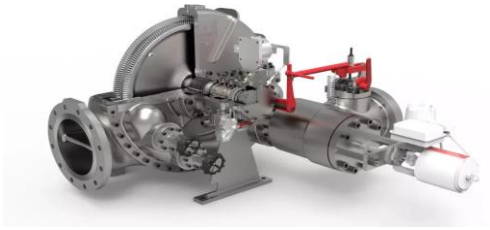


The boiler generates steam by heating water through combustion of bagasse, a fibrous sugarcane residue. Modern boilers in such plants typically have a steam production capacity around 150 tons per hour (TPH) operating at pressures up to 42 bar. Key parts include economizers, superheaters, and air preheaters that boost thermal efficiency.

2. Steam Turbine

The plant uses a back-pressure steam turbine generating electrical power while redirecting exhaust steam for sugar processing. Typical installed turbine capacity ranges between 9 MW and 30 MW depending on factory size and cogeneration design. Turbines convert high- pressure steam energy into rotational mechanical work.

3. Alternator (Generator)



Coupled with the turbine shaft, synchronous alternators produce electrical energy at voltages suitable for internal plant use and external grid supply. Generator capacity is matched with turbine power output, often around 9 MW for mid-sized sugar plants.

4. Power Distribution and Auxiliary Systems

Additional components include transformers for stepping up generator voltage for transmission, auxiliary power supply units, feedwater pumps, condensers, and cooling towers essential for turbine operation and power plant safety.

5. Control Panel Section

The control panels consist of protective relays, circuit breakers, meters, and programmable logic controllers (PĮCs). They enable real-time monitoring and control of electrical generation, distribution, and protection systems to maintain stable and safe operations.

6..Back Panel Section

The back panels mainly consist of relay racks and wiring systems for protection coordination. These safeguard electrical equipment by detecting faults and triggering protective devices minimizing damage and downtime.

Technical Specifications Summary

The power generation and steam plant at Nira Bhima Sahakari Sakhar Karkhana (NBSSKĮ) features advanced and efficient equipment designed to optimize cogeneration and energy use within the sugar factory. Key technical specifications include:

- Boiler Capacity: The boiler is designed to produce approximately 150 tons per hour (TPH) of high-pressure steam at around 42 bar. It utilizes bagasse, the fibrous residue of sugarcane, as fuel, with economizers and superheaters to improve thermal efficiency.
- Steam Turbine: The plant employs a back-pressure steam turbine designed for cogeneration. The turbine typically generates between 9 MW and 18 MW of power, converting high-pressure steam energy into mechanical energy to drive the alternator while exhausting steam for sugar processing.
- Generator (Alternator): A synchronous generator is coupled to the turbine shaft, with an installed capacity of approximately 18 MW. It supplies electrical power for the plant's internal operations and exports surplus electricity to the grid. The generation voltage is maintained around 440 V with ±10% regulation.
- Condenser System: The turbine exhaust is connected to a non-contact surface condenser with a cooling water inlet temperature of approximately 32°C. The condenser is designed to operate with a dump condenser capacity of 10 TPH, supported by cooling towers and circulation pumps for cooling water recirculation.
- Control and Protection Panels: The control system includes programmable logic controllers (PĮCs), protective relays, metering equipment, synchronized cubicles, current and potential transformers, and battery backup systems. These ensure stable operation, fault detection, and safe power distribution.
- Auxiliary Equipment: Motor-driven feedwater pumps and transfer pumps with standby arrangements facilitate boiler feedwater circulation. Special instrumentation such as thermocouples, pressure and temperature gauges, and switches monitor critical parameters for safe operation.

Design Features: Equipment is designed for tropical environments with rugged construction, ease of maintenance, and high operational reliability.

The turbine and generator systems are engineered to minimize downtime and enable automatic operation with minimal manpower.

Jearning Outcomes and Conclusion

The industrial visit to Nira Bhima Sahakari Sakhar Karkhana provided practical exposure that connected theoretical electrical engineering concepts to real-world industrial applications. Students gained deep insights into the functioning of boilers, steam turbines, and generators within a cogeneration steam power plant integrated into sugar manufacturing. Understanding the coordinated operation of control and protection systems improved their comprehension of power plant safety and efficiency.

Students also appreciated the environmental and economic benefits of utilizing bagasse as a renewable fuel source, which reduces reliance on fossil fuels and supports sustainable industrial practices. Observing advanced instrumentation and automation underscored the role of modern technology in optimizing plant performance and minimizing operational risks.

Acknowledgments

I would like to express my sincere gratitude to the management and technical staff of Nira Bhima Sahakari Sakhar Karkhana for extending their warm welcome and providing valuable insights during our industrial visit. Their detailed explanations and willingness to share knowledge significantly enhanced our understanding of the steam power plant and electrical systems.

Special thanks to the faculty and administration of our educational institute for organizing this visit, thereby offering us an excellent opportunity to connect classroom learning with real-world industrial practices. Their continuous encouragement and support were pivotal in the successful completion of this visit

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