

A TECHNICAL REPORT ON
POWER GENERATION TECHNOLOGIES
TRAINING EVENT
IN
NPTI SHIVPURI

From 30th Oct 2023 to 3rd Nov 2023

WITH
46 Students

Organized by
DEPARTMENT OF ELECTRICAL
ENGINEERING



MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत

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Acknowledgment

We would like to express our heartfelt gratitude for the exceptional 5-day training program on Power Generation Technologies held at the National Power Training Institute (NPTI) Shivpuri. This program has been a transformative and enlightening experience, and we appreciate the unwavering support and guidance provided by Director Shri Dipak Pandit.

Furthermore, we extend our sincere thanks to our college's esteemed Professor Shishir Dixit for his instrumental role in facilitating our application for this training program at NPTI Shivpuri. His encouragement and support have enabled us to participate and benefit from this invaluable opportunity.

The training program deepened our understanding of power generation technologies, their relevance in the energy sector, and the latest advancements in the field. Under Director Shri Dipak Pandit's leadership, we had the privilege of learning from experts and gaining practical insights.

This program has not only enhanced our knowledge but also inspired us to contribute to the growth and sustainability of the energy sector. We now feel better equipped to apply our newfound skills and knowledge effectively in our future endeavors.

Once again, we extend our sincere thanks to Director Shri Dipak Pandit, Professor Shishir Dixit, and the entire team at NPTI Shivpuri for making this enriching opportunity possible.

About NPTI

National Power Training Institute (NPTI), an ISO 9001 & ISO 14001 organization under Ministry of Power, Government of India is a National Apex body for Training and Human Resources Development in Power Sector with its Corporate Office at Faridabad. NPTI had been providing its dedicated service for more than five decades.

NPTI has trained over 3,20,000 Power Professionals in regular Programs over the last 5 decades. NPTI is the world's leading integrated power training institute. NPTI is the only institute of its kind in the world with a wide geographical spread and covering a wide gamut of academic and training programs in Power Sector. NPTI's committed faculty is providing excellent training in the Power Sector, which is the most important sector among various infrastructure sectors. Training provided by NPTI on Generation Simulators has improved Plant Load Factor of Generating Units, has increased the availability of Transmission & Distribution Systems and has decreased Aggregate Technical & Commercial Losses. This in turn is providing more power to the country. Thus the training being provided by NPTI is having a cascading effect in the growth of GDP and economy of the country.

About NPTI Shivpuri

- ❖ NPTI's campus is spread over a picturesque landscape of about 15 acres in Shivpuri in the suburbs of Tourist Hub.
- ❖ Nearby attractions include Madhav National Park, Bhadaiya Kund, Tatya Tope Memorial Park, Sindhia Chhatri, Shivpuri Museum, Sankhya Sagar, waterfall, etc.
- ❖ The campus is located on National Highways NH3, A.B Road, just about 100 km from Gwalior towards Indore Highways and situated 18 km before Shivpuri railway station and bus stand.
- ❖ NPTI Shivpuri's state-of-the-art multi-functional Simulators:
 - Thermal: 210 MW/ 500 MW/800 MW
 - Hydro: 250 MW
 - Smart Grid
- ❖ The simulator is developed to provide training to power utilities with Smart controls for RE-Grid Integration, IT Centre and associated offices.
- ❖ Emerson provided controls and graphics using the OVATION DCS platform for simulator commissioning, and modeling was done using JADE modeling software.
- ❖ The simulator is used for initial and retraining of control room operators, operation supervisors, and plant equipment operators.
- ❖ Training includes plant system understanding, specific operating procedures, and handling abnormal and emergency events.
- ❖ It serves as a tool for engineering and control system analysis.

1. Introduction about program

The Sankalp program at NPTI Shivpuri is a notable initiative focused on Power Generation Technologies. NPTI, or the National Power Training Institute, is a renowned institution in India that offers specialized training in the field of power generation and energy management. The Sankalp program is designed to provide comprehensive training and education in various aspects of power generation technologies, including thermal, hydro, and renewable energy sources.

This program equips participants with the knowledge and skills necessary to excel in the power generation sector. It combines theoretical learning with practical hands-on experience to prepare students for the challenges and opportunities in the power industry. The Sankalp program at NPTI Shivpuri plays a pivotal role in nurturing the next generation of professionals in the field of power generation technologies, contributing to the growth and sustainability of the power sector in India.

2. Objective of the Training

2.1. Skill Development: To provide comprehensive training and skill development in various power generation technologies, including thermal, hydro, and renewable energy sources.

2.2. Industry-Relevant Education: To offer industry-relevant education that equips participants with the knowledge and expertise required for careers in the power generation sector.

2.3. Hands-On Experience: To provide practical hands-on experience, including exposure to power plants and equipment, allowing students to apply their theoretical knowledge in real-world settings.

2.4. Promoting Sustainability: To emphasize the importance of sustainable and environmentally responsible power generation practices, encouraging students to contribute to cleaner and more efficient energy solutions.

2.5. Professional Development: To foster the professional growth of participants by instilling a strong work ethic, safety consciousness, and a commitment to ethical practices in the power generation industry.

2.6. Meeting Industry Needs: To address the skill gaps and workforce requirements of the power generation sector in India, ensuring that graduates are well-prepared to meet the industry's demands.

2.7. Research and Innovation: To promote research and innovation in power generation technologies, allowing students to explore new and advanced methods to improve the efficiency and sustainability of power generation processes.

2.8. Networking and Collaboration: To facilitate networking opportunities with industry experts and organizations, enabling students to build valuable connections in the power generation field.

3. Following topics majorly covered in 5 days training program:

- ❖ Overview of Power Generation Technologies and Industrial Safety
- ❖ Overview of Coal to Electricity/ Thermal Power Generation
- ❖ Overview of Solar Energy
- ❖ Overview of Generator Synchronization and Automatic Generator Control
- ❖ Wind Power Generation
- ❖ Hydro Power Generation

4. Achievement and Performance

4.1 Starting First Day

On the first day of the training program's inauguration, honored by the presence of Shri Dipak Pandit, participants were introduced to the Sankalp program. Shri Dipak Pandit emphasized the significance of skill development and lifelong learning. The event included participant registration, distribution of program materials, and interactive sessions aimed at fostering a sense of community. This successful inauguration marked the beginning of an empowering journey for participants under the Sankalp program, equipping them with essential skills for a brighter future.

We learned about the Sankalp program, which is a special plan to help young people who need help with their education and skills. The program wants to make sure everyone can learn and find good jobs.



Group Photo with Director Shri Dipak Pandit

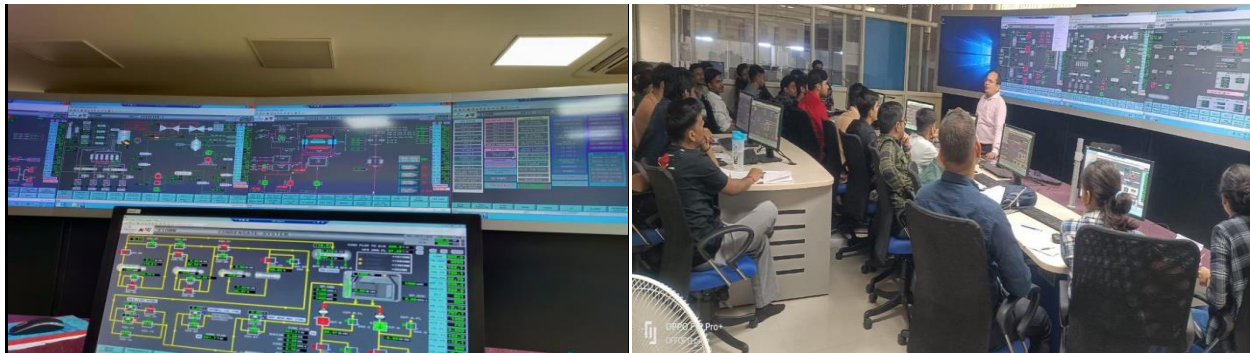
4.2 Proceedings of Day 1

On Day 1 of the training program, Shri Dipak Pandit delivered an enlightening lecture on Power Generation Technologies. He discussed various methods of power generation, their environmental impact, and the latest technological advancements. Participants gained valuable insights, setting a strong foundation for their journey in the field.



First Class of Power Generation Technology

then we learned about the Simulator of Thermal Power Generation from lecturer Shri Yogesh Kumar Paliwal. The session covered the fundamentals of thermal power generation, the technology behind simulators, and included a hands-on experience with the simulator. Participants gained valuable insights and practical knowledge for their future in the field of thermal power generation.



Simulator of Thermal Power Plant (210 MW)

4.3 Proceedings of Day 2: Study about Coal to Electricity

4.3.1 Introduction

Day 2 of the training program was dedicated to the fascinating subject of "Coal to Electricity," with Shri Yogesh Kumar Pailwal as the distinguished guest lecturer.

4.3.2 Lecture by Shri Yogesh Kumar Pailwal

Shri Yogesh Kumar Pailwal's lecture was the highlight of the day. He provided a comprehensive overview of the process of converting coal into electricity, a crucial aspect of power generation.

4.3.3 Key Highlights

1. Coal as a Power Source: He explained the importance of coal as a significant source of energy for electricity generation, its availability, and the various types of coal used.

2. Coal-Fired Power Plants: Participants gained insights into coal-fired power plants, their components, and the complex process of burning coal to produce electricity.

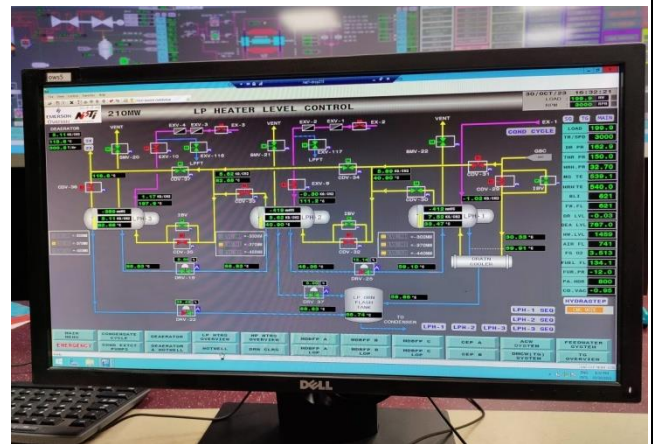
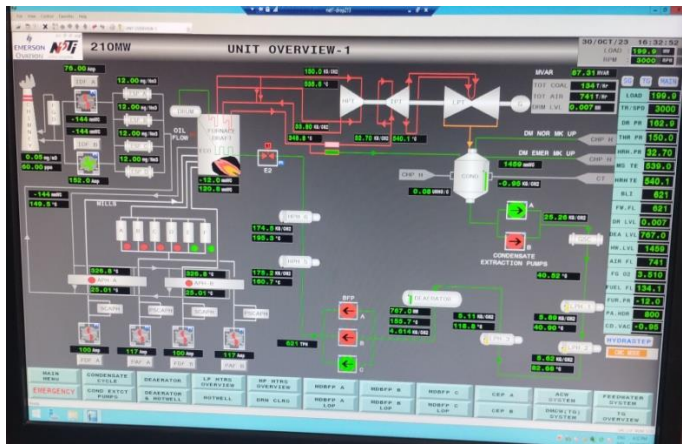
3. Environmental Considerations: The lecture addressed the environmental impact of coal-based electricity generation and the advancements in technology aimed at reducing emissions and improving sustainability.

4. Q&A Session: Shri Yogesh Kumar Pailwal engaged participants in a question and answer session, encouraging them to ask questions and deepen their understanding.



Lecture of Coal to Electricity

In Simulator, we learned about the primary equipment in thermal power generation includes the boiler, turbine, generator, condenser, cooling system, fuel handling system, ash handling system, and control systems. These components work together to convert heat from fuel combustion into electricity for various applications.



Simulator of Thermal Power Plant

4.4 Proceedings of Day 3: Study about Solar Energy

4.4.1 Introduction

Day 3 of the training program was dedicated to the fascinating subject of "Solar Energy," with Shri Yogesh Kumar Pailwal.

4.4.2 Lecture by Shri Yogesh Kumar Pailwal

Shri Yogesh Kumar Pailwal's lecture was the highlight of the day. He provided a comprehensive overview of solar energy, its harnessing, and its significance in the renewable energy landscape.

4.4.3 Key Highlights

- 1. Solar Photovoltaic (PV) Technology:** He explained how solar panels work and their role in converting sunlight into electricity, emphasizing the sustainability and eco-friendliness of solar power.
- 2. Solar Thermal Technology:** Participants gained insights into solar thermal systems that use sunlight to heat a fluid, which can then be used for various applications, including electricity generation and hot water production.
- 3. Applications of Solar Energy:** The lecture highlighted the diverse applications of solar energy, ranging from grid-connected solar power plants to off-grid solutions for rural electrification.

4. **Environmental Benefits:** He discussed the environmental benefits of solar energy, including reduced greenhouse gas emissions and a smaller ecological footprint.

5. **Q&A Session:** He engaged participants in a question and answer session, encouraging them to ask questions and deepen their understanding of solar energy.



Lecture of Solar Energy

On Day 3 of the training program, participants visited a 20KW Solar PV System. The visit offered practical exposure to solar energy technology, including solar panel configurations, inverters, monitoring, and emphasized the sustainability benefits of solar power. It was a valuable experience highlighting the significance of renewable energy sources.



Visit of Solar PV System (20KW)

4.5 Proceedings of Day 4: Generators, Synchronization, and Automatic Generator Control

4.5.1 Introduction

On Day 4 of the training program, an extensive study session was conducted with Shri Rohit Gupta as the lecturer. The focus of the study was on generators, the synchronization of multiple generators, and automatic generator control systems.

4.5.2 Key Highlights

- 1. Generators Overview:** He provided an in-depth understanding of generators, their principles of operation, and their role in power generation. This included the various types of generators commonly used in electrical systems.
- 2. Generator Synchronization:** Participants were educated about the synchronization process, which is essential when connecting multiple generators to

ensure they work together harmoniously. The study covered the methods, procedures, and equipment used for synchronization.

3. Automatic Generator Control: The lecture also delved into automatic generator control systems, explaining their significance in maintaining a stable and reliable power supply. These systems automatically start, stop, and control generators based on load demand.

4. Practical Demonstrations: The study session included practical demonstrations and hands-on exercises, allowing participants to observe the synchronization process and automatic control in action.

5. Q&A Session: He engaged with participants in a question and answer session, encouraging them to seek clarifications and deepen their understanding.



Lecture of Generator Synchronization

Then, a visit to a 33KV substation on the specified date provided participants with practical insights into electrical substations' role in electricity distribution. The visit covered transformers, switchgear, protection systems, and control room functions, enhancing the understanding of infrastructure critical for a reliable power supply.



Visit to a 33KV Substation

4.6 Visit to a Madikheda Dam

A visit to Madikheda Dam on the specified date showcased the dam's role in water resource management, irrigation, power generation, and environmental preservation. Participants observed the dam's reservoir, hydroelectric facilities, and infrastructure, gaining insights into its multifaceted contributions to the region's water security and sustainability.

About Madikheda Dam

- Hydroelectric Project Name – Madikheda Dam Power Plant
- Approved Capacity in MW – 60 MW
- Installed Capacity in MW – 60 MW
- Type of Project – Major (>25 MW)
- Water Source – Sindh River
- Hydroelectric Basin – Ganga Basin
- Hydroelectric Region – Western Hydroelectric Region
- Hydroelectric Development Type – Storage
- Number of Turbines – 3
- Capacity per Turbine – 20 MW
- Type of Turbine – Francis
- Unit Sizes – 60 MW (3 unit x 20 MW)
- Total Units – 3



Visit to a Madikheda Dam

4.7 Proceedings of Day 5: Study about Wind Power Generation and Hydro Power Generation

4.7.1 Introduction

On Day 5 of the training program, a comprehensive study session was conducted, with Shri Yogesh Kumar Paliwal serving as the lecturer. The focus of the study was on Wind Power Generation and Hydro Power Generation, emphasizing their importance in the realm of renewable energy.

4.7.2 Key Highlights

1. Wind Power Generation:

- He provided an insightful overview of harnessing wind energy for electricity generation.
- The study covered the design, operation, and components of wind turbines, focusing on the conversion of wind's kinetic energy into electrical power.
- The environmental benefits of wind power, such as reduced carbon emissions, were discussed.

2. Hydro Power Generation:

- The study delved into the utilization of water flow in hydroelectric power plants to generate electricity.

- Participants learned about the essential components of hydroelectric systems, including dams, turbines, and generators.
- The lecturer highlighted the sustainability and efficiency of hydro power, as well as its potential environmental impact.



Study about Wind Power Generation and Hydro Power Generation

4.8 Director's Motivational Speech

In the evening of Day 5, the training program concluded with a motivational speech delivered by the director. The speech aimed to inspire and encourage participants as they move forward in their educational and professional journeys. The director expressed their pride in the dedication and commitment demonstrated by the participants and emphasized the importance of lifelong learning and continuous improvement.

5. Feedback Session

Following the director's speech, a feedback session was conducted. Participants were encouraged to share their thoughts and experiences from the training program. This session allowed participants to provide constructive feedback, share their takeaways, and highlight areas for improvement. The feedback received would be invaluable for refining future training programs.

6. Certificate Distribution

As a symbol of their successful completion of the training program, certificates were distributed to all participants. The certificates recognized their efforts and achievements, affirming their commitment to skill development and knowledge enhancement.



Certificate Distribution

7. Summary

The 5-day training program at NPTI Shivpuri on Power Generation Technologies was a comprehensive and enlightening experience, covering a diverse range of topics.

On Day 1, participants were introduced to the fundamental concepts of power generation technologies and were provided with an overview of industrial safety practices. The day also included hands-on experience with simulators for thermal power plants, giving a practical insight into their operation.

Day 2 delved into the intricate process of coal-to-electricity conversion, a key component of thermal power generation. Participants also received an overview of the essential equipment involved in thermal power generation, equipping them with a deep understanding of this vital sector.

The focus on Day 3 shifted to renewable energy, with an in-depth look at Solar Energy. The day concluded with a visit to a 20KW Solar Photovoltaic System, offering participants the opportunity for hands-on experience in solar power generation.

Day 4 continued the exploration of power generation with insights into Generators, Generator Synchronization, and Automatic Generator Control. Practical sessions enriched participants' knowledge and skills in this area.

The program culminated on Day 5, covering Wind Power Generation and Hydro Power Generation, emphasizing the significance of harnessing wind and water for clean energy production. This training program provided not only theoretical

knowledge but also practical exposure, ensuring that participants left with a well-rounded understanding of power generation technologies and their crucial role in the energy sector.