

A TECHNICAL REPORT ON
O & M OF TRANSMISSION AND
DISTRIBUTION

IN

NPTI SHIVPURI

From 18th Dec 2023 to 22nd Dec 2023

WITH

44 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 are writing to express our profound 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 nothing short of transformative and enlightening, and we wish to convey our deepest appreciation for the unwavering support and invaluable guidance you provided throughout.

We would also like to extend our sincere thanks to our college's esteemed Professor Dr. Shishir Dixit for playing an instrumental role in facilitating our application for this training program at NPTI Shivpuri. His encouragement and support have been pivotal in enabling us to participate and derive maximum benefit from this enriching opportunity.

The comprehensive training program significantly deepened our understanding of power generation technologies, shedding light on their crucial relevance in the dynamic energy sector and acquainting us with the latest advancements in the field. Under your exemplary leadership, we had the privilege of learning from distinguished experts and gaining practical insights that will undoubtedly shape our future endeavors in the industry.

This program has not only enriched our knowledge base but has also ignited a newfound inspiration within us to contribute meaningfully to the growth and sustainability of the energy sector. We now feel confident and well-equipped to apply the skills and knowledge acquired during the training in our future professional pursuits.

Our heartfelt thanks extend not only to you, Director Shri Dipak Pandit, but also to Dr. Shishir Dixit for his unwavering support, Prof. Vishal Chaudhary (Faculty Coordinator) for his guidance, and the entire dedicated team at NPTI Shivpuri for orchestrating and facilitating this invaluable opportunity.

We express our sincere gratitude once again and look forward to carrying the lessons learned into our future endeavors, contributing positively to the field of power generation technologies.

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

1. Picturesque Campus:

- NPTI Shivpuri's campus spans 15 acres in the suburbs of the Tourist Hub.
- Nestled amidst a picturesque landscape, it provides an ideal setting for education and learning.

2. Convenient Location:

- Strategically located on National Highways NH3, A.B Road, around 100 km from Gwalior towards Indore Highways.
- Situated 18 km before Shivpuri railway station and bus stand for easy accessibility.

3. Nearby Attractions:

- Participants have access to nearby attractions, including Madhav National Park, Bhadaiya Kund, Taty Tope Memorial Park, Sindhia Chhatri, Shivpuri Museum, Sankhya Sagar, waterfalls, etc.
- Offers a perfect blend of education and exploration.

4. State-of-the-Art Simulators:

- NPTI Shivpuri's simulators include Thermal simulators of 210 MW, 500 MW, and 800 MW capacities, a 250 MW Hydro simulator, and a Smart Grid simulator.
- Developed to provide training with smart controls for RE-Grid Integration, an IT Centre, and associated offices.

5. Emerson's Contribution:

- Emerson, using the OVATION DCS platform, provided controls and graphics for simulator commissioning.
- JADE modeling software was employed for meticulous modeling, ensuring a realistic training environment.

6. Training Focus:

- Simulators are used for both initial and retraining of control room operators, operation supervisors, and plant equipment operators.
- Training covers plant system understanding, specific operating procedures, and the handling of abnormal and emergency events.

7. Multi-Purpose Utility:

- The simulator serves as a valuable tool for engineering and control system analysis.
- Enhances the overall competency and preparedness of professionals in the energy sector.

8. Commitment to Excellence:

- NPTI Shivpuri's investment in advanced simulators underscores its commitment to providing cutting-edge training facilities. Aims to foster skilled and knowledgeable professionals in the dynamic field of power generation technologies.

1.Introduction about program

The Sustenance program at NPTI Shivpuri stands out as a noteworthy initiative, focusing on the intricacies of Operation and Maintenance (O&M) in the realm of Transmission and Distribution. NPTI, renowned for its excellence in power sector training in India, extends its commitment to specialized education through this program. The curriculum is thoughtfully crafted to provide participants with a comprehensive understanding of the complexities associated with managing and sustaining power delivery systems. By seamlessly integrating theoretical knowledge with hands-on experiences, the program ensures that students are not only well-versed in the theoretical aspects but also possess practical skills essential for navigating the dynamic challenges of the power industry. Covering diverse topics such as grid management, equipment maintenance, and fault diagnosis, the program incorporates the latest technological advancements to keep participants abreast of industry trends. Through this initiative, NPTI Shivpuri plays a pivotal role in nurturing a cadre of skilled professionals, contributing significantly to the growth and sustainability of the power sector in India. Graduates from the Sustenance program emerge not only with technical expertise but also with a profound understanding of operational and maintenance challenges, positioning them as valuable contributors to the ongoing development of transmission and distribution networks in the country. This program stands as a beacon for quality education, fostering a skilled workforce for the evolving needs of the power industry.

2.Objective of the Training

- **Technical Mastery:** Equip participants with in-depth technical knowledge related to the O&M of transmission and distribution networks.
- **Practical Application:** Provide hands-on experiences to translate theoretical knowledge into practical skills for real-world scenarios.
- **Safety and Compliance:** Emphasize adherence to safety protocols and regulatory compliance in power sector operations.
- **Problem-Solving Skills:** Develop the ability to analyze and solve complex issues encountered in operational settings.
- **Adaptability to Technology:** Keep participants updated on the latest technological advancements in the power sector for adaptability.
- **Team Collaboration:** Cultivate effective communication and collaboration skills for seamless teamwork.
- **Resource Management:** Train in efficient management of both human and technical resources for optimal network performance.
- **Continuous Improvement:** Foster a culture of continuous learning, encouraging ongoing professional development throughout careers.

3. Topics majorly covered in 5 days training program:

- Overview of O & M of Transmission and Distribution
- Overview of AMI
- Overview of SCADA
- Overview of Smart Met
- Overview of Simulator : SOPs
- Hands on practice on OMS
- Visit to Substation
- Overview of Energy Audit and roles

4. Achievement and Performance

4.1 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 & Prof Vishal Chaudhary(Faculty Coordinator)**



4.2 Proceedings of Day 1

Session 1: Overview of Power Generation Technologies

Speaker: Shri Dipak Pandit

Shri Dipak Pandit, a seasoned expert in the field of power generation technologies, graced the symposium with an insightful lecture on the diverse landscape of power generation. The session covered a broad spectrum of technologies, ranging from traditional to cutting-edge, shedding light on the evolving nature of the energy sector.

Key points covered by Shri Dipak Pandit:

1. **Traditional Power Generation:** Delving into the foundations, Shri Dipak highlighted the significance of conventional methods such as coal, gas, and hydroelectric power generation.
2. **Renewable Energy:** Emphasizing the global shift towards sustainability, the speaker provided an in-depth overview of renewable sources like solar, wind, and geothermal energy.
3. **Emerging Technologies:** Addressing the forefront of innovation, Shri Dipak discussed emerging technologies like nuclear fusion and advanced energy storage solutions.
4. **Integration Challenges:** Acknowledging the need for a balanced energy mix, the speaker explored the challenges and opportunities associated with integrating various power generation technologies.

Session 2: Industrial Safety and Overview of Simulator Components

Speaker: Shri Yogesh Kumar Paliwal

Shri Yogesh Kumar Paliwal, an expert in industrial safety and simulation technologies, took the stage to share his wealth of knowledge in ensuring safety within industrial settings.

Key highlights from Shri Yogesh Kumar Paliwal's session:

1. **Importance of Industrial Safety:** The speaker emphasized the paramount importance of prioritizing safety in industrial operations, elucidating on the potential consequences of neglect.
2. **Regulatory Compliance:** Shri Paliwal provided insights into the ever-evolving safety regulations and standards, underscoring the necessity for compliance to ensure a secure working environment.
3. **Simulator Overview:** Shifting gears, the session transitioned into an exploration of simulators as powerful tools for training and skill development. Shri Paliwal delved into the components and functionalities of simulators used in industrial settings.
4. **Hands-on Training:** Recognizing the significance of practical training, the speaker elaborated on the benefits of hands-on simulation exercises in preparing personnel for real-world scenarios.

Key Takeaways:

1. The power generation landscape is evolving, with a growing emphasis on renewable and advanced technologies.
2. Industrial safety is non-negotiable, and compliance with regulations is crucial for a secure work environment.
3. Simulators play a pivotal role in training and preparing professionals for real-world industrial challenges.

The attendees left the symposium with a deeper understanding of power generation technologies, a heightened awareness of industrial safety, and insights into the world of simulators. The blend of expertise from Shri Dipak Pandit and Shri Yogesh Kumar Paliwal set a strong foundation for the subsequent days of the Industrial Technology Symposium.



4.3 Proceedings of Day 2

The second day of the seminar brought together industry experts and professionals to delve into crucial aspects of Simulator SOP (Standard Operating Procedures) technologies, industrial safety, and transmission system overview. Sh. Yogesh Kumar Paliwal and Sh. Arun Kumar, DGM MPEB, shared their valuable insights, providing a comprehensive understanding of these essential topics.

Session 1: Simulator SOP Technologies and Industrial Safety by Sh. Yogesh Kumar Paliwal: *Overview:* Sh. Yogesh Kumar Paliwal commenced the day's proceedings with a detailed exploration of Simulator SOP technologies and their relevance in industrial safety. He emphasized the significance of standardized operating procedures in ensuring efficient and secure industrial operations.

Key Points:

1. **Definition and Importance of SOP Technologies:** Sh. Paliwal elucidated the concept of Standard Operating Procedures and their role in streamlining processes, reducing errors, and enhancing safety protocols.
2. **Simulator Technologies:** An in-depth discussion on the various simulator technologies employed in industries, highlighting their applications in training, testing, and emergency response simulations.
3. **Industrial Safety Best Practices:** Sh. Paliwal shared insights into the latest industrial safety standards and best practices, focusing on risk mitigation and prevention strategies.



Session 2: Overview of Transmission System - Types, Components, etc., by Sh. Arun Kumar, DGM MPEB: *Overview:* Sh. Arun Kumar, a distinguished expert in the field, took the stage to provide a comprehensive overview of transmission systems. His lecture aimed to familiarize the audience with the types, components, and intricacies of transmission systems.

Key Points:

1. Types of Transmission Systems: Sh. Kumar discussed the various types of transmission systems, including overhead lines, underground cables, and substation configurations, shedding light on their respective advantages and limitations.
2. Components of Transmission Systems: An in-depth examination of key components such as transformers, circuit breakers, and conductors, emphasizing their roles in ensuring the efficient transfer of electrical power.
3. Emerging Technologies: Sh. Kumar touched upon the latest advancements in transmission system technologies, including smart grids and digital substations, highlighting their potential impact on the future of energy transmission.

Session 3: Interconnecting Power System Planning and Energy Management by Sh. Arun Kumar, DGM MPEB: *Overview:* In the concluding session, Sh. Arun Kumar shifted the focus to the critical aspects of interconnecting power system planning and energy management.

Key Points:

1. Interconnection Challenges: Sh. Kumar discussed the challenges associated with interconnecting power systems, such as grid stability, voltage regulation, and the need for synchronized operation.
2. Energy Management Strategies: An exploration of effective energy management practices, including demand-side management, grid optimization, and the integration of renewable energy sources.
3. Case Studies: Sh. Kumar shared real-world case studies illustrating successful power system interconnections and energy management implementations, providing valuable insights for the audience.

4.4 Proceedings of Day 3

On the third day of our industrial visit, we had the opportunity to explore a substation plant and delve into the fascinating world of solar energy technology. The highlight of the day was the insightful visit to a 20KW Solar PV System, where we gained practical exposure to various components of solar power generation.

Substation Plant Visit:

Practical Exposure to Solar Energy Technology: The visit to the 20KW Solar PV System provided us with hands-on experience and a comprehensive understanding of solar energy technology. We had the chance to witness the intricate configurations of solar panels, explore the functionality of inverters, and grasp the significance of monitoring systems in optimizing solar power generation.

Sustainability Benefits Emphasized: Throughout the visit, the emphasis was on the sustainability benefits of solar power. The efficiency of the solar PV system showcased how harnessing energy from the sun can significantly reduce our dependence on non-renewable sources. The visit served as a stark reminder of the importance of transitioning to cleaner and more sustainable energy solutions.

Valuable Insights into Renewable Energy Sources: The experience proved to be invaluable in highlighting the role of renewable energy sources, particularly solar power, in the global energy landscape. Understanding the practical aspects of solar technology reinforced the concept that renewable energy is not just a futuristic idea but a tangible and essential solution for a sustainable future.

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.



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 o
- 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



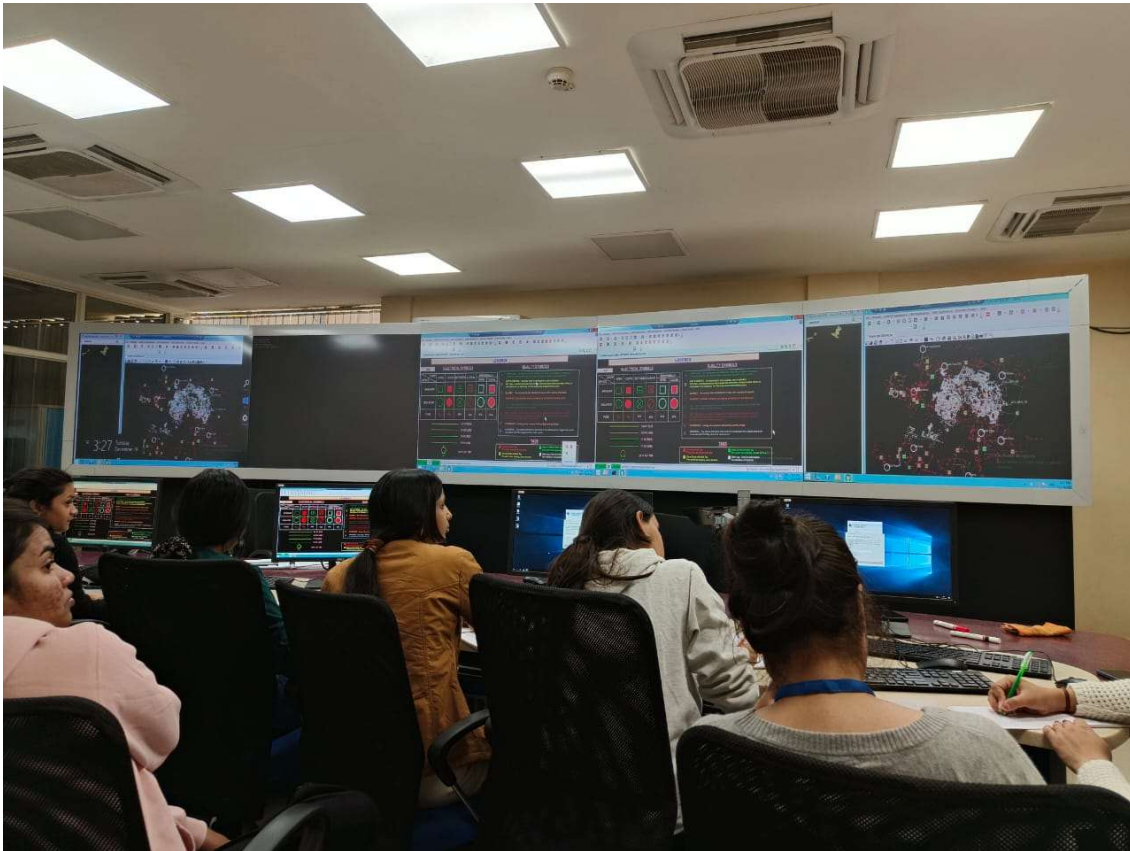
Lecture on Overview of Distribution System Components:

Conducted by Sh. Rohit Gupta, Assistant Director (AD): Following the substation plant visit, we were privileged to attend a lecture by Sh. Rohit Gupta, Assistant Director, who provided a

comprehensive overview of distribution system components. This lecture added depth to our understanding of the broader energy infrastructure.

Key Components Explored: Sh. Rohit Gupta walked us through various components of the distribution system, shedding light on transformers, circuit breakers, switchgear, and other critical elements. His expertise and insights enhanced our comprehension of the intricate network that ensures the efficient and reliable distribution of electrical power.

Relevance to Industry Practices: The lecture was strategically aligned with industry practices, emphasizing the real-world application of the distribution system components. Understanding these components is crucial not only for electrical engineers but for anyone involved in the energy sector



4.5 Proceedings of Day 4

The fourth day of our industrial visit proved to be an enlightening experience as we engaged in a hands-on demo with a distribution simulator and attended a comprehensive lecture by Sh. Rohit Gupta, Assistant Director, on Advanced Metering Infrastructure (AMI), Smart Meters, and Supervisory Control and Data Acquisition (SCADA) systems.

Distribution Simulator Demo:

Hands-On Practice: The day commenced with an engaging hands-on practice session using a distribution simulator. This interactive demo allowed us to apply theoretical knowledge in a simulated environment, providing a practical understanding of distribution system operations. Through the simulator, we were able to explore various scenarios and troubleshoot potential issues, enhancing our problem-solving skills in a controlled setting.

Realistic Simulation: The distribution simulator realistically replicated the challenges faced in the field, from voltage fluctuations to system failures. This practical exercise was instrumental in bridging the gap between theoretical concepts and the practical application of distribution system management. The hands-on practice reinforced the importance of preparedness and adaptability in maintaining a reliable electrical distribution network.



Lecture on Overview of AMI, Smart Meter, and SCADA:

Conducted by Sh. Rohit Gupta, Assistant Director (AD): In the second part of the day, we had the privilege of attending a lecture by Sh. Rohit Gupta, delving into the intricacies of Advanced Metering Infrastructure (AMI), Smart Meters, and Supervisory Control and Data Acquisition (SCADA) systems. Sh. Rohit Gupta's expertise and industry insights added significant depth to our understanding of these cutting-edge technologies.

Advanced Metering Infrastructure (AMI): The lecture commenced with an overview of AMI, detailing its role in modernizing utility operations. Sh. Rohit Gupta elucidated on the integration of smart meters and communication networks, emphasizing the benefits of real-

time data collection and enhanced consumer engagement. The discussion provided a glimpse into the transformative impact of AMI on the energy sector.

Smart Meter Technology: Sh. Rohit Gupta then navigated through the functionalities of smart meters, elucidating how these devices contribute to improved energy efficiency, billing accuracy, and customer awareness. The lecture highlighted the pivotal role of smart meters in creating a more responsive and intelligent energy grid.

SCADA Systems: The session concluded with an in-depth exploration of SCADA systems, underscoring their significance in monitoring and controlling various aspects of the distribution network. Sh. Rohit Gupta shared practical insights into the implementation of SCADA for real-time decision-making, fault detection, and overall system optimization.



4.6 Proceedings of Day 5

The final day of our comprehensive industrial training program marked a culmination of practical sessions and enlightening lectures. The day included a hands-on demo on Outage Management System (OMS) by Sh. Rohit Gupta, Assistant Director, a lecture on the role of Energy Audit in reduction by Sh. Yogesh Kumar Paliwal, and concluded with a test, feedback session, and validation by Sh. Dipak Pandit, Director.

Hands-On Practice on OMS:

Facilitated by Sh. Rohit Gupta, Assistant Director (AD): The day began with a hands-on practice session on Outage Management System (OMS), guided by the expertise of Sh. Rohit Gupta. The practical demo allowed us to navigate through real-world scenarios, understanding the functionality and importance of OMS in identifying, managing, and resolving power outages efficiently.

Interactive Learning: The interactive nature of the session enabled us to actively engage with the OMS platform, gaining valuable insights into its capabilities in outage detection, fault localization, and restoration planning. Sh. Rohit Gupta's guidance facilitated a deeper understanding of the operational dynamics of OMS, enhancing our ability to address outage challenges effectively.

Energy Audit and Its Role in Reduction Lecture:

Conducted by Sh. Yogesh Kumar Paliwal: Following the hands-on practice, we attended a lecture by Sh. Yogesh Kumar Paliwal, delving into the significance of Energy Audit and its pivotal role in reduction strategies. The session provided a comprehensive overview of energy auditing processes, emphasizing the importance of identifying energy inefficiencies and implementing measures to reduce energy consumption.

Practical Applications Explored: Sh. Yogesh Kumar Paliwal shared practical insights into conducting energy audits, showcasing real-world examples of successful energy reduction initiatives. The lecture highlighted the multifaceted benefits of energy audits, from cost savings to environmental sustainability, and underscored their relevance in contemporary energy management practices.

Assessment, Feedback, and Validation:

Conducted by Sh. Dipak Pandit, Director: The training program concluded with an assessment conducted by Sh. Dipak Pandit, Director. The test aimed to evaluate our understanding of the topics covered throughout the week. Following the assessment, Sh. Dipak Pandit facilitated a feedback session, allowing participants to share their thoughts on the training program.

Validation of Learning: Sh. Dipak Pandit's validation of the acquired knowledge served as a comprehensive conclusion to the training. The feedback session provided an opportunity for participants to express their perspectives, ensuring that the training program met its objectives and addressing any lingering questions or concerns.



Summary of NPTI Shivpuri 5-Day Training Program

The National Power Training Institute (NPTI) Shivpuri organized a comprehensive 5-day training program on Operation and Maintenance (O&M) of Transmission and Distribution from December 18th to December 22nd, 2023. The program, attended by 48 students from the Department of Electrical Engineering, covered various aspects of the power sector, including power generation technologies, industrial safety, simulator technologies, transmission systems, solar energy technology, distribution systems, and advanced technologies like AMI, Smart Meters, SCADA, and OMS.

Program Overview: The program aimed to provide participants with technical mastery, practical application, knowledge of safety and compliance, problem-solving skills, adaptability to technology, teamwork, resource management, and a commitment to continuous improvement. Major topics covered included O&M of Transmission and Distribution, AMI, SCADA, Smart Meters, Simulator SOPs, OMS, Substation Plant Visit, Energy Audit, and more.

Achievements and Performance: The program demonstrated significant achievements, starting with an impactful inauguration by Shri Dipak Pandit. Key sessions included an overview of power generation technologies, industrial safety, simulator technologies, an overview of transmission systems, and insights into power system planning and energy management.

Hands-On Experience: Participants had hands-on experiences with a distribution simulator, a visit to a substation plant, and a 20KW Solar PV System. The practical exposure to solar energy technology emphasized sustainability benefits, and the distribution simulator demo enhanced problem-solving skills in a simulated environment.

Expert Lectures: Expert lectures by Sh. Yogesh Kumar Paliwal and Sh. Rohit Gupta covered topics like industrial safety, overview of distribution system components, AMI, Smart Meters, SCADA, and OMS. The lectures provided insights into emerging technologies, safety best practices, and practical applications of distribution systems. **Assessment and Validation:** The

program concluded with an assessment conducted by Sh. Dipak Pandit, followed by a feedback session. Sh. Dipak Pandit's validation of the acquired knowledge ensured the program's success in meeting its objectives. The NPTI Shivpuri 5-day training program was a holistic learning experience, blending theoretical knowledge with practical applications, hands-on experiences, expert lectures, and industry insights. The program equipped participants with essential skills and knowledge, preparing them for the dynamic challenges of the power sector.



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.

