A Seminar on

Performance Analysis of Solar Power Generation Using Data Science and AI

Activity Report

Academic Year	2024-25
Program Driven by	A Seminar on Performance Analysis of Solar Power Generation Using Data Science and AI
Quarter	III
Program / Activity Name	Capacity Building Program
Program Type	
Program Theme	Innovation and startups
Start Date	17-02-2025
End Date	17-02-2025
Duration of the Activity (in Mins)	6 Hr
Number of Student Participant	0
Number of Faculty Participant	70
Number of external Participant	--
Expenditure Amount in Rs.	
Any Remark	--
Mode of Session Delivery	Offline
Objective	
Benefit in terms of Learning / Skills / Knowledge obtained	
Feedback	
Video url (mp4)	
Photograph 1 (jpg)	Attached
Photograph 2 (jpg)	Attached
Overall report of the Activity (pdf)	As given below

Dr. P. H. Zope
Convener IIC

Report on Expert Lecture
Title: *Performance Analysis of Solar Power Generation Using Data Science and AI*
Date: 15th February 2025
Venue: MBA AC Seminar Hall
Speaker: Dr. V. M. Deshmukh
Designation: Assistant Professor

Objective:

The main objective of this expert lecture was to explore how data science and artificial intelligence (AI) are being utilized to enhance the performance analysis and efficiency of solar power generation systems. The session aimed to provide attendees with insights into the

application of intelligent data-driven methods for optimizing energy output, detecting faults, and improving the reliability of solar energy systems.

Points Discussed:

1. **Overview of Solar Power Generation:**
   - Basics of photovoltaic (PV) systems and the growing role of solar energy in sustainable power generation.
2. **Role of Data Science in Solar Energy:**
   - How historical and real-time data from solar panels are collected and analyzed to assess performance.
   - Introduction to data preprocessing, feature selection, and time-series analysis in the solar energy context.
3. **AI for Performance Optimization:**
   - Use of machine learning algorithms to predict power output under varying environmental conditions.
   - AI-based fault detection and diagnosis in PV systems for minimizing downtime and improving system life.
4. **Predictive Maintenance:**
   - Implementation of predictive models to forecast system failures and schedule timely maintenance.
5. **Case Studies and Tools:**
   - Discussion on real-world case studies demonstrating the integration of AI in solar farms.
   - Overview of commonly used tools and platforms such as Python, TensorFlow, and cloud-based analytics.
6. **Future Prospects:**
   - The potential of combining AI with IoT and smart grids to create fully automated and efficient solar power systems.

The future of solar power generation is looking incredibly bright, driven by advances in technology, growing global demand for clean energy, and supportive policies aimed at combating climate change.Classical methods to check performance typically involve manual calculations,simple statistical analysis, and rule-of-thumb models to assess solar panel performance.Data science and AI techniques involve using machine learning, statistical models, and advanced algorithms to analyse large datasets from solar power systems. This data can include solar panel performance, weather conditions,power output, and other variables.AI models can predict future energy generation, optimize system performance, and recommend maintenance schedules.Several factors that make optimizing solar energy systems crucial, Such as Optimizing Energy Output, Predictive Maintenance, Maximizing Return on Investment (ROI), integrating with Smart Grids etc.Particle swarm optimization (PSO) is one of the artificial intelligence (AI) techniques that can be used to find approximate solutions to extremely difficult or impossible numeric maximization and minimization

problems. PSO is an AI technique that can approximate solutions to exceedingly challenging parameters AI and Data Science offer a much more powerful, predictive, and scalable approach to solar power performance analysis. However, they come with higher initial costs, complexity, and the need for specialized expertise.

Outcomes:

- Students and faculty gained a detailed understanding of how AI and data science contribute to sustainable energy solutions.
- Participants learned about real-world applications of machine learning in renewable energy sectors.
- The session encouraged students from engineering and data science backgrounds to explore interdisciplinary research.
- The talk laid the groundwork for further academic exploration in renewable energy analytics and smart energy systems.

Remarks:

Dr. V. M. Deshmukh delivered a well-structured and enlightening lecture that effectively bridged the gap between renewable energy and intelligent technologies. His engaging delivery and use of practical examples helped simplify complex technical concepts. The audience actively participated in the discussion, particularly around AI model deployment, system scalability, and challenges in data availability for solar analytics. The lecture received positive feedback for its relevance and clarity.