

## 7 AFFORDABLE AND CLEAN ENERGY



Ensure access to  
affordable, reliable,  
sustainable & modern  
energy for all



# AFFORDABLE AND CLEAN ENERGY

PROGRESS REPORT 2022-23



**Manav Rachna International Institute of Research and Studies**

(Deemed to be University under section 3 of the UGC Act, 1956)

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## 1. Preamble:

ManavRachna International Institute of Research and Studies (MRIIRS) is at the forefront of promoting the usage of affordable and clean energy through a multifaceted approach. The institution recognizes the critical importance of sustainable energy sources in today's world and has taken proactive steps to raise awareness and foster a culture of energy consciousness. Within the campus, MRIIRS conducts a range of awareness programs, competitions, and campaigns aimed at educating students and staff about the benefits of clean energy solutions. These initiatives not only encourage energy conservation but also inspire innovation in the field. Moreover, MRIIRS extends its efforts beyond the campus by engaging with the wider community, where they encourage individuals to take pledges towards reducing their carbon footprint and adopting more eco-friendly energy practices. In this way, MRIIRS is contributing to a greener and more sustainable future for all.

Sustainable Development Goal 7 focuses on ensuring access to affordable, reliable, sustainable, and modern energy for all. SDG 7 is essential for achieving many of the other Sustainable Development Goals, as access to modern energy is fundamental for eradicating poverty, improving health and education, and addressing climate change. By providing clean and sustainable energy for all, SDG 7 contributes to economic growth, environmental protection, and social development on a global scale.

The details of our work towards SDG 7 through awareness programmes, competitions, pledges, etc. conducted within and beyond campus are presented in the preceding sections.

## 2. Awards and Recognition

MRIIRS has won appreciation from different organisations for the spreading awareness about need of maintaining clean and green environment and reducing energy consumption by conducting various activities within and outside its campus.

- **Energy Swaraj Foundation has felicitated MRIIRS with Silver certificate of Appreciation for making 500+ people Energy Literate.**



Energy Swaraj Foundation  
Energy by Locals for Locals

# SILVER CERTIFICATE OF APPRECIATION

With sincere gratitude, this certificate has been awarded to  
*Manav Rachna International Institute  
Of Research And Studies*

for making their institution's **500+** people **Energy Literate**. The **Energy Swaraj Foundation** is grateful for your contribution to global sustainability and your support in Energy Swaraj Movement.



PROF. CHETAN S. SOLANKI  
Founder  
Energy Swaraj Foundation

- **MRIIRS has also received appreciation from the Mahatma Gandhi National Council of Rural Education for facilitating and completing the Green activities on campus by the faculty members and students**



MGNCRE

महात्मा गांधी राष्ट्रीय ग्रामीण शिक्षा परिषद  
Mahatma Gandhi National Council of Rural Education  
Department of Higher Education, Ministry of Education, Government of India



## Certificate of Appreciation

**Dr. Sanjay Srivastava, Vice Chancellor, MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES, Faridabad, Haryana** has contributed to the World Environment Day Celebrations June 2022 by facilitating and completing the Green activities on campus. The initiatives taken up under Swachhta Activities were building outdoor classrooms, reinforcing greenery and showcasing the green decisions of the Institution. Mahatma Gandhi National Council of Rural Education congratulates the Institution for its participation and adding impetus to the activities conducted by the faculty members and students.

Date: 20.06.2022  
Certs: MG/SAR/WED/W 003



B S C Navroon Kumar  
MGNCRE World Environment Day 2022  
Monitoring Officer

### 3. Certified Energy and Environment Management System at MRIIRS

- **Audit for the Energy Management system of MRIIRS**

ManavRachna International Institute of Research and Studies (MRIIRS) places a strong emphasis on efficient energy management within its campus. Recognizing the significance of optimizing energy consumption, MRIIRS has implemented a robust energy management system. This system allows the institution to monitor and analyze energy usage comprehensively.

To ensure the effectiveness of their energy management efforts, MRIIRS regularly conducts energy surveillance audits. These audits are essential for identifying areas where energy consumption is at its maximum. By pinpointing these high-consumption zones, the institution can develop targeted strategies for energy conservation and efficiency improvements. These systematic audits not only help reduce energy costs but also contribute to the institution's commitment to sustainability and environmental responsibility.

MRIIRS' dedication to continuous improvement in its energy management system underscores its commitment to a greener and more sustainable future, serving as an example for others to follow in the realm of responsible energy consumption.

Energy Management System of MRIIRS is ISO 50001:2018 certified since July 22, 2022 by Intercert Private Limited.



- **Audit for the Environmental Management system of MRIIRS**

ManavRachna International Institute of Research and Studies (MRIIRS) demonstrates a steadfast commitment to environmental responsibility through its rigorous environmental management system. The institution places a strong emphasis on sustainability, and as part of its dedication to this cause, it regularly undergoes surveillance audits for its Environment Management System (EMS). The EMS of MRIIRS adheres to the ISO 14001:2015 standard, which is a globally recognized benchmark for environmental management practices. This system has been ISO 14001:2015 certified by KVQA Certification Services Private Limited since July 4, 2022.

The ISO 14001:2015 certification reflects MRIIRS's proactive efforts to minimize its environmental impact, ensure compliance with relevant environmental regulations, and continually improve its environmental performance. These regular surveillance audits serve as a testament to the institution's commitment to sustainable practices and its ongoing dedication to reducing its carbon footprint. MRIIRS stands as a shining example of an educational institution that not only imparts knowledge but also actively implements and upholds eco-friendly principles in its day-to-day operations.





- **Awareness Programme on "Say No to Hazardous Pollution and Contamination"**

Department of Applied Sciences, School of Engineering, MRIIRS, Fbd. in association with IQAC, MRIIRS organized an Awareness Programme on " Say No to Hazardous Pollution and Contamination"held on 15th September 2023.

The objective of programme was to develop a keen understanding among students on different kinds of hazardous waste materials and its adverse effects.The resource person for the event was Dr. Anjali Gupta, Professor, Department of Civil Engineering, MRIIRS, Fbd. Students were enlightened about hazardous waste that is improperly managed and poses a serious threat to human health and the environment. A clean environment ensures the elimination of harmful substances that can cause diseases and ecological imbalance.

It was aimed to promote appreciable knowledge among budding professionals through expert talk.

Total 47 students benefited from the expert talk. All students participated with lot of excitement and enthusiasm.

Thus, overall the expert talk provided a platform to one and all to think beyond the boundaries and in the field of "Hazardous Pollution and Contamination ".KritikVerma, ArpanSaroop, Vivek, Gurjot, Vishal Kumar, and Bishesh Kumar Pattnayak.







- **Pledge on Renewable Energy**

To spread awareness amongst the students and faculty members about Affordable and Clean Energy and promote a commitment to their integration into our lives, a pledge taking ceremony on Renewable Energy was organised by Internal Quality Assurance Cell, ManavRachna International Institute of Research and Studies (MRIIRS) on August 22 and 23, 2023. Students and faculty members at MRIIRS took pledge that they are going to use renewable energy sources and reduce dependence on the non-renewable energy resources.

To spread awareness amongst the students and faculty members about Affordable and Clean Energy (Sustainable Development Goal- SDG7) and promote a commitment to their integration into our lives, a pledge taking ceremony on Renewable Energy was organised by Internal Quality Assurance Cell, ManavRachna International Institute of Research and Studies (MRIIRS) on August 22 and 23, 2023. Students and faculty members at MRIIRS took pledge that they are going to use renewable energy sources and reduce dependence on the non-renewable energy resources. The session was aimed to raise awareness about renewable energy sources. The session was organized in collaboration with various departments within MRIIRS. During the session, following pledge was taken by the students and faculty members: **"I wholeheartedly pledge to prioritize renewable energy in my life. I will diligently strive to reduce my reliance on fossil fuels by embracing solar and wind power, advocating for sustainable energy policies, and inspiring those around me to join the movement towards a greener and more sustainable future."**



- **Pledge on low Carbon Usage**

ManavRachna International Institute of Research and Studies, Organized Awareness Programme on "Pledge on low Carbon Usage on 31st August 2023. During the pledge, students were briefed about the benefits of the reduction of carbon usage. Renewable energy is an endless resource that never runs out. It will ultimately run out, unlike fossil fuels, which we have a finite supply of on Earth. Dr. Rajeev Kumar the coordinator of the event started the Awareness Programme by taking pledge with students on low Carbon Usage. Further Dr. Rajeev Kumar presented the details of low Carbon Usage. Low carbon only denotes a reduction in carbon dioxide (CO<sub>2</sub>). One of the main greenhouse gases responsible for the global warming is carbon dioxide. Numerous other sorts of activities, including deforestation, burning fossil fuels, and volcanic eruptions, emit it. Therefore, by reducing our CO<sub>2</sub> emissions, we are being more considerate of the environment. Wind, solar, hydroelectricity, and nuclear energy are the four primary categories of low-carbon energy. The first three are environmentally friendly because they use renewable resources like the sun and wind to generate electricity. Renewable energy is an endless resource that never runs out. It will ultimately run out, unlike fossil fuels, which we have a finite supply of on Earth. The Pledge was taken by 51 students on low Carbon Usage.



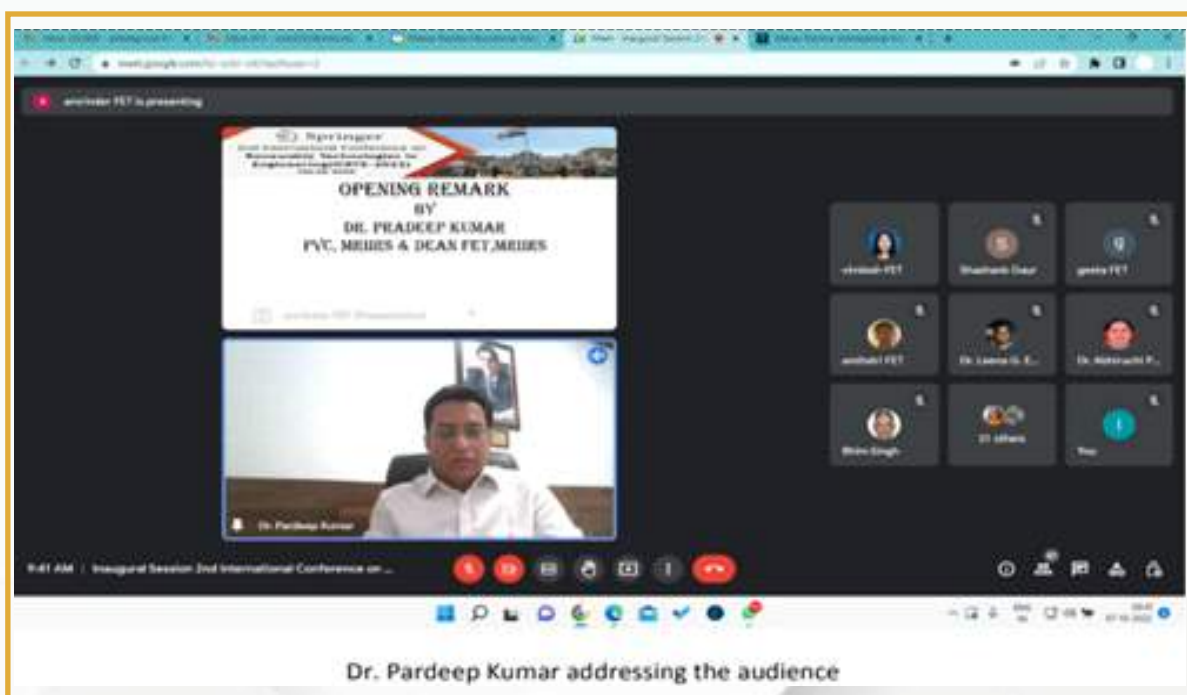
- **Quiz Competition on "Clean and Green Environment"**

A clean environment ensures the elimination of harmful substances that can cause diseases and ecological imbalance. Green environment, on the other hand, play a significant role in absorbing carbon dioxide, reducing heat and providing habitats for various species. To promote appreciable knowledge among budding professionals regarding reducing carbon usage and increasing dependence on clean and affordable energy, a Quiz competition was organized at MRIIRS on September 01, 2023. The objective of " Quiz Competition" is to develop a keen understanding among students on "Clean and Green Environment". A clean environment ensures the elimination of harmful substances that can cause diseases and ecological imbalance. Green environment, on the other hand, play a significant role in absorbing carbon dioxide, reducing heat and providing habitats for various species. It was aimed to promote appreciable knowledge among budding professionals through Quiz competition. B.Tech first year students from Computer Science Engineering participated in Quiz competition. Students have been briefed about the importance of above topic before conduction of quiz. Total 40 students participated in Quiz. There were ten teams in total comprising of four students in each. The competition was conducted into six rounds having question-answer sessions and multiple choice questions round. All students participated in the competition with a lot of excitement and enthusiasm. Thus, overall this competition provided a platform to one and all to think beyond the boundaries and in the field of " Clean and Green Environment".



- **International Conference on "Renewable Technologies in Engineering"**

Department of Electrical and Electronics Engineering, and Department of Electronics and Communication Engineering, FET, MRIIRS organized the prestigious International Conference on 'Renewable Technologies in Engineering (ICRTE 2022)' in association with Springer on 7 – 8 October 2022. This was the second International Conference organized in collaboration with Springer. The inaugural session witnessed the gracious presence of Chief Guest, Chair Professor CEA, IIT Delhi, Dr. Bhim Singh; key note speaker, Dr. Mohan Kolhe from the University of Agder, Norway; Dr. Dipankar Deb, Professor, IITRAM; and Pro Vice-Chancellor & Dean, FET Dr. Pradeep Kumar.



- **Energy Literacy Training on Energy Swaraj Portal-PAL (Portal for Action and Learning)**

Students Welfare, MRIIRS organised Energy Literacy Training on Energy Swaraj Portal- PAL (Portal for Action and Learning) supported by AICTE and NITI Aayog, which aims at disseminating awareness and encouraging masses to conserve the Environment and take steps towards Climate Correction. 927 registrations were done from MRIIRS, out of which 527 Students and Faculty Members completed the Energy Literacy Training. With the achieved target, Students Welfare became eligible for World Record Event of Global Climate Clock Assembly on the occasion of Mother Earth Day at IGI Stadium.



**Student certification on Energy Literacy Training on Energy Swaraj Portal-PAL (Portal for Action and Learning)**



- **Mega Tree Plantation Drive in Adopted Village:**

Tree plantation drives play a crucial role in energy conservation and the promotion of clean and green energy by reducing energy consumption, sequestering carbon, and contributing to a more sustainable and environmentally friendly community and world. MRIIRS organized a Mega Tree plantation drive at 10 adopted villages: Mohna, Maujpur, Hirapur, Nariyala, PanheraKhurd, Chainsa, Atali, Mothuka, Dayalpur, and Gadkheda in a single day(August 20, 2021). More than 3000 trees were distributed



**Tree plantation drive**

- **'Energy Harvesting & Storage Materials & Devices**

To spread awareness regarding Energy Harvesting amongst students and faculty members, Department of Electrical & Electronics Engineering and Electronics & Communication Engineering, ManavRachna International Institute of Research and Studies, Faridabad organized a Short Term Course (STC) on 'Energy Harvesting & Storage Materials & Devices' in Collaboration with NITTTR Chandigarh . During the STC, sessions were conducted on the topics including recent advancement in energy harvesting solutions, design aspects of solar cell, effectiveness of energy harvesting technologies in different applications, various funding agencies, sustainable power source and efficient battery solution.





## 5. Policy on Energy Consumption: Green Policy

The Green Policy of MRIIRS, Faridabad aims to institutionalize best practices for environment protection, natural resource conservation and sustainable development through a human– environment co-existence model. The university is committed towards sustainability through effective participation and supervision of institutional resources with assurance of providing excellent teaching, learning and research environment.

The MRIIRS green policy ensures that the university works in a tenable manner by managing its water and energy consumption with a wise, responsible and efficient usage of water and energy.

**Link for the Green Policy of MRIIRS:** [Click to view](#)

## 6. PROMINENT RESEARCH PUBLICATIONS ADDRESSING SDG-7

### **Grid-Connected Photovoltaic System Stability Enhancement Using Ant Lion Optimized Model Reference Adaptive Control Strategy**

<https://doi.org/10.1007/s12591-020-00525-9>

An inductive-capacitive-inductive (LCL) type filters are broadly utilized in grid-connected voltage source inverters (VSIs) since they can give substantially improved attenuation of switching harmonics in currents injected into the grid with lower cost, weight and power losses than their L and LC type counterparts. This paper discusses an improved model reference adaptive control (MRAC) strategy for designing the control parameters to voltage source converter and improves stability of photovoltaic (PV) generation in different grid capabilities. An improved damping strategy is commonly referred to as MRAC, which has been developed using the proportional resonant (PR) controller and its gain parameters are optimized by Ant Lion optimization (ALO) algorithm. The error elimination at steady-state and gain at particular frequency were provided by the PR current controller. The main focus is set on the mathematical modelling of grid-connected PV, LCL filter and PR current controller and its parameters specifically, resonant and proportional gains. Further, the phase margin and gain of the controller transfer function are presented by means of bode plot to evaluate the operating condition of the controller for different gain parameters.

### **Inverter based implementation of maximum power point techniques**

**DOI:** <http://doi.org/10.11591/ijape.v11.i3.pp229-236>

The utilization of renewable energy sources is being pushed by both greater environmental consciousness and expanding demand. Recently, solar photovoltaic technology has found increased use for a broader range of applications. This may be ascribed to solar energy's extensive availability as well as its long-term viability and low cost. According to the global photovoltaic (PV) industry, 594 gigawatts (GW) of PV capacity were installed in 2019, with the objective of replacing conventional source-based generating facilities. The major problem in PV production, however, is identifying the maximum power point tracking (MPPT) systems that are currently in use to compute peak output. For 1240 W PV power plants, this article compares perturb & observe MPPT approaches with incremental conductance MPPT techniques. The MATLAB Simulink program was utilized to conduct the study, which was based on many factors such as voltage, current, and output power under various weather conditions. When these MPPT algorithms are applied to solar trackers, the efficiency, reaction time, and steady-state oscillations all improve.

### **Particulate Matter Separator Analysis for Compression Ignition Engines Adhering Bharat Stage VI Norms - <https://doi.org/10.37285/ajmt.3.1.4>**

In compliance of the stringent Bharat Stage VI emission norms control of particulate matter in diesel engine exhaust emission is currently achieved through diesel particulate filter, catalytic convertors, baffle filters of various designs. In the present research a device comprising of a spiral duct with increasing cross sectional area over the length is designed. The duct has a lining of heat resistant and porous material fixed along the inside walls. The device is fitted at the tail pipe of compression ignition engine driven vehicle through an inlet pipe of engine exhaust with outlet connected to the tail pipe of the exhaust system. This device will collect the particulate matter in the heat resistant porous lining along the walls of the spiral thus reducing the particulate matter. The spiral flow design was simulated and was found to be in line of acceptance of flow parameters. The developed sleek design can be easily retrofitted in the existing fleet of vehicles \making them compliant for stringent statutory emission norms.

### **An Analysis of Automotive Industry Standards for Electric Power Train Vehicles - <https://doi.org/10.4271/2022-28-0394>**

Automotive Mission Plan of Government of India aspires to make Indian Automotive Industry world's number one in engineering and manufacturing by 2026; whereas the Government on the other side is promoting the National Electric Mobility Mission Plan (NEMMP) to electrify the whole transportation system of India by 2030. To incentivize these plans, ARAI has been setting up the standardization structure called Automotive Industry Standards (AIS) in terms of vehicle construction, safety requirements, energy consumption, measurement of range, net power, Central Motor Vehicles Rules (CMVR) approval for power train and kit and approval of hybrid electric vehicle. The better the structure, the precise will be the design; and hence error-free would be the manufacturing.

In the paper, the standards set by AIS will be critically analysed. The standards on which analysis made were AIS-038 which is related to safety and construction of Electric Vehicles (EVs), AIS 39 which provides standardization on electrical energy consumption measurement for EVs, AIS 40 which throws light on procedure of range measurement of EVs, AIS 41 which standardises measurement of net and 30 minute maximum power, AIS 49 that provides guidance on approval for electric power train vehicles, AIS -123 provides guidance on the approval of electric propulsion kit intended for conversion of vehicles for pure electric operation & AIS 102 that gives information on CMVR type approval for hybrid electric vehicles. These standards were compared with world's EV standards of the similar nature. The research further presents analysis of this comparison with recommendation for each standard for practical application.

**Cyber Security of Smart Metering Infrastructure Using Median Absolute Deviation Methodology - <https://doi.org/10.1155/2022/6200121>**

To combat cyber threats in the smart grid, an intrusion detection system can be integrated into the advanced metering infrastructure. Anomaly-based intrusion detection can detect even the tiniest changes in the parameter under investigation, whereas signature-based intrusion detection only recognises known attacks. The growing usage of smart grids necessitates the classification, identification, and implementation of countermeasures to threats. At the absolute least, smart grids must be protected against cyberattacks; thus, the highest level of information security must be offered. As a result of digitisation and the usage of more smart applications, the research looked at a variety of attack types, smart grid assaults, and major cyber threats on the voltage regulation. Machine learning techniques that analyse data in real time and formulate patterns to recognise an attack and scan through huge data for anomalies can be implemented into the advanced metering infrastructure (AMI) for intrusion detection for anomaly-based intrusion detection. The comparative test study done for the research found that the proposed method, median absolute deviation for anomaly identification in smart metering datasets, produced the most accurate and precise differentiations with the highest accuracy and precision. The median absolute deviation (MAD) algorithm model is trained using test data, and raw predictions are made, before true data are used to derive final test result parameters, precision, recall, and F1 scores. The methodology of the entire study is discussed in this paper, as well as how the MAD algorithm is best suited for anomaly-based intrusion detection, as well as result comparisons of other machine learning algorithms.

**Development of a Novel Spiral Duct Particulate Matter Separator for Internal Combustion Engines - <https://doi.org/10.15282/ijame.19.3.2022.11.0771>**

In compliance with the stringent BS-VI emission norms, control of particulate matter in diesel engine exhaust emission is currently achieved through diesel particulate filters, catalytic convertors, and baffle filters of various designs. In the present study a device comprised of a spiral duct with an increasing cross-sectional area over the length is designed and developed. The duct has a lining of heat-resistant and porous material fixed along the inside walls. The inlet of the devices is connected to the outlet of the tailpipe of the exhaust system. The device will collect the particulate matter in the heat-resistant porous lining along the walls of the spiral. The developed device is simple, economical and easily serviceable. The developed spiral duct particulate matter separator was tested on diesel vehicles, and the smoke density of tailpipe emission was measured in terms of the light absorption coefficient. During the analysis it was found that there is a reduction in light absorption coefficient by 25.37%. The developed design also overcomes the clogging problem of the exhaust system, which is a cause of backpressure in the case of conventional particulate filters. The design of the device is such that it can be easily retrofitted in the existing fleet of vehicles, making them compliant with stringent statutory emission norms.

**Reliability and Availability Optimization of Smart Microgrid Using Specific Configuration of Renewable Resources and Considering Sub component Faults -**  
<https://doi.org/10.3390/en15165994>

In this paper, renewable resources, namely photovoltaic panels (PV), are placed in a specific configuration to obtain the maximum reliability and availability of a microgrid and study the subcomponent-level reliability and availability. The reliability of components can be increased by trying different configurations of the components. We identify the preferred configuration used for the PV panels as bridged linked. The overall reliability of the microgrid is increased when component-wise reliability is considered. Even components are further divided into subcomponents, and the multiple faults of each component are considered. The method used for the reliability evaluation and availability study is Markov state transition modeling. The microgrid's reliability and availability are plotted concerning time using Matlab. The optimization of reliability and availability is conducted through optimization techniques such as the genetic algorithm (GA) and artificial neural networks (ANN). The results are compared and validated for the optimal values of mean time to failure (MTTF) and mean time to repair (MTTR). Using a genetic algorithm, there is a 96% improvement in the reliability, and after applying the neural networks, a significant improvement of 97% along with quick results is achieved.

## **19 MWp Solar PV Plant Installation in Educational Institute in Delhi-NCR: A case study- [10.1109/STPES54845.2022.10006439](https://doi.org/10.1109/STPES54845.2022.10006439)**

Use of fossil fuels for power generation faces issues related to air, water, noise, land alongwith other biological and socio-economic concerns. As a solar photovoltaic plant is environment friendly so it becomes an ultimate solution to these issues. To minimize the land requirement solar roof top photovoltaic plant is the best option as it uses already existing infrastructure. Optimal use of the available infrastructure minimizes the cost of power generation making it competitive with conventional sources. This paper proposes a PV system installed in an educational institution in Delhi - NCR. The total electric load of the institute is analyzed. A survey of the campus was done for exploring sites suitable for installing the solar panels. Types of solar panels are selected alongwith optimizers for maximizing the power generation. The proposed system is simulated in PVSYST. The total power generated feeds the load of the institution and the surplus power can be sold to the utilities or the options like electric vehicle charging can be applied. On considering the earnings from the system developed and different costs involved in installation, the proposed system comes out to be economically feasible.

## **TECHNIQUES OF BATTERY SELECTION FOR USAGE IN ELECTRIC VEHICLES–**

Battery chemistries plays a pivotal role for range enhancement and performance of electric vehicles. In the present research different battery chemistry used in Electric Vehicles (EVs) were analyzed. In the present work analysis is done on sodium ion, lithium ion, and metal air batteries chemistries for usage in EVs. Technical parameters and process for selection of battery for EV application is presented. Based on the review a comparative chart is prepared that help in selection of a battery chemistry for application in EV as per the requirement. Battery Management System (BMS) which is responsible for cell balancing, temperature monitoring at cell level, providing data on state of health (SoH) and State of Charge (SoC) of a battery is also studied.

## **ANFIS (Adaptive Neuro-Fuzzy Inference System) based on Microgrid's Reliability and Availability- [10.1109/PIICON56320.2022.10045275](https://doi.org/10.1109/PIICON56320.2022.10045275)**

The applicability of machine learning algorithms used to solve microgrid optimization is investigated in this paper. This paper's main objective is to build a microgrid model to achieve maximum reliability and availability using renewable resources that cater to users' needs with different demands and supplies. The model generated from the adaptive neuro-fuzzy inference system (ANFIS) is used to get the optimum reliability and availability strategy to achieve the user expectations and needs of future microgrids. The ANFIS model is trained with different data sets from Markov modeling. The dataset is divided into three sections, 40% of the data is used to train the model, testing is performed with 40%, and the last 20% of the information is checked. Implementation results show that ANFIS models emulate Markov modeling methods and artificial neural networks model and enhance reliability and availability.

## **Design and Manufacturing of Automated Guided E-Cart for Stock Relocation - [10.1109/SASM51857.2021.9841130](https://doi.org/10.1109/SASM51857.2021.9841130)**

Automated Guided Carts (AGCs) is the finest technique to mechanize a capability with the elasticity of independent material transmission. These carts are perfect for conveyance and assembly line work, with nominal interruption needed. This Research paper studies different options of automated carts available in the industry for relocation and shifting of stock in warehouses and industries. Comparing different options, a solution of the devised e-cart which is suitable for small-scale businesses (warehouses, firms) for the relocation of stock is being designed and fabricated. The designed cart is semi-automated and can be controlled by a smart device via Bluetooth. All the details such as different design options all the material requirements with an assembly of the vehicle have been discussed in the Research paper. During actual experimental analysis, the design of the chassis is found efficient enough in carrying loads up to 50 kilograms with 5 KMPH speed on different terrain. The simulation analysis conducted on Autodesk Fusion 360, for stress and strain also gives satisfactory results. From the simulation analysis FOS (15), Stress (115MPa), and Strain (0.0007) were obtained.

## **Device Simulation of PTB7:PC70BM based Plastic Solar Cells using OghmaNano Software - [10.1109/GlobConHT56829.2023.10087535](https://doi.org/10.1109/GlobConHT56829.2023.10087535)**

The pertinence of different layers of organic solar cells (OSCs), namely the active or dynamic layer, the hole transport layer (HTL), and the electron transport layer (ETL), as well as the presentation of OSC boundaries, was examined using electrical modelling through the OghmaNano software, previously known as GPVDM (General Purpose Photovoltaic Device Model) software. This study is essentially revolved around PTB7: PC70BM as the active layer. The device structure-FTO/ PEDOT:PSS /PTB7: PC70BM/ZnO/Al was employed. Here, ZnO and PEDOT: PSS were taken as ETL and HTL, separately. The thicknesses of the HTL, ETL, as well as the active layer, were adjusted, and the corresponding changes in the OSC parameters were observed. The outcomes showed that the highest power conversion efficiency (PCE) acquired was 12.55%, coupled with short circuit current density (15.69 mAcm<sup>-2</sup>), open-circuit voltage (1.030 V), and fill factor (77.6%). Further enhancements in the PCE and different boundaries of OSC can be achieved by changing the engineering of the device (OSC) and the materials.

## **Power Generation Using Municipal Solid Waste : A Review-**

[https://doi.org/10.1007/978-981-19-8963-6\\_11](https://doi.org/10.1007/978-981-19-8963-6_11)

With increasing urbanization and the improvement in lifestyle there is an increase in electricity consumption and to fulfil that higher amount of resources are needed. Much dependence on fossil fuels for electricity generation is affecting the environment and their limited availability is promoting the search for alternative fuels. Increasing urban population is producing higher amount of Municipal Solid Waste (MSW). Due to improper management of MSW, most of the developing countries across the globe are facing huge problems—socially, medically, financially and environmentally. Depending on the type of waste material, different types of techniques are suitable for its treatment. Electric power generation using MSW gives a sustainable solution to both of these issues, i.e. waste management as well as increasing electricity demand. This paper reviews various techniques available both traditional and new for obtaining fuels and generating electric power using MSW with minimized adverse effects on the environment with special consideration in the Indian scenario 250 words.

## **Proposed Solar PV System in Educational Campus in Faridabad, India -**

[10.1109/ICRAIE56454.2022.10054289](https://doi.org/10.1109/ICRAIE56454.2022.10054289)

This paper proposes a solar photovoltaic (PV) plant installation in the campus of an educational institute in Faridabad, India. The proposed PV plant is in grid connected mode. Total energy consumed in the year 2019 is analyzed. The institute is having a small scale PV installation which contributed to little more than 7% of its annual consumption. The area under installation can be increased by covering areas like parking and other available rooftop area. Three local solar panel manufacturers are taken for simulation and the one giving maximum output is selected. Simulation is done on PVsyst 7.2 software. The system generated 31832 MWh electric energy which can meet 85% of the electricity demand and still having nearly 31000 MWh surplus energy which can be sold to the grid. An economic analysis is done considering different costs involved in installing and operating the system. The amount invested can be recovered in nearly 7 years making the PV plant economically feasible.

## **Prototype of Operating A Vehicle Using Arduino Micro-Controller With Wireless Communication System -**

[10.1109/SASM51857.2021.9841174](https://doi.org/10.1109/SASM51857.2021.9841174)

This research primarily represents the structure setup and programming composition of the radio receiver vehicle operation. Hardware program model employing standard model approaches, along with operating ARDUINO UNO and Nano section to be the primary authority part, ultrasonic sensor element, PIR, RF unit, Sim-card Unit, motor driver section as the essential sections; software growth and composition purposes ARDUINO programming to compose the full program. The vehicle uses motor drive unit L-298N as the motor driver for providing the dragging force for the vehicle parts. The Sim-card component of the vehicle will produce the venue of the vehicle and likewise will be controlled to implement data on the server. The ultrasonic sensor of the vehicle will estimate the distance of the hindrances. The PIR sensor of the vehicle will anticipate the warmth near it. The incidents in the appearance of figures will be uploaded by a sim-card section on the server.

## 7. REGULAR SKILL SET ENHANCEMENT AT MRIIRS- CERTIFICATIONS EARNED BY STUDENTS AND FACULTY MEMBERS

Skill set development and enhancement are the important component of institutional development. The university is committed to conduct, through its competent constituent bodies, programs for the faculty and students for continuous skill set enhancement relevant to the recent technologies. Further, the faculty members and students are also encouraged to participate in Seminars/ Conferences/ Workshops/ Training Programs/ Short Term courses etc. within or outside the University. Sample certifications earned by faculty members and students in the relevant areas of SDG9 are as appended below:

### Certificate on Solar Energy Engineering and technology



**NPTEL-AICTE**  
**Faculty Development Programme**  
(Funded by the MoE, Govt. of India)

This certificate is awarded to  
**VIMLESH SINGH**  
for successfully completing the course  
**Solar Energy Engineering and Technology**  
with a consolidated score of **73 %**

Prof. Andrew Thangaraj  
NPTEL Coordinator  
IIT Madras

Roll No: NPTEL22GE28S34770477  
Duration of NPTEL course : 12 Weeks

The candidate has studied the above course through MOOCs mode, has submitted online assignments and passed proctored exams. This certificate is therefore acceptable for promotions under CAS as per AICTE notifications dated 24<sup>th</sup> July 2018, similar to other refresher / orientation courses.  
F.No. AICTE / RIFD / FDP through MOOCs / 2017-18

### Certificate on Adoption of Electric Vehicles in India



**ICTA 2023** INTERNATIONAL CONFERENCE ON TECHNOLOGICAL ADVANCEMENTS STEPPING TOWARDS SUSTAINABLE DEVELOPMENT

**Scopus**

**Certificate**

THIS IS TO CERTIFY THAT  
**DR. SACHIN SHARMA**  
OF **MAMY RACHMI INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES** COLLEGE/UNIVERSITY  
HAS PARTICIPATED/PRESENTED HIS/HER PAPER ENTITLED  
**ADOPTION OF ELECTRIC VEHICLES IN INDIA**  
INTERNATIONAL CONFERENCE ON TECHNOLOGICAL ADVANCEMENTS  
STEPPING TOWARDS SUSTAINABLE DEVELOPMENT  
8TH - 9TH FEBRUARY AT SVET, BAMBAL, CHANDIGARH

Dr. Sachin Sharma  
M. Rajesh Ojha  
M. Anil Kumar  
Dr. Pankaj Singh



**Certificate on Power Electronics for Renewable Energy Application**



Certificate No: ICT-16676/22

**National Institute of  
Technical Teachers Training and Research  
Chandigarh**

MINISTRY OF EDUCATION, GOVERNMENT OF INDIA

**Certificate**

*This is to certify that*

**SUNITA BANSAL**



**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND  
STUDIES, FARIDABAD  
HARYANA**

*Participated in the AICTE Recognized Faculty Development Programme*

**on**

**Power Electronics for Renewable Energy Applications**

*Conducted by*

**Electrical Engineering Department**

**from**

**31/10/2022 to 04/11/2022 (One Week)**

**at**

**Chandigarh University**



*Sh. S. L.*  
**Coordinator**

*[Signature]*  
**Director**

**Certificate on Energy Harvesting & Storage materials & Devices**



Certificate No: ICT-11730/22

**National Institute of  
Technical Teachers Training and Research  
Chandigarh**

MINISTRY OF EDUCATION, GOVERNMENT OF INDIA

**Certificate**

*This is to certify that*

**VIMLESH SINGH**

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND  
STUDIES, FARIDABAD  
HARYANA**

*Participated in the AICTE Recognized Faculty Development Programme*

**on**

**Energy Harvesting & Storage Materials & Devices**

*Conducted by*

**Applied Science Department**

**from**

**12/09/2022 to 16/09/2022 (One Week)**

**at**

**Manav Rachna International Institute of Research and Studies, Faridabad**



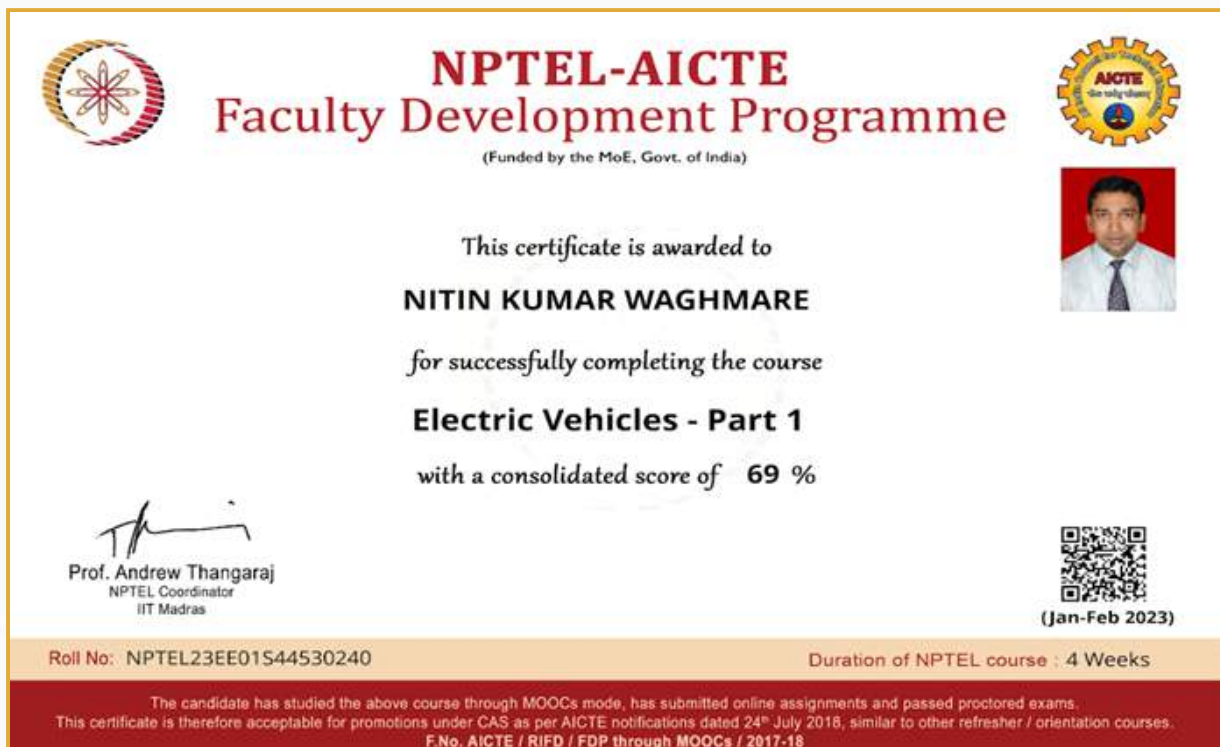
  
**Coordinator**

  
**Director**

## Paper Presentation certificate to Faculty member



## Certificate on Electric Vehicles



## Certificate on Research Scope in Electric Vehicles



Certificate No: ICT-19469/22

### National Institute of Technical Teachers Training and Research Chandigarh

MINISTRY OF EDUCATION, GOVERNMENT OF INDIA

#### Certificate

*This is to certify that*

**ABHIRUCHI PASSI**

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND  
STUDIES, FARIDABAD  
HARYANA**

*Participated in the AICTE Recognized Faculty Development Programme*

on

**Research Scope in Electric Vehicles (In collaboration with ANSYS)**

*Conducted by*

**Electrical Engineering Department**

from

**05/12/2022 to 09/12/2022 (One Week)**

at

**Manav Rachna University, Faridabad**



*Sham S.L.*  
**Coordinator**

*[Signature]*  
**Director**

# AFFORDABLE AND CLEAN ENERGY

PROGRESS REPORT 2022-23



## **Manav Rachna International Institute of Research and Studies**

(Deemed to be University under section 3 of the UGC Act,1956)

Manav Rachna Campus Rd, Gadakhor Basti Village, Sector 43,  
Faridabad, Haryana 121004