



ReNew
POWER



ReNew Power

CENTRE OF EXCELLENCE AT IIT DELHI

FOREWORD FROM Sumant Sinha

In a bid to foster industry-academia collaboration, the ReNew Power Centre of Excellence for Energy and Environment is an initiative aimed at promoting research in the realm of clean energy, with support from IIT-Delhi and ReNew Power. The centre aims to be a world-class research and development facility, where with participation from academia and support from industry, cutting-edge renewable energy solutions can be developed.

The centre has research projects ranging from developing bi-directional charging infrastructure for electric vehicles, strategies for grid strengthening using Automatic Demand Response mechanisms to flexibility assessment and enhancement for strengthening the grid for large scale renewable integration. There are also unique upcoming projects dealing with long-term natural resource forecasting for investment decisions in renewables and LIDAR-validated large-scale CFD models to simulate and optimize wind farm operations. The centre has a wide-array of research projects with practical on-ground ramifications and offers internships and research programs for undergraduate, post-graduate and doctoral students, fortifying the influence of academia on the operations of the centre.

The ReNew Power Centre of Excellence for Energy and Environment also prides itself in the fact that after the completion of research projects, the findings of the research are developed into advocacy papers and reports which are not only published in prominent publications, but also serve as blueprints for change on actual renewable energy policy matters for the government of India and multilateral organizations. The centre also promote women entrepreneurship in the renewable energy sector, thus paving the way for gender parity in STEM by creating a virtuous cycle.

As we move forward, the scope of activities, research and events organized under the centre are set to increase, making it a bubbling hub of innovation and cutting-edge research in clean energy and sustainability. I am confident that this centre will play an integral role, despite being in its nascent stage, in fostering innovations in the renewable energy sector and strengthen the role of industry-academia collaboration in clean energy research and development, for a sustainable future.



ABOUT THE Centre of Excellence

ReNew Power signed a Memorandum of Understanding with Indian Institute of Technology Delhi (IITD) to set up a research facility on renewable energy in the presence of Honourable President of India at the Rashtrapati Bhavan in November 2016. This was part of the 'Session on Industry - Academia Collaborations' during the Visitor's Conference 2016.

As per the MoU, to strengthen India's position as one of the world's leaders in the renewable energy space, ReNew Power and Indian Institute of Technology Delhi (IITD) entered into an industry-academia collaboration. ReNew Power and IITD worked together to set up a Centre of Excellence to promote development and adoption of clean energy technologies through innovative research.



Aims and objective of the Centre of Excellence

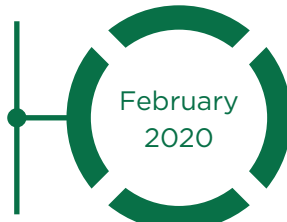
The objective of the Centre is to foster exchange of ideas, promote research on latest technology and help develop renewable energy applications suited to the Indian context.

The aim of this Centre of Excellence is to:

Establish a world-class research & development facility to develop cutting-edge renewable energy solutions suited to Indian context

1. Foster exchange of ideas between industry, academia and policy makers from across the world
2. Partner with the best Indian and International research centres, vendors, think tanks, universities and funding agencies on research and outreach programs
3. Offer research and internship programmes for bright and deserving undergraduate, postgraduate and Ph.D. students
4. Develop advocacy papers and research reports on renewable energy policy matters for the Government of India and multilateral organizations
5. Support and promote women entrepreneurship in the field of renewable energy

- Second edition of the ReNew Power IIT Delhi Centre of Excellence Sustainability Leadership Dialogue and Award organised at IIT Delhi. Panel discussion held on 'The Clean Energy Finance Gap- Funding the battle against climate change'



- First Review Committee meeting
- 2 research groups proposals in pipeline

- Research Review
- 1 research group funding extended; 2 groups complete the objectives



- Sumant Sinha Sustainability Leadership Award and Dialogue organized
- Panel discussion held on "Strengthening and promoting industry-academia collaboration for sustainability"
- EnvironmenD: Cleaning our Air & Water contest at Tryst 2018, the Annual Technical Festival of IIT Delhi

- 17 proposal received and out of which 3 groups commenced research
- The Sustainability Leadership Award instituted to recognize demonstrated action and exemplary leadership by students of IIT Delhi with respect to climate change/sustainability/ environmental issues - with a view to enhance awareness and interest amongst students about this key issue.



- The centre Inaugurated in September 2017 in the presence of Shri Prakash Javadekar, then Minister of HRD

- MoU between IITD and ReNew was signed to set up a research facility on renewable energy in the presence of Honourable President of India at the Rashtrapati Bhavan in November 2016
- This was part of the 'Session on Industry - Academia Collaborations' during the Visitor's Conference 2016



UPDATES FROM The Centre of Excellence

1ST SUSTAINABILITY LEADERSHIP DIALOGUE AND AWARDS

- The 1st Sustainability Leadership Dialogue and Awards was held on 27th November, 2018, wherein the Chief Guest, Mr. Sukhbir Singh Sandhu, Additional Secretary (Technical Education) and Chief Vigilance Officer, Ministry of Human Resource Development gave way the award to the winners
- There was also a panel discussion held on “Strengthening and promoting industry-academia collaboration for sustainability”



Esteemed panellists at the Sustainability Leadership Awards and Dialogue



Winners with Chief Guest, Mr Sukhbir Singh



Vaishali Nigam Sinha, Chief Sustainability, CSR and Communications Officer awarding the Sustainability Leadership Award



2ND SUSTAINABILITY LEADERSHIP DIALOGUE AND AWARD

- ReNew Power - IIT Delhi Centre of Excellence for Energy and Environment felicitated the winners of the 2nd Annual Sustainability Leadership Award on 19th February 2020.
- To mark this occasion, ReNew Power and IIT Delhi organized a Sustainability Leadership Dialogue where Dr. Madhukar Gupta, Additional Secretary, Department of Public Enterprise gave away the awards to winner.
- The winning candidates, Dr Shelaka Gupta, Aali Pant and Smarthveer Sidana, all students of IIT, were selected post evaluation of 19 entries by the selection committee comprising senior professors from IIT Delhi and senior members of ReNew Power.
- Dr Shelaka's was awarded for her work on Catalytic Conversion of biomass-derived platform molecules, Ms Aali Pant for her work in demonstrating suitability of coal ash as an economical, environmentally sustainable fill material behind reinforced soil structures and Mr. Smarthveer Sidana for his work within IIT on increasing awareness about sustainability. Each of the three winners were felicitated with a cash prize of 25,000.
- The award ceremony was followed by a special lecture by Prof. Navroz Dubhash from Centre for Policy Research on 'Sustainable development in the warming world; India's climate and energy trajectory'. The session concluded with an engaging panel discussion on the theme, 'Clean energy finance gap - funding the battle against climate change' moderated by Urmi Goswami from the Economic Times. The panellists included Ankur Saboo from L&T Financial Services, Naveen Thayyil from IIT Delhi and D Muthukumaran from ReNew Power.



Esteemed panellists at the 2nd Sustainability Leadership Dialogue and Award



Chief Guest, Dr Madhukar Gupta enthraling the audience with his words



Prof. Navroz Dubhash

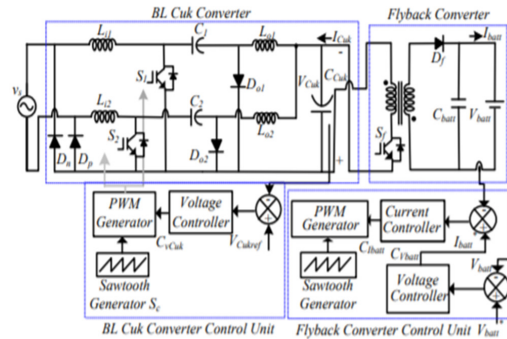


Panellists Deliberating on the topic 'Clean Energy Finance Gap- Funding the battle against climate change

COMPLETED PROJECTS AT THE CENTRE OF EXCELLENCE

1. Charging Infrastructure for Electric Vehicles

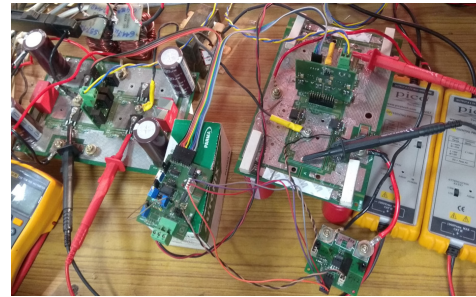
This project dealt with creating charging infrastructure for electric vehicles. The unique aspect of the charging infrastructure will be that it will be bi-directional, allowing for power to flow in both directions, thus not only charging the vehicle, but using batteries of the vehicle to transmit power back to the grid, via the charging infrastructure.



There have been 2 publications with respect to this project-

Publications:

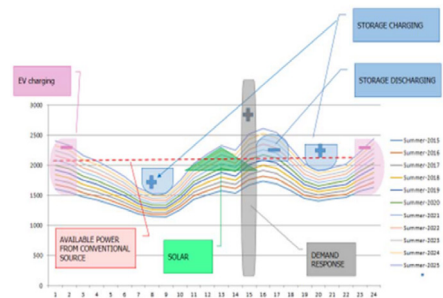
- A. Verma and B. Singh, "Multi-Objective Reconfigurable Three-Phase Off-Board Charger for EV," in IEEE Transactions on Industry Applications, vol. 55, no. 4, pp. 4192-4203, July-Aug. 2019.
- R. Kushwaha and B. Singh, "A Power Quality Improved EV Charger with Bridgeless Cuk Converter," in IEEE Transactions on Industry Applications



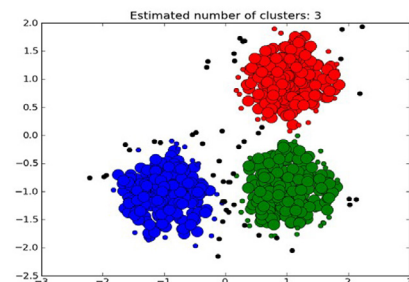
The Principal Investigator of the project was **Professor Bhim Singh**, while the Co-Principal Investigator was **Professor G Bhuvaneswari**, and two PhD students of IIT Delhi were a part of this project.

2. Strategies for Grid Strengthening: Leverage Storage for Solar Integration at Distribution Network Level

Due to the sporadic and intermittent nature of supply of renewable energy from solar and wind farms, the grids struggle with consistent supply to users. On the other hand, the user demands are fixed in time, e.g., fixed-time industrial use, air-conditioning, which peaks in the day time, EV charging, which subjects the grid to short spikes on the supply side etc. Thus, there is a mismatch in demand and supply timings. This project endeavours to bridge this gap using Automatic Demand Response (ADR) mechanisms. Essentially,



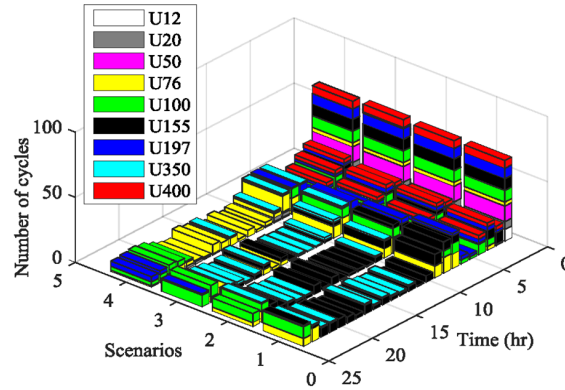
The Principal Investigator of the project was **Professor Ravi Shankar**, while the Co-Principal Investigators were **Professor Shveta Singh** and Professor **Surendra Yadav**.



ONGOING PROJECTS

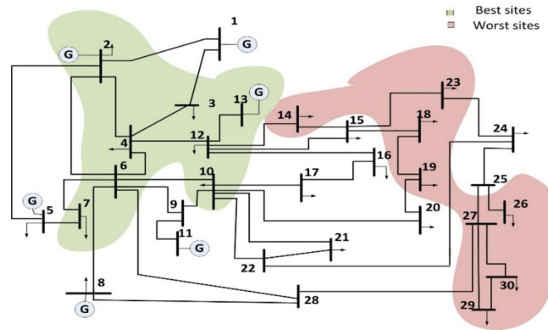
Ongoing Project #1: Flexibility Assessment and Enhancement for Strengthening the Grid for Large Scale Renewable Integration (Department of Electrical Engineering)

The project aims to assess the flexibility and strength of the electrical grid to take additional electrical energy generated by intermittent renewable sources. This flexibility varies according to the geography and this project aims to link this with the variation in electrical inertia. The impact of renewable energy intermittency on generation re-scheduling will also be studied in this project.



Some of the publications with respect to this project include:

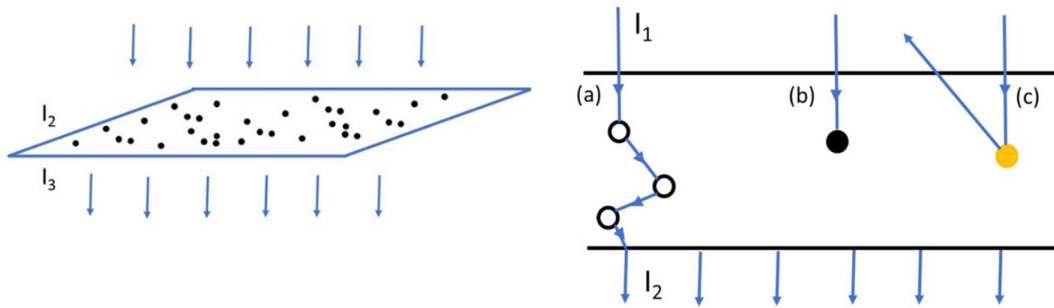
1. D. Brahma and N. Senroy, "Sensitivity Based Approach for Assessment of Dynamic Locational Grid Flexibility," accepted IEEE Trans. Power Sys., Mar 2020.
2. S. Ranjan and A. R. Abhyankar, "Stochastic Unit Commitment using Two Point Estimate Method with Proliferation of Wind Power," 2018 20th National Power Systems Conference (NPSC), Tiruchirappalli, India, 2018, pp. 1-6.
3. S. Ranjan and A. R. Abhyankar, "An Approach for Site Selection to Integrate Renewable Energy Sources Based on Power System Parameters," 2019, North American Power Systems (NAPS), USA
4. S. Ranjan and A. R. Abhyankar, "Network Constraint Compliant Choice of Renewable Energy Source Sitting," 2019, International Conference on Power Systems (ICPS), Jaipur
5. D. Brahma and N. Senroy, "Spatial Distribution of Grid Inertia and Dynamic Flexibility: Approximations and Applications," submitted to IEEE Trans. Power Sys.
6. S. Ranjan and A. R. Abhyankar, "Investigating the Need for Real-Time Adjustment Cost in Unit Commitment Framework for Wind Integrated Power Systems", submitted to IEEE Systems Journal.



The principal investigators of this project are Prof. Nilanjan Senroy & Prof. A.R. Abhyankar.

Ongoing Project #2: Effect of AQI on Solar Generation (Department of Chemical Engineering)

Through ReNew's Centre of Excellence, we collaborated with IIT Delhi to take it up as a year-long study. We have two main objectives from this project- 1) Develop a rigorous numerical model which would help us correlate loss in irradiation as a function of AQI taking into account chemical composition of particulate matter, particle size distribution and concentration, 2) Perform experiment to understand particulate matter deposition as a function of Total Suspended Solids and thereby quantify change in light intensity for a given surface coverage of the panel with the change in irradiance.



The principal investigator of this project is Prof. Vikram Singh



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