

CENTRE FOR ENERGY AND ENVIRONMENT



Rajasthan Technical University, Kota

Rawatbhata Road, Kota - 324010

Annual Report for the Year - 2014



VISIT OF STUDENTS TO WIND TURBINE TEST STATION OF NATIONAL INSTITUTE OF WIND ENERGY (FORMERLY KNOWN AS C-WET) AT KAYATHAR, TAMIL NADU.



Annual Report of Centre for Energy and Environment, RTU, Kota for the Year 2014

I. Administrative activities during the year 2014

1. For financial year 2014-15, a budget of Rs. 44.50 lakhs was allotted to the Centre for Energy and Environment under the budget heads of Students Scholarship (Teaching Assistantship), Students Education & Training Expenses, Expert lectures/Visitor for centre, Office expenses, Lab equipments, Computers & accessories, Software, Purchase of furniture & office equipment, and Library books.
2. Rules related to students of the centre for their educational tours and visits, research paper presentation and participation in conferences & workshops have been approved by 11th Finance Committee meeting held on 19th February 2014 and 20th BOM meeting of RTU held on 23th September 2014.
3. Mr. C.P. Jain, Retd. Assoc. Professor of RTU joined as Guest Faculty from 16th August 2014.
4. Mr. Bharat Kumar Saxena has been appointed as Guest Faculty from 20th December 2014.
5. Three desktop computers were purchased for the centre at a cost of Rs. 1.58 Lakhs.
6. The expenditure during the financial year 2013-14 was Rs. 14.45 Lakhs against the budget allocation of Rs. 29 Lakhs.



ICONCE-2014, KALYANI, WEST BENGAL.



II. Academic activities during the year 2014

A. Research Papers Presented / Published in Conferences and Journals:

1. Three students of the centre along with Prof. K.V.S. Rao presented their research papers in the *IEEE International Conference on Non-Conventional Energy (ICONCE)* on 16-17 January, 2014 at Kalyani, West Bengal. Mr. Bharat Kumar Saxena delivered the oral presentation of research paper. Ms. Kumari Sanno and Ms. Zainab Akhtar made the poster presentations of research paper. Conference was organized by JIS College of Engineering at Kalyani. These research papers are available online on *IEEE Xplore Digital Library* and the details are as follows:
 - a) Bharat Kumar Saxena and Dr. K.V.S. Rao, "Analysis of wind turbines for electric energy production disparity at a wind farm in Jaisalmer," pp. 164-168, Print ISBN: 978-1-4799-3339-6. [Online].
doi: <http://dx.doi.org/10.1109/ICONCE.2014.6808713>.
 - b) Kumari Sanno and Dr. K.V.S. Rao, "Estimation of wind power extraction from kites flying at high altitudes," pp. 193-197, Print ISBN: 978-1-4799-3339-6. [Online].
doi: <http://dx.doi.org/10.1109/ICONCE.2014.6808708>.
 - c) Zainab Akhtar and Dr. K.V.S. Rao, "Study of economic viability of 200 MW solar chimney power plant in Rajasthan, India," pp. 84-88 Print ISBN: 978-1-4799-3339-6. [Online].
doi: <http://dx.doi.org/10.1109/ICONCE.2014.6808689>.
2. Mr. Sachin Jain under the guidance of Dr. Namrata Sengar presented a poster entitled "A study of household fuel expenditure in different income range for cooking activities in Rajasthan," in the *Energy Meet 2014-National Conference on Energy Technologies, Material and Issues*, organized by Department of Pure & Applied Physics, University of Kota, Kota on 14-15 November, 2014. The poster was awarded as best poster presentation.



NCGET - 2014, TIRUCHIRAPPALLI, TAMIL NADU



3. Five students of the centre along with Prof K.V.S. Rao presented five research papers in the *National Conference on Green Engineering and Technologies for Sustainable Futures* on 5-6 December, 2014 at Bharathidasan Institute of Technology, Tiruchirappalli. Mr. Burhanuddin Bohra and Mr. Shahid Ali Khan delivered the oral presentations of research paper. Mr. Rahul Khandelwal, Mrs. Seema Bai Choudhary, and Ms. Kumari Sanno made the poster presentations of research paper. The conference proceedings are published by *Journal of Chemical and Pharmaceutical Sciences* as a special issue and the details of papers are:

a) Mr. Burhanuddin Bohra and Dr. K.V.S. Rao, "Quality of kitchen waste generated at Rajasthan Technical University, Kota," pp. 83-85, *Journal of Chemical and Pharmaceutical Sciences*, Special Issue 4, ISSN: 0974-2115, Dec 2014.

[Online]. [www.http://jchps.com/pdf/si4/jchps%2030%20burhanuddin%2083-85.pdf](http://jchps.com/pdf/si4/jchps%2030%20burhanuddin%2083-85.pdf)

b) Mr. Shahid Ali Khan and Dr. K.V.S. Rao, "Design and manufacturing of low cost small vertical axis wind turbine," pp. 80-82, *Journal of Chemical and Pharmaceutical Sciences*, Special Issue 4, ISSN: 0974-2115, Dec 2014.

[Online]. [www.http://jchps.com/pdf/si4/jchps%2029%20shahid%20ali%20khan%2080-82.pdf](http://jchps.com/pdf/si4/jchps%2029%20shahid%20ali%20khan%2080-82.pdf)

c) Mr. Rahul Khandelwal and Dr. K.V.S. Rao, "Characterization of organic waste generated from student messes in Kota," pp. 245-246, *Journal of Chemical and Pharmaceutical Sciences*, Special Issue 4, ISSN: 0974-2115, Dec 2014.

[Online]. [www.http://jchps.com/pdf/si4/jchps%2083%20rahul%20khandelwal245-246.pdf](http://jchps.com/pdf/si4/jchps%2083%20rahul%20khandelwal245-246.pdf)

d) Mrs. Seema Bai Choudhary and Dr. K.V.S. Rao, "Design and integration of solar-biomass hybrid energy system for drip irrigation pumping," pp.247-248, *Journal of Chemical and Pharmaceutical Sciences*, Special Issue 4, ISSN: 0974-2115, Dec 2014.

[Online]. [www.http://jchps.com/pdf/si4/jchps%2084%20seema%20bai%20247-248.pdf](http://jchps.com/pdf/si4/jchps%2084%20seema%20bai%20247-248.pdf)

e) Ms. Kumari Sanno and Dr. K.V.S. Rao, "Estimation of wind power extraction from kites flying at high altitudes comparison of five mathematical models," pp. 254-256, *Journal of Chemical and Pharmaceutical Sciences*, Special Issue 4, ISSN: 0974-2115, Dec 2014. [Online]. [www.http://jchps.com/pdf/si4/jchps%2087%20kumari%20sanno%20254-256.pdf](http://jchps.com/pdf/si4/jchps%2087%20kumari%20sanno%20254-256.pdf)





B. Research Papers of 2013 Made Available Online in 2014

One M.Tech. student of the Centre along with Prof. K.V.S. Rao presented research papers during December 2013 in two IEEE international conferences at Coimbatore and Chennai respectively. Both these research papers were published by IEEE in year 2014 and are now available online on *IEEE Xplore Digital Library*. The details of papers are:

a) Bharat Kumar Saxena and Prof. K. V. S. Rao, “Wind turbine failure analysis for wind farm at Devgarh in Rajasthan,” at 2013 IEEE International Conference on Renewable Energy and Sustainable Energy (ICRESE), Coimbatore, pp. 196-199. [Online].

doi: <http://dx.doi.org/10.1109/ICRESE.2013.6927814>.

b) Bharat Kumar Saxena and Prof. K. V. S. Rao, “Performance analysis of wind power plant at Devgarh in Rajasthan,” at 2013 International Conference on Green Computing, Communication, and Conservation of Energy (ICGCE), Kavaraipettai, Chennai, pp. 544-547. [Online]. doi:

<http://dx.doi.org/10.1109/ICGCE.2013.6823496>.

C. Research Papers Accepted for Publication in Journals & Conferences:

1. One research paper co-authored by Mr. Bharat Kumar Saxena and Dr. K.V.S. Rao entitled as “Comparison of Weibull parameters computation methods and analytical estimation of wind turbine capacity factor using polynomial power curve model: case study of a wind farm,” was accepted for publication in a peer reviewed *SpringerOpen* international journal “*Renewables: Wind, Water, and Solar*” on 07th October, 2014. The journal is open access and published by *Springer-Verlag GmbH* at Heidelberg, Germany.





2. One research paper co-authored by Ms. Zainab Akhtar and Dr. K.V.S. Rao entitled as “Theoretical performance analysis of Solar Chimney power plant for Kota region of Rajasthan, India,” was accepted for presentation in the *International Conference on Sustainable Energy Resources, Materials and Technologies (ISERMAT)*. The conference will be organized on 8-9 January, 2015 by SSN College of Engineering at Kalavakkam, Chennai.
3. One research paper co-authored by Mr. Vishnu Meena and Dr. K.V.S. Rao entitled as “Feasibility of rural electrification through gasification at village Kund Habeli of Sheopur district in Madhya Pradesh, India,” was accepted for presentation in the *International Conference on Bioenergy, Environment, and Sustainable Technologies (BEST 2015)*. The conference will be organized on 28-31 January, 2015 by Arunai Engineering College at Tiruvannamalai, Tamil Nadu.
4. One research paper co-authored by Ms. Zainab Akhtar and Dr. K.V.S. Rao entitled as “Effect of collector efficiency on levelized electricity cost of 200 MW Solar Chimney power plant in India,” was accepted for presentation in the *IEEE International Conference on Technologies for Sustainable Development (ICTSD)*. The conference will be organized on 4-6 February, 2015 by Don Bosco Institute of Technology at Mumbai.

D. Membership of Professional Bodies:

Twenty four students of M.Tech. (Renewable Energy Technology) of the Centre have become members of Solar Energy Society of India (SESI), New Delhi.





E. Workshops/Conferences Attended:

1. Two students namely Mr. Sachin Jain and Mr. Yatharth Sharma of the centre attended the *IEEE International Conference on Non-Conventional Energy (ICONCE)* on 16-17 January, 2014 at Kalyani, West Bengal.
2. Mr. Vijay Haror attended a short term course on *Grid Connected Rooftop PV Power Plants* during 19-21 February, 2014 at Mumbai. The course was organized by Dept. of Energy Science and Engineering, IIT Bombay.
3. Eleven M.Tech (RET) second semester students namely, Mr. Aamir Khan, Ms. Aditi Pareek, Mr. Ankur Kumar, Mr. Gaurav Kumar, Mr. Gaurav Sen, Ms. Nishi Swal, Mr. Rakesh Kumar Dabkeya, Mr. Sagar Patel, Mr. Shivraj Nagar, Ms. Sonali Singh Chudawat, and Ms. Tahira Bano attended the workshop on *Fuel Cell Technology from Basic Science to Application* during 24-25 March, 2014. The workshop was organized by Maulana Azad National Institute of Technology at Bhopal. The team consisting of six students of the centre Mr. Gaurav Sen, Mr Gaurav Gupta, Mr Rakesh Kumar, Mr. Sagar Patel, Ms. Sonali Singh, and Ms. Tahira Bano was adjudged First Prize in the quiz competition conducted by the organizers of the workshop.
4. Mr. Vijay Haror attended the *International Conference on Energy Efficient LED Lighting & Solar Photovoltaic Systems* during 27-29 March, 2014 at Kanpur. The conference was organized by IIT Kanpur.
5. Mr. Sachin Jain attended the *National Workshop on Opportunities and Challenges of Life- a Road Map towards Successful Career* during 3-4 July, 2014 at Kota. The workshop was organized by Placement and Counseling Cell, University of Kota, Kota.
6. Thirty one students of M.Tech. (RET) along with Prof. K.V.S. Rao attended the *Energy Meet- 2014 National Conference on Energy Technologies, Material and Issues* on 14-15 November, 2014 at Kota. The conference was organized by Department of Pure & Applied Physics, University of Kota, Kota.
7. Five students namely Ms. Aditi Pareek, Mr. Sagar Patel, Ms. Sonali Singh, Ms. Tahira Bano, and Mr. Vishnu Meena attended the *National Conference on Green Engineering and Technologies for Sustainable Futures* on 5-6 December, 2014 at Bharathidasan Institute of Technology, Tiruchirappalli.
8. Mr. Sachin Jain attended the *12th International Congress on Renewable Energy - Powering National Growth through Solar* on 8-9 December, 2014 at New Delhi. The conference was organized by Solar Energy Society of India.



F. Industrial Visits and Educational Tours Conducted:

1. Four students namely Mr. Gaurav Sen, Mr. Rakesh Kumar Dabkeya, Mr. Sagar Patel, and Mr. Shahid Ali Khan visited the Science Centre at Ahmedabad on 24th April, 2014 and TinyTech Plants (a renewable energy equipment manufacturing company) at Rajkot, Gujarat during 25-26 April, 2014.
2. Nine students namely Mr. Aamir Khan, Mr. Ankur Kumar, Mr. Burhanuddin Bohra, Mr. Gaurav Sen, Mr. Rahul Khandelwal, Mr. Rakesh Kumar Dabkeya, Mr. Sagar Patel, Mr. Shahid Ali Khan, and Mr. Vishnu Meena visited the Ankur Scientific Energy Technologies Pvt. Ltd. (a biomass gasifier manufacturing company) at Vadodara, Gujarat on 28th April, 2014. Students also visited Pandit Deendayal Petroleum University at Gandhinagar, Gujarat on 29th April, 2014.
3. Eighteen students, namely Ms. Aditi Pareekh, Mr. Ankur Kumar, Mr. Burhanuddin Bohra, Mr. Gaurav Kumar, Mr. Gaurav Sen, Ms. Jyoti Gautam, Mrs. Manpreet Kaur, Ms. Nishi Swal, Mr. Rahul Khandelwal, Mr. Rakesh Kumar Dabkeya, Mr. Sachin Jain, Mr. Sagar Patel, Mrs. Seema Choudhary, Mr. Shahid Ali Khan, Mr. Shivraj Nagar, Ms. Sonali Singh, Ms. Tahira Bano, and Mr. Vishnu Meena visited the Department of Renewable Energy Engineering, College of Technology and Engineering, at Udaipur on 3rd June 2014. Students also visited a 2.25 MW wind farm of Rajasthan Renewable Energy Corporation Ltd. at Devgarh in Pratapgarh district of Rajasthan on 4th June 2014. This wind farm is operated by Vestas Wind Technology India Pvt. Ltd.
4. Nine students namely Mr. Burhanuddin Bohra, Mr. Rahul Khandelwal, Mrs. Seema Bai Choudhary, Mr. Shahid Ali Khan, Mr. Vishnu Meena, Ms. Aditi Pareek, Mr. Sagar Patel, Ms. Sonali Singh, and Ms. Tahira Bano along with Prof. K.V.S. Rao stayed at Vivekananda Kendra in Kanyakumari and visited the wind farms at Muppandal and Kumarapuram on the way to Thiruvananthapuram on 2nd December 2014. They stayed at Rameshwaram in Tamil Nadu on 7th and 8th December 2014 and visited Ram Setu (Pamban bridge) on 7th December 2014 and first offshore wind mast at Dhanushkodi on 8th December 2014. They visited Wind Turbine Test Station (WTTS) of National Institute of Wind Energy (formerly known as “Centre for Wind Energy Technology”) at Kayathar on 9th December 2014.





G. Invited Lectures Delivered by Head, CEE

1. Prof. K.V.S. Rao was invited to submit a file for “Sustainable Development of Kota” at the divisional level working group meeting of *State Commission on Urbanization*, constituted by Government of Rajasthan. The meeting was held on 26th May, 2014 at Tagore Hall, Collectorate, Kota District.
2. General Manager of *Heavy Water Plant, Department of Atomic Energy, Government of India* invited Prof. K.V.S. Rao to be the chief guest of World Environment Day celebrations on 5th June, 2014 at Rawatbhata. Prof. Rao delivered his lecture on the theme of “Small Islands and Climate Change”. The official slogan for the year 2014 was “Raise Your Voice Not The Sea Level” by United Nations.
3. Prof. K.V.S. Rao delivered expert lecture in the *National Workshop on Opportunities and Challenges of Life - a Road Map towards Successful Career* held on 3-4 July, 2014. The workshop was organized by Placement and Counseling Cell, University of Kota at Kota.

H. Expert Lectures Organized at the Centre

Mr. V.K. Desai (Industrialist, innovator & social activist) from Rajkot, Gujarat was invited to deliver the expert lectures on renewable energy at the centre on 28th May 2014. He delivered the lectures on the theme of “Small is beautiful”. He also encouraged the students for entrepreneurship.

I. Seminars Presented by Students at the Centre:

Following students of M.Tech. (RET) third semester presented their seminars in April 2014:

| S. No. | University Roll No. | Students Name | Seminar Topics | Seminar Guides |
|--------|---------------------|---------------------|--|----------------------|
| 1. | 12EUCRE601 | Burhanuddin Bohra | Fresnel lens application in CPC | Dr. K. V. S. Rao |
| 2. | 12EUCRE603 | Jyoti Gautam | Water pumping by using solar thermal system | Dr. K. V. S. Rao |
| 3. | 12EUCRE605 | Nikita Jain | Water pumping by using wind energy | Dr. K. V. S. Rao |
| 4. | 12EUCRE607 | Rahul Khandelwal | Municipal waste management | Dr. K. V. S. Rao |
| 5. | 12EUCRE609 | Sachin Jain | Solar Cooker | Dr. K. V. S. Rao |
| 6. | 12EUCRE610 | Seema Bai Choudhary | Water pumping by using wind energy | Dr. K. V. S. Rao |
| 7. | 12EUCRE611 | Shahid Ali Khan | Levelised cost analysis of small wind turbine | Dr. K. V. S. Rao |
| 8. | 12EUCRE613 | Swapnil Jain | Water pumping by using Solar PV as a source | Dr. K. V. S. Rao |
| 9. | 12EUCRE615 | Vijay Haror | Lighting in building using fiber optics | Dr. Mahendra Lalwani |
| 10. | 12EUCRE616 | Vishnu Meena | Down draft gasifier | Dr. K. V. S. Rao |
| 11. | 12EUCRE617 | Yatharth Sharma | Solar energy utilization for desalination of water | Dr. K. V. S. Rao |



J. Thesis Examination and Viva-Voce Conducted at the Centre:

M.Tech. dissertation examination of Mr. Bharat Kumar Saxena entitled “*Computation of Wind Resource Assessment and Performance Analysis of Wind Turbines at Two Wind Farms in Rajasthan*” was conducted on 5th November 2014 at the centre. His dissertation deals with wind resource analysis of a site and performance evaluation of wind turbines working in the wind farms. Two wind farms were selected for the study and are located in the western and southern regions of Rajasthan. Weibull parameters of wind speed probability density function were estimated at hub height using four numerical methods namely graphical, empirical, modified maximumlikelihood, and energy pattern factor. MATLAB was used for the numerical and graphical analysis.

Capacity factor of the wind turbines was analytically estimated using the Weibull parameters at hub height, eighth degree polynomial power curve model, and wind turbine speed parameters. Comparison between the measured and estimated capacity factor was also done for validation. This thesis was done under the guidance of Prof. K.V.S. Rao.

Outcomes of the thesis resulted in one International Journal paper and three International conference paper publications. Journal paper will be published as an open access paper in the January 2015 volume of *SpringerOpen Journal “Renewables: Wind, Water, and Solar”*. The publisher of journal is *Springer-Verlag GmbH*, at Heidelberg, Germany.

The three research papers were presented in three *IEEE International Conferences* at Coimbatore, Chennai, and Kalyani (West Bengal) respectively. All three conference papers were then published by *IEEE* and are available online on *IEEE Xplore Digital Library*.

K. Theses Submitted at the Centre:

Following two students of the centre submitted their M.Tech. theses for viva-voce and external examination:

- Ms. Kumari Sanno thesis title was “*Effect of air density on estimation of wind power extraction of kites flying at high altitudes: Comparison of five mathematical models*”.
- Ms. Zainab Akhtar thesis title was “*Study of feasibility of solar chimney power plant in India*”.

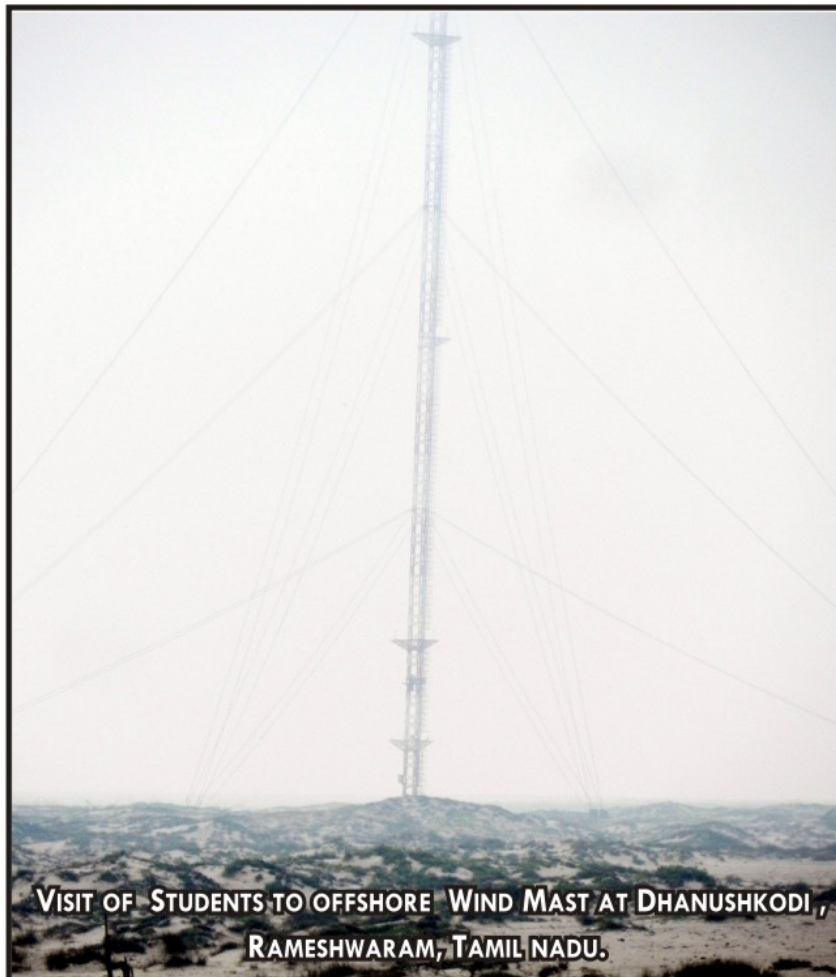
Both the above theses were done under the supervision of Prof. K. V. S. Rao.





III. Summary of Report

1. One research paper was accepted by an International Journal and it will be available online as open access paper in a *SpringerOpen Journal "Renewables: Wind, Water, and Solar"* next year.
2. Three research papers were presented in a IEEE International Conference at Kalyani, West Bengal and all the papers are made available online on *IEEE Xplore Digital Library*.
3. Two research papers that were presented in two different IEEE International conferences at Coimbatore and Chennai in year 2013, also appeared in *IEEE Xplore Digital Library* in 2014.
4. Five research papers were presented in a National Conference at Tiruchirappalli. All the papers are available online in the *Journal of Chemical and Pharmaceutical Sciences* as a special issue.
5. One poster presentation was made at the *Energy Meet 2014*, a National Conference organized by University of Kota, Kota.
6. Three research papers are accepted for presentation in three different International Conferences to be held in year 2015 at Chennai, Tiruvannamalai, and Mumbai.
7. Thus during the year 2014, Centre has published nine papers.
8. Students of the Centre participated in eight different conferences/ workshops during this year.





VISIT OF STUDENTS TO WIND FARMS AT MUPPANDAL IN TAMIL NADU.



VISIT OF STUDENTS TO VIVEKANANDA ROCK MEMORIAL AT KANYAKUMARI