

RHYTHM SINGH, PhD

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Date of birth: 19th April, 1985

Department of Hydro and Renewable Energy,
Indian Institute of Technology (I.I.T.) Roorkee,
Roorkee – 247667, Uttarakhand, India

RESEARCH INTERESTS

- Solar PV systems, Rooftop PV applications, Solar resource variability assessment
- Application of AI/ML/Fintech to renewable energy
- Grid-connected renewable energy systems, Potential estimation, grid integration issues and long-term planning
- Energy systems modelling for clean energy transition

EDUCATION

PhD	Indian Institute of Technology (I.I.T.) Bombay Thesis: “Analysis of the Potential and Impact of Grid-Connected Rooftop Solar Photovoltaic Technology” Advisor: Prof. Rangan Banerjee	Jan 2018
M.Tech	Indian Institute of Technology (I.I.T.) Delhi, Energy Studies Dissertation: “Power System Voltage Stability Analysis using ANN and Continuation Power Flow” Advisor: Prof. R. Balasubramanian CGPA: 8.40 / 10.00	May 2009
B.Tech	Motilal Nehru National Institute of Technology, Electrical Engineering Special Achievement: Prof. R. N. Tiwari Gold Medal for Academic Excellence CGPA: 9.45 / 10.00	May 2007

EXPERIENCE

- **Assistant Professor**, Department of Hydro and Renewable Energy, Indian Institute of Technology (I.I.T.) Roorkee, Dec 2018 – Till date
- **Assistant Professor**, Department of Electrical Engineering and Computer Science, Indian Institute of Technology (I.I.T.) Bhilai, Jul 2018 – Dec 2018
- **Assistant Professor**, School of Projects, Real Estate and Infrastructure Management, National Institute of Construction Management and Research (NICMAR), Aug 2014 – Jul 2018

SPONSORED RESEARCH PROJECTS

Title of Project	Funding Agency	Amount of Grant (INR)	Starting date	Status	Role
Blockchain-based P2P Energy Trading Platform for Rooftop Solar PV Users	IIT Bhilai Innovation and Technology Foundation	4,800,000	March 2023	Ongoing	PI

Machine-learning based PV power forecast and grid support solutions for PV integration in diverse climatic zones across Serbia and India	Department of Science and Technology (DST), Government of India	1,215,000	December 2022	Ongoing	PI
Development of national scheme for advanced grid-scale energy storage technologies	New Venture Fund, Washington, USA	8,302,086	June 2022	Ongoing	Co-PI
Exploring low carbon transportation pathways for India	New Venture Fund, Washington, USA	3,165,414	May 2022	Ongoing	Co-PI
Machine-learning based PV power forecast and grid support solutions for PV integration in diverse climatic zones in India	iHUB DivyaSampark, Technology Innovation Hub (TIH) for Device Technology and Materials, IIT Roorkee	5,800,000	December 2021	Ongoing	PI
Development of solar-powered decentralized fertilizer production-cum-irrigation units	Department of Science and Technology (DST), Government of India	6,826,210	August 2021	Ongoing	Co-PI
Study of Solar Resource Variability and Development of Possible Forecasting Mechanisms for Solar PV Applications	Indian Institute of Technology Roorkee	1,800,000	October 2020	Ongoing	PI

PUBLICATIONS

Journal Publications

- Gupta, P. and **Singh, R.**, 2023. Combining a deep learning model with multivariate empirical mode decomposition for hourly global horizontal irradiance forecasting. *Renewable Energy*, 206, pp.908-927.
- Gupta, P. and **Singh, R.**, 2023. Combining simple and less time complex ML models with multivariate empirical mode decomposition to obtain accurate GHI forecast. *Energy*, 263, p.125844.
- **Singh, R.** and Gautam, J., 2022. Study of hourly site-pair correlations of the clear-sky index and its predictor variables for long-term resource planning of solar cities. *International Journal of Ambient Energy*, 43(1), pp.7218-7228.
- Obrecht, M., **Singh, R.** and Zorman, T., 2022. Conceptualizing a new circular economy feature – storing renewable electricity in batteries beyond EV end-of-life: the case of Slovenia. *International Journal of Productivity and Performance Management*, 71(3), pp. 896-911.
- Gupta, P. and **Singh, R.**, 2021. PV power forecasting based on data-driven models: a review. *International Journal of Sustainable Engineering*, 14(6), pp.1733-1755.
- **Singh, R.**, 2021. Solar-city plans with large-scale energy storage: Metrics to assess the ability to replace fossil-fuel based power. *Sustainable Energy Technologies and Assessments*, 44, p.101065.
- **Singh, R.**, 2020. Approximate rooftop solar PV potential of Indian cities for high-level renewable power scenario planning. *Sustainable Energy Technologies and Assessments*, 42, p.100850.
- **Singh, R.**, 2018. Energy sufficiency aspirations of India and the role of renewable resources: Scenarios for future. *Renewable and Sustainable Energy Reviews*, 81(2), pp.2783-2795.
- **Singh, R.** and Banerjee, R., 2017. Impact of Large-Scale Rooftop Solar PV Integration: An Algorithm for Hydrothermal-Solar Scheduling (HTSS). *Solar Energy*, 157, pp.988-1004.
- **Singh, R.** and Banerjee, R., 2016. Impact of Solar Panel Orientation on Large Scale Rooftop Solar Photovoltaic Scenario for Mumbai. *Energy Procedia*, 90, pp.401-411.
- **Singh, R.** and Banerjee, R., 2015. Estimation of rooftop solar photovoltaic potential of a city. *Solar Energy*, 115, pp.589-602.

Journal Papers under Review

- Das, A. K., and **Singh, R.**, 2023. Explicit simple model for Illuminated Solar Photovoltaic P-V Characteristics, *Renewable Energy*.
- Das, A. K., and **Singh, R.**, 2023. Simple analytical model for V-I characteristics of illuminated solar cell, *Solar Energy*.

Books/ Book Chapters

- Jain, S. and **Singh, R.**, 2022. Design and Simulation of Structural Components of Affordable, Automated Solar Panel Cleaning Mechanism. In Govindan K., Kumar H., Yadav S. (eds) *Advances in Mechanical and Materials Technology*. Lecture Notes in Mechanical Engineering. (pp. 201-210). Springer, Singapore.
- Karna, S. K. and **Singh, R.**, 2021. A Framework for Assessing the Viability of Solar PV in Province-2 of Nepal Using System Dynamics Approach. In: Saran V.H., Misra R.K. (eds) *Advances in Systems Engineering*. Lecture Notes in Mechanical Engineering. (pp. 827-836). Springer, Singapore.
- **Singh, R.** and Kumar, C., 2011, *Online Voltage Stability Assessment using ANN and Continuation Power Flow*, VDM Verlag, Saarbrücken, Germany.

Peer-Reviewed Conference Proceedings

- Patel, M., **Singh, R.**, Arora, P. and Mahapatra, D., 2022, October. Assessment of total cost of ownership for electric two-wheelers with point charging and battery swapping in the Indian scenario. In *2022 International Conference and Utility Exhibition on Energy, Environment and Climate Change (ICUE)* (pp. 1-6). IEEE.
- Gupta, P. and **Singh, R.**, 2021. Univariate model for hour ahead multi-step solar irradiance forecasting. In *Photovoltaic Specialists Conference (PVSC), 2021 IEEE 48th* (pp. 0494-0501). IEEE, 2021.
- Soni, Y. P., Fernandez, E. and **Singh, R.**, 2019. Evaluation of Loading of Individual Buses on Voltage Regulation in a Radial Microgrid Feeder. In *International Conference on Electrical, Electronics and Computer Engineering (UPCON), 2019 6th* (pp. 1-4). IEEE, 2019.
- **Singh, R.**, 2019, June. Rooftop PV aspirations of India's National Solar Mission and the green building codes: The missing links and the way ahead. In *Photovoltaic Specialists Conference (PVSC), 2019 IEEE 46th* (pp. 1717-1723). IEEE, 2019.
- **Singh, R.**, 2019. Sustainability and Energy Conservation in Built Habitat through Daily Life Choices: A few Case Studies. *Proceedings of Seminar on Renewable Energy and Efficiency Measures in Built Habitat, March 8, 2019*, pp.210-217. CPWD, Ministry of Housing and Urban Affairs.
- **Singh, R.** and Banerjee, R., 2017, June. Investigation of City-Level Site-Pair Correlations of Solar Variability using Empirical Satellite Data. In *Photovoltaic Specialists Conference (PVSC), 2017 IEEE 44th* (pp. 1151-1157). IEEE.
- Deshpande, P.M. and **Singh, R.**, 2017. Study and analysis of refinery project risk with composite factor method. In M.G. Korgaonker and J. Koner (eds.), *Managing Construction and Related Sectors: Challenges, Opportunities, Status and Trends (COST) in India*, *International Conference on Construction Real Estate Infrastructure and Projects, 2016* (pp. 86-98). NICMAR.
- **Singh, R.** and Banerjee, R., 2013, June. Estimation of roof-top photovoltaic potential using satellite imagery and GIS. In *Photovoltaic Specialists Conference (PVSC), 2013 IEEE 39th* (pp. 2343-2347). IEEE.
- Balasubramanian, R. and **Singh, R.**, 2011, September. Power system voltage stability analysis using ANN and continuation power flow methods. In *Intelligent System Application to Power Systems (ISAP), 2011 16th International Conference on* (pp. 1-7). IEEE.
- Agarwal, V., Kumar, A., **Singh, R.** and Robin, T.J., 2007, December. Modified PWM schemes for Cyclo-inverters. In *Power Engineering Conference, 2007. IPEC 2007. International* (pp. 655-660). IEEE.

Popular Science Articles

- **Singh, R.**, 2016. Urban India: Reaching out to the Sun. *Geography and You*, 15(94), pp.40-43. ISSN No.: 2347884-5.

CITATION SUMMARY

Source	Number of citations	h-index	Online profile link
Google Scholar	441	10	https://scholar.google.co.in/citations?user=olyImv8AAAAJ&hl=en&oi=ao
Scopus	283	8	https://www.scopus.com/authid/detail.uri?authorId=15825813700

HONORS AND AWARDS

- **World Governance Expedition Scholarship**, Vision India Foundation and the Embassy of Israel, India (2019)
- **Certificate of Outstanding Contribution in Reviewing**, International Journal of Electrical Power and Energy Systems, Elsevier (2018)
- **Certificate of Outstanding Contribution in Reviewing**, Applied Energy, Elsevier (2018)
- **Certificate of Outstanding Contribution in Reviewing**, Solar Energy, Elsevier (2017)
- **Best Poster Award**, 2017 44th IEEE Photovoltaic Specialists Conference, Washington D.C., USA (2017)
- **Doctoral Fellowship**, Ministry of Human Resource Development, Government of India (2012)
- **Postgraduate Scholarship**, Ministry of Human Resource Development, Government of India (2007)
- **Prof. R. N. Tiwari Gold Medal for Academic Excellence**, Motilal Nehru National Institute of Technology, Allahabad (2007)
- **IET International Scholarship**, The Institution of Engineering and Technology (IET), United Kingdom (2006)
- **Institute Merit Scholarship**, Motilal Nehru National Institute of Technology, Allahabad (2006, 2005, 2003)

PHD SUPERVISION

- Abhik Kumar Das, “Explicit Analytical Model for Voltage- Current Characteristics of Illuminated Solar PV Module”, Ongoing.
- Ram Santran, “Dynamics of Low-Carbon Transportation Growth in India: Battery Electric Vehicles vs. H₂-Powered Vehicles”, Ongoing.
- Robins Anto, “Study and analysis of consumer awareness and readiness for adoption of smart grid features in the Indian power distribution sector”, Ongoing.
- Souvik Roy, “Incorporating distributed generation and demand-side resources as non-wired alternatives in distribution resource planning”, Ongoing.
- Minakshi Patel, “Integrated assessment framework for sustainable transportation options”, Ongoing.
- Priya Gupta, “Solar resource variability assessment and forecasting for PV applications”, Ongoing.

M.TECH DISSERTATION SUPERVISION

- Rajat Chauhan, “Energy storage potential of used electric vehicle batteries for renewable energy generation in India”, 2023.

- Arun Singh Mehra, “Optimization and Congestion Management in Peer-to-Peer Energy Trading Network”, 2021.
- Manoj Singh Bisht, “Analysis of variability in power generation from solar PV systems”, 2021.
- Tathagata Biswas, “Metaheuristic optimization of short-term hydrothermal-solar scheduling”, 2021.
- Jatin, “Study of hourly solar radiation site-pair correlations for long term resource planning for solar city applications”, 2020.
- Praveen Kumar, “Analytical study of built-up areas for rooftop solar PV installation”, 2020.
- Shubham Jain, “Development and simulation of structural components of automatic solar panel cleaning mechanism”, 2020.
- Swatantra K. Karna, “Assessment of viability of utility scale solar PV in Province-2 of Nepal using system dynamics approach”, 2020.

REVIEWER EXPERIENCE

Publisher	Journals	Total number of reviews
American Institute of Physics	Journal of Renewable and Sustainable Energy	6
Elsevier	Applied Energy; Computers, Environment and Urban Systems; Frontiers of Architectural Research; International Journal of Electrical Power & Energy Systems; International Journal of Hydrogen Energy; Joule; Solar Energy; Sustainable Cities and Society.	27
IEEE	IEEE Transactions on Transportation Electrification	1
Institution of Engineering and Technology	IET Generation, Transmission & Distribution	2
Nature	Nature Communications	1
Springer	Journal of the Indian Society of Remote Sensing	2
Taylor & Francis	International Journal of Ambient Energy; Journal of Maps; Remote Sensing Letters	14

TEACHING ENGAGEMENTS

- IIT Roorkee
 - Solar Photovoltaic Design and Application (M.Tech), 2023
 - Financing, Policy and Regulations for Renewable Energy (M.Tech), 2023.
 - Instrumentation for Small Hydro Power Station (M.Tech), 2019 – 2023.
 - Solar PV Concepts, Technology and Applications (B.Tech), 2022.
 - Energy Conservation and Management (M.Tech), 2019 – 2022.
 - Renewable Energy Resources’ Development Technology (B.Tech), 2019 – 2022.
 - Hydro Electric Equipment (M.Tech), 2019 – 2022.
 - Rural Electrical Energy System Planning and Design (M.Tech), 2019 – 2021.
- IIT Bhilai
 - Control Systems – I (B.Tech), 2018.
 - Electrical Machines Laboratory (B.Tech), 2018.
 - Mathematical Methods for Engineers (M.Tech), 2018.
- National Institute of Construction Management and Research
 - Management of Power Projects (PG), 2015 – 2018.
 - Energy and Power Infrastructure Management Systems (PG), 2015, 2018.

- Risk Management: Theory and Software (PG), 2015 – 2017.
- Smart Grid Technology and Applications (PG), 2017.
- Static and Rotating Electrical Equipment (PG), 2014.

ADMINISTRATIVE ENGAGEMENTS

- Faculty In-charge, Solar Energy Lab, Department of Hydro and Renewable Energy, IIT Roorkee, Mar 2023 – Till date.
- Faculty In-charge, Building, Department of Hydro and Renewable Energy, IIT Roorkee, Jan 2023 – Till date
- Faculty In-charge, Time-table and Examinations, Department of Hydro and Renewable Energy, IIT Roorkee, Jan 2019 – Till date.
- Faculty In-charge, Electrical Lab, Department of Hydro and Renewable Energy, IIT Roorkee, Jan 2019 – Till date.
- Member, Ranking Analytics Committee (RAC), IIT Roorkee, Jul 2019 – Jun 2021.
- Convener, Faculty Search Committee, Department of Hydro and Renewable Energy, IIT Roorkee, Jan 2019 – Dec 2019.
- Warden, Castle Dio Boys' Hostel, IIT Bhilai, Aug 2018 – Dec 2018.
- Coordinator of PG program in Project Engineering and Management, National Institute of Construction Management and Research, Jul 2017 – Jun 2018.

COURSES OR CONFERENCES ORGANIZED

- Training program on “Impact on Grid due to High Penetration of Renewable Energy”, sponsored by NHPC Ltd., organized at IIT Roorkee, 1st – 3rd Dec., 2022.
- “International Conference on Hydro and Renewable Energy: Net-Zero Carbon Energy Systems”, organized at IIT Roorkee, 17th – 18th Oct. 2022.
- Lead trainer for five-days training program for energy/ utility professionals from SAARC countries on “Power purchase agreements for renewable energy projects”, sponsored by SAARC Energy Centre, Islamabad, Pakistan, 8th Nov – 12th Nov, 2021.
- Training program for professionals from power utilities and regulatory commissions, titled “Green Time-of-Day (ToD) based tariff”, in collaboration with USAID PACE-D 2.0 RE program, organized at IIT Roorkee, 19th Apr, 2021.
- Training program for professionals from power utilities and regulatory commissions, titled “Rooftop solar PV business models for low paying consumers of utilities”, in collaboration with USAID PACE-D 2.0 RE program, organized at IIT Roorkee, 8th Apr – 9th Apr, 2021.
- Faculty Development Programme titled “Modelling and Simulation of Energy Systems”, sponsored by QIP, organized at IIT Roorkee, 11th Jan – 15th Jan, 2021.
- Faculty Development Programme titled “Modelling and Simulation of Energy Systems”, sponsored by AICTE, organized at IIT Roorkee, 19th Oct – 23rd Oct, 2020.
- Short-term course titled “Distributed Control System, Instrumentation, SCADA systems and Communication Network”, sponsored by NHPC, organized at IIT Roorkee, 28th Sep – 30th Sep, 2020.
- Workshop titled “Student Solar Ambassadors Workshop”, organized at IIT Roorkee on 2nd Oct, 2019.

INVITED TALKS

- “New technologies in the power sector”, at National Institute of Construction Management and Research, Pune, Nov. 2022.

- “Solar Resource Assessment for PV Power Projects”, at National Institute of Technology Tiruchirapalli, Feb. 2022.
- “The role of alternate energy technologies in India's growth”, at National Institute of Foundry and Forge Technology (NIFFT), Ranchi, Aug. 2021.
- “Solar Resource Assessment for PV Power Projects”, at Malaviya National Institute of Technology (MNIT), Jaipur, Mar. 2021.
- “Solar PV Potential Estimation”, at Jaypee Institute of Information Technology, Noida, Mar. 2021.
- “Rooftop Solar PV Potential Estimation for Smart City Development”, at Rajasthan Technical University, Kota, Jan 2021.
- “Solar PV Potential Estimation for Power Scenario Planning”, at Dr APJ Abdul Kalam Technical University, Lucknow, Jan 2021.
- “Solar PV Potential Estimation for Planning of Renewable Energy Scenario”, at NIT Tiruchirappalli, Jan 2021.
- “Solar Resource Assessment for Planning of Solar Power Plants”, at IIT Bhilai, Dec 2020.
- “Solar PV Potential Estimation”, at Malaviya National Institute of Technology (MNIT), Jaipur, Oct 2020.
- “Solar PV Potential Estimation”, at Cochin University of Science and Technology (CUSAT), Sep 2020.
- “Higher Studies: Insights into the world of Research and Academics”, at Motilal Nehru National Institute of Technology (MNNIT) Allahabad, Jun 2020.
- “Solar Energy for Rural Development”, at Unnat Bharat Abhiyan, National Institute of Rural Development and Panchayati Raj, Feb 2020.
- “Hydro-electric Equipment”, at Department of Hydro Power Development, Govt. of Arunachal Pradesh, Jan 2020.
- “Estimation of Rooftop Solar Photovoltaic Potential of a City”, at Department of Electrical Engineering, IIT Bombay, Mar 2015.

MEMBERSHIPS OF PROFESSIONAL BODIES

- Member of System Dynamics Society (SDS), since Oct 2022.
- Member of the Institute of Electrical and Electronic Engineers (IEEE), since Feb 2019.
- Professional member of the International Solar Energy Society (ISES), from Oct 2017 to Sep 2020.
- Member of the Institution of Engineering and Technology (IET) from 2006 to 2009.

COMMUNITY SERVICE

- Worked as a full-time volunteer for community service with the Bhaktivedanta Academy for Culture and Education, New Delhi, India from June 2009 to January 2011.