

# Roshan Raghavendra Rao

Ph.D, Indian Institute of Science, Bangalore, India

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## Current Research work

- *Photovoltaic (PV) capacity is increasing worldwide. Soon, PV panels are expected to reach their End-of-Life (EoL) in large numbers. I have been working on a strategy to upcycle EoL-PV panels as building material.*
- *The current work involves understanding the influence of degradation in the PV panels on its optical and thermal properties.*

## Education

**Aug 2017 – June 2023. Doctor of Philosophy (Ph.D)**, Centre for Sustainable Technologies (CST), **Indian Institute of Science**, Bangalore

Submission date: June 2023

8.4/10 CGPA

Advisor: Prof. Monto Mani ([http://cst.iisc.ac.in/sudesi/acad\\_backg/](http://cst.iisc.ac.in/sudesi/acad_backg/))

**Aug 2013 – Dec 2016. Master of Science (Engg) (Atmospheric Science)**, Centre for Atmospheric and Oceanic Sciences (CAOS), **Indian Institute of Science**, Bangalore

Graduation date: March 2017

6.1/8 CGPA

Thesis: A method to derive an aerosol composition from downward solar spectral fluxes at the surface

Advisors: Prof. J Srinivasan and Prof. S K Satheesh (CAOS, IISc)

**Sep 2008 – Apr 2012. Bachelor of Engineering (Mechanical Engineering)**, Nitte Meenakshi Institute of Technology (NMIT) (autonomous, affiliated to VTU), Bangalore

Graduation date: April 2013

8.6/10 CGPA

Project Advisor: Prof. Sekhar Majumdar (NMIT, Bangalore)

### Indexed Journal Publications

1. **Roshan R. Rao**, Suchi Priyadarshani, and Monto Mani, "Examining the use of End-of-Life ( EoL ) PV panels in housing and sustainability," *Solar Energy*, vol. 257, no. June 2023, pp. 210–220, 2023, doi: 10.1016/j.solener.2023.04.033
2. **Roshan R. Rao**, Monto Mani, Praveen C. Ramamurthy, "An updated review on factors and their inter-linked influences on photovoltaic system performance", *Heliyon* 4 (2018) e00815. doi: 10.1016/j.heliyon.2018. e00815
3. **Roshan R. Rao**, H. R. Swetha, J. Srinivasan and Sheela K Ramasesha, "Comparison of performance of solar photovoltaics on dual axis tracker with fixed axis at 13 degrees N latitude" *Current Science*, VOL. 108 (11), 2087 - 2094 (2015)  
(<http://www.currentscience.ac.in/Volumes/108/11/2087.pdf>)

### Conference Publications

1. **Roshan R Rao**, Suchi Priyadarshani, Monto Mani, "An Investigation into thermal performance of buildings built using upcycled End-of-Life Photovoltaic panels", 5<sup>th</sup> Building Simulation Applications 2022 (BSA 2022), July 29 – July 01, 2022, Bozen/Bolzano, Italy
2. Suchi Priyadarshani, **Roshan R Rao**, Monto Mani, Daniel Maskell "Investigating the role of humidity on indoor wellness in vernacular and conventional building typologies", 5<sup>th</sup> Building Simulation Applications 2022 (BSA 2022), July 29 – July 01, 2022, Bozen/Bolzano, Italy
3. **Roshan R Rao** and Monto Mani, "Degradation observation of 9 year old PV modules in Bangalore, India", 46th IEEE Photovoltaic Specialists Conference (PVSC-46), June 16-21, 2019, Chicago, Illinois, USA. DOI: 10.1109/PVSC40753.2019.8981278
4. **Roshan R Rao** and Monto Mani, "Case study on degradation of 8-year-old BiPV modules in Bangalore, India", 7<sup>th</sup> edition of the World Conference on Photovoltaic Energy Conversion (WCPEC-7), June 10-15, 2018, Waikoloa Village, Hawaii, USA. DOI: 10.1109/PVSC.2018.8547411
5. Gayathri Aadithya, **Roshan R Rao** and Monto Mani, "Integrability Comparison between BIPV and BAPV in Tropical Conditions: A Bangalore Case-Study", 2017 IEEE 44th Photovoltaic Specialist Conference (PVSC), Washington, DC, 2017, pp. 604-607. DOI: 10.1109/PVSC.2017.8366449
6. **Roshan R Rao**, Sheela K Ramasesha and J Srinivasan, "Performance Study of rooftop photovoltaic panels", Third National Research Conference on Climate Change, November 3-4, 2012 at IISc, Bangalore. (<http://icrn.in/themes/icrn/presentations/Roshan%20Rao%20introduction.pdf>)

## Other Publications

7. Siddharth Nair, **Roshan Rao**, Tarun Kumar, Guru Prasad G, Manish Kumar, Khadeeja Henna P, Aysha Saifudeen, Monto Mani, "Design of a Do-It-Yourself (DIY) based Solar Powered LED Lighting System for Training and Empowering Rural youth", 7th International Conference on Research Into Design, 9 - 11 January 2019, Indian Institute of Science, Bangalore, India
8. Tarun Kumar, **Roshan Rao**, Praveen C Ramamurthy and Monto Mani, "Safety of Light Emitting Diode (LED) Based Domestic Lighting Rural Context", 15th IEEE India Council International Conference (INDICON) (INDICON 2018), 16 – 18 December 2018, Amrita Vishwa Vidyapeetham, Coimbatore, India
9. Siddharth Nair, **Roshan Rao**, Tarun Kumar, Guru Prasad G, Manish Kumar, Khadeeja Henna P, Aysha Saifudeen, Monto Mani, "Roshini- Developing a DIY Rural Solar Light: utilizing products at End-of-Life (EoL) stage", IEEE Global Humanitarian Technology Conference (GHTC 2018) 18 – 22 October 2018, San Jose, California, USA
10. **Roshan R Rao**, Satheesh S K, J Srinivasan, "High resolution spectral irradiance measurements: Spectral aerosol radiative forcing and techniques to develop an aerosol model", EGU General Assembly 2016, April 16-22, 2016, Vienna, Austria. (<http://adsabs.harvard.edu/abs/2016EGUGA..18.5646R>)
11. **Roshan R Rao**, Satheesh S K, J Srinivasan, "Estimation of optically equivalent aerosol composition using ground-based spectral irradiance measurements", National Climate Science Conference, 2-3 July 2015 at IISc, Bangalore (<http://dccc.iisc.ac.in/Abstracts%20for%20presentation.pdf>)

## Work Experience

1. June 2012 – July 2013. Project Assistant at Divecha Centre for Climate Change, Indian Institute of Science, Bangalore
2. Sep 2016 – July 2017. Project Assistant at Interdisciplinary Centre for Energy Research (SERIUS project), Indian Institute of Science, Bangalore

## Projects

1. Improvement assessment on using a dual axis tracking system for a flat photovoltaic system by conducting experiment using a setup of a dual axis sun tracked photovoltaic system and an optimally fixed angle photovoltaic system on rooftop. (**2012-2013**)
2. Techno-commercial project of installation of 20kWp grid tied three phase solar power plant on JNTM Library rooftop which powers the Main Building of IISc. Project was co-funded by MNRE (**2012-2013**)
3. Performance study of CPV (Concentrated Photovoltaic) in an urban region of India by setting up a 230Wp CPV panel on a dual axis tracker on rooftop at IISc. (**2012-2013**)

4. Analysis of photovoltaic performance variability due to dust, temperature and wind interplay. (2016-2017)

### **Relevant Skills**

#### **Computational Tools expertise**

1. MATLAB and SIMULINK
2. System Advisor Model (Performance and Financial model for renewable energies)

#### **Instruments/Devices operational expertise**

1. Pyranometer (GHI Broadband measurement)
2. Pyrhelimeter (DNI broadband measurement)
3. Thermal imager
4. Spectroradiometer (350 -2500 nm high res. Spectral solar irradiance measurement)
5. I-V Tracers
6. Automatic Weather station

#### **Others**

1. Delivered one-day training to the research assistants as a part of RVE (Remote village electrification) scheme of MNRE on difficulties and uncertainties of solar home systems working on the project headed by Dr. Hippu Salke at NIAS during September 2013.
2. Participated in the “workshop on solar photovoltaics for off-grid electricity access in rural India” held at Divecha Centre for Climate Change, Indian Institute of Science, Bangalore, India on 14th Jan 2013

#### **Media**

1. An Article has been published in page 7, November 5, 2012 of ‘Bangalore Mirror’, a daily newspaper in Bangalore, under the headline “*Sunflower ‘boost’ for solar power; City-based IISc researchers show solar panels which track the sun’s movement like sunflowers generate 20 per cent more energy than fixed panels*”
2. An article has been published in page 52-53, August 16-31, 2017 issue of ‘Down To Earth’, (down to earth archive) an Indian science and environment fortnightly, under the headline “*Exposure to LED lights could be harmful. Scientists suggest a simple solution*”.

#### **Awards**

1. I was awarded the prestigious BHAVAN (Building Energy Efficiency Higher & Advanced Network) fellowship to pursue collaborative research at the Lawrence Berkeley National Laboratory, Berkeley. This work is in collaboration with Berkeley stepping in to identify sustainable end-of-life strategies to address the issue of mounting PV waste worldwide.