

ROSHMI SEN

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RESEARCH INTERESTS

Life Cycle Analysis of Buildings, Multi-objective Optimization in Buildings, AI/ML application in building envelope optimization, Energy Efficient Building Envelopes, Housing for Urban Poor, Green Buildings, Low Exergy Cooling in Tropics, District Cooling, Emission Efficient Cities

EDUCATION

- Doctor of Philosophy, *Indian Institute of Technology Kharagpur* 2021
- Master of City Planning (MCP), *Indian Institute of Technology Kharagpur* 2011
- Bachelor of Architecture (B Arch), *Jadavpur University*, Kolkata, India 2009

EXPERIENCE

Assistant Professor-II (May 2018-present)

National Institute of Technology Rourkela, Department of Planning and Architecture

As full time PhD candidate at IIT Kharagpur (July 2012- April 2018)

Indian Institute of Technology Kharagpur, Department of Architecture and Regional Planning

Research Experience

- Wrote a research proposal along with PhD supervisor during span of doctoral studies which investigated upon the energy efficiency in affordable housing schemes in housing unit and housing cluster levels, funded by the **Housing and Urban Development Corporation of India (HUDCO)**, with a research grant amount of INR 2,100,000/- (March 2014-16)
- **Visiting Student Research Collaborator at the CHAOS lab at the Andlinger Centre for Energy and Environment, Princeton University** between December 2016 and September 2017- worked on low-exergy cooling systems applicable to mass housing in India

Teaching Experience

- Teaching assistant in 2nd and 5th year Architecture Design Studios, Housing and Community Planning course for 3rd year Undergraduate students, Planning Workshop Studio for graduate students

Practicing Architect-Urban Planner (August 2011-July 2012)

M/s Haven Architects, A/6 New Raipur Road, Kolkata 700084

-Prepared Development Planning Report on “Comprehensive Rejuvenation Plan for Rabindra Sarobar” under National Lake Conservation Plan by Ministry of Environment and Forests; scope of work also included primary field surveys, formulating policy guidelines, designing for adaptive reuse of defunct buildings, presentations to client (City Development Authority)

Freelance Architect-Planner (June 2011-July 2012)

Design and preparation of municipal sanction and working drawings of a 3-storied residential cum commercial mixed used building at Kalaikunda, Kharagpur (7500 sq ft built up)

Internship experiences

Deutsche Gesellschaft für Internationale Zusammenarbeit - Advisory Services in Environmental Management (GIZ-ASEM), New Delhi, Summer Intern (May 2010-July ‘10)

Development Consultants Private Limited (DCPL), 24 Park Street, Kolkata 700016

Trainee Architect (July 2007-December 2007)

FELLOWSHIPS, AWARDS AND HONOURS

- **Fulbright Nehru Doctoral Research Fellowship (FNDRF)** (December 2016-August 2017)
C.H.A.O.S Lab, Andlinger Center of Energy and Environment, Princeton University
- **UPP Scholar Award** (declined), (2012)
Admission to funded PhD program in Department of Urban Planning and Policy (UPP), College of Urban Planning and Public Affairs (CUPPA), University of Illinois at Chicago, USA
- **GATE scholar, [All India Rank- 6]** (2009)
Graduate Aptitude Test in Engineering (GATE) is a highly competitive examination, which opens admission for postgraduate and doctoral programs in Indian Engineering and Architecture institutes

PATENTS

- Sen, R. and Kar, A. (2014) *A Two-Tier Compact Bed cum Workspace Combination Readily Reconfigurable from Bed to Workspace and vice versa*. **Indian Patent Office**. Patent no. 370712 (granted, June 2021)

PROJECT GRANTS AS PRINCIPAL INVESTIGATOR

- TEQIP III seed money/minor research grant (2019), for prototyping *a Two-Tier Compact Bed cum Workspace Combination Readily Reconfigurable from Bed to Workspace and vice versa* (INR200,000)
- DST-TDP, grant id TPN 79283, approved with cost Rs.19,99,478/- for 2 years duration (awaiting funding)

PUBLICATIONS IN REFEREED SCI JOURNALS

- Darka, A, Sen, R. and Naik, K. (2025). "Feasibility Study on Energy Saving Scenarios of Preinstalled Vapour Compression Chiller Based District Cooling System" (upcoming, **Journal of Heat Transfer Engineering**)
- Kumar, S. and Sen, R. (2025), 'Are larger cities more emission efficient? Exploring the nexus between household carbon emission, population size and density', **Applied Energy**, Volume 377, Part B, 2025, 124500. <https://doi.org/10.1016/j.apenergy.2024.124500>
- Sen, R., Bhattacharya, S. P., and Chattopadhyay, S (2021), 'Are low-income mass housing envelopes energy efficient and comfortable? A multi-objective evaluation in warm-humid climate', **Energy and Buildings**, Volume 245, 2021, 111055, ISSN 0378-7788, DOI: <https://doi.org/10.1016/j.enbuild.2021.111055>

PUBLICATIONS IN REFEREED NON-SCI JOURNALS

- Sen, R., Teitelbaum, E., and Meggers, F. "Community cooling infrastructure from waste heat among diverse building types in Rourkela Steel Township, India", **Journal of Physics: Conference Series**, Volume 2069, 8th International Building Physics Conference (IBPC 2021) 25-27 August 2021, Copenhagen, Denmark. DOI: <https://iopscience.iop.org/article/10.1088/1742-6596/2069/1/012218>
- Chattopadhyay, S., Banerjee, S. and Sen, R. (2016) "Mapping Low-Carbon Precincts in Residential Neighbourhoods: A comparative case study of the traditional and the modern types." **GSTF Journal of Engineering and Technology (JET)**, Vol.3. No 4 April 2016. DOI: 10.5176/2251-3701_3.4.155
- Sen, R. and Chattopadhyay, S. (2011) "The efficacy of government-initiated slum upgrading programs- A critical analysis of Kolkata slums", **Spatio-Economic Development Record**. 18 (6). pp. 157-163
- Sen, R. (2011) "Revitalizing an ethnic community through cultural tourism: The case of the Chinatown of Kolkata, India", **The International Hospitality and Tourism Student Journal** [online] 3 (3). (accessible at <http://www.sturesearch.ch/?p=923>)

CONFERENCE PUBLICATIONS AND PRESENTATIONS

- Debnath, A. and Sen, R. (2024, Dec 30). "Redevelopment of Pilgrimage Sites in India in the Modern Era- significance, promises and challenges" Oral Presentation. International Conference on Religious Architecture, National Institute of Technology Patna, December 29-30, 2024, Patna.

- Sen, R. and Meggers, F. (2024, April 25). “Adopting district energy systems in Indian context- what are the promises and obstacles?” Virtual Poster. International Conference on Urban Affairs, Urban Affairs Association (UAA), April 24-27, 2024, New York.
- Darka, A, Sen, R. and Naik, K. (2024). “Feasibility Study on Energy Saving Scenarios of Preinstalled Vapour Compression Chiller Based District Cooling System”. *Proceedings of NCRAC 2024*, IIT Madras, March 13-15, 2024, Chennai
- Sen, R., Bandopadhyay, R., Bansal, S., Barman, S and Sio, S. (2022). “De-carbonization and environmental planning roadmap for Rourkela Steel City - a city under transformation”. *Proceedings of ISOCARP 2022, October 3-6, Brussels, Belgium*
- Kumar, S. and Sen, R. (2022, August 30-1) How do urban carbon dioxide emissions, urban scale and population density relate to each other? A literature-based discovery. *International Association for Urban Climate (IAUC) virtual poster session*, Sydney, Australia.
- Sen, R., Bhattacharya, S. P., and Chattopadhyay, S. “Comfort-energy nexus in naturally ventilated affordable mass housing with alternative constructions in the developing world”, *EGU General Assembly 2021*, online, 19–30 Apr 2021, EGU21-8003, <https://doi.org/10.5194/egusphere-egu21-8003>, 2021.
- Sen, R. and Chattopadhyay, S. (2021) “Evaluating affordable housing schemes – a conceptual framework for a triple bottom line approach towards sustainability accounting”, *Proceedings of International conference on Resilient and Livable City Planning*, Vijayawada, 10-13 February 2021, SPA Vijayawada, pp. 376-378.
- Sen, R., Meggers, F. and Chattopadhyay, S. (2017) “Planning for centralized cooling systems in high density mass housing in tropics – towards smart energy policy in residential communities.” *Proceedings of 53rd ISOCARP World Congress*, 23rd-27th October, Portland, USA.
- Banerjee, S., Sen, R. and Chattopadhyay, S. (2016) “A Comparative Study on the Effects of Urban Morphology on the Urban Heat Island Profile in Residential Neighbourhoods: A Case of Kolkata, India.” *Proceedings of 32nd PLEA International Conference*, Los Angeles, 11-13th July, Los Angeles, USA. ISBN: 978-0-692-74961-6
- Sen, R., Kandra, S. and Chattopadhyay, S. (2014) “Investigation on the Performance of Alternative Walling Materials in an Affordable Housing Unit situated in Warm Humid Climate.” *Proceedings of 30th PLEA International Conference*, vol.1., Ahmedabad, 14-17th Dec. Ahmedabad.CEPT University, Center for Advanced Research in Building Science & Energy pp. 524-531
- Sen, R. and Maparu, T.S. (2012) “Metamorphoses of Cities: Issues of urbanization and case study of three significant urban growth centers in India”. *International Symposium on Cities under Change*. Kolkata, 17-19 Oct 2012. Centre for Built Environment
- Chattopadhyay, S. and Sen, R. (2011) “Housing the urban poor and the issues of land: a critical analysis”, *Proceedings of 59th National Town and Country Planners’ Congress: Land as a resource for urban development*, Chandigarh. 10-12thFeb. New Delhi. ITPI. pp. 284-293

COURSES TAUGHT (SINCE 2018) at NIT Rourkela

Undergraduate

Architectural Design VIII (PA412), Advanced Building Construction Studio (PA431), Climate Responsive Architecture (PA2801), Non-Graphic Computer Application (PA1901), Advanced Building Materials (PA4301), Interior Design (PA3109), Advanced Structural Systems (PA5401), Building Construction Sessional-I (PA1302), Estimation Costing and Specification Theory (PA3906), Estimation Costing and Specification Sessional (PA3904), Academic Portfolio (PA4901)

Postgraduate (currently offered to PhD students)-

Environmental Planning (PA6405), Sustainable Development (PA6400)

COURSES DEVELOPED at NIT Rourkela

Undergraduate- Environmental Impact Assessment in Architecture, Parametric Design Studio, Architectural Photography Studio, Climate Responsive Architecture, Advanced Building Material, Green Building Rating Systems

Postgraduate- Environmental Planning, Sustainable Development

STUDENT MENTORSHIPS

At NIT Rourkela, B Arch

- 2019-20 - “National Academy of Administration, Parchmarhi- a green rated building” by Harsha Reddy; “NetZEB Nature Interpretation Center and Museum” by Dhananjay Naik, 2019
- 2020-21- “Tourism Hub and Demonstration Center at Bishnupur” by Abhishek Das; “School for Deaf and Mute”, by Jyothika Bhukiya
- 2021-22- “Center for self-employment for rural women and provision of education at Balasore” by Swarup Kumar; “Sports complex in Vijayawada” by Chaparala Naveen Kumar
- 2022-23- “Maritime Museum in Kolkata” by Shradha Sio
- 2023-24- “NetZero Business Hotel” by Naga Sai Lokesh; “Agricultural Hub” by Metta Bhaskara Rao

At NIT Rourkela, M Tech

- 2023-24- “Feasibility study on energy saving scenarios of a district cooling system in a campus community”, by Aditya Darka (co-supervision with Mechanical Engineering Department)

At NIT Rourkela, summer interns from other institutes

- 2019-20 –Vaidehi (SPA Delhi), Akanksha Bhardwaj (BIT Meshra), Soumya Ranjan Mohanta (SPA Bhopal)

At IIT Kharagpur (as a PhD student)

- “An investigation on the urban heat island effect in various housing clustering layouts for affordable housing schemes”- Master of City Planning project by Shreya Banerjee, 2016 (co-mentorship along with PhD advisor)

ADMINISTRATIVE RESPONSIBILITIES

At NIT Rourkela- Professor in-charge (PIC) of Environment lab, PIC Departmental Library, PIC Departmental Website, Faculty advisor for Batch of 2021-26.

INVITED TALKS

- Cooling your home: How to connect residential buildings to district cooling? (Webinar) - 29.05.2019, as a Member of District Energy in Cities Technical Taskforce, *United Nations Environment Programme (UNEP)*, hosted by Copenhagen Center on Energy Efficiency; available at: <https://www.youtube.com/watch?v=Hbg3Wcy7bQA>
- SDGs and Implementation of District Cooling in India (Webinar)- 8.11.2020, on World Town Planners Day, hosted by Institute of Town Planners, India, West Bengal Chapter (ITPI-WBRC)
- “From an Architect, Designer and Urban Planner to a Building Scientist- my journey with the interdisciplinary”- 7.02.2022, The Gender Advancement for Transforming Institutions (GATI), hosted by the department of Electrical Engineering, NIT Rourkela
- Integrating Radiant Heating and Cooling in Built Environment Design - 28.10.2022, Bhubaneswar, URJAVARAN 2022-23: Dialogues in Sustainable HVAC and Architecture, *Indian Society of Heating Refrigeration and Air conditioning Engineers (ISHRAE)*, hosted by ISHRAE Bhubaneswar chapter
- Costs and benefits of introducing centralized cooling in Indian buildings (Webinar)- 28.05.2024, organized by ISHRAE Bhubaneswar chapter for ISHRAE India

WORKSHOPS

- Convener/Coordinator, “Parametric Form Finding with Architectural Design Tools”, in collaboration with National Association of Students of Architecture [3-7th February 2024]
- Co-Convener, ACRESERVE 2023, ISHRAE Bhubaneswar Chapter [6th October 2023]
- Convener/Coordinator, workshop on brick flat dome construction with Ar Laurent Fournier and undergraduate students at Planning and Architecture Department, NIT Rourkela [3rd September 2024]

PEER REVIEW ACTIVITIES

- Peer reviewer for Elsevier journal Habitat International

- Peer reviewer for International Building Performance Simulation Association (IBPSA) conferences 2017, 2019, IBPC conference 2021
- Member of DC-NBC team – part of the team that has reviewed and edited the chapter on District Cooling, upcoming in the National Building Code 2025 (Draft) of India
- External evaluator for international doctoral thesis of Mersheann Srimin Perera from Curtin University, Australia, 2024

PROFESSIONAL CERTIFICATIONS

- Indian Green Building Council- Accredited Professional (IGBC AP), issued by Confederation of Indian Industries (CII), Credential ID: IGBCAP240690
- Geospatial Technologies for Urban Planning, issued by Indian Institute of Remote Sensing, Indian Space Research Organization (ISRO), Credential ID: EDU162016116220

MEMBERSHIP IN PROFESSIONAL SOCIETIES

- Member, Council of Architecture (CoA), India
- Member, Indian Institute of Architects (IIA)
- Member, International Association for Building Performance Simulation (IBPSA), India
- Member, Institute of Town Planners (ITPI), India
- Member, Indian Society of Heating, Refrigeration and Air Conditioning (ISHRAE)
- Member, Indian Green Building Council (IGBC)
- Member, International Association for Urban Climate (IAUC)

OUTREACH ACTIVITIES

- Chapter working committee member, ISHRAE Bhubaneswar Chapter
2023-24: Organizing climate change awareness related competitions in schools of Rourkela in various times of the year as *K-12 chair*
2022-23: Organized online essay writing competition on International Women's Day 2024 as *Women chair*
- Question paper setter for Anna University's M Arch Program on Real Estate Economics; 2023 & 2024

PERSONAL SKILLS, INTERESTS AND ACCOLADES

Languages: *English, Bengali, Hindi*

Leadership Activities: Research Scholars' Representative for the Research Scholars community of the Department of Architecture and Regional Planning at IIT Kharagpur (2014-15),
Member of ISHRAE Chapter Working Committee of Bhubaneswar Chapter (2023-24, 2024-25)-
Woman Chair
Chair of K-12 program, Bhubaneswar Chapter 2024-25
Woman Chair, ISHRAE, East Zone (2025-26)

Artistic: *Photography:* Acceptances in national and international photo contests,
Painting: Acceptance in national level painting exhibition held in the Academy of Fine Arts Kolkata along with professional artists - one of the most prestigious art galleries in Kolkata, Dec2013.

Interdisciplinary Collaborative Practice (*diverse team building during student life*):
First Prize winner of interdisciplinary design competition, 'El-Dorado' - a city planning problem with optimized metro route design, as a part of *Kshitij 2010*, the tech fest of IIT Kharagpur
Second Prize winner of interdisciplinary design competition, 'Kryotech' - a commercial green building design as a part of *Kshitij 2011*, the tech fest of IIT Kharagpur

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