



RENEWABLE AND SUSTAINABLE ENERGY LABORATORY (RSEL)

KATHMANDU UNIVERSITY

RSEL ANNUAL BULLETIN-2024

MESSAGE FROM LEAD



This year has marked significant achievements for our laboratory in the pursuit of sustainable energy. We are dedicated to advancing the transition to 100% renewable energy, fostering a circular bio-economy, enhancing building energy efficiency and climate change. Despite operating in a resource constraint region, these obstacles have strengthened the resilience and dedication of the team. In 2024, we have not just met several challenges but grown through them, transforming obstacles into opportunities for resilience and impactful progress.

Our laboratory has flourished despite the hurdles, fueled by new connections and ideas that have enriched our collaborations. With support from German Academic Exchange Program (DAAD), Swedish Research Council, NORPART, Norway, ERASMUS plus, EU, the Academy of Finland and EnergizeNepal, we are engaged in seven international and one national project. These collaborations have facilitated the exchange of thirty-six exchange students from Kathmandu University to other universities, eight students from foreign universities to Kathmandu University lasting three to six months in Germany, Sweden, Norway and Thailand. We are a multidisciplinary team of five PhD fellows and six full time non-degree researchers working together towards the common goal of advancing sustainable energy.

We look forward to forging new partnerships with collaborators who align with our commitment and vision.

-Prof. Sunil Prasad Lohani, Ph.D.

CONGRATULATIONS TO THE LEAD

The RSEL team is pleased to announce the appointment of our esteemed lead, Prof. Sunil Prasad Lohani, Ph.D. to the position of full professor. This significant achievement is a well-deserved acknowledgement of his unwavering dedication, expertise and impactful contributions to the academic and scientific community. Prof. Lohani, who established RSEL, has played a crucial role in shaping its vision and growth. Under his leadership, the lab has become a hub for innovation, providing numerous opportunities for students and researchers to thrive. Over the years, Prof. Lohani has not only guided the direction of RSEL but has also served as a mentor to many, inspiring them to push boundaries and achieve excellence. His ability to lead with vision and compassion has transformed lives and elevated the work of the entire team.

Please join us in congratulating Prof. Lohani on this remarkable achievement. We are incredibly proud to have such a distinguished leader and scholar to inspire us, and are excited about the advancements RSEL will achieve under his guidance.



ONGOING PhD RESEARCH

Geeta Bhatta



Pathways to 100% Renewable energy in Nepal

The main objective of this research is to set pathways for the source diversification (high share of Solar) with hydropower. Comprehensive GIS-based machine learning approach for solar resource assessment will be carried out for techno-economical potential of solar PV in Nepal. The study will estimate the capacity of energy storage needed to balance high share for solar energy and RoR hydro. For storage technology, the focus will be on pumped hydro energy storage (off-river) to balance load fluctuation.

Navin K. Jha



Technical and Environmental Assessment of Household Bio-digester in Nepal

This study will conduct technical assessment of existing household bio-digesters in two different altitudes (Terai and Hilly region). The effect of temperature on biogas digestion will be evaluated and laboratory-scale biogas digester will be used for validation, a life cycle assessment (LCA) and inventory analysis of household biogas plants in Nepal will be

conducted. Further, analysis on social perception of biogas plants as alternative energy sources will be conducted.

Sujesh Shrestha



Techno-Economic Analysis of Hydrogen Utilization in Anaerobic Digestion Process of Biogas Plants in Nepal

The study will investigate Bio-methanation of CO₂ sourced from biogas into CH₄ through integration of H₂ in anaerobic digestion process. It will assess the reactor's performance of converting CO₂ into CH₄ through establishment of lab scale reactor and H₂ utilization and CO₂ conversion. Further, it will explore probable sources of H₂ for Nepal and LCA and Economic Analysis of overall production process (from H₂ production and utilization to CH₄ production).

Utsav S. Rajbhandari



An Integrated Energy System Analysis for Nepal's Pathway to Net Zero Emission

This study will focus on policy and planning based analyses – especially the ones formulated by Nepal. Nepal aims for Net Zero Emissions by 2045, but the energy sector faces a significant gap between current trends and targets. Thus, the study aims to measure the extent of these gaps, explore strategic options for clean energy development, and evaluate optimal pathways for supporting net zero emission target using integrated energy system models.

Ravi Suwal



Climate Smart Building in Context of Nepal: An Evaluation Based on Mitigation and Adaptation Approaches

The research aims to address issues of household thermal energy consumption, emphasizing impact of climate change on residential buildings. It will addresses gaps in understanding thermal energy needs, retrofitting strategies and climate smart construction. The main objective is to investigate variations in energy demand within Nepal's residential sector, specifically in response to weather-induced alterations. This research contributes to the formulation of effective strategies for adaptation and mitigation within residential buildings, underscoring the need for proactive measures.

FULL TIME NON DEGREE RESEARCHER



Poushan Shrestha



Urusha Gautam



Smika Sharma



Sarvesh Pandey



Shrija Mandal



Ashal Adhikari

Exchange Students (2023/24)

Program	Location	Student	Level	Year
SEED	KU to Linnaeus, Sweden	Buddha Shrestha	PhD	2024
		Ravi Suwal	PhD	2023
		Ajay Kr. KC	PhD	2023
		Navin Jha	PhD	2022
	KU to KTH, Sweden	Hari K.C.	PhD	2024
		Kushal Shrestha	PhD	2023
		Geeta Bhatta	PhD	2022
Re-Tech	KU to USN, Norway	Niroj Koirala	Master's	2024
		Subham Kandel	Master's	2024
		Sujesh Shrestha	PhD	2023
		Rajani Neupane	Master's	2023
		Ayush N. Ghimire	Master's	2023
		Ashish Dutta Bhatta	Master's	2023
eREET	KU to TH Koln, Germany	Geeta Bhatta	PhD	2024
		Nava Raj Shrestha	Master's	2024
		Naman Gurung	Bachelor's	2024
		Subodh Luitel	PhD	2023
		Gaurav Tamrakar	Master's	2023
		Dipesh KC	Master's	2022
		Rohini Khyen	Master's	2022
		Upama Nepal	Master's	2022
		Prabin Dhakal	Master's	2021
		Manisha Basukala	Master's	2021
		Sunder Shrestha	Bachelor's	2021
	TH Koln, Germany to KU	Nicolas Guzman Chaves	Master's	2024
		Jorge Mayorga	Master's	2023
ForHimSDG	KU to AIT, Thailand	Ujjwal Pradhan	PhD	2024
		Utsav S. Rajbhandari	PhD	2023
		Sagar Pathak	Master's	2023
		Asmita Bhattarai	Master's	2024
	AIT, Thailand to KU	Sumnima Ghimire	PhD	2024

		Tshering Lhamo Dukpa	PhD	2024
		Nihal Ahmad	PhD	2024
		Sarnai Battulga	PhD	2023
		Trishala Singh Rathour	Master's	2023

Besides the part-time exchange students, two students from Kathmandu University, Mr. Nawaraj Thapa Magar and Mr. Atlantic Bhandari, are pursuing their **Master's degree** at the **University of South-Eastern Norway (USN)** under the **Re-Tech, NORPART Project**.

COLLABORATIONS

Our lab has had the privilege of collaborating with esteemed professors from prestigious universities worldwide.

Continent	University
Europe	Potsdam institute for Climate Impact Research (PIK), , Germany
	University of South Eastern Norway (USN), Norway
	Karlsruhe Institute of Technology (KIT), Germany
	KTH Royal Institute of Technology (KTH), Sweden
	University of Turku (UTU), Finland
	University of Eastern Finland (UEF), Finland
	Linnaeus University, Sweden
	Wageningen University & Research (WUR), the Netherlands
	Lund University, Sweden
	University of Groningen, the Netherlands
	TH Köln – University of Applied Sciences, Germany
	Norwegian University of Science and Technology (NTNU), Norway
	Berliner Hochschule für Technik (BHT), Germany
	Heidelberg University, Germany
North America	University of California, Berkeley, USA
	University of Kentucky, USA
	Duke University, USA
	Seattle University (SU), USA
Australia	Australian National University (ANU), Australia
	Charles Sturt University, Australia
Asia	Tribhuvan University. Nepal

	Purbanchal University (PU), Nepal
	Manmohan Technical University, Nepal
	Asian Institute of Technology (AIT), Thailand
	TERI School of Advanced Studies (TERI SAS), India
	Birla Institute of Technology (BIT), India
	Beijing University of Chemical Technology (BUCT), China
	University of Science and Technology Beijing (USTB), China
	University of Sri Jayewardenepura, Sri Lanka

ONGOING PROJECTS

Year	Title	Countries Involved
2025 to 2026	Blended Learning Environments for Nepal's Dynamic Energy Development using an Interactive Distance Education Approach (BLENDED-IDEA). (PI: Prof. Sunil Pd. Lohani at Kathmandu University, KU)	Germany, Italy, Nepal
2024 to 2026	Advanced Climate Change Education for Sustainable futures and Systems change (ACCESS). Funded by ERASMUS PLUS. (PI: Prof. Sunil Pd. Lohani at Kathmandu University, KU)	Finland, Nepal
2023 to 2026	Technological and socio-economic solutions to reduce small-scale combustion emissions in Nepal (SmokefreeHomes). Funded by the Research Council of Finland. (PI: Prof. Sunil Pd. Lohani from Kathmandu University, KU)	Finland, Nepal
2022 to 2026	Instituting of Research-based education systems for the development of Renewable energy technology in the Circular economy (Re-Tech). Funded by Norwegian Partnership Programme for Global Academic Cooperation (NORPART). (PI: Prof. Sunil Pd. Lohani at Kathmandu University, KU)	Norway, Nepal, Bangladesh, Sri Lanka
2022 to 2025	Promoting Himalayan Development by Strengthening Teaching and Research on Sustainable Development Goals (ForHimSDG). Funded by the Federal Ministry for Economic Cooperation and Development, German Academic Exchange Service (DAAD). (PI: Prof. Sunil Pd. Lohani at Kathmandu University, KU)	Germany, Thailand, Nepal
2022 to 2025	The Doctoral school in Sustainable Energy Engineering (SEED). Funded by Swedish Research Council (VR). (PI: Prof. Sunil Pd. Lohani at Kathmandu University, KU)	Sweden, Bolivia, India, Nepal
RECENTLY COMPLETED PROJECTS		
2021 to 2024	Energizing Higher Education – Renewable Energy for Economic Transition (e-REET). Funded by German Academic Exchange Program (DAAD), Germany. (PI: Prof. Sunil Pd. Lohani at Kathmandu University, KU)	Germany, Nepal

2022 to 2024	Demonstrating applicability of modified prefabricated household floating drum biodigester (ENEP-RENP-II-22-04). Funded by EnergizeNepal Project (NORAD). (PI: Prof. Sunil Pd. Lohani at Kathmandu University, KU)	Nepal
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RECENT PUBLICATIONS (2023-2024)

1. Bhatta, G., Lohani, S. P., KC, M., Bhandari, R., Palit, D., & Anderson, T. (2025). Harnessing solar PV potential for decarbonization in Nepal: A GIS based assessment of ground-mounted, rooftop, and agrivoltaic solar systems for Nepal. *Energy for Sustainable Development*, 85, 101618. <https://doi.org/10.1016/j.esd.2024.101618>
2. Mandal, S., Adhikari, A., Chaulagain, A., Thapa, A., Gautam, S. M., Lohani, S. P., & Uprety, B. (2024). Techno-enviro-economic assessment of hydropower-driven decarbonization pathways for Nepalese cement industry. *Journal of Environmental Chemical Engineering*, 114729. <https://doi.org/10.1016/j.jece.2024.114729>
3. Jha, N. K., Lohani, S. P., Khatiwada, D., Pradhan, P., & Shakya, S. R. (2024). Assessing greenhouse gas emissions and decarbonization potential of household biogas plant: Nepal's case study. *Energy for Sustainable Development*, 83, 101592. <https://doi.org/10.1016/j.esd.2024.101592>
4. KC, D., Lohani, S. P., Shrestha, P., & Xue, C. (2024). Expert perspective on technological choice for cooking energy transition in Nepal. *Clean Energy*, 8(4), 40–48. <https://doi.org/10.1093/ce/zkae035>
5. Timilsina, M. S., Chaudhary, Y., Shah, A. K., Lohani, S. P., Bhandari, R., & Uprety, B. (2024). Syngas composition analysis for waste to methanol production: Techno-economic assessment using machine learning and Aspen plus. *Renewable Energy*, 228, 120574. <https://doi.org/10.1016/j.renene.2024.120574>
6. Jha, N. K., Mainali, B., & Lohani, S. P. (2024). Strategy for Circularity Enhancement in Bioeconomy Sector: A Case Study from Biogas Sector of Nepal. *Circular Economy and Sustainability*. <https://doi.org/10.1007/s43615-024-00402-5>
7. Shaw, T. K., Rajendran, D. K., Raghuvanshi, S., & Lohani, S. P. (2024). Evaluating the influence of calcined eggshells and ultrasonication in the Co-digestion of avoidable and unavoidable Food Waste and OLS regression analysis of the reactor system. *Journal of Cleaner Production*, 465, 142789. <https://doi.org/10.1016/j.jclepro.2024.142789>
8. Lohani, S. P., Shaw, T. K., Shrestha, S., Dhungana, B., Jha, N. K., Chen, H., Mohamed, A., Cheng, S., & Raghuvanshi, S. (2024). Household biogas technology in the cold climate of low-income countries: a review of sustainable technologies for accelerating biogas generation. *Progress in Energy*, 6(3), 032003. <https://doi.org/10.1088/2516-1083/ad407f>
9. Lohani, Sunil Prasad, Acharya, Renisha, Shrestha, Poushan, Shrestha, Sundar, Manisha, K. C., Pradhan, Prajal (2024): Sustainable biogas production potential in Nepal using waste biomass: A spatial analysis - Sustainable Development. <https://doi.org/10.1002/sd.2937>.
10. Shaw, T. K., Rajendran, D. K., Raghuvanshi, S.*, & Lohani, S. P. (2023). Anaerobic co-digestion of unavoidable and avoidable food-waste with addition of eggshells and applied kinetic studies. *Materials Today: Proceedings*, October 2023. <https://doi.org/10.1016/j.matpr.2023.11.138>
11. Cheng S.*, Lohani S.P.*, Rajbhandari U.S., Shrestha P., Shrees S., Bhandari R., Jeuland M.,(2023): Sustainability of large-scale commercial biogas plants in Nepal, *Journal of Cleaner Production*, 139777, <https://doi.org/10.1016/j.jclepro.2023.139777>.
12. Sedai A.*, Dhakal R., Koirala P., Gautam S., Pokhrel R., Lohani S.P., Moussa H., Pol S. (2023): Renewable energy resource assessment for rural electrification: A case study in Nepal, *International Journal of Low-Carbon Technologies* 1–13 <https://doi.org/10.1093/ijlct/ctad089>
13. Shrestha S., Pandey R., Aryal N.*, Lohani S.P.* (2023): Recent advances in co-digestion conjugates for anaerobic digestion of food waste, *Journal of Environmental Management*, 345, 118785, <https://doi.org/10.1016/j.jenvman.2023.118785>.

14. Chen, H., Xu, Q., Cheng, S., Wu, T., Boitin, T., Lohani, S.P., Mang, H.P., Li, Z., Wang, X. (2023): Comprehensive Analysis and Greenhouse Gas Reduction Assessment of the First Large-Scale Biogas Generation Plant in West Africa. *Atmosphere*, 14, 876. <https://doi.org/10.3390/atmos14050876>.
15. Jiang F., Xiong Y., Xu Q., Lohani S.P., Jiang Z., Zhao Y., Peng X. (2023): Materials, process, and applications in energy storage systems, *Frontiers in Energy Research*, 11, 1221873. <https://doi.org/10.3389/fenrg.2023.1221873>.
16. Xu Q., Yang G., Wang C., Liu Z., Zhang X., Li Z., Lohani S.P., Zhao Y., Xiong Y., Ding Y. (2023): Experimental study on the reinforcement of a gravity heat pipe based on a latent thermal functionally fluid, *Energy*, 278, 127782, <https://doi.org/10.1016/j.energy.2023.127782>.
17. Kafle U., Anderson T*, Lohani S. P.* (2023): The Potential for Rooftop Photovoltaic Systems in Nepal, *Energies*, 16 (2), 747. <https://doi.org/10.3390/en16020747>

KEY ACTIVITIES

Workshops and Seminars

1. **Session chair** at the **International Conference on Sustainable Energy by Asian Institute of Technology (AIT), Thailand** - October 2024.



2. **Presented two papers** on clean cooking transition and circular bioeconomy at the **International Conference on Sustainable Energy by Asian Institute of Technology (AIT), Thailand** - October 2024.



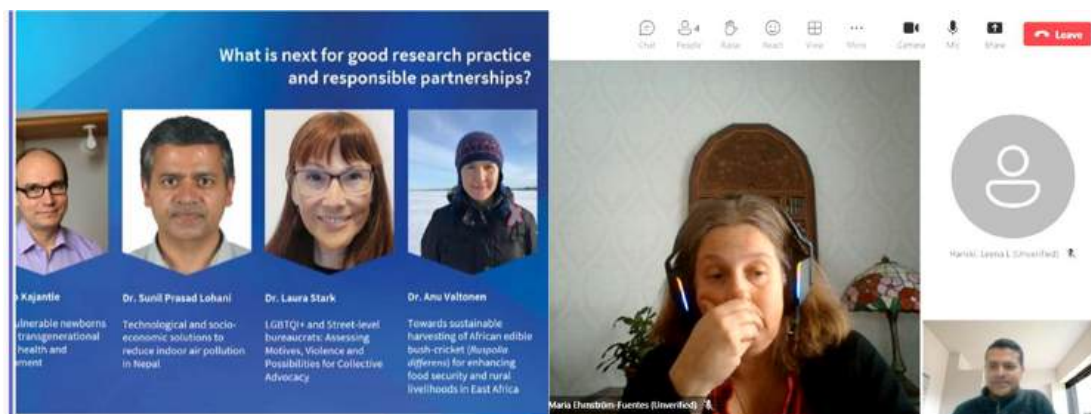
3. International Workshop on **Technological and Socio-economic Solutions to Reduce Indoor Air Pollution in Nepal**– October 2024 (Activity of SmokeFreeHomes Nepal)



4. International Workshop on **Current Status of Climate Change Curriculum at Kathmandu University and Purbanchal University**– September 2024 (Activity of ACCESS, Erasmus+).



5. **Panel session** at the opening seminar “Towards Sustainable Partnerships, DEVELOP2” organized by **the Research Council of Finland** – February 2024.



6. **Keynote speaker** on the **International Conference on 15th Operational Research Society of Nepal (ORSN)** - February 2024.



7. **Project Dissemination Workshop for Demonstrating the Applicability of Modified Prefabricated Household Floating Drum Biodigester**– September 2024 (Activity of EnergizeNepal,NORAD).



8. Seminar on **Biogas, Biomass, and Waste Management**-March 2024 (Activity of NORPAT- Re-Tech).



9. **International workshop on Energy Transition for Sustainable Development** (Activity of SEED project) – January 2024.

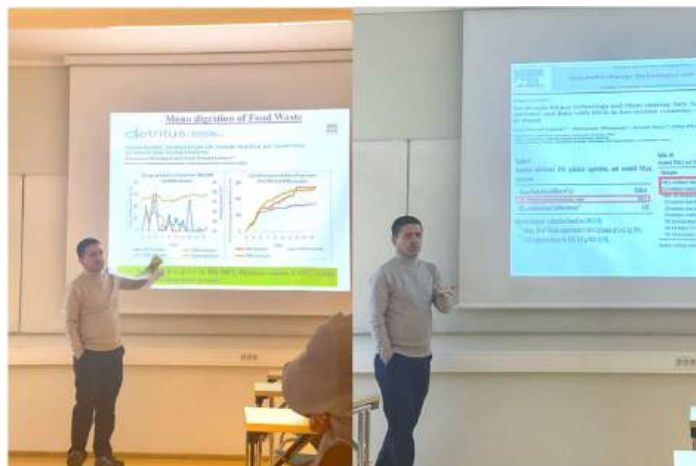


Guest Lectures

1. Guest lecture session at **Linnaeus University, Växjö** to the **SEED exchange doctoral student**-September 2024.



2. A guest lecture session by **Prof. Sunil Pd. Lohani** at the University of South Eastern on Biogas - March 2024.



3. A guest lecture session by **Prof. Sunil Pd. Lohani** at the Khwopo College of Engineering on Energy Source Diversification in Nepal - July 2024.



4. A guest lecture session by **Assoc. Prof. Rajan Thapa, University of Eastern Norway** on “**Biomass Gasification**” under the Re-Tech project - March 2024



Networking Visits and Meetings

1. Interaction between the graduate students of MPOSE, KU and Dr. Rajan Kumar Thapa, Associate Professor at the University of South-Eastern Norway (USN) - November 2024.



2. Meeting with Deputy Director and Energy Research Group at **Chulaongkorn University**, Thailand - October 2024.



3. Consortium meeting at the **KTH Royal Institute of Technology**, Stockholm – September, 2024.



4. Visit to the **Ministry of Foreign Affairs of Finland**, the **University of Turku**, **Finland Future Research Center**, **Helsinki University**, **Aalto University** and **Wageningen University** as part of the **ACCESS project** - July 2024.



5. Visit to the **University of South Eastern Norway** under the **NORPART project** - March 2024



6. At the **Research Institute for Sustainability (RIFS)**, **Potsdam University of Climate Impact Research (PIK)** and **Berlin University of Applied Science (BHT)** - March 2024



7. Discussions with the **University leadership** of **Gandaki University** and interaction with **private stakeholders**- January 2024



Project Meetings

1. ACCESS project members interact with the students and faculty of Mechanical Department and Environment Department in Kathmandu University



2. RSEL organized an exchange experience meeting for the exchange students under the e-REET project.



3. RSEL organized an exchange experience meeting for the exchange students under the **ForHIM-SDG project**.



Field Visits

1. Monitoring visit under **Re-Tech Project** by RSEL team- January 2024



Contact details

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