SmokeFree Homes NEPAL

Results Sharing Workshop

on

Technological and Socio-economic Solutions to Reduce Indoor Air Pollution in Nepal

Project Overview

Development Research Academy Programme DEVELOP2, 2023-2026

Prof. Rejina Maskey Byanju, PhD

Central Department of Environmental Science

Tribhuvan University, Nepal

Squar Hotel, Lalitpur, April 15, 2026

DEVELOP2

Ministry for Foreign Affairs of Finland

Research Council of Finland

RSEL

UNIVERSITY OF EASTERN FINLAND

Project Information

- Development research – DEVELOP2 (2023–2026)

Ministry for Foreign Affairs of Finland

- Principal investigator: Research Director Dr. Jarkko Tissari

University of Eastern Finland, Department of Environmental and Biological Sciences (UEF)

UNIVERSITY OF EASTERN FINLAND

Project partners, UEF/FINE

- **Small-Scale Combustion group**
- **Doc. Jarkko Tissari**

SIMO – Mobile small-scale combustion simulator

UEF// University of Eastern Finland

Curtesy: SmokeFreeHomes Nepal 1st WS, Kathmandu, Nepal JTissari

Project partners, UEF/IEOH

- **Dr. Marko Hyttinen**

GOAL

Mitigation of exposure and control of airborne contaminants in indoor and working environments, minimization of adverse health effects.

FOCUS

- *Exposure assessment*
- *Health effects*
- *Risk assessment*

UEF// University of Eastern Finland *Curtesy: SmokeFreeHomes Nepal 1st WS, Kathmandu, Nepal JTissari*

Project partners, KU

Renewable and Sustainable Energy Laboratory (RSEL)

Kathmandu University

RSEL Thematic Area

- Net zero emissions and 100% Renewables
- Energy Storage
- Building Energy Efficiency
- Circular Bio-Economy
- Clean energy transition (clean cooking, transport etc.)

Dr. Sunil P Lohani

Lead
Renewable and Sustainable Energy Lab

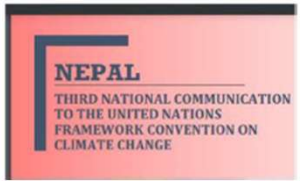
School of Engineering
Kathmandu University

Curtesy: SmokeFreeHomes Nepal 1st WS, Kathmandu, Nepal JTissari

Project partners, TU

Rejina Maskey Byanju, PhD
Professor

Air Pollution Emission Sources Estimation

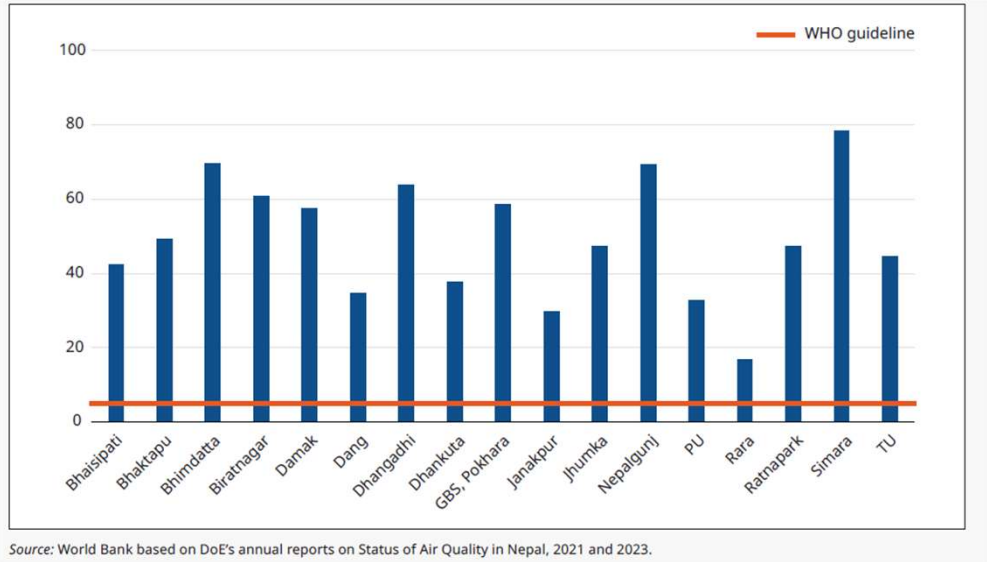


Emission Factor and Emission Inventories: Develop country specific Emission Factors

Background

Nepal is among most polluted country

Fig.1 : Annual average $PM_{2.5}$ concentrations in the Kathmandu Valley and the Terai region



Source: World Bank based on DoE's annual reports on Status of Air Quality in Nepal, 2021 and 2023.

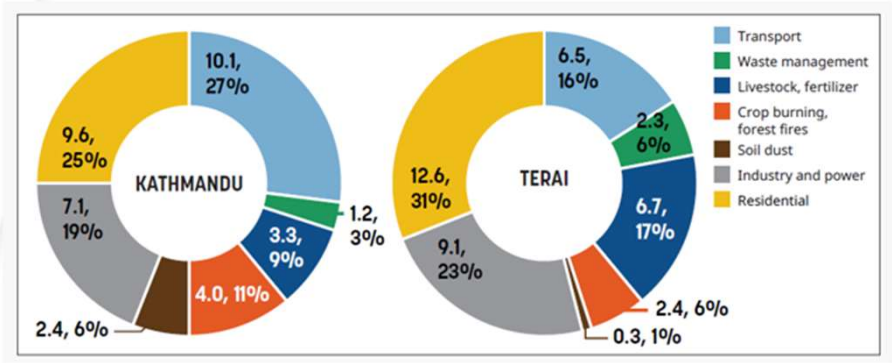


Fig.3 : Contributions of different source sectors to population-weighted annual-average $PM_{2.5}$ concentrations in Kathmandu and Terai in 2021 (in µg/m^3 and %)

(source: World Bank. 2025)

Background contd.

Household air pollution is a silent killer in Nepal, disproportionately affecting women and children

- Globally 2.4 billion people rely on polluting solid fuels *(WHO, 2022)*
- Air pollution in Nepal was estimated to have led to over 48,500 premature deaths and the loss of more than 1.4 million disability adjusted life years (DALY).
- 26,000 premature deaths from $PM_{2.5}$ alone (nearly 12,000 from ambient exposure and more than **14,000** from household exposure- **RBC**) (World Bank, 2019).

Photo: StoveTeam International/ECPA

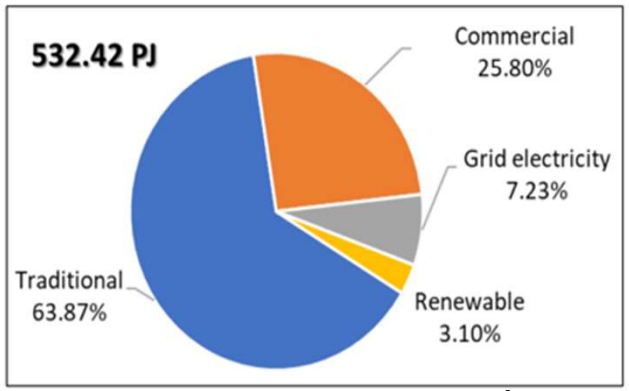


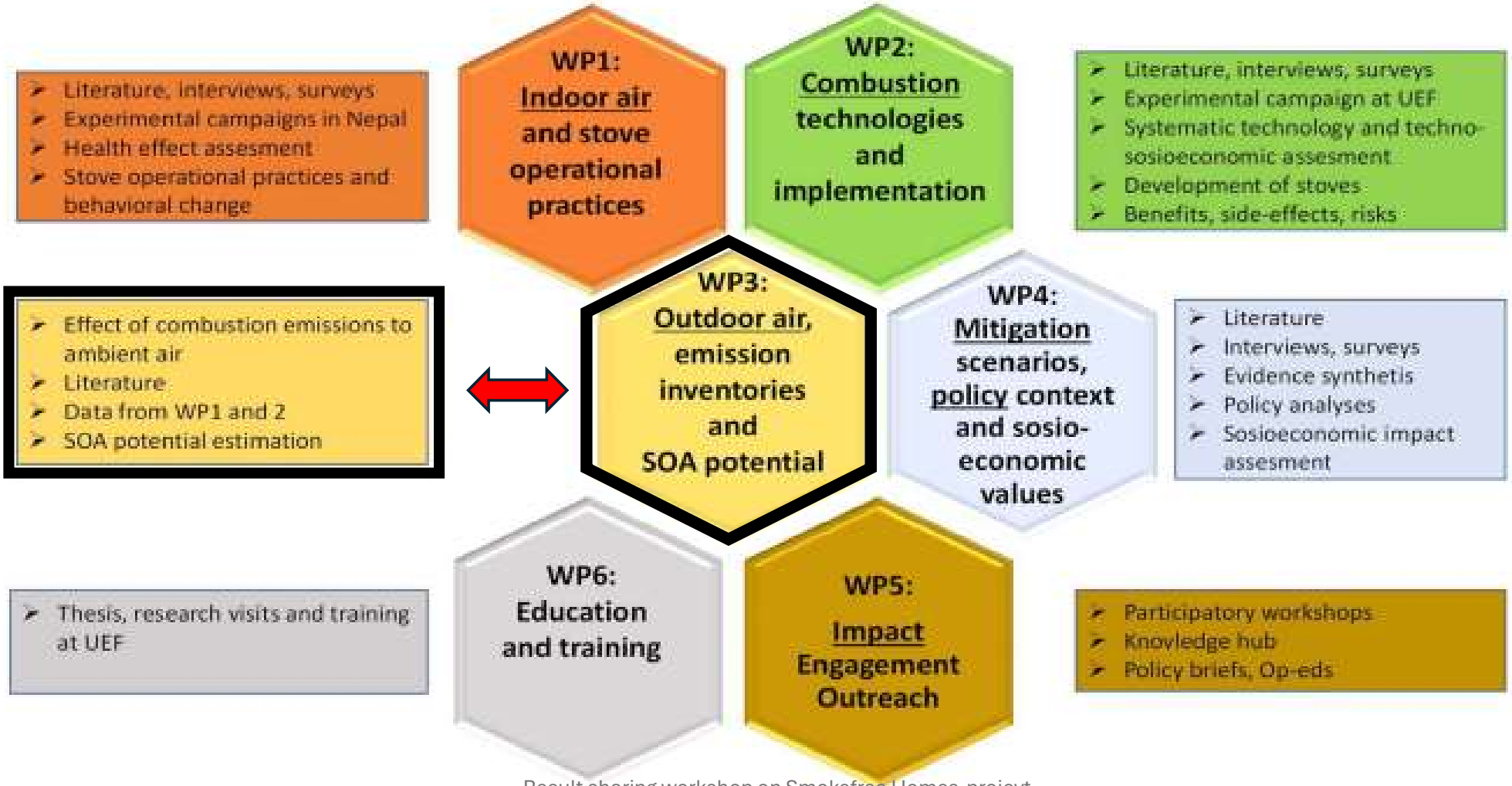
Fig.2: Energy consumption for FY 2079/80 by fuel type ***(WECS,2024)***

Objective

- To find out the most effective, techno-economic, and socially acceptable measures to reduce RBC emissions from Nepalese rural houses and thus, lower the exposure of indoor air pollutants to women and children.

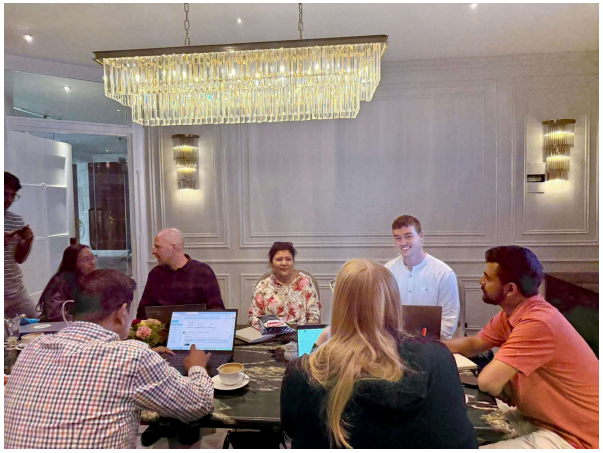
Photo: Enna Mool, CDES,TU

WORKING PLAN AND THE ROLE



Research implementation: methods and activities Meetings

- Total of Meetings: 12 Online and 4 in-person (3 in Nepal and 1 in Finland)
- Kickoff meeting On- line: 20.11.2023



First Inception Workshop 2024

- 17 October 2024
- Hotel Himalaya, Lalitpur, Nepal
- Total Participants: 44 (11 F & 33 M)
- Affiliations: Academic institutions, Governmental institutions, NGO/INGO, Private Sector

Research implementation: methods and activities

First Field Monitoring: CHITWAN

20th - 29th October 2024

- Ratnanagar Municipality
- Kalika Municipality
- Rapti Municipality
- Khairahani Municipality

Photo: Charan Bhattarai/CDES

Second Field Monitoring: RASUWA & KAVRE 1-17th March, 2025

Photo: Balkrishna & Enna, CDES,TU

Measurement campaign at the UEF

- The experiments focused on SOA, particulate and gaseous emissions, and indoor air quality
- Experiments were performed using four different stoves and five different wood species

Risks and risk mitigation measures

- Permit restrictions prevented the import of firewood from Nepal. To address this, a similar wood species was successfully sourced from Pakistan.
- a delay occurred in sample analysis: some OC/EC and PAH samples will only be analyzed in 2026 due to malfunctions in the analytical equipment.
- Additional measurements will be performed in Chitwan in April 2026.

Research implementation: personnel, researcher mobility, visits, conferences

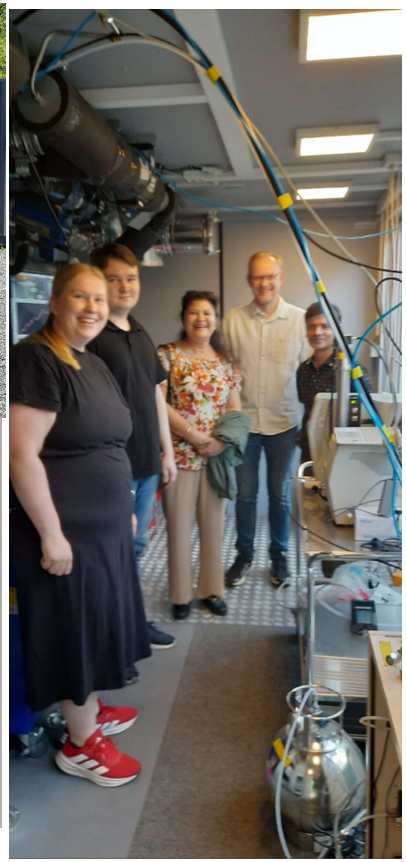
- **Develop2 program**:
- At the **opening seminar**, principal investigator of the project, Jarkko Tissari, gave a presentation about the project and Professor Sunil Prasad Lohani (KU) participated remotely in the panel discussion organized at the seminar.
- **Develop2 Annual Seminar, Dec 11, 2022:**
- - Professor Sunil Prasad Lohani (KU) and Professor Rejina Maskey (TU) gave presentations

researcher mobility

Result sharing workshop on Smokefree Homes-projevt overview

Researcher mobility, visits

Visit to Different Laboratories-UEF



Seminar at UEF

Results reporting: academic publications and degrees

Paper, published:
Sunil Prasad Lohani, Rosy Pradhan Shrestha, Mandip Shrestha, Henna Rinta-Kiikka, Jarkko Tissari, 2025, Rethinking clean cooking solutions: Assessing the impact of subsidy and distribution modality on improved cook stove programs in Nepal, Energy Research & Social Science, Volume 123, 104027, ISSN 2214-6296, https://doi.org/10.1016/j.erss.2025.104027.

Papers, submitted:
Narayan Babu Dhital, Juho Louhisalmi, Henna Rinta-Kiikka, Sampsa Väätäinen, Jani Leskinen, Olli Sippula, Jarkko Tissari (2026) Effect of an electrostatic precipitator on particle mass, composition, and number size distributions in residential wood combustion emissions. Submitted to Fuel 24.12.2025.

Sunil Prasad Lohani, Smika Sharma, Henna Rinta-Kiikka, Marko Hyttinen, Rejina Maskey Byanju, Jarkko Tissari, Marc Jeuland (2026). Navigating the Clean Cooking Transition in Nepal: Strategic Insights from SWOT and PESTEL Analyses. Submitted to World Development 13.1.2026.

Results reporting: academic publications and degrees

Papers ready for submission:

Poushan Shrestha, Sarvesh Pandey, Smika Sharma, Rejina Maskey Banjyu, Henna Rinta-Kiikka, Marko Hyttinen, Jarkko Tissari, Sunil Prasad Lohani (2026). Unlocking Clean Cooking Transition: How Behavior and Finance Shape Adoption Pathways. Manuscript.

Charan Bhattarai, Rejina Maskey Byanju, Bhupendra Das, Balkrishna Poudel, Enna Mool, Ramesh Sapkota, Jarkko Tissari, Henna Rinta-Kiikka, Marko Hyttinen, Narayan Dhital, Indira Parajuli, Sunil Lohani
(2026) Household Cooking Stoves and Indoor Air Quality in Bagmati Province, Nepal. Manuscript

Several papers are under preparation.

Degrees

Post Doctoral Degree: Narayen Babu Dhital, PhD

Charan Bhattarai (TU) successfully defended his Master's thesis in September 2025. The thesis, titled "Household cooking practices and indoor air quality in Bagmati Province, Nepal" was based on measurements done in Nepal.

Balkrishna Poudel (TU) has submitted his Master's thesis, titled "Ruralhousehold biomass combustion emissions in Nepal: an inventory across three ecological regions" was also based on measurements done in Nepal. The defense is expected to be in spring 2026.

Markus Palmumaa (UEF) is preparing his Master's thesis related to SOA formation, based on data from the 2025 measurement campaign at UEF. The thesis is expected to be completed in 2026.

Strengthening Research Capacity through Seminars

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THANK YOU

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https://uefconnect.uef.fi/en/technological-and-socio-economic-solutions-to-reduce-indoor-air-pollution-in-nepal/

https://sites.uef.fi/fine/front-page/main-on-going-research/technological-and-socio-economic-solutions-to-reduce-indoor-air-pollution-in-nepal-smokefreehomes-nepal/