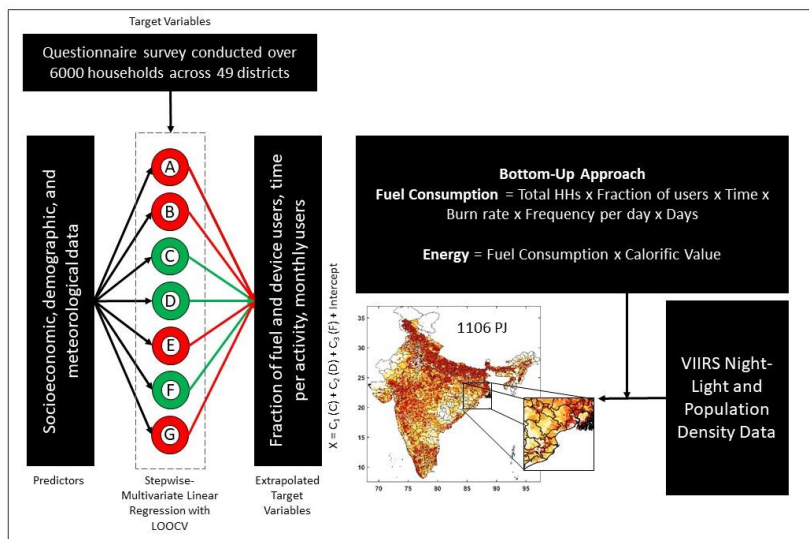


## Heating and lighting: Understanding overlooked activities in the Indian residential sector

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### Key highlights:

- India-wide surveys (~6000 households) of residential water and space heating and lighting.
- A regression-based approach to determine fuel consumption for all Indian districts.
- Study also includes special devices: Kangri and Hurricane lamps.
- Energy and fuel consumption estimate at 4km x 4km horizontal resolution.

### Summary of your Research:

In this study, the NCAP COALESCE residential questionnaire surveys that cover 6000+ households are used to understand fuel and energy consumption from the non-cooking residential sector (includes water and space heating, kerosene lighting). The stepwise multivariate linear regression models are build based on the demographic, socioeconomic and meteorological variables. Further, the bottom-up approach is used to understand fuel consumption.

The rural and urban parts of India share 89 and 11 % of the total energy consumption, and 94% is consumed for residential heating activities, 2% of the energy is consumed by kerosene. Firewood, agriculture residue, dung cake, and charcoal provide 70, 12, 10, and 6% of the energy respectively.

We observed higher use of biomass for water heating in the western and southern regions, while Jammu and Kashmir show lesser dependency on biomass. Hilly northern parts use more than 25 GJ y<sup>-1</sup> HH-1 energy, where >90% consumed by space heating and >30% comes from charcoal.

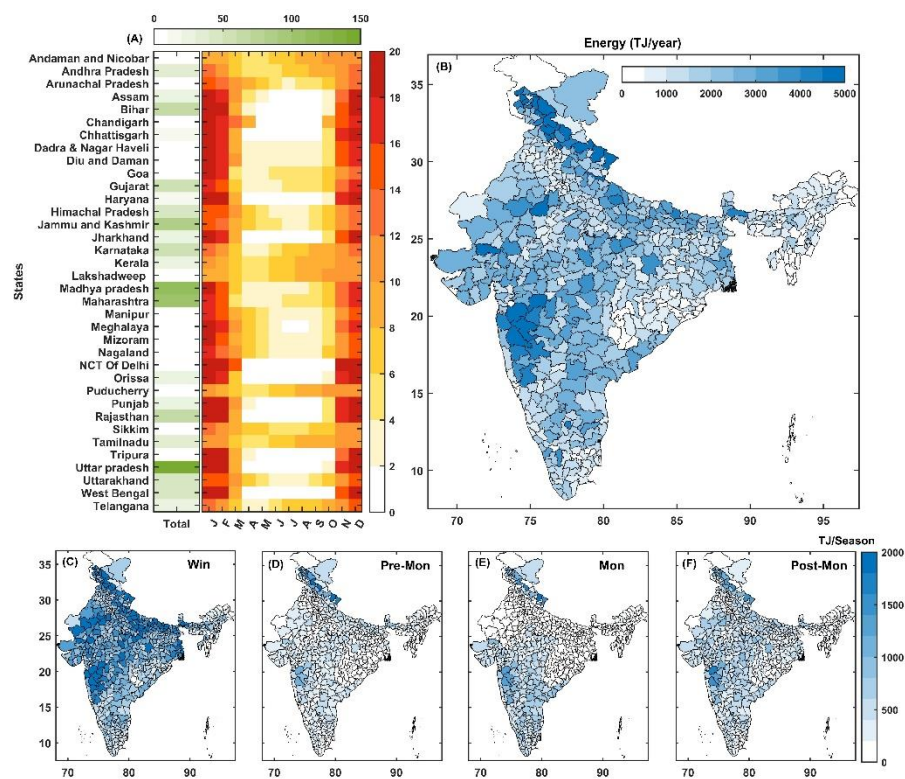


Figure: State-wise total energy consumption from the non-cooking residential sector activities. (A: Green) Total energy consumed (PJ year<sup>-1</sup>); (A: Red) Percentage of total state energy consumption, and (B) spatial variation in the non-cooking residential energy (TJ yr<sup>-1</sup>). (C), (D), (E), and (F) are energy consumed for winter, pre-monsoon, monsoon, and post-monsoon respectively (TJ/season).

### Take away/conclusion :

- Extreme usage of space heating for ~10 hours a day in hilly northern parts of India, the majority of this energy is covered through charcoal burning in special devices such as Kangari.
- The biomass fuel consumption for heating activities covers 95% of the total energy matrix, where 70% is shared by firewood.
- 50% of the energy is consumed in the winter season, whereas other seasons have an equal share of the other half. Surveys uncover southern and western India perform biomass-based water heating in all seasons despite warmer weather, unlike other regions where heating is temperature-sensitive activity. Whereas, kerosene consumption for lighting shows a slight peak during monsoon which was unknown earlier.

### Research Article citation

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