Overview of the Seventh Residential Electricity Consumption Roundtable on Modeling Residential Electricity Demand

Venue: Board Room, Foundation for Innovation Technology and Transfer, IIT Delhi.
Date and Time: 9th January 2025

Prayas (Energy Group) hosted the seventh annual roundtable on Residential Electricity Consumption (REC) on January 9, 2025, at the Indian Institute of Technology (IIT) Delhi. Electricity consumption by the residential sector in India has grown at a compound annual growth rate (CAGR) of 8% and is expected to grow further due to increasing incomes, urbanization, and technological advancements. Systematically examining residential demand and ensuring that future demand is adequate, efficient, and well-managed is crucial. These annual roundtables provide a platform for various organizations working on India's REC to share their research, analysis, and interventions, as well as to exchange ideas on future work. Previous roundtables have focused on diverse aspects of REC, such as electricity access, sustainable cooling, and utility-driven demand-side management, among others.

This year's roundtable centered on the approaches and methodologies adopted for residential energy demand estimation models. Five organizations—NITI Aayog, TERI, AEEE, CSTEP, and Prayas (Energy Group)—presented their models, outlining the parameters and methodologies they used. While there were similarities in the approaches and methodologies across the models, differences were observed in the scale and granularity of analysis. The modelling exercises utilized open-source datasets, such as the National Sample Survey (NSS), National Family Health Survey (NFHS), and reports published by organizations like the UN, IPCC, and NIUA. Future projections were developed based on scenario-specific assumptions. These scenarios considered parameters such as appliance penetration, appliance efficiency, projected urbanization rates, per capita fuel requirements, and building envelope efficiency. Separate models were created for the urban and rural residential sectors.

The presentations were followed by a roundtable discussion that delved into how macro-level indicators, such as income and price elasticities, could enhance the accuracy of residential electricity demand estimation. During deliberations on appliance use behaviours, interesting insights emerged regarding thermal comfort, particularly the transition from coolers to air conditioners (ACs). The discussion emphasized the importance of architectural design and the role of technology and building characteristics in shaping modelling approaches and assumptions.

Experts from 12 organizations participated in the roundtable discussions. They highlighted the need for modelling efforts to consider resilience as a critical parameter to account for contingencies, such as grid failures. They also stressed the importance of catering to specific stakeholders, which requires balancing the trade-offs between disaggregation and endogenization. Additionally, building sector policies and codes, such as the Energy Conservation Building Code (ECBC), Eco Niwas Samhita (ENS), and Energy Conservation Sustainable Building Code - Residential (ECSBC-R), were recognized as critical factors in developing modelling scenarios. This year's discussions reaffirmed the importance of refining methodologies for residential energy demand estimation to support informed decision-making and sustainable energy planning for India's growing residential sector.