

Optimizing Residential Prosumer Flexibility: Which consumer archetype balances energy affordability with sustainability?

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Extended Abstract

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Abstract Summary

The primary objective of this study is to evaluate how different solar-equipped household profiles influence the optimal use and economic value of flexible loads. The paper (i) constructs representative consumer profiles capturing heterogeneity in demand patterns and technology adoption, (ii) quantifies the extent to which flexibility can reduce energy costs and improve household welfare, and (iii) assesses how rooftop solar, tariff structures and system conditions affect the realization of these benefits. The study employs a combination of empirical data and synthetic generation, utilising databases from ENEDIS, EXPESIGNO, xKY, EtudELEC and RTE. The paper's main conclusion is that consumer archetypes respond differently to flexibility measures. The value addition is that the paper provides a unified framework that combines heterogeneous demand modeling, load constraints and welfare-based optimization offering a more realistic way to evaluate the value of residential flexibility. It is expected to improve understanding of which residential prosumers benefits most from flexibility and how those benefits can be expanded through better tariff and market design.

Presenting Author Biography

Dr. Mathew is a post doctoral researcher at Université Grenoble Alpes, France working under a French-Australian project on energy transition (FACET). Her research interests include consumer demand, energy storage, electricity markets and renewable energy policy. Her educational background includes a Doctorate in energy economics from Université Savoie Mont Blanc, France and she was also an Erasmus scholar from Lund University, Sweden. Prior to her doctorate, she worked for 7+ years in climate change and renewable energy with international agencies including UNEP and UNDP.