

The Price of Fairness in Energy Community Formation

Robin Derzbach, Aabhash Dhakal, Christoph Flath
Julius-Maximilians-Universität Würzburg, Würzburg, Germany

Extended Abstract

[Download file](#)

Abstract Summary

Energy communities allow households to share locally generated electricity, reducing costs and emissions. Their design is governed by the energy trilemma: balancing energy security, sustainability, and affordability. Yet community composition engages all three objectives: selecting prosumers with large PV and batteries maximises self-consumption and CO₂ reduction, but systematically excludes low-asset households, raising a fairness question: how equally should energy costs be distributed across members? Under RED III [1] and Germany's forthcoming §42c EnWG [2], communities must navigate this tension, yet no study has quantified the cost of fairness constraints on community composition under real dynamic tariffs.

We address this gap with three contributions. (1) We quantify the “price of fairness”: tightening the Gini cap $\bar{G}$ on member cost inequality from unconstrained to $\bar{G} = 0$ raises procurement cost by 8% while shrinking the community from 41 to 8 members. (2) We operationalise the trilemma at the community level through three EUR-denominated KPIs, tail cost (security), CO₂ cost (sustainability), procurement cost (affordability), and show they are strongly correlated ($\rho > 0.97$ for procurement–tail; $\rho > 0.79$ across all pairs at moderate-to-relaxed $\bar{G}$), collapsing the multi-objective problem to a single efficiency-vs-fairness dimension. (3) We frame formation as provider-led sequential screening: each candidate is evaluated by their marginal trilemma impact, and leave-one-out markups induce self-selection i.e. candidates whose addition worsens performance are priced out, not rejected, aligning with RED III non-discrimination.

Presenting Author Biography

PhD Candidate - University of Würzburg