

When Grid Tariffs Meet Renewable Support Schemes: Evidence of Policy Conflicts from a Market Equilibrium Perspective

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Extended Abstract

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Abstract Summary

Integrating fluctuating renewable energy sources remains a central challenge in decarbonising the German power system, particularly as electrification and demand-side flexibility increase pressure on distribution grids. While flexible sector-coupling technologies such as electric vehicles and heat pumps can support market integration, their coordinated response under zonal wholesale pricing may exacerbate local grid congestion. To address this, Germany introduced dynamic distribution grid charges in 2025, creating a second price signal that directly affects demand-side behaviour and interacts with wholesale market outcomes.

We analyse this interaction using an equilibrium reformulation of the fundamental electricity market model ELTRAMOD. By deriving the Karush–Kuhn–Tucker conditions of individual agents' optimisation problems, we construct a mixed complementarity problem in which generators maximise profits and demand-side agents maximise utility, while wholesale price formation is determined endogenously. This framework captures the joint determination of market clearing and the dispatch of flexible demand subject to dynamic grid charges.

In the absence of such charges, increasing demand-side flexibility stabilises market returns for solar generation by raising demand during low-price periods, particularly at mid-day. However, this effect is reversed when dynamic grid charges are introduced. Flexible consumption is shifted to evening and early-morning hours, reducing mid-day demand and depressing wholesale prices during periods of peak solar generation. As a result, self-cannibalisation effects intensify, lowering market-based revenues and increasing reliance on support mechanisms.

The findings underscore the importance of aligning distribution grid regulation with renewable support policies to avoid unintended market distortions and ensure system-wide efficiency.

Presenting Author Biography

Dr. Hannes Hobbie, Postdoctoral Researcher and Group Leader Electricity Markets, Chair of Energy Economics.