Electricity Markets in Transition and Crisis: Balancing Efficiency, Equity, and Security

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1. Motivations underlying the research

Since 2021, the European electricity markets have experienced two significant shocks: a positive demand shock in 2021 after the Corona restrictions and a negative supply shock of natural gas price following the war in Ukraine in 2022. The severity of these shocks and high prices can partly be explained by the low short-term price elasticity of electricity demand and supply. The effects of these events were exacerbated by coinciding with other supply-side shocks, such as low levels of wind, low water levels in hydropower reservoirs, high coal prices, and extended outages in nuclear plants in parts of Europe.

Following the Corona shock, there has been calls for reforming the electricity market design to better prepare them for the future and address socio-economic effects og higher prices, while some member countries declared that the market design was not the cause of the crisis and had generally worked well. Nonetheless, the market design had not prevented the markets from being exposed to sudden shocks. This is not to suggest that the electricity markets no longer work, but to revisit and overhaul their design in an already evolved context and continuous technological progress, mass connection of renewables, and a reorientated energy policy towards security of supply. Even prior to the shocks, the electricity market design was ripe for an overhaul.

The short-term electricity markets ensured short-term security of supply, albeit with high prices affecting affordability. This effect was amplified when the hedge positions of many retailers were not sufficient. This has resulted in calls for revisiting the market design to consider measures such as price caps, redistributive mechanisms for windfall profits, increased demand flexibility, integrating more renewables, and active networks. Meanwhile, it remains imperative to balance the three objectives of the energy trilemma: sustainability, supply security, and affordability.

The EU has acknowledged the need for finding pathways to tackle price volatility, accelerate investments in renewables, and enhance flexibility and resilience of the power system. This paper revisits the role, design, and policy aspects of the EU wholesale electricity markets in the context of recent shocks. It also discusses the changing market context and design challenges facing the markets and how this affects maintaining the energy trilemma pillars.

2. A short account of the research performed

In this paper we briefly revisit the premise of organized electricity markets, their main technical and economic characteristics, and how they differ from most commodity markets. We then point out that the purpose of electricity markets has gradually undergone a paradigm shift from the pursuit of economic efficiency as the prime objective towards becoming an instrument for cost-effective delivery of various policy targets.

The paper argues that the three pillars of energy Trilemma of sustainability, security of supply, and affordability have characteristics of public goods and markets alone will not deliver these targets without some forms of intervention. We then discuss the main market allocation mechanisms in the electricity sectors and in particular focus on the important role of long-term markets.

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The paper reviews some recent market-based and non-market remedies proposed in response to the electricity markets crisis and how to improve their design. This is then followed by discussing some redistribution mechanisms that are relevant and important to consider in the anticipated electricity market design reforms. These, among others, include negative prices, missing money, windfall taxes, and price caps.

3. Main conclusions and policy implications of the work

In conclusion, we reiterate that a market design reform with a view to the future was ripe before the emergence of the two crises. There is a need to better understand the design of long-term markets and their interaction with the short-term markets. This includes both long-term contracts between private parties and contracts for differences (CfDs) between governments and private actors. Price caps cannot be ruled out on political economy grounds and short-term distributional reasons in extraordinary circumstances. The new market design can aim to distinguish between the inframarginal rents, windfalls, and renewable resource rents. While most attention has been on the market design, there are also non-market instruments to consider, such as sector coupling with the gas and future hydrogen sectors, locational factors related to networks, and promotion of demand flexibility services.

At governance level, an independent strategic authority, such as the Future System Operator (FSO) being considered in the UK, can assume the responsibility for long-term planning and investment. Security of supply can be a mandate of this authority and long-term markets. Finally, we point out that the choice of instruments should be with a view to the pros and cons of these in relation to the elements of the energy Trilemma. Finally, in the Appendix we present a comprehensive table of the main instruments related to market design reform and their pros and cons in relation to the pillars of the energy Trilemma.