

New Transactions in Electricity: Peer-to-Peer and Peer-to-X

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Motivation

The electricity sector used to be characterised by transactions initiated by large and professional players: business-to-business at the wholesale level, and business-to-consumer at the retail one. This is changing due to the development of distributed energy resources (DER), including electric vehicles, and the digitalisation of the electricity infrastructure. Households, farms, small commercial activities and the like have today the ability to trade electricity and other related products peer-to-peer (P2P) or to offer those resources connected ‘behind the meter’ to business players (P2X).

P2P and P2X transactions open a new world in the electricity sector and have the potential to disrupt existing business models and regulation. Several initiatives are visible on the ground, but academic literature on the matter is still limited and an analytical framework able to capture the meaning and implications of these new transactions is largely missing. However, developing such a framework is vital in order to clarify the phenomenon and investigate the future of this emerging transactional space, whose ability to thrive in a highly regulated sector, where incumbents have significant power, is still unclear.

Short account of the research

P2P and P2X transactions call for a collection of empirical evidence on early implementation cases and the identification of typical forms that simplify the heterogeneous reality. In the paper, we initially distinguish three forms of P2P transactions and three forms of P2X transactions. The three forms of P2P transactions are peer-to-peer in sandboxes, peer-to-peer within platforms, and peer-to-peer in communities. The three forms of P2X transactions are peer-to-system, peer-to-grid, and peer-to-system with an integrator. We illustrate these six forms with case studies from the world of practice.

Then we simplify reality further by distinguishing only four fundamental ‘families of transactions’. They are peer-to-peer with a third party, peer-to-peer within a community, peer-to-grid, and peer-to-system with an integrator.

Finally, the last part of the paper looks for a logical matrix of diversity and coherence in the functioning of this new world. We identify and discuss three pillars that look fundamental to enabling the new transactions. They are the ‘matching loop’, the ‘pricing mechanism’, and the ‘delivery loop’.

Main conclusions and policy implications

There is no doubt that a new world of electricity transactions has emerged. It combines new players, which are of the same size as consumption units and have a non-professional nature, with new products or services originated from behind the meter of the traditional electric system. Representing a significant departure from the traditional electricity arrangements, these transactions look like heterogeneous, having not yet crystallised into regular forms of business models and governance. It is because they demand a sophisticated frame to work. First, a new type of matching loop to lower transaction costs, otherwise too high for small non-professional peers to handle. Second, a sophisticated pricing mechanism to provide peers with adequate incentives for investing in the relevant assets and operating them to offer attractive products or services to other actors. Third and final, a guaranteed delivery loop capable of ensuring the physical distribution of the product or service to the purchasing side.

The need of carefully aligning all these three pillars implies that P2P and P2X transactions are very sensitive to constraints and to the actual behaviour of traditional decision-makers like regulators, grid operators and market operators. However, P2P and P2X transactions are gradually getting a more

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favourable 'political economy' regime in those electricity systems characterized by large numbers of prosumers and electric vehicle owners.

To conclude, four families of transactions with peer look already capable of managing durably the particularities associated with the transaction of small quantities of energy, flexibility or storage. The variety of forms and the uncertainty about their future evolution is normal at this early stage, as it was in the 1990s and the 2000s when wholesale and retail trade of electricity began. It should not surprise but attract more attention. It may also happen that the world of B2B and B2C transactions could evolve in new ways able to perform P2P and P2X transactions.