

Peer-to-peer electricity trading: challenges for the distribution system operator (DSO) under EU law

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Abstract— The electricity market’s current organization is top-down and centralized: electricity is produced in large plants and then transported over transmission and distribution lines to end users. As renewable production increases, this business model is assumed to change. Indeed, so-called ‘prosumers’ could sell excess electricity and require other energy-related services (e.g. battery storage and electrical vehicle charging). Accordingly, the DSO’s business model will have to adapt to increased local flows of electricity. In turn, this will require an updated legal framework and regulatory approach. In this paper, I highlight

some key changes in the legal and regulatory framework of DSOs. This will be done through an explorative analysis of the EU law requirements. Next, this is confronted with the rules on peer-to-peer electricity trading. Subsequently, I investigate the impact of new market players such as microgrids and energy communities on the role of the ‘public’ DSO. This paper closes with the suggestion to adopt the term ‘neutral market facilitator’ for the new role DSOs perform in the energy transition.

Index Terms— electricity distribution system, EU law, power grids, prosumers.

I. INTRODUCTION

With its latest overhaul of the electricity market model, the European Union (EU) marked the place of the customer at the heart of the energy transition. Several new legal instruments accompany this shift in perspective. For this paper, the fourth Electricity Directive (hereinafter: ED [1]) and the recast Renewable Energy Directive (hereinafter: REDII [2]) take center stage, as these directives contain novel provisions on consumer rights and the position of the distribution system operator. Until the enactment of the *Clean Energy for all Europeans Package* (CEP) in 2018-2019, there was little room under EU energy law for peer-to-peer electricity trading. The three successive Electricity Directives mainly dealt with liberalization and free market competition to ensure fair prices for consumers [3]. The CEP adapts and updates this legislative framework to accommodate new energy services such as storage and vehicle charging. More importantly, it introduces an array of legal tools to empower consumers. Hence, the CEP aims to foster decentralized and renewable energy production. To this effect, the CEP introduced a list of ‘energy rights’ for end consumers. These rights exceed mere consumer protection objectives, instead enabling full market participation. Under the CEP, the once passive end user of electricity has become an active participant in the energy market (‘prosumer’), who

may hold production assets, has flexible demand and diverse attitudes towards energy [4]-[5]. No longer limited to the sole provision of electricity at inflexible rates, the ‘new’ electricity market value chain will be decentralized and market-based. This shift translated into the need for adapted legal concepts and rights.

In this paper, I first turn to the responsibilities of the DSO. After a summary of the new rights of energy users in the CEP, I raise some expected challenges for DSOs in the future energy landscape.

II. THE DSO IN THE ELECTRICITY DIRECTIVE

In simple terms, the distribution system operator (DSO) [6] acts as the operator of the physical electrical grid and connects the end users with it. It is not to be confused with suppliers, which sell electricity to customers. Due to its monopolistic role in the current electricity market, it is subject to regulatory supervision. This can also be linked to the DSO’s responsibility for ‘ensuring the long-term ability of the system to meet reasonable demands for the distribution of electricity’, taking into account the environment and energy efficiency (art. 31.1 ED). The regulator also sets the fees or ‘tariffs’ the DSO may charge for access to its network. In general, the

DSO shall not abuse its monopoly to discriminate between grid users or foreclose access to new entrants ('third-party access', art. 6 and 31.2 ED). With regards to new actors in the electricity market (such as active customers and energy communities, see below), the Electricity Directive specifies such tariffs must be cost-reflective. This is elaborated further and more generally in the Electricity Regulation 2019/943. Article 18 of that Regulation imposes such network charges to be transparent, cost-reflective and discriminatory. To incentivize DSOs, the regulator should compare the cost levels to other system operators (benchmarking). Furthermore, it may introduce performance targets to achieve goals such as (energy) efficiency, flexibility and smart grid development (18.8 Regulation).

Included in the Clean Energy Package are several updates to the DSO's legal and regulatory framework. If a Member State opts for it, the DSO is required to prioritize dispatch of renewable energy source (RES) generation or high-efficiency cogeneration (art. 31.4 ED).

Article 31, paragraphs 5-8 provide the rules DSO must follow to acquire certain energy products and services on the market. The general principles include market-based procedures, which should be transparent and non-discriminatory. Exceptions, however, are possible depending on NRA approval or with regards to fully integrated network components. In its activities on the energy markets, the DSOs should also coordinate with TSOs and other market participants.

Article 31.8 gives further guidance on how a DSO must act in procuring these products and services. In particular, it must ensure that all market participants have a fair chance. To this extent, this paragraph expressly lists new market players such as those engaged in RES generation, demand response, storage and aggregation. The gist of this provision is that by including all market participants in the drafting of the procurement rules, the DSO can avoid (unintentional) foreclosure of the market by locking-out certain methods of providing these services. Where applicable, DSOs must cooperate with TSOs. This goes specifically for distribution-grid level delivery of balancing services, for which cooperation is provided under article 57 Electricity Regulation and art. 182 System Operation (SO) Guideline.

Secondly, article 31.5 states the DSO must also follow par.6 conditions in procuring services to cover energy losses. As a type of balancing service, this can be situated as a (frequency) ancillary service (cfr. art. 2.48 ED). Curiously, the directive mentions that the DSO must act as a '*neutral market facilitator*' in doing so. This is a new concept, that receives no further elaboration in the directive (or the CEP for that matter).

The third type of activities is included in art. 31.7 and constitutes a sub-set of specific activities: non-frequency ancillary services. Such services include '*steady state voltage*

control, fast reactive current injections, inertia for local grid stability, short-circuit current, black start capability and island operation capability' (art. 2.49 ED). These, too, must in principle be procured on a transparent, non-discriminatory and market-based procedure. Only if the national regulatory authority deems this to be inefficient from an economic perspective and grants a derogation, such requirements may be foregone. Paragraph 7 also includes a general exception with regards to fully integrated network components. This refers to components of the distribution grid, which might include storage facilities, intended solely to serve the secure and reliable operation of the grid. These cannot be used for balancing or congestion management. Implicitly, these services need to be procured under par. 6 conditions. This is coherent, since balancing and congestion management are services *other than* ancillary non-frequency. The third Electricity Directive's legal guidelines were more succinct, and only referred to grid loss compensation and balancing (art. 25.5-6 Directive 2009/72).

The DSO is also increasingly responsible for grid development planning. To this effect, it must publish a transparent overview of its planned investments for the coming five to ten years. This plan furthermore should include flexibility requirement projections and elaborate on the incorporation of demand response, energy efficiency and storage (art. 32.3 ED). The objective of electromobility is another new task of DSOs. These must cooperate with operators of electrical vehicle recharging points. More fundamentally, a DSO may not engage in such activities (except for own use or if no other parties engages in it) (art. 33 ED). In the same vein, DSOs cannot own or operate energy storage facilities (art. 36 ED). Exemptions to this general prohibition are possible, subject to regulatory approval, 'where they are fully integrated network components'. Alternatively, the regulator might deem such a derogation necessary, in particular if a tendering procedure was unsuccessful.

In summary, the Electricity Directive frames the role of the DSO in two ways. First, it obliges DSOs to include new market participants (decentralised production units, aggregators, storage etc) while procuring products and services on the market. Open and market-based procedures are the default option, although preference may be given to renewable energy if appropriate incentives are provided. Second, the Directive expands unbundling rules for DSOs: it may not operate electrical vehicle charging or storage units, as this could cause undue competition with market players. Whether these new tasks and responsibilities herald the future role of the DSO as a '*neutral market facilitator*' will be discussed below (see V).

III. PEER-TO-PEER TRADING

The concept of peer-to-peer economy hardly needs introduction as an interface for consumers to exchange goods and services among each other. At first glance, one would expect to find a definition of peer-to-peer (P2P) trading in the legal instruments organizing the energy (electricity) markets. However, the concept of peer-to-peer electricity trading is not as such incorporated in the fourth Electricity Directive. Instead, its definition is included in the recast Renewable Energy Directive, art. 2.18:

'peer-to-peer trading' of renewable energy means the sale of renewable energy between market participants by means of a contract with pre-determined conditions governing the automated execution and settlement of the transaction, either directly between market participants or indirectly through a certified third-party market participant, such as an aggregator. [...]

Remarkably, the definition limits the scope of peer-to-peer trading to *'contract[s] with pre-determined conditions governing the automated execution and settlement of the transaction'*, colloquially known as *'smart contracts'*.

In general, the REDII allows a range of market participants to engage in P2P trading of renewable energy. It is therefore not restricted to any type of customers (individuals, household users, renewables self-consumers etc). However, any energy must originate from renewable sources (defined in art. 2.1 REDII).

The energy trading can take place directly between market participants. Alternatively, this activity may be outsourced to a third party, such as an aggregator. In this case, this third party must be certified, under conditions to be set by the Member States. One wonders, however, how this peer-to-peer trading would be different from other activities performed by market participants. A separate certification seems burdensome, especially when no general certification requirement is put in place by the Directive.

The REDII definition also contains a normative element (omitted in the quote above):

The right to conduct peer-to-peer trading shall be without prejudice to the rights and obligations of the parties involved as final customers, producers, suppliers or aggregators.

Indeed, the right to participate in P2P trading seems therefore guaranteed for all market participants as defined in art. 2.25 Electricity Regulation. Considering the extensive personal scope of the rights established by the new Electricity Directive, it is difficult to determine the added value of the concept of P2P trading included in the REDII. Particularly, the notion of *'peer-to-peer'* does not seem to limit the eligible parties to engage in such a transaction. Only the reference to smart contracts introduces a unique novelty to the renewable energy trading framework. In any case, peer-to-peer trading is

explicitly mentioned as an option for the sale of renewable energy by renewables self-consumers in art. 21 REDII. For renewable energy communities (art. 22 REDII), it is not listed but the legal text surely accommodates it.

While the Electricity Directive does not contain a specific reference to peer-to-peer trading, its provisions are sufficiently broad to include it [7], and even prevent discriminatory or burdensome requirements imposed on it. Still, Member State legislators and regulators will need to specify the framework in order for peer-to-peer exchange of electricity to materialize.

IV. NEW RIGHTS FOR CONSUMERS

As section III has shown, the CEP introduced a restricted notion of P2P trading. In my opinion, however, the legislative package introduces rights and obligations enabling (and indeed promoting) transactions between energy consumers.

Some of these new energy rights apply to customers *as individuals*, while others facilitate market entry for *groups* of customers (either jointly acting or in an energy community). Another distinction pertains to the scope of the rights. Traditionally, consumer rights were limited to a sectorial application of general consumer protection rights, e.g. by referring to clear billing information and the right to switch supplier without excessive costs or procedures. The CEP introduced (or consolidated) the next generation of customer rights, i.e. *'market participation rules'*. These, too, both apply to individual customers and groups, but the individual's rights cannot be infringed by participation in a collective model.

In general, every customer can trade electricity services, other than supply, regardless of their supply contract (art. 13 ED). In article 17 ED, only demand response through aggregation is mentioned specifically, but the scope of the article seems wider (*'electricity markets'* defined in art. 2.9 ED also encompassing capacity, balancing and ancillary services). Every customer with a smart meter is entitled to a dynamic electricity price contract (art. 11 ED). Even if the cost-benefit assessment at the national level was negative and therefore no general roll-out occurs, an individual customer may still request a smart meter at fair, reasonable and cost-effective conditions (article 21 ED).

The notion of active customer (article 2.8 ED) refers to a final customer who consumes, stores or sells electricity he has generated within his premises, on condition this does not constitute his primary commercial activity. Under the REDII, active customers are called *'renewables self-consumers'*, although the scope of the definition is almost identical, except being limited to *renewable* energy production (art. 2.14 and art. 21 REDII). Article 15 ED states that active customers cannot be subject to excessive procedures or charges. Every customer has the right to join or leave a citizen energy community (article 16 ED). This CEC is new legal entity which represents the interests of its members or shareholders and engages in a range of energy services. Most relevant for

this paper is the possibility for Member States to allow such a CEC to act as a grid operator for the network owned and developed by the energy community (16.2.b and 16.4 ED).

By introducing new actors and associated rights, the aforementioned directives require simultaneous and coherent implementation in Member State law. But the challenge is not limited to introducing new legislation. At the same time, Member States should review existing legislation for possible unforeseen barriers and discrimination towards the participation of these actors in the electricity market.

All in all, peer-to-peer trading of electricity is incorporated in the CEP, but only a small portion of the legal framework bears this name (i.e. the definition in the REDII).

V. (LEGAL) CHALLENGES FOR DSOS

The legal framework set out above will spark new roles and actors in the electricity market. Subsequently, trading will no longer occur in a linear way, with all actors neatly defined and largely immobile. Instead, energy transactions will follow the shape of the grid: every electricity customer becomes a potential supplier of electricity and related services (demand response, storage, EV charging...). The rapid rise of decentralised production, electrical vehicles and storage units opened possibilities for customer to put their assets to wider use.

Given the physical nature of electricity, the conclusion of an energy contract does not entail the transfer of electrical current. Instead, the purchase and sale of electricity is registered as an accounting transfer. Of course, this does not remove the need for a physical grid, owned and operated by a DSO. Although DSO activity has been traditionally considered a monopoly to avoid duplication (or privatization) of grid infrastructure, the CEP might entail some shocks to this paradigm.

First, alternatives to the public grid such as direct lines and microgrids (operated by an energy community) will eat away at the public DSO's dominant position. The legal framework should reflect this shift. With this diversification in infrastructure ownership, the associated tariffs structure will need to be revised too. Where an energy community has the

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right to operate as a DSO for its grid, article 16.4 ED clarifies that it may conclude a network operation agreement with the public DSO. Any network charges must correctly take into account fed into and consumed from the public grid. Furthermore, the energy community-DSO will need to be exempt from the unbundling requirements that apply to DSOs (art. 16.2.c and 38.2 ED). In any case, third-party access rule will apply to such private grids, which will require the need for tariffs to be under regulatory oversight (art. 6.3 ED).

Second, the DSO may become a 'neutral market facilitator' (NMF). Introduced in art. 31.5 ED, this concept received no formal definition. (It appears in technical articles though:[8]-[9].) Looking at its context, its scope seems limited (procurement to cover energy losses) and refers mainly to market-based procedures. It is therefore unclear why the term is not used generally to describe the DSO's (renewed) role, since similar open-ended terms ('transparent', 'effective participation', 'objective'...) are used in other paragraphs of article 31 ED. At several instances, the ED refers to the criteria for tendering procedures. This fits with the EU's goal towards competitive and non-discriminatory electricity markets (art. 3 ED). This, too, connects to the DSO as an interface for market participants. Instead of partaking in the market itself, the DSO merely facilitates the presence of others. In the past, the DSO's responsibility amounted to operating and maintaining the grid infrastructure, to which it granted access to third parties under certain conditions (art. 6 ED). From being a gatekeeper, the DSO might evolve into bridgebuilders [10], connecting several market participants offering a range of services.

VI. CONCLUSION

Faced with revolutionary changes in the legal framework, the DSOs will change their business model and, more generally, their role in the electricity trading landscape. Mapping the new responsibilities of the DSO revealed the concept of 'neutral market facilitator', which perhaps summarizes best its promotion to bridgebuilder between different participants in the electricity markets.

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