

Market Power of Digital Energy Intermediaries: A Framework for Identifying Competition Risks*

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Abstract

Digital intermediaries such as aggregators, peer-to-peer platforms, and flexibility marketplaces are becoming critical infrastructure for integrating distributed energy resources into power systems. While a large body of literature addresses the technical design of these platforms, the competitive risks arising from their market structure remain largely unexplored. This paper proposes an analytical framework that links four design dimensions (geographical scope, clearing mechanism, openness, and vertical integration) to specific channels through which market power can emerge in electricity. We apply it to three operating platforms, a vertically integrated VPP operator, a white-label energy-community SaaS provider, and an independent flexibility marketplace, using contract terms, court and regulatory decisions, and procurement data as evidence. The risks operate through different mechanisms: hardware-based lock-in, cross-utility data concentration, and two-sided network effects. The framework identifies conditions for market power, not findings of dominance. Targeted safeguards such as interoperability, data portability, transparent clearing rules, and non-discriminatory access can keep these emerging markets contestable.

Keywords: digital energy platforms, market power, distributed energy resources, energy regulation, flexibility markets

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1 Introduction

The platformization of energy provisioning is well under way. The integration of distributed energy resources (DERs) increasingly depends on digital intermediaries that manage, aggregate, or facilitate energy-related transactions at the distribution level. Local energy communities, flexibility marketplaces, and virtual power plant (VPP) operators reconfigure the relations between producers and consumers of energy, turning passive consumers into prosumers [1].

Much of the research on these platforms is technical: surveys of peer-to-peer (P2P) energy trading cover pricing, blockchain, and optimization [2]. Heymann and Galus count roughly 200 platforms active in the European energy sector and propose a menu of regulatory options for policy makers [3]; closest to our concern, Kloppenburg and Boekelo identify power concentration among the perils of energy-sector platformization [4]. Saviuc et al. document that independent aggregation is legally recognized in 19 EU Member States but operational in only 7 [5].

The perils, however, have received far less systematic attention. In particular, prior work does not map the *design choices* of digital energy intermediaries to distinct *market-power channels* across operating cases. The forces driving concentration in other digital markets, i.e. network effects, data advantages, and switching costs [6, 7], are also present in energy provisioning, but they operate under sector constraints that localize and condition them. Wang et al. [8] and Azizan Ruhi et al. [9] analyze aggregator market power as a bidding and mechanism problem; Prüfer and Schottmüller [10] show that data-driven markets can tip to monopoly under mild conditions. Eschenbaum and Greber [11] show in a dynamic trading game that a platform’s clearing rule determines how much market power prosumers can exercise on it. We extend Kloppenburg and Boekelo’s concern by specifying the mechanisms through which concentration could arise, and Heymann and Galus’s regulatory menu by matching safeguards to risk channels.

This paper makes three contributions: (1) an analytical framework linking four design dimensions to competition-risk channels; (2) its application to three operating platforms; and (3) regulatory safeguards matched to each channel. Throughout, we define *Digital Energy Intermediaries* (DEIs) broadly as entities that manage, aggregate, or facilitate energy-related transactions, services, or data flows involving distribution-connected resources, including vertically integrated operators that intermediate access through technical control. The common thread is gatekeeping: control over the markets, data, or infrastructure that prosumers need to participate in the energy transition.

2 What Makes Energy Platforms Distinct

DEIs share many features with platforms in other sectors [4, 6], but three characteristics shape how market power could emerge in energy provisioning. First, *physical-infrastructure dependency*: DEIs cannot function without the distribution grid and its operational rules; energy intermediation is bounded by grid topology, voltage levels, and congestion patterns. Second, *temporal rigidity*: electricity is a time-coupled commodity, making liquidity highly period-specific, so that market power can be exercised in narrow temporal windows unavailable to platforms trading storable goods. Third, the *essential-service nature* of electricity alters welfare analysis and justifies stronger oversight.

Together, these characteristics *localize* market-power risks rather than remove them: market power is more likely to manifest as multiple regional or feeder-level bottlenecks than as a single

Table 1: Four design dimensions and their competition-risk channels

<i>Dimension</i>	<i>Description</i>	<i>Competition-Risk Channel</i>	<i>Precedent / Evidence</i>
Geographical scope	Bounded areas defined by grid topology and regulation	Multi-local tipping; economies of scope could let one operator dominate multiple localities	EPEX/Nord Pool market allocation (EC, AT.39952) [15]
Clearing mechanism	P2P (participants trade) vs. centralized (operator sets prices/dispatch)	Centralized: pricing authority + data concentration. P2P: matching infrastructure as gatekeeping lever	Conflicted governance in flexibility platforms (Ofgem, 2019) [16]
Openness	Participation terms: hardware requirements, exclusivity clauses, API/data access	Hardware-based switching costs, sunk equipment, API restrictions → risk of first-mover entrenchment	OPCOM discriminatory access (EC, AT.39984) [17]
Vertical integration	Platform + generation, retail, DSO, or data infrastructure	Information asymmetry, self-preferencing in dispatch, cross-subsidization	EDF data leveraging (Autorité, 22-D-06) [18]

Note: The EDF decision was a settlement procedure, limiting its precedential weight; all precedents concern firms other than the Section 4 case studies.

national monopoly. We refer to this pattern as *multi-local dominance*, where “locality” refers to electrically constrained areas (a DNO territory, a grid zone, a voltage level) rather than political boundaries. The limited traded volumes documented for early European local flexibility markets reinforce this risk [12], and a single operator can manage many separate localities, achieving economies of scope while holding strong positions in each.

3 Four Design Dimensions

By market power we mean the ability to profitably set prices or conditions above the competitive level; on two-sided platforms, both sides must be assessed jointly [6, 13, 14]. We do not measure market power; we identify mechanisms through which platform design choices create the *conditions* for its emergence. Each mechanism has an efficiency counterpart, which we note where relevant; identifying a channel is thus a reason for monitoring, not a finding of harm. We classify DEIs along four dimensions that jointly determine competition-risk channels (Table 1).

Geographical scope. Network effects drive tipping in each electrically constrained area, while physical constraints prevent winner-take-all outcomes at the national level. The result is multi-local dominance, i.e. a collection of regional bottlenecks under common ownership.

Clearing mechanism. Centralized models (VPP operators) concentrate pricing authority and data; P2P models distribute pricing but concentrate control over the matching infrastructure. The distinction parallels the marketplace-versus-reseller dichotomy [19]; transposed to energy, centralized operators act as resellers that assume merchant and balancing risk on the energy they dispatch, while marketplaces earn transaction fees, generating distinct incentives for rent extraction. Clearing design also shapes market power among participants: when the platform’s sell price falls with aggregate exports, prosumers with storage withhold supply and underuse their batteries, a Cournot-like effect whose size depends strongly on the pricing rule and that largely disappears once storage is split across more than three owners [11]; multi-agent learning reproduces this withholding under quantity-sensitive pricing [20].

Openness. We define openness by the participation terms a platform chooses: hardware requirements, exclusivity and dispatch-rights clauses, and API and data-access conditions. These design choices determine the degree of multi-homing, switching costs, and interoperability observed in equilibrium [6, 7, 14]; in energy they bind more tightly than in most digital markets, as proprietary hardware, exclusive dispatch rights, and metering-point restrictions can enforce single-homing outright. Such terms often have efficiency rationales *ex ante*, as integrated systems compete *for* customers, while raising exit costs *ex post* [7].

Vertical integration. Control of multiple value-chain stages enables (i) information asymmetries from cross-business data access, (ii) self-preferencing when dispatch algorithms favor affiliated assets, and (iii) cross-subsidization from regulated revenues. Integration also eliminates double marginalization; the concern thus requires an input rivals cannot bypass.

Finally, note that the dimensions compound: a geographically concentrated platform with centralized clearing, strict single-homing, and vertical integration would create gatekeeping power that no single dimension produces alone.

Each dimension has observable indicators: for scope, active venues per procurement territory; for clearing, published rules and objective functions; for openness, exclusivity and hardware clauses, data-export interfaces, and stranded equipment value on exit; for integration, value-chain stages under common control and the share of affiliated dispatched capacity.

4 Case Studies

We now apply the framework to three platforms, selected to maximize variation on the openness and vertical-integration dimensions, using contract terms, court and regulatory decisions, and procurement data as evidence. Table 2 summarizes the results; the subsections document the evidence behind each entry.

4.1 sonnenCommunity: Compounding Switching Costs

sonnenCommunity (sonnen GmbH) integrates proprietary batteries with retail tariffs and VPP operation; roughly 25,000 batteries form the 250 MWh German sonnenVPP, with further VPPs in the USA, Australia, and Italy [21]. sonnen intermediates prosumer access to wholesale and ancillary markets through technical control over dispatch. Five mutually reinforcing participation conditions stand out:

Hardware requirement. The sonnenFlat direkt tariff requires a current-generation sonnen-Batterie [22, 23]; owners of third-party batteries cannot participate, and adding assets requires sonnen’s prior consent (Ziff. 4.2.3).

VPP enrollment and dispatch control. Participation enrolls the battery in the sonnenVPP [22]; the contract grants sonnen the right to charge and discharge the battery at its discretion, set state-of-charge limits, and curtail PV feed-in remotely (Ziff. 4.4.8), with control extending to heat pumps, EV charging, and other controllable devices (Ziff. 8.3) [23]. The VPP is FCR-prequalified with three of the four German TSOs (TenneT 2018, Amprion 2021, TransnetBW 2024), with the reserve marketed by Next Kraftwerke, a Shell subsidiary since 2021 [24, 25].

Exclusivity. sonnen holds the sole right to purchase and market all electricity produced in the system (Ziff. 4.4.3); operating modes other than the one chosen by sonnen are not permitted (Ziff. 4.6.4), and the profit share lapses if the customer reserves more than 20% of capacity as

backup (Ziff. 4.1.4.5) [23].

Connectivity requirement. Permanent online access to the battery is a contractual prerequisite for performance (Ziff. 8.1) [23]. Warranty terms historically carried the same tether: in a 2018 action against the warranty terms of five battery manufacturers, Verbraucherzentrale NRW singled out the combination of mandatory connectivity, data collection, and updates at sonnen [26]; the claim failed at first instance (LG München I, 2019) [27], but on appeal eight contested clauses, including the connectivity and mandatory-update requirements, were held invalid for intransparency (OLG München, 2020) [28]; the requirement now sits in the tariff terms.

Unilateral changes. In 2021, sonnen announced the termination of legacy sonnenFlat home contracts effective August 2022, before the advertised 10-year amortization, prompting Verbraucherzentrale NRW to examine a representative action [29]; we found no record that one was filed.

Summing up, these conditions have technical and commercial rationales: FCR prequalification requires guaranteed control and update capability, and the bundling of hardware, tariffs, and VPP operation is a form of systems competition that can be procompetitive *ex ante*. The competition risk lies in their combined *ex-post* effect: each layer raises exit costs, and integration spans hardware, retail, VPP, and, via Next Kraftwerke, wholesale/ancillary marketing, i.e. four stages within one group until the 2026 sale. The EU Data Act’s IoT data-access rights (Chapter II, applicable since September 2025) [30] bear directly on the connectivity and third-party-service layers.

Ownership developments underline that these are risk channels rather than realized market power: Shell, which had acquired sonnen in 2019 for almost EUR 500 million, sold it in August 2026 to the family office Tiven; the price was undisclosed, and Handelsblatt puts the loss at several hundred million euros [31]. Documented switching costs have thus coexisted with weak profitability, and financial distress offers an alternative reading of the 2021 contract terminations.

4.2 Exnaton: Cross-Utility Data Asymmetry

Exnaton (a Swiss software company) provides white-label SaaS for energy sharing and dynamic tariffs, serving 50+ utilities in five countries as of its 2025 Series A round, including E.ON brands, Volkswagen Elli, and TotalEnergies [32]. Three features bear on concentration risk despite an asset-light model.

Data asymmetry. Each utility’s customers see only their own brand, but all clients’ 15-minute smart-meter data are processed on one cloud platform, so the vendor holds an aggregate dataset that no single client can replicate; whether it is used across clients is undocumented. Prüfer and Schottmüller’s tipping model [10] is analytically relevant *if* data-enabled quality gains attract further clients; whether this loop operates here is an open question. The efficiency counterpart would be equally real: cross-client learning would give dozens of small utilities capabilities none could build alone.

Integration layer. Exnaton is an add-on to ERP systems such as SAP rather than a replacement [33, 34]; switching means replacing the engine and rebuilding the integration, a standard SaaS switching cost. The Data Act’s cloud-switching rules (Chapter VI, applicable since September 2025, switching charges phased out by January 2027) [30] mandate portability and switching assistance, not the client’s re-integration effort.

Data portability. CSV/XML and API export of billing data is documented [34]; we found no

public statement on cross-client data use or exit terms.

4.3 Piclo Flex: Two-Sided Network Effects and Their Limits

Piclo operates the leading independent flexibility marketplace originating in Great Britain, matching system operators and flexibility service providers (FSPs) via competitive auctions; as of October 2026, 500+ sellers have registered 600,000+ assets (48+ GW) [35]. The structure is a *competitive bottleneck* [14]: each DSO effectively single-homes on one procurement platform per territory while FSPs can multi-home, so platform competition occurs for the DSO side; cross-side network effects [6] favor the platform with the largest FSP pool.

Ofgem identified the peril early: in 2019, it warned that network effects could yield a concentrated market structure and monopoly power, a concern that could develop “if the GB Flexibility Platform sector becomes dominated by one platform operated on an unregulated basis” [16]. After a government-funded trial with all six DNO groups, five had joined Piclo Flex commercially by 2020 [36], bringing the market close to tipping; SP Energy Networks then adopted Piclo end to end, seeking over 1.5 GW across 1,700+ locations for 2023–2028 [37].

Competition then came from the buyers’ side. UK Power Networks, an early high-volume Piclo user [38], appointed EPEX SPOT after a competitive tender in November 2023 [39]; Electricity North West made Electron its core platform in March 2024 [40], and SSEN selected ElectronConnect in May 2024 [41]. As of 2025, Piclo Flex is the primary venue for two of six DNO groups (SP Energy Networks, Northern Powergrid) and one of two routes for a third [42]; Piclo has diversified internationally [35] and, with Piclo Max (launched 2024), towards a seller-side access layer that connects into rival venues [40]. Regulation came only afterwards. Elexon, appointed Market Facilitator in July 2024 [43] with a mandate to reduce friction across flexibility markets [43, 44], went live in December 2025 with ten common rules for NESO and the DNOs [45]; a common asset registration (FMAR), letting assets register once across markets, is due in 2027 [46].

Piclo is therefore not a case of dominance; it follows the pattern expected in a competitive bottleneck [14], with concentration first and competition *for* the market on the single-homing side afterwards. An energy-specific feature appears decisive: that side consists of regulated buyers bound by procurement rules, who can re-tender in a way dispersed consumers cannot. The intervention targets fragmentation, not dominance; by making asset data portable, it would lower switching costs and let competition for the market recur at each re-tender. Venue dependency remains a live channel.

4.4 Scope and Limitations

Three caveats apply. First, none of the three platforms has been found dominant or abusive by any competition authority; the precedents in Table 1 concern other firms and markets. Second, every documented design feature admits an efficiency explanation (systems competition, learning economies, matching efficiencies, or eliminated double marginalization), so the evidence establishes risk channels, not violations. Third, the cases were selected for variation on the framework’s dimensions and therefore illustrate rather than test it (see Section 5).

Table 2: Comparative evidence on competition-risk mechanisms across three platform archetypes

	<i>sonnenCommunity</i>	<i>Exnaton</i>	<i>Piclo Flex</i>
<i>Geogr. scope</i>	Multi-local VPPs (DE, US, AU, IT)	Multi-local (five countries, incl. CH, DE, AT, BE)	Int'l (UK incl. NI, IT, PT, BE, AU, US)
<i>Clearing</i>	Centralized (operator dispatch)	Hybrid (15-min dynamic allocation)	Competitive auction
<i>Openness</i>	Low: hardware-restricted tariff; exclusive marketing and dispatch; contested connectivity terms	Medium: CSV/XML and API export documented; re-integration needed to switch	Medium to high: FSPs multi-home; DSOs moved to rival platforms 2023–24
<i>Vert. integration</i>	High (until 2026): hardware, retail, VPP, wholesale via Shell group	Low in assets; 50+ utilities' data on one platform	Low: no asset ownership
<i>Key evidence</i>	FCR-prequalified (3 of 4 German TSOs); warranty clauses held intransparent; 2021 contract terminations	50+ utilities; SAP/ERP add-on; no public statement on cross-client data use	48+ GW registered; primary venue for 2/6 DNO groups (2025); Ofgem warning (2019); facilitator live Dec. 2025
<i>Risk channel</i>	<i>Compounded switching costs</i>	<i>Vendor dependency + potential data asymmetry</i>	<i>Venue dependency (attenuated by re-tendering; intervention pending)</i>

Table 3: Regulatory safeguards matched to design dimensions

<i>Dimension</i>	<i>Safeguard</i>
Geographical scope	Multi-contracting at metering points; prohibition of territorial market-allocation agreements
Clearing mechanism	Transparent clearing rules; auditable dispatch algorithms; published objective functions
Openness	Interoperability mandates; data portability; limits on hardware exclusivity; standardized APIs with non-discriminatory access
Vertical integration	Functional separation for DSO-operated platforms; non-discriminatory access; data firewalls between business lines

5 Regulatory Implications and Conclusion

Table 3 maps safeguards to each dimension, enabling targeted rather than one-size-fits-all regulation.

sonnen shows why openness safeguards must address the full stack of hardware requirements, third-party access, and warranty conditions rather than any single layer; the consumer-law challenge to the connectivity clauses [28] shows these layers are already contested. Exnaton shows that record-level export, which it documents, is not the binding constraint; the open questions are aggregated cross-client data and the integration layer. Piclo, finally, shows that where a regulated procurer single-homes, re-tendering can discipline a platform before regulation does.

These safeguards complement participation-enabling frameworks such as EU Directive 2019/944 and FERC Order 2222; the EU Digital Markets Act offers a partial ex-ante template. Podszun [47] argues that ex-ante rules address the structural shortcomings of ex-post competition enforcement in platform markets; the case is arguably stronger for DEIs, where risk channels are observable before dominance.

The decentralization of energy provisioning does not automatically produce competitive mar-

kets. Ofgem’s explicit monopoly-power warning, sonnen’s contract terminations and intransparent warranty clauses, and the absence of sector-wide data-portability standards for energy-community software show that these risks are concrete; the GB flexibility market shows that they are not inevitable. Early, targeted action on interoperability, transparency, and data access is therefore preferable to costly ex-post enforcement. The EU Data Act does not cover all channels; energy-specific rules on clearing transparency, aggregator market access [5], and platform switching costs remain relevant.

The framework is a starting point for further research. The cases suggest three testable conjectures: where the single-homing side can re-tender, concentration should be followed by switching to rival platforms, whereas household lock-in should make it persist; concentration should be markedly higher within grid areas than nationally; and the data channel should matter only where service quality depends on other clients’ data. Testing these with procurement and market data, and complementing models of strategic trading on a single platform [11] with models of platform competition across grid areas, are natural next steps.

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