

FEDECOM Internal Market Watch Newsletter Edition - Ed. n°5 (Q3 2025)

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BACKGROUND:

The first four editions of the internal market watch newsletter investigated FEDECOM pilot countries ([Ed. N° 1, Q2 2023](#)), the 15 Exploitable Results ([Ed. N° 2, Q1 2024](#)), the customer segments and business model archetypes ([Ed. N° 3, Q3 2024](#)), and energy trading ([Ed. N° 4, Q2 2025](#)).

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17 entries (7 case studies, 6 financing documents, and 4 regulatory briefs)



Blockchain & P2P trading

Insights spanning dynamic pricing game models, optimized consensus protocols, AI-driven trading algorithms, and comprehensive system surveys to advance blockchain and P2P within energy community frameworks.

Academic Papers & Technical Studies

- (September 2025, [Elsevier Results in Engineering](#)): "A systematic review on blockchain-based energy trading in a decentralized transactive energy system: Opportunities, complexities, strategic challenges, research directions"; highlights challenges such as maintaining balance between supply and demand, privacy, trust, and resilience.
- (July 2025, [ScienceDirect](#)): "A Review of Blockchain Consensus Mechanisms for P2P Energy Trading"; examines optimized protocols (e.g., PoS, DPoS) to improve scalability, performance, and latency in P2P energy systems.
- (July 2025, [Journal of King Saud University](#)): "Decentralized P2P Energy Trading: A Blockchain-Enabled Pricing Paradigm"; presents a game-theory-based dynamic pricing model for microgrid P2P trades, demonstrating high efficiency and user benefits in field tests.
- (June 2025, [Springer](#)): "Proximal policy optimization-driven decentralized P2P energy trading model for optimal real-time operations in smart energy communities"; presents a decentralized energy trading model using deep reinforcement learning, aiming to optimize energy transactions among smart homes, reducing energy costs and promoting efficient consumption patterns, demonstrating its scalability and practical applicability.
- (June 2025, [MDPI](#)): "Advancing Sustainable Energy Transition: Blockchain and P2P Energy Trading in India's Green Revolution"; explores challenges and potential solutions for a decentralized, open-sourced energy system in India.
- (March 2025, [Frontiers in Blockchain](#)): "Revolutionizing the Energy Sector: Exploring Diversified Blockchain Platforms"; analyzes security, scalability, AI integration, and privacy strategies across blockchain platforms for energy.
- (February 2025, [TechRxiv](#)): "Enabling a Decentralized Local Energy Market in Energy Communities Through a Blockchain-Based Platform"; integrates smart contracts for order management within local energy communities.
- (April 2025, [arXiv](#)): "Blockchain-enabled Energy Trading and Battery-based Sharing in Microgrids"; demonstrates that P2P battery-sharing algorithms reduce wasted energy by 74% and grid purchases by 12% versus centralized models.
- (December 2024, [T&F](#)): "Blockchain-based P2P Renewable Energy Trading: Traceability and Security Solutions"; proposes a full-stack solution to enhance transaction security and traceability in distributed energy markets.
- (December 2024, [ScienceDirect](#)): "Decentralized Peer-to-Peer Energy Trading in Microgrids: Blockchain Approaches"; reports on protocol designs, consensus impact, and system performance from recent experiments.
- (September 2024, [Nature Scientific Reports](#)): "Applications of Blockchain Technology in P2P Energy Trading"; categorizes blockchain use cases: P2P trading, hydrogen supply, demand response, REC tracking.
- (December 2021, [IEEE Conference on Energy Conversion](#)): "Blockchain-Based Market-Clearing Mechanism for P2P Energy Trading"; reviews market clearing methods for blockchain-based P2P energy trading for microgrid systems, focusing on auction theory, constrained optimization, game theory, and agent methods. It aims to enhance the throughput of microgrids by promoting dynamic electricity markets and ensuring transaction integrity.
- (September 2021, [ScienceDirect](#)): "Blockchain-Based P2P Energy Trading System"; proposes a decentralized framework for local energy generation and real-time trading resilience, foundational for consensus protocol selection.

Industry News, Pilots & Commentary

- (July 2025, [JPMorgan Unit via Public Power](#)): "J.P. Morgan Unit is Developing New Blockchain Application for Carbon Markets"; tokenizes voluntary carbon credits on blockchain to improve market transparency.
- (July 12, 2025, [BiomassProducer.com.au](#)): "Blockchain Makes Clean Energy Trading Simple (Here's How It Works)"; highlights Australian microgrids reducing costs by up to 30% via blockchain-powered P2P trading.
- (July 2025, [Ecadin](#)): "Unlocking the Power of Blockchain for Energy and Sustainability"; outlines blockchain's role in P2P trading, REC tracking, emissions management, and smart grids.
- (July 2025, [Current News](#)): "Verv Claims UK First with Launch of Blockchain-Powered P2P Energy Trading Pilot"; Verv and Repowering London pilot P2P energy trading in 40 Hackney flats under an Ofgem sandbox.
- (June 2025, [Powerline](#)): "Decentralised Power: Enhancing Access to Clean Energy through P2P Trading"; reports India rooftop solar pilots delivering ~43 % cost reductions.
- (June 2025, [World Energy Council & PwC](#)): "The Developing Role of Blockchain" white paper; highlights scalability limits, protocol fragmentation, grid integration hurdles, and evolving regulatory uncertainties.
- (June 2025, [WattCrop](#)): "Blockchain and the Energy Sector in 2025"; highlights DAG-based micro-transactions, tokenized carbon credits, and Power Ledger pilots in Australia and France.
- (May 2025, [DebutInfoTech](#)): "Why Blockchain in P2P Energy Trading Is Shaping Renewable Energy's Future" community study; over 300 communities onboarded, achieving 35 % operational cost reductions.

Digital twins for energy communities

Digital twins can facilitate real-time optimization, predictive maintenance, scenario analysis, and resource integration in energy communities. They enable scalable management and energy trading, despite challenges like data interoperability and system complexity.

Projects

- **TwinEU (Horizon Europe)** Pan-European electricity grid DT federating local twins for forecasting, resilience, and flexibility markets; implementation of 8 demonstrations across 11 EU countries.
- **TwinERGY (H2020)** enables positive changes on how citizens and communities consume energy by empowering them to track their energy use and to proactively participate in the market.
- **DATA CELLAR (Horizon Europe)** Energy Data Space with digital twins and DSS for planning and lifecycle analysis.
- **Twin2Share (TIKS)** conception, prototypical implementation and scientific evaluation of an innovative software product that can be easily adapted (configured) to the requirements of a specific energy community (EC) and supports all phases from start-up to operation.

Journal papers

- **(September 2025, Elsevier): "Transforming nano grids to smart grid 3.0: AI, digital twins, blockchain, and the metaverse revolutionizing the energy ecosystem"** outlines a Smart Grid 3.0 architecture integrating AI and digital twins, relevant for evolving community energy systems.
- **(February 2025, Applied Energy): "A Digital Twin of Multiple Energy Hub Systems with P2P Energy Sharing"**
- Presents a MARL-based digital twin for multi-hub energy clusters (PV, storage, EVs) simulating P2P energy trading and assessing cost savings, emissions reduction, and grid peak shaving.
- **(July 2025, IET Research via Wiley): "Digital Twin Technology for Renewable Energy, Smart Grids, Energy Storage and Vehicle-to-Grid Integration: Advancements, Applications, Key Players, Challenges and Future Perspectives in Modernising Sustainable Grids"** comprehensive review of digital twins in smart grids and renewable systems.
- **(July 2025, TechXplore): "How digital twins can accelerate the global transition from fossil fuels to clean energy"** exploring benefits such as improved system prediction and optimization, but also highlighting limitations and recommending improved data collection and modeling.
- **(June 2025, MDPI): Integrating Machine Learning and Digital Twins for Enhanced Smart Building Operation and Energy Management"** Meta-analysis showing how combined DT+AI frameworks improve predictive control, occupant feedback loops, and multi-energy building coordination.
- **(March 2025, Elsevier) "Digital Twin Role for Sustainable and Resilient Renewable Energy Systems"** analyzes solar microgrids, predictive maintenance, and demand flexibility.
- **(March 2025, Frontiers): "Sustainable innovations in digital twin technology: a systematic review about energy efficiency and indoor environment quality in built environment"** highlights the need for a multidisciplinary framework.
- **(April 2025, MDPI) "Analysis of Digital Twin Applications in Energy Efficiency: A Systematic Review"** explores the role of Digital Twins in energy efficiency across various industries.
- **(April 2025, EnergyCentral): "Digital Twins in Utilities – Bridging Physical and Digital Worlds"**; discusses DT adoption in grid planning, outage management, and demand forecasting across utilities.
- **January 2024, Elsevier): "Enabling Coordination in Energy Communities: A Digital Twin with Bi-Level Optimization Model"** Demonstrates a bi-level optimization architecture powered by a DT to coordinate energy sharing in community microgrids, improving social welfare and reducing peak loads.
- **(October 2024, Springer): "Digital Twins of Smart Energy Systems: A Systematic Literature Review on Enablers, Design, Management and Computational Challenges"**; review of 263 digital twin use cases in smart energy systems, with focus on architecture, IoT-DT integration, blockchain opportunities, simulation tools, and barriers.
- **(July 2024, EC³): "Digital Twins in Building Management: Boosting Efficiency in Renewable Energy Communities"** presents a digital twin technology-based approach for managing multidisciplinary data in renewable energy communities, integrating IoT, Big Data, and territorial modeling for decision-making.
- **(April 2024, MDPI): "Applications and Challenges of Digital Twin Technology in Smart Grids"**: Covers hardware-software integration, edge deployment, real-time control, AI tools, and regulatory limitations across 5 main domains in smart-grid DTs.
- **(November 2023, arXiv): "Smart Energy Network Digital Twins: Findings from a UK-Based Demonstrator Project"** describes open-source DT for distribution network emulation; real-world PV meter data reduced export curtailment.
- **(August 2023, Springer): "Collaborative Digital Twins: The Case of the Energy Communities"** proposes "Collaborative Digital Twins" (CDTs) as intelligent digital twins for RECs and smart cities, promoting collaborative decision-making.

Enablers of citizen-led communities

These resources highlight how practical pilots, supportive funding, and clear legal frameworks are all essential for scaling energy communities that empower citizens and accelerate the clean energy transition.

Pilot case studies & industry platforms

- (March 2022, [Energies MDPI AG](#)): “A Distributed Ledger-Based Automated Marketplace for the Decentralized Trading of Renewable Energy in Smart Grids”; describes a case study where participants achieved 6–12 % savings on energy costs and producers saw 37 % higher revenues via neighborhood P2P trades.
- (March 2023, [Sustainability MDPI AG](#)): “A Case Study of Existing Peer-to-Peer Energy Trading Platforms”; introduces a Stackelberg game-theory model for dynamic microgrid pricing via blockchain smart contracts.
- (June 2025, [Power Ledger](#)): “Powerledger’s TraceX is now integrated with ERCOT (Electric Reliability Council of Texas) enabling low-cost micro-transactions for EV charging.
- (July 2025, [COMPETE 2030 – Indie Energy & ISEP](#)): “Towards Energy Communities for a Sustainable & Just Future”; EnergyP2P project in Portugal pilots a blockchain-enabled, AI-powered community VPP & smart contract trading.
- (July 2025, [IEECP](#)): “Advancing Energy Communities through Digitalisation”; LIFE InEEsS workshops in Spain explore blockchain to digitalize community governance, incentives, and renewables deployment.
- (July 2025, [ENEA – Italy](#)): “Energy Communities, ENEA Unveils Italy’s First Smart Community”; blockchain-enabled Local Token Economy in Anguillara Sabazia for renewable energy and goods/services exchange.
- (May 2025, [List.Solar](#)): “Top P2P Energy Trading Platforms 2025” ranking; highlights Power Ledger, LO3 Energy, Electron, and six other fastest-growing systems.

Funding, citizen engagement & policy

- (June 2025, [Revolve Media](#)): “How Citizen Energy Can Power a Fairer Transition”; explores cooperative models, citizen equity financing, and the enabling policy landscape.
- (June 2025, [Lexology via Holland & Knight](#)): “Treasury and IRS Release Updated Guidance on Energy Community Bonus Tax Credit”; Notice 2025-31 clarifies MSAs, non-MSAs, and coal-closure tract designations as of June 23, 2025.
- (June 2025, [EU Mayors Initiative](#)): “Housing for resilient cities: empowering citizens for a clean energy transition” previews the Citizens Energy Package, targeting energy poverty and local capital mobilisation.
- (April 2025, [Innovation News Network](#)): “Unlocking EU finance for energy communities” discusses EU budget tools and policy reforms needed to unlock financing for citizen-led initiatives.
- (April 2025, [EUSEW](#)): “An EU budget that works for the people: unlocking finance for energy communities” highlights the importance of energy communities in Europe’s clean energy transition, but challenges in financing their growth remain. It calls for tailored EU-level financial support mechanisms, such as an EU Guarantee Facility, simplified state aid procedures, and technical assistance.
- (May 2024, [Energy Transitions](#)): “Financing the energy transition in the EU” Policy factsheet stating that the EU needs to double its low-carbon finance to meet its climate targets, with annual investments increasing by 60%. The EU can lead by investing in low-carbon technologies, but policy delays and slow disbursement of funds are affecting confidence.

Legal, regulatory & strategic briefs

- (May 2025, [Centre on regulation in Europe](#)): “Flexibility in the energy sector” Report claiming that flexibility is no longer an add-on, but a critical enabler for a secure, reliable, decarbonised energy system. The EU framework is largely sound, but requires focused national action, investment, and market reforms to close implementation gaps and realise the benefits of flexibility.
- (March 2025, [DG for Regional and Urban Policy](#)): “Handbook on Cross-border Energy Communities” provides detailed insights for EU Member State pairs, assessing legal frameworks, current barriers, existing interconnections, EU funding support, and national grid management and congestion issues. Key insights include legal barriers, EU funding, interreg programs, and grid congestion.
- (March 2025, [Mansfield](#)): “Tariffs Policy Update: What It Means for Cross-Border Energy Trade” – Details the U.S. administration’s imposition of 25% tariffs on Canadian and Mexican goods, with specific implications for energy product trade, aiming to address trade imbalances.
- (March 2022, [Elsevier Energy Strategy Reviews](#)): “Benefits of cross-border citizen energy communities at distribution system level” The EU energy transition faces challenges in integrating renewable electricity generation into distribution systems. To address this, a solution is proposed: “citizen energy communities” that allow cross-border participation. This innovative approach links distribution systems using a switchable element, leading to more efficient system utilization and relevant national laws.