MASTER THESIS | MASTER'S THESIS

Titel | Title

Comparative Analysis of the Electricity Market in EU and Ukraine

verfasst von | submitted by

Oleksandr Skulskyy

angestrebter akademischer Grad | in partial fulfilment of the requirements for the degree of

Master of Laws (LL.M.)

Wien | Vienna, 2025

Studienkennzahl lt. Studienblatt | Degree programme code as it appears on the student record sheet:	UA 992 548
Universitätslehrgang lt. Studienblatt | Postgraduate programme as it appears on the student record sheet:	Europäisches und Internationales Wirtschaftsrecht (LL.M.)
Betreut von | Supervisor:	Dr. Marco Botta Privatdoz. LLM PhD

TABLE OF CONTENTS

List of Figures

List of Abbreviations

AC	Alternating Current
ACER	Agency for the Cooperation of Energy Regulators
aFRR	Automatic Frequency Restoration Reserve
BM	Balancing Market
BI	Barriers Index
BRP	Balancing Responsible Parties
BSP	Balancing Service Provider
CACM	Capacity Allocation and Congestion Management
CfD	Contract for Difference
CHP	Combined Heat and Power
CM	Capacity Mechanism
DAM	Day-Ahead Market
DC	Direct Current
DSO	Distribution System Operator
EEE	European Economic Area
EE CCR	Eastern Europe Capacity Calculation Region
EEX	European Energy Exchange
ENTSO-E	European Network of Transmission System Operators for Electricity
EnC	Energy Community
EIP	Electricity Integration Package
EU	European Union
EUPHEMIA	EU Pan-European Hybrid Electricity Market Integration Algorithm
EUR	Euro
FCA	Forward Capacity Allocation
FCR	Frequency Containment Reserve
FiP	Feed-in Premium
FiT	Feed-in Tariff
FSR	Florence School of Regulation
FTR	Financial Transmission Right
GO	Guarantee of Origin
HHI	Herfindahl-Hirschman Index
HVDC	High Voltage Direct Current
IDM	Intraday Market
IGCC	International Grid Control Cooperation
IEA	International Energy Agency
JAO	Joint Allocation Office
kWh	Kilowatt-hour

LMP	Locational Marginal Pricing
LTTR	Long-Term Transmission Right
MARI	Manually Activated Reserves Initiative
MCP	Market Clearing Price
MW	Megawatt
MWh	Megawatt-hour
NECP	National Energy and Climate Plan
NEURC	National Commission for State Regulation of Energy and Public Utilities (Ukraine)
NEMO	Nominated Electricity Market Operator
NRA	National Regulatory Authority
OECD	Organisation for Economic Co-operation and Development
OTC	Over-the-Counter
PCI	Projects of Common Interest
PICASSO	Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation
PPA	Power Purchase Agreement
PSI	Pivotal Supplier Index
PSO	Public Service Obligations
PTR	Physical Transmission Right
RCC	Regional Coordination Centers
RES	Renewable Energy Sources
RR	Replacement Reserve
RSI	Residual Supply Index
SDAC	Single Day-Ahead Coupling
SIDC	Single Intraday Coupling
SoLR	Supplier of Last Resort
SvK	Svenska Kraftnät
TERRE	Trans-European Replacement Reserve Exchange
TPP	Thermal Power Plant
TSO	Transmission System Operator
TYNDP	Ten-Year Network Development Plan
UEEX	Ukrainian Energy Exchange
USS	Universal Service Supplier
USSR	Union of Soviet Socialist Republics
WEM	Wholesale Electricity Market*
XBID	Cross-Border Intraday

* WEM was an element of Ukraine's single-buyer model until introduction of electricity market reform in 2019.

Table of Abbreviated / Short-Titled Legislation

Short title	Full Title	Legislation Reference
ACER Regulation	Regulation establishing a European Union Agency for the Cooperation of Energy Regulators	Regulation (EU) 2019/942
CACM Regulation	Capacity Allocation and Congestion Management Regulation	Regulation (EU) 2015/1222
EBGL	Electricity Balancing Guideline	Regulation (EU) 2017/2195
Electricity Directive	Directive on common rules for the internal market for electricity	Directive (EU) 2019/944
Electricity Regulation	Regulation on the internal market for electricity	Regulation (EU) 2019/943
EMIR	Regulation on OTC derivatives, central counterparties and trade repositories	Regulation (EU) 648/2012
EML	Electricity Market Law	Law of Ukraine No 2019-VIII
FCA Regulation	Forward Capacity Allocation Regulation	Regulation (EU) 2016/1719
MiFID II	Markets in Financial Instruments Directive II	Directive 2014/65/EU
NC DC	Network Code on Demand Connection	Regulation (EU) 2016/1388
NC ER	Network Code on Emergency and Restoration	Regulation (EU) 2017/2196
NC HVDC	Network Code on Requirements for Grid Connection of High Voltage Direct Current Systems and Direct Current-Connected Power Park Modules	Regulation (EU) 2016/1447
NC RfG	Network Code on Requirements for Grid Connection of Generators	Regulation (EU) 2016/631
RED	Renewable Energy Directive	Directive (EU) 2018/2001
REMIT	Regulation on Wholesale Energy Market Integrity and Transparency	Regulation (EU) 1227/2011
SOGL	System Operation Guideline	Regulation (EU) 2017/1485
Transmission System Charging Guidelines	Guidelines Relating to the Inter-Transmission System Operator Compensation Mechanism and a Common Regulatory Approach to Transmission Charging	Regulation (EU) 838/2010
Transparency Regulation	Regulation on Submission and Publication of Data in Electricity Markets	Regulation (EU) 543/2013

Chapter I. INTRODUCTION

General Overview

This thesis explores the development and functioning of electricity markets in the EU and Ukraine through a comparative legal lens. It focuses on assessing the resilience of the EU's market design and the progress of Ukraine's alignment with the EU model under the Energy Community (EnC) framework.

Integrating Ukraine's electricity sector into the EU market framework holds strategic importance for both sides. For Ukraine, it is an opportunity to strengthen its energy sector, encourage investment, and ensure more reliable and affordable electricity, particularly in the context of Russia's ongoing military aggression. For the EU, it strengthens regional energy security, enhances decarbonization potential, and supports market expansion. Closer integration also enhances interconnection, market coupling, and long-term system flexibility, making electricity market alignment a shared strategic priority in a time of regional instability.

Why Electricity Matters: Foundations for Understanding Market Regulation

Electricity has a unique position in the modern economy not only because of its significant role in human development and technological progress, but also due to its physical and economic characteristics. Unlike most other commodities, electricity cannot be stored in large volumes and must be produced and consumed at the same time, which requires a complex grid infrastructure. These features have important implications for the structure and regulation of electricity markets. Therefore, before turning to the legal and institutional analysis of electricity market design, it is useful to briefly recall the historical, economic, and technological developments that led to electricity's central role in modern life.

Historically, the advent of electricity was a cornerstone of the Second Industrial Revolution, which began in the late 19th century. The first hydroelectric power station at Cragside, UK opened in 1878,[2] Edison's coal-fueled power plants in London (the Holborn Viaduct)[3] and in New York City (the Pearl Street Station)[4] marked the beginning of a new era in which electricity became available on a commercial scale for industrial and domestic use. This resulted in a major shift from manual labor and steam-powered machines to electrically powered technologies. The

[2] *'Hydro-electricity restored to historic Northumberland home'* BBC News (London, 26 February 2013) <https://www.bbc.co.uk/news/uk-england-tyne-21586177> accessed 21 June 2024.

[3] Kiran Stacey, *'Britain Passes Historic Milestone with First Days of Coal-Free Power'* Financial Times (London, 16 May 2016) <https://www.ft.com/content/fc2c8d12-191d-11e6-bb7d-ee563a5a1cc1> accessed 21 June 2024.

[4] Carl Sulzberger, *'History' IEEE Power & Energy Magazine* (March/April 2013) <https://magazine.ieee-pes.org/marchapril-2013/history-7/> accessed 21 June 2024.

competition between DC and AC power technologies significantly increased transmission distances, making it even more affordable.

Electrification progressively improved industrial productivity and living conditions. It expanded urbanization and enhanced public services, including transportation, water supply, and street lighting. By enabling the use of appliances like refrigerators, washing machines, and electric stoves, electricity not only reduced domestic labor but also contributed to a meaningful social change – the increased engagement of women in education, employment, and public life advanced gender equality.[5]

Today, electricity remains a vital element driving economic growth and improving the quality of life by powering industries, businesses, and services, and enabling continuous innovation and productivity. Newest technologies, such as artificial intelligence and big data, heavily rely on electricity, making them among the key drivers of the expected substantial growth in global electricity demand.[6] On the other hand, these same technologies offer important opportunities for integrating digital intelligence into electricity grids, enhancing real-time monitoring, demand-side management, and overall system efficiency.[7]

The role of electricity in the global energy transition is also crucial. With the growing focus on climate change, renewable electricity sources, such as wind, solar, and hydropower, are becoming a key resource to replace fossil fuels in global energy consumption. As noted by experts, "*a solution that does address all three problems [air pollution, global warming, and energy insecurity] at the same time is to transition the world's all-purpose energy to electricity and heat that are provided by clean, renewable energy and storage.*"[8]

Thus, while electricity remains a vital commodity, the way it is produced, traded, transmitted, and distributed is crucial to ensuring a secure, efficient, and sustainable supply. These principles form the foundation of the EU's contemporary energy policy, as reflected in the *Clean Energy Package*. For Ukraine, which is aligning its legal framework with the EU model, the implementation of these rules also represents an essential part of its own energy transition.

[5] Ana Swanson, '*Why household appliances are the 20th century's most disruptive technologies'* (World Economic Forum, 22 October 2015) <https://www.weforum.org/agenda/2015/10/why-household-appliances-are-the-20th-centurys-most-disruptive-technologies/> accessed 21 June 2024.

[6] IEA, *Electricity 2024* (Analysis and Forecast to 2026, IEA Publications, January 2024) <https://www.iea.org/reports/electricity-2024/executive-summary> accessed 21 June 2024.

[7] Vida Rozite, Jack Miller, Sungjin Oh, *'Why AI and Energy are the New Power Couple'* (IEA, 23 May 2023) <https://www.iea.org/commentaries/why-ai-and-energy-are-the-new-power-couple> accessed 21 June 2024.

[8] Mark Z Jacobson, *100% Clean, Renewable Energy and Storage for Everything* (Cambridge University Press 2020) 13.

Research Motivation and Contribution

Against this background, electricity market design and functioning have attracted increasing legal, economic, and policy scrutiny. As electricity plays an increasingly central role in decarbonization, while also facing new geopolitical and technological challenges, the architecture of the electricity markets requires constant adaptation. These dynamics pose significant challenges for regulators, policymakers, and academics, especially as the EU deepens integration with neighbouring countries. Understanding how regulatory frameworks adapt during crises and policy transitions is essential for achieving effective and lasting reform.

This thesis explores the design of electricity markets as a highly complex and dynamic area of energy law. In recent years, electricity markets in the EU have come under significant pressure. Thus, the 2021-2022 energy crisis revealed structural weaknesses in the existing framework, including high price volatility, limited demand-side flexibility, poor investment signals, and concerns over security of supply. In response, the 2024 reform introduced substantial changes aimed at strengthening the resilience and performance of the EU electricity markets.

At the same time, Ukraine continued to advance its electricity market reforms, despite the challenges posed by Russia's full-scale invasion in 2022. During this period, the EnC also expanded its *Electricity Integration Package* (EIP), substantially updating the integration obligations of its Contracting Parties, including Ukraine, and significantly expanding the regulatory landscape that is still being implemented.

A substantial body of academic literature addresses various aspects or elements of electricity market design, focusing on isolated regulatory challenges or specific legal issues. In contrast, this thesis adopts a holistic and multi-layered comparative approach, focusing on the interconnected architecture of electricity market design and seeking to spot a broader view on the challenges often present at the intersections of its multiple market elements. It aims to demonstrate how inefficiencies, distortions, or incomplete reforms in one market segment – for example, retail price regulation or public service obligations – can propagate into inefficiencies in wholesale markets, competition dynamics, balancing mechanisms, and investment signals.

Moreover, given the rapid regulatory developments that occurred during the thesis preparation period – including the 2024 EU reform and the 2022 EIP expansion – this research provides one of the most up-to-date legal analyses, systematically integrating these recent changes into a unified comparative framework. It seeks to contribute to both academic discussion and policymaking by highlighting the key convergences and divergences between electricity market regulations in the EU and Ukraine.

Statement of Research Goals, Methodology, and Structure

The primary goal of this thesis is to conduct a comparative legal analysis of the EU and Ukraine's electricity markets, addressing ***two main questions***: (i) whether the EU internal electricity market design is sufficiently resilient and fit for purpose in light of recent crises; and (ii) how Ukraine's market design compares to the EU model, highlighting areas of convergence and divergence and identifying reforms needed for deeper integration.

The EU's transition from state monopolies to a competitive and integrated internal electricity market offers a useful reference point for all EnC countries. Particular attention is given to how key elements of market design interact across product layers (energy, capacity, balancing, and ancillary services), timeframes (forward, day-ahead, intraday, and real-time), and spatial levels (cross-border integration and grid management). Learning from both the strengths and weaknesses of the EU model can support more effective and resilient reforms in EnC countries like Ukraine.

This thesis applies a comparative legal approach to examine the legislative frameworks, institutional setups, and market functioning in both the EU and Ukraine. This research relies on primary legal sources, including EU directives, regulations, EnC acquis, and Ukrainian legislation. This is further supported by secondary sources, including official reports from ACER, the Commission, the EnC Secretariat, OECD, academic literature, and market data.

The thesis structure follows its comparative legal approach and research goals. Chapter I outlines the research context, scope, and objectives. Chapter II traces the historical evolution of electricity markets in the EU and Ukraine. Chapter III examines the multi-layered design of the EU electricity market and its performance, while Chapter IV does the same for Ukraine's, assessing its alignment with the EU model and identifying key implementation challenges. Finally, Chapter V summarises the main findings and provides key reform recommendations.

To conclude, this thesis explores a highly dynamic and policy-relevant area of energy law, examining the EU's evolving legal frameworks and Ukraine's ongoing integration under the Energy Community Treaty. The comparative analysis, which spots the most recent legal and institutional developments, seeks to provide both an up-to-date academic contribution and practical insights into the future evolution of electricity market design in the EU and Ukraine.

Chapter II. EVOLUTION OF ELECTRICITY MARKETS IN EUROPE

2.1 Global Trends in Electricity Markets Liberalization

According to MIT Economics Professor Paul L Joskow, "*electricity sectors almost everywhere on earth evolved with (primarily) vertically integrated geographic monopolies that were either state-owned or privately owned and subject to price and entry regulation as natural monopolies.*"[9] The main elements of the electricity supply chain – generation, transmission, distribution, and retail supply – were historically concentrated in individual electric utilities, which had exclusive rights to service all types of consumers within a specified territory.

The performance of these regulated monopolies varied significantly between countries. While sector outcomes were generally better in developed economies compared to developing ones, persistent challenges – such as high operating costs, construction cost overruns on new facilities, elevated retail prices, and declining production costs from new entrants – created pressure for reforms. These challenges motivated policymakers to explore liberalization as a means to reduce costs, improve service quality, and stimulate innovation.[10]

The primary goal of the electricity sector liberalization reform has been to establish new institutional arrangements for the electricity sector that provide long-term societal benefits and ensure that a fair share of these benefits reaches consumers through prices that reflect the efficient economic cost and service quality. Competitive wholesale markets have been introduced to incentivize tighter control over construction and operational costs, to foster technological innovation, and to ensure that risks associated with technology choices and cost overruns are shifted from consumers to suppliers. The opening of retail competition enables consumers to select electricity suppliers based on price, service quality, and product offerings, including tailored service packages and demand-side solutions.

Nonetheless, certain critical infrastructure components, which reflect significant portions of electricity supply costs, particularly distribution and transmission networks, remain regulated as legal monopolies. Reforms to traditional regulatory arrangements for these networks are seen as essential complements to the introduction of wholesale and retail competition, while their effective functioning heavily relies on a well-operated transmission and distribution network infrastructure. In many jurisdictions, privatization of network companies, combined with

---

[9] Paul L Joskow, *'Lessons Learned From Electricity Market Liberalization'* (2008) 29 (Special Issue 2) The Energy Journal 10 <https://www.jstor.org/stable/27085628> accessed 21 June 2024.

[10] Paul L Joskow, *'Electricity Sectors in Transition'* (1998) 19(2) The Energy Journal 30 <https://www.jstor.org/stable/41322773> accessed 21 June 2024.

performance-based regulation, has been used to impose stricter budget limitations, enhance cost efficiency, and promote service quality improvements.

Many of the liberalization initiatives in Europe and elsewhere were launched during the early 1990s, a period marked by reduced political concern over energy security. The end of the Cold War diminished perceived risks associated with energy imports, particularly gas from Russia, while technological advancements and surplus generation, primarily gas-fired plants, provided favorable conditions for market reforms.[11] In this context, liberalization of electricity markets was viewed not only as economically desirable but also as politically feasible.

The following sections examine how these global liberalization trends have been realized in the European Union and Ukraine. This chapter provides the historical and institutional background, helping to understand the current legal and regulatory frameworks for electricity markets in both jurisdictions, which are examined in detail in the following chapters.

2.2 Evolution of the Electricity Market in the EU

Like in most parts of the world, for much of the 20th century, electricity in European countries was provided by public utilities, which were natural monopolies with the obligation to serve everyone in their designated territory at a fair price (rate), reviewed and approved by a state authority. Public ownership was seen as "*the simplest and crudest measure that can be taken to avoid abuse of market power by a monopolist. […] Public ownership of energy assets, including but not limited to energy networks, has long been the norm, either as the result of acts of nationalization (such as in France in 1946 or in the United Kingdom between 1947 and 1949) or due to the direct involvement of central or local governments in the establishment of these industries (the stadtwerke, or municipal utilities, in Germany).*"[12] Although this model was "*criticized by both consumers and politicians because of the lack of incentives to reduce costs or address operating inefficiencies, [as well as] for having poor incentives to develop efficiencies for lower costs to the end consumer*"[13], it was dominant in all European countries until the end of the 20th century.

At the same time, the strategic importance of the electricity sector for both industrial competitiveness and an essential service for households underscored a need for a unified EU electricity market as part of the broader European integration project. The establishment of the

---

[11] Tooraj Jamasb and Michael Pollitt, *'Electricity Market Reform in the European Union: Review of Progress toward Liberalization & Integration'* (2005) 26 (Special Issue: European Electricity Liberalisation) The Energy Journal 16 <https://www.jstor.org/stable/23297005> accessed 21 June 2024.

[12] Manfred Hafner and Giacomo Luciani (eds), *The Palgrave Handbook of International Energy Economics* (Springer 2022) 218.

[13] Ibid. 475-476.

EU Single Market in 1993 further strengthened the case for energy market integration. In its working document on the Internal Energy Market[14], the Commission emphasized the need to eliminate regulatory barriers and harmonize national frameworks in order to create a functioning internal electricity market. While competition and consumer welfare were core principles of the Union, vertically integrated, state-owned electricity monopolies constituted a blocking point to achieving a unified energy market.[15] Consequently, electricity market liberalization became both an economic necessity and a critical step toward completing the EU's internal market project.

The evolution of the EU electricity market has primarily occurred through a series of legislative reforms known as '*Energy Packages'*. While the *First* and *Second Packages* introduced competition and third-party access, the *Third Energy Package* advanced unbundling, independent regulation, and cross-border market coordination. The most recent *Clean Energy Package* (the '*Fourth Package'*) has shifted the policy focus towards decarbonization, flexibility, and consumer empowerment, reflecting the EU's growing climate objectives.

In addition to these core legislative packages, the evolving EU electricity market framework has been progressively complemented by a wide range of additional legal instruments. These include numerous implementing regulations, network codes, and sector-specific regulations addressing areas such as cross-border capacity allocation, market transparency, balancing, congestion management, market integrity, and many others. Collectively, these instruments have supported the practical implementation of market coupling, enhanced cross-border coordination, and strengthened market functioning across the Union.

The following subsections examine these successive reforms in greater detail, focusing on the legal, institutional, and operational changes that had implications for the EU's modern electricity market design.

2.2.1 1st Energy Package: Initial Step Toward Market Opening

Although the Common Market and free movement of goods were initially established by the Treaty of Rome in 1957,[16] no common EU market for energy products such as electricity existed until the adoption of Directive 96/92/EC[17] – the first version of the so-called '*Electricity Directive*' – in 1996. The Directive aimed to "*establish common rules for the production of*

[14] Commission, '*The Internal Energy Market'* (Communication) COM (88) 238 final.

[15] Ibid., para 37.

[16] Treaty Establishing the European Economic Community [1957] <https://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:11957E/TXT> accessed 21 June 2024 (not published in the Official Journal).

[17] Council Directive 96/92/EC of 19 December 1996 concerning common rules for the internal market in electricity [1996] OJ L27/20.

electricity and the operation of electricity transmission and distribution systems,"[18] and to eliminate discrimination between the systems' users, particularly in favor of affiliates of the operators of such systems. In other words, it marked the EU's first step towards liberalizing the electricity sector by distinguishing between the regulated network segment and the potentially competitive activities of generation and supply.

The Directive 96/92/EC introduced the principle of unbundling, requiring Member States to ensure the functional, but not necessarily legal or ownership, separation of generation and supply businesses of state-owned monopolies from the operation of networks. This approach, although limited to accounting and organizational separation, represented a necessary foundation for introducing deregulation and competition into electricity generation and supply.

This initial attempt to liberalize the sector was accompanied by strong resistance from Member States, who were concerned about the potential risks of reform and thus reluctant to transfer control over a critical economic domain. As a result, progress toward establishing a competitive market was slow and uneven.

2.2.2 2nd Energy Package: Deepening Market Integration

While Directive 96/92/EC marked the beginning of electricity market liberalization, its limited scope and flexible implementation, which allowed Member States broad discretion, led to uneven market opening and drew criticism,[19] ultimately prompting the adoption of the more robust Second Energy Package in 2003.

The cornerstone of the *Second Energy Package* was the adoption of Directive 2003/54/EC[20] – the second recast of the Electricity Directive. This new Directive reinforced the unbundling requirements, mandating that transmission system operators (TSOs) and distribution system operators (DSOs) be "*independent, at least in terms of their legal form, organization and decision making from other activities not relating to [transmission and distribution].*"[21] Although full ownership unbundling had not yet been imposed, the move towards greater functional separation represented a necessary step to neutral network operation.

Beyond unbundling, the Directive introduced an important institutional innovation by obliging Member States to establish independent national regulatory authorities (NRAs). These regulators were responsible for "*ensuring non-discrimination, effective competition and the*

---

[18] Ibid., rec 22.

[19] Leigh Hancher, *'Slow and Not So Sure: Europe's Long March to Electricity Market Liberalization'* (2002) 10(9) Electricity Journal <https://doi.org/10.1016/S1040-6190(97)80504-0> accessed 21 June 2024.

[20] Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC [2003] OJ L 176/37.

[21] Ibid., arts 10, 15.

efficient functioning of the market."[22] NRAs were intended to act autonomously from both market participants and political authorities, strengthening confidence in the impartial governance of liberalized electricity sectors.

In addition, Regulation (EC) 1228/2003 on conditions for access to the network for cross-border exchanges in electricity[23] was adopted. As a directly applicable legal instrument, the Regulation harmonized rules for the management of cross-border interconnectors and access to transmission infrastructure. It introduced the requirement for market-based allocation of cross-border transmission capacity, promoting transparency, non-discrimination, and efficiency in cross-border electricity trading.[24]

At the same time, the Regulation (EC) 1228/2003 provided for limited exemptions from certain obligations to encourage investment in new interconnection capacity between Member States.[25] These exemptions were intended to stimulate private investment in cross-border infrastructure by allowing project developers to recover costs and earn returns under preferential conditions, thus supporting the physical integration of national electricity markets into a truly European internal market.

Overall, the *Second Energy Package* substantially enhanced transparency, competition, and technical integration in European electricity markets. It reinforced the institutional framework and harmonized cross-border access and infrastructure development, thereby laying the groundwork for a truly interconnected and competitive internal electricity market.

2.2.3 3rd Energy Package: Completing Market Liberalization

Adopted in 2009, the *Third Package* reform continued to remove remaining barriers to market entry and enhance the institutional framework. It comprised three main legislative instruments:

- Directive 2009/72/EC[26] – the third recast of the *Electricity Directive*;
- Regulation (EC) 713/2009[27] establishing ACER – the Agency for the Cooperation of Energy Regulators; and

[22] Ibid., art 23.

[23] Regulation (EC) 1228/2003 of the European Parliament and of the Council of 26 June 2003 on conditions for access to the network for cross-border exchanges in electricity [2003] OJ L 176/1.

[24] Ibid., art 8.

[25] Ibid., art 7.

[26] Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC [2009] OJ L 211/55.

[27] Regulation (EC) 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators [2009] OJ L 211/1.

- Regulation (EC) 714/2009[28] on conditions for access to the network for cross-border exchanges (repealing Directive 2003/54/EC).

The recast Electricity Directive 2009/72/EC further shaped the legal and organizational framework for the generation, transmission, distribution, and supply of electricity within the EU. It reinforced open market access, enhanced consumer protection, and laid down clearer rules for system operation, licensing, tendering procedures, and public service obligations. Most importantly, it completed the unbundling process by requiring the effective separation of transmission operations from generation and supply activities. Member States were obliged either to implement full ownership unbundling or, subject to strict conditions, to apply alternative models such as the Independent System Operator or Independent Transmission Operator arrangements.

While the Directive continued to allow some discretion in implementation details, the accompanying regulations had direct effect and were uniformly applicable across Member States. Regulation (EC) 713/2009 established ACER – an independent EU-level agency with the purpose of fostering regulatory coordination, developing common cross-border market rules, and supporting NRAs in enforcing consistent regulatory standards while ensuring their independence from political interference. Simultaneously, Regulation (EC) 714/2009 promoted coordinated action among TSOs through the establishment of the *European Network of Transmission System Operators for Electricity* (ENTSO-E), formalizing cooperation on system operation, network planning, and capacity allocation.[29]

A crucial innovation of the *Third Energy Package* was the introduction of the network codes and guidelines – binding technical and commercial rules governing cross-border electricity trade, which significantly advanced market harmonization, transparency, and competition, laying the foundation for an integrated internal market.

As a result, the *Third Energy Package* finalized the major structural reforms envisioned since the early 1990s. It completed the unbundling of utilities, strengthened independent regulatory oversight, consolidated market rules for cross-border trade, and created a coherent institutional architecture for the governance of the European electricity market. At the same time, the adoption of the *Third Package* did not mark the end of market liberalization. New legislative initiatives emerged to address evolving challenges over the next decade, then culminating in the broader and more ambitious *Clean Energy Package*.

[28] Regulation (EC) 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) 1228/2003 [2009] OJ L 211/15.

[29] Ibid., art 5.

2.2.4 Evolution between the Packages

The market design established under the *Third Energy Package* outlined an internal electricity market in which electricity could flow freely across Europe, moving from areas with lower production costs to regions of higher demand. This price-based system was designed to give consumers access to the cheapest available electricity across the EU. To make sure prices reflect supply and demand across a wider area, the market needed stronger regional integration, efficient cross-border trading, and greater transparency. Consequently, successive regulatory measures were introduced to strengthen market integrity, efficiency, and cross-border operational coordination.

In 2011, the Parliament and the Council adopted REMIT[30], which addressed the growing need for market transparency and to prevent market manipulation and insider trading in the rapidly liberalizing and interconnected wholesale electricity market. It set strict rules for monitoring and reporting transactions in wholesale energy markets, allowing NRAs to detect and prevent abusive practices and protect the integrity of the internal energy market.

Subsequent steps toward deeper market integration were taken with the adoption of CACM Regulation.[31] This instrument introduced a harmonised methodology for calculating and allocating cross-border transmission capacity, optimising the utilization of interconnectors, and enhancing the efficiency of cross-border electricity trade. A key innovation was the development of *a single market coupling algorithm* to jointly calculate electricity prices and cross-border capacities, improving the cross-border integration of national electricity markets.

Further integration of real-time system operations was advanced by the adoption of the *Electricity Balancing Guideline* (EBGL)[32] in 2017. The EBGL harmonised the procurement and activation of balancing services across borders and laid the groundwork for pan-European balancing platforms, such as MARI, PICASSO, and TERRE, aiming to improve the cost-efficiency and system security on a continental scale.

In parallel, the EU adopted a comprehensive set of network codes and guidelines aimed at harmonising technical, operational, and market rules across its Member States. These instruments include, *inter alia*, the Forward Capacity Allocation Regulation (FCA

[30] Regulation (EU) 1227/2011 of the European Parliament and of the Council of 25 October 2011 on wholesale energy market integrity and transparency [2011] OJ L 326/1.

[31] Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management [2015] OJ L 197/24

[32] Commission Regulation (EU) 2017/2195 establishing a guideline on electricity balancing [2017] OJ L 312/6.

Regulation),[33] the System Operation Guideline (SOGL),[34] the Emergency and Restoration Regulation (NC ER),[35] and several connection codes governing generation, demand facilities, and HVDC systems (NC RfG;[36] NC DC;[37] and NC HVDC[38]). Complementary frameworks such as the Transparency Regulation[39] and Transmission System Charging Guidelines[40] further strengthened market transparency and equitable cost allocation within the internal market.

These instruments constitute not only the core *'inter-package'* legislation, but they are also a major part of the so-called "*electricity acquis communautaire*" under the EnC framework.[41] As legally binding obligations for Contracting Parties, including Ukraine, their implementation has become a central driver of electricity sector reform and a key benchmark for assessing integration into the EU internal electricity market.

Throughout the decade following the adoption of the *Third Energy Package*, the EU electricity market gradually evolved, addressing technological advances, the expansion of renewable energy, and the growing complexity of cross-border system operations. Despite important progress, the market continued to face structural challenges that could not be fully addressed through the incremental legislative measures adopted between the Energy Packages. These include the need for greater system flexibility, deeper consumer participation, and accelerated decarbonisation - the issues ultimately required a more comprehensive and coordinated policy response, leading to the adoption of the new *'package'* reform.

2.2.5 4th Energy Package: Clean Energy for All Europeans

The *Clean Energy for All Europeans Package* (shortly referred to as the *Clean Energy Package* or *Fourth Energy Package*) represents the fourth comprehensive reform initiative aimed at advancing the EU's internal energy market. Finalising this comprehensive reform required over

[33] Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on forward capacity allocation [2016] OJ L 259/42.

[34] Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation [2017] OJ L 220/1.

[35] Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a network code on electricity emergency and restoration [2017] OJ L 312/54.

[36] Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators [2016] OJ L 112/1.

[37] Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a Network Code on Demand Connection [2016] OJ L 223/10.

[38] Commission Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules [2016] OJ L 241/1.

[39] Commission Regulation (EU) 543/2013 of 14 June 2013 on submission and publication of data in electricity markets and amending Annex I to Regulation (EC) 714/2009 [2013] OJ L 163/1.

[40] Commission Regulation (EU) 838/2010 of 23 September 2010 on laying down guidelines relating to the inter-transmission system operator compensation mechanism and a common regulatory approach to transmission charging [2010] OJ L 250/5.

[41] EnC Sekretariat, '*Energy Community Acquis'* (List for Electricity) <https://www.energy-community.org/enc-lex/law/acquis.html> accessed 28 April 2025.

two years of negotiations following the Commission's initial proposal published in November 2016. The final texts were adopted through the trialogue procedure between the Commission, the Council, and the Parliament, concluding in 2019.[42]

The *Clean Energy Package* encompasses eight legislative acts covering diverse aspects of the energy sector, including renewable energy, energy efficiency, governance, building performance, and electricity market design. For the purposes of this thesis, the focus is limited to the legislation that is relevant to the evolution of the internal market for electricity. These include two Directives and three Regulations:

- Directive (EU) 2018/2001[43] on the promotion of the use of energy from renewable sources (*Renewable Energy Directive* or *RED*). This Directive, recasting the earlier RED, established a new binding target for renewable energy of at least 32% by 2030, to be transposed into the national legislation by June 2021.
- Directive (EU) 2019/944[44] on common rules for the internal market for electricity (last recast of *Electricity Directive)*. It reinforced consumer-centric provisions, promoting market-based pricing, consumer choice, and active consumer participation. The Directive granted households and small businesses the right to request smart meters at no cost, access to dynamic pricing contracts, and the right to become '*prosumers*' by producing and selling electricity.
- Regulation (EU) 2019/943[45] on the internal market for electricity (the first recast of the *Electricity Regulation*), governing the wholesale electricity market and network operations. Unlike *Electricity Directives*, which required transposition into national law, the *Electricity Regulation* is directly applicable and enforceable without further legislative action. It reinforces the principles of market-driven price formation, cross-border trading, and decarbonization. The Regulation also introduced a new process for bidding zones review to better reflect structural grid constraints, mandated the establishment of Regional Coordination Centers (RCCs) to enhance TSO cooperation, and created a new EU-level entity for DSOs to participate in the drafting of network codes and guidelines.

---

[42] FSR, '*The Clean Energy for all Europeans Package*' (10 June 2020) <https://fsr.eui.eu/the-clean-energy-for-all-europeans-package/> accessed 25 June 2025.

[43] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) [2018] OJ L 328/82.

[44] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast) [2019] OJ L 158/125.

[45] Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast) [2019] OJ L 158/54.

- Regulation (EU) 2019/942[46] establishing a European Union *Agency for the Cooperation of Energy Regulators* (*ACER Regulation*). It reflects the expanded responsibilities of ACER under the new market design, including oversight of RCCs, monitoring regional markets, and supporting regulatory convergence.
- Regulation (EU) 2019/941[47] on risk-preparedness in the electricity sector introduced a harmonized framework for crisis prevention and management, including mandatory national risk assessments and cross-border crisis coordination mechanisms.

Together, these instruments not only reinforced the foundational liberalisation principles established in earlier packages but also integrated the EU's evolving climate and decarbonisation objectives directly into electricity market design. It established stronger regional cooperation mechanisms, strengthened consumer rights, and prepared the European electricity system to accommodate a rapidly growing share of renewable energy while maintaining system security and market integrity.

2.2.6 Market Evolution Beyond the Clean Energy Package

The *Clean Energy Package* represents the most recent and comprehensive EU's '*package'* reform and continues to serve as a foundational element of the internal electricity market's regulatory framework. Yet, it did not mark the end of market evolution. Instead, the regulatory framework has continued to evolve in response to accelerating technological change, the growing share of variable renewable energy, emerging system flexibility needs, and new geopolitical and economic disruptions – most notably the energy price crisis triggered by Russia's full-scale invasion of Ukraine in 2022. While the period after 2019 saw mainly gradual legal and institutional updates, the 2024 reform marked the start of a more comprehensive and forward-looking phase of electricity market regulation.

In May 2024, the Parliament and the Council adopted two key legislative instruments:

- Regulation (EU) 2024/1747,[48] amending the Electricity Regulation and the ACER Regulation, and
- Directive (EU) 2024/1711,[49] amending the Electricity Directive and RED.

---

[46] Regulation (EU) 2019/942 of the European Parliament and of the Council of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators (recast) [2019] OJ L 158/22.

[47] Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC [2019] OJ L 158/1.

[48] Regulation (EU) 2024/1747 of the European Parliament and of the Council of 13 June 2024 amending Regulations (EU) 2019/942 and (EU) 2019/943 as regards improving the Union's electricity market design [2024] OJ L, 2024/1747.

[49] Directive (EU) 2024/1711 of the European Parliament and of the Council of 13 June 2024 amending Directives (EU) 2018/2001 and (EU) 2019/944 as regards improving the Union's electricity market design [2024] OJ L, 2024/1711.

The 2024 Electricity Market Reform is widely recognised by scholars and regulators as a reform of '*package-level*' significance.[50] It introduced a set of targeted legal instruments to address vulnerabilities revealed by the recent energy crisis. These include measures to strengthen consumer empowerment, enhance long-term price stability, and improve capacity adequacy. Rather than reversing the course of liberalization, the 2024 reform aims to strike a balance between the goals of competition and market integration, on the one hand, and the security of supply, investment certainty, and the accelerated rollout of renewable energy, on the other. This approach underscores the EU's ongoing commitment to adapting its electricity market regulation to emerging systemic challenges.

The detailed legal analysis of the 2024 reform package – including its market design implications and the underlying shift in regulatory philosophy – will be addressed in the following chapter, which examines the current design of the EU internal electricity market and its evolving structural features.

2.2.7 Concluding Remarks on Three Decades of EU Electricity Market Reform

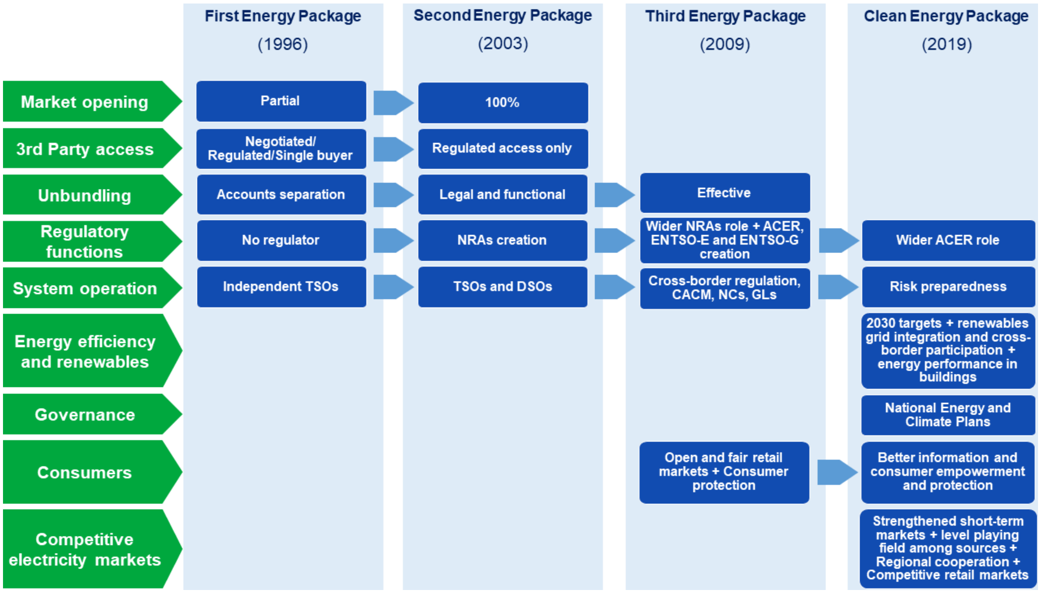
The regulatory developments described above illustrate one of the most ambitious and sustained legal reform efforts in European economic policy. Over the past three decades, the European Union has progressively transformed its electricity sector from a patchwork of national monopolies into a legally integrated, increasingly decarbonised internal electricity market. This process unfolded through ***four successive legislative reform waves*** – the *First* (1996), *Second* (2003), *Third* (2009), and *Fourth* (2019) *Energy Packages* – each addressing new regulatory, institutional, and technical challenges (see also *Figure 1* below).

Each legislative package progressively deepened integration and market functioning by:

- Opening access to competition in generation and supply,
- Establishing independent regulators and network operators,
- Strengthening cross-border trading rules and infrastructure cooperation, and
- Promoting broader decarbonisation and consumer empowerment.

[50] Georg Zachmann, '*How important is the new electricity market reform?*' (Bruegel, 16 March 2023) <https://www.bruegel.org/newsletter/how-important-new-electricity-market-reform> accessed 25 June 2025; Alberto Pototschnig and Leigh Hancher, '*The Future Electricity Market Design'* (FSR, 14 December 2023) <https://fsr.eui.eu/the-future-electricity-market-design/> accessed 25 June 2025.

Figure 1. Evolution of EU electricity market design across the Packages (1996–2019)[51]



Beyond these staged reforms, the internal electricity market has continued to evolve dynamically. Emerging challenges have driven continuous adaptation, such as the increased penetration of variable renewable energy, the need for greater system flexibility, consumer participation, and resilience to external shocks such as the 2021-2022 energy crisis. These developments have culminated in the 2024 Electricity Market Reform, which now represents the current design of the electricity market within the Union. The following section examines the historical development of Ukraine's electricity market and its evolving relationship with the EU's internal market model.

2.3 Evolution of the Electricity Market in Ukraine

2.3.1 Historical Background of Ukraine's Electricity Sector

The development of electricity in Ukraine began nearly in parallel with its emergence in other industrialized nations. By the end of the 19th century, the first electric lights appeared in Kyiv and other major cities, marking the beginning of the electrification era. In 1890, Kyiv witnessed the construction of the first electric power plant, and by the early 20th century, multiple urban centres in Ukraine had established their own electricity networks.

A more rapid and large-scale expansion of electrification occurred during Ukraine's integration into the Soviet Union, where energy development followed centralized state planning. Under the Soviet regime, industrialization was a strategic priority, making Ukraine one of the USSR's

[51] ACER, *EU Wholesale Electricity Market Design* (Final Assessment, April 2022) 17 <https://www.acer.europa.eu/sites/default/files/documents/Publications/Final_Assessment_EU_Wholesale_Electricity_Market_Design.pdf> accessed 27 May 2025.

core power hubs by the mid-20th century.[52] The electricity sector in Ukraine's SSR was highly centralized, vertically integrated, leaving no scope for market-based mechanisms or competition. All elements of the value chain (generation, transmission, distribution, and supply) were state-owned and directed. While extensive, the energy infrastructure suffered from inefficiencies and inflexibility, typical of centrally planned economies.

After declaring independence in 1991, Ukraine faced the major challenge of transitioning its economy from a centrally planned to a market-based model. In this context, liberalization of the electricity sector became an important element of the broader policy agenda. Ukraine's reform process unfolded in parallel with – but under markedly different conditions from – the liberalisation of electricity markets in the United States and the European Union during the 1990s. Unlike the EU and the US, Ukraine's reforms were held back by political and economic instability, ageing infrastructure, and weak institutions. These challenges limited investor confidence and slowed the development of a competitive electricity market.

These structural challenges fundamentally shaped the pace and character of electricity sector reform in Ukraine, producing a trajectory distinct from that of the EU. Recognising these differences is important for understanding Ukraine's later efforts to align with the EU internal electricity market, especially through its participation in the EnC and, more recently, its EU candidate status granted in 2022.

2.3.2 Single-Buyer Model: An Interim Structure Before Full Liberalisation

The first significant step towards liberalizing Ukraine's electricity market was taken in 1996, when the vertically integrated, state-regulated model was replaced by a ***single-buyer model*** in the form of a mandatory centralized one-sided electricity pool. Under this structure, a designated central entity purchased electricity from all qualified producers, resold it to suppliers, and set the weighted average prices on a day-ahead basis.

The legal foundation for this model was established by the Law of Ukraine "*On Electricity*" (1997).[53] According to Article 15 of that law, all electricity generated by power plants exceeding certain thresholds (installed capacity above 20 MW and/or electricity output exceeding 100 million kWh in the previous year) had to be transacted through the *Wholesale*

[52] Є. Т. Базеєв, Г. Б. Варламов, І. А. Вольчин [та ін.], *Енергетика: історія, сучасність і майбутнє. Пізнання й досвід – шлях до сучасної енергетики* (наук. ред. Ю. О. Ландау, І. Я. Сігал, С. В. Дубовської, Київ: Б.в., 2013) (Y. T. Bazeyev, G. B. Varlamov, I. A. Volchyn [et al.], *Energy: History, Present, and Future. Knowledge and Experience – the Path to Modern Energy* (ed. Y. O. Landau, I. Ya. Sigal, S. V. Dubovskoy, Kyiv: B.v., 2013), 323-325.

[53] Закон України «Про електроенергетику» від 16 жовтня 1997 № 575/97-ВР [1997] Урядовий Кур'єр (20.11.1997) (Law of Ukraine '*On Electricity*' of 16 October 1997 No 575/97-VR [1997] the Governmental Courier (20.11.1997)) <http://zakon0.rada.gov.ua/laws/show/575/97-%D0%B2%D1%80/> accessed 21 June 2024.

Electricity Market (WEM). WEM was defined as an organized system for conducting electricity purchase and sale operations, governed by a contractual arrangement among its participants.[54]

The participants in WEM included electricity-generating companies, Ukrenergo (the Ukrainian TSO), regulated suppliers known as *Oblenergos*, which combined distribution and supply functions, and unregulated suppliers that provided electricity to non-residential consumers on a competitive basis at contractual prices. The central role in WEM was played by the state enterprise *Energorynok*, which acted as the exclusive buyer of electricity from generating companies and the exclusive seller to both regulated and unregulated suppliers – effectively serving as the single market intermediary.

Although the single-buyer model introduced elements of price-based competition, especially among thermal power plants (TPPs),[55] most participants remained subject to regulatory oversight by Ukraine's NRA, NEURC. In 2014, TPPs produced roughly 41% of Ukraine's electricity, but this segment was dominated by state-owned plants and one private energy group, DTEK, resulting in a Herfindahl-Hirschman Index (HHI) of around 3,800, indicating high concentration and limited competition.[56]

WEM functioned primarily as the day-ahead market using a ***weighted average pricing*** method. Higher costs from thermal and renewable generators were averaged with lower-cost output from nuclear and hydroelectric plants. Electricity sold to suppliers incorporated not only energy costs but also transmission tariffs, excise duties, and implicit cross-subsidies to support regulated tariffs for socially sensitive consumer categories, including the entire household segment and public transportation. This pricing structure created widespread price discrimination, distorted cost-reflective market signals, and inhibited efficient demand-side response.

Over time, several structural shortcomings became evident. While the model allowed for some degree of generator competition, it was severely constrained by market concentration. Extensive cross-subsidisation and price suppression contributed to the accumulation of financial debts among market participants, undermining liquidity and creditworthiness across the value chain. The pricing and regulatory environment did not provide sufficient investment

---

[54] Договір між членами Оптового ринку електричної енергії України від 15.11.1996 (Agreement Between the Members of the Wholesale Electricity Market of Ukraine dated 15.11.1996) <https://zakon.rada.gov.ua/rada/show/n0001227-96/ed19961115#Text> accessed 21 June 2024.

[55] Постанова НКРЕКП, *Правила Оптового ринку електричної енергії України. Додаток 2 до Договору між членами Оптового ринку електричної енергії* [2 березня 1996] (Resolution of NEURC, *Rules of the Wholesale Electricity Market of Ukraine. Annex 2 to the Agreement among the Members of the Wholesale Electricity Market* [2 March 1996]) <https://zakon.rada.gov.ua/rada/show/v0921227-03#Text> accessed 21 June 2024.

[56] Т. І. Салашенко, *Наукове забезпечення лібералізації ринку електричної енергії України* (Харків: ФОП Лібуркіна Л. М., 2020) (T Salashenko, *Scientific Support for the Liberalization of the Electricity Market of Ukraine* (Kharkiv: FOP Liburkina L.M., 2020) 205.

signals, stimulate modernization, or the adoption of new technology, leading to inefficiencies and weak performance. These ultimately required a comprehensive restructuring to align with modern market principles and international best practices.[57]

2.3.3 Aligning Ukraine's Electricity Market with the EU Model

Although the single-buyer model was originally conceived as a transitional phase towards a liberalized electricity market, it took Ukraine more than two decades to initiate this transition. Electricity market reform was part of the broader shift from a centrally planned economy to a European-aligned, market-based system. This alignment accelerated after Ukraine joined the EnC in 2011, undertaking commitments to adopt EU energy legislation (the *acquis*).[58]

Ukraine's first legislative attempt to adopt an EU-style electricity market model came in 2013 with the adoption of the Law of Ukraine "On the Principles of the Functioning of the Electricity Market of Ukraine".[59] However, implementation was derailed just weeks later, when the government suspended preparations for signing an Association Agreement with the EU.[60] This decision triggered mass protests called the *Revolution of Dignity*, which led to the collapse of the government and loss of territories. The ensuing political and economic crisis brought energy sector reform efforts to a halt.

A renewed reform cycle began in 2017 with the adoption of the Law of Ukraine "On the Electricity Market" (the Electricity Market Law or EML),[61] which repealed the 2013 framework and introduced a comprehensive market design based on the EU's *Third Energy Package*.[62] The new model officially commenced operations on 1 July 2019, replacing the legacy single-buyer system with a liberalized multi-segment market.

The market structure introduced under the EML established ***forward, day-ahead, intraday, and balancing market segments***, and mandated the unbundling of Ukrenergo (Ukrainian TSO). It

---

[57] А. С. Завербний, '*Аналізування проблем реформування українського ринку електричної енергії'* (2012) №748 Вісник Національного університету "Львівська політехніка" (A. S. Zaverbnyi, '*Analysis of the Problems of Reforming the Ukrainian Electricity Market'* (2012) 748 Bulletin of the National University "Lviv Polytechnic"*)* 318-320 <http://nbuv.gov.ua/UJRN/VNULPM_2012_748_46> accessed 21October 2024.

[58] Energy Community Treaty [2006] OJ L 198/18.

[59] Закон України «Про засади функціонування ринку електричної енергії України» від 24 жовтня 2013 р. № 663-VII [2013] Урядовий Кур'єр 232-233 (Law of Ukraine 'On the Principles of the Operation of the Electricity Market of Ukraine' dated 24 October 2013 No 663-VII [2013] the Governmental Courier 232-233) <http://zakon2.rada.gov.ua/laws/show/663-18> accessed 21October 2024.

[60] Shaun Walker, *'Ukraine Suspends Preparations for EU Trade Pact'* The Guardian (London, 21 November 2013) <https://www.theguardian.com/world/2013/nov/21/ukraine-suspends-preparations-eu-trade-pact> accessed 21 October 2024.

[61] Закон України «Про ринок електричної енергії» від 13 квітня 2017 р. № 2019-VIII [2017] Урядовий Кур'єр 147 (Law of Ukraine 'On the Electricity Market' dated 13 April 2017 No 2019-VIII [2017] the Governmental Courier 147) <http://zakon3.rada.gov.ua/laws/show/2019-19> accessed 21 October 2024.

[62] Ірина Коссе, '*Реформа ринку електроенергії в Україні'* (Інститут економічних досліджень та політичних консультацій, 2020) (Iryna Kosse, *Electricity Market Reform in Ukraine* (Institute for Economic Research and Policy Consulting, 2020) 15-25 <www.ier.com.ua/files/…/Policy…/Policy_Paper_4_final.pdf> accessed 21 June 2024.

also laid the foundation for the retail market liberalization. According to the EnC Secretariat's 2023 Implementation Report, Ukraine had achieved 72% implementation of its electricity-related obligations.[63] However, the report noted that key structural distortions remained. Administrative price caps continued to undermine wholesale price signals, and public service obligations (PSO) were still applied in forms incompatible with competitive market principles.

At the same time, it is worth noting that many aspects of the more advanced EU electricity market architecture, as outlined in the 2019 *Clean Energy Package,* were not yet included in the scope of the *Electricity Implementation Package* (EIP) under the EnC framework until its revision in December 2022.[64] The revised EIP nearly doubled the number of legislative acts Ukraine and other EnC Contracting States are now obliged to adopt, making compliance more challenging. Due to this, earlier assessments were based on a narrower set of requirements and did not fully reflect the widening gap between Ukraine's electricity market and the more advanced EU framework. Due to this updated benchmark, in 2024, Ukraine's implementation rate fell to 46%[65]– the decline not reflecting regression but rather the higher standards introduced by the *Clean Energy Package*.

2.3.4 Concluding Remarks on Ukraine's Electricity Market Evolution

Ukraine's electricity sector has undergone significant changes in recent decades, with the launch of a liberalized market in 2019 as a major step toward aligning with the EU framework. However, reforms remain incomplete: legacy pricing mechanisms, regulatory distortions, and limited institutional capacity continue to constrain the development of a fully liberalised, transparent, and competitive electricity market.

For much of the post-2011 period, Ukraine's implementation commitments were centred around the *acquis* of the *Third Energy Package* under the EnC framework. The December 2022 revision of EIP redefined this trajectory by making the *Clean Energy Package* the new benchmark for compliance by the Energy Community's contracting parties, including Ukraine. This expansion introduced more demanding obligations, including cross-border integration, regional balancing, consumer participation, and decarbonisation.

---

[63] EnC Secretariat, *Annual Implementation Report 2023: Ukraine* (1 November 2023) 3 <https://www.energy-community.org/dam/jcr:3da7c4f8-ea23-4169-b1e9-66b0ed05fcb7/EnC_IR2023.pdf> accessed on 29 April 2025.

[64] Ministerial Council Decision 2022/03/MC-EnC of 15 December 2022 [on the adoption of a revised Electricity Integration Package] <https://www.energy-community.org/dam/jcr:e6c3f31f-a770-45db-8c7f-f69d7392628e/Decision03-2022-MC_newELacquis_15-12-2022.pdf> accessed on 1 July 2025.

[65] EnC Secretariat, *Annual Implementation Report 2024: Ukraine* (1 November 2024) 3 <https://www.energy-community.org/dam/jcr:a4f6d762-c1d6-49bf-bf39-a2dfbaf0171f/IR2024_Ukraine.pdf> accessed on 15 May 2025.

The revised EIP has thus shifted the focus of Ukraine's reform agenda from establishing a basic market to deeper structural and institutional convergence with the EU's electricity market model. In this context, the divergence in the substantive functionality of market institutions also increased, making the reform even more challenging, especially in the context of war with Russia and Ukraine's urgent energy security needs.

2.4 Final Observations on Electricity Market Evolution in Europe

The evolution of electricity markets over the past three decades reflects a global shift from state-controlled, vertically integrated structures to competitive, consumer-driven systems. The European Union has played a leading role in this transformation on our continent, progressively building an internal electricity market through four successive legislative packages, supported by complementary implemented instruments, such as guidelines and network codes. This regulatory evolution progressively dismantled monopolistic structures, promoted cross-border integration, and aligned market functioning with decarbonisation, security of supply, and consumer empowerment objectives.

Ukraine pursued similar strategic goals but along a more complex and challenging path. After experimenting with a *single-buyer* model throughout the late 1990s and 2000s, it launched a liberalized electricity market in 2019, structured around the EU's *Third Energy Package*. However, persistent regulatory distortions, institutional weaknesses, and high market concentration have limited the effectiveness of the reform. Since 2022, the alignment benchmark has shifted. With the adoption of the revised EIP, Ukraine is now formally required to implement the core elements of the EU's *Clean Energy Package*. This recalibration highlighted not only the significant gap in market maturity between the EU and its neighbours, but also the growing expectations for structural convergence and regional integration.

The comparative evolution of electricity markets in the EU and Ukraine reflects a shared commitment to market liberalisation and integration but also reveals ongoing gaps in institutional capacity and regulatory effectiveness. The successful implementation of electricity market reforms ultimately relies on sustained political commitment, economic stability, and the development of robust and independent institutions.

The following chapters shift from historical development to legal and structural analysis. Chapter III examines the current architecture of the EU internal electricity market, focusing on its multi-layered design. Chapter IV assesses the design and institutional functioning of Ukraine's electricity market, evaluating to what extent it reflects the principles of EU electricity *acquis* and identifying key divergences that remain on the path toward integration.

Chapter III. THE CURRENT DESIGN OF THE EU ELECTRICITY MARKET

3.1 Structural Foundations of the EU Electricity Market Design

The design of the EU internal electricity market is a complex, multi-layered system aimed at integrating diverse national energy systems into a competitive, efficient, and decarbonised pan-European framework. Rooted in successive waves of market liberalisation – beginning with the *First Energy Package* in the late 1990s and culminating in the *Clean Energy for All Europeans Package* in 2019 – the current EU market architecture seeks to reconcile objectives of economic efficiency, technological transformation, climate targets, and public service obligations.

The EU electricity market design is primarily based on the *Electricity Regulation* and the *Electricity Directive*, along with various sectoral regulations, guidelines, and network codes that define its structure, operation, and institutional framework. This chapter undertakes to assess its current design, distinguishing between its two principal functional layers: the ***wholesale*** and the ***retail***.

The ***wholesale segment*** – where electricity is traded among producers, suppliers, traders, and large industrial consumers – is examined using a three-dimensional framework encompassing ***product structure, temporal organisation, and spatial integration***. This approach reflects the highly formalised and algorithm-driven nature of market coupling, cross-zonal trade, and transmission capacity allocation within the internal market.

By contrast, the ***retail market*** – governing the relationship between retail suppliers and end-users – is assessed through a different analytical lens. While underpinned by EU-wide rights and liberalisation principles, retail markets remain largely shaped by national regulatory structures and consumer behaviour patterns. More fundamentally, classic spatial and temporal metrics are not directly applicable to the retail layer: retail markets do not require cross-border infrastructure or geographic integration, as they function as the contractual downstream of the wholesale segment. Similarly, electricity consumption at the retail level typically occurs as needed, rather than aligning with the temporal scheduling and dispatch logic that defines wholesale market timeframes. Accordingly, this chapter assesses the retail segment by examining the available *contract types* and design of *retail price regulation*, along with the degree of *supplier competition*, the role and scope of public service obligations, and the development of *consumer empowerment tools* such as *dynamic pricing*, smart metering, and access to real-time consumption data.

The chapter concludes with an integrated assessment of internal market performance during the recent energy crisis, drawing on regulatory monitoring reports, assessments, and policy communications by the EU institutions. This section identifies the structural vulnerabilities of the existing market design that are exposed under crisis conditions, particularly with regard to price formation, investment signals, and consumer protection, which led to the subsequent 2024 Electricity Market Reform. The reform demonstrates the EU's regulatory resilience to systemic shocks while staying on course toward its climate and energy goals.

3.2 Wholesale Market Layer: Three-dimensional Market Architecture

3.2.1 Defining the Structural Layers of the Wholesale Market

The wholesale electricity market comprises the set of organised and bilateral trading platforms through which electricity and related system services are exchanged among producers, suppliers, traders, and large industrial consumers. Unlike the retail market, which concerns the sale of electricity to final customers, the wholesale segment functions upstream, forming the core arena for *price discovery, dispatch scheduling, and system optimisation*. It is in the wholesale market that the physical and economic realities of the electricity system are most closely aligned, with price signals, capacity allocation, and technical constraints all interacting through structured mechanisms governed by EU law.

According to the classic competition law doctrine, *"a relevant economic market has two principal dimensions: the goods or services comprising it (the '<u>product market</u>') and the area within which the undertakings operating in the market are involved in the supply of those goods or services (the '<u>geographic market</u>'). However, it is sometimes necessary to consider also a third dimension: the times or periods during which supply and demand on that market occur (the '<u>temporal market</u>')."* [66]

In the context of the EU electricity markets, these dimensions are not mere theoretical constructs but form the foundation of the market's legal, economic, and technical architecture. The EU wholesale market operates simultaneously across three interdependent dimensions:

- the *<u>product dimension</u>*, encompassing not only *energy* (electricity as a commodity), but also related services such as balancing, ancillary services, and capacity – each governed by distinct rules, timeframes, and market logics;
- the *<u>temporal dimension</u>*, structured along the continuum of timeframes – from forward hedging contracts and day-ahead auctions to intraday adjustments and real-time system balancing – each serving specific operational and economic purposes; and

[66] David Bailey and Laura Elizabeth John (eds), *European Union Law of Competition* (8th edn, Oxford University Press 2018) 240.

- the _geographic dimension_, shaped by physical network constraints, bidding zones configuration, and cross-border integration, all collectively determine how electricity can flow and where prices are formed.

Together, these three dimensions define the functioning of the EU wholesale electricity market. They embody the unique nature of electricity as a *non-storable*, *physically constrained* commodity requiring *real-time balancing* within a synchronized grid. As such, market design must align economic objectives with engineering realities and regulatory oversight to maintain a secure, reliable, and well-functioning system.

3.2.2 Product and Temporal Architecture of the Wholesale Market Segment

3.2.2.1 Defining Products and Timeframes

A foundational element of the EU wholesale market layer is the structured definition of its ***product dimension*** and its alignment with specific ***temporal layers***. While classical competition law doctrine[67] and case law[68] define the relevant *product market* as the set of products or services that are regarded as interchangeable or substitutable by consumers, due to their characteristics, prices, and intended use, this general approach requires significant adaptation in the electricity sector. The Commission's 2024 Market Definition Notice[69] explicitly recognizes the need for sector-specific analysis, noting that market definitions must reflect the technical characteristics and regulatory frameworks of the industry in question.

Electricity differs fundamentally from most other traded commodities. It cannot be economically stored in large quantities and must be delivered instantly across a synchronised network. Supply and demand must remain continuously balanced, and the safe operation of the grid depends on compliance with multiple technical parameters. These features render conventional market definitions inaccurate. Instead, a tailored legal and functional framework is required – one that encompasses not only ***what*** is traded, but also ***when*** and ***for what purpose***.

This differentiated approach is embedded in Article 2(9) of the Electricity Directive, which defines '*electricity markets*' as "*markets for the trading of energy, capacity, balancing and ancillary services in all timeframes.*" This definition reflects the multi-layered structure of electricity trading, recognising that each product addresses a specific system need – whether adequacy, flexibility, or stability – and is activated at a distinct stage of the market sequence:

---

[67] Ibid. 247.

[68] Case T-504/93 *Tiercé Ladbroke SA v Commission* [1997] ECR II-00923.

[69] Commission, '*Commission Notice on the Definition of the Relevant Market for the Purposes of Union Competition Law*' (Communication) [2024] OJ C 164/5, para 15.

- ***Energy*** refers to the actual flow of electric power delivered and consumed, measured in kilowatt-hours (kWh), and traded across several market timeframes, including *forward, day-ahead, intraday, and balancing markets*.
- ***Balancing*** represents a hybrid product, positioned at the final layer of the energy market sequence. While functionally overlapping with *ancillary services*, it is procured *ex ante* as reserved *capacity* and activated close to real-time as *energy* to stabilize system frequency and correct short-term imbalances.
- ***Ancillary services,*** particularly non-frequency ones, provide essential system support functions such as *voltage control, inertia, and black-start capability*. These are procured by TSOs and DSOs, on either a continuous or event-driven basis.
- ***Capacity*** refers to the future availability of generation or demand-side flexibility. It is remunerated for readiness – not delivery – and is typically used to safeguard system adequacy during peak demand or scarcity events.

While *electric energy* is the core traded commodity, its physical delivery depends on the continuous compliance with multiple technical parameters. These are not traded directly, but are instead managed through dedicated market instruments such as *balancing products*, *capacity mechanisms*, and *ancillary service markets*. In this sense, the EU electricity market is not merely a platform for energy exchange, but a multi-layered mechanism for managing temporal, technical, and systemic risks.

By referring to "*all timeframes*," the legal definition affirms that electricity market products are determined not solely by their technical features, but also by the specific stage in the market sequence at which they are traded, scheduled, or activated. The ***temporal*** dimension is thus not ancillary but fundamental to the identity and role of each market product.

Accordingly, the EU wholesale market design segments products across a continuum of timeframes – from multi-year forward contracts to real-time balancing – aligning product structure with operational needs and system constraints. The following subsections examine in detail how energy, balancing, ancillary services, and capacity are defined, structured, and deployed across this temporal architecture.

3.2.2.2 Energy as the Core Product

Electric energy (electricity) constitutes the fundamental product traded across various segments of the EU wholesale and retail electricity markets. Defined as the measurable flow of power over time (in kWh or MWh), its physical attributes are simple, but its economic, legal, and temporal dimensions are subject to a complex and differentiated market framework.

Within the *wholesale segment,* energy is traded in bulk between generators, suppliers, traders, and large industrial consumers. These transactions are structured across a sequential set of timeframes – beginning with *forward contracts* and extending through *day-ahead* and *intraday* trading to real-time *balancing* – each underpinned by a distinct regulatory and market design. Collectively, they form a dynamic architecture for energy price formation, dispatch planning, and system operation.

What distinguishes electric energy from conventional commodities is not only its non-storability and instantaneous consumption but also the technical imperative to maintain real-time balance between generation and load. Energy is not traded as a generic good, but rather as a *time-specific* service, defined by delivery windows as short as 15 minutes and governed by algorithms that optimise dispatch across physical and geographic constraints.

As such, energy trading serves both commercial and system-critical functions. It enables market participants to hedge exposures, optimise procurement, and arbitrage prices across time and geography. Simultaneously, it facilitates system balancing, the efficient integration of renewable generation, and the optimisation of cross-border electricity flows. To achieve these dual goals, core market platforms apply the *marginal pricing* principle to determine dispatch and clearing prices within each timeframe.

The subsections that follow examine the operation of the EU's markets for energy across this temporal continuum, starting with the forward market and proceeding through the day-ahead, intraday, and balancing stages. This approach illustrates how electric energy is priced, traded, and activated at each interval of the market timeline.

3.2.2.2.1 Forward Market

The wholesale market begins with ***forward and long-term energy contracts***, typically traded bilaterally (OTC) or via exchanges, with or without physical supply. These contracts span a range of maturities – from months to several years ahead of delivery – and, although not centrally coordinated at the EU level, play a critical role in enabling market participants to hedge against price volatility, manage procurement costs, and support long-term investment planning.[70]

OTC contracts are bilateral agreements between suppliers, traders, or large industrial consumers, offering flexibility in terms of volume, duration, pricing, and delivery. These contracts can be physical, involving electricity delivery, or financial, with settlement based on

[70] FSR, '*Electricity Markets in the EU'* (14 September 2020) <https://fsr.eui.eu/electricity-markets-in-the-eu/> accessed 9 April 2025.

price differences. Many such transactions are based on standardised legal templates, such as the *EFET General Agreement*,[71] which reduces counterparty risk and enhances legal certainty.

Exchange-traded forwards (commonly referred to as futures) are standardised contracts listed on regulated markets such as the *European Energy Exchange* (EEX), *Nasdaq*, or *OMIP*. These contracts are generally financially settled, meaning no physical delivery occurs; rather, positions are marked to market and cash-settled. Price formation occurs through order-book mechanisms (often under a *pay-as-bid* approach), and market transparency is maintained through pre- and post-trade disclosure requirements.

Although the forward market is not subject to detailed EU-level sectoral legislation, it is covered by horizontal regulatory regimes. All forward energy trades – whether OTC or exchange-based – fall within the scope of REMIT, which mandates transaction reporting and prohibits insider trading and market manipulation. Where a forward contract qualifies as a *financial derivative*, they are also subject to the requirements of MiFID II[72] and EMIR[73], imposing obligations for central clearing, collateralisation, and risk mitigation.

Accommodating approximately 88% of all traded electricity volumes in the wholesale market[74], the forward market plays a vital role in price risk management and serves as a reference for subsequent trading layers, including the day-ahead and intraday markets.

However, despite their structural importance for hedging and investment planning, forward markets in the EU remain ***fragmented***, ***with liquidity concentrated in a few hubs***. According to ACER, liquidity in forward electricity markets declined significantly between 2019 and 2022, largely due to the energy crisis, and has remained below pre-crisis levels in most Member States. Even in Germany – the EU's most liquid forward market – trading beyond one year ahead remains limited, with almost no liquidity in contracts beyond three years.[75] As ACER observed, "*current forward markets may not be well suited for the hedging of investments, which require a much longer time horizon. The costs of collaterals, which expand with longer*

---

[71] Energy Traders Europe, '*Our Contracts Overview*' (EFET, 2025) <https://www.energytraderseurope.org/our-contracts-overview> accessed 26 June 2025.

[72] Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (recast) [2014] OJ L173/349.

[73] Regulation (EU) 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories [2012] OJ L201/1.

[74] European Union Emissions Trading System, '*Forward Electricity Market*' (Internal Electricity Market Glossary) <https://emissions-euets.com/internal-electricity-market-glossary/1472-forward-electricity-market> accessed 27 May 2025.

[75] ACER, *Progress of EU Electricity Wholesale Market Integration* (2024 Market Monitoring Report, 14 November 2024) 23–24 <https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Market_Integration.pdf> accessed 27 May 2025.

time horizons, are a major obstacle in accessing longer maturity contracts for investment hedging."[76]

In response, the Commission has identified the development of an efficient and accessible ***long-term power purchase agreement*** **(*PPA*)** market as a key priority for advancing the energy transition. Existing PPA markets across Member States remain highly fragmented, facing significant legal and transactional barriers that restrict access for smaller market participants and complicate project financing. The proposed standardization of PPA contracts and the development of guidelines are expected to facilitate cross-border consistency and reduce transaction costs.[77] These measures are intended to complement progress in forward market integration and the availability of hedging instruments, thereby enabling market actors to more effectively manage both short- and long-term risks.

3.2.2.2.2 Day-Ahead Market

The ***day-ahead market*** (DAM) is the principal venue for short-term price formation and dispatch scheduling in the EU wholesale electricity market. It enables market participants to submit matched offers to buy and sell electricity for each hour or quarter-hour of the following day, with physical delivery scheduled accordingly. As the key spot market, the DAM serves as a reference price layer between long-term contracts and real-time system balancing, underpinning hedging, retail supply, and operational decision-making.

Although bidding typically opens several days in advance, the main auction closes at 12:00 CET on the day before delivery (D-1). Bids and offers are submitted via *Nominated Electricity Market Operators* (NEMOs), designated under Article 4 of CACM Regulation to operate electricity exchanges in the day-ahead and intraday timeframes. NEMOs manage the central order books, collect and validate bids and offers, execute the market-clearing algorithm, and publish results. In parallel, TSOs provide the available cross-zonal capacity, verify network constraints, and ensure that accepted schedules are technically feasible.

Participants in the day-ahead market include generators (both dispatchable and intermittent), retail suppliers, large industrial consumers, aggregators, traders, and storage operators. The latter submits buy bids when charging and sells bids when discharging, depending on market signals and system needs.

To promote open access, original Article 8(3) of the Electricity Regulation required NEMOs to offer day-ahead and intraday products with minimum bid sizes not exceeding 500 kW. The

---

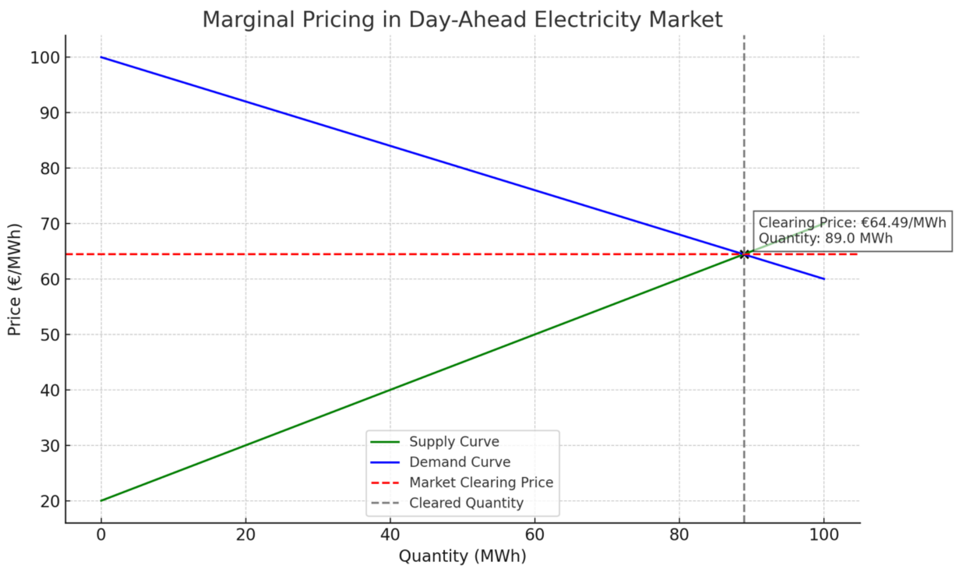
[76] Ibid. 24-25.

[77] Commission, '*Reform of the EU Electricity Market Design*' (Staff Working Document) SWD/2023/58 final 17-23.

2024 Electricity Market Reform reduced this threshold to 100 kW, thereby reinforcing access for small-scale renewables, aggregators, and demand-side response. The ongoing harmonisation of market time units to 15-minute intervals across all coupled day-ahead markets is a key step in improving temporal granularity and facilitating the integration of variable renewable energy sources. Following a revised timeline, this change is now scheduled to be implemented from 1 October 2025, aligning bidding and scheduling intervals across Member States with evolving system flexibility needs.[78]

Day-ahead prices are determined using a ***marginal pricing*** mechanism. In each time interval and bidding zone, supply and demand curves are aggregated, and the market-clearing price (MCP) is set at the intersection point (see *Figure 2* below). The MCP corresponds to the highest price accepted for supply and is applied to all cleared bids.

Figure 2. Marginal Pricing in the Day-Ahead Electricity Market.



This mechanism enables *merit-order dispatch*: generation units are dispatched in ascending order of bid prices, with all cleared volumes remunerated at the MCP. Marginal pricing supports economic efficiency, transparent price signals, and market integration. It also strengthens investment incentives for low-cost and flexible technologies, including renewable energy and storage. Moreover, the MCP serves as the reference for indexed forward contracts, intraday adjustments, and balancing settlements.

In addition to price formation, the DAM performs key ***operational functions***. It determines day-ahead generation and consumption schedules, which TSOs use to forecast grid conditions

[78] EPEX SPOT, '*Market Coupling Steering Committee Aligns on Revised Go-Live Date for 15-Minute MTU in SDAC*' (14 May 2025) <https://www.epexspot.com/en/news/market-coupling-steering-committee-aligns-revised-go-live-date-15-minute-mtu-sdac> accessed 26 June 2025.

and optimise system operation. The DAM is also the main platform for integrating variable renewable generation, which typically submits bids at zero marginal cost based on short-term weather forecasts. Cross-zonal electricity flows and congestion patterns are determined *ex post*, after market closure, making the DAM the central reference point for both economic dispatch and physical system balancing in the EU internal electricity market.

Althoug day-ahead trades represent only 9%[79] of total wholesale electricity volumes, the DAM remains the most liquid and transparent segment of the market.[80] Together with forward, intraday, and balancing markets, it constitutes a core pillar of the temporal architecture of the EU internal market.

3.2.2.2.3 Intraday Market

The ***intraday market*** (IDM) provides a *continuous trading* platform for electricity after the closure of DAM segment and up to shortly before physical delivery. It enables market participants to adjust their positions in response to updated forecasts of consumption, generation, or system constraints, thereby enabling operational flexibility and reducing real-time imbalances. Participants in the IDM include the same range of actors as those in DAM.

Intraday trading is facilitated by the same NEMOs that operate day-ahead trading platforms. These entities continuously match buy and sell orders and publish transaction data in real-time. The gate opening typically follows shortly after publication of the day-ahead auction results (around 15:00 CET on D-1), while gate closure occurs between 60 and 5 minutes before delivery, depending on national rules and TSO coordination. However, as part of the 2024 reform, the Electricity Regulation was amended to require a harmonised intraday gate closure time no later than 30 minutes before delivery, starting from 1 January 2026, with limited derogations allowed until 2029. Minimum volume thresholds and product granularity requirements in IDM mirror those of DAM, including the 100 kW ceiling for bid sizes reaffirmed by the 2024 reform.

Unlike the DAM, which uses a uniform *marginal pricing* mechanism, the IDM operates predominantly on a ***pay-as-bid basis***. Orders are matched ***continuously and individually***, with each transaction settled at the prices specified by the participant.[81] While this approach reduces

[79] European Union Emissions Trading System, *Forward Electricity Market* (Internal Electricity Market Glossary) <https://emissions-euets.com/internal-electricity-market-glossary/1472-forward-electricity-market> accessed 27 May 2025.

[80] ACER, *Progress of EU electricity wholesale market integration* (2023 Market Monitoring Report, November 2023) 21 <https://www.acer.europa.eu/sites/default/files/documents/Publications/2023_MMR_Market_Integration.pdf> accessed 27 May 2025.

[81] Leonardo Meeus, *The Evolution of Electricity Markets in Europe* (Edward Elgar Publishing 2020) 33.

price transparency compared to marginal pricing, it enables greater trading granularity, faster adjustments, and smoother real-time operations.

Despite its critical role in short-term system optimisation, the IDM currently accounts for only around 2% of total wholesale electricity sales.[82] Its liquidity remains highly concentrated in a few national markets and is often clustered in the final hours before delivery, when forecast uncertainty or balancing costs volatility are high.[83]

3.2.2.2.4 Balancing Market

The ***balancing market*** (BM) represents the final temporal layer in the structure of the EU wholesale electricity market. It follows the forward, day-ahead, and intraday markets, where supply and demand are forecasted, scheduled, and adjusted *ex ante*. The BM addresses residual imbalances between supply and demand in real-time, ensuring system frequency and operational stability during the delivery period by activating balancing energy bids submitted before market gate closure.

While the BM functions as the final stage in the sequential trading of electric energy, its design and implementation are significantly more complex than earlier market layers. ***Balancing is not limited to energy activation alone***, it also includes the ***procurement of reserve capacity*** as an element of frequency-related ***ancillary services***. Accordingly, balancing is often described as a hybrid product, combining elements of *energy, capacity*, and *ancillary services*. It is procured in advance as reserve capacity, activated in real time as energy, and provides critical operational support to maintain system security and frequency stability.

This multiple legal and technical nature is explicitly recognised in EU legislation:

1) under Article 2(10) of the Electricity Regulation, '*balancing*' refers broadly to "*all actions and processes, in all timelines, through which transmission system operators ensure […] maintenance of the system frequency […] and compliance with the amount of reserves needed with respect to the required quality*."
2) Article 2(11) of the Regulation defines '*balancing energy*' as "*energy used by transmission system operators to carry out balancing,*" placing it alongside forward, day-ahead, and intraday energy products.
3) Article 2(13) of the Regulation defines '*balancing capacity*' as "*a volume of capacity that a balancing service provider has agreed to hold and in respect to which [they] have agreed to submit bids for a corresponding volume of balancing energy.*"

[82] European Union Emissions Trading System, '*Forward Electricity Market'* (Internal Electricity Market Glossary) <https://emissions-euets.com/internal-electricity-market-glossary/1472-forward-electricity-market> accessed 27 May 2025.

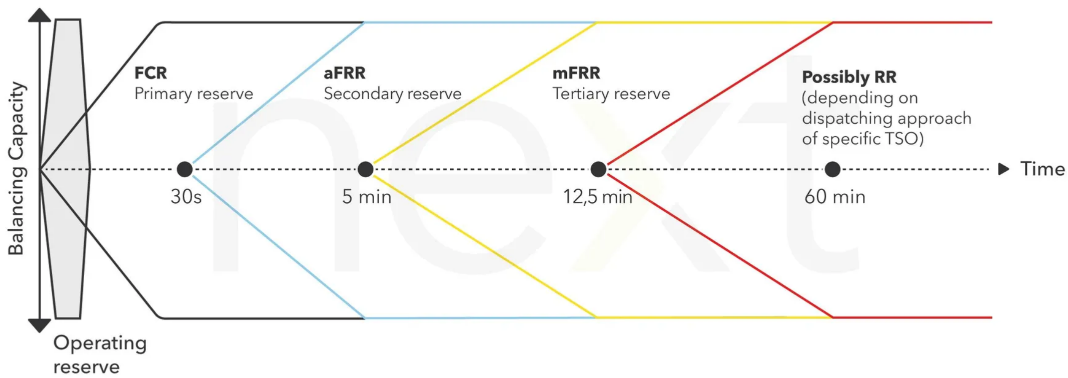
[83] ACER, *2023 Market Monitoring Report* (n 80) 23-24.

4) Article 2(48) of the Electricity Directive includes balancing within the definition of '*ancillary services*' needed to maintain a secure system operation.

Balancing products are formally standardised across the EU through the *System Operation Guideline*,[84] which defines four main reserve categories according to their activation method and time horizon (see *Figure 3* below):

- *Frequency Containment Reserve* (FCR): automatically and continuously activated within seconds to stabilise frequency deviations at the system level;
- *Automatic Frequency Restoration Reserve* (aFRR): automatically activated within 30-60 seconds to restore system frequency to the nominal levels and correct imbalances;
- *Manual Frequency Restoration Reserve* (mFRR): manually activated within 5-15 minutes to correct larger or cross-border imbalances;
- *Replacement Reserve* (RR): activated within 30-60 minutes to replace earlier deployed reserves and address sustained imbalances across a longer time horizon.

Figure 3. Balancing products activation sequence:[85]



Balancing products are exchanged through two closely related market segments:

1) **The BM for the *balancing energy***, which constitutes the final product in the electric energy trading sequence. *Balancing energy* is activated in real-time to correct short-term deviations and is remunerated based on actual delivery (€/MWh). It may be sourced from pre-contracted providers or from "free bids" submitted ahead of BM gate closure, depending on merit-order and system needs.
2) **The ancillary services segment for *balancing capacity***, which is procured *ex ante* – typically via daily, weekly, or monthly auctions – to ensure sufficient availability of

[84] SOGL, art 3(2)(6)-(9).

[85] Next Kraftwerke, '*mFRR (manual Frequency Restoration Reserve / R3): What is it?*' <https://www.next-kraftwerke.com/knowledge/mfrr> accessed 30 June 2025.

reserves during operational periods. Prequalified balancing service providers (BSPs) are remunerated for their availability (€/MW), not for the activation of energy itself.

This layered interplay between *energy* and *capacity* also provides a conceptual bridge to the next sections, which examine in detail the *capacity mechanisms* that support long-term resource adequacy, and the *non-frequency ancillary services* that ensure technical system stability beyond real-time balancing needs.

The pricing mechanism for balancing products differs between the energy and capacity segments. *Balancing energy* is typically settled under *marginal pricing*,[86] whereby all activated bids for a given product and direction receive the price of the most expensive accepted bid. The approach aligns with the efficiency logic of the DAM but is applied in real-time conditions. By contrast, *balancing capacity* is remunerated based on the outcome of *ex ante* procurement auctions, applying *pay-as-bid* or *uniform* pricing, depending on national regulatory choice.

While DAM and IDM operate under fully harmonised EU rules, the BM integration is still a work in progress. The EBGL, adopted in 2017, introduced common definitions and obligations, including technical capabilities, prequalification criteria, settlement arrangements, standard product definitions, and the progressive harmonisation of procurement platforms. At the same time, significant national divergences persist in areas such as bid sizes, gate closure times, and procurement timelines, reflecting differences in system needs, market maturity, and regulatory discretion.

Balancing is a critical tool not only for managing the physical stability of the network infrastructure, but it also enables greater penetration of variable renewable energy, manages local constraints, and enhances the resilience of the EU interconnected grid. The 2024 Electricity Market Reform further introduced new requirements for TSOs and NRAs to facilitate the participation of non-fossil flexibility resources – including demand-side response, energy storage, and low-carbon dispatchable generation – in balancing procurement.[87]

In summary, the balancing market closes the loop of energy trading by managing deviations between scheduled and actual electricity flows. It ensures real-time system security, complements earlier markets, and – through its combination of energy, capacity, and service characteristics – embodies the most complex product within the EU electricity market design.

---

[86] EBGL, art 30(2).

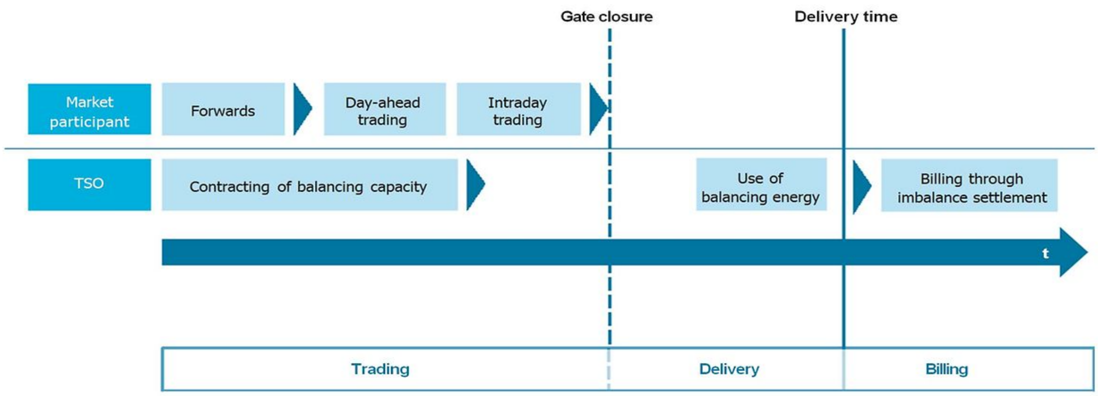
[87] Commission, '*Reform of the EU Electricity Market Design*' (Staff Working Document) SWD/2023/58 final 56-64.

Combined with other energy markets in the *wholesale segment,* they operate as a multi-layered temporal sequence, where each timeframe serves a distinct economic and operational function:

- ***Forward Market*** enables long-term hedging and investment planning;
- ***Day-ahead Market*** provides centralised price formation and dispatch scheduling;
- ***Intraday Market*** allows short-term corrections in response to updated forecasts;
- ***Balancing Market*** ensures real-time frequency stability and operational security.

Together, these layers form a coherent and interdependent market architecture that governs dispatch, price discovery, and system balancing across the EU. While each segment is governed by different levels of harmonisation and regulatory detail, they collectively contribute to a unified, market-based mechanism for continuously matching electricity supply and demand in real-time. The sequence of these market segments is further illustrated in *Figure 4* below.

Figure 4. Chronological sequence of the wholesale electricity market[88]



Finally, the market for electric energy should not be understood as a single trading venue, but rather as a dynamic sequence of temporally layered market environments, each designed to ensure that electricity is available where and when it is needed, at efficient prices and within physical and operational constraints. This architecture reflects both the economic logic of competitive electricity markets and the technical imperatives of power system operation.

3.2.2.3 Ancillary Services and Capacity Mechanisms

Although electric energy is the core commodity traded in the EU electricity market, its secure and stable delivery depends on a range of supporting mechanisms that extend beyond energy trading itself. The physical nature of electricity – instantaneous delivery, sensitivity to network

[88] SMARD, *'Electricity Price Components in the Retail Market'* (Bundesnetzagentur, Germany) <https://www.smard.de/page/en/wiki-article/5884/5976> accessed 15 May 2025.

conditions, and the need for continuous system balance – creates system needs that energy markets alone cannot fully address.

To provide operational and long-term safeguards, which energy-only markets are not designed to ensure, the wholesale market design incorporates a set of supporting instruments, such as:

- ***Ancillary services***, which maintain the technical operability and stability of the grid, ensuring voltage control, frequency stability, inertia, and black-start capability;
- ***Capacity mechanisms***, which address resource adequacy risks by ensuring that sufficient generation or demand-side flexibility is available to meet future peak loads and system stress events.

These instruments are particularly critical in the context of the EU's decarbonization goals, the increased penetration of variable RES, and the growing demand for resilience tools beyond conventional energy procurement.

3.2.2.3.1 Ancillary Services: Ensuring Technical System Integrity

Ancillary services constitute an essential component of the EU electricity market architecture, ensuring the secure and stable operation of the power system beyond the real-time energy balancing. While balancing services aim to correct short-term supply-demand imbalances to maintain system frequency, ancillary services address underlying system parameters, including voltage stability, inertia, and system restoration capabilities. These services are not traded as energy volumes and are activated in real time, often concurrently with or immediately following energy delivery.

Under Article 2(48) of the Electricity Directive, ancillary services encompass both frequency-related services (balancing), and non-frequency-related services, which include *voltage control, reactive power support, inertia provision, black-start capability, and fault current support*. While the frequency-related subset – covered under the balancing subsection above – has undergone some regulatory harmonisation, non-frequency ancillary services remain only partially defined in the EU law and are primarily managed at the national level without any standardization.

Among these, only *inertia* and *black-start capability* are currently defined in the EU legislation. *Inertia* refers to the system's resistance to changes in frequency through kinetic energy stored in synchronous machines. *Black-start capability* refers to a generator's ability to restart the grid following a blackout without an external electricity supply.[89] Other critical services, such as

[89] NC RfG, arts 2(33), 2(45).

voltage control, fast reactive current injection, *short-circuit power,* and *island operation capability*, remain undefined in EU legislation, despite their importance.

The legal framework anticipates further harmonisation on the EU level: Article 59(1)(d) of the Electricity Regulation mandates the Commission to adopt implementing acts and network codes for the standardisation and transparent procurement of non-frequency ancillary services. However, as of 2025, such measures remain pending. In the meantime, national TSOs and increasingly DSOs procure these services using domestic procedures, including long-term contracts, cost-based tenders, and regulated compensation schemes. This results in significant fragmentation with technical standards and procurement practices varying widely across Member States.

In contrast to energy markets, where volumes are defined and traded in advance, *ancillary services are often provided on a continuous or event-driven basis and consumed instantaneously*. Their real-time nature is operational rather than commercial, though increasing digitalisation and automation may enable more structured market procurement in the future.

Nonetheless, even in the absence of full market integration, EU law still requires core principles to be upheld. Article 20 of the Electricity Regulation requires TSOs to procure ancillary services in a *cost-efficient* and *market-based* manner whenever possible. Articles 31 and 40 of the Electricity Directive further mandate transparency and non-discrimination, unless specific derogations are granted by national regulatory authorities.

The landscape of service providers is also evolving. While conventional synchronous generators remain the main providers, battery storage systems, aggregated demand response, and emerging technologies capable of supplying synthetic inertia or fast fault current are playing a growing role, particularly in decentralized and inverter-based grids.

3.2.2.3.2 Capacity Mechanisms as a Resource Adequacy Instrument

Capacity mechanisms (CMs) represent a forward-looking element of the EU electricity market design intended to ensure that sufficient generation or demand-side resources are available in future periods of system stress, regardless of the short-term energy markets dynamics. Unlike energy, which is consumed in real-time, or ancillary services, which are activated in response to immediate operational needs, capacity is a commitment to be available in the future – a form of system insurance against demand spikes, supply failures, or extreme events.

Under the *energy-only market model*, investment incentives are presumed to arise through scarcity pricing during tight conditions. However, concerns about '*missing money*' (where market revenues are insufficient to cover fixed costs) and '*missing markets*' (where some services or future needs are not priced at all) have led many Member States to introduce CMs as a corrective tool. These concerns are amplified in systems with high shares of non-dispatchable renewables, where market volatility and low marginal cost reduce price signals for flexible and firm capacity providers.[90]

Recent demand growth exacerbates these adequacy concerns. According to the IEA, global electricity consumption growth accelerated almost twice and reached 4.3% in 2024, and is projected to grow nearly 4% annually through 2027.[91] In the EU, the Commission anticipates a 60% increase in electricity demand by 2030, mainly due to the electrification of transport and heating, alongside increased demand from energy-intensive digital infrastructure.[92] These projections highlight the growing difficulty of ensuring long-term adequacy solely through market-based energy prices, underscoring the relevance of CMs.

Initially, the Electricity Regulation classified them as ***exceptional*** and ***temporary*** instruments. Article 2(22) defined CMs as a "*temporary measure intended to ensure the required level of resource adequacy by remunerating resources for their availability*." Article 21 permitted their introduction only as a *last resort* and after demonstrating that market-based measures are insufficient. However, the 2021-2022 energy crisis exposed fundamental vulnerabilities in the *energy-only model*. Sharp increase in wholesale energy prices and concerns about security of supply demonstrated that energy-only markets could not be relied upon to deliver system adequacy under stress, address rapidly growing electricity demand, and provide investment incentives for firm capacity due to the growing share of low-cost renewables. In this context, the 2024 Electricity Market Reform redefined CMs as an independent structural component of a new hybrid design, where energy markets ensure dispatch efficiency and price discovery, while CMs provide forward-looking investment signals and ensure adequacy.[93]

Because of their potential to distort price signals, reduce demand-side participation, and favor national over cross-border solutions, CMs have always faced state aid scrutiny under Articles

---

90 FSR, *'Capacity Mechanisms'* (30 June 2024) <https://fsr.eui.eu/capacity-remuneration-mechanisms/> accessed 24 April 2025.

91 IEA, *Electricity 2025* (Analysis and forecast to 2027, IEA Publications, February 2025) <https://iea.blob.core.windows.net/assets/0f028d5f-26b1-47ca-ad2a-5ca3103d070a/Electricity2025.pdf> accessed 24 April 2025.

92 Commission, DG Energy, '*In Focus: EU Investing in Energy Infrastructure'* (15 October 2024) <https://energy.ec.europa.eu/news/focus-eu-investing-energy-infrastructure-2024-10-15_en> accessed 24 April 2025.

93 ENTSO-E, *The Role of Capacity Mechanisms to enable a secure and competitive energy transition* (Policy Paper, April 2025) <https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Publications/Position%20papers%20and%20reports/2025/entso-e_pp_capacity_mechanisms_250415.pdf> accessed 24 April 2025.

107 and 108 TFEU.[94] In *Tempus Energy Ltd v Commission*,[95] the General Court annulled the Commission's decision not to raise objections against the UK's capacity market, holding that it had failed to assess the participation of demand-side response in line with State aid rules.

Following that judgment and in response to the growing proliferation of CMs across Member States, the Commission adopted the 2022 Guidelines on State aid for climate, environmental protection, and energy.[96] These guidelines elaborated the requirements under Articles 20-26 of the Electricity Regulation, mandating that CMs must (i) address a clearly identified adequacy concern, (ii) use market-based allocation processes, (iii) be technology-neutral and proportional in scope, (iv) remain limited in duration, and (v) allow cross-border participation.

Even after becoming permanent instruments following the 2024 reform, CMs remain subject to strict design conditions under the Electricity Regulation and State aid guidelines to avoid undermining market efficiency. Their role is to complement, but not substitute, price-based dispatch. The reform clarifies, however, that CMs should explicitly support the deployment of non-fossil flexible resources and align with decarbonization objectives.[97]

Within the EU, two principal CMs models exist:[98]

- ***strategic reserves*** – resources outside normal markets, activated only in emergencies; and
- ***capacity markets*** – integrated auctions that reward availability.

This distinction reflects both the regulatory intent and the degree of market integration. Therefore, their implementation across Member States remains fragmented, raising risks of distortion and inefficiency. In addition to this, full integration of CMs as an independent element of the EU internal electricity market is limited by ***several other challenges***. First, a large share of remunerated capacity remains *fossil fuel–based*, risking the prolongation of carbon-intensive assets if carbon pricing signals are diluted.[99] Second, while *demand-side response* is eligible in principle, *participation remains limited* due to the absence of mechanisms for consumers to express preferences or react dynamically. Finally, growing shares of *variable renewables shift* adequacy concerns from simple capacity shortfalls to *more*

---

[94] Consolidated version of the Treaty on the Functioning of the European Union [2012] OJ C326/47.

[95] Case T-793/14 *Tempus Energy Ltd and Tempus Energy Technology Ltd v Commission* ECLI:EU:T:2018:790.

[96] Commission, *'Guidelines on State aid for climate, environmental protection and energy 2022'* (Communication) C/2022/481 [2022] OJ C80/1.

[97] Commission, '*Reform of the EU Electricity Market Design*' (Staff Working Document) SWD/2023/58 final 102-107.

[98] FSR, *'Capacity Mechanisms'* (30 June 2024) <*https://fsr.eui.eu/capacity-remuneration-mechanisms/*> accessed 24 April 2025.

[99] ACER, *Security of EU Electricity Supply* (2024 Monitoring Report, 16 December 2024) 27 <https://www.acer.europa.eu/sites/default/files/documents/Publications/Security_of_EU_electricity_supply_2024.pdf> accessed 24 April 2025.

complex flexibility needs, requiring procurement of non-fossil services such as ramping, inertia, and storage.[100]

In conclusion, CMs have evolved from transitional safeguards into structural pillars of the EU electricity market. By complementing energy-only signals with stable revenue streams for adequacy, they help address both the investment and decarbonisation challenges of the energy transition. Their continued development, however, must ensure consistency with internal market rules, transparency, and environmental objectives, particularly as the EU seeks greater cross-border coordination and higher renewable penetration.

3.2.2.4 Concluding Remarks on Product and Temporal Architecture

This section has examined the EU wholesale electricity market architecture through its core ***product categories*** – *energy, balancing, ancillary services, and capacity* – and the ***temporal logic*** that underpins their design and operation. Each product serves a distinct yet interdependent role within the market framework, contributing to the secure, efficient, and flexible functioning of the power system.

Electric energy constitutes the core traded commodity. It is delivered and consumed in real time, but transacted across layered timeframes: *forward, day-ahead, intraday, and balancing*. These segments differ not only in timing but also in their function and market share. Approximately 88% of traded volumes occur in *forward markets*, which serve hedging, risk management, and long-term planning functions. The *day-ahead market,* as the most liquid segment, accounts for around 9%, providing the main price signal and dispatch schedule. The *intraday market* contributes roughly 2%, allowing market participants to adjust positions close to real-time. Finally, the *balancing energy* market represents less than 1% of traded volumes, but plays a crucial role in maintaining real-time system stability and frequency control.

Balancing is not limited to activating *balancing energy* within the BM segment, but also includes reserving *balancing capacity* in advance to ensure that sufficient flexible resources are available when needed. The *balancing capacity* is procured as an ***ancillary service*** to deliver frequency containment and frequency restoration, alongside other *non-frequency services* such as voltage control, inertia provision, and system restoration capabilities. All these ancillary instruments ensure system operability. Finally, ***capacity mechanisms*** address forward-looking adequacy concerns by securing the availability of resources during future scarcity conditions.

[100] Emma Menegatti and Leonardo Meeus, '*Cross-Border Participation: A False Hope for Fixing Capacity Market Externalities?'* RSC Working Paper 2024/53 (European University Institute, Robert Schuman Centre for Advanced Studies, November 2024) 26 <https://cadmus.eui.eu/server/api/core/bitstreams/59f5ad95-8002-50dc-b5c8-ee0b8b39396f/content> accessed 27 June 2025.

While these products differ in their function, legal basis, and temporal horizon, they collectively reflect the layered architecture required to manage a non-storable, network-constrained, and increasingly low-carbon energy system. The ***temporal dimension*** is embedded in each product, not only as a timeframe of operation, but as a determinant of its market role, especially in price formation.

This structural segmentation enables a wholesale layer of electricity markets in the EU to match physical system needs with legal and economic tools across multiple time scales. The result is a highly differentiated but internally coherent product architecture – one that supports both system reliability and efficient price signals. The next section turns to the *spatial organisation* of these markets, examining how location, network constraints, and bidding zone configuration shape the delivery and pricing of electricity across the EU.

3.2.3 Spatial Organization of the Wholesale Electricity Market

3.2.3.1 Foundations of Spatial Market Organization

In both economic and legal doctrine, the definition of a *geographic market* is a fundamental concept used to delineate the boundaries within which undertakings compete in the supply and demand of goods or services. A relevant geographic market is said to exist where competitive conditions are sufficiently homogenous, and where a hypothetical change in price in one area would not induce sufficient substitution in adjacent areas due to cost, infrastructure limitations, or regulatory barriers.[101]

In electricity markets, the spatial dimension is particularly important due to the *physical limitations of the power system*. Electricity cannot be stored in bulk, nor can it be transported without constraints. Its dependence on the grid, proximity, network topology, and transmission capacity determines how far electricity can be traded and reliably transported. As a result, the geography of electricity markets is determined merely by technical realities such as *transmission infrastructure, congestion, interconnection availability, and operational security*.

This section examines the ***spatial dimension*** of the wholesale electricity market, highlighting that different market segments exhibit varying degrees of harmonisation and cross-border integration. Markets for electric energy – particularly the *forward, day-ahead, and intraday segments* – are the most harmonised and operate cross-border, even though *balancing market* integration remains only partially developed. By contrast, the organisation of *ancillary services* and *capacity mechanisms* is still largely fragmented, with limited harmonisation and

[101] Bailey and John (n 66) 282-283.

predominantly national arrangements. Even in the most advanced segments, spatial integration remains partial due to cross-border capacity constraints and network congestion.

Network integration began with the *First Energy Package*, which established non-discriminatory third-party access to national grids. The *Third Energy Package* strengthened this by enhancing cross-border market coupling and creating ACER to support regulatory harmonisation. The *Clean Energy Package* further reinforced these goals by mandating cross-border integration, improving transparency in capacity allocation, and enhancing the effective use of interconnectors through market coupling.

Throughout this evolution, ***bidding zones*** served as the primary geographic units for energy products in the wholesale segment, determining the pricing and dispatch across the EU. These zones, however, are not always aligned with physical congestion points or system balancing needs, resulting in inefficiencies in both market signals and grid operations. This misalignment lies at the heart of the ongoing debate about whether the current zonal architecture should evolve toward smaller zones or nodal pricing models, especially as system flexibility and decentralised generation become more prominent. Bidding zones are therefore the primary focus of the spatial analysis that follows. They are central to the operation of the forward, day-ahead, and intraday markets and form the spatial foundation for market coupling and cross-zonal capacity allocation. Subsequent subsections will examine their structure, limitations, and the mechanisms through which spatial integration of these markets is currently implemented.

3.2.3.2 Bidding Zones as the Core Spatial Units

After nearly 30 years of market integration, the so-called EU single electricity market remains a complex, interconnected network of national markets operating under a common regulatory framework. While the EU has progressively harmonised market rules and improved cross-border trading, electricity markets still function through spatially defined bidding zones – geographic units that determine how prices are formed and how electricity is traded within and between Member States.[102]

Bidding zones constitute the largest geographical area in which bids and offers from market participants can be matched without the need to attribute cross-zonal capacity.[103] Yet in practice, most bidding zones continue to follow national borders rather than reflecting actual network congestion, except Denmark, Sweden, Italy, and Norway.[104] *Figure 5* below presents

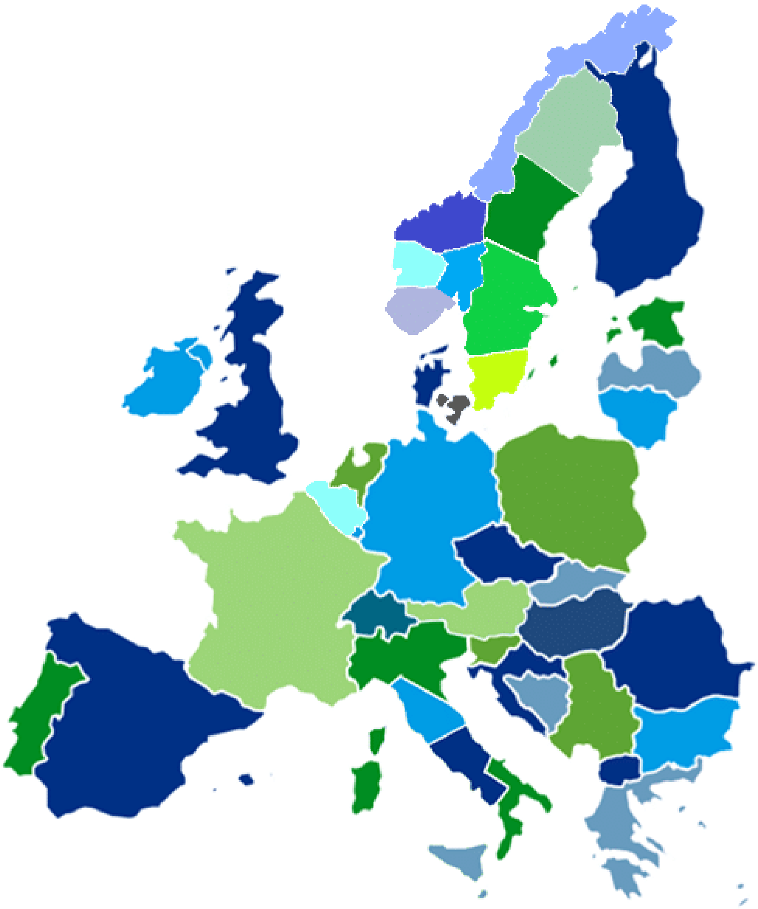
[102] Meeus (n 81) 57.

[103] Electricity Regulation, art 2(65).

[104] Alberto Pototschnig, '*The Geographical Structure of the Electricity Market: Some Facts'* (Energetika.NET, 19 June 2020) <https://www.energetika.net/eu/novice/envision/the-geographical-structure-of-the-electricity-market-some-f> accessed 29 June 2024.

the current bidding zones configuration in Europe, which has remained largely unchanged for nearly three decades despite significant changes in grid infrastructure, generation mix, and market dynamics.

Figure 5. Current bidding zones configuration in Europe.[105]



Despite their central role in market design, the '*political*' configuration of bidding zones has led to market inefficiencies and, in some cases, regulatory actions by the Commission's Directorate-General for Competition (DG COMP). These cases illustrate the tension between internal market integration and national interests, underscoring the need for a systematic review and reform of bidding zone configurations.

One of the most prominent cases occurred in Sweden. A DG COMP investigation into Swedish TSO *Svenska Kraftnät (SvK)* was launched in 2006 following a complaint by the Danish energy industry association.[106] The complaint alleged that Danish consumers were paying higher electricity prices because SvK was limiting cross-border flows from Norway to Denmark in order to manage internal congestion within Sweden. DG COMP concluded that SvK was indeed

---

[105] Meeus (n 81) 51, fg 3.1.

[106] *Swedish Interconnectors* (Case COMP/39.351) Commission Decision [2010] OJ C 142, 1.6.2010.

discriminating against cross-border trade, favoring internal flows over external ones, and therefore abusing its dominant position in the market.[107]

SvK initially proposed to resolve the issue by investing in internal transmission lines, but the Commission found this insufficient, noting that such investment required "*long leading time […] (often 10 years) and the outcome cannot be guaranteed*".[108] As part of a negotiated resolution, *Sweden* agreed to *split its national market into four bidding zones*. This decision fundamentally changed the Swedish electricity market, ensuring that internal Swedish trading and cross-border traders were subject to the same transmission constraints and pricing signals. By aligning zonal boundaries with physical constraints, Sweden improved price signals and fostered more efficient market competition.

By contrast, *Germany has opted to maintain a single national bidding zone*, despite facing similar issues. In 2018, another DG COMP investigation was launched, this time concerning *TenneT*, the German TSO.[109] The complaint alleged that *TenneT* was artificially restricting cross-border trade by limiting the import of cheap Danish wind power into Germany. This practice was seen as favouring local generation and restricting cross-border competition.

In response, *TenneT* committed to a short-term increase in transmission capacity on the Danish border and long-term capacity expansions by 2026.[110] However, unlike Sweden, Germany refused to split its national market into multiple bidding zones, instead choosing to prioritise infrastructure investment and short-term mitigation measures.[111] This political decision, however, continued to cause structural congestion. As a result, German TSOs have frequently resorted to redispatch measures, instructing generators to alter output to manage bottlenecks. This approach is both less efficient and costly. In 2017 alone, redispatch costs borne by German consumers amounted to €1.4 billion, with *TenneT* alone accounting for over €1 billion.[112]

Redispatching is increasingly recognised as a transitional mechanism, necessary to compensate for the inability of the current zonal design to internalise physical grid constraints within market processes. Persistently high redispatching costs in several Member States, notably Germany,

---

[107] Ibid., para. 27.

[108] Ibid., para. 85.

[109] Commission, '*Antitrust: Commission Opens Formal Investigation into TenneT's Limitation of Capacity on the Germany-Denmark Electricity Interconnector'* (Press Release, 19 March 2018) <https://ec.europa.eu/commission/presscorner/detail/en/ip_18_2122> accessed 19 March 2025.

[110] Commission, *'Antitrust: Commission Accepts TenneT's Commitments to Increase Capacity on the Germany-Denmark Electricity Interconnector'* (Press Release, 7 December 2018) <https://ec.europa.eu/commission/presscorner/detail/en/ip_18_6722> accessed 19 March 2025.

[111] *DK/DE Interconnector* (Case AT.40461) Commission Decision [2018] OJ C 58, 14.2.2019.

[112] Holger Schneidewindt, *'The Fatal DG Comp-TenneT-Deal'* (Energy Democracy, 18 June 2018) <https://energy-democracy.org/the-fatal-dg-comp-tennet-deal/> accessed 19 March 2025.

underscore the need for more effective market-based procurement of flexibility and for forward-looking grid planning to reduce structural congestion. Minimising dependence on redispatching will require not only expanded transmission infrastructure, but also progress toward more granular locational price signals, enabling congestion costs to be reflected directly in market outcomes. Although EU legislation does not formally classify redispatching among electricity market products, some authors regard it as a quasi-market mechanism due to its increasingly market-based activation and compensation processes.[113]

The Swedish and German cases reveal a fundamental policy dilemma: while splitting bidding zones along physical constraints enhances market efficiency, it may also result in regional price divergence – an outcome that many governments are reluctant to accept for political and social reasons. The Commission's enforcement actions demonstrate that maintaining politically convenient zonal boundaries can, in some cases, conflict with EU competition law and the objectives of the internal market.

In response to persistent inefficiencies and political resistance, the *Clean Energy Package*, specifically Article 14 of the Electricity Regulation, launched a formal ***bidding zone review process*** with the objective of maximising economic efficiency, enhancing cross-zonal trading opportunities, and maintaining security of supply. Although the first consolidated effort in 2018 failed to deliver substantial changes,[114] the process advanced when ACER adopted a review methodology requiring TSOs to provide *Locational Marginal Pricing (*LMP*)* simulations to evaluate alternative configurations.[115] This initiated a series of regulatory developments, including decisions in 2022 and 2023, and under the revised methodology, TSOs relaunched the bidding zone review in July 2023 and submitted the Main Report in April 2025.[116]

The Main Report[117] includes LMP simulation results and economic efficiency assessments, which indicate that in the Nordic region, no alternative configuration provided a positive efficiency benefit. In contrast, splitting Germany-Luxembourg into five bidding zones showed significant positive benefits (€251-339 million). However, TSOs from both regions emphasize

---

[113] Electricity Regulation, art 13.

[114] ACER, '*Bidding Zone Review*' <https://www.acer.europa.eu/electricity/market-rules/capacity-allocation-and-congestion-management/bidding-zone-review> accessed 16 March 2025.

[115] ACER Decision No 29/2020 of 24 November 2020 on the methodology and assumptions that are to be used in the bidding zone review process and for the alternative bidding zone configurations to be considered <https://eepublicdownloads.entsoe.eu/clean-documents/cep/ACER_Decision_%2B_Annexes.pdf> accessed 1 July 2025.

[116] ENTSO-E, 'Bidding Zone Review Timeline' (20 January 2025) <https://www.entsoe.eu/assets/graphics/bzr/bzr-timeline_20-Jan-2025_large.png> accessed 15 March 2025.

[117] ENTSO-E, *Bidding Zone Review of the 2025 Target Year* (Main Report, April 2024) <https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Network%20codes%20documents/NC%20CACM/BZR/2025/Bidding_Zone_Review_of_the_2025_Target_Year.pdf> accessed 9 June 2025.

that such results must be considered in conjunction with broader operational and policy factors. Some of ACER's proposals have been criticised for failing to deliver stable or geographically coherent configurations and for achieving only marginal improvements in pricing efficiency. The persistent challenge in defining stable pricing areas suggests that a simple zonal split may not suffice for Europe's increasingly complex and dynamic electricity system.[118]

In conclusion, bidding zones remain a central yet contested element of the EU electricity market design. While the move toward more evidence-based reviews and refined methodologies signals progress, persistent reliance on politically defined zonal boundaries continues to undermine efficient price formation and cross-border trade. As the system evolves to accommodate higher shares of renewables and decentralised resources, the question of whether incremental adjustments to zonal configurations can deliver sufficient locational signals – or whether more dynamic and granular approaches will be needed – will become increasingly critical to the future development of the internal electricity market.

3.2.3.3 Cross-Zonal Markets Integration

Having examined bidding zones as the primary spatial units for price formation in the EU wholesale electricity market, this subsection now explores the mechanisms that enable the cross-zonal integration of energy trading across those zones into the EU single electricity market. The analysis focuses solely on the markets for electric energy, as it is the only product of the wholesale market for which significant spatial integration has been implemented to date through harmonised EU rules and operational platforms. In contrast, ancillary services and capacity mechanisms remain less integrated spatially.

The spatial integration of energy trading spans multiple market timeframes, reflecting the layered temporal structure of the wholesale market. Accordingly, this subsection follows the same temporal sequence established in Section 3.2.2: starting with the forward market, continuing through the day-ahead and intraday markets, and concluding with balancing market integration. For each market layer, the relevant cross-zonal capacity allocation mechanisms are examined – both ***implicit*** and ***explicit*** – highlighting how they contribute to the evolving integration of Europe's internal electricity market.

3.2.3.3.1 Forward Market Spatial Integration: FCA and LTTRs

In the forward market timeframe, the cross-zonal integration of energy trading remains partial and uneven. Unlike the day-ahead and intraday markets, where implicit market coupling aligns

[118] Teodora Dobos, Martin Bichler and Johannes Knörr, *'Challenges in Finding Stable Price Zones in European Electricity Markets: Aiming to Square the Circle?'* (2025) 382 Applied Energy <https://doi.org/10.1016/j.apenergy.2025.125315> accessed 15 March 2025.

energy trading with physical transmission constraints, the forward market continues to rely on ***explicit allocation*** of cross-zonal capacity. This is governed by the FCA Regulation, which establishes harmonised rules for the allocation of *long-term transmission rights* (LTTRs).

Historically, explicit capacity allocation dominated across all timeframes of cross-border electricity trading. Market participants had to acquire transmission rights separately from energy contracts, which often led to inefficient outcomes: interconnection capacity was not fully utilized, and price convergence between bidding zones was limited.[119]

Under the *forward capacity allocation* (FCA) framework, TSOs issue LTTRs – typically annual or monthly – on eligible interconnectors. These rights allow market participants to hedge against price differentials between bidding zones, thereby facilitating forward trading and long-term contracting. Similar to forward energy contracts, LTTRs are classified into *Physical Transmission Rights* (PTRs) and *Financial Transmission Rights* (FTRs).[120]

Under a ***PTR***, the holder acquires the right to nominate a specific volume of physical electricity flow across an interconnector for a defined time period (e.g., an hour or a day). If the holder does not nominate a physical flow, the capacity is automatically made available to the market through the *market coupling* mechanism within the day-ahead segment, and the PTR holder receives financial compensation equal to the price difference for energy on DAMs of the relevant interconnected bidding zones in accordance with the "*use-it-or-sell-it*" principle.

By contrast, ***FTRs*** provide no right to nominate physical flows. Instead, the holder receives a purely financial settlement equal to the observed day-ahead price difference between the two bidding zones for the relevant delivery period. Under FTRs, the holder is paid out if the price spread is positive; otherwise, it must pay if the spread is negative.

Both PTRs and FTRs serve as hedging instruments, allowing market participants to manage congestion risk and price uncertainty when trading electricity across borders. However, FTRs are increasingly preferred, as they simplify system operation, avoid the complexity of physical nominations, and align more easily with the fully coupled day-ahead market.

The *Joint Allocation Office* (JAO) serves as the central platform for LTTR allocation across most European interconnectors, providing a common interface for market participants and facilitating the harmonization of allocation rules. However, the actual issuance of LTTRs depends on the outcome of the bidding zone review process and the ability of TSOs to guarantee long-term cross-zonal capacity.

---

[119] Meeus (n 81) 26-27.

[120] Ibid. 31-33.

The continued reliance on explicit capacity allocation in forward markets is a necessary trade-off between market integration and hedging needs. While full *market coupling* is desirable in principle, long-term cross-border hedging requires products that enable market participants to manage congestion risk long-term – something that implicit coupling cannot yet provide.

At the same time, the coverage and liquidity of LTTRs remain uneven across Europe. On several borders, LTTRs are not issued due to regulatory or technical limitations, undermining effective hedging. The Commission, ACER, and NRAs continue to promote the progressive harmonization and expansion of LTTR issuance as a key priority for completing the spatial integration of the forward market, but structural problems persist. Forward markets remain largely national and fragmented, liquidity is insufficient, particularly in smaller bidding zones, and LTTRs are often undervalued or poorly aligned with market participants' hedging needs.[121] To address these challenges, ACER recommends further reform of the FCA framework and the development of ***zone-to-hub*** LTTRs as a promising tool to improve cross-border hedging opportunities and liquidity integration.[122] Strengthening the forward market remains essential to ensuring that market participants can manage risks effectively across all timeframes of the internal electricity market.

3.2.3.3.2 Day-Ahead and Intraday Market Coupling: CACM Regulation

Unlike explicit FCA, spatial market integration in the *day-ahead* and intraday timeframes relies on ***implicit*** cross-zonal capacity ***allocation***, where electricity trading and the use of cross-border transmission capacity are *optimised jointly* through the *market coupling*. Under the earlier model of explicit allocation, short-term electricity trading often failed to reflect real-time physical flows or network constraints, hindering the development of a truly integrated internal market. The implicit *market coupling*, in contrast, ensures that electricity flows from low-price to high-price zones, enhances price convergence, improves interconnection capacity utilisation, and strengthens cross-border competition.[123]

The legal framework for *market coupling* is set by the CACM Regulation, which implements a *Single Day-Ahead Coupling* (SDAC) and a *Single Intraday Coupling* (SIDC) across the EU internal electricity market.

In the ***SDAC***, all supply and demand orders from participating bidding zones are aggregated through NEMOs, while TSOs submit available cross-zonal transmission capacities. The

---

[121] ACER, *Further Development of the EU Electricity Forward Market* (Policy Paper, February 2023) 4-5 <https://www.acer.europa.eu/sites/default/files/documents/Position%20Papers/Electricity_Forward_Market_PolicyPaper.pdf> accessed 5 June 2025.

[122] Ibid. 22–23.

[123] Meeus (n 81) 26-27.

EUPHEMIA algorithm then solves a large-scale optimisation problem, seeking to maximise social welfare, subject to transmission constraints, bidding conditions (such as block orders), and regulatory price caps. EUPHEMIA simultaneously determines the quantity of energy traded within and between bidding zones and establishes the market-clearing prices for each zone. This optimisation process ensures that electricity flows naturally from low- to high-priced zones, efficiently utilising interconnection capacity and reinforcing price convergence across Europe. Therefore, it is referred to as ***flow-based market coupling***.

Following the day-ahead market closure, the ***SIDC*** enables continuous cross-zonal intraday trading, allowing market participants to adjust their positions in response to updated forecasts. Under the SIDC framework – initially developed through the XBID platform – market participants can buy and sell electricity bilaterally based on available cross-zonal capacity. Orders are matched in real time by *continuous algorithms* that execute compatible trades as soon as they appear, based on price and time priority. In contrast to the SDAC-based approach, the *continuous trading* model does not apply a *marginal pricing* mechanism, which ensures more robust price signals and coordinated congestion management. To address these limitations, ongoing revisions of the CACM Regulation aim to introduce mandatory intraday auctions at a pan-European level.[124] These auctions, when adopted into EU law, would complement continuous trading by providing additional price discovery points and improving the efficient allocation of intraday capacity.

In parallel, the Commission also identifies the harmonisation of IDM Gate Closure Times as a priority for improving short-term market efficiency. Experience shows that market participants conduct a large share of intraday trading close to delivery, yet Gate Closure practices still vary significantly across Member States. Reducing and harmonising Gate Closure Times would better align trading with system flexibility needs and facilitate the efficient integration of variable renewable generation.[125]

Through these mechanisms – *implicit market coupling* in the day-ahead (SDAC) and intraday (SIDC) timeframes – Europe has progressively built a more integrated and efficient internal electricity market. These mechanisms ensure that the spatial integration of energy trading is operationally implemented into the market processes, aligning commercial transactions with the physical realities of the interconnected European grid. Together, these tools make the EU

[124] ACER Decision No 03/2022 of 14 December 2022 on the amendment of the CACM Regulation <https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/ACER%20Decision%2003-2022%20on%20CACM%202.0.pdf> accessed 24 April 2025.

[125] Commission, '*Reform of the EU Electricity Market Design*' (Staff Working Document) SWD/2023/58 final 52-54.

internal electricity market not merely a regulatory aspiration, but a functioning economic reality that delivers cross-border competition, efficient price formation, and enhanced system security.

3.2.3.3.3 Balancing Market Integration: EBGL Framework

In contrast to the forward, day-ahead, and intraday markets, where spatial integration is already advanced and fully operational, cross-zonal integration of ***balancing markets remains incomplete and still evolving***.

Balancing markets operate in real-time to maintain system frequency and correct short-term imbalances between generation and consumption. While TSOs operate balancing operations within their technical operational spatial units – *Load-Frequency Control* areas, which may differ from bidding zones – price formation for balancing energy is aligned with the bidding zones used for other energy products.[126] This ensures that price signals for balancing energy and imbalance settlement remain consistent with the spatial structure of other energy markets.

The legal framework for balancing market integration is provided by two complementary instruments: the EBGL and Article 6 of the Electricity Regulation.

The EBGL mandates the creation of ***four European platforms*** for the cross-zonal exchange of balancing energy: (i) TERRE for RR products; (ii) MARI for mFRR energy; (iii) PICASSO for aFRR energy; and (iv) IGCC for imbalance netting. All four platforms became operational in 2022. They enable TSOs to activate balancing energy bids from participating bidding zones, increasing liquidity, enhancing efficiency, and promoting the cost-effective sharing of balancing energy across borders. The platforms operate based on common merit order lists and harmonised activation and settlement rules following *the marginal pricing* principle. The volume of cross-zonal exchange of balancing energy is growing, but still varies across Member States due to a limited engagement of TSOs.[127]

By contrast, the procurement of ***balancing capacity*** is not regulated by the EBGL framework and remains largely based on regional voluntary cooperation between TSOs, such as FCR cooperation.[128] The principal regulatory framework is provided by Article 6 of the Electricity Regulation, which sets out key requirements for balancing capacity products and their procurement processes. In particular, it requires that balancing capacity products be defined transparently and in a technology-neutral manner, procured on a market basis where

[126] Electricity Regulation, art 6(6).
[127] ACER, *2023 Market Monitoring Report* (n 80) 25-28.
[128] ENTSO-E, '*Frequency Containment Reserves (FCR)*' <https://www.entsoe.eu/network_codes/eb/fcr/> accessed 2 June 2025.

appropriate, and designed to support regional reserve dimensioning while avoiding distortions in the allocation of cross-zonal capacity across timeframes.

In line with these provisions, balancing capacity procurement is progressively shifting toward shorter timeframes, such as day-ahead or close-to-real-time auctions. In 2022, more than 80% of capacity for FCR, aFRR, and RR was procured day-ahead.[129] This development is critical for enhancing liquidity, enabling flexible resources to participate, and fostering competition between energy and capacity markets. Although no formal EU-wide platforms for balancing capacity yet exist, the harmonisation of procurement practices and product definitions represents a necessary step toward deeper cross-zonal integration.

In summary, the spatial integration of balancing markets remains inherently asymmetric. While the exchange of ***balancing energy*** is being progressively harmonized and integrated through European platforms under the EBGL, the procurement of ***balancing capacity*** continues to be predominantly national, albeit framed by emerging harmonization and regional coordination principles under Article 6 of the Electricity Regulation. This reflects both the complexity of balancing market integration and the current state of EU law: balancing energy platforms represent a more advanced phase of cross-zonal integration, while balancing capacity markets remains a future integration challenge.

3.2.3.4 Challenges and Next Steps in Spatial Market Integration

The cross-border integration of wholesale electricity markets represents one of the most significant achievements of the EU electricity market evolution and plays a key role in linking its product, temporal, and spatial dimensions, ensuring that energy trades across different timeframes are physically deliverable through Europe’s interconnected transmission grid.

The spatial integration delivers substantial welfare benefits for consumers across the EU. According to ACER, cross-border electricity trade contributed an estimated ***€34 billion in welfare gains*** in 2021 alone by enhancing price convergence and reducing volatility levels, which would otherwise have been nearly seven times higher in isolated national markets.[130] Market coupling ensures that electricity generally flows from low- to high-price areas, facilitating the optimal use of renewables and neighboring flexibility resources, and enhancing resilience to price shocks and the security of supply across Member States.

However, several structural and regulatory obstacles continue to constrain the efficiency of cross-zonal market integration. Notably, ***flow-based market coupling*** within SDAC is still ***not***

[129] ACER, *2023 Market Monitoring Report* (n 80) 25-28.

[130] ACER, *Final Assessment of EU Wholesale Electricity Market Design* (n 50) 20-24.

fully implemented across all bidding zones. Despite multiple deadlines, key regions – including the Core and Nordic areas – have faced repeated delays and partial roll-outs, limiting the scope for improved congestion management and price convergence. [131]

The struggled ***recalibration of bidding zones,*** as a key mechanism for aligning market price signals with physical grid constraints, represents another challenge, underscoring the persistent trade-off between economic efficiency and political feasibility in spatial market design. At the same time, the regulatory and procedural alignment of market operations is not sufficient for unlocking the full potential of market integration. To support a truly single electricity market, the grid must offer sufficient ***physical interconnection capacity*** to allow energy to flow efficiently across borders in response to market signals. The *Clean Energy Package* introduced a legally binding ***70% minimum target*** for making cross-zonal transmission capacity available to the market.[132] This target is essential for enabling market coupling algorithms to optimise energy flows across Member States and to deliver the full welfare benefits of market integration. However, the actual level of cross-zonal capacity available to the market remains well below this target in many regions. In 2022, the EU-wide average was only around 51%, constrained by both physical grid bottlenecks and conservative capacity calculation practices.[133]

Thus, although Europe's spatial market integration has advanced significantly, especially in markets for electric energy, critical technical, regulatory, and political barriers remain. Bridging these gaps is crucial to realizing the full benefits of the internal electricity market, particularly in light of increasing shares of variable renewables and growing demand for flexibility.

3.2.4 Concluding Remarks on the Wholesale Market Layer

The EU's wholesale electricity market is built upon a highly structured and differentiated architecture that seeks to align three fundamental dimensions of market operation: ***product, temporal,*** and ***spatial***. Each dimension is designed to address a key characteristic of electricity as a traded good: its non-storability, its requirement for continuous real-time balancing, and its delivery across a constrained and interconnected transmission network. The EU market design translates these characteristics into a multi-layered framework that aims to support competitive trading, system reliability, and decarbonisation objectives across the internal market.

The sequence of electricity markets in Europe, as presented in *Figure 6* below, illustrates the multi-layered product and temporal architecture of market operation, capturing also explicit

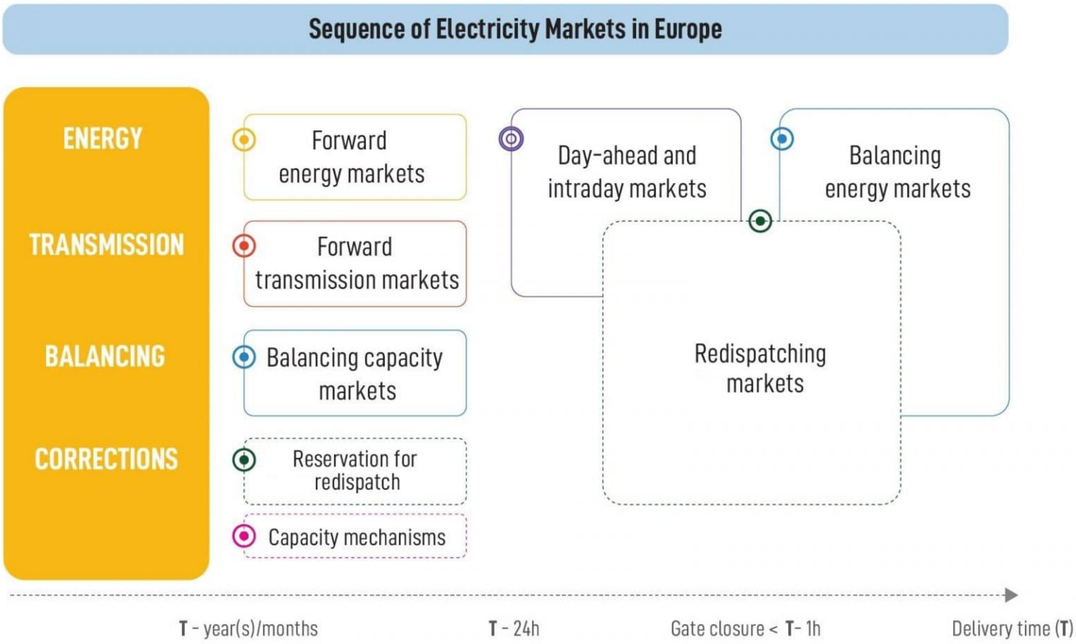
[131] Ibid. 25-28.

[132] Electricity Regulation, art 16.

[133] ACER, *Implementation of the Minimum 70% Margin for Cross-Zonal Trade* (Market Monitoring Report, 21 July 2023) 23-24 <https://www.acer.europa.eu/sites/default/files/documents/Publications/2023_MMR_MACZT.pdf> accessed 5 June 2025.

spatial market products. It highlights how different markets and mechanisms are structured across timeframes, from long-term forward markets to real-time balancing and redispatching.

Figure 6. Sequence of Electricity markets in Europe[134]



The progress toward full integration of market operations varies significantly across different products. ***Energy*** markets are the most mature in terms of EU-wide harmonisation and geographic integration. Cross-zonal integration mechanisms have been well established across all main timeframes: *long-term transmission rights* (LTTRs) in the forward market and *market coupling* mechanisms for day-ahead (SDAC) and intraday (SIDC) markets. In parallel, balancing energy platforms (PICASSO, MARI, TERRE) are gradually improving cross-border efficiency, despite remaining limitations in coverage and capacity products.

Ancillary services and ***capacity mechanisms,*** in contrast, remain largely national in scope and are not yet integrated at the EU level. *Balancing capacity* procurement continues to be organised nationally, with limited regional coordination emerging under Article 6 of the Electricity Regulation. Non-frequency *ancillary services* are procured based on national grid needs, without standardisation or cross-border exchange mechanisms. *Capacity mechanisms*, while subject to EU State aid scrutiny and common design principles under the *Clean Energy Package* reforms, also operate nationally, without yet harmonised product definitions or pan-European platforms.

While short-term mechanisms such as market coupling, cross-zonal capacity allocation, and redispatching manage congestion dynamically, they cannot substitute for the physical

[134] Meeus (n 81) xx.

transmission capacity required to support a truly integrated European electricity market. Without sufficient cross-border interconnection, market-based processes will remain constrained by structural bottlenecks, limiting competition, price convergence, and flexibility. Since 2002, the EU has set political targets to strengthen ***interconnection***, raising the ambition to ***15%*** of installed generation capacity ***by 2030*** to accommodate growing shares of renewables and cross-border trading.[135] Complementing this, the *Ten-Year Network Development Plan* (TYNDP)[136] and *Projects of Common Interest* (PCIs) framework[137] provide the strategic planning and investment mechanisms needed to expand Europe's transmission backbone. Yet, despite these efforts, grid development remains insufficient to match the EU's decarbonisation and market integration goals. Accelerated investments, deeper coordination between TSOs and Member States, and stronger political commitment are essential to ensure that physical infrastructure evolves in parallel with market design so that the internal electricity market can function as a coherent and deliverable system.

In sum, the EU's Wholesale Market Layer provides a strong and increasingly integrated foundation for electricity trading, system balancing, and cross-border optimisation. Its legal and operational architecture has matured substantially, particularly in the energy markets segment. However, other market layers, as ancillary services and capacity mechanisms, still require further harmonisation and integration. In parallel, the physical transmission network must also evolve to ensure that infrastructure constraints do not undermine market efficiency or the achievement of decarbonisation objectives.

3.3 Retail Market Layer: Architecture, Pricing, and Competition

3.3.1 Defining the Structure of the Retail Market

While the wholesale electricity market facilitates the efficient matching of supply and demand across various timeframes, the real interaction of final consumers with the electricity system happens in the retail segment. The retail market functions as the interface between complex upstream price formation mechanisms and end-user pricing, contract structures, and service delivery. As such, retail market design is not merely a downstream administrative layer; it plays

135 Commission, '*Electricity interconnection targets*' <https://energy.ec.europa.eu/topics/infrastructure/electricity-interconnection-targets_en> accessed 29 June 2025.

136 Regulation (EC) 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) 1228/2003 [2009] OJ L211/15.

137 Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) 715/2009, (EU) 2019/942 and (EU) 2019/943 and repealing Regulation (EU) 347/2013 [2022] OJ L 152/45.

a central role in determining how competitive dynamics, decarbonisation incentives, and market risks are transmitted to households and businesses.

Since the early 2000s, retail electricity markets in the EU have passed a long path of progressive liberalisation, promoting consumer choice, enabling market-based pricing, and introducing innovation in supply models. However, while EU-wide legislation mandates open access to retail supply, dynamic pricing opportunities, and non-discriminatory treatment of consumers across Member States, substantial differences persist across national retail frameworks, especially with respect to price regulation, supplier obligations, and consumer protections.

The recent energy crisis underscored existing vulnerabilities of the EU's retail market design. Poor supplier hedging practices, price caps design, and rigid public service obligations mechanisms exposed both suppliers and consumers to significant financial and operational stress. As highlighted in ACER's 2023 Final Assessment,[138] retail market design must be reconsidered not only through the lens of consumer rights but also in terms of system resilience, supplier viability, and economic efficiency.

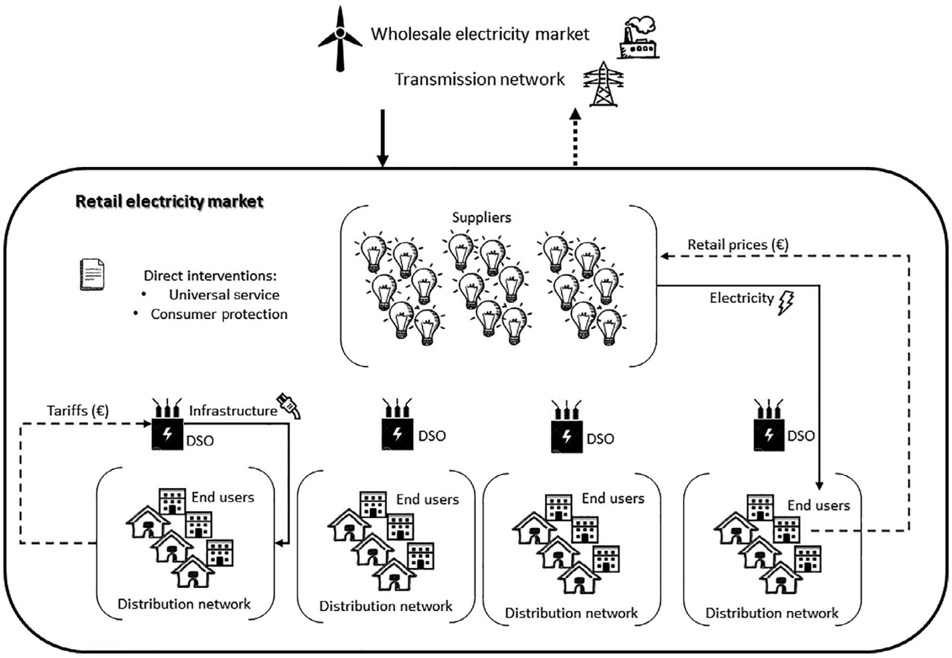
This section proceeds in three parts. The first outlines the structural and legal architecture of EU retail electricity market, including its actors, rights, and service obligations. The second focuses on electricity prices as the primary expression of consumer welfare and risk allocation, and how they are transmitted through different contract types. The third part examines competition as the central mechanism of achieving the retail market objectives. Together, these dimensions provide a basis for evaluating whether liberalisation of the retail segment has delivered on its promise of an accessible, affordable, and efficient electricity supply.

3.3.2 Legal and Institutional Dimensions of Retail Market

In contrast to the multilayered design of the wholesale segment, the structural and institutional architecture of the EU retail electricity market is less complex (see *Figure 7*). Nevertheless, it forms the final contractual and operational interface between the liberalised electricity system and end-users. Understanding this architecture is essential to contextualise how consumer rights are realised, how service continuity is guaranteed, and how upstream market signals are translated into downstream contracts. As such, it plays a pivotal role in achieving the core goals of market liberalization – enhancing consumer welfare and enabling informed choice.

[138] ACER, *Final Assessment of EU Wholesale Electricity Market Design* (n 50) 65-67.

Figure 7. EU Retail Electricity Market Structure[139]



The retail market comprises two primary consumer groups – *household* and *non-household* (i.e., commercial and industrial) customers – as well as a range of supply-side actors. On the other side, in addition to licensed *suppliers*, the Electricity Directive introduced new market participants such as independent *aggregators* and *citizen energy communities*, who may offer services that combine consumption, generation, and flexibility. Logistics and metering functions are performed by distribution system operators (DSOs) – natural monopolies remaining in the regulated segment of the electricity market, together with TSOs.

Pursuant to Article 4 of the Electricity Directive, all final customers are entitled to choose their electricity supplier, to have multiple simultaneous contracts and metering points, and to switch suppliers without disproportionate costs or barriers. Moreover, customers must be able to engage in aggregation and electricity sharing independently of their supply contract.

To ensure continuous access to electricity, as an essential service, Member States may designate certain suppliers to fulfill specific public service obligations (PSO). Thus, *universal service suppliers* (USSs) must guarantee the supply of electricity to household customers under pre-defined conditions, while *suppliers of last resort* (SoLRs) ensure emergency continuity where market-based providers fail or exit.[140]

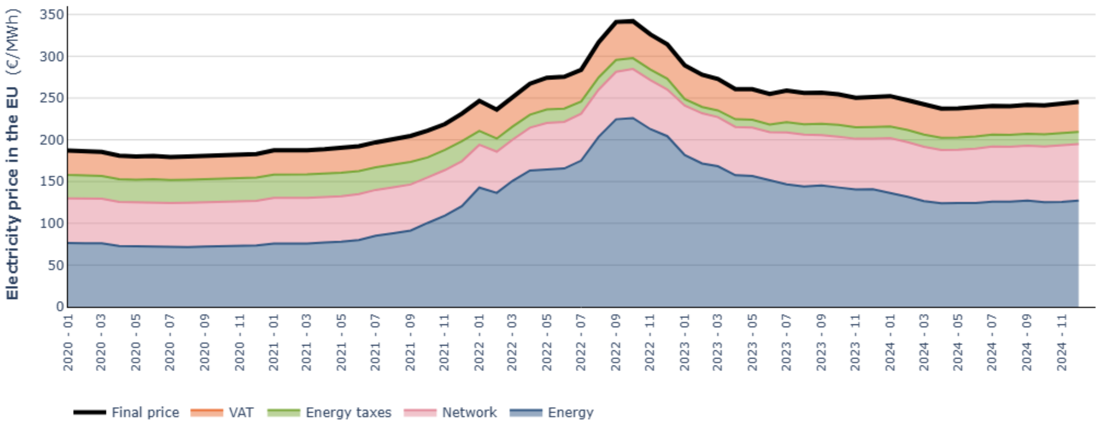
---

[139] Luis A Boscán, '*European Union retail electricity markets in the Green Transition: The quest for better consumer involvement*' (2019) WIREs Energy and Environment <https://doi.org/10.1002/wene.359> accessed 30 June 2025.

[140] Electricity Directive, arts 27, 27a.

From a product perspective, the electricity supplied to end-users through the retail market is not limited to the energy component procured on wholesale markets. The final retail price is a composite of several elements, including regulated network charges, covering both *distribution* and *transmission tariffs*, and applicable *taxes* (see *Figure 8* below). While distribution charges reflect the cost of local infrastructure, transmission tariffs account for broader system-level costs. In addition to the costs of using high-voltage transmission infrastructure, they also include ancillary services and CMs. These costs originate in upstream regulated or competitive segments but are ultimately passed through to consumers via the network component.

Figure 8. Monthly average electricity price for households in the EU[141]



As illustrated in *Figure 8* above, the energy component accounted for approximately half of the average household electricity price in 2024 across most EU Member States, with network and taxes charges making up a substantial share. This layered price structure highlights how the physical delivery system is inseparable from its regulatory framework, and why retail pricing must be analysed in relation to both competitive and regulated cost components. It also highlights the strong interdependence between retail and wholesale markets, underscoring the importance of end-user pricing that reflects the upstream volatility and cost dynamics.

In the context of the recent energy crisis, the functioning of pricing models in practice should be critically reassessed, including questions about how risks are allocated, how consumer welfare is measured, and whether the current system delivers on the goals of liberalization.

3.3.3 Retail Pricing and Consumer Welfare

Having established the institutional and service architecture of the EU retail electricity market, the analysis now turns to price formation – the primary channel through which market signals, regulatory decisions, and supplier risk management reach consumers. In a liberalized,

[141] Commission, DG Energy, '*Quarterly Report on European Electricity Markets: Q4 2024',* (2025) 17(4) Market Observatory for Energy <https://energy.ec.europa.eu/document/download/139371bf-b50b-4fd4-afd1-761b782a0703_en?filename=Quarterly%20report%20Q4%202024%20Electricity.pdf> accessed 15 May 2025.

consumer-centered energy system, pricing is not merely a commercial outcome, but a legal and economic expression of how costs are allocated, risks are distributed, and the value is signaled. Price directly determines affordability, access, and consumer engagement, and thus stands at the centre of any assessment of consumer welfare and market effectiveness.

Retail electricity pricing in the EU is based on various contractual models, each differing in levels of flexibility, cost reflectiveness, and exposure to wholesale market dynamics (see *Figure 9*). These include *fixed-term, fixed price*; *dynamic price*; and *fixed-but-flexible contracts*.

Figure 9. Examples of Retail Price Plans[142]

Source: ACER.

Fixed-term, fixed-price contracts *(yellow line)* involve consumers paying a stable unit rate (e.g., 30 cents/kWh) regardless of time of day, season, or wholesale fluctuations. This model offers maximum predictability during the contract term (typically 12 to 36 months) but, as noted by ACER, "*do not 'nudge' the consumer towards adjusting their consumption patterns in line with the [real] costs of delivering energy*".[143] Since they suppress real-time price signals, they implicitly assume and internalise system balancing and increased cost.

Dynamic pricing contracts *(grey line)*, which are directly indexed to wholesale markets (e.g., day-ahead spot prices), thereby exposing consumers to real-time fluctuations. While enabling load shifting and demand-side flexibility, this model requires transferring significant volatility risk to end-users and requires consumer awareness. The feasibility and uptake of these contract types are limited by the uneven rollout of smart metering infrastructure across Member States. By the end of 2023, ten countries – including Germany, Czechia, Hungary, and Slovakia – had

[142] ACER, *Final Assessment of EU Wholesale Electricity Market Design* (n 50) 68.
[143] Ibid.

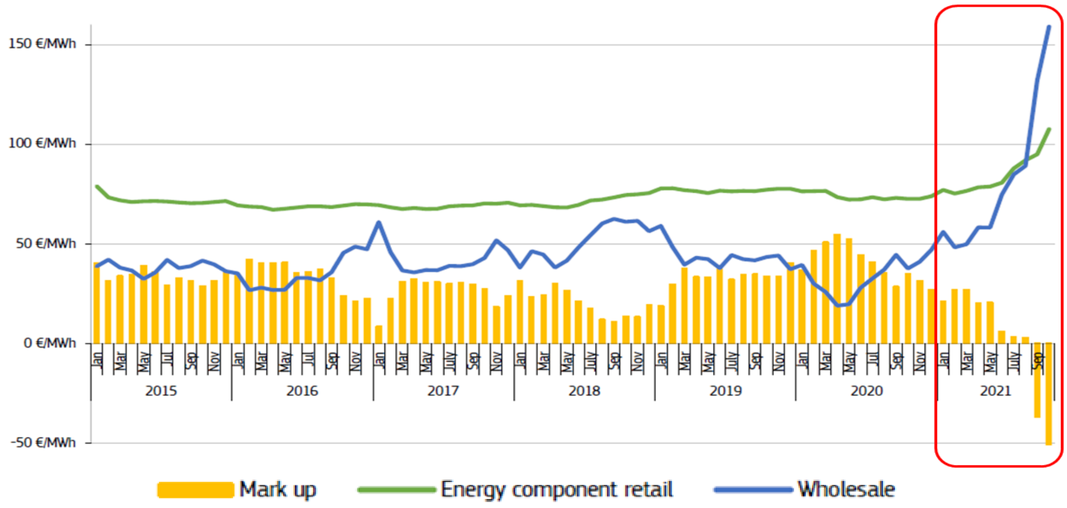
smart meter roll-out rates below 30%, while several other states, such as Bulgaria and Cyprus, reported minimal deployment.[144]

Fixed but flexible contracts *(blue line)* maintain a stable average price over the contract period, incorporating intraday variation through time-of-use or peak/off-peak pricing structures. This hybrid model provides partial responsiveness while maintaining a level of consumer protection against price volatility.

These contract structures show how retail markets reflect the transmission of wholesale price dynamics to end-users. While the *Clean Energy Package* aims to promote contract diversity and dynamic pricing to boost consumer engagement, in practice, contract options and consumer choices continue to favour traditional, risk-averse structures. Consumer behavioral engagement is often constrained by limited offerings, a lack of transparency, and a persistent reliance on regulated or default pricing schemes.

Despite all the liberalization efforts, fixed-price contracts – being the least cost-reflective to wholesale price dynamics – were the predominant model across most EU Member States, leaving both consumers and suppliers largely insulated from short-term market signals. Therefore, during the 2021-2022 energy crisis, driven by gas supply constraints and geopolitical shocks, many retail suppliers found themselves locked into fixed-price contracts, while wholesale procurement costs surged above the retail revenue (see *Figure 10*).

Figure 10. EU wholesale and retail electricity prices (EUR/MWh) (2015 – 2021)[145]



[144] ACER and CEER, *Energy Retail Market* (2024 Market Monitoring Report, 30 September 2024) 21-22 <https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER-CEER_2024_MMR_Retail.pdf> accessed 2 June 2025.

[145] ACER, *Final Assessment of EU Wholesale Electricity Market Design* (n 50) 63.

While consumer prices must ultimately reflect the cost of supply, maintaining such large gaps over time proved financially unsustainable. Following sudden retail price increases, numerous suppliers exited the market, forcing reliance on *Supplier of Last Resort* (SoLR) arrangements or emergency public interventions.[146] These developments exposed structural fragilities in the dominant retail pricing model and highlighted the need for better alignment between contract design, risk management, and consumer engagement.

The large-scale activation of SoLR mechanisms during the 2021-2022 crisis subjected this key consumer protection tool to a real-world stress test. As reported by ACER, several SoLR arrangements revealed operational and financial shortcomings: in some cases, appointed SoLRs refused to take on new customers due to the scale of the financial risk under volatile wholesale conditions; in others, SoLRs themselves became insolvent, forcing repeated reallocation of stranded customers.[147]

In response to market vulnerabilities, Member States often intervene administratively. Even after the energy crisis, public price interventions remained widespread, with 100% of households receiving regulated electricity in at least six Member States – including Bulgaria, Cyprus, Croatia, and Hungary. In another twelve Member States, including France, Italy, Poland, and Spain, partially regulated pricing co-existed alongside market-based offers.[148] In most jurisdictions, no definitive timeline has been set for phasing out such interventions. As ACER warns, untargeted and prolonged price regulation can distort market dynamics, hinder innovation, and ultimately weaken the effectiveness of liberalisation.[149]

To sum up, the 2021-2022 energy crisis exposed significant discrepancies in retail pricing models, hedging strategies, and consumer protection frameworks. This brought a fundamental policy dilemma: if consumer protection is the primary objective, to what extent should competition remain central to the design of retail markets? While administrative price interventions can offer short-term protection, in the long term, they may mask inefficiencies, weaken consumer engagement, and reduce supplier responsiveness to demand-side needs. Understanding the value of competition requires more than observing prices – it calls for a closer look at market structures, switching behavior, and the barriers that shape supplier entry and consumer engagement. These are questions that the following subsection now addresses.

[146] Ibid. 69.

[147] Ibid.

[148] ACER and CEER, 2024 *Energy Retail Market Monitoring Report* (n 148) 23-24.

[149] Ibid. 48-49.

3.3.4 Retail Competition: From Liberalisation Prospects to Market Realities

Retail competition is central to delivering consumer welfare in liberalised markets by promoting supplier diversity, price responsiveness, and innovation. However, the 2021-2022 energy crisis exposed the limits of this model, revealing that liberalized markets were not necessarily better equipped to protect consumers from price shocks. Therefore, one of the main objectives of the 2024 Electricity Market Reform was to redefine the balance between competition, resilience, and consumer protection.

Scholars have long debated whether competition in retail electricity markets delivers tangible benefits to end-users. These perspectives can be grouped broadly into three camps: theorists (*Joskow*), innovation advocates (*Littlechild*), and critical institutionalists (*Esposito* and *Wilson*).

Joskow argues that retail competition in electricity markets should be assessed against the benchmark of direct wholesale access. Without meaningful value-added services, such as real-time metering and demand response tools, retailers should not expect to earn a margin over wholesale prices.[150] In contrast, *Littlechild* maintained that retail competition is vital not only for direct consumer welfare but also as a stimulus to upstream market efficiency.[151] Other authors link retail competition to broader concepts of energy justice[152] or even question consumers' ability to choose the best supplier.[153]

These debates occur against the backdrop of the EU's longstanding commitment to promoting retail competition. While the Electricity Directive guarantees key consumer rights – such as supplier switching, transparent billing, dynamic pricing, and participation in demand response or aggregation – a significant gap persists between formal liberalisation and market reality.

Empirical indicators confirm that effective competition remains elusive in many Member States. According to the 2024 ACER-CEER Market Monitoring Report,[154] Herfindahl-Hirschman Index (HHI) values exceeded the 2,000 threshold in 17 out of 27 Member States, indicating moderate to high concentration (see *Figure 11*).

---

150 Paul L Joskow, '*Why Do We Need Electricity Retailers? Or, Can You Get It Cheaper Wholesale?*' (2000) MIT-CEEPR Working Paper 00-001, 5-6 <http://dspace.mit.edu/handle/1721.1/44965> accessed 30 June 2025.

151 Stephen C Littlechild, '*Why we need electricity retailers: A reply to Joskow on wholesale wpot price pass-through'* (22 August 2000) Research Papers in Management Studies WP 21/2000 <https://www.jbs.cam.ac.uk/wp-content/uploads/2020/12/wp0021.pdf> accessed 2 June 2025.

152 Fabrizio Esposito, Lucila de Almeida, Klaus Mathis and Bruce R Huber (eds), *Energy Law and Economics* (vol 5, Springer 2018), ch '*A Shocking Truth for Law and Economics: Consumer Welfare Explains the Internal Market for Electricity Better Than Total Welfare'* 101-133.

153 Chris M Wilson and Catherine W Price, '*Do Consumers Switch to the Best Supplier?*' (2010) 62 Oxford Economic Papers 647-668 <https://doi.org/10.1093/oep/gpq006> accessed 2 June 2025.

154 ACER and CEER, 2024 *Energy Retail Market Monitoring Report* (n 148).

Figure 11. CR3 and HHI scores for the household electricity market in 2023[155]

Country	HHI household, 2023	2023/2022	2023/2019	CR3
Austria	1 365	– 9 %	– 6 %	48
Belgium	2 761	0 %	15 %	78
Bulgaria	3 502	0 %	0 %	100
Croatia	8 489	2 %	3 %	100
Cyprus	10 000	0 %	0 %	100
Czechia	2 799	– 2 %	12 %	78
Denmark	1 370	No data	104 %	50
Estonia	No data	No data	No data	No data
Finland	1 032	– 3 %	18 %	48
France	4 860	– 1 %	– 8 %	93
Germany	No data	No data	No data	No data
Great Britain	1 559	0 %	60 %	59
Greece	3062	-43%	-57%	82
Hungary	5 059	0 %	33 %	100
Ireland	3 108	4 %	5 %	79
Italy	2 878	– 24 %	– 39 %	65
Latvia	No data	No data	No data	No data
Lithuania	3 749	– 46 %	– 63 %	87
Luxembourg	8 272	7 %	7 %	100
Malta	10 000	0 %	0 %	100
Netherlands	2 032	0 %	– 2 %	72
Norway	736	2 %	5 %	36
Poland	2 441	0 %	– 23 %	77
Portugal	4 829	– 10 %	– 23 %	No data
Romania	2 071	– 4 %	– 26 %	65.57
Slovakia	No data	No data	No data	No data
Slovenia	1 895	– 1 %	21 %	No data
Spain	2 490	– 3 %	– 7 %	82
Sweden	852	12 %	1 %	No data

Source: ACER based on data provided by National Regulatory Authorities.

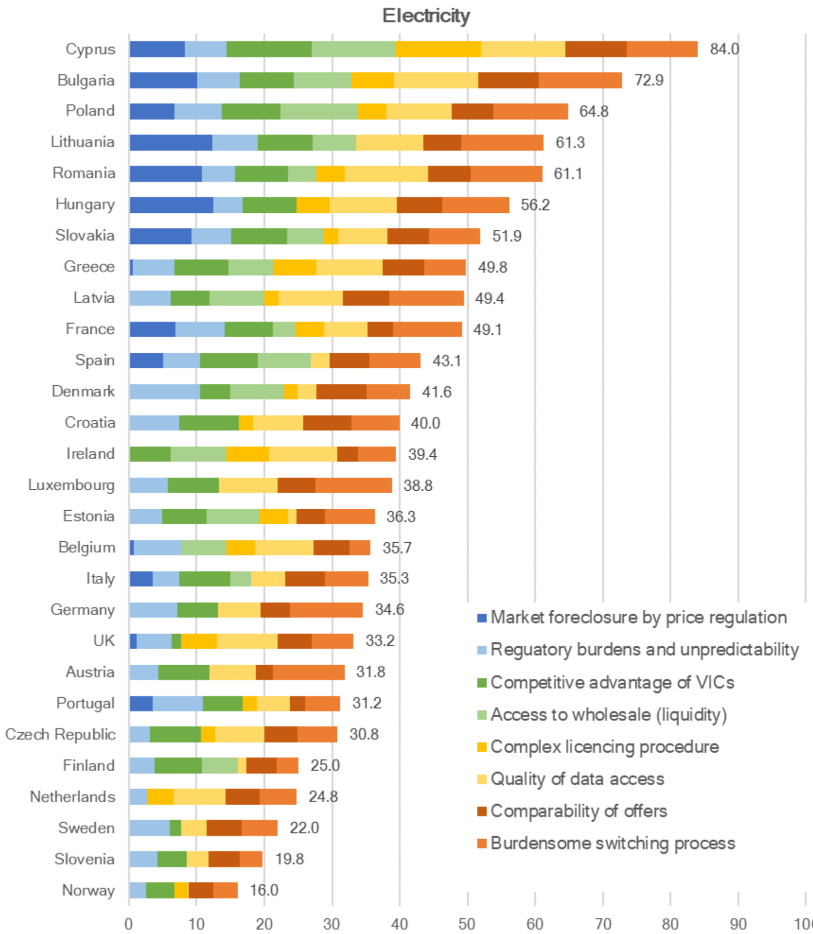
Market concentration is also evident in the CR3 ratio, which represents the combined market share of the three largest suppliers. As of 2023, CR3 in most EU countries exceeded 70%, underscoring the limited degree of competition in the household segment despite two decades of formal liberalization.

High CR3 and HHI values often correlate with persistent regulated tariffs, low switching rates, and limited supplier diversity – factors that undermine the theoretical benefits of retail competition. These structural and behavioural barriers are also captured by the *Barriers Index* (BI), an assessment tool developed by the Commission to evaluate the extent to which national retail markets enable or obstruct effective supplier entry and consumer engagement.

[155] Ibid. 72.

The BI does not measure competitiveness *per se*, but rather reflects the cumulative burden that regulatory, procedural, and behavioural barriers place on new or independent suppliers. It comprises eight sub-indicators grouped into four categories, each scored from 0 to 10. The sub-scores are aggregated into a single country-level index, ranging from 0 (no barriers) to 100 (maximum barriers), reflecting non-structural barriers to retail markets (see *Figure 12*).

Figure 12. Barriers Index – Electricity Retail Market[156]



The 2023 results reveal a wide disparity across Member States. The highest BI scores are recorded in Cyprus, Bulgaria, Poland, and Lithuania – the countries with persistent price regulation, vertical integration, and procedural burdens. In contrast, the Netherlands, Sweden, Slovenia, and Norway got the lowest BI rates due to liberalised tariff regimes, open access to market data, and straightforward licensing regulations.

However, despite the valuable insights of the BI, the report cautions against using this tool as a direct proxy for market concentration or competitiveness. For instance, Portugal, with a low BI score, has one of the highest HHIs of nearly 6,000, indicating near-monopoly conditions. This

[156] Commission, DG Energy, '*European Barriers in Retail Energy Markets*' (Final Report, Publications Office, 2021) 58 <https://data.europa.eu/doi/10.2833/5217> accessed 29 June 2025.

highlights the importance of interpreting structural metrics, such as CR3 and HHI, in conjunction with behavioral and regulatory indicators to form a more comprehensive picture of retail market performance.[157]

Another indicator of consumer engagement and the retail market competition is the consumer switching rate. According to the 2024 ACER-CEER data,[158] over 50% of EU households had never switched their electricity provider. The average switching rate across the EU household segment in 2023 was just 7.15%. Rates declined in 16 Member States, with over 91% of EU households still staying with the same supplier, often under regulated default contracts.

The report attributes this stagnation to three main causes: (i) insecurity and lack of trust following the 2022 energy crisis; (ii) reduced supplier offerings, limiting consumer options; and (iii) price interventions, which reduce perceived benefits of switching and narrow the price difference between suppliers. The correlation is notable: Member States with high switching rates (>10%) generally had lower shares of regulated tariffs (16.92%), whereas those with low switching rates (<10%) showed significantly higher exposure to price interventions (65.63%).

In summary, despite the EU's efforts to liberalise its retail electricity market, many of the expected benefits, such as stronger competition and better outcomes for consumers, have not been fully realised. High market concentration, limited switching rates, and reliance on regulated tariffs reveal a persistent gap between formal liberalisation and effective competition. Indicators as HHI and BI show how structural dominance, regulatory obstacles, and consumer inertia continue to limit supplier diversity and consumer engagement. To unlock all the benefits of liberalisation – more innovation, better price signals, and greater consumer empowerment – policymakers must address these interlinked structural and behavioural barriers.

3.3.5 Concluding Remarks on Retail Market Layer

The EU retail electricity market plays a central role in shaping how consumers interact with the liberalized internal electricity market. It is designed to encourage competition, guarantee access to electricity, and give consumers more control through greater choice and transparency. Yet, while formal liberalisation has been achieved in most Member States, effective competition and equitable outcomes remain uneven. Regulatory fragmentation, legacy market concentration, and behavioural inertia continue to impede the emergence of a fully dynamic and consumer-responsive retail landscape.

---

[157] Lucila de Almeida *et al*, '*When Indicators Fail Electricity Policies: Pitfalls of the EU's Retail Energy Market Barrier Index*' (2022) 165 *Energy Policy* 112892 <https://doi.org/10.1016/j.enpol.2022.112892> accessed 30 June 2025.

[158] ACER and CEER, 2024 *Energy Retail Market Monitoring Report* (n 148) 50.

The 2021-2022 energy crisis put the resilience of this retail market to the test. Surging wholesale prices exposed the critical misalignments between retail pricing models, insufficient hedging strategies, and underdeveloped SoLR frameworks. These events highlight the urgent need to build retail frameworks that can withstand market volatility while fostering investment, innovation, and consumer confidence – a challenge that remains especially relevant for countries like Ukraine, where retail market reforms are still underway.

Looking ahead, the challenge for the EU retail market design is to balance three competing imperatives: ensuring price stability and fairness; enabling efficient market signals for demand response and system balancing; and fostering a competitive yet sustainable supplier ecosystem. Addressing these goals will require rethinking how retail contracts are structured, how hedging practices are regulated, how protections for vulnerable consumers are targeted, and how new actors like aggregators and citizen energy communities are integrated.

3.4 Assessment of the EU Electricity Market Performance

3.4.1 Resilience and Limitations of the EU Electricity Market Design

This chapter's analysis highlights the structural complexity of the EU electricity market design, which integrates product, temporal, and spatial elements into a cohesive system, enabling coordinated electricity trading, balancing, and system operations by aligning physical system requirements with legal and economic tools across different timeframes and regions. Over two decades of gradual liberalisation, this design has successfully connected national markets, boosted cross-border competition, and generated significant consumer benefits across the EU.

Prior to the 2021-2022 energy crisis, the EU electricity market design was generally regarded as effective in achieving its core objectives of efficiency, reliability, and gradual decarbonization. As ACER notes, "*the current wholesale electricity market design ensures efficient and secure electricity supply* ***under relatively 'normal' market conditions***" and is fundamentally worth keeping.[159] The European Commission similarly concluded that "*the merit order approach remains fit for purpose*" and that market rules had helped mitigate the impact of the crisis.[160] In this sense, the architecture of the EU electricity market has demonstrated considerable resilience and adaptability in the face of evolving system needs and policy goals.

At the same time, the extreme stress conditions of the 2021-2022 crisis revealed ***structural weaknesses in the existing design***. Although the crisis stemmed from external geopolitical and supply shocks – not from the market structure itself – the system proved unprepared to handle

[159] ACER, *Final Assessment of EU Wholesale Electricity Market Design* (n 50) 2.

[160] Commission, '*Reform of the EU Electricity Market Design*' (Staff Working Document) SWD/2023/58 final 7.

such volatility without major public intervention. They included limited *short-term market integration*, with inadequate cross-zonal capacity, delays in flow-based market coupling, and incomplete harmonization in intraday market practices. Despite progressive integration of the *balancing markets*, they remain fragmented and lack sufficient cross-border coordination. *Forward markets* remain structurally fragmented and illiquid, with inadequate hedging tools and low engagement of smaller participants.

At the ***spatial level***, persistent political resistance undermines the efforts to align bidding zone configurations with the real grid constraints, driving up the costs for redispatching and ultimately reducing consumers' welfare.

On the ***consumer side***, the crisis revealed deep vulnerabilities in retail pricing models and supplier risk management practices. Many consumers found themselves unexpectedly exposed to wholesale price volatility, while SoLR mechanisms and regulated tariffs came under severe strain. Public interventions, while necessary in the short term, risked distorting market signals and undermining competition if maintained beyond the immediate crisis period. More broadly, the market design had not yet evolved sufficiently to value and incentivise ***flexibility at scale*** – a critical capability given the increasing penetration of variable renewable generation. Demand-side flexibility, storage, and low-carbon flexible generation remained underdeveloped and insufficiently integrated into market mechanisms.

In sum, while the EU electricity market design proved fundamentally robust under normal conditions, the crisis highlighted the need for targeted reforms to address its structural limitations. The experience reinforced the importance of evolving the market architecture to support the twin goals of deep decarbonisation and system resilience in an increasingly complex and dynamic electricity system.

3.4.2 Key Elements of the 2024 EU Electricity Market Reform

The new electricity market design rules were formally adopted on 21 May 2024 and entered into force on 16 July 2024, through amendments to: the Electricity Directive, the RED, the Electricity Regulation, and the ACER Regulation.[161] The 2024 reform of the EU electricity market design builds directly on the lessons of the 2021-2022 crisis and the structural challenges identified by ACER in its 2023 Final Assessmnet[162] and later by the Commission in its *Staff Working Document on the Reform of the EU Electricity Market Design*.[163]

[161] Commission, '*Electricity Market Design*' <https://energy.ec.europa.eu/topics/markets-and-consumers/electricity-market-design_en> accessed 11 June 2025.

[162] ACER, *Final Assessment of EU Wholesale Electricity Market Design* (n 50).

[163] Commission, '*Reform of the EU Electricity Market Design*' (Staff Working Document) SWD/2023/58 final.

The Commission reaffirmed the importance of preserving the core market design, particularly the merit order approach. However, it emphasised the need for the market to evolve in order to better support investment in low-carbon generation, enhance system flexibility, and ensure that consumers are adequately protected from excessive price volatility.[164]

Many of the priorities articulated in the 2024 reform directly address the structural challenges reviewed in the preceding sections of this chapter. These include the need to enhance liquidity and standardize PPAs on forward markets, complete the integration of short-term markets, accelerate the implementation of flow-based market coupling, improve the efficiency of bidding zones configuration, and strengthen the integration of balancing markets.

Additionally, the reform aims to enhance the efficiency of RES support schemes across the internal market. The Commission emphasised that enabling large-scale rollout of low-carbon generation requires stable, transparent, and investment-friendly support mechanisms. In this context, the reform prioritizes ***Contracts for Difference** (CfDs)* as a preferred model, ensuring that renewable investments can achieve predictable revenue streams while maintaining market-based price signals.[165] A greater standardization and cross-border alignment of CfDs are intended to reduce fragmentation and minimize distortions between national markets.

The next reform priority is to enhance the market incentives for the procurement of ***non-fossil flexibility services*** – an area with significant design gaps. The Commission emphasized that increasing shares of variable renewables will necessitate significantly higher system flexibility. To address this, the reform supports the development of new market products and platforms to facilitate the participation of demand-side flexibility, storage, and low-carbon flexible generation, by improving their access and removing regulatory barriers to balancing and ancillary services markets, as well as refining procurement procedures.[166]

Another key pillar of the reform is the enhancement of ***consumer protection*** and the promotion of affordability and resilience. The reform requires more effective hedging policies for suppliers offering fixed-price contracts, while also promoting contract transparency and enhanced consumer choice between fixed and dynamic pricing. To mitigate future price shocks, the reform provides for clear consumer tools, with an emphasis on interventions that are targeted, time-bound, and market-compatible to avoid long-term distortions [167] Notably, the reform also promotes *energy sharing models* with collective self-consumption, prosumer engagement, and demand-side response, facilitating their contribution to system flexibility and decarbonisation.

[164] Ibid. 11-13.
[165] Ibid. 23-34.
[166] Ibid. 56-69.
[167] Ibid. 74-92.

Taken together, these priorities reflect a clear shift in market design thinking: from a narrow focus on energy-only trading to a more comprehensive architecture that integrates investment incentives, flexibility, and system resilience. The 2024 reform thus seeks to ensure that the internal market can effectively advance the EU's climate goals while preserving competition and protecting consumers.

3.4.3 Concluding Remarks on the EU Electricity Market Design

The EU electricity market design has demonstrated remarkable resilience and adaptability during significant system transformations and unprecedented stress. Its architecture remains fundamentally robust and has supported the development of one of the most integrated cross-border electricity markets globally.

The existing EU market architecture inherently supports decarbonization and flexibility by prioritizing low-marginal-cost renewables in dispatch and enabling smaller producers to benefit from transparent market pricing, regardless of bidding sophistication. It also incentivises demand-side flexibility and storage, which can displace more expensive fossil generation. By enhancing transparency and reducing information asymmetries, the design fosters competition and enables new business models. The integration of EU markets strengthens security of supply: in the short term, higher local prices naturally attract imports during periods of stress, while in the longer term, shared generation capacity and reserves across Member States will improve system flexibility and adequacy.

At the same time, the 2021-2022 crisis has revealed structural limitations that need to be addressed to ensure the market is fit for purpose. The 2024 reform marks a significant step towards this goal by expanding beyond energy-only trading to incorporate investment incentives for low-carbon generation, stronger consumer protections, and greater opportunities for active participation. As the EU advances its climate and energy objectives, the electricity market design must continue to evolve, strengthening its resilience, integrating more RES, and empowering consumers to play a stronger role.

This evolving framework of EU electricity markets serves as a benchmark for electricity market reforms in many neighbouring countries. The next chapter examines how lessons from the EU's electricity market experience are influencing Ukraine's reform efforts and investigates the main challenges and prospects of aligning its market framework with European standards.

Chapter IV. UKRAINE'S ELECTRICITY MARKET ARCHITECTURE

4.1 Structural Foundations of Ukraine's Electricity Market Design

Chapter III of this thesis analysed the internal electricity market design of the European Union, focusing on the ***wholesale*** and ***retail segments***, and a deeper disaggregation of the wholesale layer along product, temporal, and spatial dimensions. This multi-layered framework is predominantly a market-based structure, which highly relies on marginal pricing, market coupling, and consumer empowerment. Building on that foundation, the present Chapter shifts focus to Ukraine's electricity market design, evaluating how closely it aligns with or diverges from the EU model.

As outlined in Chapter II, Ukraine's reform efforts up to December 2022 were primarily guided by the requirements of the EU's *Third Energy Package*, implemented under the framework of the Energy Community Treaty. By that time, Ukraine's electricity sector had reached a formal implementation rate of 72%, having established liberalised wholesale and retail segments, legal unbundling of its TSO, and partial regulatory alignment.[168] However, more advanced elements of EU electricity market design, particularly those related to integrated market operation, regional coordination, and enhanced consumer rights, had not been yet applicable under the EnC *acquis* for its Contracting States, including Ukraine.

This changed with the revision of the *Electricity Integration Package (EIP)* in December 2022.[169] The revised EIP extended the binding acquis to the core instruments of the *Clean Energy for All Europeans Package*. These new obligations introduced a more comprehensive model of market integration, including spatial integration of all product and temporal layers, in line with the EU practice. As of 2024, Ukraine has begun transposing the revised framework, but full legislative adoption and functional implementation remain ongoing.

To facilitate the assessment of Ukraine's electricity market design and its evolving integration trajectory, this Chapter follows the structure of Chapter III and focuses on two key layers: (i) the wholesale market, including its structure, price formation, and regional integration; and (ii) the retail market, covering supplier competition, tariff regulation, public service obligations, and consumer protection. Throughout, the analysis highlights the main implementation gaps and structural constraints that hinder Ukraine's effective convergence with the EU electricity market design.

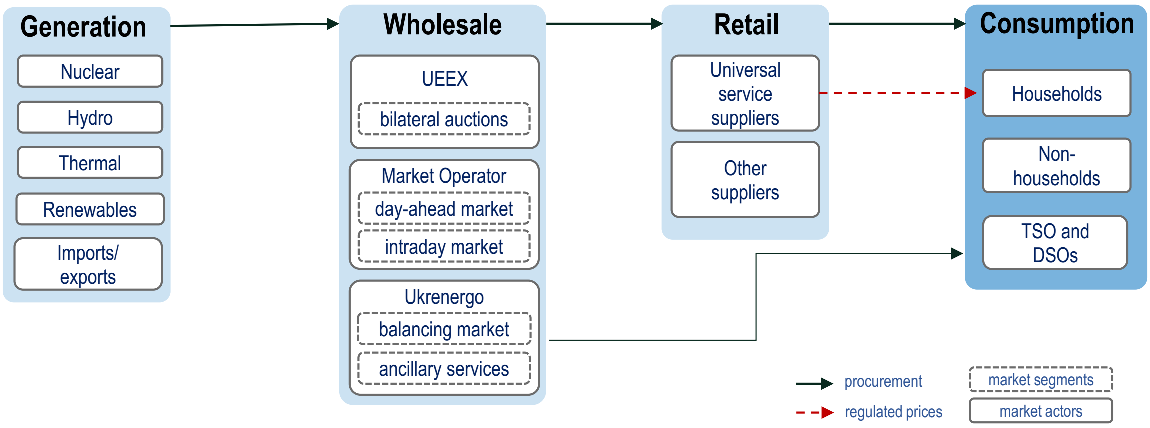
---

[168] EnC Secretariat, *Annual Implementation Report 2023: Ukraine* (n 62).

[169] Ministerial Council Decision 2022/03/MC-EnC (n 64).

Figure 13 below provides an overview of Ukraine's current electricity market design, covering the structural interfaces between core market segments and their participants, also illustrating its regulated segments. It also underscores the hybrid nature of the current model, where liberalised trading platforms coexist with significant state-directed mechanisms, regulated price segments, and residual legacies of the single-buyer structure.

Figure 13. Ukraine's Electricity Market Design[170]



Drawing on the *2023 OECD Market Study of Ukraine's Electricity Sector*[171] and the latest EnC Secretariat's *Implementation Reports*[172], this chapter focuses not merely on legal transposition but also on the operational performance of the market. The objective is to outline the functional discrepancies and institutional bottlenecks that must be addressed for Ukraine to transition from formal liberalisation to meaningful integration within the EU internal electricity market.

4.2 Ukraine's Wholesale Electricity Market

The wholesale market forms the structural backbone of Ukraine's electricity market and has been the primary focus of reform efforts since the adoption of the EML[173] in 2017. This layer includes the core market segments for electricity trading – forward, day-ahead, intraday, and balancing markets – as well as provisions for ancillary services. While the formal architecture resembles that of the EU model, implementation gaps, market distortions, and weak inter-segment linkages continue to limit its effectiveness.

Ukraine's electricity generation fleet remains largely composed of Soviet-era infrastructure, with most new capacity coming from renewables. As of 2021, installed capacity included about 22 GW of thermal power (mostly coal-fired), 14 GW of nuclear, 6 GW of combined heat and

[170] OECD, *Competition Market Study of Ukraine's Electricity Sector* (Report, OECD Publishing 2023) 44 <https://doi.org/10.1787/f28f98ed-en> accessed 16 June 2025.

[171] Ibid.

[172] EnC Secretariat, *Annual Implementation Report 2024: Ukraine* (n 65) 3.

[173] EML (n 60).

power (CHP), 6.5 GW of run-of-river hydro, and over 7 GW of solar and wind. Nuclear power accounted for approximately 55% of total electricity generation, followed by thermal generation, hydropower, and renewable sources.[174] However, these figures reflect the pre-war generation landscape. Since Russia's full-scale invasion in February 2022, large parts of Ukraine's generation have been damaged, occupied, or disconnected from the grid.

The market is characterised by high concentration. The state-owned *Energoatom* has a nuclear generation monopoly, while *DTEK Group*, Ukraine's largest vertically integrated private energy holding, plays a leading role in coal-fired and renewable generation. *Ukrenergo*, Ukraine's TSO, is responsible for system balancing and the procurement of ancillary services. Organised market platforms for day-ahead and intraday trading are operated by the *Market Operator* (MO), while the *Guaranteed Buyer* (*Garpok*) plays a central role in renewable energy support under the feed-in tariff schemes.[175]

This section follows the product-temporal logics outlined in Chapter III and examines each market segment in sequence, identifying key structural features, market performance, and divergence from EU regulatory and functional benchmarks.

4.2.1 Product and Temporal Organisation of Ukraine's Wholesale Market

Ukraine's wholesale electricity market, formally launched on 1 July 2019. Its structure includes forward market (called '*bilateral contracts*'), a *day-ahead market* (DAM), an *intraday market* (IDM), a *balancing market* (BM), and a developing framework for *ancillary services*. While Ukraine's market architecture is intended to mirror the EU's model, its actual functionality remains constrained by structural and institutional shortcomings.

4.2.1.1 Forward Market

The forward market segment (or '*bilateral contracts*' as referred to in the EML) constitutes the largest share of electricity trading volume in Ukraine's wholesale market. In 2021, about 78% of total electricity sales were conducted under bilateral agreements,[176] which is broadly consistent with the EU's 88% average.

While EML formally grants market participants the right to conclude bilateral agreements under freely negotiated terms, Article 66 obliges **all non-RES generators** to conduct such sales exclusively via the platform operated by the *Ukrainian Energy Exchange* (UEEX), thus leaving only a minor share for OTC agreements. Bilateral contracts differ in duration and delivery terms

[174] OECD (n 176) 27.

[175] Ibid. 25.

[176] Ibid. 47.

and are typically customised to reflect the specific commercial or operational requirements of the contracting parties. The UEEX enables forward trading across various time horizons – from daily to annual – offering distinct baseload and peakload products.

The UEEX facilitates two principal auction formats:

- ***One-sided auctions***, initiated by a seller, are divided into a special section (for regulated transactions, such as related to public service obligations, transactions to cover grid losses by the TSO and DSOs, sales by Garpok, and purchases by state-owned companies) and a commercial section (for unregulated trading among private actors).
- ***Two-way continuous auctions***, introduced in 2022, allow for the simultaneous participation of multiple sellers and buyers in trading standardized products.

In practice, the special section **dominates**, accounting for about ***83%*** of all bilateral segment.[177] These transactions are subject to regulated pricing and participation rules, with contract duration typically capped at *12 (in some cases – 36) months*.[178] In contrast, the commercial section – where no statutory duration limits apply[179] – suffers from limited uptake due to low liquidity, regulatory unpredictability, and an absence of product standardisation.

Although generally supported by market participants, the ***two-way continuous auction*** platform remained unused due to several structural obstacles. These include the predominance of regulated volumes, inconsistent enforcement of price caps by the regulator, competition from existing segments, and a lack of institutional support for product standardization.[180]

Ukraine's forward market lacks key features of the EU-style forward market: contracts are not standardized, there is no central clearing, and most products are illiquid.[181] The churn rate is a key indicator of market liquidity, with higher values reflecting stronger trading activity. ACER sets a threshold of 3.0 as the minimum benchmark for effective forward market liquidity.[182] According to the OECD assessment, Ukraine's forward market segment exhibits a churn rate

---

[177] UEEX, '*Spot Electricity Market UEEX'* (Results of Q4 2021, 2022) <https://www.ueex.com.ua/files/ueex_electricity_q4_2021.pdf> accessed 17 June 2025.

[178] Постанова Кабінету Міністрів України від 15.07.2019 №499 *Про затвердження Порядку проведення електронних аукціонів з продажу електричної енергії за двосторонніми договорами* [2019] Урядовий Кур'єр 112 (Cabinet of Ministers of Ukraine, Resolution No. 499 dd.15.07.2019 *On Approval of the Procedure for Holding Electronic Auctions for the Sale of Electricity under Bilateral Agreements* [2019] the Governmental Courier 112) <https://zakon.rada.gov.ua/laws/show/499-2019-%D0%BF#Text> accessed 16 June 2025.

[179] UEEX, *Regulations on Organization and Conduct of Electronic Auctions for the Purchase and Sale of Electricity under Bilateral Contracts in Commercial Sections on the Commodity Exchange*, approved by minutes No.620 dd. 20 November 2019 <https://www.ueex.com.ua/files/regulations_electronic_commercial_auctions-140622-eng.pdf> accessed 17 June 2025.

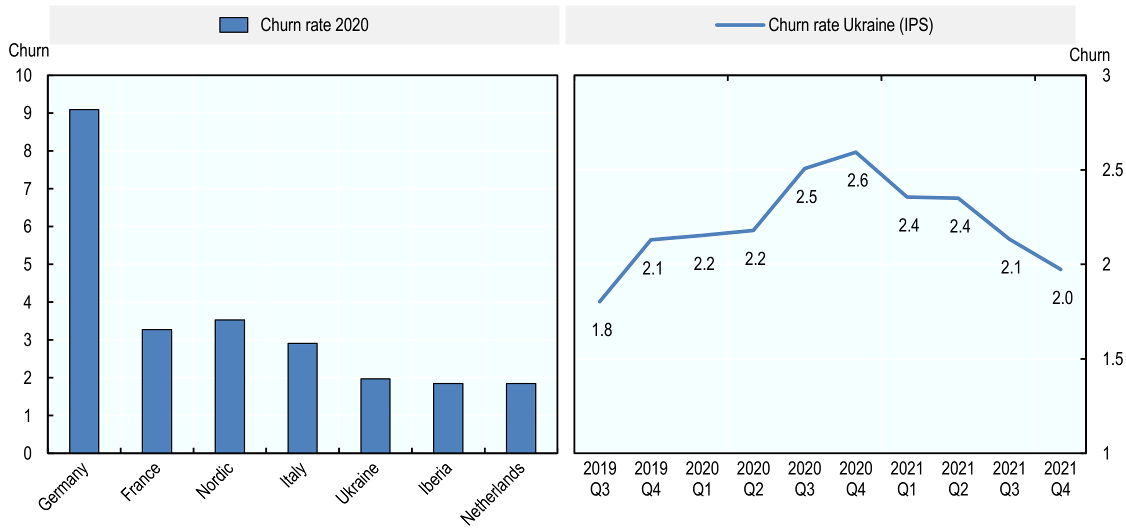
[180] OECD (n 176) 47-48.

[181] Ibid. 93-94.

[182] ACER and CEER, *Electricity Wholesale Market Volume* (2020 Annual Monitoring Report, October 2021) 65 <https://www.ceer.eu/wp-content/uploads/2024/05/ACER-MMR2020-EWMV.pdf> accessed 20 June 2025.

of about 2.1. While this remains below the ACER's benchmark for liquid markets, it is comparable to rates observed in most EU Member States (see *Figure 14*).

Figure 14. Churn Rate Comparison for EU and Ukraine[183]



The low liquidity of Ukraine's forward market is driven by dominance of regulated transactions, low participation by independent traders, limited access to standardized cleared products, and a fragmented trading structure. Additionally, quarterly baseload indices published by the UEEX only cover the commercial section and exclude outlier prices, limiting transparent price signals. This weakens reference pricing and adds uncertainty to forward contract valuation, further impairing the market's core functions – hedging, competition, and efficient allocation.

In contrast to the EU forward market, which is underpinned by regulated exchanges, central counterparty clearing, and transparent standardised products, Ukraine's forward segment remains fragmented, administratively segmented, and prone to regulatory interference. The dominance of the special section and persistent uncertainty around price regulation discourage market participation, undermine confidence in the forward market, and stall its evolution into a competitive, investment-friendly environment.

4.2.1.2 Day-Ahead and Intraday Markets

DAM and IDM – both operated by the state-owned *Market Operator* (MO) – were launched in July 2019 as central elements of Ukraine's liberalised electricity market design. As in the EU, the DAM follows a *marginal pricing* (pay-as-cleared) approach, while the IDM uses a *pay-as-bid* basis.[184] Despite their formal alignment with EU structural design, their market functioning remains limited.

---

[183] OECD (n 176) 84.

[184] EML, art 67.

As of early 2022, the DAM accounted for approximately ***18%*** of total electricity volumes, while the IDM contributed 2%.[185] Although the IDM share aligns with the EU average, Ukraine's *significantly higher DAM share* – double of the EU's typical ***9%*** – does not reflect stronger market reliance. Rather, it stems from ***regulatory obligations*** requiring certain producers, importers, the TSO, and DSOs to transact predefined volumes in this market segment.

Both DAM and IDM in Ukraine use hourly settlement intervals and a minimum trading unit of 1 MW per order, which contrasts with the 15-minute intervals and 100 kW (or less) minimum bid sizes targeted by the Electricity Regulation. At the same time, gate opening and closure times for DAM and IDM in Ukraine are broadly harmonized with EU practices, allowing smooth integration into SDAC and SIDC once product standardization is acheived.

Although DAM remains the most liquid and economically relevant segment of Ukraine's wholesale electricity layer, market concentration continues to limit competition. In 2021, *Energoatom, Ukrhydroenergo, and Garpok* collectively accounted for over 60% of DAM sales, and *Energoatom and Ukrhydroenergo* supplied 63% of IDM volumes. On the purchasing side, *D.Trading (DTEK*) and *United Energy* accounted for more than 60% of DAM purchases.[186] This high concentration, combined with limited liquidity and predictable bidding patterns, reduces the ability of both DAM and IDM to deliver transparent and competitive price signals.

According to OECD, churn rates of Ukraine's DAM and IDM are 0.2 and 0.04, respectively.[187] While these numbers indicate limited liquidity of Ukraine's short-term markets, they are broadly comparable with relatively low rates in most EU markets, typically ranging between 0.4 and 1.0 for DAM and 0.015 to 0.15 for IDM.

High concentration and limited competition in DAM and IDM have led to extensive regulatory interventions intended to curb market power and protect consumers. The primary tool has been administrative ***price caps,*** maintained by NEURC since the market's launch in 2019. However, their poor design – frequently revised, lack automatic indexing, and application without clear criteria – have also contributed to weak market performance.[188] While EML envisages such measures as temporary and exceptional, they have become a persistent feature of short-term market functioning. The resulting distortions constrain marginal pricing, limit trading flexibility, and discourage longer-term hedging strategies.

---

185 NEURC, '*Electricity Market Data Dashboard'* <https://public.tableau.com/app/profile/neurc/viz/2__16324695298060/sheet0_1> accessed 17 June 2025.

186 OECD (n 176) 53-54.

187 Ibid. 85.

188 Ibid. 85-91.

Finally, both markets remain underdeveloped in terms of voluntary participation, product granularity, and functional design. Much of the DAM volume is driven by regulatory obligations rather than competitive incentives. Both short-term markets, although broadly harmonised in gate structure, lack regional coupling, sub-hourly products, and continue to suffer from low liquidity. Thus, while the institutional framework of DAM and IDM is formally harmonised with the EU model, their actual contribution to efficient dispatch and market-based system optimisation remains limited.

4.2.1.3 Balancing Market

As in the EU, the BM constitutes the final layer of Ukraine's electricity trading sequence, complementing DAM and IDM by enabling the real-time correction of imbalances between scheduled and actual generation or consumption. Operated by *Ukrenergo*, the BM has been operational since July 2019 and adheres to the core principles of the EU model. Like European TSOs, *Ukrenergo* procures both *balancing capacity* and *balancing energy* through activation of standard balancing products, including FCR, aFRR, mFRR, and RR. These products are recognised in Ukraine's electricity market rules ('*UA Market Rules*')[189] and enable technical alignment with the EU balancing model.

Similar to other market segments, the BM's performance remains limited, suffering from persistent concentration. Participation is relatively narrow: while generators are obliged to offer all available balancing capacity, consumer-side and aggregated demand-side participation is nearly absent, and the number of certified *balancing service providers* (BSPs) remains low. Offers are submitted at least 45 minutes before delivery and cleared every 15 minutes using the *marginal pricing* principle, which is comparable to the EU balancing framework. Similar to DAM and IDM, the BM heavily relies on regulated ***price caps***, creating distortions in price signals and incentives. As the OECD notes, linking balancing prices to day-ahead market caps weakens cost-reflectiveness and may enable strategic behaviour across market segments.[190]

Accumulated debts increasingly threaten the BM's liquidity and undermine its effective functioning. Most of those originate from the SoLR's customers, specifically those in occupied territories and insolvent coal mines, which cannot be disconnected due to environmental reasons. By October 2022, *Ukrenergo* reported a net BM debt of UAH 6.4 billion (UAH 17.5 billion owed by BRPs to *Ukrenergo* and UAH 11.1 billion owed by *Ukrenergo* to BSPs).[191]

---

[189] Постанова НКРЕКП № 307 від 14 березня 2018 року *«Про затвердження Правил ринку»*, *Урядовий кур'єр* (22.06.2018) 117 (NEURC Resolution No 307 of 14 March 2018 *on the Approval of Market Rules*, the Governmental Courier (22 June 2018) 117) <https://zakon.rada.gov.ua/laws/show/v0307874-18#Text> accessed 17 June 2025.

[190] OECD (n 176) 56.

[191] Ibid. 96.

Thus, in comparison with the EU model, Ukraine's BM remains underdeveloped, with persistent price caps, high market concentration, and weak demand-side participation limiting its further alignment. Overcoming these structural challenges will be essential for the full integration of Ukraine's electricity market into the EU framework.

4.2.1.4 Ancillary Services and Capacity Mechanisms

Ukraine's market design also incorporates elements such as ancillary services and, to a limited extent, capacity-related products. It is partly aligned with the current EU model and rather reflects its earlier framework. Ancillary services in Ukraine are legally divided into frequency-related and non-frequency categories, in line with EU practice. However, capacity mechanisms as an independent structural element of electricity market design have not yet been implemented. Instead, balancing capacity procurement serves as a functional proxy for resource adequacy, as was the case in the EU prior to the 2024 reform.

Frequency-related ancillary services include the balancing capacity reserves procured *ex ante* to ensure sufficient resources are available to maintain system frequency. In Ukraine, these services are procured by *Ukrenergo* within the same set of products as in the EU – FCR, aFRR, mFRR, and RR. However, due to an acute shortage of balancing resources caused by Russian airstrikes after the full-scale invasion, *Ukrenergo* began awarding longer-term contracts, including a five-year FCR tender in August 2024[192] and a similar five-year aFRR procurement in May 2025,[193] which contradicts EU trends with short-term (daily to weekly) procurements.

Ukraine's ***non-frequency ancillary services***, compared to the EU, encompass a limited set of products aimed at maintaining voltage stability under normal operating conditions and enabling grid recovery in the event of widespread outages. *Voltage and reactive power regulation* is typically activated by the TSO in real time, often within 10 minutes of dispatch instructions. *System restoration services* (*black-start capability*) rely on prequalified units capable to restart generation without an external supply, further narrowing the pool of eligible providers.

Under EML, ancillary services are, in principle, procured on a market basis. However, where competition is not feasible – due to limited technical providers, geographic concentration, or market dominance thresholds being exceeded – NEURC may authorise procurement through

---

[192] Ukrenergo, '*НЕК "Укренерго" провела конкурентний 5-річний спецаукціон з придбання резерву підтримки частоти*' ('*NPC "Ukrenergo" Conducted a Competitive 5-Year Special Auction for the Procurement of Frequency Containment Reserve'*) (Press Statement, 15.08.2024) <https://ua.energy/electricity-market/nek-ukrenergo-provela-konkurentnyj-5-richnyj-spetsauktsion-z-prydbannya-rezervu-pidtrymky-chastoty/> accessed 30 June 2025.

[193] Ukrenergo, '*27 травня НЕК "Укренерго" проведе додатковий спецаукціон з придбання швидких резервів' ('NPC "Ukrenergo" to Conduct an Additional Special Auction for the Procurement of Fast Reserves on 27 May'*) (Press Statement, 02.05.2025) <https://ua.energy/zagalni-novyny/27-travnya-ukrenergo-provede-dodatkovyj-spetsauktsion/> accessed 30 June 2025.

administratively determined, cost-recovery pricing. In practice, procurement of non-frequency ancillary services has mainly been conducted via negotiated bilateral agreements, reflecting the limited number of qualified providers and the highly localised nature of these services.

From a harmonisation perspective, non-frequency ancillary services remain an emerging area of EU electricity market integration. Although the EU Electricity Regulation foresees future alignment through implementing acts and network codes (Article 59(1)(d)), such instruments have yet to be adopted. In the interim, Ukraine's approach broadly mirrors EU practice, where procurement remains primarily national and is often based on long-term contracts, cost-based tenders, or regulated compensation mechanisms.

Regarding ***capacity mechanisms*** (CMs), Ukraine's regulatory framework does not currently include any capacity remuneration schemes beyond the balancing capacity procurement. No distinct capacity markets, strategic reserves, or forward capacity obligations have been implemented. However, this absence does not yet create a harmonisation gap. CMs have only recently been formalised at the EU level through the 2024 reform and remain an evolving instrument. Their incorporation into Ukraine's regulatory framework can be expected in subsequent stages of legal convergence.

In sum, while Ukraine has legally adopted EU-compliant definitions and procurement principles for ancillary services, both frequency-related and non-frequency services remain administratively managed and nationally confined. Capacity mechanisms have yet to be introduced, but are not yet part of the binding acquis. As such, these areas represent fields of ongoing convergence potential rather than present compliance deficits.

4.2.1.5 Concluding Remarks on Product and Temporal Organisation

In legal and institutional terms, Ukraine's wholesale electricity market broadly replicates the EU model in its product and temporal layering. Although all key trading platforms – forward contracting, day-ahead, intraday, balancing, and ancillary services – have been formally established, their functioning remains significantly impaired by structural concentration, regulatory interventions, and limited liquidity.

Ukraine's forward market lacks standardisation, transparency, and central counterparty clearing. The DAM and IDM segments remain highly concentrated and subject to administrative price regulation. Balancing market operations demonstrates technical compliance but suffers from narrow participation, rigid price caps, and accumulating financial imbalances. Non-frequency ancillary services are procured administratively, reflecting both technical and institutional constraints, while capacity mechanisms remain absent, though not yet required under the binding acquis.

Overall, Ukraine's product and temporal market architecture is structurally established but functionally incomplete. The transition from formal design to operational convergence with the EU internal electricity market will depend on addressing structural competition barriers, regulatory distortions, and market confidence issues across all trading layers.

4.2.2 State of Competition in Ukraine's Wholesale Segment

While the previous section analysed the formal product and temporal architecture of Ukraine's wholesale electricity market, the existence of organised trading platforms alone does not ensure effective competition. Market concentration, structural incumbency, and barriers to entry remain critical determinants of market functioning and price formation.

This section explores the competitive structure of Ukraine's wholesale market, focusing on three key elements: ***market concentration, market power, and barriers to entry***. The analysis captures market conditions existing in 2021, i.e. before structural shifts driven by the full-scale Russian invasion.

4.2.2.1 Market Concentration

Despite the structural reforms introduced by EML in 2017, Ukraine's wholesale segment remains highly concentrated, with 89% of total electricity production distributed among five generating companies. The state-owned *Energoatom*, which operates Ukraine's entire nuclear fleet, remains the largest single producer, contributing approximately *52%* of total generation. Given nuclear's baseload role and its obligations under the PSO regime, *Energoatom's* dominant share influences overall market volumes, but its price-setting role in marginal segments remains limited.

By contrast, the concentration in marginal price-setting segments is even more pronounced. The privately-owned DTEK Group held a near-monopoly position in domestic coal-fired generation with approximately 80% of Ukraine's coal capacity and around 18% of total generation volumes. DTEK further consolidates its portfolio dominance through significant ownership of renewables (wind and solar).[194]

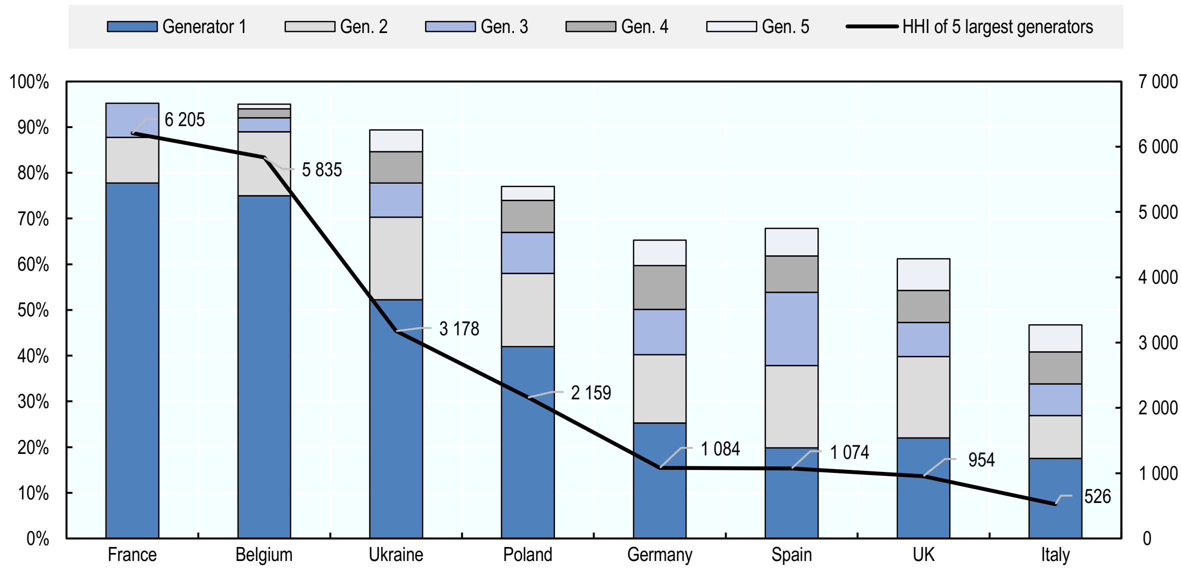
The extent of Ukraine's generation concentration is highlighted by international comparisons. As illustrated in *Figure 15*, Ukraine's five largest generators exhibit a combined market share

---

[194] Svitlana Chekunova, '*Improving the Wholesale Electricity Market Model in Ukraine*' (Razumkov Centre, 04 August 2021) <https://razumkov.org.ua/en/articles/improving-the-wholesale-electricity-market-model-in-ukraine> accessed 11 May 2025.

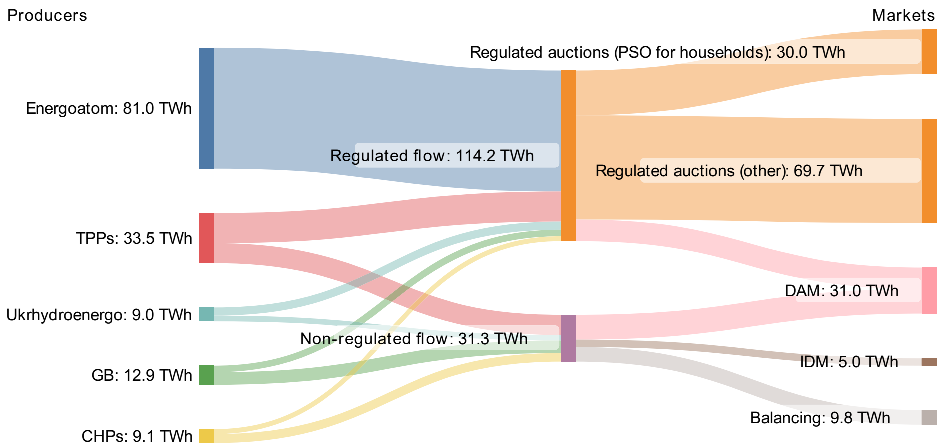
comparable to highly concentrated markets, such as France and Belgium, with an HHI of 3,178, substantially above the typical EU competition thresholds. In contrast, liberalised EU Member States such as Germany, Spain, and Italy operate with significantly lower concentration levels, reflected in HHI values well below 1,500.

Figure 15. Concentration and HHI of the five largest generators, 2021[195]



This highly concentrated ownership structure directly translates into equally concentrated trading outcomes across wholesale segments. On the bilateral (forward) market, where the majority of volumes are traded, concentration is reinforced by regulated allocations, including PSO, grid loss compensations, and public procurement obligations.

Figure 16. Allocation of electricity volumes across producers and market segments[196]



As shown in *Figure 16* above, more than 70% output of *Energoatom* and *Ukrhydroenergo* (another state-owned company controlling hydro generation assets) was distributed via

[195] OECD (n 176) 75.

[196] Ibid. 76.

regulated mechanisms, leaving only limited volumes available for competitive trading. In total, approximately 80% of total electricity production was allocated through regulated flows, including PSO, transmission losses compensation mechanisms, and regulated bilateral agreements with *Garpok* and other state entities. Thus, the regulated allocations cover nearly the entire forward (bilateral) segment and a significant portion of DAM volumes. These regulatory obligations assign designated producers to supply designated market segments under predefined terms. Consequently, producers' shares across different trading layers are effectively fixed in advance, leaving limited room for competitive volume reallocation driven by market forces.

In sum, Ukraine's wholesale generation sector remains structurally dominated by a small group of state-owned and vertically integrated private incumbents. Unlike in most EU Member States, where competitive entry, active trader participation, and decentralized generation portfolios provide meaningful competition, Ukraine's wholesale market continues to exhibit structural dominance that severely constrains competitive price formation across all segments.

4.2.2.2 Market Power

High concentration in generation capacity alone does not automatically translate into the exercise of market power, particularly in electricity markets where dispatch depends on real-time system conditions and merit-order dynamics. Market power assessments, therefore, require dynamic metrics that reflect dispatch patterns, bidding behaviour, and the physical flexibility of competing suppliers.[197] The OECD assessment applies both the *Pivotal Supplier Index* (PSI) and the *Residual Supply Index* (*RSI*) to evaluate market power in Ukraine's DAM. These indicators consider whether a supplier is "*pivotal*", that is, *indispensable to meeting demand at any given time interval*.[198]

In Ukraine's DAM, *Energoatom* is technically pivotal most of the time due to its baseload nuclear capacity and significant volumes allocated through PSO. However, since its nuclear output is largely inflexible and administratively priced under the PSO schemes, its impact on marginal price-setting remains limited.

By contrast, DTEK's coal-fired generation constitutes the key marginal supplier with material market power potential.[199] DTEK's coal units are frequently dispatched in the upper segments

---

[197] Severin Borenstein, James Bushnell and Christopher R Knittel, '*Market Power in Electricity Markets: Beyond Concentration Measures*' (1999) 20(4) Energy Journal 65-88 <https://www.jstor.org/stable/41326187> accessed 1 July 2025.

[198] Dmitri Perekhodtsev et al., *The Model of Pivotal Oligopoly Applied to Electricity Markets* (CEIC Working Paper 02-06, September 2002) <https://www.researchgate.net/publication/228795969_The_model_of_pivotal_oligopoly_applied_to_electricity_markets> accessed 20 June 2025.

[199] OECD (n 176) 82-83.

of the merit-order curve and are often the price-setting technology during peak load periods. The RSI analysis demonstrates that DTEK was pivotal during 47% of peak hours assessed in the OECD study, particularly during high-demand winter periods. This structural positioning allows DTEK to potentially influence price outcomes even when overall concentration indicators appear moderate on a purely static basis.[200]

Overall, Ukraine's DAM is particularly vulnerable to market power exploitation during scarcity periods, when hydropower and renewables are insufficient to displace marginal coal units, and supply competition in flexible capacity becomes limited. The absence of independent flexible generation, storage resources, or demand-side participants further reinforces the pricing power of existing dominant incumbents.

4.2.2.3 Barriers to Entry

Beyond the structural concentration in the generation, Ukraine's wholesale electricity market remains characterised by significant barriers to entry, both *structural* and *regulatory*. ***Structural barriers*** arise from the composition of the generation fleet itself. Large-scale nuclear, hydro, and domestic coal resources, which dominated Ukraine's pre-war generation mix, are inherently non-replicable and remain fully or largely controlled by state-owned or vertically integrated incumbent actors. In the nuclear sector, *Energoatom's* exclusive control over Ukraine's entire nuclear fleet, accounting for 52% of total generation, is an absolute barrier to entry. New nuclear development is limited to state-controlled investment decisions, with no realistic prospect for independent entry due to regulatory monopoly, strategic state control, and the scale and capital intensity of nuclear projects. International financing constraints tied to nuclear safety and geopolitical risks further restrict new baseload development outside the state-owned framework.

On the ***regulatory*** side, several additional barriers limit contestability and investment incentives. Persistent administrative price caps across DAM, IDM, and BM segments suppress market returns and profitability of flexible generation, storage, or demand-response solutions that depend on volatility-driven price signals. Investor confidence has also been undermined by historical policy instability, particularly in the renewables sector, where payment arrears have led to legal disputes and deterred further private investment.[201]

In practice, capacity expansion has remained concentrated among a few large actors, with little entry of smaller or independent flexible generation providers. This is in stark contrast to the EU

[200] Ibid.

[201] Ibid. 94-96.

internal electricity market, where decentralized, small-scale generation, storage, aggregators, and active traders have become increasingly common in competitive wholesale markets. Thus, despite the legal framework permitting third-party participation, unfavourable investment conditions and high market risks still discourage new entrants, allowing incumbent players to maintain their dominant position.

4.2.3 Regulatory Interventions in Ukraine's Wholesale Market

In the case of significant concentration and dominance in a market, regulatory oversight becomes essential to prevent potential abuse of market power. In electricity markets, such oversight often takes the form of transitional regulatory measures designed to manage risks during the initial stages of liberalisation. However, in the case of Ukraine, such interventions have evolved into permanent and deeply embedded mechanisms that constrain competitive market functioning and delay effective market maturation.

While Ukraine's wholesale market formally replicates the product and temporal architecture of the EU electricity market, its operation remains heavily shaped by state interventions. In contrast to EU practice, where interventions are increasingly targeted, temporary, and governed under strict state aid disciplines, Ukraine retains broader, more persistent measures. These interventions affect market functioning in different ways, encompassing distortionary price regulation through administrative *price caps*, the allocation of significant generation volumes outside competitive markets via *PSO*, and, more positively, the progressive implementation of *market transparency and monitoring mechanisms*, particularly through the adoption of the REMIT framework as part of Ukraine's alignment with EU market governance standards.

4.2.3.1 Price Caps

Since liberalisation in 2019, administrative price caps, originally introduced as a temporary safeguard against volatility and market abuse, have become a persistent feature shaping price formation across all segments of Ukraine's wholesale market. Unlike the EU framework, where technical bidding limits are harmonized, automatically adjusted, and set at levels that permit full scarcity pricing, Ukraine's price caps have been applied directly to suppress price levels across virtually all trading hours.

The OECD analysis confirms that maximum price limits have significantly distorted price formation in Ukraine's wholesale market, especially during peak hours, thereby limiting the ability of prices to accurately reflect true supply and demand conditions. Thus, between August 2021 and January 2022, day-ahead prices reached the price cap in approximately 35% of peak hours.[202] By compressing market prices near regulatory ceilings, price caps undermined the functioning of marginal pricing, discouraged demand response, suppressed incentives for flexible generation, storage, and peak capacity investments, and distorted bidding behaviour across multiple market segments.[203]

Beyond the wholesale level, price caps also affected the retail market. Since suppliers purchased electricity in capped markets, their procurement prices were detached from true cost conditions, which complicated retail price reform and discouraged the emergence of innovative tariff products. These caps also contributed to the accumulation of cross-debts, which reached UAH 54.5 billion by the end of 2021, burdening all market participants across the value chain.[204]

Until 2022, the methodology for calculating these price caps was not formally disclosed, and the caps appeared to be loosely based on estimated coal-fired generation costs, with minimal consideration of broader marginal cost dynamics. As gas prices increased in late 2020 and 2021, marginal costs for gas-fired generation often exceeded the applicable peak price caps, making many gas-fired CHP and dual-fuel plants uneconomical. Although NEURC introduced *ad hoc* financial support schemes through ancillary services procurement to partially compensate affected generators, this created further distortions and disincentives for market entry.[205]

In October 2022, NEURC adopted a *Methodology for Calculating Maximum Price Caps,*[206] introducing a rule-based approach whereby price caps are updated using rolling averages of observed market prices and predefined adjustment parameters intended to limit excessive price volatility. However, despite this procedural improvement, price caps have remained a permanent instrument applied across all short-term market segments, preventing marginal prices from fully reflecting scarcity or delivering investment signals aligned with EU principles.

In addition, price caps distort bidding behaviour by serving as focal points for tacit collusion. As noted by the OECD, generators often cluster bids just below the cap, anticipating that others will do the same, resulting in implicit price coordination even without explicit collusion.[207]

[202] Ibid. 86.

[203] Chekunova (n 200).

[204] Ibid.

[205] OECD (n 176) 87-88.

[206] Постанова НКРЕКП № 1221 від 27 вересня 2022 року *«Про затвердження Методики визначення істотного коливання цін та встановлення граничних цін на ринку на добу наперед, внутрішньодобовому ринку та балансуючому ринку»* (NEURC Resolution No 1221 of 27 September 2022 *on Approval of the Methodology for Determining Significant Price Fluctuations and Setting Price Caps on the Day-Ahead, Intraday and Balancing Markets*) <https://zakon.rada.gov.ua/rada/show/v1221874-22#Text> accessed 21 June 2025.

[207] OECD (n 176) 88-89.

The absence of scarcity pricing also contributes to the so-called "*missing money*" problem: generators are unable to recover sufficient revenues during scarcity periods to support capital investment in flexible resources. In liberalized EU markets, temporary scarcity prices enable generators to recover capital costs during periods of tight supply, thereby supporting long-term system adequacy, while in Ukraine this mechanism is effectively blocked due to price caps, preventing deployment of peaking capacity, demand response, and storage.[208]

Thus, Ukraine's continued use of rigid administrative price caps represents a significant divergence from EU design principles. While EU regulations[209] permit technical bidding limits for operational security, these are harmonized, automatically adjustable, and explicitly designed to avoid unnecessary restrictions on market price formation. By contrast, Ukraine's approach effectively prevents the market from performing its economic functions.

4.2.3.2 Public Service Obligations (PSO)

PSOs have long served as a core mechanism for maintaining cross-subsidization in Ukraine's electricity sector. The underlying policy of shielding household consumers from full cost-reflective prices originated well before liberalization, having been embedded in earlier administrative models, including the single-buyer regime that operated prior to 2019. While the formal introduction of PSO within the 2019 liberalization reform aimed to integrate these objectives into a market-based framework, in practice, the PSO system continues to pre-allocate large volumes of electricity outside competitive trading platforms, severely limiting the functioning of the voluntary market and efficient price formation (*see Figure 16 above*).

Since 2021, Ukraine's PSO framework for **household** consumers has operated as a hybrid model combining physical and financial elements. State-owned *Energoatom* and *Ukrhydroenergo* are obliged to sell substantial portions of their generation directly to USSs at regulated prices, ensuring electricity supply to protected consumers at below-market tariffs. Concurrently, these producers make financial contributions to Garpok, which compensates USSs for the gap between market wholesale prices and regulated end-user prices. This dual mechanism spreads the financial burden of low household pricing across both state-owned producers, effectively bypassing competitive market pricing.[210]

The financial impact of these PSO mechanisms has been severe across the electricity value chain. For household supply alone, *Energoatom's* PSO-related financial transfers reached UAH

[208] Ibid.

[209] Electricity Regulation, arts 10, 11.

[210] Ibid. 62-63.

145.4 billion in 2024, with a projected annual obligation of UAH 161.9 billion for 2025.[211] Meanwhile, significant payment gaps emerged for USSs, who often struggled to recover sufficient revenues to cover procurement costs.

In addition to PSO for households, Ukraine operates a separate PSO mechanism to support ***renewable energy generation*** (RES) under feed-in tariff (FiT) contracts. Under this scheme, *Garpok* purchases electricity from RES producers at administratively set FiT levels and covers related imbalance costs. The significant gap between high FiT payments and average wholesale market prices generates chronic financial deficits within Garpok. Although EML envisages that these costs be compensated through *Ukrenergo's* transmission tariff, in practice, NEURC has consistently approved the transmission tariffs at levels insufficient to fully recover the accumulating RES PSO obligations, seeking to avoid imposing additional financial burdens on final consumers. As a result, Garpok's financial shortfalls have translated into growing debts towards RES producers and *Ukrenergo*, which has repeatedly been forced to finance these deficits through state-backed borrowing instruments. As of April 2025, Ukrenergo's debt linked to RES PSO obligations accounted for over UAH 16 billion.[212]

The OECD highlights that Ukraine's PSO design diverges significantly from the EU's. While EU Member States may impose PSO for social objectives, such measures must be transparent, targeted, limited in duration, and carefully designed to minimise distortions to market functioning. Ukraine's PSO system, by contrast, remains permanent, deeply embedded, structurally distorting price formation, limiting liquidity, weakening investment signals, and perpetuating extensive cross-subsidisation between consumer groups.[213] These arrangements "*preserve cross-subsidisation and prevent real competition by shielding consumers from price signals while deterring supplier entry*."[214]

4.2.3.3 Market Transparency and Monitoring

In contrast to price regulation and PSO, the development of market transparency and monitoring frameworks in Ukraine represents a positive aspect of its alignment with EU governance standards. The gradual implementation of REMIT was crucial for improving market oversight, increasing transparency, and preventing abusive market practices.

---

[211] Energoatom, *Energoatom Fully Fulfils its PSO Obligations* (Press Statement, 14 May 2025) <https://energoatom.com.ua/news/energoatom-na-100-vikonuje-svoyi-zoboviazannia-v-mezax-pso> accessed 22 June 2025.

[212] Ivan Boiko, '*Ukrenergo Plans to Reduce Green Energy Debt*' (UNIAN, 13 June 2025) <https://www.unian.ua/economics/energetics/ukrenergo-planuye-zmenshuvati-borgi-za-zelenu-energiyu-13037517.html> accessed 22 June 2025.

[213] OECD (n 176) 62.

[214] Салашенко (Salashenko) (n 55) 245-246.

Ukraine, however, substantially delayed its REMIT implementation obligations, completing primary legislative transposition only by mid-2023.[215] NEURC adopted secondary legislation and began registering wholesale energy market participants in October 2023. However, Ukraine currently operates under a simplified *REMIT Light* framework adopted by the EnC Ministerial Council. Compared to the full EU REMIT regime, *REMIT Light* does not include centralised data collection via ACER, omits reporting obligations for market participants, and lacks coordination mechanisms for cross-border investigations.[216]

The OECD notes that NEURC progressively developed its monitoring capacity by adopting procedures for market data collection, defining reporting forms, and publishing quarterly and annual monitoring reports before the war. Nevertheless, several weaknesses persist. Calculation methodologies for key competition indicators, including HHI, PSI, and RSI, have not been publicly disclosed. Additionally, real-time surveillance is still limited, as NEURC relies heavily on operational data provided *ex pos*t by the *Market Operator, Ukrenergo*, and the *UEEX*.[217]

Public data disclosure remains incomplete. Unlike the EU's ENTSO-E Transparency Platform, Ukraine does not yet provide public access to aggregated bid curves, transaction-level data, or detailed market participant positions. This limits the ability to assess market dynamics or detect potential manipulation. Although NEURC and MO publish certain aggregated data, Ukraine still lacks the comprehensive transparency standards seen in the EU.[218]

Nevertheless, the gradual implementation of REMIT-based monitoring and transparency mechanisms marks an important step toward greater legal and institutional alignment with EU electricity market governance. Enhancing transparency remains essential for supporting competitive price formation, preventing market abuse, and building trust among stakeholders as Ukraine moves closer to integration with the EU's internal energy market.

To conclude, regulatory interventions continue to play a significant role in shaping the functioning of Ukraine's wholesale electricity market. While administrative price caps and extensive PSO have prevented the emergence of competitive price formation and market-based investment signals, they remain embedded as structural instruments rather than transitional safeguards. These interventions maintain broad cross-subsidisation, reduce market liquidity,

[215] Закон України *«Про внесення змін до деяких законів України щодо запобігання зловживанням на оптових енергетичних ринках»* від 10 червня 2023 № 3141-IX [2023] Голос України 14 (Law of Ukraine "*On Amendments to Certain Laws of Ukraine for the Prevention of Abuse in Wholesale Energy Markets"* dated 10 June 2023 No 3141-IX [2023] the Voice of Ukraine 14) <https://zakon.rada.gov.ua/laws/show/3141-20#Public> accessed 22 June 2025.

[216] Natalia Hutarevych, '*Implementation of REMIT into Ukrainian Legislation'* (2021) 11-12 Ukrainian Journal of Business Law <http://www.ujbl.info/article.php?id=1532> accessed 22 June 2025.

[217] OECD (n 176) 112-113.

[218] Ibid.

and distort price signals across wholesale and retail segments – outcomes that diverge from core principles of the EU internal market. At the same time, the gradual development of REMIT-based transparency and monitoring frameworks demonstrates Ukraine's growing institutional alignment with EU market governance standards. Achieving further convergence will require not only the continued strengthening of transparency and market surveillance capacities but also a progressive withdrawal from distortionary interventions, allowing competitive market forces to play their full role in price setting, investment allocation, and system adequacy.

4.2.4 Spatial Integration into the EU Internal Electricity Market

The preceding analysis shows that while Ukraine's wholesale electricity market formally replicates key elements of the EU's product and temporal market architecture, it continues to operate under structural distortions that limit its ability to function as a fully competitive and efficient market environment. However, beyond the design of electricity market segments, the ultimate objective of Ukraine's electricity sector reform under the EnC framework is full spatial integration into the EU internal electricity market. Market liberalisation is not an end in itself but a means to enable Ukraine's technical, procedural, and institutional participation in cross-border electricity trading, system coordination, and shared balancing resources within the European energy system.

The emergency synchronisation of Ukraine's electricity system with ENTSO-E in March 2022 represented a historic milestone in its physical integration.[219] However, technical synchronisation alone does not establish market-based integration. For a long time, Ukraine remained legally and institutionally disconnected from EU mechanisms for market coupling, coordinated capacity allocation, and regional balancing cooperation.[220] This structural gap left Ukraine's wholesale market effectively peripheral to the EU's internal electricity market despite growing technical cooperation with neighbouring TSOs.

The adoption of the revised EIP in December 2022[221] fundamentally redefined Ukraine's integration agenda. Ukraine became legally obliged to transpose and implement instruments governing cross-border integration, including *CACM Regulation, FCA Regulation, and EBGL*. Full participation in *Single Day-Ahead Coupling* (SDAC), *Single Intraday Coupling* (SIDC), and the regional balancing platforms now requires Ukraine to complete complex procedural

---

[219] ENTSO-E, *'Continental Europe Successful Synchronisation with Ukraine and Moldova Power Systems'* (16 March 2022) <https://www.entsoe.eu/news/2022/03/16/continental-europe-successful-synchronisation-with-ukraine-and-moldova-power-systems/> accessed 22 June 2025.

[220] EnC Secretariat, *Annual Implementation Report 2023: Ukraine* (n 62) 3.

[221] Ministerial Council Decision 2022/03/MC-EnC (n 64).

steps, including the designation of a NEMO for market coupling, coordination of regional capacity calculations, and alignment of national balancing rules with EU standards.

While technical preparations have advanced, including the expansion of cross-border transmission capacities, joint capacity allocation pilots, and emerging cooperation within the *Eastern Europe Capacity Calculation Region* (EE CCR), these developments remain preliminary. Ukraine currently conducts daily and monthly capacity allocations with Moldova, Romania, Slovakia, Hungary, and Poland, including participation in JAO processes for certain borders.[222] However, these bilateral or transitional arrangements have yet to evolve into systematic, fully integrated participation in EU-wide market coupling. As of November 2024, Ukraine's spatial integration remains limited, with the EnC Secretariat assessing progress at only ***14%***.[223] This latest assessment confirms that transposition of most of the EU's spatial *acquis* remains pending, with the legislative efforts[224] being delayed.

In conclusion, Ukraine's wholesale electricity market reform faces a dual challenge that reflects the integrated logic of the EU internal market model. On one hand, ***eliminating persistent structural distortions*** – including concentration, limited liquidity, extensive regulatory interventions, and suppressed price signals – remains essential to ensure that Ukraine's electricity market design operates on genuinely competitive, market-based principles. On the other hand, the transposition and ***full implementation of the spatial integration acquis*** is necessary to enable Ukraine's full participation in the EU internal electricity market. These two reform tracks are fundamentally interdependent: establishing a functional and competitive wholesale market is a prerequisite for meaningful cross-border integration, while progress in coupling Ukraine's market with neighbouring systems further strengthens domestic investment signals and competitive pressures. OECD rightly observes that advancing spatial integration offers Ukraine not only new commercial opportunities but also a powerful incentive for accelerating necessary internal market reforms.[225] Successful implementation of the revised EIP will thus determine whether Ukraine transitions from a synchronised but peripheral system into a fully embedded participant in the EU's internal electricity market framework.

[222] EnC Secretariat, *Annual Implementation Report 2023: Ukraine* (n 62) 4.

[223] Ibid.

[224] Проєкт Закону України "Про внесення змін до законів України щодо об'єднання ринків електричної енергії України та Європейського Союзу", реєстр. № 12087, зареєстровано 2 жовтня 2024 року (*Draft Law of Ukraine on Amendments to the Laws of Ukraine on the Integration of Electricity Markets of Ukraine and the European Union*, Reg No 12087, registered 2 October 2024) <https://itd.rada.gov.ua/billInfo/Bills/Card/44974> assessed 15 May 2025.

[225] OECD (n 176) 124-126.

4.3 Ukraine's Retail Electricity Market

4.3.1 Retail Market Segmentation

While Ukraine's electricity market liberalisation has advanced in formal design, significant structural challenges remain equally evident in the retail electricity market. Formally, all end-consumers have the legal right to choose electricity suppliers under the 2019 market reform. In practice, however, the retail market is segmented into distinct categories with widely distinct degrees of competition and price regulation. ***Business consumers*** – especially medium and large non-household users – participate in a partially liberalised competitive segment where supply is based on freely negotiated prices. By contrast, the ***household*** segment remains fully price-regulated under an extensive PSO regime, preventing the emergence of effective competition and preserving structural cross-subsidisation. This segmentation has created a dual-track retail market structure where competition is viable in certain industrial customer groups but remains absent for most smaller consumers and households. Therefore, the design and functioning of Ukraine's retail market diverge from EU principles, where market-based pricing is combined with targeted social support for vulnerable consumers.

The ***household segment*** remains fully regulated under PSO mechanisms. The designated USSs are obligated to supply households and certain protected groups at fixed, regulated retail tariffs. One USS is designated for each administrative region, typically selected from legacy incumbent utilities. The USSs function as the retail-level instrument of the PSO mechanism (as explored above in this chapter) is to ensure that electricity is provided to eligible consumers at administratively set prices that remain detached from price fluctuations in the wholesale market layer. Competitive supply is effectively absent in this segment, while regulated pricing prevents meaningful supplier entry or consumer switching.

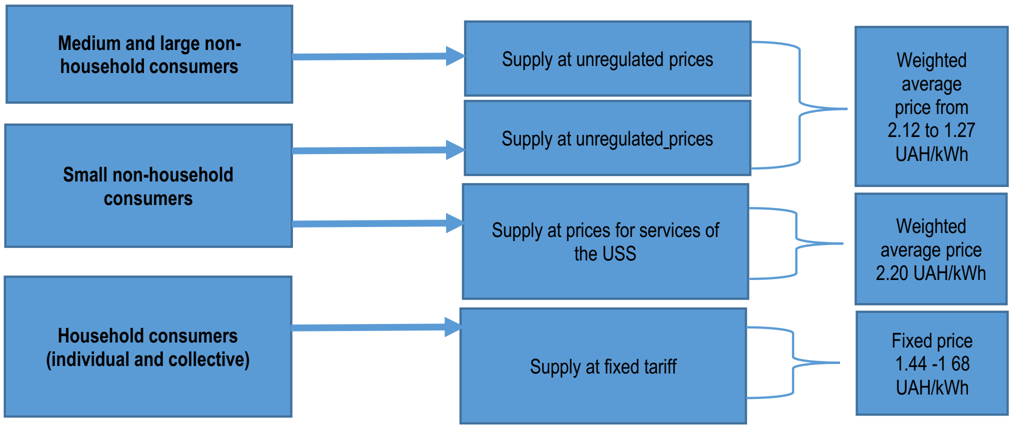
Non-household consumers are segmented based on contracted capacity. *Small non-household customers* (below 50 kW) remain eligible for regulated supply by USSs, while *medium and large non-household consumers* (above 50 kW) participate in the competitive segment, purchasing electricity at freely negotiated market prices. According to NEURC data[226], supplies in the competitive segment accounted for approximately 62% of total retail electricity supply in 2022, while the regulated segment accounted for the remaining 38% of total consumption. This indicates that while formal market liberalisation exists across all customer classes, a significant share of total retail supply remains subject to regulated pricing mechanisms.

---

[226] NEURC, *Brochure to the 2022 Annual Report* (June, 2023) 10 <https://www.nerc.gov.ua/storage/app/sites/1/Docs/Byuleten_do_richnogo_zvitu/broshura_do_richnogo_zvitu_nkrekp-2022.pdf> accessed 22 June 2025.

The segmented structure of Ukraine's retail market (see *Figure 17* below) highlights the distinct regulatory and competitive conditions applied to each customer group, along with indicative average retail price levels in 2021.

Figure 17. Consumer Groups in Ukraine's Retail Electricity Market (2021)[227]



Entry conditions for suppliers are administratively straightforward: licensing requirements are formalised, and as of 2022, 1072 suppliers were licensed by NEURC. However, the actual number of active market participants remains substantially lower, with market activity heavily concentrated among USSs, who continue to dominate both the regulated household segment and a significant portion of small business supply.[228]

The main justification for maintaining a regulated household price in Ukraine has been affordability. In contrast to the EU framework, which permits such interventions only temporarily and exclusively for vulnerable or energy-poor consumers, Ukraine's regulated tariffs have applied to all households, irrespective of income or consumption level, resulting in broad cross-subsidisation. OECD data show that Ukrainian households spent an average of 2.67% of total household expenditures on electricity, which is lower than the EU average of 4.3% and far below levels seen in some Member States (e.g., Slovakia with 9.2%).[229] These figures suggest that Ukraine's universal price regulation, in contrast to the EU, is poorly targeted, disproportionately benefiting higher-income households with greater consumption.[230]

In June 2024, the government increased regulated household tariffs by 60% (from UAH 2.64/kWh to UAH 4.32/kWh)[231] to address the growing financial pressures from infrastructure

[227] OECD (n 176) 102.

[228] NEURC, *Brochure to the 2022 Annual Report* (n 231) 10.

[229] OECD (n 176) 107.

[230] Ibid. 108.

[231] Ігор Орел, 'Уряд підвищив тариф на електрику для населення з 1 червня на 64%' (Форбс Україна, 31 травня 2024) (Igor Orel, '*Government Raises Household Electricity Tariff by 64 % from 1 June*' (Forbes Ukraine, 31 May

damage and rising fiscal demands. Despite this substantial increase, the structure of the price regulation remains unchanged, with the tariffs continuing to apply universally to all households, regardless of income or consumption levels. This approach remains inconsistent with the EU model under the Electricity Directive, which permits retail price interventions only as temporary and narrowly targeted measures for vulnerable or energy-poor consumers.

In summary, despite formal legal liberalisation, Ukraine's retail electricity market remains functionally segmented and structurally more regulated than those of most EU Member States. While the EU approach has gradually shifted toward targeted, income-based price protections and widespread supplier competition, Ukraine continues to maintain broadly regulated tariffs that apply universally to households and small businesses. This model diverges substantially from EU best practices, as it restricts retail price interventions to temporary and narrowly defined measures. As a result, meaningful consumer choice and supplier competition remain largely absent in significant portions of Ukraine's retail market.

4.3.2 Market Competition and Switching Behavior

As explored in previous sections of this chapter, the market structure of the retail segment remains concentrated, with USSs continuing to dominate both the regulated household segment and a significant share of the small business segment. While over 1,000 suppliers are formally licensed by NEURC, only about 30% remain commercially active.[232] In the households sector, USSs supply virtually all consumers at administratively fixed prices, and supplier switching is practically nonexistent. Small non-household customers, although formally able to switch, also show limited switching behavior due to continued eligibility for regulated tariffs.

The persistence of universal price regulation for households distorts supplier incentives. The inability of suppliers to offer competitive prices to households undermines supplier entry, limits product differentiation, and prevents the emergence of innovative tariff structures or value-added services that are increasingly characteristic of competitive EU retail markets.

In the medium and large ***non-household segment*** (above 50 kW), where supply is based on freely negotiated contracts, supplier switching is more active. The OECD reports a switching rate of approximately 16% for non-household consumers in 2021, reflecting moderate supplier competition among industrial and large commercial customers. The supplier structure in the competitive segment is dominated by *DTEK Group*, holding a 33% market share, with the rest divided among numerous smaller suppliers. This combination of a dominant player and

---

2024)) <https://forbes.ua/news/uryad-pidnyav-tarif-na-elektriku-dlya-naselennya-z-1-chervnya-na-60-31052024-21502> accessed 23 June 2025.

[232] NEURC, *Brochure to the 2022 Annual Report* (n 231) 10.

fragmented competitors results in moderate overall concentration, with NEURC reporting an HHI of approximately 1,323 in 2023[233] – a level broadly comparable to non-household retail segments in many EU Member States (*see Figure 11 in section 3.3.4 above*).

Compared to EU Member States, Ukraine's retail competition reflects some similar structural features, such as supplier concentration and consumer inertia, but remains quantitatively weaker in most dimensions. Across the EU, large incumbents often dominate household markets despite formal liberalisation, and consumer inertia persists due to low price awareness and perceived complexity. According to the latest ACER-CEER Market Monitoring Report, average *household switching rates* across the EU reached 7.15% in 2023,[234] reflecting a decline during the recent energy crisis but still far above Ukraine's negligible switching in this segment.

For *non-household* customers, Ukraine's switching rate reached 16% in 2021,[235] slightly exceeding the EU average of 13.94% in 2023[236] but still reflecting only modest supplier rivalry. While Ukraine's non-household supplier concentration (HHI 1,323) is broadly comparable to EU averages, the combination of a dominant supplier and persistent universal price regulation continues to suppress effective competition and dynamic consumer choice.

In summary, while competitive supplier choice exists for certain industrial and large commercial customers, Ukraine's retail electricity market remains structurally concentrated and functionally non-competitive for both households and businesses.

4.3.3 Summary Assessment of Ukraine's Retail Market Design

Ukraine's retail electricity market formally operates under liberalised principles, granting end-users the legal right to choose their supplier. However, in practice, the market remains heavily segmented and structurally distorted by extensive regulatory interventions. USSs fully dominate the regulated household segment, while competition in the medium and large business segment remains moderately concentrated, broadly reflecting patterns observed in EU markets.

The core structural barrier is the persistence of universal price regulation for all household consumers, regardless of income level or vulnerability. While the Electricity Directive permits limited, targeted price interventions for vulnerable or energy-poor consumers, Ukraine continues to maintain universal, regulated tariffs as a *de facto* broad affordability mechanism, where high-income households capture a substantial share of the implicit subsidies. Despite a

---

[233] NEURC, *Brochure to the 2023 Annual Report* (2024) <https://www.nerc.gov.ua/storage/app/sites/1/Docs/Byuleten_do_richnogo_zvitu/broshura_do_richnogo_zvitu_nkrekp-2023.pdf> accessed 23 June 2025.

[234] ACER and CEER, 2024 *Energy Retail Market Monitoring Report* (n 148) 50.

[235] OECD (n 176) 60-61.

[236] Ibid. 51.

significant tariff increase in June 2024, which raised household prices by 60%, Ukraine has not yet adopted income-based social protection instruments to replace general price controls.

Retail competition is *de facto* absent in the household and small business segments, where designated USSs retain absolute supplier dominance under universal price regulation. In the competitive non-household segment, supplier concentration remains moderate (HHI 1,323) and broadly comparable to the EU's, with switching rates around the EU average.

Ukraine also remains at an early stage in developing consumer flexibility mechanisms, which constitute a core element of the EU's consumer-centric vision under the *Clean Energy Package*. In the EU's market design, demand-side flexibility – activated through real-time price signals, dynamic contracts, and active prosumer participation – is increasingly recognized as an essential tool for ensuring economic efficiency, system adequacy, and mitigating market volatility.[237] Smart metering infrastructure, a key enabler of demand-side flexibility, has seen limited deployment to date even across many EU Member States. According to the 2023 ACER-CEER Market Monitoring Report, rollout rates across the EnC vary widely – from 76% in Montenegro to 4% in Serbia – with many failing to comply with functional requirements such as interoperability, real-time data access, and consumer empowerment features.[238]

In Ukraine, comprehensive public reporting on the deployment of household smart meters is lacking. The annual number of installed smart devices was first referred to in the 2023 NEURC report,[239] and the overall penetration rate, as well as their technical compliance, cannot be reliably determined. Moreover, universal price regulation eliminates any meaningful financial incentive for households and small businesses to leverage smart meter functionalities for demand-side flexibility or to participate in dynamic pricing offers.

In conclusion, Ukraine has formally adopted a liberalised legal framework for its retail electricity market. However, its continued reliance on universal price regulation, limited supplier competition, and poor design of support schemes for vulnerable consumers diverges from principles embedded in the *Clean Energy Package*. As of 2024, the EnC Secretariat assesses Ukraine's implementation of the retail *acquis* at 44%,[240] highlighting the extent of reform still required to bring Ukraine's retail market into full alignment with EU standards for competitive, consumer-centric, and flexible electricity markets.

---

[237] Commission, '*Reform of the EU Electricity Market Design*' (Staff Working Document) SWD/2023/58 final 63-64.

[238] ACER and CEER, 2024 *Energy Retail Market Monitoring Report* (n 148) 22.

[239] NEURC, *Brochure to the 2023 Annual Report* (2024) <https://www.nerc.gov.ua/storage/app/sites/1/Docs/Byuleten_do_richnogo_zvitu/broshura_do_richnogo_zvitu_nkrekp-2023.pdf> accessed 23 June 2025.

[240] EnC Secretariat, *Annual Implementation Report 2024: Ukraine* (n 65) 4.

4.4 RES Integration and Ukraine's decarbonization objectives

The integration of RES into competitive electricity markets is a core pillar of the *Clean Energy Package*, primarily governed by the RED and the Electricity Regulation. Under the revised 2022 EIP, Ukraine became legally obliged to adopt national RES targets, implement market-based supporting mechanisms, and establish transparent system for guarantees of origin (GO).

As of 2024, Ukraine has made significant progress in aligning its legal framework for renewable energy with the *Clean Energy Package acquis*. The EnC Secretariat assessed Ukraine's RES implementation score at 61%, up from 36% the year before.[241] A major step forward was the adoption of Ukraine's *National Energy and Climate Plan* (NECP) on 25 June 2024.[242] The NECP sets Ukraine's ***target of a 27% share of RES*** in gross final energy consumption by 2030, with sectoral targets of *25.4% for electricity*, *17.2% for transport*, and *35% for heating and cooling*. Although these targets remain below the EU-wide target of 32%, they mark a significant advance compared to Ukraine's previous absence of binding RES commitments.

The adoption of the *Green Transformation Law*[243] in June 2023 provides the legal foundation for transitioning from predetermined feed-in tariffs (FiTs) to market-based support through ***feed-in premium (FiP) mechanisms***. In light of the challenges faced during Ukraine's first competitive RES auction in September 2024, the OECD emphasizes that building investor confidence in the financial sustainability and predictability of auction frameworks will be crucial for the effective implementation of market-based support schemes.[244]

For smaller-scale RES deployment, Ukraine has also adopted reforms to facilitate ***self-consumption*** and ***renewable energy communities***. The *Green Transformation Law* enables a transition from FiTs to net billing for self-consumers, with FiTs remaining available for households until 2029. Regulatory provisions for renewable energy communities have been adopted with a relatively advanced implementation score of 75% in this area; however, critical secondary legislation remains pending.[245]

The development of a functioning ***GO system*** also marks progress toward RED compliance. Ukraine's electronic GO registry for electricity, heating, cooling, and renewable gases became

---

[241] Ibid. 7.

[242] Ministry of Energy of Ukraine, *National Energy and Climate Plan for the Period until 2030* (2022) <https://me.gov.ua/download/2cad4803-661e-4ae9-9748-3006d6eb3e1c/file.pdf> accessed 23 June 2025.

[243] Закон України «Про внесення змін до деяких законів України щодо відновлення та "зеленої" трансформації енергетичної системи України» від 30 червня 2023 № 3220-IX [2023] *Голос України* 18 (Law of Ukraine *"On Amendments to Certain Laws of Ukraine on the Restoration and "Green" Transformation of the Energy System of Ukraine"* dated 30 June 2023 No.3220-IX [2023] Voice of Ukraine 18) <https://zakon.rada.gov.ua/laws/show/3220-20/conv#Text> accessed 16 May 2025.

[244] OECD (n 176) 139-140.

[245] EnC Secretariat, *Annual Implementation Report 2024: Ukraine* (n 65) 7.

operational in August 2024. The next implementation steps include adopting supplier disclosure rules and calculating the residual energy mix to ensure full transparency and consumer empowerment in line with RED requirements.[246]

However, while Ukraine's RES sector already contributes a substantial share of generation capacity, effective market-based integration of renewables remains underdeveloped. The OECD highlights that the expansion of RES will require substantial reforms across the dimensions of liquidity, flexibility, balancing, and cross-border coordination.[247] Ukraine's ongoing RES market reform will also need to take into account the evolving debates within the EU on how to ensure stable and investment-friendly integration of renewables. As analyzed in Chapter III, recent EU-level debates emphasize the importance of long-term contracting instruments such as *contracts for difference* (CfDs), *power purchase agreements* (PPAs), and improved balancing market frameworks to ensure both investment security and efficient system operation as RES penetration grows.[248] These evolving elements of EU electricity market design will increasingly shape Ukraine's own reforms.

In summary, Ukraine's successful RES integration into competitive electricity markets will depend not only on completing the transition to market-based support schemes but also on addressing the broader structural challenges that remain essential for full alignment with the *Clean Energy Package*. These include improving wholesale market liquidity, strengthening balancing mechanisms, enabling consumer-side flexibility, and establishing stable long-term contracting frameworks. Embedding RES into Ukraine's market architecture thus requires not only regulatory compliance but full functional convergence with the EU's evolving policies.

4.5 Overall Summary for Ukraine's Electricity Market Design

Since the adoption of EML in 2017, Ukraine has implemented significant electricity market reforms, formally establishing core market structures in line with EU design principles under the EnC framework. Its *wholesale market* now includes all key trading segments: *bilateral contracts (forward), day-ahead, intraday, balancing,* and *ancillary services* markets. The *retail market* is legally open to supplier competition across all consumer groups, and Ukraine's grid has achieved technical synchronisation with the ENTSO-E network.

Nonetheless, despite this formal alignment, persistent structural distortions continue to undermine the development of a competitive and integrated electricity market. Both wholesale and retail segments remain shaped by *regulatory interventions* that weaken price signals,

---

[246] Ibid.

[247] OECD (n 176) 139-141.

[248] Commission, '*Reform of the EU Electricity Market Design*' (Staff Working Document) SWD/2023/58 final.

restrict competition, and discourage market entry by new suppliers. In the wholesale market, up to 80% of total electricity volumes are still allocated through administratively regulated forward and short-term markets. High concentration is persistent across all wholesale segments. In the retail market, universal price regulation continues to block effective competition in the household segment, while targeted support for vulnerable consumers has yet to replace broad cross-subsidies.

Ukraine's technical synchronisation with ENTSO-E in 2022, though being an important integration step, did not resolve the underlying legal and procedural disconnection from EU market coupling and balancing platforms. The revised 2022 EIP significantly broadened Ukraine's legal obligations to cover the 2019 *Clean Energy Package* acquis and key EU legislative instruments adopted between 2015 and 2019, including cross-border capacity allocation under CACM and FCA Regulations, balancing cooperation under EBGL, and full institutional alignment with ACER rules. In total, the revised EIP more than doubled the number of electricity-related legal acts that Ukraine is now required to transpose and implement.[249] They cover not only market design but also institutional governance, regional coordination, and consumer rights. For Ukraine, as for the other EnC Contracting Parties, this revision marked the beginning of a new phase of integration, with a substantially expanded and more demanding implementation agenda.

As of 2024, the EnC Secretariat assesses Ukraine's electricity market implementation at 46% for wholesale markets, 44% for retail markets, and only 14% for regional integration.[250] The delayed adoption of Draft Law No. 12087, which aims to transpose the remaining elements of the *Clean Energy Package*, as well as other spatial acquis, represents a major legislative bottleneck hindering progress towards market coupling.

According to the OECD, there are ***four core areas*** where structural distortions continue to impair Ukraine's market functioning:[251]

1) Market liquidity and forward market development: The dominance of regulated contracts impedes the growth of standardized forward products and price discovery. Consolidating trading volumes into standardized, competitive market platforms should reduce market fragmentation, thereby fostering liquidity and enhancing hedging opportunities.

[249] EnC Sekretariat, '*Energy Community Acquis'* (List for Electricity) <https://www.energy-community.org/enc-lex/law/acquis.html> accessed 28 April 2025.

[250] EnC Secretariat, *Annual Implementation Report 2024: Ukraine* (n 65) 3-4.

[251] OECD (n 176) 133-141.

2) Structural concentration and limited supplier rivalry: High market shares are held by state (*Energoatom, Ukrhydroenergo*) and private (*DTEK*) incumbents, reinforcing market dominance, especially in wholesale and competitive retail segments. Strengthening market surveillance and enhancing monitoring of potential abuses of market power are identified as key priorities to safeguard competition as market reforms progress.
3) Persistent price regulation and inefficient PSO: The continued use of universal price caps and non-targeted PSO undermines competition, distorts price signals, and impedes supplier entry, especially in the household segment. Replacing universal pricing mechanisms with income-based, targeted social protection instruments should improve market functioning.
4) Limited progress on consumer flexibility and demand-side integration: The absence of dynamic pricing frameworks, poor smart metering deployment, and a lack of regulatory incentives for prosumer participation hinder Ukraine's ability to develop consumer flexibility to improve system balancing, particularly as variable RES penetration grows.

In this context, the comprehensive implementation of the *Clean Energy Package* and full transposition of pending legislative instruments will be essential not only for improving Ukraine's electricity market functioning but also for enabling its full integration into the EU market architecture. This reform trajectory is also increasingly supported by Ukraine's broader fiscal and institutional commitments under its post-war recovery framework. The IMF confirms that Ukraine's recovery strategy includes, among others, a phased liberalisation of energy tariffs, restoration of effective competition in electricity markets, and strengthening of regulatory governance – all coordinated with the European Commission. [252] Reflecting this alignment, the Commission has reaffirmed its commitment to support full integration of Ukraine and Moldova into the EU internal electricity market by early 2027, contingent on continued progress in price reform, market coupling, and institutional readiness.[253]

[252] IMF, *Ukraine: Fifth Review Under the Extended Arrangement Under the Extended Fund Facility, Requests for Waivers of Applicability of Performance Criteria, Modification of Performance Criterion, Rephasing of Access, and Financing Assurances Review – Press Release; Staff Report; and Statement by the Executive Director for Ukraine* (IMF Country Report No 2024/314, 2024) <https://doi.org/10.5089/9798400290534.002> accessed 1 July 2025.

[253] Commission, DG ENEST, '*Commission steps up support for Ukraine's energy security and paves the way for full market integration*' (24 February 2025) <https://enlargement.ec.europa.eu/news/commission-steps-support-ukraines-energy-security-and-paves-way-full-market-integration-2025-02-24_en> accessed 16 May 2025.

Chapter V. CONCLUSION

5.1 Research Scope and Limitations

This thesis has undertaken a comprehensive comparative analysis of electricity market design in the European Union and Ukraine. The research addressed both segments of the electricity market: the *wholesale* (with its product, temporal, and spatial architecture) and the *retail* (encompassing competition, pricing models, and consumer protection). The study reviewed the EU's gradual market liberalization, ending with the *Clean Energy Package* and the 2024 reform, and compared it to Ukraine's slower and incomplete reform path. In doing so, the research identified both formal convergence and persistent gaps in operational functioning, institutional maturity, and market performance.

The analysis also assessed the effectiveness of core market mechanisms, including marginal pricing, market coupling, and supplier competition. It also evaluates how market concentration, limited liquidity, and regulatory measures impact market performance. It compares Ukraine's progress with the EU model to identify integration outcomes and remaining reform needs.

While prioritizing the assessment of multilayered dimensions and their interactions, the study provides a broader perspective that is often missing in more narrowly focused research, instead diffusing sector-specific details. This approach also opens more opportunities for future research, especially those that are novel for market design (e.g., prosumers, electricity sharing schemes, and citizen energy communities), which are likely to redefine both market dynamics and system flexibility in the coming decade.

Extreme regulatory dynamics impose additional limitations. The research was conducted during the 2022 energy crisis and intense political turbulence, followed by major regulatory changes introduced by the 2024 Electricity Market Reform, making this study particularly time-sensitive.

The Ukrainian regulatory landscape is also in constant change. Notably, a revised draft of the Electricity Market Law (Draft Law No. 12087-д[254]), which aims to transpose the *Clean Energy Package acquis* into Ukraine's legislative framework, was released for public discussion just as this thesis was being finalized. This highlights that Ukraine's market framework is also evolving rapidly and may soon diverge significantly from the state described in this thesis.

[254] Проєкт Закону України "*Про внесення змін до деяких законів України щодо імплементації норм європейського права з інтеграції енергетичних ринків, підвищення безпеки постачання та конкурентоспроможності у сфері енергетики*", реєстр. №12087-д, зареєстровано 27 червня 2025 року (Draft Law of Ukraine *"On Amendments to Certain Laws of Ukraine to Implement European Law Norms on Energy Market Integration, Improve Security of Supply and Competitiveness in the Energy Sector"*, Reg No 12087-d, registered 27 June 2025) <https://itd.rada.gov.ua/billInfo/Bills/Card/56682> accessed 30 June 2025.

5.2 Addressing Research Questions: EU Resilience and Ukraine's Reform Challenges

This thesis set out to address two core questions: (i) whether the EU internal electricity market design is sufficiently resilient and fit for purpose amid recent crises; and (ii) how Ukraine's market design compares to the EU model, identifying key areas of convergence and divergence, as well as reforms needed for deeper integration.

<u>EU Model as a Resilient Benchmark</u>

Prior to 2021, the EU electricity market design was widely regarded as an example of successful liberalization and market coupling, delivering significant welfare gains, improving the security of supply, and fostering decarbonization by prioritizing low-marginal-cost renewables in dispatch. However, the 2021-2022 energy crisis, triggered by surging natural gas prices and Russia's full-scale invasion of Ukraine, exposed structural weaknesses in the EU electricity market design and brought several of its shortcomings to light:

- *Low liquidity in the forward market*: Longer-term hedging volumes were insufficient to mitigate severe wholesale price spikes, resulting in widespread supplier exits and overwhelming pressure on SoLR arrangements.
- *Retail vulnerability*: Despite formal liberalisation, many EU retail markets remain highly concentrated, with a low switching rate and significant reliance on regulated tariffs. This limited consumers' responses to wholesale price signals during the crisis.
- *Market flexibility gaps*: The market design had not fully integrated demand-side flexibility and storage, thereby limiting adaptability during periods of high renewable variability and stress.

At the same time, the above shortcomings do not invalidate the EU model; rather, they illustrate that a market-based architecture requires complementary safeguards to remain effective under extreme conditions. To address these challenges, the 2024 reform introduced targeted measures, including enhanced supplier hedging obligations; expanded capacity mechanisms to improve system adequacy; new provisions for energy sharing, collective self-consumption, and consumer protection; as well as incentive tools for greater integration of demand-side response and storage as core elements of market design.

As a result of the reform, the EU electricity market transitioned from an energy-only model to a hybrid model that combines market-based dispatch with enhanced instruments to ensure future adequacy and resilience. ***Thus, the EU internal electricity market remains fundamentally robust, as long as it continues to evolve in response to changing external challenges.***

Ukraine's Market Design: Convergences and Divergences

Following the adoption of the 2017 Electricity Market Law, Ukraine's electricity sector has experienced considerable structural reform. However, despite formal alignment with the EU multi-layered model, substantial gaps remain in actual implementation.

Ukraine's *wholesale market* remains highly ***concentrated***. In particular, a state-owned company providing baseload generation produces over 50% of the total electricity, while another vertically integrated private incumbent dominates in flexible thermal generation, driving electricity prices during peak periods. ***Market liquidity*** remains weak in all segments. The ***absence of standardized forward products*** retains market fragmentation and serves as an entry barrier. Short-term markets (DAM, IDM, and BM), although formally harmonized, function under persistent administrative ***price caps.*** Significant electricity volumes remain regulated through PSO mechanisms and other mandatory sale and purchase obligations. Together, these factors constrain effective price discovery, investment signals, and operational efficiency.

In the *retail segment*, ***universal price regulation*** applies to all household customers and a significant portion of the small businesses. This differs from the EU approach, which restricts regulated tariffs to targeted support for vulnerable consumers. Regulated pricing, the dominance of designated universal service suppliers, and the slow rollout of smart meters collectively hinder effective supplier competition, consumer engagement, and demand-side flexibility. As a result, although the market is formally liberalized, it remains functionally weak.

5.3 Reform Priorities for Ukraine's Electricity Sector

Overcoming the structural and institutional shortcomings requires a sustained reform effort and gradual alignment with the EU's evolving electricity market model. The following outlines key policy and regulatory priorities for this transition:

1) ***Strengthen Wholesale Market Function and Price Formation***

- Phase out administrative price caps: Transition towards market-based price formation in the day-ahead, intraday, and balancing markets.
- Boost Forward Market Liquidity: Introduce standardised contract structures and clearing arrangements to support reference pricing and hedging.
- Finalize Product Harmonization: Progressively align trading products (e.g., minimum bid size and time intervals) in all short-term markets with EU standards.

2) ***Enhance Cross-Border Integration***

- Implement Market Coupling with the EU: Prioritise the technical and regulatory alignment with the EU's *Single Day-Ahead Coupling* and *Single Intraday Coupling*.
- Plan for Capacity Mechanisms Compatibility: When introducing capacity mechanisms, ensure their design aligns with EU state aid guidelines and principles.

3) Reform Retail Market and Enhance Consumer Engagement

- Targeted Tariff Reform: Replace universal regulated tariffs with targeted, income-based support for vulnerable consumers, consistent with the EU *acquis*.
- Promote Dynamic Pricing and Smart Metering: Accelerate smart meter deployment to enable dynamic pricing contracts and consumer participation in demand response.
- Facilitate Supplier Switching: standardise supplier switching procedures and enhance consumer awareness and information access.

4) Develop System Flexibility and Decarbonisation

- Prioritise Demand-Side Flexibility: Incentivise demand-response aggregation to unlock flexibility and reduce reliance on legacy baseload capacity.
- Prioritize Non-Fossil Flexibility Resources: Enable large-scale storage, distributed flexibility, and prosumer participation as a core part of balancing and ancillary service procurement.
- Align RES support schemes: Update RES support schemes to promote their market-based integration in line with the latest EU acquis, including the adoption of CfDs.

Taken together, these recommendations outline a roadmap for Ukraine to achieve genuine convergence with the EU's internal electricity market. This transformation is essential not only to fulfil Ukraine's obligations within the EnC and prepare for eventual EU membership, but also to establish a stable, secure, competitive, and consumer-oriented electricity market.

5.4 Final Remarks

Electricity market design is inherently dynamic, evolving in response to economic, technological, and geopolitical developments. The EU's experience illustrates both the strengths and limitations of liberalized markets, highlighting the need for continuous institutional adaptation and regulatory refinement. For Ukraine, as it advances toward EU accession, it is crucial to accelerate market liberalisation by addressing structural inefficiencies and advancing alignment with the evolving EU framework.

BIBLIOGRAPHY

1. EU Legislation and Official Acts

1.1. Treaties

- Treaty Establishing the European Economic Community [1957] <https://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:11957E/TXT> accessed 21 June 2024 (not published in the Official Journal).
- Consolidated version of the Treaty on the Functioning of the European Union [2012] OJ C326/47.

1.2. Directives

- Directive (EU) 2024/1711 of the European Parliament and of the Council of 13 June 2024 amending Directives (EU) 2018/2001 and (EU) 2019/944 as regards improving the Union's electricity market design [2024] OJ L, 2024/1711.
- Council Directive 96/92/EC of 19 December 1996 concerning common rules for the internal market in electricity [1996] OJ L27/20.
- Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC [2003] OJ L 176/37.
- Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC [2009] OJ L 211/55.
- Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast) [2019] OJ L 158/125 ('***Electricity Directive***').
- Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (recast) [2014] OJ L173/349 ('***MiFID II***').
- Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) [2018] OJ L 328/82 ('***RED***').

1.3. Regulations

- Regulation (EU) 2024/1747 of the European Parliament and of the Council of 13 June 2024 amending Regulations (EU) 2019/942 and (EU) 2019/943 as regards improving the Union's electricity market design [2024] OJ L, 2024/1747.
- Regulation (EC) 1228/2003 of the European Parliament and of the Council of 26 June 2003 on conditions for access to the network for cross-border exchanges in electricity [2003] OJ L 176/1.
- Regulation (EC) 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) 1228/2003 [2009] OJ L 211/15.
- Regulation (EC) 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators [2009] OJ L 211/1.
- Regulation (EU) 2019/942 of the European Parliament and of the Council of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators (recast) [*2019]* OJ L 158/22 ('***ACER Regulation***').

- Commission Regulation (EU) 2017/2195 establishing a guideline on electricity balancing [2017] OJ L 312/6 (‘***EBGL***’).
- Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management [2015] OJ L 197/24 (‘***CACM Regulation***’).
- Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation [2017] OJ L 220/1 (‘***SOGL***’).
- Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on forward capacity allocation [2016] OJ L 259/42 (‘***FCA Regulation***’).
- Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a network code on electricity emergency and restoration [2017] OJ L 312/54, (‘***NC ER***’).
- Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a Network Code on Demand Connection [2016] OJ L 223/10 (‘***NC DC***’).
- Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators [2016] OJ L 112/1 (‘***NC RfG***’).
- Commission Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules [2016] OJ L 241/1 (‘***NC HVDC***’).
- Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) 715/2009, (EU) 2019/942 and (EU) 2019/943 and repealing Regulation (EU) 347/2013 [2022] OJ L 152/45.
- Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast) [2019] OJ L 158/54 (‘***Electricity Regulation***’).
- Commission Regulation (EU) 838/2010 of 23 September 2010 on laying down guidelines relating to the inter-transmission system operator compensation mechanism and a common regulatory approach to transmission charging [2010] OJ L 250/5 (‘***Transmission System Charging Guidelines***’).
- Regulation (EU) 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories [2012] OJ L201/1 (‘***EMIR***’).
- Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC [2019] OJ L 158/1.
- Commission Regulation (EU) 543/2013 of 14 June 2013 on submission and publication of data in electricity markets and amending Annex I to Regulation (EC) 714/2009 [2013] OJ L 163/1 (‘***Transparency Regulation***’).
- Regulation (EU) 1227/2011 of the European Parliament and of the Council of 25 October 2011 on wholesale energy market integrity and transparency [2011] OJ L 326/1 (‘***REMIT***’).

1.4. ACER Decisions

- ACER Decision No 03/2022 of 14 December 2022 on the amendment of the CACM Regulation <https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/ACER%20Decision%2003-2022%20on%20CACM%202.0.pdf> accessed 24 April 2025.
- ACER Decision No 29/2020 of 24 November 2020 on the methodology and assumptions that are to be used in the bidding zone review process and for the alternative bidding zone configurations to be considered <https://eepublicdownloads.entsoe.eu/clean-documents/cep/ACER_Decision_%2B_Annexes.pdf> accessed 29 June 2025.

2. Ukrainian Legislation and Official Acts

2.1. Laws of Ukraine

- Закон України «Про електроенергетику» від 16 жовтня 1997 № 575/97-ВР [1997] Урядовий Кур'єр (20.11.1997) (Law of Ukraine '*On Electricity*' of 16 October 1997 No 575/97-VR [1997] the Governmental Courier (20.11.1997)) <http://zakon0.rada.gov.ua/laws/show/575/97-%D0%B2%D1%80/> accessed 21 June 2024.

- Закон України «Про засади функціонування ринку електричної енергії України» від 24 жовтня 2013 р. № 663-VII [2013] Урядовий Кур'єр 232-233 (Law of Ukraine 'On the Principles of the Operation of the Electricity Market of Ukraine' dated 24 October 2013 No 663-VII [2013] the Governmental Courier 232-233) <http://zakon2.rada.gov.ua/laws/show/663-18> accessed 21October 2024.

- Закон України «Про ринок електричної енергії» від 13 квітня 2017 р. № 2019-VIII [2017] Урядовий Кур'єр 147 (Law of Ukraine 'On the Electricity Market' dated 13 April 2017 No 2019-VIII [2017] the Governmental Courier 147) <http://zakon3.rada.gov.ua/laws/show/2019-19> accessed 21 October 2024 ('***EML***').

- Закон України *«Про внесення змін до деяких законів України щодо запобігання зловживанням на оптових енергетичних ринках»* від 10 червня 2023 № 3141-IX [2023] Голос України 14 (Law of Ukraine "*On Amendments to Certain Laws of Ukraine for the Prevention of Abuse in Wholesale Energy Markets"* dated 10 June 2023 No 3141-IX [2023] the Voice of Ukraine 14) <https://zakon.rada.gov.ua/laws/show/3141-20#Public> accessed 22 June 2025.

- Закон України «Про внесення змін до деяких законів України щодо відновлення та "зеленої" трансформації енергетичної системи України» від 30 червня 2023 № 3220-IX [2023] *Голос України* 18 (Law of Ukraine *"On Amendments to Certain Laws of Ukraine on the Restoration and "Green" Transformation of the Energy System of Ukraine"* dated 30 June 2023 No.3220-IX [2023] Voice of Ukraine 18) <https://zakon.rada.gov.ua/laws/show/3220-20/conv#Text> accessed 16 May 2025.

2.2. Governmental Decrees

- Постанова Кабінету Міністрів України від 15.07.2019 №499 *Про затвердження Порядку проведення електронних аукціонів з продажу електричної енергії за двосторонніми договорами* [2019] Урядовий Кур'єр 112 (Cabinet of Ministers of Ukraine, Resolution No. 499 dd.15.07.2019 *On Approval of the Procedure for Holding Electronic Auctions for the Sale of Electricity under Bilateral Agreements* [2019] the Governmental Courier 112) <https://zakon.rada.gov.ua/laws/show/499-2019-%D0%BF#Text> accessed 16 June 2025.

- Ministry of Energy of Ukraine, *National Energy and Climate Plan for the Period until 2030* (2022) <https://me.gov.ua/download/2cad4803-661e-4ae9-9748-3006d6eb3e1c/file.pdf> accessed 23 June 2025.

2.3. NEURC Resolutions

- Постанова НКРЕКП № 1221 від 27 вересня 2022 року *«Про затвердження Методики визначення істотного коливання цін та встановлення граничних цін на ринку на добу наперед, внутрішньодобовому ринку та балансуючому ринку»* (NEURC Resolution No 1221 of 27 September 2022 *on Approval of the Methodology for Determining Significant Price Fluctuations and Setting Price Caps on the Day-Ahead, Intraday and Balancing Markets*) <https://zakon.rada.gov.ua/rada/show/v1221874-22#Text> accessed 21 June 2025.

- Постанова НКРЕКП, *Правила Оптового ринку електричної енергії України. Додаток 2 до Договору між членами Оптового ринку електричної енергії* [2 березня 1996]

(Resolution of NEURC, *Rules of the Wholesale Electricity Market of Ukraine. Annex 2 to the Agreement among the Members of the Wholesale Electricity Market* [2 March 1996]) <https://zakon.rada.gov.ua/rada/show/v0921227-03#Text> accessed 21 June 2024.

- Постанова НКРЕКП № 307 від 14 березня 2018 року *«Про затвердження Правил ринку»*, *Урядовий кур'єр* (22.06.2018) 117 (NEURC Resolution No 307 of 14 March 2018 *on the Approval of Market Rules*, the Governmental Courier (22 June 2018) 117) <https://zakon.rada.gov.ua/laws/show/v0307874-18#Text> accessed 17 June 2025.

2.4. *Other Regulations*

- Договір між членами Оптового ринку електричної енергії України від 15.11.1996 (Agreement Between the Members of the Wholesale Electricity Market of Ukraine dated 15.11.1996) <https://zakon.rada.gov.ua/rada/show/n0001227-96/ed19961115#Text> accessed 21 June 2024.
- UEEX, *Regulations on Organization and Conduct of Electronic Auctions for the Purchase and Sale of Electricity under Bilateral Contracts in Commercial Sections on the Commodity Exchange*, approved by minutes No.620 dd. 20 November 2019 <https://www.ueex.com.ua/files/regulations_electronic_commercial_auctions-140622-eng.pdf> accessed 17 June 2025.

2.5. *Drafts of Laws*

- Проєкт Закону України "Про внесення змін до законів України щодо об'єднання ринків електричної енергії України та Європейського Союзу", реєстр. № 12087, зареєстровано 2 жовтня 2024 року (*Draft Law of Ukraine on Amendments to the Laws of Ukraine on the Integration of Electricity Markets of Ukraine and the European Union*, Reg No 12087, registered 2 October 2024) <https://itd.rada.gov.ua/billInfo/Bills/Card/44974> assessed 15 May 2025.
- Проєкт Закону України "*Про внесення змін до деяких законів України щодо імплементації норм європейського права з інтеграції енергетичних ринків, підвищення безпеки постачання та конкурентоспроможності у сфері енергетики*", реєстр. № 12087-д, зареєстровано 27 червня 2025 року (Draft Law of Ukraine *"On Amendments to Certain Laws of Ukraine to Implement European Law Norms on Energy Market Integration, Improve Security of Supply and Competitiveness in the Energy Sector"*, Reg No 12087-d, registered 27 June 2025) <https://itd.rada.gov.ua/billInfo/Bills/Card/56682> accessed 30 June 2025.

3. Energy Community Legislation, Official Acts and Implementation Reports

- Energy Community Treaty [2006] OJ L 198/18.
- *Energy Community Acquis* (List for Electricity) <https://www.energy-community.org/enc-lex/law/acquis.html> accessed 28 April 2025.
- Ministerial Council Decision 2022/03/MC-EnC of 15 December 2022 [*on the adoption of a revised EIP*] <https://www.energy-community.org/dam/jcr:e6c3f31f-a770-45db-8c7f-f69d7392628e/Decision03-2022-MC_newELacquis_15-12-2022.pdf> accessed on 1 July 2025.
- Secretariat's *Annual Implementation Report 2023: Ukraine* (1 November 2023) <https://www.energy-community.org/dam/jcr:3da7c4f8-ea23-4169-b1e9-66b0ed05fcb7/EnC_IR2023.pdf> accessed on 29 April 2025.
- Secretariat's *Annual Implementation Report 2024: Ukraine* (1 November 2024) <https://www.energy-community.org/dam/jcr:a4f6d762-c1d6-49bf-bf39-a2dfbaf0171f/IR2024_Ukraine.pdf> accessed on 15 May 2025.

4. Case Law and Commission's Decisions

4.1. General Court

- T-793/14 *Tempus Energy Ltd and Tempus Energy Technology Ltd v Commission* ECLI:EU:T:2018:790.
- T-504/93 *Tiercé Ladbroke SA v Commission* [1997] ECR II-00923.

4.2. European Commission

- *DK/DE Interconnector* (Case AT.40461) Commission Decision [2018] OJ C 58/7, 14.2.2019.
- *Swedish Interconnectors* (Case COMP/39.351) Commission Decision [2010] OJ C 142/28, 1.6.2010. Full text available at: <https://ec.europa.eu/competition/antitrust/cases/dec_docs/39351/39351_1223_4.pdf> accessed 21 June 2024.

5. Books, Academic Articles, and Other Papers

5.1. Books

- Bailey D and John L E (eds), *European Union Law of Competition* (8th edn, Oxford University Press 2018).
- Esposito F, de Almeida L, Mathis K and Huber B R (eds), *Energy Law and Economics* (vol 5, Springer 2018), ch '*A Shocking Truth for Law and Economics: Consumer Welfare Explains the Internal Market for Electricity Better Than Total Welfare'* 101-133.
- Hafner M and Luciani G (eds), *The Palgrave Handbook of International Energy Economics* (Springer 2022).
- Jacobson M Z, *100% Clean, Renewable Energy and Storage for Everything* (Cambridge University Press 2020).
- Meeus L, *The Evolution of Electricity Markets in Europe* (Edward Elgar Publishing 2020).
- Базеєв Є. Т., Варламов Г. Б., Вольчин І. А. та ін., *Енергетика: історія, сучасність і майбутнє. Пізнання й досвід – шлях до сучасної енергетики* (наук. ред. Ю. О. Ландау, І. Я. Сігал, С. В. Дубовськой, Київ: Б.в., 2013) (Y. T. Bazeyev, G. B. Varlamov, I. A. Volchyn et al., *Energy: History, Present, and Future. Knowledge and Experience – the Path to Modern Energy* (ed. Y. O. Landau, I. Ya. Sigal, S. V. Dubovskoy, Kyiv: B.v., 2013).
- Салашенко Т. І., *Наукове забезпечення лібералізації ринку електричної енергії України* (Харків: ФОП Лібуркіна Л. М., 2020) (Tetiana Salashenko, *Scientific Support for the Liberalization of the Electricity Market of Ukraine* (Kharkiv: FOP Liburkina L.M., 2020).

5.2. Academic Articles

- de Almeida L, '*When Indicators Fail Electricity Policies: Pitfalls of the EU's Retail Energy Market Barrier Index*' (2022) 165 Energy Policy <https://doi.org/10.1016/j.enpol.2022.112892> accessed 30 June 2025.
- Borenstein S, Bushnell J and Knittel C R, '*Market Power in Electricity Markets: Beyond Concentration Measures*' (1999) 20(4) Energy Journal <https://www.jstor.org/stable/41326187> accessed 20 June 2025.
- Boscán L A, '*European Union retail electricity markets in the Green Transition: The quest for better consumer involvement*' (2019) WIREs Energy and Environment <https://doi.org/10.1002/wene.359> accessed 30 June 2025.

- Dobos T, Bichler M and Knörr J, *'Challenges in Finding Stable Price Zones in European Electricity Markets: Aiming to Square the Circle?'* (2025) 382 Applied Energy <https://doi.org/10.1016/j.apenergy.2025.125315> accessed 15 March 2025.
- Hancher L, '*Slow and Not So Sure: Europe's Long March to Electricity Market Liberalization*' (2002) 10(9) Electricity Journal <https://doi.org/10.1016/S1040-6190(97)80504-0> accessed 21 June 2024.
- Hutarevych N, '*Implementation of REMIT into Ukrainian Legislation'* (2021) 11-12 Ukrainian Journal of Business Law <http://www.ujbl.info/article.php?id=1532> accessed 22 June 2025.
- Jamasb T and Pollitt M, *'Electricity Market Reform in the European Union: Review of Progress toward Liberalization & Integration'* (2005) 26 (Special Issue: European Electricity Liberalisation) The Energy Journal <https://www.jstor.org/stable/23297005> accessed 21 June 2024.
- Joskow P L, *'Electricity Sectors in Transition'* (1998) 19(2) The Energy Journal <https://www.jstor.org/stable/41322773> accessed 21 June 2024.
- Joskow P L, *'Lessons Learned From Electricity Market Liberalization'* (2008) 29 (Special Issue 2) The Energy Journal <https://www.jstor.org/stable/27085628> accessed 21 June 2024.
- Pototschnig A, '*The Geographical Structure of the Electricity Market: Some Facts'* (Energetika.NET, 19 June 2020) <https://www.energetika.net/eu/novice/envision/the-geographical-structure-of-the-electricity-market-some-f> accessed 29 June 2024.
- Pototschnig A and Hancher L, '*The Future Electricity Market Design'* (FSR, 14 December 2023) <https://fsr.eui.eu/the-future-electricity-market-design/> accessed 25 June 2025.
- Wilson C M and Price C W, '*Do Consumers Switch to the Best Supplier?*' (2010) 62 Oxford Economic Papers <https://doi.org/10.1093/oep/gpq006> accessed 2 June 2025.
- Завербний А.С., '*Аналізування проблем реформування українського ринку електричної енергії'* (2012) №748 Вісник Національного університету "Львівська політехніка" (Zaverbnyi A.S., '*Analysis of the Problems of Reforming the Ukrainian Electricity Market'* (2012) No 748 Bulletin of the National University "Lviv Polytechnic"*)* <http://nbuv.gov.ua/UJRN/VNULPM_2012_748_46> accessed 21October 2024.

5.3. *Other Academic Papers*

- Chekunova S, '*Improving the Wholesale Electricity Market Model in Ukraine*' (Razumkov Centre, 04 August 2021) <https://razumkov.org.ua/en/articles/improving-the-wholesale-electricity-market-model-in-ukraine> accessed 11 May 2025.
- Joskow P L, '*Why Do We Need Electricity Retailers? Or, Can You Get It Cheaper Wholesale?*' (2000) MIT-CEEPR Working Paper 00-001 <http://dspace.mit.edu/handle/1721.1/44965> accessed 30 June 2025.
- Littlechild S C, '*Why we need electricity retailers: A reply to Joskow on wholesale wpot price pass-through'* (22 August 2000) Research Papers in Management Studies WP 21/2000 <https://www.jbs.cam.ac.uk/wp-content/uploads/2020/12/wp0021.pdf> accessed 2 June 2025.
- Menegatti E and Meeus L, '*Cross-Border Participation: A False Hope for Fixing Capacity Market Externalities?'* RSC Working Paper 2024/53 (European University Institute, Robert Schuman Centre for Advanced Studies, November 2024) <https://cadmus.eui.eu/server/api/core/bitstreams/59f5ad95-8002-50dc-b5c8-ee0b8b39396f/content> accessed 27 June 2025.
- Perekhodtsev D et al., '*The Model of Pivotal Oligopoly Applied to Electricity Markets'* (CEIC Working Paper 02-06, September 2002)

<https://www.researchgate.net/publication/228795969_The_model_of_pivotal_oligopoly_applied_to_electricity_markets> accessed 20 June 2025.

- Коссе I, '*Реформа ринку електроенергії в Україні'* (Інститут економічних досліджень та політичних консультацій, 2020) (Kosse I, *Electricity Market Reform in Ukraine* (Institute for Economic Research and Policy Consulting, 2020) <www.ier.com.ua/files/…/Policy…/Policy_Paper_4_final.pdf> accessed 21 June 2024.

6. Institutional Reports, Policy Papers, and Working Documents

6.1. European Commission

- Commission, '*Commission Notice on the Definition of the Relevant Market for the Purposes of Union Competition Law*' (Communication) [2024] OJ C 164/5.
- Commission, DG Energy, '*European Barriers in Retail Energy Markets'* (Final Report, Publications Office 2021) <https://data.europa.eu/doi/10.2833/5217> accessed 29 June 2025.
- Commission, *'Guidelines on State aid for climate, environmental protection and energy 2022'* (Communication) C/2022/481 [2022] OJ C80/1.
- Commission, '*The Internal Energy Market'* (Communication) COM (88) 238 final.
- Commission, DG Energy, '*Quarterly Report on European Electricity Markets: Q4 2024',* (2025) 17(4) Market Observatory for Energy <https://energy.ec.europa.eu/document/download/139371bf-b50b-4fd4-afd1-761b782a0703_en?filename=Quarterly%20report%20Q4%202024%20Electricity.pdf> accessed 15 May 2025.
- Commission, '*Reform of the EU Electricity Market Design'* (Staff Working Document) SWD/2023/58 final.

6.2. ACER

- ACER and CEER, *Energy Retail Market* (2024 Monitoring Report 2024, 30 September 2024) <https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER-CEER_2024_MMR_Retail.pdf> accessed 2 June 2025.
- ACER and CEER, *Electricity Wholesale Market Volume* (2020 Annual Monitoring Report, October 2021) <https://www.ceer.eu/wp-content/uploads/2024/05/ACER-MMR2020-EWMV.pdf> accessed 20 June 2025.
- ACER, *EU Wholesale Electricity Market Design* (Final Assessment, April 2022) <https://www.acer.europa.eu/sites/default/files/documents/Publications/Final_Assessment_EU_Wholesale_Electricity_Market_Design.pdf> accessed 15 May 2025.
- ACER, *Further Development of the EU Electricity Forward Market* (Policy Paper, February 2023) <https://www.acer.europa.eu/sites/default/files/documents/Position%20Papers/Electricity_Forward_Market_PolicyPaper.pdf> accessed 5 June 2025.
- ACER, *Implementation of the Minimum 70% Margin for Cross-Zonal Trade* (Market Monitoring Report, 21 July 2023) <https://www.acer.europa.eu/sites/default/files/documents/Publications/2023_MMR_MACZT.pdf> accessed 5 June 2025.
- ACER, *Progress of EU Electricity Wholesale Market Integration* (2023 Market Monitoring Report, November 2023) <https://www.acer.europa.eu/sites/default/files/documents/Publications/2023_MMR_Market_Integration.pdf> accessed 27 May 2025.

- ACER, *Progress of EU Electricity Wholesale Market Integration* (2024 Market Monitoring Report, 14 November 2024) <https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Market_Integration.pdf> accessed 27 May 2025.
- ACER, *Security of EU Electricity Supply* (*2024 Monitoring Report*, 16 December 2024) <https://www.acer.europa.eu/sites/default/files/documents/Publications/Security_of_EU_electricity_supply_2024.pdf> accessed 24 April 2025.

6.3. *Other Organizations*

- ENTSO-E, *The Role of Capacity Mechanisms to enable a secure and competitive energy transition* (Policy Paper, April 2025) <https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Publications/Position%20papers%20and%20reports/2025/entso-e_pp_capacity_mechanisms_250415.pdf> accessed 24 April 2025.
- ENTSO-E, *Bidding Zone Review of the 2025 Target Year* (Main Report, April 2024) <https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Network%20codes%20documents/NC%20CACM/BZR/2025/Bidding_Zone_Review_of_the_2025_Target_Year.pdf> accessed 9 June 2025.
- IEA, *Electricity 2024* (Analysis and Forecast to 2026, IEA Publications, January 2024) <https://www.iea.org/reports/electricity-2024/executive-summary> accessed 21 June 2024.
- IEA, *Electricity 2025* (Analysis and forecast to 2027, IEA Publications, February 2025) <https://iea.blob.core.windows.net/assets/0f028d5f-26b1-47ca-ad2a-5ca3103d070a/Electricity2025.pdf> accessed 24 April 2025.
- NEURC, *Brochure to the 2022 Annual Report* (Junee 2023) 10 <https://www.nerc.gov.ua/storage/app/sites/1/Docs/Byuleten_do_richnogo_zvitu/broshura_do_richnogo_zvitu_nkrekp-2022.pdf> accessed 22 June 2025.
- NEURC, *Brochure to the 2023 Annual Report* (2024) <https://www.nerc.gov.ua/storage/app/sites/1/Docs/Byuleten_do_richnogo_zvitu/broshura_do_richnogo_zvitu_nkrekp-2023.pdf> accessed 23 June 2025.
- OECD, *Competition Market Study of Ukraine's Electricity Sector* (Report, OECD Publishing 2023) <https://doi.org/10.1787/f28f98ed-en> accessed 16 June 2025.

7. Other Resources

- ACER, '*Bidding Zone Review*' <https://www.acer.europa.eu/electricity/market-rules/capacity-allocation-and-congestion-management/bidding-zone-review> accessed 16 March 2025.
- Boiko I, '*Ukrenergo Plans to Reduce Green Energy Debt*' (UNIAN, 13 June 2025) <https://www.unian.ua/economics/energetics/ukrenergo-planuye-zmenshuvati-borgi-za-zelenu-energiyu-13037517.html> accessed 22 June 2025.
- Commission, '*Antitrust: Commission Opens Formal Investigation into TenneT's Limitation of Capacity on the Germany-Denmark Electricity Interconnector*' (Press Release, 19 March 2018) <https://ec.europa.eu/commission/presscorner/detail/en/ip_18_2122> accessed 19 March 2025.
- Commission, *'Antitrust: Commission Accepts TenneT's Commitments to Increase Capacity on the Germany-Denmark Electricity Interconnector'* (Press Release, 7 December 2018) <https://ec.europa.eu/commission/presscorner/detail/en/ip_18_6722> accessed 19 March 2025.
- Commission, '*Electricity interconnection targets*' <https://energy.ec.europa.eu/topics/infrastructure/electricity-interconnection-targets_en> accessed 29 June 2025.

- Commission, ‘*Electricity Market Design*’ <https://energy.ec.europa.eu/topics/markets-and-consumers/electricity-market-design_en> accessed 11 June 2025.
- Commission, DG ENEST, ‘*Commission steps up support for Ukraine’s energy security and paves the way for full market integration*’ (24 February 2025) <https://enlargement.ec.europa.eu/news/commission-steps-support-ukraines-energy-security-and-paves-way-full-market-integration-2025-02-24_en> accessed 16 May 2025.
- Commission, DG Energy, ‘*In Focus: EU Investing in Energy Infrastructure*’ (15 October 2024) <https://energy.ec.europa.eu/news/focus-eu-investing-energy-infrastructure-2024-10-15_en> accessed 24 April 2025.
- Energoatom, *Energoatom Fully Fulfils its PSO Obligations* (Press Statement, 14 May 2025) <https://energoatom.com.ua/news/energoatom-na-100-vikonuje-svoyi-zoboviazannia-v-mezax-pso> accessed 22 June 2025.
- ENTSO-E, ‘Bidding Zone Review Timeline’ (20 January 2025) <https://www.entsoe.eu/assets/graphics/bzr/bzr-timeline_20-Jan-2025_large.png> accessed 15 March 2025.
- ENTSO-E, ‘*Frequency Containment Reserves (FCR)*’ <https://www.entsoe.eu/network_codes/eb/fcr/> accessed 2 June 2025.
- ENTSO-E, ‘*Continental Europe Successful Synchronisation with Ukraine and Moldova Power Systems*’ (16 March 2022) <https://www.entsoe.eu/news/2022/03/16/continental-europe-successful-synchronisation-with-ukraine-and-moldova-power-systems/> accessed 22 June 2025.
- EPEX SPOT, ‘*Market Coupling Steering Committee Aligns on Revised Go-Live Date for 15-Minute MTU in SDAC*’ (14 May 2025) <https://www.epexspot.com/en/news/market-coupling-steering-committee-aligns-revised-go-live-date-15-minute-mtu-sdac> accessed 26 June 2025.
- Energy Traders Europe, ‘*Our Contracts Overview*’ (EFET, 2025) <https://www.energytraderseurope.org/our-contracts-overview> accessed 26 June 2025.
- European Union Emissions Trading System, ‘*Forward Electricity Market*’ (Internal Electricity Market Glossary) <https://emissions-euets.com/internal-electricity-market-glossary/1472-forward-electricity-market> accessed 27 May 2025.
- FSR, ‘*Capacity Remuneration Mechanisms*’ (30 July 2024) <*https://fsr.eui.eu/capacity-remuneration-mechanisms/*> accessed 24 April 2025.
- FSR, ‘*Electricity Markets in the EU*’ (14 September 2020) <https://fsr.eui.eu/electricity-markets-in-the-eu/> accessed 9 April 2025.
- FSR, ‘*The Clean Energy for all Europeans Package*’ (10 June 2020) <https://fsr.eui.eu/the-clean-energy-for-all-europeans-package/> accessed 25 June 2025.
- *'Hydro-electricity restored to historic Northumberland home'* BBC News (London, 26 February 2013) <https://www.bbc.co.uk/news/uk-england-tyne-21586177> accessed 1 July 2024.
- IMF, *Ukraine: Fifth Review Under the Extended Arrangement Under the Extended Fund Facility, Requests for Waivers of Applicability of Performance Criteria, Modification of Performance Criterion, Rephasing of Access, and Financing Assurances Review – Press Release; Staff Report; and Statement by the Executive Director for Ukraine* (IMF Country Report No 2024/314, 2024) <https://doi.org/10.5089/9798400290534.002> accessed 1 July 2025.
- Next Kraftwerke, ‘*mFRR (manual Frequency Restoration Reserve /R3): What is it?*’ <https://www.next-kraftwerke.com/knowledge/mfrr> accessed 30 June 2025.

- NEURC, ‘*Electricity Market Data Dashboard’* <https://public.tableau.com/app/profile/neurc/viz/2__16324695298060/sheet0_1> accessed 17 June 2025.
- Rozite V, Miller J, Oh S, *'Why AI and Energy are the New Power Couple'* (IEA, 23 May 2023) <https://www.iea.org/commentaries/why-ai-and-energy-are-the-new-power-couple> accessed 21 June 2024.
- SEM-O, ‘*Capacity Market: A Helicopter Guide to Understanding the Capacity Market’* <https://www.sem-o.com/sites/semo/files/documents/general-publications/Capacity-Market-A-Helicopter-Guide-to-Understanding-the-Capacity-Market.pdf> accessed 24 April 2025.
- Schneidewindt H, *‘The Fatal DG Comp-TenneT-Deal’* (Energy Democracy, 18 June 2018) <https://energy-democracy.org/the-fatal-dg-comp-tennet-deal/> accessed 19 March 2025.
- Stacey K, *'Britain Passes Historic Milestone with First Days of Coal-Free Power'* Financial Times (London, 16 May 2016) <https://www.ft.com/content/fc2c8d12-191d-11e6-bb7d-ee563a5a1cc1> accessed 21 June 2024.
- Sulzberger C, *'History' IEEE Power & Energy Magazine* (March/April 2013) <https://magazine.ieee-pes.org/marchapril-2013/history-7/> accessed 21 June 2024.
- Swanson A, *‘Why household appliances are the 20th century’s most disruptive technologies’* (World Economic Forum, 22 October 2015) <https://www.weforum.org/agenda/2015/10/why-household-appliances-are-the-20th-centurys-most-disruptive-technologies/> accessed 21 June 2024.
- UEEX, ‘*Spot Electricity Market UEEX*’ (Results of Q4 2021, 2022) <https://www.ueex.com.ua/files/ueex_electricity_q4_2021.pdf> accessed 17 June 2025.
- Ukrenergo, ‘*НЕК “Укренерго” провела конкурентний 5-річний спецаукціон з придбання резерву підтримки частоти*’ (‘*NPC “Ukrenergo” Conducted a Competitive 5-Year Special Auction for the Procurement of Frequency Containment Reserve’*) (Press Statement, 15.08.2024) <https://ua.energy/electricity-market/nek-ukrenergo-provela-konkurentnyj-5-richnyj-spetsauktsion-z-prydbannya-rezervu-pidtrymky-chastoty/> accessed 30 June 2025.
- Ukrenergo, ‘*27 травня НЕК “Укренерго” проведе додатковий спецаукціон з придбання швидких резервів’ (‘NPC “Ukrenergo” to Conduct an Additional Special Auction for the Procurement of Fast Reserves on 27 May’*) (Press Statement, 02.05.2025) <https://ua.energy/zagalni-novyny/27-travnya-ukrenergo-provede-dodatkovyj-spetsauktsion/> accessed 30 June 2025.
- Walker S, *‘Ukraine Suspends Preparations for EU Trade Pact’* The Guardian (London, 21 November 2013) <https://www.theguardian.com/world/2013/nov/21/ukraine-suspends-preparations-eu-trade-pact> accessed 21 October 2024.
- Zachmann G, ‘*How important is the new electricity market reform?*’ (Bruegel, 16 March 2023) <https://www.bruegel.org/newsletter/how-important-new-electricity-market-reform> accessed 25 June 2025;
- Орел І, ‘Уряд підвищив тариф на електрику для населення з 1 червня на 64%’ (Форбс Україна, 31 травня 2024) (Orel I, ‘*Government Raises Household Electricity Tariff by 64 % from 1 June’* (Forbes Ukraine, 31 May 2024)) <https://forbes.ua/news/uryad-pidnyav-tarif-na-elektriku-dlya-naselennya-z-1-chervnya-na-60-31052024-21502> accessed 23 June 2025.

ABSTRACT

Diese Masterarbeit bietet eine vergleichende Analyse der Ausgestaltung des Elektrizitätsmarktes in der Europäischen Union und der Ukraine mit dem Ziel, den Grad der Konvergenz zu bewerten und Reformprioritäten zu identifizieren. Sie untersucht die Entwicklung und aktuelle Struktur des EU-Binnenmarktes für Strom, mit Fokus auf die Groß- und Einzelhandelssegmente, das Zusammenspiel von Produkt-, Zeit- und Raumdimensionen sowie die Resilienz des Modells im Lichte der jüngsten Energiekrise.

Die Arbeit argumentiert, dass das EU-Marktmodell, trotz der Herausforderungen und Schwachstellen, die während der Energiekrise 2021–2022 zutage traten, ein verlässlicher Referenzrahmen bleibt, der in der Lage ist, sich an die sich wandelnden Systemanforderungen anzupassen.

Die Studie zeigt ferner, dass die Ukraine zwar formal eine liberalisierte Marktarchitektur übernommen hat, die weitgehend mit dem EU-Modell übereinstimmt, jedoch erhebliche strukturelle und funktionale Abweichungen bestehen. Dazu zählen eine anhaltende Marktkonzentration, geringe Liquidität, verzerrende administrative Eingriffe und eine begrenzte Verbraucherpartizipation. Der effektive Integrationspfad der Ukraine erfordert nicht nur die Übernahme des EU-Besitzstands, sondern auch gezielte Reformen zur Beseitigung bestehender struktureller Mängel und Hemmnisse.

ABSTRACT (in English)

This thesis presents a comparative analysis of the electricity market design in the European Union and Ukraine, with the aim of assessing the degree of convergence and identifying reform priorities. It examines the evolution and current structure of the EU internal electricity market, focusing on its wholesale and retail segments, the interplay of product, temporal, and spatial dimensions, and the resilience of the model in light of the recent energy crisis.

The thesis argues that, notwithstanding the challenges and vulnerabilities revealed during the 2021-2022 energy crisis, the EU market model remains a reliable benchmark, capable of adapting to evolving system needs.

The study further demonstrates that while Ukraine has formally adopted a liberalised market architecture broadly aligned with the EU model, significant structural and functional divergences persist. These include persistent market concentration, weak liquidity, distortive administrative interventions, and limited consumer engagement. Ukraine's path to effective integration requires not only the transposition of the acquis but also targeted reforms that eliminate existing structural malfunctions and constraints.