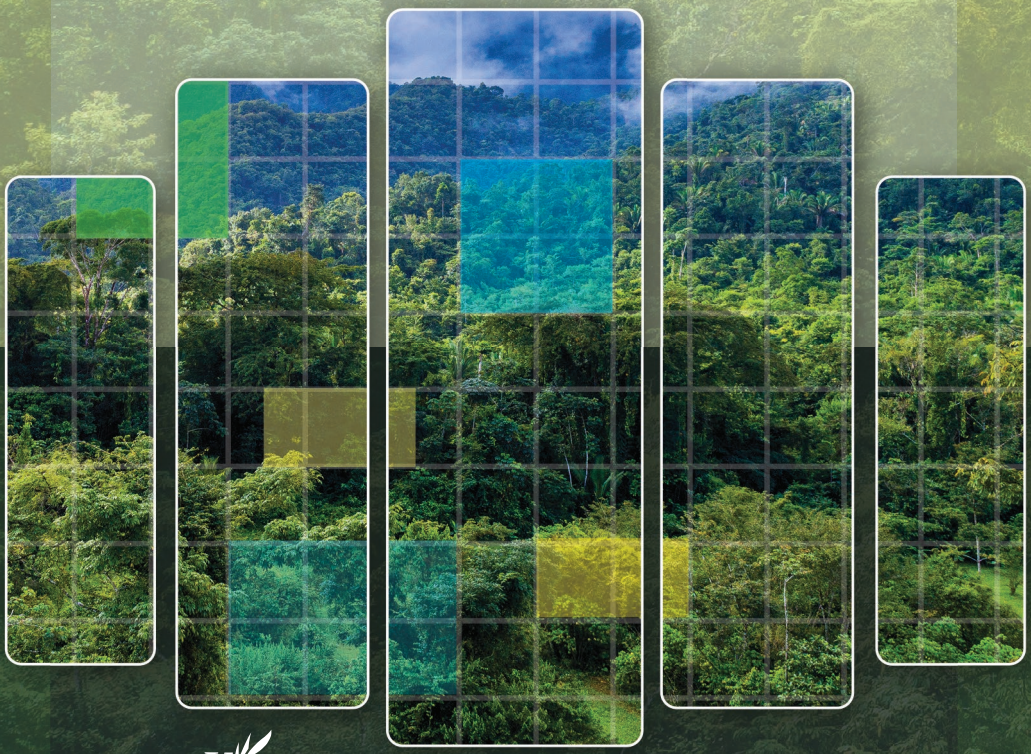
Robert Szuchy

SMART GRIDS AND THE GREEN TRANSITION:

Shaping the Future of Europe's Internal Electricity Market



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Smart Grids and the Green Transition: Shaping the Future of Europe's Internal Electricity Market

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energy law, electricity market, green transition, energy efficiency

ISBN 978-963-646-442-4 (pdf)

DOI: https://doi.org/10.56037/978-963-646-442-4

https://openaccess.hu/

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L'Harmattan Publishing • Éditions L'Harmattan

Budapest • Paris
2025

Supported by Károli Gáspár University of the Reformed Church in Hungary

Proofread by Sándor Kertész and Szabolcs Molnár

L'Harmattan Kiadó
Kossuth Lajos utca 14–16.
H-1053 Budapest, Hungary

L'Harmattan France
5-7 rue de l'Ecole Polytechnique
75005 Paris

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© Éditions L'Harmattan, 2025

ISBN 978-2-336-57575-9
ISBN 978-963-646-442-4 (pdf)
DOI: https://doi.org/10.56037/978-963-646-442-4

Volumes may be ordered, at a discount, from
L'Harmattan Könyvesbolt
1053 Budapest, Kossuth L. u. 14–16.
Tel.: +36-70-554-3177
harmattan.hu
librairie.internationale@harmattan.fr
www.amazon.fr

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I. INTRODUCTION

Europe's electricity sector is undergoing a profound transformation driven by urgent climate imperatives, recent energy crises, and rapid technological innovation. Terms like *smart grids*, *the green transition*, and *Europe's internal electricity market* have moved to the forefront of energy policy and law as the European Union (EU) strives to decarbonize its economy and secure a reliable energy supply. In recent years, the climate crisis – exemplified by EU commitments to cut greenhouse gas emissions 55% by 2030 on the path to climate neutrality by 2050 – and geopolitical events affecting energy supply have elevated energy law's importance.[1] The EU now views energy law and regulation as critical tools to facilitate a clean energy transition while ensuring security of supply and affordability for consumers. Against this backdrop, *smart grid* technologies and *digitalisation* are revolutionizing how electricity is produced, delivered, and consumed, creating both opportunities and new regulatory challenges.

At the same time, the EU's long-standing project of building an integrated internal electricity market provides the framework within which these changes unfold. This Introduction defines and explains these core concepts and situates the book's subject in its contemporary context. It highlights why smart grids and the green transition have become so pivotal to Europe's energy future – due to climate goals, energy security concerns, technological advances, and digitalisation – and how EU law and regulation are evolving in response. In doing so, it positions *Smart Grids and the Green Transition: Shaping the Future of Europe's Internal Electricity Market* as a timely contribution to academic and professional debates on the future of energy in Europe.

1. Smart Grids: Modernizing Europe's Electricity Networks

Smart grids refer to advanced electricity networks that use digital technologies to intelligently manage the production, delivery, and consumption of power. In essence, a smart grid is an "upgraded" power grid equipped with two-way digital communication between suppliers and consumers, along with intelligent

[1] HOLMAN & SIEMPLENSKI LEFORT, 2024.

metering and monitoring systems. Unlike the traditional one-directional electric grid, a smart grid can *automatically monitor energy flows and adjust to changes in supply and demand* in real time. Smart grids are commonly defined as electricity networks that integrate the behavior and actions of all users – generators, consumers, and those who both produce and consume (so-called *prosumers*) – in order to ensure an efficient, sustainable, low-loss, high-quality, secure, and safe electricity system. In practical terms, this means adding a layer of information and communication technology onto the physical grid infrastructure. Sensors, smart meters, and control devices distributed throughout the network collect data and enable operators to balance supply and demand dynamically.

One of the most important features of smart grids is the empowerment of end-users. These intelligent systems enable direct interaction between consumers and energy suppliers, giving consumers unprecedented opportunities to monitor and control their own energy usage. For example, households with *smart meters* can see their electricity consumption in real time and adjust their usage to save money – or even feed electricity back to the grid from on-site renewables like rooftop solar panels. Indeed, smart grids paired with smart meters allow consumers who generate their own renewable power to sell it back to the grid, blurring the line between consumer and producer[2]. With real-time pricing signals (such as time-of-use tariffs), consumers are incentivised to shift consumption to off-peak times or high-renewable output periods, improving overall efficiency. In this way, smart grids facilitate *demand-side flexibility* – consumers actively adjusting demand in response to supply conditions – which helps keep the system stable as more variable renewable energy is added.

Crucially, smart grids are seen as the "backbone" of a decarbonized energy system. By leveraging digital controls, they can reliably integrate large shares of electricity from renewable sources like wind and solar, whose output fluctuates with weather and time of day. A smart grid can respond swiftly to changes in generation (for example, a sudden drop in wind power) by drawing on distributed storage, flexible demand, or cross-border imports. It can also accommodate new electric loads such as heat pumps and electric vehicles in a cost-efficient way, by charging or discharging these resources at optimal times[3]. In the coming decades, as Europe electrifies more of its heating and transport to cut emissions, smart grids will be essential to manage these new demands. The European Commission has explicitly recognized that without major upgrades to networks and metering systems – in other words, without deploying smart grids – the EU will fall short of its energy and climate objectives: *renewable energy expansion would stagnate, grid reliability would be compromised, opportunities for energy*

[2] European Commission: *Smart grids and meters*
[3] European Commission: *Smart grids and meters*

efficiency would be missed, and the development of the internal energy market itself would be greatly slowed. Smart grid deployment is therefore not an end in itself, but a means to achieve broader policy goals: a cleaner, more efficient and interconnected European energy system.

2. The Green Transition and EU Climate Goals

The green transition denotes the sweeping shift from a fossil-fuel based energy model toward a sustainable, low-carbon economy. In Europe, this transition is driven by ambitious climate and environmental targets. Under the European Green Deal and subsequent legislation, the EU has committed to reduce greenhouse gas emissions by at least 55% by 2030 (compared to 1990 levels) and to reach net-zero emissions by 2050, effectively achieving climate neutrality[4]. Decarbonizing the power sector – which means replacing coal, gas, and other carbon-intensive generation with renewable and carbon-free sources – is central to meeting these goals. The share of electricity generated from renewables in the EU is expected to rise from roughly 37% in 2020 to 60% or more by 2030[5]. Achieving this will require integrating vast amounts of wind and solar capacity onto European grids in a short timeframe. The "green transition" in the electricity sector thus encompasses not only the growth of renewable energy, but also improvements in energy efficiency, the electrification of transportation and heating, and the adoption of technologies like energy storage and demand response – all aimed at reducing carbon emissions and environmental impact.

This clean energy transition has taken on increased urgency and complexity in light of recent energy crises. In 2022, the war in Ukraine precipitated a severe disruption in European energy markets, with curtailed natural gas flows and soaring electricity prices. This crisis exposed the EU's vulnerability due to reliance on imported fossil fuels and underscored that the green transition is not only an environmental imperative but also a strategic necessity for energy security. In response, European policymakers doubled down on renewable energy deployment and energy savings. EU Member States invested approximately €110 billion in new renewable energy projects in 2023, roughly ten times more than investments in fossil fuels, reflecting a strengthened resolve to shift to domestically produced green energy and reduce dependence on foreign suppliers[6]. At the policy level, the European Commission and Council launched the

[4] HOLMAN & SIEMPLENSKI LEFORT, 2024.
[5] European Commission: *Electricity market design*
[6] HOLMAN & SIEMPLENSKI LEFORT, 2024.

REPowerEU plan[7] in 2022 to rapidly diversify away from Russian gas, accelerate the roll-out of renewables, and improve energy system resilience[8]. Moreover, the EU's Fit for 55 legislative package – termed the fifth energy package and adopted in 2024 – explicitly aligns energy laws and targets with the new climate ambitions and emergency measures, for example by raising renewable energy targets and strengthening measures for energy efficiency and storage. In sum, Europe's green transition is being propelled forward by a convergence of climate goals and security concerns. This has elevated the importance of modernizing the grid and market (through smart technologies and legal reforms) to handle a future dominated by clean energy. It is a transition not just in technology and fuel mix, but in the regulatory paradigm governing electricity.

3. Europe's Internal Electricity Market: Integration as a Foundation

All of these developments are unfolding within the framework of the EU's internal electricity market – a cornerstone of European energy policy that has been built over the past three decades. The internal energy market refers to the EU-wide system of common rules and integrated infrastructure that allows electricity (and gas) to flow freely across member state borders. The overarching principle is that an integrated EU energy market is the most cost-effective way to ensure secure, sustainable and affordable energy supplies for EU citizens. In practical terms, this means that electricity can be generated in one EU country and delivered to consumers in another, taking advantage of geographic and resource diversity across Europe. Through market integration – facilitated by cross-border interconnectors and harmonized regulations – the EU aims to boost competition (driving down prices), improve efficiency, and enhance security of supply by sharing resources. Indeed, the European Commission notes that the EU electricity market is designed to incentivise the clean energy transition and deliver energy security, while ensuring affordability by empowering consumers with choice and competition[9].

Since the 1990s, EU legislation has liberalized national electricity industries and progressively knit them together. Successive *Energy Packages* (First in 1996–98, Second in 2003, Third in 2009, and the Fourth "Clean Energy for All Europeans" Package in 2019) dismantled state-owned monopolies, required the unbundling of transmission networks, established independent regulators

[7] European Commission, Communication "REPowerEU Plan", COM(2022) 230 final, 18 May 2022

[8] European Parliament: Internal Energy Market

[9] European Commission, Communication "Electricity Market Design", COM(2023) 148 final, 14 March 2023.

and EU-wide bodies (such as the Agency for the Cooperation of Energy Regulators, ACER, and the European Network of Transmission System Operators for Electricity, ENTSO-E), and strengthened consumer rights. As a result, today's internal electricity market is a complex regime governed by EU directives and regulations that set rules on everything from market access and trading to renewables support and capacity mechanisms. Notably, the Electricity Regulation (EU) 2019/943 and Electricity Directive (EU) 2019/944 (adopted in 2019) updated the market's design to better integrate renewable energy and empower consumers as "active customers." The focus of EU energy law has thus expanded: what began primarily as a liberalisation and competition project now also explicitly seeks to facilitate decarbonisation and innovation. The EU electricity market rules are being adapted to support the massive influx of renewable generation and new flexibility resources. For example, national electricity markets are coupled through EU algorithms to smooth out variable wind and solar supply across regions, and demand response and energy storage are increasingly being incorporated into market operations. The market is also fostering new business models – such as electricity aggregators that bundle consumer flexibility for sale in markets – which were unheard of in the monopoly era.

Recent events have tested and triggered further evolution of the internal market. The energy price volatility of 2021–2022, coupled with concerns about supply shocks, prompted EU leaders to call for structural reform of the electricity market to ensure Europe's energy sovereignty and to protect consumers[10]. In March 2023, the European Commission proposed a major reform of electricity market design, and by mid-2024 the EU adopted new rules aimed at *boosting renewable integration, enhancing consumer protection, and stabilizing prices*. These reforms (part of the Green Deal Industrial Plan) include measures to encourage long-term contracts like power purchase agreements and two-way contracts-for-difference, so that investments in renewables and other clean technologies can be driven by stable revenues rather than short-term price spikes. They also strengthen oversight of markets (expanding ACER's powers to investigate abuses) and bolster requirements for cross-border cooperation on security of supply[11]. In short, Europe's internal electricity market remains a work in progress, continually adjusted to meet new policy goals. What is clear is that the internal market provides the coordination mechanism and regulatory architecture for the green transition: it enables European countries to share energy resources and innovations, and it sets common rules that increasingly reflect climate priorities and technological change. The interplay between *market integration* and *decarbonisation* is a key theme – and smart

[10] European Parliament, Resolution of 5 April 2022 on a European strategy for energy system integration (Internal Energy Market), 2020/2242(INI).

[11] European Parliament, Resolution of 5 April 2022

grids lie at the heart of both, as they will help bridge the gap between local clean energy resources and a continental market.

4. Digitalisation, Smart Technology, and New Regulatory Challenges

Underpinning many of the changes in Europe's electricity landscape is the rapid digitalisation of the energy system. Modern information and communication technologies (ICT), advanced sensors, automation, big data analytics, and artificial intelligence are being deployed across generation, networks, and consumer devices. This digital revolution promises to make energy systems more connected, intelligent, efficient, reliable and sustainable[12]. For instance, utilities now use smart sensors and AI to forecast energy demand and renewable output with greater accuracy, and to instantly detect faults or bottlenecks in the grid. The rise of the Internet of Things (IoT) means that appliances, electric vehicles, thermostats, and batteries can all become part of an interactive energy network – able to respond to price signals or grid needs automatically. Such technologies greatly enhance the capability to integrate decentralized renewable generation and manage the variability of wind and solar. They also open the door to new services (like mobile apps for energy management, or automated demand response programs) and new participants (tech companies aggregating consumer data or optimizing energy use through algorithms) in the energy market. In the EU's view, digitalisation is a key enabler of the Green Deal objectives: it can *optimize electricity grids, improve energy efficiency in homes and industry, and facilitate the electrification and integration of sectors*, all of which are crucial for decarbonisation Indeed, the European Commission's *Digitalisation of Energy Action Plan* (2022) stresses that digital innovations can help deploy renewables faster and operate the energy system more flexibly, while also saving energy and costs for consumers and companies. In quantitative terms, smarter grid management and coordination across Europe can reduce the need for costly infrastructure expansion: for example, investing in digital solutions at the distribution level is expected to allow faster deployment of electric cars, heat pumps, and distributed renewables by maximizing the use of existing grid capacity.[13]

However, this digital transformation also poses significant regulatory challenges. As more data flows through the electricity system and more critical infrastructure is controlled by software, regulators must address issues of data privacy, cybersecurity, interoperability, and market fairness. *Data governance*

[12] European Commission, Communication "Digitalising the energy system – EU Action Plan", COM(2022) 552 final, 18 October 2022.

[13] European Commission: *Smart grids and meters*

is a prime concern: smart meters and connected devices generate detailed information about household energy usage, raising questions about how to protect consumers' personal data and who has the right to access or monetize these data. EU law has already established a robust personal data protection framework (the General Data Protection Regulation, GDPR), which fully applies to the energy sector. Still, translating its principles to smart grids requires careful implementation. The distinction between personal and non-personal data becomes crucial – for example, whether fine-grained energy consumption data can be tied to an identifiable individual. The European Commission has noted that a legal framework respecting consumers' privacy is *essential for public acceptance of smart grids*, and that consumers should be able to easily access and verify their own energy data while confidential business information is also safeguarded. In parallel, *cybersecurity* has emerged as a vital regulatory domain. A highly digitalized grid is vulnerable to cyber attacks or malfunctions that could disrupt electricity supply. To counter this, the EU is developing new rules (including an upcoming network code on cybersecurity for cross-border electricity flows) to ensure uniform high standards of cyber defense in all member states. The Digitalising the Energy System action plan[14] explicitly aims to create a *"secure, transparent and competitive market for digital energy services, ensuring data privacy and sovereignty, and supporting investment in digital energy infrastructure"*. In other words, regulators are tasked with enabling innovation in services like demand aggregation or peer-to-peer trading, but without compromising consumer rights or system security.

The advent of smart grids also challenges traditional regulatory and market structures. For decades, electricity regulation assumed a one-directional flow from large power plants to passive consumers, and monopoly network utilities operated under predictable conditions. Now, with prosumers, energy cooperatives, and aggregators participating, the roles and responsibilities in the market are being redefined. Regulators must determine how these new actors fit into licensing, grid access rules, and balancing responsibilities. Questions arise such as: How should the benefits and costs of smart grid investments be shared among generators, network operators, and consumers? What technical standards should apply to ensure all the new devices and systems can interoperate seamlessly? How can price signals and tariffs be reformed to reward flexible consumption or storage that benefits the grid? Many of these issues are still being worked out. The European Commission's Smart Grids Task Force and its successor, the Smart Energy Expert Group, have spent years examining topics like standards, interoperability, data formats, and *demand-side flexibility*

[14] European Commission, Communication "Digitalising the Energy System – EU Action Plan. COM(2022) 552 final, 18 October 2022.

to guide regulatory directions[15]. It is recognized that if clear standards and a "fair cost-sharing system" are not developed, network operators may be hesitant to invest in smart technologies and consumers may be slow to accept them. Thus, EU policymakers have identified priority actions to encourage smart grid deployment, including: developing technical standards, ensuring robust data protection and cyber security, creating regulatory frameworks that incentivize smart investments, keeping retail markets open and competitive for new services, and continuing to support innovation and pilot projects. The evolution of network regulation – e.g. updating grid codes, tariff design, and incentive schemes for utilities – is now geared toward facilitating these goals. In summary, smart grids and digitalisation are transforming Europe's electricity system into something far more complex and interactive than before. While this promises great efficiency and sustainability benefits, it requires agile regulatory oversight and new legal tools to address the multifaceted challenges that arise.

5. A Timely Contribution to Energy Law and Policy Debates

Europe's electricity sector is in the midst of a profound transformation driven by urgent climate imperatives, recent energy crises, and rapid technological innovation. Achieving the EU's binding targets – cutting greenhouse gas emissions by 55% by 2030 on the way to *climate neutrality by 2050* – requires nothing less than a sweeping overhaul of how energy is produced, traded, and consumed. At the same time, events like the 2022 energy crisis (sparked by geopolitical upheavals) have underscored the strategic necessity of reducing reliance on imported fossil fuels. These pressures have elevated the importance of energy law and regulation as tools to facilitate a clean and secure energy transition. Smart grids and digitalisation stand at the center of this transition: advanced metering, AI-driven analytics, and automated controls are revolutionizing electricity networks, enabling real-time balancing and new services, but also creating novel regulatory challenges around data governance and cybersecurity. Crucially, all these developments are unfolding within the framework of Europe's long-standing project to build an integrated internal electricity market. This EU-wide market – developed over three decades to allow electricity to flow across borders under common rules – provides the foundation for the green and digital transition, ensuring that *cross-border integration* and competition go hand in hand with decarbonisation efforts.

In this evolving landscape, issues once treated separately – climate change mitigation, market regulation, consumer rights, technology innovation, and

[15] European Commission, Recommendation 2012/148/EU of 9 March 2012 on preparations for the roll-out of smart metering systems *[OJ L 73, 13 March 2012, pp. 9–22].*

even trade and foreign policy – are now deeply intertwined in the energy sector. Lawyers, regulators, and industry professionals must navigate an increasingly complex web of rules that govern everything from renewable energy subsidies and emissions caps, to grid interoperability standards, data privacy, and AI-based services. The pace of legal change in recent years has been striking. Under the European Green Deal, the EU enacted a European Climate Law[16] and launched the ambitious Fit for 55 legislative package[17] (2021–2024) to align energy and climate laws with the new 55% emissions reduction goal. This package overhauled core legislation – raising renewable energy and energy efficiency targets, extending carbon pricing – including a new Carbon Border Adjustment Mechanism (CBAM) to curb carbon leakage –, and establishing a Social Climate Fund to support vulnerable populations – thereby tightly integrating climate objectives with market rules. At the same time, traditional energy market law has continued to evolve. The recast Internal Electricity Market Directive (2019), for example, mandates the rollout of smart metering and demand response programs, putting consumers at the heart of the market and facilitating flexibility services. In response to the recent supply and price crises, EU institutions even deployed emergency measures in 2022–2023 to cap energy prices and coordinate gas storage – an extraordinary intervention that highlighted the law's agility in times of crisis. Energy law has truly moved to the forefront of EU policy: it is now expected to deliver on the *"trilemma"* of sustainability, security of supply, and affordability all at once.

This book positions itself within that dynamic context as a timely scholarly contribution. It aims to provide readers – particularly law students specializing in energy or environmental law, as well as energy sector practitioners and policymakers – with a comprehensive exploration of the legal and regulatory challenges shaping Europe's smart grid-enabled green transition. Throughout the chapters that follow, we examine how smart grid technologies are reshaping the "rules of the game" in the internal market and how EU energy legislation is adapting (or in some areas, lagging behind). We investigate questions such as: What does current EU law require regarding smart metering, energy data-sharing, and active consumer participation? How do competition and market rules apply when traditional utilities, tech companies, and new actors (like aggregators and prosumers) converge in the electricity market? Do existing market regulations support or hinder the integration of ever-larger shares of renewables and the use of flexibility resources across borders? And what new regulatory frameworks might be needed to address emerging developments

[16] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ("European Climate Law"), *[OJ L 243, 9 July 2021, pp. 1–17]*.

[17] European Commission. (2021): Fit for 55: Delivering the EU's 2030 Climate Target on the way to climate neutrality (COM(2021) 550 final, 14 July 2021). Brussels.

– for instance, electric vehicle fleets feeding energy back into the grid, or artificial intelligence optimising regional grid operations? By delving into these issues, Smart Grids and the Green Transition: Shaping the Future of Europe's Internal Electricity Market seeks to illuminate how law and policy can evolve to meet Europe's energy challenges. The analysis is both backward-looking and forward-looking: it assesses how existing EU law (for example, the Third Energy Package and the Clean Energy for All Europeans Package of 2019) set the stage for smarter, cleaner grids, and it grapples with cutting-edge issues where legal doctrine and regulatory practice are still catching up – such as energy data governance, privacy and competition concerns in data-driven electricity services, and ensuring cybersecurity (cyber-resilience) of an increasingly digitized grid.

In sum, the convergence of smart grid innovation, ambitious climate policy, and market integration represents one of the most dynamic and consequential areas of European law today. The stakes could not be higher: the EU's ability to meet its climate objectives, ensure energy security in an uncertain world, and foster innovation and economic efficiency in the energy sector all hinge on getting the legal and regulatory framework right. As Europe navigates this complex green transition – balancing decarbonisation with reliability and affordability – the analyses in this book aim to contribute to a deeper understanding of how law can shape a sustainable and secure energy future. The chapters ahead elaborate each of these themes in detail, charting the evolution of EU energy law and policy and exploring how it can continue to adapt in order to shape the future of Europe's internal electricity market.

II. THE CONCEPT AND DOCTRINAL POSITION OF ENERGY LAW

1. The concept of energy law

Energy law can nowadays be considered as a new field of law (or even branch of law)[18] . There is no universally accepted academic designation for it. This situation also contributes to many misunderstandings about what energy law actually is. However, it is undisputed that in many countries we have been encountering regulations governing 'energy' in legal form for centuries. Already in the 19th century, and especially in the early 20th century, there were a number of regulations on energy, particularly on coal and then oil. Later on, regulation extended – basically after World War II – to the regulation of non-fossil energy sources, such as nuclear energy, hydropower, wind and other renewable energy sources.

Today, energy law is becoming increasingly important even if we only consider the fight against climate change or the European Union's energy dependence. The issue of security of supply is also becoming increasingly important. At the same time, energy law is inherently linked to other branches of law and cannot be interpreted in isolation. A telling example is the technological dependence that existed for many years, when several Member States – particularly in the Baltic region – had no alternative pipeline connections and were therefore reliant on a single source of natural gas, namely Russia. This situation highlighted not only legal, but also political and economic dimensions of energy dependence. Over time, however, the European Union and its Member States have taken significant steps to diversify supply, develop alternative sources, and strengthen energy security. Today, energy – and especially energy prices – continues to play a central role in domestic and EU-level policymaking.

2. The evolution of the concept of energy law

Energy law has matured significantly since 2017 as a distinct field of legal scholarship and practice. Once considered a "new" or emerging branch, it is now firmly established with dedicated literature and a clearer scope. Energy law encompasses the legal frameworks governing the production, transmission, distribution, and use of energy resources – from traditional fossil fuels like

[18] HEFFRON, 2015, p. 132.

coal and oil to non-fossil sources such as nuclear power and renewables. It operates at the intersection of multiple disciplines (economics, environmental science, and technology) and multiple legal domains (public law, private law, international law), which makes its precise contours fluid. Nonetheless, energy law's core mission remains managing the balance between security of supply, economic efficiency, and environmental sustainability in the energy sector. In recent years, the climate crisis and geopolitical events have elevated energy law's importance. The urgent need to combat climate change, evidenced by EU commitments to climate neutrality by 2050, and concerns about dependence on dominant suppliers have placed energy law at the forefront of policy-making. Today, energy law serves as a critical tool to facilitate the clean energy transition while ensuring reliable and affordable energy for society.

2. The Position of Energy Law within the Legal System

The "position" of energy law refers to its place within the legal system and its relationship to other fields. Energy law can nowadays be considered as a new field of law (or even branch of law)[19] . There is no single academic literature that addresses this field. This situation also contributes to many misunderstandings about what energy law actually is. Traditionally, energy law was seen as a sub-discipline of administrative or economic law, concerned largely with regulation of public utilities. However, its cross-cutting nature means energy law draws on principles from property law (defining rights in energy resources), contract and commercial law (energy trading contracts, market rules), environmental law (sustainability and emissions control), and competition law (preventing market dominance abuses). For instance, energy law must address how competition rules apply to powerful state-owned enterprises, without jeopardizing the energy security of countries reliant on a single gas supplier. However, it is undisputed that in many countries we have been encountering regulations governing 'energy' in legal form for centuries. Already in the 19th century, and especially in the early 20th century, there were a number of regulations on energy, particularly on coal and then oil. Later on, regulation extended – basically after World War II – to the regulation of non-fossil energy sources, such as nuclear energy, hydropower, wind and other renewable energy sources.

The number of publications on energy law in Europe has been increasing since the 1980s, while in Hungary there are very few publications on energy law. [20] At the same time, of course, there are many other outstanding works in

[19] Ibid. p. 132.

[20] The following is an example of a purely energy law related book: Fazekas (ed.): A magyar elektromosenergia szektor működése és szabályozása I.

Hungary on energy law issues. Typically, these works were in the fields of environmental law, agricultural law or taxation.[21] The evolution of EU law, especially Article 194 of the Treaty on the Functioning of the EU (TFEU), has given energy policy an explicit legal basis and clarified EU competences in energy. This Treaty provision balances EU internal market powers with each Member State's sovereign right to choose its energy mix. Thus, energy law in the EU context sits at a junction between national sovereignty and collective European objectives. The increasing prominence of energy in EU policy (e.g. the creation of an *Energy Union* framework and the European Green Deal) has further solidified energy law as a standalone field, with its own principles like "energy solidarity" emerging from case law (as discussed later) and its integration with climate law.

3. The regulatory field of energy law

Is there even such a thing as an EU energy law? This has been expressed by many other energy lawyers[22] . Is there such a thing as EU energy law? Could it be that EU energy law is nothing more than applying certain general EU legal rules to the energy sector?

Common market rules include the free movement of goods, people and goods in transit, environmental protection and now climate protection. But EU rules also includes ensuring freedom of establishment. As the rules in this area affect the businesses and individuals operating in that area.

The answer to this question can be approached in such a way that the separation and highlighting of energy law can also be justified on the basis of the extent to which the given area affects a specific sector, in this case the energy sector. This is currently separate at regulatory, scientific, business, commercial and legal levels in the EU and the EU applies separate regulatory solutions to problems in this area from other industrial and commercial sectors.

This specific subject matter can provide the basis for treating it as a special subject, separate from other areas of law, as many legal scholars have done over the last twenty years. Hundreds of practising lawyers have also specialised in this field.

It should be noted that there are few areas of law among the individual industries that deserve special attention. Of course, transport law, maritime law, or shipping law, for example, could be considered such an area, but I would consider less so paper law or automotive regulation, even though these areas

[21] Cf. FODOR, 2014.
[22] TALUS, 2013, p. 1.

are also subject to very extensive EU and national legislation. However, energy law and energy was an area of the 20th century that has significantly shaped the century. Let us therefore examine the main areas covered by energy law.

The regulatory field of energy law spans a broad range of issues, reflecting the complexity of the energy sector. It includes upstream activities (like exploration and production of oil, gas, and renewable generation) and downstream activities (transmission grids, distribution networks, and retail supply). Energy law addresses both economic regulation – controlling tariffs, market access, unbundling of vertically integrated monopolies – and technical regulation, such as network codes and safety standards. Increasingly, environmental regulation is integral to energy law: laws setting renewable energy targets, emissions trading, efficiency mandates, and technology-specific rules (e.g. for offshore wind or hydrogen production) all form part of the energy legal framework. The first of these rounds is called the un. "upstream" market, which can also be translated as "extraction". This includes not only the rules for the extraction of oil and gas, but also the extraction of coal, uranium and unconventional hydrocarbons, such as shale oil or shale gas, and the legal regulation of these.

The second main area is electricity generation, from conventional (e.g. coal, oil, nuclear), renewable (solar, solar, hydro) and other alternative sources (e.g. geothermal).

The third major area of regulation is the transport and delivery of energy resources to users. This includes the regulation of the distribution of natural gas and electricity. It also includes the transport of oil and gas through pipelines and the supply of electricity to users. It also includes regulation of cross-border capacity. It also covers the storage of hydrocarbons and gas storage. It also includes issues relating to the regulation and promotion of renewable energy.

The fourth major regulatory area is consumer protection, of which there are many examples in the Third Energy Package.

The fifth group includes energy-related rules with an energy dimension, such as rules on the energy consumption of products, some of which are environmental "labelling" rules. [23]

And seventh, as the most recent area of regulation, it regulates modern, innovative, forward-looking energy issues – which will be discussed later – and the outlines of which have already been published in the Clean Energy[24] energy regulation published in December 2016. This includes new regulations such as decentralised energy storage, smart metering and smart grids.

[23] Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products *[OJ L 153, 18.6.2010, p. 1].*

[24] Communication from the Commission: Clean Energy For All Europeans Brussels, 30.11.2016 COM(2016) 860 final

And last but not least, there is the issue of so-called e-mobility, the regulatory issues related to the supply of electricity to vehicles, which is a very large regulatory area in itself and is also related to other areas of transport.

Since 2017, there has been a marked shift toward regulation that facilitates the energy transition. Contemporary energy law incorporates concepts like "energy efficiency first" and frameworks to integrate distributed energy resources, energy storage, and demand-side management into the grid. Moreover, energy law now explicitly promotes consumer-centric policies – empowering consumers as "prosumers" (producing their own energy), enabling energy communities, and enhancing consumer rights in retail markets. The regulatory field is thus no longer limited to traditional utility regulation; it has expanded to govern innovation in smart grids, electric mobility, and digitalisation of energy, ensuring that legal structures accommodate new technologies and policy goals (like decarbonisation and decentralisation of energy supply).

The introduction underscores that energy law, as of 2025, is both more comprehensive and more critical than ever. It is not only about regulating markets for efficiency, but also about achieving climate neutrality and energy security – goals now codified in EU law (e.g. the European Climate Law binding the EU to net-zero by 2050). The events of the past years – notably the COVID-19 pandemic recovery and the armed conflict in Ukraine – have tested and proven the importance of robust energy legal frameworks. The EU's 2024 State of the Energy Union report found that the Union "withstood critical risks to its security of energy supply, regained control over the energy market and prices, and accelerated the transition towards climate neutrality", highlighting that the regulatory and financing framework put in place is steering Europe toward its 2030 climate and energy goals. Energy law is thus firmly entrenched as a key component of both legal scholarship and practical governance, interacting dynamically with international developments and domestic considerations.

III. SOURCES OF EU ENERGY LAW

To understand the complex nature of energy law, it is essential first to grasp its sources and the structure of its legal framework. Only by clearly identifying the hierarchy of legal norms – ranging from primary treaty provisions to secondary legislation, case law, and soft law – can one appreciate how energy law functions as a system and how it adapts to technological, economic, and policy developments.

1. Primary sources of law

a) EU Treaties

The primary source of EU energy law is the EU's founding treaties, as amended (in particular the Treaty of Lisbon which introduced a specific energy provision). First, let's look at the primary source of EU energy law. The first such source was the Euratom Treaty[25] . In the 1950s, to compensate for the general shortage of 'conventional' energy, the six founding Member States (Belgium, France, Germany, Italy, Luxembourg, the Netherlands and Germany) looked to nuclear energy as the key to energy independence. As the cost of investing in nuclear energy was beyond the means of each Member State, the founding countries joined forces within Euratom. The general objective of the Treaty is to promote the creation and growth of the European nuclear industry, so that all Member States can benefit from the development of nuclear energy and ensure security of energy supply. At the same time, the Treaty guarantees increased protection of the public and prohibits the use of nuclear material for civilian purposes for military purposes. It is important to note that Euratom's competence covers only the civilian and peaceful uses of nuclear energy. The Euratom Treaty, which was initially intended to coordinate research programmes in the Member States for the peaceful uses of nuclear energy, now promotes the pooling of knowledge, infrastructure and funding for nuclear energy. It ensures the security of nuclear energy supply through centralised control.

[25] Treaty establishing the European Atomic Energy Community (Euratom), signed in Rome on 25 March 1957, *[OJ C 203, 7 June 2016]*.

The second and most important source today is the Treaty on the Functioning of the European Union (TFEU)[26] , also known as the Lisbon Treaty. The TFEU regulates a number of issues affecting the energy sector, such as competition law issues, in particular the prohibition of abuse of dominant position and cartels, the prohibition and regulation of state aid, services of general economic interest, which will be of particular importance in the energy sector. At the same time, this TFEU already contains a specific section on energy regulation. Article 194 TFEU explicitly grants the EU competence in energy policy, setting out objectives of ensuring the functioning of the energy market, security of supply, promoting energy efficiency and renewables, and interconnection of networks. It also affirms the principle that each Member State retains the right to determine its energy mix and the conditions for exploiting its energy resources. This balance between Union and national competence is crucial: while the EU can harmonize many aspects of energy markets, it cannot force a country to adopt or abandon a particular energy source (as confirmed by the Court of Justice in the *Paks II* nuclear power plant state aid case [27], where judges reiterated that "Member States are free to determine the composition of their own energy mix"). Primary law also embeds horizontal principles affecting energy, such as environmental protection (Article 11 TFEU) and competition rules (Articles 101–109 TFEU) which apply to energy companies. The EU Charter of Fundamental Rights can even come into play indirectly (for example, solidarity and consumer protection principles informing energy policy). In addition to EU treaties, some aspects of energy are governed by the Euratom Treaty (for nuclear energy cooperation and safety), which remains a separate primary treaty framework.

In the context of the establishment and functioning of the internal market and the need to preserve and improve the environment, the objectives of the Union's energy policy, in a spirit of solidarity between Member States, are to ensure the functioning of the energy market, guarantee security of energy supply in the Union, promote energy efficiency and energy saving and the development of new and renewable energy sources; and promote the interconnection of energy networks .[28]

Without prejudice to the application of the other provisions of the Treaties, the European Parliament and the Council, acting in accordance with the ordinary legislative procedure, shall lay down the measures necessary for the attainment of the objectives to be achieved in the areas listed above. Those measures shall be adopted after consultation of the Economic and Social Committee and the Committee of the Regions.

[26] Consolidated version of the Treaty on the Functioning of the European Union, *[OJ C 202, 7 June 2016, p. 47].*

[27] Judgment of the General Court in Case T-101/18, *Austria* v *Commission.*

[28] Article 194 TFEU.

At the same time, the TFEU ensures that EU rules must not affect the right of Member States to determine the conditions for exploiting energy sources, or the choice of Member States between different energy sources or the general structure of their energy supply. Also, TFEU provides that where the rules on energy are primarily of a fiscal nature, the Council, acting unanimously after consulting the European Parliament, shall lay down the relevant rules by a special legislative procedure.

b) National constitutions and fundamental laws

Within Member States, national constitutions and fundamental laws can influence energy law (e.g. enshrining public service obligations or environmental rights). However, these are not uniform across the EU. In federal states, regional constitutions might allocate energy competences. Generally, property rights provisions are relevant (since energy resources or networks may be publicly or privately owned, subject to expropriation rules for public interest projects like grid expansion). As energy has become a strategic sector, some constitutions or laws define energy supply as part of the "public interest" or "public utilities" domain, justifying regulation.

2. Secondary sources of law

Secondary sources of law are essentially those that aim to create a single energy market. Secondary legislation – directives, regulations, decisions – form the bulk of EU energy law.

a) Electricity Transit Directive

The background to the Electricity Transit Directive[29] is that European regulators have recognised that the terms of contracts for the transmission of electricity between transmission networks must be set by the companies concerned and that the terms of transmission must be fair and must not create, directly or indirectly, conditions that are contrary to Community competition rules.

In order to facilitate the conclusion of supply contracts, the Commission will ensure that a conciliation procedure is established, to be applied at the request of either party, without the result of such a procedure having legally binding force, because of the need to approximate the provisions adopted by the Member States concerning the supply of electricity. Member States shall take the necessary measures to facilitate the transit of electricity between high-voltage transmission systems in accordance with the conditions laid down

[29] Council Directive of 29 October 1990 on the transit of electricity through transmission grids *[OJ L 313, 13.11.1990, p. 30]*.

in this Directive. This Directive shall apply to high-voltage electricity transmission systems and to the companies responsible for such systems in the Member States, as listed in the Annex.

b) Hydrocarbon Research Directive

Another very important source of secondary legislation is the single regulation on hydrocarbon exploration, which is set out in the Hydrocarbons Exploration Directive[30] .

The legislation calls for steps to be taken to ensure non-discriminatory access to and the exercise of the right to explore for, extract and exploit hydrocarbons under conditions that encourage greater competition in the sector, to promote the best possible methods of exploration and exploitation of Member States' reserves and to strengthen the integration of the internal energy market.

To that end, it is necessary to establish common procedural rules to ensure that procedures for granting authorisations for the prospection, exploration and production of hydrocarbons are open to all undertakings possessing the necessary capacity; whereas the granting of authorisations should be based on objective and public criteria; whereas, moreover, the conditions for granting authorisations should be known in advance to the undertakings participating in the procedure.

c) Electricity directives

One of the first and most important steps in the integration of the electricity market was the adoption of the first electricity directive[31] as part of the regulatory package known as the "First Energy Package".

The Directives provided for a gradual opening of the market, with a minimum level of liberalisation. Member States were allowed to set a higher level, at their discretion, when implementing the Directive. In addition to market liberalisation, it was also possible to maintain the public service obligation in parallel to ensure the supply of consumers.

The first Directive covered the whole energy sector, from production to the consumer level. This Directive establishes common rules for the generation, transmission and distribution of electricity. It lays down rules on the organisation and functioning of the electricity sector, access to the market, the conditions and procedures applicable to calls for tenders, the granting of authorisations and the operation of systems.

[30] Directive 94/22/EC of the European Parliament and of the Council of 30 May 1994 on the conditions for granting and using authorisations for the prospection, exploration and production of hydrocarbons *[OJ L 164, 30.6.1994, p. 3]*.

[31] Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity *[OJ L 27, 30.1.1997, p. 20]*.

For the development of new production capacity, it offered two procedures. The first was the authorisation procedure, under which the conditions for granting an authorisation must be laid down in public rules and there must be a right of appeal in the event of a refusal to grant an authorisation. Under the competitive tendering procedure, the amount of new capacity needed and the conditions for the conclusion of the contract should be published at regular intervals. In order to ensure continuity of energy supply, a system operator should be appointed in each Member State to ensure a balanced load on the system and to provide data.[32]

The Second Electricity Directive[33], adopted as part of the Second Energy Package, also served to unify the energy market by further opening up the market. Member States must apply an authorisation procedure for the creation of new generation capacity which meets the requirements of objectivity, transparency and non-discrimination. Member States or their designated transmission system owners should designate one or more transmission system operators for a period of time to be determined by the Member State, taking into account efficiency and economic balance. Distribution licensees shall also be designated.

This Directive provides for additional unbundling rules for distribution licensees. Where the distribution system operator is part of a vertically integrated undertaking, it must be independent at least in its legal form, organisation and decision making from other activities not relating to distribution. These rules shall not create an obligation to separate the assets of the distribution system from the vertically integrated undertaking in terms of ownership. Furthermore, where the distribution system operator is part of a vertically integrated undertaking, it must be independent in organisational and decision-making terms from other activities not relating to distribution.

The second energy package aimed at a gradual opening of the market. The deadline for implementation of the second package was 1 July 2004. However, due to the lack of a level playing field and inadequate unbundling rules, a Commission study in 2007 revealed that market liberalisation had not actually been achieved, leading to the adoption of a new package of directives in 2009. This is the so-called third energy package, of which Directive 72/2009/EC[34] is part.

The Third Energy Package, adopted in 2009, was a decisive turning point in the creation of a genuine internal electricity market. The centrepiece was

[32] ÁRVA: Energy Policy, p. 4.

[33] 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 *[OJ L 176, 15.7.2003, p. 37]*.

[34] 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 *[OJ L 211, 14.8.2009, p. 55]*.

Directive 2009/72/EC[35], which introduced the strictest version of unbundling rules, the so-called ownership unbundling. Under this model, transmission system operators (TSOs) must be completely independent from supply and generation activities, ensuring that network operation cannot be influenced by vertically integrated energy companies. Alternatively, Member States could opt for the Independent System Operator (ISO) or Independent Transmission Operator (ITO) models, provided that genuine independence and non-discriminatory access to the grid were guaranteed. The Directive also strengthened consumer rights, improved regulatory oversight through the creation of ACER (the Agency for the Cooperation of Energy Regulators), and promoted cross-border integration of energy markets.

Despite these measures, the energy market still faced fragmentation, insufficient investment in infrastructure, and challenges linked to renewable energy integration. To address these, the EU adopted the Clean Energy for All Europeans Package[36] in 2019, which includes the recast Electricity Directive (EU) 2019/944[37]. This Directive updated the framework by enhancing consumer empowerment, reinforcing rules on energy communities, and promoting demand-side flexibility. It also required Member States to ensure competitive retail markets, transparent billing, and the roll-out of smart metering. The 2019 Directive further refined unbundling rules and the responsibilities of distribution system operators (DSOs), recognising their role in integrating decentralised renewable generation and smart grids.

Today, Directive (EU) 2019/944 remains the core legislative instrument governing the internal electricity market, alongside the Electricity Regulation (EU) 2019/943. Together, these provisions form part of the broader EU energy and climate framework, complementing the European Climate Law, the REPowerEU Plan[38], and the evolving legislative measures under the Fit for 55 package[39]. The trajectory of the electricity directives demonstrates a clear progression: from the gradual and cautious liberalisation of the 1990s to today's highly integrated, consumer-centred, and decarbonisation-oriented electricity market design.

[35] 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 *[OJ L 211, 14 8. 2009, pp. 55–93].*

[36] Clean Energy for All Europeans Package: including, inter alia, Directive (EU) 2019/944 on common rules for the internal market for electricity, and Regulation (EU) 2019/943 on the internal market for electricity *[OJ L 158, 14 06 2019. pp. 125–199].*

[37] 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 *[OJ L 158, 14 06 2019, pp. 125–199*].

[38] European Commission, Communication REPowerEU Plan .

[39] European Commission, Communication Fit for 55.

d) Gas market directives

Similar to the electricity market, the opening of the natural gas market has been carried out in accordance with the three energy packages, the first main regulation being Directive 98/30/EC[40] , followed by Directive 98/30/EC[41] as part of the second energy package.

Then, as part of the third energy package, Directive 2009/73/EC was adopted in 2009[42] which contains the current gas market rules. This Directive lays down common rules for the transmission, distribution, supply and storage of natural gas. It sets out the rules relating to the organisation and functioning of the natural gas sector, market access, procedures for granting authorisations for the transmission, distribution, supply and storage of natural gas and the operation of networks. The rules laid down in this Directive for natural gas, including liquefied natural gas (LNG), should also apply without discrimination to biogas and biomass gases and other types of gas, provided that these types of gas can be technically and safely injected into and transported through the natural gas system.

The current legal framework for the EU gas market was originally established under Directive 2009/73/EC, part of the Third Energy Package. This Directive ensured the unbundling of transmission operators, third-party access to networks, and enhanced consumer rights. However, the energy transition and the need to integrate renewable and low-carbon gases required further reform. As a result, in June 2024 the EU adopted the new Gas and Hydrogen Markets Directive (EU) 2024/1788[43] and the Gas and Hydrogen Markets Regulation (EU) 2024/1789[44], which repeal and replace the 2009 Gas Directive. These new instruments extend the internal market framework to renewable gases and hydrogen, set rules for hydrogen network operators, and reinforce cross-border cooperation, reflecting the EU's decarbonisation and energy security objectives.

e) Other directives and regulations

There are also a number of other directives and regulations that regulate the EU energy market, such as Directive 2014/94/EU on the deployment of alternative

[40] Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the internal market in natural gas *[OJ L 204, 21.7.1998, p. 1].*

[41] Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the internal market in natural gas *[OJ L 204, 21.7.1998, p. 1]*

[42] Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC *[OJ L 211, 14.8.2009, p. 94].*

[43] Directive (EU) 2024/1788 of the European Parliament and of the Council of 13 June 2024 on common rules for the internal markets for renewable gas, natural gas and hydrogen, amending Directive (EU) 2023/1791 and repealing Directive 2009/73/EC [*OJ L, 15 July 2024].*

[44] Regulation (EU) 2024/1789 of the European Parliament and of the Council of 13 June 2024 on the internal markets for renewable gas, natural gas and hydrogen (recast), amending Regulations (EC) No 715/2009, (EU) No 1227/2011, (EU) 2019/942 and (EU) 2019/943, and repealing Regulation (EC) No 715/2009 *[OJ L, 15 July 2024].*

fuels infrastructure[45] , which is transport-focused but arguably energy-related. The Directive devotes a specific section to electricity as a potential alternative fuel source. It also refers back to the Electricity Directive, by applying its rules in accordance with the rules of that Directive.

Also in the field of energy[46] is the regulation on the geological storage of carbon dioxide The geological storage of carbon dioxide (CO2) can prevent and significantly reduce the adverse effects of climate change. The Carbon Capture and Storage Directive (also referred to as the CCS Directive) establishes a legal framework to help address climate change through the environmentally safe geological storage of CO2

An example of a regulation is Regulation (EU) No 994/2010 concerning measures to enhance the security of EU natural gas supply[47]. Natural gas is a key component of the EU's energy mix, accounting for a quarter of primary energy supply and is used mainly for electricity generation, heating, industrial feedstock, and transport fuels. Gas consumption in Europe has grown rapidly over the last decade. As domestic production has declined at the same time, gas imports have increased at an even faster pace, increasing import dependency and the need to address security of gas supply concerns. The objective of this Regulation is to safeguard security of gas supply by preventing and responding to supply disruptions in a coordinated manner and ensuring the proper and continuous functioning of the internal market for gas. The Regulation establishes a common framework within which security of gas supply is a shared responsibility between natural gas undertakings, EU Member States and the Commission. It also provides a transparent mechanism for coordinating the response to emergencies at national, regional or European level in a spirit of solidarity.

Since 2017, this corpus has significantly expanded and evolved, with recasts of major directives and new regulations adopted under the EU's push for an Energy Union and the subsequent European Green Deal. We outline key categories of secondary legislation:

i) Internal Energy Market Directives and Regulations

The EU has progressively enacted three "energy packages" to liberalize and integrate electricity and gas markets (1990s First Package, 2003 Second Package, 2009 Third Package). In 2019, a Clean Energy for All Europeans

[45] Directive 2014/94/EU of the European Parliament and of the Council on the deployment of alternative fuels infrastructure *[OJ L 307, 28.10.2014, p. 1]*.

[46] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC and 2008/1/EC of the European Parliament and of the Council and Regulation (EC) No 1013/2006 *[OJ L 140, 5.6.2009, p. 114]*.

[47] Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of natural gas supply and repealing Council Directive 2004/67/EC *[OJ L 295, 12.11.2010, p. 1]*.

Package updated the internal market rules. The former Electricity Directive 2009/72/EC was repealed and replaced by Directive (EU) 2019/944 on common rules for the internal electricity market, and the Electricity Regulation (EC) 714/2009 was replaced by Regulation (EU) 2019/943 on the internal market for electricity[48]. These 2019 laws, in force since 1 January 2020, introduced new provisions reflecting the EU's 2030 climate and consumer empowerment goals. Notably, they strengthen unbundling rules, enhance regional coordination (establishing Regional Coordination Centres for grid operation), and put consumers "at the heart" of the energy system (with rights to smart meters, dynamic pricing, and to participate in energy communities). Similarly, in gas, Directive 2009/73/EC and Regulation 715/2009 remain the core Third Package instruments; however, in December 2021 the Commission proposed a new Decarbonised Gas and Hydrogen Package to reform gas market rules. By late 2023, political agreement was reached to adopt a Gas and Hydrogen Markets Directive and Regulation[49], aimed at facilitating market entry for renewable and low-carbon gases (biomethane, hydrogen) and creating dedicated hydrogen network governance. These new gas laws (entering into force in 2024) will overhaul the 2009 framework, setting up rules for open access hydrogen pipelines and requiring planning for hydrogen infrastructure and markets. In the interim, Regulation (EU) 2017/1938 on security of gas supply[50] (as amended) and a 2019 amendment extending EU rules to pipelines to/from third countries (Nord Stream etc.) have reinforced the regulatory regime. The internal market legislation is buttressed by numerous binding Network Codes (Commission regulations) on specific technical and commercial aspects (grid connection standards, capacity allocation, balancing, etc.), which continue to be developed and updated via comitology with input from ACER and ENTSO-E/G.

ii) Renewable Energy and Energy Efficiency Directives

A cornerstone of EU energy law is legislation promoting clean energy to meet climate goals. The Renewable Energy Directive (RED)[51] has been recast multiple times. Directive 2009/28/EC (with its famous 20% by 2020 target)

[48] Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity *[OJ L 158, 14.6.2019, pp. 54–124]*

[49] Directive (EU) 2024/1788 of the European Parliament and of the Council of 13 June 2024 on common rules for the internal markets for renewable gas, natural gas and hydrogen, amending Directive (EU) 2023/1791 and repealing Directive 2009/73/EC *[OJ L, 2024/1788, 15.7.2024]*

[50] Regulation (EU) 2017/1938of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010 *[OJ L 280, 28.10.2017, pp. 1–56]*

[51] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC *[OJ L 140, 5.6.2009, p. 16–62.]*

was replaced by Directive (EU) 2018/2001 (RED II)[52], which set an EU-level target of at least 32% renewable share by 2030 and introduced mechanisms like guarantees of origin and rules for renewable self-consumers. Under the European Green Deal's Fit for 55 package, RED II was amended in 2023 (often dubbed RED III)[53] to raise the 2030 target to 42.5% (with an indicative aim of 45%). RED III also sets sub-targets for sectors (e.g. a minimum percentage of renewable fuels in transport and industry, including a specific quota for renewable hydrogen in industry by 2030). The Energy Efficiency Directive (2012/27/EU, replaced by 2018/2002/EU) has similarly been revised: the 2018 version required a 32.5% improvement in energy efficiency by 2030; an amending directive in 2023 increased ambition to about 36-39% (translating to a binding target of reducing EU final energy consumption by at least 11.7% by 2030 compared to projected use). These directives impose obligations such as energy savings schemes, building renovation strategies, and efficiency standards for public procurement. Complementing them is the Energy Performance of Buildings Directive (2010/31/EU, amended in 2018 and with a new recast under negotiation) which sets requirements for building energy efficiency and will move toward all new buildings being zero-emission by 2030.

iii) Climate Law and Emissions Trading

While not purely "energy law" in a market sense, climate legislation deeply influences the energy sector. The EU Emissions Trading System (EU ETS), originally set up by Directive 2003/87/EC[54], is a cap-and-trade scheme covering power generation and large industry. In 2018 and 2023, it was significantly revised. As part of Fit for 55, Directive (EU) 2023/959[55] amended the ETS to cut emissions by 62% in ETS sectors by 2030 (from 2005 levels), phase out free allowances for industries by 2034, and extend ETS to maritime shipping. A new Emissions Trading System for buildings and road

[52] 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) *[OJ L 328, 21.12.2018, p. 82–209].*

[53] Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652 *[OJ L 2023/2413, 31.10.2023].*

[54] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC *[OJ L 275, 25 October 2003, pp. 32–46].*

[55] Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system *[OJ L 130, 16 May 2023, pp. 134–202.]*

transport[56] will start in 2027, pricing carbon in those sectors, accompanied by a Social Climate Fund[57] to assist vulnerable households with the transition. Furthermore, the European Climate Law (Regulation (EU) 2021/1119)[58] has enshrined the target of at least 55% greenhouse gas reduction by 2030 and climate neutrality by 2050 into binding EU law. This overarching regulation guides energy legislation by providing long-term direction. Additionally, the Carbon Border Adjustment Mechanism (CBAM) Regulation (EU) 2023/956[59] introduces carbon tariffs on imports like cement, steel, electricity, which will gradually replace free ETS allowances – a measure to ensure global competitiveness while EU industries decarbonize. These climate measures directly affect energy production choices (e.g. coal plant phase-outs have accelerated due to rising carbon costs) and investment in low-carbon technologies.

iv) Other sectoral directives and regulations

EU energy law also comprises rules on specific topics. The Electricity Regulation (EU) 2019/943 and ACER Regulation (EU) 2019/942[60] strengthen the powers of the EU Agency for Cooperation of Energy Regulators (ACER) and set principles for cross-border trade (like capacity allocation, congestion management). The Risk-Preparedness Regulation (EU) 2019/941[61] requires Member States to prepare for and manage electricity crises in solidarity. There are regulations on energy infrastructure: the revised Trans-European Networks for Energy (TEN-E) Regulation (EU) 2022/869[62] refocuses support on cross-border grids, storage, and excludes oil and gas pipelines (except hydrogen) from receiving EU "Project of Common Interest" status, aligning infrastructure planning with climate goals. In 2022, prompted by war, the

[56] Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC as regards the strengthening of the EU emissions trading system and extending it to maritime transport, and amending Decision (EU) 2015/1814 *[OJ L 130, 16 May 2023, pp. 134–202]*

[57] Regulation (EU) 2023/955 of the European Parliament and of the Council of 10 May 2023 establishing a Social Climate Fund *[OJ L 130, 16 May 2023, pp. 1–32].*

[58] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ("European Climate Law") *[OJ L 243, 9 July 2021, pp. 1–17].*

[59] Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism *[OJ L 130, 16 May 2023, pp. 52–104].*

[60] Regulation (EU) 2019/942 of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators (recast) [*OJ L 158, 14 June 2019, pp. 22–53].*

[61] 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 *[OJ L 158, 14 June 2019, pp. 1–21.*]

[62] 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) No 715/2009, (EU) 2019/942 and (EU) 2019/943 and Directives 2009/73/EC and (EU) 2019/944, and repealing Regulation (EU) No 347/2013 *[OJ L 152, 3 June 2022, pp. 45–102].*

EU also passed Regulation (EU) 2022/1032[63] on gas storage, which mandates that Member States fill gas storage to 90% before winter each year from 2023 (80% in 2022) to bolster supply security. Meanwhile, State aid guidelines and bloc exemption regulations for energy and environment (revised in 2022) govern how governments can support energy projects (e.g. renewable subsidy schemes, capacity mechanisms) consistent with the internal market. Finally, the EU's Taxonomy Regulation (EU) 2020/852[64] provides a classification of sustainable investments, which in 2022 was controversially extended via a delegated act to include certain gas and nuclear projects as "transitional" – a move illustrating how financial regulation is influencing energy sector investments.

v) International agreements and external dimension

International law is a source of energy law in the EU when the Union or its states are parties to it. The Paris Agreement (2015)[65], though not EU law per se, has been ratified by the EU and all Member States and drives EU energy-climate legislation (the EU's NDC under Paris led to the European Climate Law targets). The Energy Charter Treaty (ECT)[66] is another key instrument: a multilateral treaty from the 1990s aimed at protecting foreign energy investments and facilitating transit. The EU and Euratom, as well as most Member States, joined the ECT. However, by 2024 the EU and many members decided to withdraw from the ECT on the grounds that it "was not matching EU or global energy and climate ambitions" After efforts to modernize the ECT failed to gain consensus, the Council of the EU in May 2024 agreed on a coordinated withdrawal. This historic decision (taking effect one year from notification) marks a significant shift: the EU is asserting that investment protection under old treaties must not impede climate action. Other international frameworks include the Paris-based International Energy Agency (IEA) obligations for oil stocks (for those EU states in the IEA), and bilateral agreements (for instance, treaties on gas supply or electricity grid synchronisation with neighboring countries).

[63] Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) No 715/2009 with regard to gas storage *[OJ L 173, 30 June 2022, pp. 17–33].*

[64] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 ("Taxonomy Regulation") *[OJ L 198, 22 June 2020, pp. 13–43].*

[65] Paris Agreement, adopted under the United Nations Framework Convention on Climate Change (UNFCCC) in Paris on 12 December 2015, entered into force on 4 November 2016.

[66] Energy Charter Treaty (ECT), signed in Lisbon on 17 December 1994, entered into force on 16 April 1998, UNTS Vol. 2080, p. 95.

The EU also engages in diplomatic initiatives (energy partnerships with countries like Norway, the U.S., OPEC states, and more recently efforts to secure critical minerals through trade agreements).

f) International Dimension of EU Energy Law

The European Union's energy law is not confined to internal legislation; it is also shaped by international agreements and broader external relations. International law becomes a source of EU energy law whenever the Union itself, or its Member States, are parties to binding treaties. Some of these instruments have had a profound impact on the development of the EU's energy and climate framework, while others underpin the Union's external energy relations and market integration.

One of the most influential global frameworks is the Paris Agreement (2015)[67]. Although not EU law in the strict sense, the Agreement has been ratified by both the Union and its Member States and provides the overarching climate framework within which EU energy policy operates. The EU's nationally determined contribution (NDC) under Paris directly informed the legally binding targets laid down in the European Climate Law[68], including the 2030 emissions reduction objective and the 2050 climate neutrality goal. In this sense, the Paris Agreement demonstrates how international commitments can act as a catalyst for internal legislative change.

Another central, though increasingly controversial, treaty has been the Energy Charter Treaty (ECT)[69]. Concluded in the 1990s, the ECT was designed to protect cross-border energy investments and facilitate energy transit. The EU, Euratom, and most Member States were contracting parties. However, by 2024, the Union and several Member States initiated a coordinated withdrawal, after attempts at modernisation failed. The Council of the EU formally agreed that the ECT no longer aligned with European or global climate ambitions. This marks a significant legal and political shift: the EU has asserted that outdated investment protection regimes must not obstruct the clean energy transition.

Beyond these global instruments, the EU is also a party to the Energy Community Treaty[70], signed in 2005 and entering into force in 2006. This treaty extends the EU's internal energy market rules to the Western Balkans and neighbouring regions, thereby creating a broader pan-European energy

[67] Paris Agreement, adopted under the United Nations Framework Convention on Climate Change, Paris, 12 December 2015, entered into force 4 November 2016, UNTS Vol. 3156, p. 3.

[68] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ("European Climate Law") *[OJ L 243, 9 July 2021, pp. 1–17].*

[69] Energy Charter Treaty, p. 95.

[70] Treaty establishing the Energy Community, signed in Athens on 25 October 2005, entered into force on 1 July 2006 *[OJ L 198, 20 July 2006, pp. 18–38].*

space. Contracting parties currently include Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, Serbia, and Kosovo (under UNSC Resolution 1244). The Energy Community's objectives are to foster a stable investment climate, integrate electricity and gas markets, strengthen security of supply, promote renewables and energy efficiency, and ensure the application of core elements of the EU acquis. The Energy Community institutions, supported by a Permanent Secretariat in Vienna, adopt binding decisions and recommendations that align the participating states with EU energy law, while also providing a framework for enforcement in case of persistent breaches.

Other international frameworks further influence EU energy law. The International Energy Agency (IEA)[71] imposes obligations on oil stockholding for its member states, which include most EU countries. The EU also concludes bilateral and multilateral energy agreements, ranging from long-term gas supply contracts to electricity grid synchronisation arrangements with neighbouring states. In recent years, energy diplomacy has become a key component of the Union's external action, with strategic partnerships developed with the United States, Norway, and key OPEC producers. Moreover, the EU has expanded its focus to the security of supply of critical raw materials necessary for the energy transition, embedding energy policy in trade and investment agreements with third countries.

Taken together, these international agreements illustrate the external dimension of EU energy law: the Union's internal market and climate ambitions are inextricably linked to its global commitments, regional partnerships, and energy diplomacy. The interplay between these legal and political instruments highlights how the EU positions itself not only as a regulatory actor at home but also as a global leader in shaping the governance of the energy transition.

g) Case law and judicial practice of the European Union

When we talk about energy law, we should not forget the decisions of the European Commission, whether in the field of state aid or competition law, which have significantly influenced the development trend and practice of energy law.

Also of great importance and considered as a source of European energy law are the case law and interpretations of the Court of Justice of the European Union (CJEU) which have developed the law. The Court of Justice of the EU (CJEU) and the General Court have shaped energy law through landmark rulings. Post-2017, one of the most consequential decisions was *Germany v. Poland (OPAL pipeline)*[72] in July 2021, where the CJEU elevated the principle of energy solidarity to a binding legal principle in EU law. The Court annulled a Commission decision that had allowed Gazprom increased use of the OPAL

[71] Agreement on an International Energy Program, Paris, 18 November 1974, establishing the International Energy Agency (IEA).

[72] *Germany* v. *Poland* (OPAL pipeline), C-848/19 P, Judgment of 15 July 2021, ECLI:EU:C:2021:598.

gas pipeline, finding that the Commission failed to consider the detrimental impact on Poland's energy security – thereby breaching the solidarity principle. This case clarifies that Article 194 TFEU's solidarity clause is justiciable, requiring EU measures to weigh the interests of all Member States in energy supply matters. Another seminal ruling was *Republic of Moldova v. Komstroy* (C-741/19, Sept 2021[73]), where the CJEU declared that the ECT's investor-state arbitration clause is incompatible with EU law for intra-EU disputes. This effectively bans intra-EU investment arbitration under the ECT (building on the 2018 *Achmea* judgment) and has catalyzed the aforementioned EU withdrawal from the treaty. The EU courts have also handled numerous state aid cases: in *Austria v. Commission (Paks II)*, the General Court in 2022 upheld the Commission's approval of Hungary's state aid for a nuclear plant, reinforcing that promoting nuclear energy is a legitimate choice and that EU state aid control cannot force a shift to other energy sources. In competition law, cases like *Gazprom*[74] (a 2018 Commission antitrust settlement) tested how to remedy abusive practices in a politically sensitive sector – a topic likely to recur as the Commission navigates energy companies' market power in times of crisis. Additionally, enforcement actions for failure to implement directives (for example, several infringement cases in 2020–2022 for late transposition of the 2019 electricity and gas directives) and decisions reviewing capacity mechanisms or renewable support schemes (often under state aid law in the Commission, with judicial appeals in Luxembourg) have added to the jurisprudence. The Court has generally supported EU measures fostering market integration and decarbonisation, while insisting on procedural propriety and respect for higher norms like environmental protection and solidarity.

In addition to Paks II, another major nuclear state aid case was *Hinkley Point*[75], where the CJEU dismissed Austria's appeal against the Commission's approval of UK support for the nuclear project. The judgment confirmed that Member States retain wide discretion in defining their energy mix under Article 194 TFEU, and that nuclear power remains a legitimate policy option. The Court emphasised that EU state aid control cannot be used to exclude particular energy sources from national strategies, thereby reinforcing the principle of technological neutrality.

Judicial review has also been decisive in the field of capacity mechanisms. In *Tempus Energy case*[76], the General Court annulled the Commission's decision

[73] *Republic of Moldova* v. *Komstroy* (C-741/19), Judgment of 2 September 2021, ECLI:EU:C:2021:655

[74] Commission Decision of 24 May 2018 relating to a proceeding under Article 102 TFEU and Article 54 of the EEA Agreement (Case AT.39816 – Upstream gas supplies in Central and Eastern Europe – Gazprom), C(2018) 3106 final.

[75] Case C-594/18 P, *Republic of Austria* v. *European Commission*, Judgment of the Court of Justice (Grand Chamber) of 22 September 2020, ECLI:EU:C:2020:742.

[76] Case T-793/14, *Tempus Energy Ltd and Tempus Energy Technology Ltd* v. *European Commission, Judgment of the General Court* (Eighth Chamber) of 15 November 2018, ECLI:EU:T:2018:790.

approving the UK capacity market without opening a formal investigation. The Court held that the Commission had failed to adequately assess the measure's compatibility with internal market rules, particularly the risk of discrimination against demand-side response operators. This case clarified that even in times of energy security concerns, the Commission must rigorously apply state aid procedures.

A further illustration is the *Ostrołęka case*[77], concerning Polish capacity mechanisms. The CJEU upheld the Commission's decision finding the scheme compatible with EU law but at the same time highlighted the importance of ensuring that such mechanisms do not create undue market distortions or undermine the EU's decarbonisation objectives. Together with Tempus Energy, the Ostrołęka ruling shows how the Courts are willing to scrutinise state aid for security of supply, while still allowing national flexibility if EU requirements of necessity, proportionality and non-discrimination are met.

h) Legal literature and soft laws

A rich body of academic commentary, expert reports, and soft law complements binding sources. The Commission and ACER issue guidelines, communications, and recommendations – for instance, the Commission's guidance on electricity market design (2022) and on implementing the new hydrogen targets. While not legally binding, these soft law instruments influence national regulators and market participants. Standard-setting organisations (CEN/CENELEC for technical standards in smart grids, for example) produce norms that, once referenced by legislation or widely adopted, effectively become part of the regulatory landscape. Academic discourse on EU energy law has expanded immensely after 2017, reflecting on topics such as the interaction between energy and climate law, the concept of energy justice, and the evolving role of consumers. This literature often informs law-making (e.g. ideas from scholars on energy poverty and consumer rights have fed into EU policy papers). In sum, the sources of EU energy law by 2025 are multi-layered, ranging from hard law in treaties and regulations to interpretative case law and persuasive soft law – together constructing a robust framework to drive Europe's historic energy transition.

And last but not least, in the context of the development of energy law, it is worth highlighting the work of the jurists and other practitioners who have contributed so much over the last thirty years not only to the interpretation and application of energy law, but also to the development of energy law.

[77] Case C-57/19 P, *Republic of Poland* v. *European Commission*, Judgment of the Court of Justice (Grand Chamber) of 28 October 2020, ECLI:EU:C:2020:841.

IV. SMART GRIDS IN THE EUROPEAN UNION

1. The European Union and smart systems

The fast-developing energy market aims to create real choice for all EU consumers, citizens and businesses, to open up new business opportunities and expand cross-border trade, thereby creating efficiency gains, competitive prices and higher levels of service, and to contribute to security of supply and sustainability.

The fundamental freedoms for EU citizens, including the free movement of goods, the freedom of establishment and the freedom to provide services, can only be achieved in a fully open market, allowing all consumers to choose their traders and energy traders to supply their customers freely. In order to ensure competition and the supply of energy at the most competitive price possible, Member States and national regulators should allow cross-border market access for energy from different energy sources. In order to promote competition in the internal market for electricity and natural gas, consumers should be able to choose their trader and to contract with more than one trader to meet their energy needs.

While the 2020 target of 80% smart meter penetration was ambitious, implementation across the Union has been uneven. According to Commission and ACER reports, by 2020 only a limited number of Member States – including Italy, Sweden, Finland and Spain – had reached or exceeded full roll-out, often surpassing 90% of households. Others, such as Germany, Belgium or Portugal, significantly lagged behind, citing high costs, limited consumer benefits, or technical barriers. As a result, by 2023 the EU average penetration of smart electricity meters stood at around 57%, with gas smart meters remaining even less widespread. This divergence highlights the structural and regulatory differences across Member States, despite the harmonised objectives set at EU level.

The current Electricity Directive (EU) 2019/944[78] reinforces the Union's commitment to smart metering. It requires Member States to ensure deployment "where cost-benefit assessments are positive," while guaranteeing interoperability, data protection, and consumer access to real-time consumption data. This legal framework not only seeks to enhance transparency and consumer

[78] 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 *[OJ L 158, 14 June 2019, pp. 125–199]*.

empowerment but also to integrate smart meters into the broader digitalisation of the energy system, in line with the 2022 Action Plan on Digitalising the Energy System[79].

Smart grids and metering are increasingly recognised as crucial enablers of the clean energy transition. They facilitate demand response, support the integration of decentralised renewable generation, and lay the groundwork for e-mobility and prosumer participation in local energy communities. At the same time, the uneven roll-out poses risks of a "two-speed Europe," where consumers in advanced markets benefit from innovative services, while others remain in traditional supply arrangements. Bridging this gap remains a central regulatory challenge, as the EU seeks to align its internal energy market with climate neutrality objectives under the European Climate Law and the REPowerEU Plan[80].

2. The regulatory framework

The rules currently in force for the EU energy market are set out in the so-called "Clean Energy for All Europeans" package, often referred to as the Fourth Energy Package. Adopted in 2019, this legislative framework recast the previous rules of the Third Energy Package and significantly modernised the internal electricity market. Its central instrument is Directive (EU) 2019/944[81] on common rules for the internal electricity market, complemented by Regulation (EU) 2019/943[82].

Within the energy market, and in particular the electricity market, several key objectives must be pursued simultaneously. The first is the issue of security of supply. As provided in the 2019 directive, the internal electricity market aims to create real choice for all consumers in the Union – citizens and businesses alike – open new business opportunities, expand cross-border trade, and thereby generate efficiency gains, competitive prices, higher levels of service, and contribute to the security and sustainability of supply.

Consumer protection continues to play a central role. Industry, commerce, and small and medium-sized enterprises, as well as all EU citizens who benefit from the economic advantages of the internal market, should also enjoy a high level of consumer protection. In particular, household consumers – and, where appropriate, small businesses – are entitled to public service guarantees,

[79] European Commission, Communication "Digitalising the energy system – EU Action Plan".

[80] European Commission, Communication REPowerEU Plan.

[81] 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 [2019] *OJ L 158/125*.

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

especially with respect to security of supply and fair tariffs, in order to ensure fairness, competitiveness, and indirectly, job creation.

Directive (EU) 2019/944 also reinforces competition. To enable consumers to take full advantage of the opportunities offered by a liberalised internal market for electricity, Member States must attach the utmost importance to ensuring fair competition among suppliers and facilitating access to the market and to new generation capacity. Crucially, the 2019 framework introduced enhanced rights for "active customers" and energy communities, strengthened the rollout and minimum functionalities of smart metering systems, and established clearer provisions on data access, interoperability, and consumer empowerment.

3. Smart Metering and the Drive for Digitalisation

A significant innovation of the Third Energy Package[83] was its push toward smart metering systems as a tool for consumer empowerment and energy efficiency. Member States were obliged to assess the cost-effectiveness of smart electricity meters, and if beneficial, proceed with a wide-scale rollout. EU policy set a clear ambition: by 2020, at least 80% of consumers should be equipped with smart meters in those countries where the cost-benefit analysis was positive. These smart meters record energy consumption in real time and enable two-way communication between the user and the utility. The goal was to provide consumers with detailed feedback on their usage and to facilitate new services such as time-of-use pricing (where electricity tariffs are lower at off-peak times), thereby incentivizing more efficient energy use. Indeed, under EU rules, consumers must be offered meters that accurately reflect their actual consumption and time of use, enabling informed choices and demand-side management. In parallel, the Energy Efficiency Directive 2012/27/EU[84] (which updated a 2006 law that time) required that final customers receive individualized consumption information – reinforcing the mandate for smart meters and better billing data as part of the EU's energy-saving efforts.

Progress on smart meter deployment has been substantial: by 2020, most Member States had rolled out millions of smart electricity meters, collectively covering well over 80% of EU households, while others obtained derogations where cost assessments did not justify full rollout. The benefits of smart metering

[83] 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*.

[84] Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC *[OJ L 315, 14. 11. 2012, pp. 1–56].*

include not only improved billing accuracy and consumer awareness, but also easier supplier switching and integration of distributed renewable generation (since bidirectional metering can credit households for feeding power (e.g. from solar panels) into the grid).

Building on the foundation of smart meters, the EU has more recently turned its focus to the broader digitalisation of the energy system. In 2022 the European Commission adopted the Digitalising the Energy System Action Plan[85], which outlines measures to boost data sharing, smart-grid investments, and cybersecurity in the electricity and gas networks. The Commission envisions massive investments in modern grid infrastructure – an estimated €170 billion dedicated to digitalisation out of €584 billion in power grid investments needed by 2030. This includes deploying next-generation smart meters, sensors, automated grid management systems, and data hubs. A reconstituted Smart Grids Task Force (now the "Smart Energy Expert Group") has been tasked with advising on regulatory updates for data interoperability and standards. By harnessing digital technology, the EU aims to create "smart" energy grids that can self-balance, incorporate many renewable sources, and enable consumers to participate actively (for example, through demand response programs or community energy sharing). Cybersecurity and data privacy are recognized as critical challenges in this digital transition, and new EU rules (like the 2023 Cybersecurity Regulation for energy) are being implemented to protect critical energy infrastructure. In short, the roll-out of smart metering and the broader digitalisation agenda are key enablers for the EU's twin goals of an efficient internal energy market and the green transition.

4. Smart Grids: Key Role in Decarbonisation

As Europe modernizes its energy networks, the concept of "smart grids" has become central to energy policy. A smart grid is commonly defined as an advanced electricity network that cost-efficiently integrates the behavior and actions of all users connected to it – producers, consumers and those who are both (prosumers) – in order to ensure an economically efficient, sustainable power system with low losses, high quality, security of supply, and safety. In practical terms, a smart grid uses digital communications, automated control technologies and real-time data to dynamically manage electricity flows. This bidirectional communication – between suppliers and consumers – allows the grid to respond to changes in supply or demand quickly and to optimize the performance of the system as a whole.

[85] European Commission, Communication "Digitalising the energy system – EU Action Plan".

One hallmark of a smart grid is the ability of consumers to actively participate. For example, appliances or electric vehicles can adjust their charging times based on price signals or grid needs, and households can become energy producers (via rooftop solar panels) selling excess power back to the grid. Through such innovations, consumers gain unprecedented opportunities to control and reduce their energy consumption, especially when smart grids are coupled with time-varying tariffs or demand response programs. At the same time, network operators benefit from finer control – monitoring grid conditions in real time and detecting faults or bottlenecks more quickly – which improves reliability and reduces operational costs.

The European Commission has identified smart grids as "a key enabler for a low-carbon electricity system", vital for achieving climate goals. They are considered the "backbone" of the future decarbonised energy system, because they allow much higher shares of renewable energy to be integrated reliably. Variable renewable sources like wind and solar are often decentralized and intermittent; smart grids can balance these fluctuations by flexibly managing demand (for instance, by temporarily reducing consumption when supply is low) and by efficiently distributing power from many small generators. Smart grids also facilitate the electrification of transportation (e.g. charging infrastructure for electric vehicles) and decentralized storage (such as batteries), which will be crucial for reducing emissions in other sectors. The EU's 2050 long-term strategy explicitly notes that investments in smart grids promote demand-side energy efficiency, enable distributed generation, and support the shift to electrified transport.

From an economic perspective, the deployment of smart grids is expected to spur innovation and growth. It opens the energy sector to new market entrants, such as IT and telecom companies offering energy management services, alongside traditional utilities. European technology firms – many of them small and medium-sized enterprises – have an opportunity to become leaders in smart grid technologies globally, from advanced metering to AI-driven grid analytics. The EU also stresses that this transition must respect data protection and cybersecurity, ensuring that the digital grid infrastructure is resilient against cyber threats.

In summary, smart grids represent the convergence of the energy transition and the digital revolution. EU legislation (notably the Third Package and subsequent directives) has laid the groundwork by mandating smart metering and encouraging innovation-friendly grid regulation. Moving forward, smart grids will form the neural system of a decarbonised, secure, and consumer-centric energy sector – enabling Europe to meet its climate commitments while preserving a reliable supply of affordable energy.

5. The obligation to implement smart metering systems

The Directives was set the objective of introducing smart metering systems. However, the introduction of smart metering systems should be based on an economic evaluation. If the evaluation concludes that the introduction of such metering systems is economically reasonable and cost-effective only for consumers of a certain amount of electricity, Member States may take this into account when introducing smart metering.[86] In order to promote energy efficiency, Member States or, where the Member State has so provided, the regulatory authority, shall strongly encourage electricity undertakings to optimise electricity consumption, for example by providing energy management services, developing innovative pricing formulas or introducing smart metering systems or, where appropriate, smart grids. For example, Member States are encouraging the modernisation of distribution networks through the creation of smart grids, which should be implemented in a way that encourages decentralised electricity generation and ensures energy efficiency[87]. The Directive required least 80% of consumers to be equipped with smart metering by 2020 .[88]

6. Definition of smart grids

Innovation in the products and services offered to European citizens and businesses is increasingly becoming the key to economic growth in the European Union. Innovation is also helping to tackle one of the main challenges facing Europe today: ensuring the efficient and sustainable use of natural resources. This thinking must also be reflected in the design of the future energy infrastructure. Without major upgrades to existing networks and metering systems, renewable energy production will stagnate, grid security will be compromised, opportunities for energy savings and efficiency will be missed, and the pace of development of the internal energy market will be greatly slowed.[89]

Smart grids are defined by the European Smart Grid Task Force as electricity networks that effectively integrate the behaviour and actions of all users (producers, consumers and both) connected to the grid to ensure the availability of an economically efficient, sustainable, low-loss, high quality, secure and safe electricity system.

[86] Directive 2009/72/EC (55) Preamb.
[87] Directive 2009/72/EC (27) Preamb.
[88] Directive 2009/72/EC, Annex I, point 2.
[89] Smart grids: from innovation to deployment: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, 12.4.2011. COM(2011) 202

Smart grids can be characterised as upgraded electricity networks with two-way digital transmission between supplier and consumer, and smart metering and monitoring systems. Smart grids usually include smart metering as an integral part.

Smart grids enable direct interaction and communication between consumers, households, businesses, other network users and energy suppliers. Consumers thus have unprecedented opportunities to directly control and influence their individual consumption patterns, making it attractive for them to switch to more efficient energy use, especially when coupled with time-of-use pricing. More efficient, targeted management increases the security and cost-effectiveness of network operation. Smart grids will be the backbone of the future decarbonised energy system. They will help integrate large amounts of marine and onshore renewable energy into the system and, while promoting the uptake of electric vehicles, will continue to ensure the availability of traditionally generated energy and balance the energy system. The deployment of smart grids will provide an opportunity for EU technology providers, mainly SMEs in the electrical and electronics industry, to become more competitive and leaders on the global technology scene.

Smart grids provide a platform for traditional energy companies and new entrants such as ICT companies (including SMEs) to develop new innovative energy services, while taking due account of data protection and cyber security challenges. This dynamic process is expected to sharpen competition in the retail market, promote the reduction of greenhouse gas emissions and create opportunities for economic growth.

The provisions of the Third Energy Package, and in particular Annex I, point 2 of the Electricity Directive 2009/72/EC, oblige Member States to assess the implementation of smart metering systems (which are crucial for the implementation of smart grids) and to install 80% of the meters that are positively assessed. Smart grids can also be seen as a means for Member States to fulfil their obligation to promote energy efficiency. The Energy End-Use Efficiency and Energy Services Directive 2006/32/EC (the revision of which is currently under consideration by the Commission[90]) also requires metering that accurately reflects the actual energy consumption of the final customer and provides information on the actual period of use.

Regarding the long-term importance of smart grids, the Commission Communication "*Roadmap for a competitive low-carbon economy in 2050*"[91] states that smart grids are of particular importance for a low-carbon economy, as they promote demand-side efficiency, the deployment of renewable energy, distributed generation and the electrification of the transport sector.

[90] Energy Efficiency Plan 2011, COM(2011) 109.

[91] Communication from the Commission: A Roadmap for moving to a competitive low carbon economy in 2050 COM(2011) 112/4.

7. An overview of the legal regulation of smart and controlled devices

Over the past decade, some 300 smart grid projects have been launched in Europe, with more than EUR 5.5 billion invested. The EU budget contributed approximately EUR 300 million to this. The actual roll-out of smart grids in the EU is still in its early stages. Currently, only about 10% of EU households have some form of smart metering installed, and most of these do not necessarily provide a full range of services to consumers. However, consumers with smart meters have still been able to reduce their energy consumption by 10%. The results of some pilot projects suggest that the actual energy savings could be even greater. Other pilot projects have shown that smart grids significantly reduce CO2 emissions. The *Smart* 2020 study[92], which examines the global impact of smart grids, estimates that CO2 emissions have been reduced by 15%.

Smart grids are expected to create new jobs and generate further economic growth. At present, however, there is a significant gap between actual and optimal levels of investment in Europe, which can only be partly explained by the current economic downturn. Investment costs are likely to fall primarily on network operators and suppliers. At the same time, network operators will be reluctant to make major investments until a fair cost-sharing system is developed and a balance is found between the investment costs required in the short term and the expected benefits in the longer term.

Investors are currently working on an optimal model for sharing costs and benefits along the value chain. It is unclear how the complex systems of smart grids can be integrated, how cost-effective technologies can be selected, which technical standards will prevail for future smart grids, and whether consumers will accept the new technology at all.

According to the European Commission, it is advisable to focus on the following: developing technical standards; ensuring the protection of consumer data; creating a regulatory framework that encourages the use of smart grids; ensuring an open and competitive retail market in the interests of consumers; and ensuring continuous support for technological and system innovations.

[92] SMART 2020: Enabling the low carbon economy in the information age

8. Basic legal framework for smart meters

a) The growing share of renewable energy sources

Smart energy networks are an important step towards conscious consumer behavior and higher energy efficiency, and they are also an innovation that will allow a greater proportion of electricity generated from renewable energy sources to be fed into the grid than has been possible until now.

In the context of the deployment of smart metering systems, a key task and prerequisite is the development of technical and legal solutions to ensure the protection of personal data, which is a fundamental right enshrined in Article 8 of the Charter of Fundamental Rights of the European Union and Article 16 of the Treaty on the Functioning of the European Union. Member States and stakeholders should ensure that the use of smart metering systems is monitored and that the fundamental rights and freedoms of individuals are respected, particularly during the initial phase of the roll-out of smart meters.

With the roll-out of smart energy networks becoming a reality, particular attention should be paid to the security and protection of personal data processed by smart metering systems. All those involved in data processing in the context of smart metering systems should take all reasonable steps to ensure that the data cannot be linked to an identified or identifiable person by the network operator or any other third party using any method likely to be used, unless it processes the data in accordance with applicable data protection principles and legislation.

b) Smart Meters in the Member States of the European Union

The European Union has progressively built a legal framework to promote the rollout of smart energy meters for electricity and gas. The Third Energy Package (2009) required Member States to prepare for the implementation of intelligent metering systems "for the long-term benefit of consumers," conditional on a positive economic assessment of costs and benefits. For electricity, the EU set a *non-binding* target of rolling out smart meters to at least 80% of consumers by 2020 in cases where the cost-benefit analysis (CBA) was positive. In the gas sector, no specific EU-wide deadline was imposed; instead, an EU interpretative note advised that smart gas metering should be achieved within a "reasonable period of time".

Complementing the Third Package, the Energy Efficiency Directive (2012)[93] encouraged using smart meter data to develop energy services like demand-response and dynamic pricing, while explicitly mandating respect for personal data protection and consumer rights (as enshrined in Articles 8 and 38 of the

[93] Directive 2012/27/EU of the European Parliament and of the Council of 25 October *[OJ L 315, 14.11.2012, pp. 1–56]*

EU Charter of Fundamental Rights). This ensured that the push for digital metering went hand-in-hand with safeguarding data privacy and a high level of consumer protection.

In 2019, the *Clean Energy for All Europeans* package updated these requirements. The Electricity Directive (EU) 2019/944 obliges Member States with positive CBA results to proceed with smart meter rollouts on a clear timeline. Each country had to develop a 10-year roadmap for deployment, aiming to reach at least 80% smart meter coverage within seven years of the assessment (or by 2024 for those who had begun rollouts earlier). The 2019 Electricity Directive also set minimum functional requirements for new smart meters – for example, ensuring meters support consumer data access, remote reading, and compatibility with dynamic pricing – so that the devices facilitate active consumer participation in the energy market. National authorities are required to monitor these deployments to ensure that the systems deliver benefits to consumers and the energy system.

Throughout these policy developments, the EU has stressed that modern metering infrastructure must respect privacy and cybersecurity. All smart metering systems must comply with the General Data Protection Regulation (GDPR) and other data protection rules, given that they handle granular consumption data. In practice, this means privacy by design in meter data handling and giving consumers control over their data. Recent EU actions also strengthen this aspect – for instance, in 2023 the European Commission adopted an Implementing Regulation (EU) 2023/1162[94] to improve interoperability and non-discriminatory access to metering data. This measure is meant to empower consumers (and their authorized service providers) with easier access to energy usage data, while maintaining high cybersecurity standards. In July 2024, additional guidance was issued to streamline Member States' reporting on smart meter implementation, further solidifying a consumer-centric and secure approach to smart metering.

c) Progress of Smart Meter Deployment in Europe

There has been considerable progress in smart meter deployment across EU Member States over the past decade. Following 2012's CBA deadline, more than two-thirds of EU countries found positive business cases for electricity smart meters and committed to large-scale rollouts. By 2014, three early adopters – Finland, Italy, and Sweden – had already installed nearly 45 million smart electricity meters, about 23% of the total EU installations projected at that time. These countries were pioneers, each effectively reaching full deployment well before 2020. For example, *Italy* completed its first nationwide rollout by

[94] Commission Implementing Regulation (EU) 2023/1162 of 6 June 2023 on interoperability requirements and non-discriminatory and transparent procedures for access to metering and consumption data *[OJ L 151, 7 June 2023, pp. 1–24].*

2011, *Spain* reached virtually 100% installation by 2018 under a government mandate, and *Sweden* and *Finland* both achieved near-100% coverage in the 2010s (Sweden by 2009 and Finland by 2014) and have since moved on to upgrading meters to second-generation systems[95]. Several other mid-sized countries like *Estonia* (≈98% by 2017) and *Denmark* (≈80% by 2019) also met or exceeded the 80% benchmark early. These success stories show that, at least in some national contexts, the 80% target from the Third Energy Package was not only met but surpassed.

By contrast, a number of Member States lagged behind the initial targets, due to either negative CBAs or delayed policy decisions. As of the early 2020s, countries including the Czech Republic, Greece, Croatia, and Cyprus had only limited pilots or decided against extensive electricity smart meter rollouts, largely because the expected costs outweighed the benefits in their analyses. Germany – Europe's largest electricity market – initially took a cautious approach: its 2013 CBA was inconclusive/negative for a full rollout, so Germany pursued a limited deployment focused on larger consumers. However, this stance recently shifted. In 2023 the German government passed a new law to accelerate smart meter installation, making rollouts mandatory from 2025 with binding targets to reach 100% coverage by 2030. This policy reversal was driven by the recognition that smart metering is critical for Germany's energy transition and digitalisation goals. Other large countries like France and Poland also ramped up efforts in the late 2010s: France's *Linky* program, launched in 2015, has installed tens of millions of smart electricity meters (approaching full coverage by 2021–2022), and Poland set a legal mandate to equip 80% of households with smart meters by 2028.

EU-wide, the deployment is steadily increasing but has not yet reached universality. According to ACER (the EU Agency for the Cooperation of Energy Regulators), about *54% of European households* had an electricity smart meter by the end of 2021[96]. By the end of 2022, at least *13 EU countries* had exceeded 80% penetration of smart electricity meters in households. This means that a majority of EU members have either met or are on track to meet the original 80% objective, even if the EU as a whole fell short of the 80%-by-2020 aspiration. In total numbers, EU commitments as of the late 2010s projected roughly 200 million smart electricity meters to be installed by the early 2020s. The latest market data (including the UK in European figures) indicated that about 56% of all EU+UK electricity customers had a smart meter by 2022, and the rollout

[95] Smart meter deployment in the EU: which countries are leading and which are trailing? https://www.tripica.com/blog/smart-meter-deployment-the-impact-on-eu-households#:~:text=to%20complete%20the%20%E2%82%AC500%20million,smart%20grid%20funding%20for%20Spain

[96] Smart grids and meters. https://energy.ec.europa.eu/topics/markets-and-consumers/smart-grids-and-meters_en#:~:text=According%20to%20the%20EU%20Agency,at%20the%20end%20of%202022

continues to grow as lagging countries catch up. Many of the early movers are now in second phases (deploying newer devices or expanding functionality), while later adopters are accelerating installations to comply with the 2019 directive's timeline (e.g. planning to hit 80% by mid-decade).

d) Smart Metering in the Gas Sector

Rolling out smart meters for natural gas has proven more challenging and slower than for electricity. The benefits of gas smart metering (such as operational savings and more accurate billing) are generally smaller than those for electricity, and the Third Energy Package left gas deployment timelines to Member States' discretion. In 2014, only a handful of countries had committed to full smart gas meter rollouts by 2020 – notably Ireland, Italy, Luxembourg, the Netherlands, and the UK – while several others were conducting trials or planning partial deployments. Many countries' CBAs for gas metering came out negative, leading them to postpone or scale down plans. For instance, Germany, Austria, and most of Eastern Europe did not move forward with mass gas meter replacements in the 2010s due to unclear profitability or lack of a compelling case, and some countries (Malta, Cyprus) have no gas distribution network at all.

Nonetheless, progress is being made in some regions for gas meters. Italy has been actively installing smart gas meters for its consumers over the past decade, and France launched the *Gazpar* program (run by GRDF) which began in 2015 and was completed around 2022, replacing roughly 11 million gas meters with smart versions. The Netherlands also pursued a dual-fuel approach, rolling out smart meters for both electricity and gas to most households by the early 2020s. According to a market analysis by Berg Insight, the installed base of smart gas meters in Europe reached about 55.9 million units in 2023, which corresponds to roughly *45%* of all gas customers being equipped. This is a substantial increase from about 40% penetration estimated for 2020[97], showing that smart gas metering is gradually catching up. Still, gas smart meter penetration remains lower than electricity's, and in several Member States the business case for gas meters is still not convincing. The ongoing decarbonisation of heating (e.g. switching from natural gas to electric heat pumps in some countries) also casts some uncertainty on future gas consumption levels, making regulators cautious about major new investments in gas metering infrastructure. Where smart gas meters are being deployed, it is often driven by specific national strategies or regulatory mandates rather than an EU-wide requirement.

[97] REPORT FROM THE COMMISSION Benchmarking smart metering deployment in the EU-27 with a focus on electricity /* COM/2014/0356 final */

e) Costs and Benefits of Smart Metering

Smart metering is widely regarded as a *win-win solution* for consumers and the energy system, although costs and benefits vary by country. Financially, a smart meter system (per metering point) was found to cost about €200–250 on average per customer in earlier EU studies. Newer assessments show costs have come down slightly – about €180–200 per meter on average in the EU as of 2019. There is considerable variation: some large-scale deployments achieved very low unit costs (for example, Italy's first rollout and Malta's system were around €80–€100 per meter), whereas other cases (like a planned rollout in the Czech Republic) were estimated as high as €700+ per meter. These cost differences depend on factors such as labor costs, meter functionality, communication infrastructure choices, and geography. Importantly, most Member States finance electricity meter rollouts through regulated network tariffs (DSOs recover the costs via small surcharges on bills), spreading the investment over time.

The benefits generated by smart meters tend to outweigh these costs in the long run in positively assessed scenarios. A 2019 EU-wide study estimated that *each smart meter* yields about €270 in gross benefits for electricity over its lifetime (to be shared among consumers, suppliers, and network operators), and about €230 per smart gas meter, thanks to efficiency gains. Energy savings at the consumer level are a key part of these benefits: by providing detailed, real-time feedback on usage, smart meters encourage consumers to reduce waste – typically achieving 2–10% energy savings on average.[98] These savings come from behavioural changes (customers seeing their consumption patterns and adjusting accordingly) and from new pricing schemes (e.g. shifting usage to off-peak times to take advantage of cheaper rates). For the *energy system*, smart meters also unlock operational and strategic benefits that, while harder to quantify, are very significant. For instance, distribution system operators can detect outages or anomalies faster and pinpoint issues remotely, plan network investments more precisely, and reduce manual meter reading and administrative costs – all of which ultimately filter down into cost savings for consumers through lower network charges. On a broader scale, having timely consumption data from across the grid enables more effective integration of renewable energy and new technologies: utilities can manage variable solar/wind generation by incentivizing demand response, and consumers with electric vehicles or home batteries can participate in flexibility services because smart meters measure energy flows accurately in near-real-time.

Overall, where smart metering has been deployed, consumer satisfaction tends to increase due to more accurate billing (ending estimated bills and surprise corrections) and improved energy awareness. However, it's noted that the business case for smart meters can depend on local factors. In countries

[98] The EU's Smart Metering Imperative

with relatively stable or low electricity prices, or where old meters were cheap to read, the economic payback of smart meters is slower – this contributed to some hesitant rollouts in the past. As technology costs fall and as the energy system transforms (with greater need for consumer flexibility), the case for smart meters is strengthening even in those trailing countries. The encouraging results from the majority of EU nations – where rollouts have surpassed 80% of consumers and are delivering positive outcomes – suggest that smart meters are a foundational investment for the future-proof digital energy grid.

9. Key Benefits of Smart Meters

- **Accurate and Transparent Billing:** Smart meters automatically record actual consumption and transmit data remotely, which eliminates estimated bills and billing errors. Consumers are billed only for the energy they actually use, ending the problem of unexpected "back-billing" adjustments.
- **Energy Savings for Consumers:** By seeing detailed usage data (often available through in-home displays or web portals), consumers can identify wasteful patterns. Studies indicate that households with smart meters achieve about 2–10% reductions in energy consumption on average, thanks to this increased awareness and the ability to adjust habits. These savings directly translate to lower utility bills.
- **Cost Savings and New Services:** Over the lifetime of a meter, the aggregate savings enabled by smart metering (through energy conserved, peak demand reduced, and operational efficiencies) are estimated around €270 per electricity meter **and** €230 per gas meter. Smart meters also open the door to innovative services – for example, energy suppliers can offer dynamic pricing **or** time-of-use tariffs (cheaper rates at off-peak times) and other tailored plans that empower consumers to save money by shifting their consumption patterns. Furthermore, automation allows for convenient services like remote meter reading, real-time outage notifications, and faster switching between suppliers.
- **Grid Efficiency and Reliability:** For energy companies and grid operators, widespread smart metering provides granular, real-time data on electricity flows. This improves grid management, allowing operators to balance supply and demand more effectively and quickly detect and isolate outages or losses. Utilities can better plan infrastructure upgrades with accurate load profiles, potentially deferring expensive investments by optimizing the existing network. In the long term, this can reduce the overall costs of operating the grid (benefiting consumers via tariff reductions).

- **Renewables Integration and Flexibility:** Smart meters are a key enabler for the clean energy transition. They support demand-side response programs by tracking when electricity is used, thus allowing consumers or automated systems to reduce consumption during peak times or when renewable generation is low. This flexibility helps integrate higher shares of solar and wind energy on the grid by smoothing out demand peaks. Smart meters also facilitate emerging models like energy communities and peer-to-peer energy sharing, where consumers who produce their own renewable power (for example via rooftop PV panels) can feed electricity into the grid and get accurately credited for it. In sum, smart metering data makes the energy system more interactive and resilient, which is crucial for meeting the EU's climate goals.

10. Consumer Protection and Data Privacy

From the outset, EU smart metering initiatives have been accompanied by strong measures to protect consumer rights and privacy. The right to personal data protection is guaranteed by Article 8 of the EU Charter of Fundamental Rights, and this applies to the detailed consumption data that smart meters generate. EU legislation (both the older directives and newer regulations) requires that consumers be informed and their privacy respected during smart meter rollouts. In practical terms, this means data collected by smart meters belongs to the consumer, and its processing is subject to GDPR rules on consent, transparency, and security. Utilities and metering companies must implement high standards of cybersecurity to prevent unauthorized access to meter data. The EU's 2019 *Cybersecurity Act* and sector-specific standards mandate that smart grid components, including meters, have appropriate security certifications and protections. For example, many smart meter systems use encryption and secure communication protocols (such as the DLMS/COSEM standard) to safeguard data in transit and at rest.

At the national level, some regulators have gone further to reassure the public. In Austria, for instance, regulations allow consumers to opt out of the granular reporting – customers can choose to have their smart meter upload data less frequently (e.g. only once a day or month, instead of every 15 minutes) to address privacy concerns. Such measures aim to give individuals control over how detailed their energy profile is. Additionally, Member States and the EU have developed guidelines for conducting *Data Protection Impact Assessments* in smart grid projects, ensuring privacy considerations are built in from the design phase of these systems.

On the consumer protection side, beyond privacy, the EU also emphasizes that smart metering should benefit consumers through better information and

service, not burden them. Article 38 of the EU Charter affirms a high level of consumer protection, which underpins policies like requiring that smart meters be installed at no upfront cost to the average consumer in many countries (costs are spread in tariffs), and that consumers receive clear communication and advice during the rollout. EU guidelines have insisted that customers be properly informed about the installation of smart meters, how to use in-home displays or data portals, and how to access potential advantages like switching to a dynamic pricing contract. This comprehensive approach – combining technological upgrades with privacy safeguards and consumer-centric policies – is ensuring that the transition to smart meters in Europe proceeds in a balanced and acceptable way.

In conclusion, the deployment of smart meters across EU Member States is a critical component of the Union's energy modernisation efforts. While progress has been uneven, the general trend is a broad move toward intelligent metering infrastructure that empowers consumers, improves energy efficiency, and facilitates the clean energy transition. Ongoing initiatives continue to address the challenges (economic, technical, and social) so that both electricity and gas consumers throughout the EU can eventually enjoy the full benefits of smart metering under robust protection of their rights.

V. DATA PROTECTION MEASURES FOR SMART GRIDS

1. Data management rules

When determining the scope of data that can be processed within smart energy networks, Member States should take all necessary measures to ensure that, as far as possible, anonymized data is used, thus ensuring that individuals cannot be identified. When collecting, processing, and storing personal data, Member States shall ensure that the data used is adequate and relevant. Data collection must be limited to the information that is most necessary for the purpose of the processing, and the data must be stored in such a way that the identification of the data subjects is only possible for as long as it is necessary for the purpose of the processing of personal data.

The processing of personal data by and within smart metering systems was considered lawful if it met one or more of the criteria listed in Article 7 of Directive 95/46/EC. Furthermore, the processing of personal data by third parties providing value-added energy services also had to be lawful and based on at least one of the six requirements set out in Article 7 of Directive 95/46/EC[99] .

2. GDPR rules for smart systems

In the transforming energy market, thanks to new technologies, fundamental changes are expected in two areas: data protection and data security, and the possibility of using available data in the energy sector.

[99] Article 7 of Directive 95/46/EC: „Member States shall provide that personal data may be processed only if:
(a) the data subject has given his or her explicit consent; or
(b) processing is necessary for the performance of a contract to which the data subject is party or in order to take steps at the request of the data subject prior to entering into a contract; or
(c) processing is necessary for compliance with a legal obligation to which the controller is subject; or
d) processing is necessary for the protection of the vital interests of the data subject; or
e) processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller or in a third party to whom the data are disclosed; or
f) processing is necessary for the purposes of the legitimate interests pursued by the controller or by the recipient or by a third party, except where such interests are overridden by the interests or fundamental rights and freedoms of the data subject in particular his or her right to privacy with regard to personal data.

When determining the scope of data that can be processed within smart systems, all necessary measures must be taken to ensure that anonymized data is used as far as possible, thus ensuring that individuals cannot be identified in the future. When collecting, processing, and storing personal data, it must be ensured that the data used is appropriate and relevant. Data collection must be limited to the information that is most necessary for the purpose of processing, and data must be stored in such a way that it allows the identification of data subjects only for as long as is necessary for the purpose of processing personal data.

The processing of personal data by and within smart metering systems is considered lawful if it meets the criteria set out in the General Data Protection Regulation ("GDPR").[100] Furthermore, the processing of personal data by third parties providing value-added energy services must also be lawful.

Where processing is based on the consent of the data subject, consent must always be freely given, specific, informed and unambiguous, and the data subject must give their consent separately for each value-added service. The data subject must have the right to withdraw consent at any time. Withdrawal of consent should not affect the lawfulness of processing based on consent before its withdrawal.

EU Member States should clearly define the roles and responsibilities of data controllers and data processors. Before processing operations commence, Member States should carry out an analysis to determine the extent and duration of the need for service providers and network operators to retain personal data for the maintenance and operation of smart energy networks and for billing purposes. New types of smart energy services typically use cloud-based infrastructure due to its dynamic and scalable nature, which has implications for data protection.[101]

Where processing is based on the consent of the data subject, consent must always be freely given, specific, informed and unambiguous, and the data subject must give their consent separately for each value-added service. The data subject should have the right to withdraw consent at any time. Withdrawal of consent should not affect the lawfulness of processing based on consent before its withdrawal.

Member States should clearly define the roles and responsibilities of data controllers and data processors. Before processing operations commence, Member States should carry out an analysis to determine the extent and

[100] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance) *[OJ L 119, 4.5.2016, p. 1]*

[101] The data protection issues of cloud services are discussed in detail in: KLEIN, 2018a, pp. 89–122. and KLEIN, 2018b, pp. 68–86.

duration of the need for service providers and network operators to retain personal data for the maintenance and operation of smart energy networks and for billing purposes.

3. Data security

Member States shall ensure that the security of personal data is guaranteed from the initial stage of network deployment, by applying the principle of data protection by design. This involves implementing measures to protect personal data against accidental or unlawful destruction, accidental loss, and all forms of unlawful processing, in particular the unauthorized disclosure, dissemination, alteration, and unauthorized access to personal data. It is advisable to use encrypted channels, as this is one of the most effective technical solutions against misuse. Member States should ensure that all current and future components of smart energy networks comply with the "security-related" standards developed by European standardisation organisations, including the basic requirements for information security in smart energy networks set out in the Commission's standardisation mandate M/490. the essential requirements for information security in smart energy networks. International security standards, in particular the ISO/IEC 27000 series of standards ("*ISMS family of* standards"), should also be taken into account. Member States should ensure that, in accordance with Article 4 of Directive 2002/58/EC, in the event of a personal data breach, the controller notifies the supervisory authority and the individuals concerned without undue delay (preferably within 24 hours of becoming aware of the breach) the supervisory authority and those individuals whose personal data may be adversely affected by the breach.

4. Consumers at the heart of the Energy Union

If industrial, commercial and residential consumers can be fully integrated into the energy system, there will be significant savings in energy reserves, the costs of which would otherwise have to be paid by consumers. However, they could even benefit from price fluctuations and earn money by participating in the market. Engaging consumers is therefore a prerequisite for a successful and cost-effective energy transition.

One of the most important commitments of the Energy Union is to strengthen the position of consumers. However, current market rules often prevent consumers from taking advantage of new opportunities. Although they can generate and store electricity and influence their energy consumption more

easily than ever before, the current structure of the retail market does not allow them to fully exploit these advantages.

In most Member States, final consumers have little or no incentive to change their energy consumption in response to market price changes, as they do not receive real-time price signals. The market design package now provides an opportunity to deliver on this commitment. More transparent, real-time price signals encourage consumer participation in the market (at both individual and aggregate levels) and make the electricity system more flexible, facilitating the integration of electricity from renewable energy sources. Thanks to technological developments, households can save a lot of energy, while appliances and systems such as smart home appliances, electric vehicles, electric heating, air conditioning systems and heat pumps in insulated buildings, and district heating and cooling can automatically adapt to price fluctuations and flexibly connect to the electricity grid, playing a significant role at the system level. In order for consumers to benefit financially, it is important that they have access to well-functioning, intelligent systems and that they enter into electricity supply contracts that guarantee dynamic prices linked to the spot market.

In addition to consumers influencing their energy consumption in response to price signals, new demand-side services are also emerging: certain new market players undertake to manage the electricity consumption of a specified number of consumers, who are compensated for their flexibility. Although these services are already supported by existing EU legislation, practical experience shows that the current provisions are not effective enough to remove the primary market barriers preventing these service providers from entering the market. The relevant provisions need to be strengthened in order to promote the wider uptake of such new services.

Thanks to rapidly falling technology costs, more and more consumers can afford to reduce their energy bills by installing rooftop solar panels and solar cells. However, self-consumption is still hampered by the lack of common rules for so-called "prosumers". These obstacles could be removed by appropriate rules, e.g. by guaranteeing consumers the right to generate energy for their own use and to feed surplus energy into the grid in return for remuneration, taking into account the costs and benefits at the level of the entire system (e.g. appropriate contribution to grid maintenance costs).

5. Transparency of information

Transparency of information is another important tool for stimulating competition and encouraging consumer participation. Previous consultations and studies carried out by the Commission show that consumers are dissatisfied with the lack of transparency of information on electricity markets, which

makes it difficult for them to benefit from competition and participate actively in the markets. They feel that they do not have enough information about other suppliers or new energy services, and complain that offers and switching procedures are too complicated. The reform also addresses data protection, given the increased use of new technologies (in particular smart metering) will generate energy data of high commercial value[102] .

When it comes to putting consumers at the heart of the energy market, market restructuring must also focus on how to protect the most vulnerable social groups and prevent an increase in the number of energy-poor households. As energy poverty is becoming increasingly widespread and it is not yet clear how consumer vulnerability and energy poverty can be reduced, the proposal for market restructuring requires Member States to monitor energy poverty trends in an appropriate and regular manner, based on principles defined at EU level. The revised directives on energy efficiency in general and on the energy performance of buildings contain further measures to combat energy poverty.

6. The future of intelligent systems

The aim of this chapter was to review the main aspects and expected regulatory trends of different smart systems, in particular smart grids and smart metering. It also addressed the expected regulatory difficulties and technological challenges associated with each of these areas.

The widespread deployment of intelligent systems raised a number of data protection issues, and it was therefore necessary to present the main data protection rules related to this issue. The emergence of smart grids in a competitive retail market was hopefully expected to encourage consumers to change their behaviour and become more aware of and adapt to new patterns of 'smart' energy consumption. At the same time, the operators of such systems had access to detailed data on consumer patterns, which gave them a significant competitive advantage over other market players in offering tailored services, which could have raised competition issues in addition to data protection concerns. Balancing supply and demand and the widespread deployment and grid connection of hard-to-regulate renewable energies required the deployment of smart grids, which also allowed efficient management of consumption at the consumer end.

[102] KLEIN, 2024.

VI. E-MOBILITY AND INTELLIGENT SYSTEMS

1. The regulatory framework for e-mobility

The issue of e-mobility cannot be overlooked in the context of intelligent systems, as electronic charging infrastructures necessarily imply the need to implement intelligent systems. Directive 2014/94/EU on the deployment of alternative fuels infrastructure[103] sets out the basic framework for future developments.

The Directive requires EU Member States to ensure the deployment of publicly accessible infrastructure for the supply of electricity to motor vehicles. Member States should be allowed to take into account the number and characteristics of existing public electric charging stations in their territory in order to provide for an adequate number of public electric charging stations in their national policy framework. Electric mobility is a rapidly developing area. Current charging interface technologies are based on cable connection, but future interface technologies such as wireless charging or battery swapping should also be taken into account. Legislation should be put in place to promote technological innovation. This Directive should therefore be updated, where appropriate, to take into account future standards for technologies such as wireless charging and battery swapping.

In its Communication of 3 March 2010 entitled "*Europe 2020: A strategy for smart, sustainable and inclusive growth*", the Commission set the objective of improving competitiveness and security of energy supply through more efficient use of resources and energy. The Commission's White Paper "*Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*" of 28 March 2011 called for a reduction of oil dependency in transport. This should be achieved through a series of policy initiatives, including the development of a sustainable strategy for alternative fuels and the development of appropriate infrastructure. The Commission also proposed in the White Paper to reduce greenhouse gas emissions from transport by 60% by 2050 compared to 1990 levels.

[103] Directive 2014/94/EU of the European Parliament and of the Council on the deployment of alternative fuels infrastructure *[OJ L 307, 28.10.2014, p. 1]*.

2. European Union objectives in the field of e-mobility

One of the targets set by Directive 2009/28/EC of the European Parliament and of the Council is a 10% share of renewable energy in transport fuels. On the basis of stakeholder and national expert consultations and technical knowledge reflected in the Commission's Communication of 24 January 2013 entitled "Clean Energy for Transport: an Alternative Fuel Strategy for Europe", electricity, hydrogen, biofuels, natural gas and liquefied petroleum gas (LPG) have been identified as the main alternative fuels currently suitable for replacing oil in the long term, inter alia in view of their potential for simultaneous and combined use, for example through the use of mixed-fuel technology systems.

3. Intelligent systems for e-mobility

Where technically feasible and financially reasonable, electric vehicle charging stations should be equipped with smart metering systems to contribute to the stability of the electricity system by charging batteries from the grid during periods of generally low electricity demand and to allow secure and flexible data management. In the longer term, this could also allow electric vehicles to recharge their batteries when demand is usually high. Smart metering systems under Directive 2012/27/EU will enable the real-time data needed to ensure grid stability and facilitate the rational use of charging services. Smart metering systems provide accurate and transparent information on the cost and availability of charging services, thereby encouraging charging during off-peak periods of low electricity demand and lower energy prices. Smart metering systems can be used to optimise charging, with benefits for both the electricity system and consumers .[104]

4. Smart grids for e-mobility

Distribution system operators play an important role in relation to electric charging stations. In the exercise of their functions, distribution system operators, some of which may be part of vertically integrated undertakings which own or operate an electricity service station, should cooperate in a non-discriminatory manner with all other owners or operators of electricity service stations, in particular by providing information necessary for the effective availability and efficient use of the system.

[104] LADOS, 2011. p. 16.

In the design of electric vehicle infrastructure, attention should be paid to ensuring the interaction of such infrastructure with the electricity system and the consistency of Union electricity policy with the principles laid down in the framework of Directive 2009/72/EC. The construction and operation of electric vehicle charging stations should be designed as a competitive market open to all parties interested in the deployment or operation of charging infrastructure.

Member States had to ensure, through their national policy frameworks, that by 31 December 2020 an adequate number of public electric charging stations were in place to ensure the provision of electric vehicle transport at least in urban/suburban agglomerations and other densely populated areas and, where appropriate, within networks defined by Member States. The number of such electric charging stations had to be determined taking into account, inter alia, the estimated number of electric vehicles to be registered by the end of 2020, as set out in the national policy framework, and best practices and recommendations issued by the Commission. Where appropriate, the specific needs related to the installation of public electric charging stations at public transport stations also had to be taken into account.

The directive allowed for charging stations to be both private and public. Examples of public charging points included privately owned charging points which were publicly accessible through registration cards or fees, charging points which were open to third parties through rental of electric or other charging points in car-sharing schemes, and charging points in public car parks. Electric or other charging stations which allowed physical access by private users by means of a licence or lease were considered as public electric or other charging stations.

5. Smart metering and billing systems and e-mobility

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For non-public charging stations for electric vehicles, Member States were to explore whether synergies were technically and financially feasible with plans for the progressive deployment of smart metering systems, as required by Annex I, point 2 of Directive 2009/72/EC.

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VII. REGULATION OF THE EUROPEAN UNION

1. The EU internal energy market

To unify and liberalise the EU's internal energy market, three successive legislative packages were adopted between 1996 and 2009 on market access, transparency and regulation, consumer protection, support for interconnection and adequate levels of supply. These measures have allowed new gas and electricity suppliers to enter Member States' markets, while both industrial and domestic consumers are now free to choose their supplier. Other EU policies on the internal energy market deal with the security of electricity, gas and oil supply and the development of trans-European networks for the transport of electricity and gas.

In the energy sector, the completion of the EU internal market requires the removal of a number of barriers to trade and other barriers, the approximation of tax and pricing policies, and measures on standards and regulations, environmental and safety legislation. The aim is to create a market with fair market access, a high level of consumer protection, an adequate level of interconnection and sufficient energy production capacity. In February 2011, the European Council set the target of completing the internal energy market and interconnections by 2014, with a view to ending any isolation of Member States from the European gas and electricity networks by 2015.[105]

The first package of legislation (Directive 96/92/EC concerning common rules for the internal market in electricity and Directive 98/30/EC concerning common rules for the internal market in natural gas) was replaced in 2003 by a second package of legislation allowing new gas and electricity suppliers to enter the markets of the Member States and consumers to choose their gas and electricity supplier (the 2004 Directive on the freedom of industrial consumers to choose their electricity and gas supplier). In April 2009, a third legislative package was adopted, amending the second package, with the aim of further liberalising the internal market for electricity and gas. The Electricity Directive (2009/72/EC), repealing Directive 2003/54/EC, and the Gas Directive (2009/73/EC), repealing Directive 2003/55/EC, regulate the ownership of the transmission network by clearly separating supply and production activities from network operation through three organisational models; full "ownership unbundling"; the Independent System Operator (ISO – responsible for network

[105] http://www.europarl.europa.eu/ftu/pdf/hu/FTU_5.7.2.pdf

maintenance while assets remain the property of the integrated company); the Independent Transmission Operator (ITO – detailed set of rules ensuring autonomy, independence and the necessary investments in transmission). Ensuring also more effective regulatory oversight by truly independent national energy regulators, while strengthening and harmonising their powers and independence, in order to allow effective and non-discriminatory access to transmission networks. It was also strengthened consumer protection and ensured that vulnerable consumers are protected.

The growing evidence of climate change and increasing energy dependence reinforces the European Union's (EU) determination to build a low energy economy while making the energy we consume secure, competitive, locally produced and sustainable.[106]

EU energy policy ensures the efficient functioning of the EU energy market and promotes the interconnection of energy networks and the efficient use of energy. It covers all energy sources, from fossil fuels to nuclear and renewables (solar, wind, biomass, geothermal, hydro and tidal). Article 194 of the Treaty on the Functioning of the European Union (TFEU) has created a specific legal basis for the Union and the Member States to cooperate on energy matters under shared competences.

2. The Evolution of Electrical Energy Legislation towards the Present Regulatory Framework

a) Principles of regulation

The internal market for electricity in the Community, which has been developing rapidly since 1999, aims to create real choice for all consumers in the European Union, i.e. citizens and businesses, to open up new business opportunities and to expand cross-border trade, thereby creating efficiency gains, competitive prices and higher levels of service, and to contribute to security of supply and sustainability.

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[107] and its predecessor Directive 96/92/EC[108] on common rules for the internal market in electricity have made a significant contribution to the creation of the internal market in electricity.

[106] http://eur-lex.europa.eu/summary/chapter/energy.html?root_default=SUM_1_CODED%3D18&locale=hu

[107] 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

[108] Directive 96/92/EC the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity

As part of the Third Energy Package, Directive 2009/72/EC laid down the primary rules in force for the EU electricity market. This Directive established common provisions governing the generation, transmission, distribution, supply and consumer protection of electricity, with the aim of developing and integrating competitive electricity markets within the Community. It set out rules concerning the organisation and functioning of the electricity sector, open market access, the conditions and procedures applicable to tendering processes, the granting of authorisations and the operation of systems. Furthermore, it defined universal service obligations and the rights of electricity consumers, while also clarifying the obligations relating to competition.

The rules for the organisation of the sector aimed to create a competitive, secure and environmentally sustainable electricity market. EU countries were entitled to impose public service obligations on companies operating in the electricity sector, covering security, security of supply, continuity of service, quality, price, environmental protection and energy efficiency.

EU countries had to ensure that all consumers had the right to choose their electricity supplier and that, if they wanted to change supplier, they could do so easily within three weeks, with the help of the operator. They also had to ensure that consumers received the relevant consumption data.

EU countries were to put in place independent mechanisms (such as an energy ombudsman or a consumer body) to deal effectively with complaints or disputes. EU countries were also obliged to monitor security of supply. They had to set technical security requirements to ensure the integration of their national markets at one or more regional levels. In addition, national regulators were to work with the Agency for the Cooperation of Energy Regulators to ensure compatibility of regulatory frameworks between regions.

b) Separation rules

From 3 March 2012, EU countries had to unbundle transmission systems and transmission system operators. From 3 March 2012, Member States were required to ensure that all the companies that own the transmission system act as TSOs and that the same person or persons are not eligible:

i. to directly or indirectly exercise control over an undertaking performing any of the functions of production or supply, and to directly or indirectly exercise control or any right over a transmission system operator or over a transmission system; or
ii. directly or indirectly to exercise control or exercise any right over a transmission system operator or over a transmission system, and to exercise directly or indirectly control or any right over an undertaking performing any of the functions of production or supply.

Furthermore, the same person or persons shall not be entitled to appoint members of the supervisory board, administrative board or board legally representing an undertaking, of a transmission system operator or a transmission system, and to exercise directly or indirectly any control or any right over an undertaking performing any of the functions of production or supply; and that the same person is not a member of the supervisory board, administrative board or legally representative body of a transmission system operator or a transmission system operator, on the one hand, and of a company owning a transmission system operator or a transmission system, on the other hand.

Undertakings must first be certified before being formally designated as transmission system operators. A list of transmission system operators designated by EU countries will be published in the Official Journal of the European Union.

c) Access to networks and market opening

EU countries were required to set up a system where third parties were entitled to access transmission and distribution systems. Tariffs under this system were required to be published.

Member States were required to establish a system whereby third-party access to the transmission and distribution system was based on public tariffs for all eligible customers and applied in an objective manner without discrimination between system users. Member States were required to ensure that those tariffs, or the methodologies used to calculate them, were approved before they entered into force; and that those tariffs, or methodologies where only methodologies had been approved, were published before they entered into force.

The transmission or distribution system operator was entitled to refuse access if the necessary capacity was not available. Such refusal was required to be justified on the basis of objective and duly substantiated technical and economic criteria. Where Member States had so provided, the regulatory authorities or Member States were required to ensure that these criteria were applied consistently and that customers who had been refused access were entitled to initiate dispute settlement proceedings. In the event of refusal and where appropriate, the regulatory authorities were also required to ensure that the transmission or distribution system operator provided meaningful information on the measures that would have been necessary to reinforce the network. The party requesting the information was entitled to be charged a fair fee corresponding to the cost of providing the information.

One of the key provisions of the Directive was that it allowed any consumer to buy electricity from any energy trader. The opening up had been gradual: from 1 July 2004 for non-household consumers and from 1 July 2007 for all consumers, the Directive had provided for the freedom to buy electricity from any trader.

VIII. THE DEVELOPMENT AND OUTLOOK OF EUROPEAN UNION ENERGY REGULATORY FRAMEWORKS

1. The Energy Union

The challenges facing the EU energy system require unity and cooperation between EU countries to ensure that energy is secure, affordable and sustainable for consumers. To this end, in 2015 the European Commission adopted its strategy for the creation of the Energy Union.[109]

A stable and resilient Energy Union, based on an ambitious climate policy, aimed to provide EU consumers (households and businesses alike) with secure, sustainable, competitive and affordable energy. But to achieve this, the EU's energy system needed to be fundamentally transformed.

The EU envisaged an integrated energy system across Europe, with energy flowing freely across borders, based on market competition and the most efficient use of resources, with effective regulation of energy markets at EU level where appropriate. The European Commission's objective was to make the Energy Union a sustainable, low-carbon and climate-friendly economy in the long term. The Commission worked to ensure that strong, innovative and competitive European companies developed the industrial products and technologies needed to deliver energy efficiency and low-carbon technologies inside and outside Europe.

The new system aimed to ensure that price signals accurately reflected long-term needs and policy objectives, in order to strengthen investor confidence. The Commission's ambition was, rather idealistically, to create an Energy Union with citizens at its heart: where citizens took ownership of the energy transition and were actively involved in market processes; where citizens' wallets benefited from new technologies; and where vulnerable consumers were adequately protected.

To achieve these goals, the Commission believed that it was necessary to move away from a fossil fuel-based economy, where energy supply was based on a centralised, supply-side approach, rooted in outdated technologies and outdated business models. It was considered essential to give consumers greater freedom by providing them with information and choice, and by developing

[109] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN BANK FOR RISK A framework strategy for a stable and resilient Energy Union and forward-looking climate policy (COM/2015/080 final)

the flexibility to manage not only supply but also demand. It was equally necessary to leave behind a fragmented system with uncoordinated national policies, market barriers and energy-isolated regions.

In 2013, the EU imported 53% of its energy at a cost of around €400 billion, making it the world's largest energy importer. Six Member States depended on a single external supplier for all their gas imports, leaving them highly exposed to the risk of supply shocks. It was estimated at the time that every 1% increase in energy savings would have allowed a 2.6% reduction in gas imports[110], while approximately 75% of EU housing stock remained energy inefficient. The transport sector relied 94% on oil products, 90% of which were imported.

The EU as a whole spent more than €120 billion a year, directly or indirectly, on energy subsidies, often in an unjustified manner[111]. The EU energy sector was projected to require more than €1 trillion of investment by 2020 alone[112]. European countries had relatively low wholesale electricity prices compared with global standards, although these were still 30% higher than in the United States. At the same time, gross electricity prices paid by households rose on average by 4.4% between 2012 and 2013. Wholesale gas prices in the EU remained more than twice as high as in the US[113].

The price differential with other economies also affected the competitiveness of European industry, particularly in energy-intensive sectors. By 2013, European renewable energy companies employed more than one million people and had a combined annual turnover of around €129 billion[114]. EU companies held 40% of all patents registered worldwide for renewable energy technologies. The main challenge at that time was to maintain Europe's leadership in global investment in renewable energy.

Altogether, these figures reflected the key dilemmas and vulnerabilities of EU energy policy in 2013, highlighting both its heavy import dependence and its ambition to remain a global leader in renewable energy.

At that time, the European Union had energy rules at EU level, but in practice there were 28 separate national regulatory frameworks, as this was before Brexit. This situation needed to change. An integrated energy market was needed to increase competition and to improve market efficiency by making better use of energy production facilities across the EU, and to ensure affordable prices for consumers.

[110] Commission Communication on energy efficiency and its contribution to energy security and the 2030 climate and energy framework (COM(2014) 520).

[111] European Energy Security Strategy (COM(2014) 330).

[112] Commission estimates. The IEA estimates that €1.3 trillion will be needed to secure energy production, transport and distribution by 2025.

[113] DG Energy calculations based on Platts market reports and IEA data for the first half of 2014.

[114] Eur'Observeur 2014 report.

The retail market was not functioning properly. Many household consumers had few energy suppliers to choose from and were therefore unable to control their energy costs sufficiently. An unacceptably high percentage of European households were unable to pay their energy bills.

Energy infrastructure was ageing and could not keep up with increased renewable energy production. There was a strong need to attract investment, but the existing market structure and national policy frameworks did not provide sufficient incentives and predictability for potential investors.

Many markets were not well connected to their neighbours, leaving Europe still divided into separate energy "islands." This increased energy costs for consumers and reduced energy security.

Increased investment in high-tech, globally competitive companies in a stable policy environment was expected to create jobs and growth for Europe. New business sectors and models, as well as new professions, could be created. The transformation fundamentally changed the position of actors in the energy system, including consumers.

Europe had to make the right choices at that point. If it had continued down the old path, it would have paid a much higher price for the inevitable transition to a low-carbon economy later on, due to the economic, social and environmental burdens of fragmented national energy markets. The EU had to seize the unique opportunity offered by the then still low oil and gas prices, reinforced by the falling cost of cleaner forms of energy, a robust EU climate policy and the emergence of a range of new technologies, and take a decisive turn in the right direction – towards an Energy Union.

The five mutually reinforcing and closely interlinked dimensions of the Energy Union building strategy were designed to contribute to enhancing energy security, sustainability and competitiveness. These were: energy security, solidarity and confidence; a fully integrated European energy market; energy efficiency to reduce demand; decarbonisation of the economy; and research, innovation and competitiveness. The following provided an overview of the main directions that the Commission needed to take in order to achieve its Energy Union objectives.

a) Energy security

Energy security was driven by building the internal energy market and increasing the efficiency of energy consumption. Improving transparency and enhancing solidarity and trust between Member States were essential to ensure energy security. The EU's energy security was also closely linked to its neighbours.

Energy production within the EU also contributed to reducing Europe's dependence on energy imports. Renewable energies were the main source of energy needed to meet decarbonisation targets, but conventional and (depending

on the choice of each Member State) non-conventional fossil resources also played a role. Indeed, oil and gas production from unconventional sources (such as shale gas) also represented an open opportunity, provided that due attention was paid to issues of public acceptance and environmental impact.

At that time, many Member States did not have a legal framework that adequately ensured security of electricity supply and had an outdated and inconsistent approach to assessing security of electricity supply. The Commission worked with Member States to define acceptable levels of risk of supply disruption and prepared an objective, EU-wide, fact-based security of supply assessment, including the situation in each Member State. The analysis also took into account cross-border flows, variations in renewable energy production, demand-side response mechanisms and storage possibilities. Capacity mechanisms to address security of supply issues only needed to be developed if the adequacy assessment of a regional system identified the need for them, taking into account energy efficiency potential and the possibility of demand-side response measures.

The Energy Union was not just an inward-looking project. A stronger and more united EU could also play a more constructive role in its relations with its partners, to the benefit of both sides. Energy policy was often used as a foreign policy tool, especially by large energy-producing countries and transit countries. This fact was to be taken into account when shaping Europe's external energy policy. The EU therefore had to increase its weight in global energy markets. Together with its main partners, the EU worked towards a better global energy governance system that would allow for more competitive and transparent global energy markets.

b) A fully integrated internal energy market

Despite the progress made in previous years, the European energy system was still underperforming. It was recognised that the then-current market structure did not provide sufficient incentives for investment, while market concentration and weak competition remained a problem, and the EU's energy picture was still too fragmented. Europe needed a new political impetus to complete the internal energy market.

(a) The "hardware" of the internal market: the physical interconnection of markets.

At that time, Europe's electricity transmission and gas transport systems – especially cross-border networks – were not sufficient to ensure the proper functioning of the internal energy market and to connect the remaining energy islands to the electricity and gas backbone.

For electricity, a specific minimum target for interconnection of 10% of the installed electricity generation capacity of the Member States had been

set, to be achieved by 2020. The measures needed to reach this 10% target were set out in the Commission Communication accompanying that document (the Energy Union framework strategy). The Commission was to report in 2016 on the measures needed to reach the 15% target by 2030.

The transition to a more secure and sustainable energy system required significant investments in generation, grid construction and energy efficiency, estimated at around €200 billion per year over the following decade. As the lion's share of the costs of these investments was to be borne by the private sector, access to finance was a key factor. The European Investment Bank, the Connecting Europe Facility and funding from the European Structural and Investment Funds already provided the necessary means. In addition, the proposed European Fund for Strategic Investments was also expected to provide additional funding to further facilitate access to finance for projects of European importance such as energy networks, renewable energy and energy efficiency. The Commission analysed proposals for energy investment programmes that pooled resources to finance economically viable investments, avoiding distortions of competition and market fragmentation.

Investors could also benefit from the European Fund for Strategic Investments' investment portal, which aimed to increase transparency of the EU investment project portfolio and disseminate information to potential investors. The Commission also pooled information on infrastructure projects financed by the European Network Facility and EU cohesion policy funds to increase coherence and maximise the impact of the many existing funding schemes.

The Commission regularly assessed progress in the implementation of major infrastructure projects contributing to the Energy Union, in particular through the monitoring of projects of common interest. This stocktaking included an annual report on progress towards the 10% target for electricity interconnection, with a particular focus on the implementation of the Regional Action Plans. Finally, the Commission convened a dedicated Energy Infrastructure Forum to discuss progress with Member States, regional cooperation groups and EU institutions. The Forum held its first meeting at the end of 2015.

(b) Implementation and modernisation of the internal energy market "software"

Full implementation and strict enforcement of existing energy policy and related legislation were the first priority for the creation of the Energy Union. It would have been a mistake to build new policies and approaches on weak foundations.

The Commission used all policy instruments at its disposal to this end and insisted that Member States fully implement the Third Internal Energy

Market Package, in particular with regard to unbundling and the independence of regulators. Certain ex-ante conditions had to be met before European structural and investment funds could be properly used to co-finance energy investments, which helped to ensure compliance with EU energy legislation.

The Commission was preparing an ambitious legislative proposal to re-design the electricity market and to interconnect the wholesale and retail sectors. The new legislation was intended to enhance security of supply and to ensure that the electricity market was better adapted to the energy transition involving the entry of many new producers (in particular renewables) and allowed consumers to participate fully in the market, in particular through demand-side response mechanisms. Closer integration (including at regional level), increased cross-border trade and the development of short- and long-term markets with efficient pricing created an attractive investment environment and provided the necessary flexibility for the market integration of new generation sources.

The best way to reduce the need for capacity mechanisms is to build a fully functioning internal energy market that is attractive to investment. The Commission has previously published guidelines[115] and rules[116] to mitigate the harmful effects of poorly designed, fragmented and uncoordinated public interventions. However, the effective application of these guidelines can only be a first step towards ensuring that divergent national market regimes (including capacity mechanisms and uncoordinated renewable energy support schemes) become more compatible with the internal market. Some forms of public intervention, although justified and necessary in certain cases to address market malfunctioning, have in the past had a serious negative impact on the efficient functioning of the internal energy market. The Commission, in cooperation with Member States, will seek to ensure that capacity mechanisms and support for electricity production from renewable sources fully comply with existing rules and do not distort the internal energy market. Environmentally harmful subsidies should be fully phased out[117] . A renewed emissions trading scheme will also play an important role in creating an attractive investment climate.

Finally, the Commission will ensure increased transparency on energy costs and prices by developing a systematic and detailed monitoring and reporting system (including on the impact of energy costs and prices on competitiveness). In doing so, it will pay particular attention to public

[115] *See*: Communication "Making the most of public interventions" (C(2013) 7243).

[116] Guidelines on State aid for environmental protection and energy for the period 2014–2020 (hereafter 'the Environmental and Energy State Aid Guidelines') *[OJ C 200, 28.6.2014, p. 1].*

[117] *See*: the Roadmap to a Resource Efficient Europe (COM(2011) 571) and the 2012 Communication on Making the Internal Energy Market Work (COM(2012) 663); in line with the G20 commitment on this.

interventions, such as regulated tariffs, energy taxation policies and the level of state aid, and their impact on pricing mechanisms (including the electricity price gap).

c) Consumer protection and new price regulation

In the Energy Union, it was to be possible for a consumer in one Member State to make an informed choice and buy energy freely and easily from a company in another Member State. However, this required an adjustment of the then-current national regulatory framework. At that time, the vast majority of European households were passive consumers, and in some Member States there was limited choice between suppliers and switching was relatively difficult.

To empower consumers, Member States and their public authorities were required to fully implement and enforce existing EU rules, including consumer rules. Regional and local authorities were also to take the necessary support measures to provide consumers with easily understandable and accessible information, user-friendly tools and financial support to encourage energy savings.

Smart technologies helped consumers and the energy service companies that served them to take advantage of energy market opportunities by enabling them to control their energy consumption (and, where appropriate, generate their own energy). This made the market more flexible and, where appropriate, reduced consumers' bills.

The Commission will continue to encourage standardisation and support the national roll-out of smart meters[118] to reward flexible energy use, and promote the further development of smart appliances and networks. It will also seek to exploit the synergies between the Energy Union and the Digital Single Market and will take measures to ensure privacy and cyber security.

But this will only deliver results if market prices send the right signals. In some Member States, still regulated tariffs limit the development of effective competition, discouraging investment and the entry of new market players. Regulated end-user prices are often used to protect households (and even non-household consumers) from the effects of rising energy costs. The consequences of such measures, possibly in the form of a shortfall in electricity prices, have to be borne by unregulated consumers, electricity companies and/or the public purse. Although these measures are intended to protect consumers' interests, they are harmful to consumers' interests in the long term. The Commission will seek to phase out regulated prices below cost price through the competition and economic governance frameworks and will encourage Member States to set a timetable for the removal of all regulated tariffs.

[118] *See*: the report "Evaluation of the implementation of smart metering in the EU-27, with a special focus on electricity" (COM(2014) 356).

So the European Commission is arguing that all prices, including retail prices, should be market-based, so that the real cost is paid by the retail consumer. Presumably this regulatory direction will raise concerns in many Member States, including Hungary, given that many tariffs and price controls are designed to reflect social policy objectives and not necessarily the real cost of energy.

The Commission's idea was that, in the process of phasing out regulated prices, Member States were to set up a mechanism to protect vulnerable consumers, preferably within the general social system. If it was to be implemented through the energy market, this could have taken the form of solidarity-based tariffs or discounts on energy bills. The costs of such schemes were to be borne jointly by non-beneficiary consumers. Therefore, in order to keep the overall cost low and to limit distortions of competition resulting from regulated prices (i.e. for example to prevent a further increase in the tariff gap in Member States), it was important that the target beneficiaries of schemes were carefully defined.

d) Energy efficiency

In October 2014, the European Council set an indicative target to improve energy efficiency by at least 27% at EU level by 2030. This was to be adjusted by 2020, which was likely to mean an increase to 30% at EU level. In that situation, it was necessary to fundamentally rethink energy efficiency and treat it as an energy source in its own right, with a value equivalent to the energy saved. In the context of the market structure review, the Commission ensured that energy efficiency and demand-side response mechanisms were given the same priority as generation capacity.

The EU had already implemented an unprecedented package of measures to make its energy consumption more efficient. Thanks to legislation on energy labelling and eco-design, consumers were able to make informed choices about energy consumption. While all sectors of the economy needed to take steps to improve their energy efficiency, the Commission paid particular attention to those sectors with the greatest potential for efficiency gains, such as transport and construction. The Commission also sought further synergies between energy and resource efficiency policies and the circular economy, including by exploring the potential of waste-to-energy.

e) Low carbon transport sector

Transport accounted for more than 30% of final energy consumption in Europe. To realise the energy efficiency potential of the sector, continued efforts were needed to lower the carbon standards for cars and light commercial vehicles after 2020, and to introduce measures to increase fuel efficiency and reduce carbon emissions from heavy-duty vehicles and buses. The development of

transport management as a modern, forward-looking tool to reduce carbon emissions was also to be encouraged.

This was to be accompanied by measures to better exploit the potential of the single market and internalise external costs. The Commission encouraged the use of tolling systems based on the polluter pays principle and stepped up efforts to develop a Single European Transport Area based on more optimal fleet use.

The Commission also took further steps to decarbonise the transport sector, which still mainly used oil products. This required a gradual transformation of the whole transport system and an increased pace of development and introduction of alternative fuels. The Commission also accelerated the deployment of the necessary infrastructure, such as filling stations and refuelling stations.[119] The market demand for such vehicles could be greatly influenced by the simultaneous introduction of adequate infrastructure, vehicle fleets and fuel supply.

The electrification of transport plays an important role in breaking the dependency on oil and decarbonising the transport sector (in particular short and medium term road and rail transport). Europe needs to accelerate the electrification of its vehicle fleet and other transport assets and take the lead in electric transport and energy storage technologies. This implies the full integration of electric vehicles into urban transport policies and the electricity grid, both as energy consumers and as potential energy storage facilities.

f) Ambitious EU climate policy

Under the agreement on the 2030 climate and energy framework, the EU committed to reducing its internal greenhouse gas emissions by at least 40% compared to 1990. This represented an ambitious contribution to international climate negotiations towards a binding climate agreement by 2015. The EU's commitment was set out in the Communication on the Energy Union Framework Strategy for the Paris Summit, published at the same time as that Communication. Together with Member States, the Commission sought to persuade other major economies to join Europe's ambition. This was done through active EU climate diplomacy, making maximum use of available trade and development instruments.

A well-functioning EU emissions trading system was the cornerstone of European climate policy. Thanks to the market stabilisation reserve and the measures needed to meet the highly ambitious targets set out in the 2030 legislative framework, the EU ETS set incentive prices for carbon emissions and encouraged cost-effective reductions in greenhouse gas emissions. The European

[119] *See*: Directive 2014/94/EU on the deployment of alternative fuels infrastructure, already referred to earlier.

Commission wanted the EU ETS to play its full role as a technology-neutral, cost-effective and EU-wide catalyst for investment in the low-carbon economy. It strengthened the functioning of the internal energy market through EU-wide pricing and encouraged the market uptake of renewables and other low-carbon and energy-efficient technologies. Policies to prevent carbon leakage were to reflect the level of efforts made by other major economies.

National targets were to continue to be set for sectors outside the scope of the EU ETS, and the agriculture and forestry sectors were to be integrated into the EU 2030 framework, so that these sectors also would have sufficient incentives to reduce greenhouse gas emissions and contribute to the fight against climate change.

g) Market leadership in renewable energy

The European Union was committed to being a world leader in renewable energy and a global centre for the development of the next generation of high-tech and competitive renewable energies. The EU had also set itself the target of reaching 27% of the EU's energy consumption from renewable energy sources by 2030.

Europe was well on track to meet the first milestone of 20% of the energy mix from renewables by 2020: thanks in large part to the EU's commitment, the cost of building new wind and photovoltaic capacity had been greatly reduced and support schemes were being reformed to further reduce costs. But meeting the 27% target faced new challenges.

Renewable energy production could only be progressively and effectively integrated into a market that supported competitive renewables and stimulated innovation if energy markets and grids were capable of accommodating renewables. Existing legislation and new market regulations needed to be fully implemented to allow for the introduction of new technologies and smart grids and demand-side response mechanisms to enable a successful energy transition.

Investment decisions on electricity from renewable sources also had to take into account the realities of resource and grid availability, public acceptance, geographical location of consumption and administrative barriers. In addition, new infrastructure (in particular interconnection points) had to be designed to allow the integration of renewable electricity into the internal energy market at lower cost.

The EU had to invest in modern and sustainable alternative fuels, including biofuel production processes and the bioeconomy in general. This was to allow Europe to maintain its technological and industrial leadership and to meet its climate objectives. Europe also had to take into account the impact of bioenergy on the environment, land use and food production. Alongside other EU funding sources, the EU Investment Plan helped to raise the necessary finance.

h) Energy Union for research, innovation and competitiveness

The new research and innovation (R&I) strategy was to be a top priority for the EU. If the European Energy Union was to be at the forefront of the global renewable energy scene, it had to encourage the development of the next generation of renewable energy technologies and advanced storage solutions.

Leadership in smart grid and smart home technologies, clean transport and fuel use, and safe nuclear power generation were also key to making the Energy Union a driver for growth, jobs and competitiveness.

2. New orientations for energy consumers

As part of the Energy Union package, the Commission published on 15 July 2015 a Communication setting out new orientations for energy consumers[120]. The English name of the Communication is more revealing, as the capital letter "New Deal"[121] , refers back to the policies of US President Franklin D. Roosevelt and his administration between 1933 and 1939, when during the 1932 election campaign Roosevelt promised his electorate a "New Deal". This communication from the Commission was aimed at removing the barriers that prevented consumers from obtaining the market benefits that, in the absence of these barriers, they would have enjoyed as a result of new rules and increased competition.

3. Barriers and obstacles for consumers

The Energy Union framework strategy outlined earlier envisages an Energy Union "*where citizens are at the heart of the energy transition: where citizens take ownership of the energy transition and actively participate in market processes; where citizens' wallets benefit from new technologies; and where vulnerable consumers are adequately protected*".

While the European energy sector has been transformed over the last decade, retail energy markets, the focus of this Communication, have not kept pace. Among the obstacles preventing consumers – households, businesses and

[120] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A new Energy Consumers' Agenda (COM/2015/0339 final)

[121] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Delivering a New Deal for Energy Consumers (COM/2015/0339 final)

industry – from taking full advantage of the ongoing energy transition, from meaningfully controlling their consumption and reducing their bills are:

1. The lack of adequate information on costs and consumption or limited transparency of supply makes it difficult for consumers (or trusted intermediaries and energy service companies, such as purchasing community service providers acting on behalf of consumers) to assess the market situation and opportunities.
2. The increasing share of network charges, taxes and especially levies in the average household final electricity bill.
3. Inadequate competition in many retail markets, lack of rewards for active participation and difficulty in switching providers are all disincentives.
4. The underdeveloped market for residential energy services and demand-side response measures limits the choice available to consumers.
5. Preventing consumers from consuming energy from their own production limits the potential benefits to them.
6. Unequal access to information and significant barriers to market entry for new competitors are slowing down the uptake of available advanced technologies and practices such as smart metering, smart appliances, decentralised energy sources and energy efficiency improvements.

By restructuring the electricity market, the Commission aimed to deliver a new direction for energy consumers, including through closer links between wholesale and retail markets. New and innovative energy service companies were to use new technologies to enable all consumers to participate fully in the energy transition by consciously adapting their consumption patterns, leading to energy-efficient solutions and savings for consumers and contributing to an overall reduction in energy consumption.

IX. THE EUROPEAN COMMISSION'S "WINTER PACKAGE" ON CLEAN ENERGY

1. Legal Basis for European Legislation

In October 2014, the European Council set out the 2030 climate and energy framework, which includes a strong internal economy-wide target to reduce greenhouse gas emissions by at least 40% by 2030. The Paris agreement requires an EU approach. The implementation of the 2030 climate and energy framework adopted by the European Council is a priority in the follow-up to the Paris Agreement.

Against this background, on 30 November 2016 the European Commission published a complex package of measures to ensure the EU's competitiveness in the changing global energy market, which is also changing as a result of the transition to clean energy.[122]

The Commission stated that the European Union was required to lead the transition to clean energy, rather than merely adapt to it. To this end, the EU committed to a 40% reduction in carbon emissions by 2030, with a view to modernising the EU economy so that all Europeans could benefit from the jobs and growth that it would bring. The proposals presented at that time had three main objectives: to put energy efficiency first; to become a world leader in renewable energy; and to ensure fair conditions for consumers.

Consumers were also to play an active and central role in the energy markets of the future. The objective was to give them more choice across the EU, access to reliable tools for comparing energy prices and the ability to generate electricity for their own use and sale. Increased transparency and better regulation gave civil society more scope to participate in energy systems and respond to price signals. The package also included a number of measures to protect the most vulnerable consumers.

The Commission's *Clean Energy for All Europeans* proposals aimed to demonstrate that the shift to clean energy was the key driver for future growth and smart investment. More than €300 billion had been invested in clean energy worldwide in 2015. The EU was ideally placed to exploit this transition as an industrial opportunity through its research, development and innovation policies. Mobilising up to €177 billion of public and private investment per

[122] Communication from the Commission: Clean Energy For All Europeans Brussels, 30.11.2016, COM(2016) 860 final

year from 2021, this package was expected to deliver 1% GDP growth for a decade and create 900,000 new jobs.

The *Clean Energy for All Europeans* package of legislative proposals addressed energy efficiency, renewable energies, the development of the electricity market, security of electricity supply and governance of the Energy Union. It also set a new direction for green design and proposed a strategy for connected and automated mobility.

Some elements of the package dealt with accelerating innovation in clean energy and renovating Europe's buildings. It also included measures to mobilise public and private investment, make EU industry more competitive and reduce the social impact of the clean energy transition. Consideration was also given to ways in which the EU could strengthen its leadership in clean energy technologies and help third countries achieve their policy goals.

2. New directions for regulation

The legislative proposals covered energy efficiency, the use of renewable energy sources, the organisation of the electricity market, security of supply and the rules for the governance of the Energy Union. The package of initiatives had three main objectives:

- prioritising energy efficiency,
- becoming a leader in renewable energy,
- ensuring fairness for consumers.

Background measures included an initiative to accelerate clean energy innovation and the renovation of European buildings, as well as measures to stimulate public and private sector investment and ensure maximum impact of the available EU budget; to promote industry-led initiatives to increase competitiveness; to mitigate the social impact of the clean energy transition; to ensure the involvement of different actors, including Member State authorities and regional and local authorities, as well as businesses, social partners and investors; and to maximise Europe's leadership in clean energy technologies and services to help third countries achieve their policy goals.

The package of initiatives was part of a broader process of EU leadership to deliver smarter and cleaner energy for all, helping to implement the Paris Agreement, underpin economic growth, stimulate investment and technological leadership, create new job opportunities and improve citizens' well-being.

To meet the EU's 2030 climate and energy targets, the EU needed to invest around €379 billion per year from 2020 to 2030, mainly in energy efficiency, renewable energy and infrastructure. EU businesses had to lead this investment process. In this respect, much depended on the capacity of EU businesses to

innovate. Thanks to the combined public and private sector investment of €27 billion a year in research, technological development and innovation in Energy Union-related areas, the EU was well placed to turn this transition into concrete industrial and economic opportunities.

The initiatives put forward by the Commission at that time were expected to boost industrial production by 5% in construction, 3.8% in machinery and 3.5% in iron and steel, with the potential to create 700,000 new jobs in construction, 230,000 in machinery and 27,000 in iron and steel.

a) Putting energy efficiency first

Energy efficiency was the most widely available energy source. The idea behind the focus on energy efficiency was that the cheapest and cleanest source of energy was the one that did not need to be produced and used. This meant mainstreaming energy efficiency throughout the energy system: actively seeking to optimise energy consumption on the demand side, reduce costs for consumers and reduce import dependency, while investment in infrastructure to improve energy efficiency was to be seen as a cost-effective way to make the transition to a low-carbon circular economy. This implied, in particular in the area of fossil fuel use, the need to address the overcapacity in the market.

As requested by the European Council in October 2014, the Commission reviewed the EU's energy efficiency target and concluded that the EU should set a binding EU-wide target of 30% by 2030. Compared to the target of at least 27% adopted in 2014, this increase was expected to mean an increase of €70 billion in GDP and 400,000 new jobs, while the EU would have to spend even less on fossil fuel imports[123]. The increased target was also intended to help meet the EU's 2030 targets for reducing greenhouse gas emissions and using renewable energy sources.

The Commission proposed to extend beyond 2020 the energy savings obligations of the Energy Efficiency Directive, which required energy suppliers and distributors to save 1.5% of energy each year. This measure had been an attraction for private investors in the first period and had supported the emergence of new types of market players such as energy service providers, including those from purchasing communities, and was expected to have a similar effect after 2020. The newly organised electricity market also ensured a level playing field for demand-side players.

Buildings accounted for 40% of total energy consumption, and around 75% of them were energy inefficient[124]. Improving the energy efficiency of buildings was not helped either by the low level of investment or by the many barriers. While buildings were regularly maintained and renovated, investments to save

[123] The so-called "European Electricity Initiative", has recently been transformed into a "European Technology and Innovation Platform for Smart Grids and the Energy Transition".

[124] *See*: the proposal to amend the Energy Efficiency Directive, COM(2016) 761.

energy were often not made because of fierce competition for scarce resources, a lack of reliable information and trained professionals, or doubts about the potential benefits. If only 1% of buildings continued to be renovated every year, it would have taken a century before all buildings were up to date and near-zero energy. Clean energy buildings did not only save energy: they also improved the comfort and quality of life of their users, and provided opportunities for renewable energy, energy storage, digital technologies and the connection of buildings to the transport system. Investment in the clean energy transition of buildings therefore played a central role in creating a low-carbon economy.

Increasing investment in public buildings such as hospitals, schools and office buildings also depended on the availability of private capital and innovative mechanisms such as energy service companies offering energy efficiency contracts. Energy savings also benefited public and municipal budgets, as these public buildings spent around €1 billion a year on energy. However, investment in energy efficiency of public sector assets was greatly helped by transparent and clear rules on public sector investment and statistical treatment of asset renovation. The Commission was examining, in close cooperation with Member States, the impact of public accounting rules on the market for energy efficiency contracts and undertook to update its guidance on the statistical treatment of this type of partnerships by the end of spring 2017.

The strengthened provisions for long-term building renovation strategies in the amendment to the Energy Performance of Buildings Directive were expected to accelerate building retrofits and to have the effect of decarbonising the building stock by mid-century. The proposal also improved the information available to project promoters and investors by strengthening the provisions on energy certification, ensuring the availability of information on the real energy consumption of public buildings and linking the intensity of public aid to the energy savings achieved. The proposal also encouraged Member States to target investments on people living in energy poverty, as increasing energy efficiency was one of the best ways to tackle the underlying causes of energy poverty.

To support the EU's low-emission mobility strategy and increase the use of electricity for transport, the Energy Performance of Buildings Directive made it mandatory to install electric charging stations. For existing buildings, this provision applied only to commercial buildings with more than 10 parking spaces and only from 2025 onwards. For new buildings and buildings undergoing major renovation, residential buildings with more than 10 parking spaces were required to install the necessary wiring and commercial buildings with more than 10 parking spaces were required to install charging stations. Small and medium-sized enterprises and public authorities could be excluded from the scope of the new rules, the latter because they were already covered by the provisions of the Alternative Fuels Directive, provided that the charging stations

they installed were publicly accessible. In order to improve energy efficiency in transport and to promote digital mobility solutions, this package of initiatives also included an EU strategy for the deployment of cooperative intelligent transport systems.

Energy-intensive industries (e.g. steel and automotive) were to continue to strive to improve energy efficiency. Investments in this area generally paid for themselves through lower energy costs. In newer sectors, such as defence, there was further untapped potential for energy efficiency and the cost savings that could be achieved had a direct beneficial impact on public budgets.

Eco-design and energy labelling continued to play an important role in helping consumers save energy and resources and in providing European industry with additional business opportunities. After careful reflection, the Commission decided to focus this policy area more strongly on products with the greatest potential for savings, whether in terms of energy savings or the mainstreaming of the circular economy.

The Commission adopted a work plan on eco-design for 2016–2019, as well as a number of product-specific measures. The Eco-design Work Plan outlined the Commission's priorities for the following three years, identifying existing product-specific measures that were to be reviewed in the light of technological developments and new products for which unrealised savings potential might justify regulation[125]. Together, the measures identified in the Eco-design Work Plan could have achieved annual primary energy savings of more than 600 TWh by 2030, equivalent to the annual primary energy consumption of a medium-sized Member State. This was to ensure that Europe maintained its global leadership in product efficiency standards and continued to deliver economic and environmental benefits for consumers and businesses.

b) Achieving global leadership in renewable energy

The European renewable energy industry employs more than 1,100,000 people and Europe is still the world leader in wind energy. A few major European companies produced 43% of all wind turbines installed worldwide. The reduction in the cost of solar and wind technologies is largely due to ambitious EU policies. This has made renewable energy cheaper and more accessible worldwide. Although Europe has lost its leading role to imports in the production of photovoltaic panel modules, the added value of photovoltaic panel installation is predominantly (more than 85%) generated in Europe.[126]

[125] The proposed initiative on market organisation consists of a recast of the Electricity Directive (COM(2016) 864), a recast of the Electricity Regulation (COM(2016) 861), a recast of the ACER Regulation (COM(2016) 863) and a new Regulation on electricity sector risk preparedness (COM(2016) 862).

[126] Impact assessment for the recast of the Renewable Energy Directive, SWD(2016) 418. *See* also: http://gramwzielone.pl/uploads/files/Solar_Photovoltaics_Jobs___Value_Added_in_Europe.pdf.

In Europe, the renewable energy sector employs the most workers in wind, photovoltaic solar and solid biomass. However, employment in the photovoltaic industry has declined: due to the loss of production capacity, the number of jobs in the sector in 2014 was just over a third of the 2011 figure.[127] The wind energy sector employed the majority of workers in the renewable energy sector. In the period 2005-2013, the European wind energy sector's revenues increased eightfold, and the total estimated revenues for the EU as a whole are now around €48 billion. During the same period, from 2005 to 2013, the number of people employed in the wind energy sector increased fivefold, and in 2014 the total number of people employed was 320,000. The Commission is also involved in industry-led initiatives to support the EU's global leadership in renewable energy and clean technologies in general.

The European Council has set a target of at least 27% of the European Union's energy consumption to come from renewable energy sources by 2030. This minimum target is binding at EU level, but will not be broken down into binding targets for each Member State. Instead, Member States will make commitments through integrated national energy and climate plans[128] as part of the proposed governance structure for meeting the EU target together. The horizontal pressure from regional consultations on the plans, the Commission's ability to make recommendations and the other legislative proposals put forward as part of the package of initiatives, together as a comprehensive policy framework, will encourage Member States to make ambitious commitments and not to 'free-ride'. Where the Commission identifies shortcomings, whether in terms of commitment levels, quality of implementation, renewables or energy efficiency, it can take the necessary measures to remedy them. The target will be reviewed in the future in line with the EU's international commitments.

Growth in renewables must be driven by the most innovative technologies that can deliver significant savings in greenhouse gas emissions. Renewable energy solutions for long-term decarbonisation objectives are projected to represent a global market of €6,800 billion[129] from 2014 to 2035, with significant growth potential, especially outside Europe. In the last few years, 85% of investment in generation capacity has been in renewable energy infrastructure, mostly low voltage and mainly at distribution grid level. The new proposals aim to take this trend further, for example by removing barriers to captive power generation.

The Renewable Energy Directive, together with the legislative proposals for the new organisation of the electricity market[130], will create a regulatory

[127] EurObserv'ER, 15th edition, 2015.

[128] This will be addressed in the new regulation on governance of the Energy Union, COM(2016) 759.

[129] International Energy Agency, World Energy Investment Outlook Special Report, 2014.

[130] The Market Organisation initiative consists of the recast of the Electricity Directive (COM(2016) 864), the recast of the Electricity Regulation (COM(2016) 861), the recast of

framework that ensures a level playing field for all technologies without jeopardising our climate and energy policy goals. Electricity will play an important role in the transition to a clean energy system. The share of renewables in electricity generation has risen to 29% and will soon reach 50% for the EU as a whole. At this time, variable sources such as wind and solar power are playing a crucial role, and much of the energy generated will enter the energy system in a decentralised way at the level of the distribution system. Market rules need to be adapted to support this development, to promote the integration of time-varying sources and to ensure security of electricity supply. The new regulatory framework will therefore ensure that renewable energy is fully present in the electricity market and that market regulation is not to the detriment of renewables.

To better accommodate the growing share of renewable energy sources, most of which are time-varying, wholesale markets need to further develop and provide appropriate conditions for shorter term transactions, in particular for time-varying generation. By trading closer to the time of generation, well-integrated electricity markets based on short term transactions will also be able to reward market flexibility for both generation, demand and storage. In addition, market rules need to be adapted to allow full participation and revenue generation from renewable energy sources in all market segments, including system services markets.

Priority take-up will be maintained for existing installations, small-scale renewable energy installations and demonstration projects. All other installations will be subject to the rules on non-discriminatory third party access, regardless of the technology used. In addition, for renewable energy, feed-in restrictions will only be possible where strictly necessary.

These new rules will allow companies that generate electricity from renewable energy sources to get an increasing share of their revenues from the market. However, especially for new technologies, market revenues still cannot fully cover the high capital costs. Investors need a predictable environment. Therefore, the principles set out in the Renewable Energy Directive to support the deployment of renewable energy sources from 2020 will ensure that any subsidies that may be necessary are cost-effective and distort the market as little as possible.

The successful integration of renewables will continue to require adequate transmission and distribution infrastructure and a well-connected European grid. Europe's electricity grid is the most secure in the world, but significant investment will still be needed in this area until 2030. The Commission is working closely with Member States at regional level (Baltic Energy Market

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the ACER Regulation (COM(2016) 863) and the new Regulation on electricity sector risk preparedness (COM(2016) 862).

Interconnection Plan, Central and South-East European Gas Interconnection Group, South-West Europe and the North Seas) to help develop key infrastructure elements. It has also set up an expert group to advise on the formulation and delivery of the 2030 interconnection targets.

Bioenergy is and will continue to be an important renewable energy source. It brings jobs and economic development to rural areas, displaces fossil fuels and contributes to energy security.

The development of advanced alternative transport fuels will be stimulated by the blending obligation imposed on fuel distributors, while food-based biofuels will contribute to the EU's renewable energy target at a gradually decreasing rate. Another new central objective of the electricity market framework is to support the electrification of transport, which will now be reinforced by the provisions for retail electricity markets.

In the EU, the use of solid biomass for heat and electricity is mainly local and regional, building on the resources generated as a by-product of forest-based industries, and is considered overall climate-friendly at current levels. However, concerns have been raised that continued quantitative growth could lead to adverse climate impacts. Long-term climate policy requirements include the need to limit additional pressure on forests.

c) Ensuring fairness for consumers

Consumers were at the heart of the Commission's Clean Energy Package. Consumers were at the heart of the Energy Union. Energy was a critical commodity and essential for full participation in modern society.

The transition to clean energy had to be equitable for the sectors and regions or vulnerable social groups affected. The Commission proposed to reform the energy market so that consumers were better informed and had a wider choice about how to meet their energy needs. For businesses, this meant greater competitiveness, and for citizens, it meant more opportunities to be informed, more actively involved in the energy market and more control over their energy costs.

For consumers to be truly central to the Energy Union, they first and foremost had to be better informed about their energy consumption and its costs. The proposals gave consumers the right to use smart meters and receive clear bills, and made it easier for them to switch suppliers. The proposals also made switching cheaper by removing termination fees. Consumers were able to use certified comparison tools to obtain reliable information on the offers available to them. The proposals further made energy certificates more reliable by introducing an indicator on smart solutions.

Under the package of initiatives adopted at that time, the Commission also increased transparency through the second biennial report on energy costs and prices. Energy costs had an impact on energy procurement resources, on

household energy expenditure and on Europe's competitiveness. With a 74% dependence on imports, the EU remained vulnerable to volatile world fossil fuel prices. Over the preceding years, global market developments had reduced the EU's "energy bill" by 35%, which had helped economic growth. Wholesale electricity prices were at a 12-year low, while natural gas prices had fallen by 50% since 2013 and oil prices by almost 60% since 2014. Price differentials had narrowed compared to other world economies.

The end-user prices paid by households were quite different. Falling energy prices had been offset by rising system costs and taxes and levies imposed by governments – governments suffering from a lack of resources often resorted to taxing energy. Retail electricity prices had increased by 3% per year since 2008, and retail gas prices by 2%. As a result, energy costs had risen slightly and accounted for almost 6% of total household expenditure.

With the package of initiatives in force at that time, changes to the regulatory environment and the shift from centralised, conventional electricity generation to decentralised, smart and interconnected markets made it easier for consumers to generate, store, share and consume their own energy, or sell it on the market, either directly or through energy cooperatives. Consumers could provide demand-side feedback directly or through purchasing communities. New smart technologies enabled them, if they exercised this choice, to control and actively influence their energy consumption while increasing their comfort. Thanks to these changes, households and businesses were able to participate more intensively in the energy system and react to the signals sent through prices. This also required the removal of wholesale and retail price caps, while ensuring full and adequate protection for vulnerable consumers. The proposed new rules also created opportunities for new and innovative businesses to offer more and better services to consumers. This supported innovation and digitalisation and helped European businesses to provide technical solutions that contributed to improving energy efficiency and reducing greenhouse gas emissions.

Energy poverty is still a major challenge across the EU and is rooted in low incomes and energy inefficient housing. The lowest income households spent almost 9% of their total expenditure on energy in 2014.[131] This is a 50% increase on ten years earlier, much higher than for the average household. The package of initiatives aimed to provide a new way of protecting vulnerable consumers, including by helping Member States to reduce energy costs for consumers through investments in energy efficiency.

[131] Working Paper on Energy *Poverty*, *see* footnote 4 above.

3. Regulatory framework to encourage the transition to clean energy

a) Socially fair transition

Energy was recognised as a critical commodity and service, essential for full participation in modern society. The objective was to deploy more instruments, in addition to those already in existence, to ensure that the transition to clean energy was achieved under equitable conditions, taking into account the transformative impact of the transition on sectors, regions or vulnerable members of society that were adversely affected.

In this respect, the aim was for the most important instruments – the European Structural and Investment Funds, including the European Social Fund – to provide support for the necessary adjustments in the sectors and regions concerned, as well as for the transition to new business models and new types of jobs. Over the period 2014–2020, at least €1.1 billion from the European Social Fund was intended to improve the education and training systems needed to adapt skills and qualifications and to create new jobs in energy- and environment-related sectors. Some Member States also aimed to use the European Social Fund to alleviate energy poverty, in addition to the €5.2 billion allocated from the European Regional Development Fund and the Cohesion Fund for energy efficiency investments in housing. Many Member States chose to dedicate these allocations to social housing and to households in need, with the goal of providing a lasting solution to the energy poverty of nearly 1 million households. Improving the energy efficiency of buildings was considered one of the most important tools to make energy more affordable and to tackle energy poverty. In addition to the measures proposed in the legislation, the Commission's intention was to set up an Energy Poverty Observatory to provide reliable statistics on the number of households in energy poverty in each Member State and to promote the dissemination of best practices.

The transition to clean energy was also seen as an opportunity to create sustainable jobs. The aim was to ensure that a successful transition would be supported through retraining of workers, better anticipation and planning for change and skills, and better matching of skills demand and supply. The European Social Fund was intended to support these efforts at all stages of life, from raising awareness among children in schools, to promoting relevant skills training and entrepreneurship in clean energy, to social inclusion through relevant careers. The Commission's European Skills Programme sought to address skills challenges and shortages in specific economic sectors (the so-called "Skills Sector Cooperation Plans"). The objective of the pilot plans launched in that year (in particular in the automotive and maritime technology sectors) was to demonstrate that such programmes could address the skills

needs related to the clean energy transition. The ongoing sectoral cooperation plan on skills in the maritime sector already covered offshore wind farms and ocean energy, and was expected to serve as an important test for second-wave sectors such as renewable energy and construction.

Social partners were considered to play a crucial role in mapping skills needs and in anticipating and managing change. The goal was for these partners, already supporting the work on the Energy Union at EU level, to be more closely involved not only in the procedures but also in the discussion of integrated national energy and climate plans.

b) EU funding for real economic performance

The objective was that financing the energy transition should combine private investment and public financing in order to mobilise private investment and address market failures. The legislative proposals included in that package, together with the proposal to reform the EU Emissions Trading Scheme, were intended to facilitate private investment. Functioning energy and carbon markets, together with regulatory stability and policy transparency, were considered key to meeting the investment challenge.

In addition, EU funding instruments were expected to significantly support the transition to clean energy, as demonstrated by the European Fund for Strategic Investments. The Fund was on track to mobilise at least €315 billion of additional real economy investment by mid-2018. At the same time as the launch of the second phase of the European Fund for Strategic Investments, the Commission proposed to reinforce and extend the Fund. The intention was that at least 40% of the projects under the Infrastructure and Innovation Framework would relate to climate, energy and environment policies and contribute to the objectives of the Paris Agreement.

c) Appropriate incentives for investment in the clean energy transition

The objective was that research and innovation play a key role in promoting Europe's global competitiveness and leadership in advanced renewable energy technologies and energy efficiency solutions[132], and in enabling their successful integration into the economy as a whole. The European Union was part of the Innovation Mission launched at the 2015 Paris Climate Change Conference, which brought together countries that had committed to doubling research funding for clean energy over five years.

The Commission presented with that package a targeted strategy to accelerate clean energy innovation. The aim of this strategy was to set out clearer priority areas and concrete actions to ensure that the results of decarbonisation

[132] *See* also the proposal for a recast of the Renewable Energy Directive, COM(2016) 767.

innovation were more widely disseminated and brought to market faster. In doing so, the initiative was intended to serve as a testing ground for future new horizontal approaches to innovation and competitiveness.

Europe could make the most of its transition to a low-carbon economy by accelerating clean energy innovation: it could create economic growth and jobs through increased exports and new businesses, and empower citizens through the integration of digital solutions.

Industrial initiatives also played an important role in stimulating innovation within the EU and strengthening the EU's global competitiveness. These initiatives were already an important element of the European Strategic Energy Technology Plan (SET-Plan). There were good examples of such industry-led initiatives in the solar, smart grid and energy storage sectors. Another good example was the Strategic Roadmap for Ocean Energy, which aimed to maximise private and public investment in ocean energy development by de-risking the technology as much as possible.

The Commission announced an initiative to collect and make available relevant data, analysis and information in the Energy Union Strategy. In particular, this was intended to allow the Commission to provide an informed analysis of the global performance of EU clean energy technologies, not only in terms of research and innovation, but also in terms of market share, imports/exports, employment, economic growth and investment. This competitiveness assessment was to be regularly updated at the time of the adoption of the annual report on the state of the Energy Union, and the key priorities and actions were to be reviewed accordingly.

d) Building the necessary physical infrastructure

The European energy system was in a transitional phase. The Commission recognised that energy networks needed to be upgraded and modernised to meet the growing demand for electricity resulting from a major shift in the energy value chain and the energy mix as a whole. Special purpose infrastructure was also needed to facilitate low-emission mobility.

While the short-term priority was to ensure the proper functioning of the internal energy market by developing missing interconnectors to meet the target of 10% energy interconnection by 2020, through removing the isolation of several Member States and internal bottlenecks, the Commission recognised that the energy infrastructure planned at that time also had to be compatible with long-term policy choices, including the shift to low-emission mobility.

This also meant that energy efficiency had to be mainstreamed throughout the energy system design: actively seeking to reduce demand-side energy consumption and costs for consumers, reduce import dependency, and consider infrastructure investments that increased energy efficiency as a cost-effective

way to make the transition to a low-carbon, circular economy[133]. The Commission recognised that investing in increasingly smart and resilient infrastructure had been identified as one of the options that would definitely pay off.

e) Digitalisation in the energy sector

The Commission's Digital Single Market Strategy of May 2015 aimed to create the right environment and conditions for the deployment of advanced digital networks and services, including in the energy sector.

The Commission recognised that, to achieve fairness for consumers, innovative businesses combining new energy technologies with digital technologies (big data, cloud computing) and mobile communications (5G) were needed to offer new products and services (decentralised electricity generation, energy management systems, smart devices and smart controllers; small-scale storage, including electric vehicles) that supported active consumers and helped optimise energy consumption (reduction and shifting), thereby saving money. In September 2016, the Commission proposed a review of the EU telecoms rules to meet Europe's growing demand for interconnection by encouraging investment in ultra-high capacity networks. The Commission also presented the 5G Action Plan, which set out a common EU roadmap for the coordinated commercial roll-out of 5G by 2020[134].

At the same time, the Commission recognised that issues of data access, privacy and data protection, cybersecurity, open standards and interoperability needed to be addressed. Work on the latter was launched in the Commission Communication on the digitisation of European industry of April 2016. The Commission also launched the new European Cloud Computing Initiative, which was intended to become the backbone of the new energy data system.

The Commission further recognised that ensuring the resilience of energy systems to cyber risks and threats was becoming increasingly important, as the widespread use of information and communication technology and data traffic had become the foundation of the underlying infrastructure of energy systems. The Energy Cybersecurity Experts Platform was analysing the specific security needs of energy infrastructure and was advising the Commission on this.

[133] *See*: the proposal to amend the Energy Efficiency Directive, COM(2016) 761.
[134] COM(2016) 588.

X. PROGRESSING TOWARDS MARKET HARMONISATION

1. Grounds for and objectives of the proposals

European citizens spend a significant part of their income on energy, which is also an important factor for European industry. The energy sector also plays a key role in meeting the commitment to reduce greenhouse gas emissions in the EU by at least 40% by 2030, which is expected to require an increase in the share of renewable energy to 50%.

The proposals of the Commission was to recast the Directive concerning common rules for the internal market in electricity, the Electricity Market Regulation and the Regulation establishing the Agency for the Cooperation of Energy Regulators are part of a larger package of measures ("*Clean Energy for All Europeans*") presented by the European Commission. The package contained the main proposals that the Commission has developed in line with the roadmap for the Energy Union[135] . It includes both legislative proposals and non-legislative initiatives, all aimed at delivering tangible benefits for citizens by creating favourable framework conditions and stimulating jobs, growth and investment, while contributing to all five dimensions of the Energy Union. Three themes are given particular attention in the package: the focus on energy efficiency, the EU's global leadership in renewables and fairness for energy consumers.

Both the European Council[136] and the European Parliament[137] have repeatedly underlined that a well-functioning integrated energy market is the key to affordable energy prices, stable energy supply and the integration and development of cost-effective, large-scale renewable electricity generation.

Price competitiveness is crucial for economic growth and consumer welfare in the EU, and ensuring this is an essential element of EU energy policy. The current structure of the electricity market follows the rules of the third energy package[138] adopted in 2009. These rules were subsequently complemented by

[135] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank: 'A framework strategy for a stable and resilient Energy Union and forward-looking climate policy', COM(2015) 080 final.

[136] Outcome of the 3429th Transport, Telecommunications and Energy Council meeting of 26 November 2015, 4632/15; and outcome of the 3472nd Transport, Telecommunications and Energy Council meeting of 6 June 2016, 9736/16.

[137] European Parliament resolution (13 September 2016): "Towards a new Energy Market Design" (P8_T A(2016) 0333).

[138] 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

legislation against market abuse[139] , and implementing legislation on electricity trading and network operation rules[140] . The EU internal energy market is based on well-established principles. Principles such as ensuring third party access to electricity networks, allowing consumers to choose freely between energy suppliers, ensuring unbundling through strict rules and removing barriers to cross-border trade, market oversight should be carried out by independent energy regulators, and regulators and network operators should cooperate at EU level within the Agency for the Cooperation of Energy Regulators (ACER) and the European Network of Transmission System Operators for Electricity (ENTSO for Transmission).

The third energy package has brought tangible progress for consumers. The liquidity of European electricity markets has improved and cross-border trade has been greatly boosted. In many Member States, consumers now have a greater choice. Increased competition, particularly in wholesale markets, has helped to keep wholesale prices down. Consumers' position in energy markets has clearly been strengthened, thanks to the new consumer rights introduced by the third energy package.

New developments have led to a radical transformation of European electricity markets. The share of electricity generated from renewable energy sources is

2003/54/EC *[OJ L 211, 14.8.2009, p. 55-93*], Regulation (EC) No 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) No 1228/2003 *[OJ L 211, 14.8.2009, p. 15-35]*, Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators *[OJ L 211, 14.8.2009, p. 1-14]*, hereinafter 'the ACER Regulation').

139 Regulation (EU) No 1227/2011 of the European Parliament and of the Council of 25 October 2011 on wholesale energy market integrity and transparency *[OJ L 326, 8.12.2011, p. 1-16]*; Commission Implementing Regulation (EU) No 1348/2014 of 17 December 2014 on the reporting of data for the implementation of Article 8(2) and (6) of Regulation (EU) No 1227/2011 of the European Parliament and of the Council on wholesale energy market integrity and transparency *[OJ L 363, 18.12.2014, p. 121-142].*

140 Regulation (EU) No 1227/2011 of the European Parliament and of the Council of 25 October 2011 on wholesale energy market integrity and transparency *[OJ L 326, 8.12.2011, p. 1-16*]; Commission Regulation (EU) No 543/2013 of 14 June 2013 concerning the submission and publication of data on electricity markets and amending Annex I to Regulation (EC) No 714/2009 of the European Parliament and of the Council *[OJ L 163, 8.12.2013, p. 1., 15.6.2013, pp. 1-12];* Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing guidelines on capacity allocation and congestion management *[OJ L 197, 25.7.2015, pp. 24-72]*; Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code of conduct for the operational and commercial requirements for the connection of generating units to the network *[OJ L 112, 15.6.2016, p. 1., 27.4.2016, pp. 1-68]*; Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a network code for the connection of users *[OJ L 223, 18.8.2016, pp. 10-54]*; Commission Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code for the connection of high-voltage direct-current systems and DC connected generating installations *[OJ L 241, 26.8.2016, p. 1., 8.9.2016, p. 1-65];* Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing guidelines for long-term capacity allocation *[OJ L 259, 27.9.2016, p. 42-68]*; and additional guidelines and network codes already approved by Member States and therefore shortly to be adopted.

increasing steeply. This trend is set to continue, as a move in this direction is a prerequisite for meeting the EU's climate change commitments under the Paris Agreement. The emergence of electricity from renewable energy sources, which is inherently more volatile and less predictable than conventional sources, will make the market more flexible and will require adjustments to market and grid operation rules. At the same time, the wholesale electricity market has been distorted as a result of mostly uncoordinated public interventions, which has also had a negative impact on investment and international trade[141] . Major changes are also taking place in the field of technology. Electricity is now traded almost across Europe through so-called market interconnections (MTOs) established jointly by energy exchanges and transmission system operators (TSOs). Thanks to digitalisation and the rapid development of internet-based metering and trading solutions, not only industry but also businesses and even households are now able to produce and store energy and participate in electricity markets through so-called "user-side response" solutions. The electricity market of the next decade will be characterised by more diversified and decentralised electricity generation, increased interdependence between Member States and new technological opportunities that will allow consumers to reduce their bills and become active players in the electricity markets through user-side response, consumption or storage of their own generated energy.

The aim of that initiative to restructure the electricity market was therefore to adapt the then-current market rules to the new market conditions, allowing electricity to move freely in response to undistorted signals transmitted through prices, so that it could reach where it was most needed in time. This was intended to increase consumer choice, allow society to maximise the benefits of cross-border competition and, with the right signals, encourage the investment needed to decarbonise the energy system. The initiative also gave priority to energy-efficient solutions and aimed to contribute to the EU becoming a world leader in renewable energy production, which was also considered useful for achieving the EU's objective of creating jobs and boosting growth and investment.

2. Adjusting market rules

The current market rules are based on the energy production technologies that have been most in use over the last decade, i.e. centralised, large-scale production methods involving fossil fuel power plants, with limited consumer participation. As electricity from renewable energy sources, which is inherently intermittent, will play an increasing role in the future energy mix and

[141] *See*: Commission Communication "Delivering an internal electricity market and the optimal contribution of public intervention", C(2013) 7243, 5.11.2013.

consumers need to be allowed to participate in the market, the rules need to change. Short term electricity markets allowing trading of electricity generated from renewable energy sources are key to the integration of renewable electricity into the market. The reason for this is that accurate forecasting of the amount of energy produced from renewable energy sources (due to uncertain weather conditions) is usually only possible shortly before the actual production of energy. In order to enable producers of electricity from renewable energy sources to sell it on fair terms, it is necessary to create markets where it is sufficient to appear only a short time before the actual delivery (so-called "intraday" or "balancing" markets) – this would also improve the liquidity of the markets. Short-term markets offer new business opportunities for market participants providing energy reserve solutions for high energy demand but low renewable energy production. These solutions include the possibility for consumers to reschedule their energy demand (the so-called "user-side response") and are closely linked to storage system operators and flexible generators. While managing fluctuating energy volumes in smaller regions can be very costly, aggregating variable generation over larger areas can save consumers a lot of money. However, integrated short term markets remain scarce.

Current market failures make the energy sector less attractive for new investment. A properly interconnected, market-based energy system, where prices follow market signals, would provide an incentive for investment in generation and transmission and ensure that it takes place where the market needs it most, while minimising the need for public investment.

Market rules at the level of individual Member States (such as price caps) and various forms of public intervention currently hinder electricity prices from reflecting real scarcity. In addition, existing bidding zones are often drawn along political borders rather than corresponding to actual areas of supply shortages. The current direction of market reform, however, shifts the focus towards addressing network constraints and demand centres instead of national boundaries.

a) Consumers at the heart of the Energy Union

If industrial, commercial and residential consumers can be fully integrated into the energy system, there will be substantial savings in energy reserves, the cost of which would otherwise be borne by consumers. But they can also benefit from price fluctuations and make money by participating in the market. Activating consumers is therefore a prerequisite for a successful and cost-effective energy transition.

One of the key commitments of the Energy Union is to empower consumers. But current market rules often prevent consumers from taking advantage of new opportunities. While they can generate and store electricity and control

their energy consumption more easily than ever before, the current structure of the retail market does not allow them to take full advantage of these benefits.

In most Member States, final consumers have little or no incentive to change their energy consumption in response to market price changes, as they do not receive real-time price signals. The market restructuring package now provides an opportunity to deliver on this commitment. More transparent, real-time price signals will provide an incentive for consumers to participate in the market (either individually or in aggregate) and will make the electricity system more flexible, facilitating the integration of electricity from renewable energy sources. Technological developments can also save households a lot of energy, while appliances and systems such as smart appliances, electric vehicles, electric heating, air conditioning and heat pumps in insulated buildings, and district heating and cooling can automatically adapt to price fluctuations and play a significant role at system level, allowing them to be flexibly connected to the electricity grid. To ensure that consumers benefit financially, it is important that they have access to well-functioning, intelligent systems and electricity supply contracts that guarantee dynamic prices linked to the spot market.

As well as consumers influencing their energy consumption according to price signals, new demand-side services are emerging: some new market players are taking on the responsibility of managing the electricity consumption of a limited number of consumers, who are compensated for their flexibility. While these services are currently supported by existing EU legislation, practical experience shows that the existing provisions are not effective enough to remove the primary market barriers to market entry for these operators. In order to improve the take-up of these new services, the relevant provisions need to be strengthened.

In many Member States, electricity prices do not follow supply and demand at all, but are regulated by public authorities. Price regulation can discourage effective competition, discourage investors and prevent new entrants from entering the market. The Commission has therefore committed in its Energy Union Framework Strategy[142] to phase out prices that are not regulated at a cost-recovering level and encourages Member States to set a timetable for the abolition of all regulated prices. One of the objectives of market restructuring is to ensure that supply prices are not influenced by any public intervention, with some justified exceptions. This draft regulation may represent the main resistance from Member States, as it would prevent prices from being set in an "authoritarian" way, which may run counter to some Member States' policy objectives.

[142] *See*: Commission Communication "A stable and resilient Energy Union and a forward-looking climate framework strategy", COM(2015) 080.

Thanks to rapidly falling technology costs, more and more consumers can afford to reduce their energy bills with rooftop solar panels and solar panels. However, the lack of common rules for so-called "producer-consumers" still makes it difficult to produce energy for own use. These obstacles could be removed by appropriate rules, e.g. by guaranteeing consumers the right to produce energy for their own use and to feed the surplus into the grid against payment, taking into account the costs and benefits at the level of the whole system (e.g. appropriate contribution to grid maintenance costs).

The development of local energy communities can be a good way of managing energy at community level: these communities either use the electricity produced directly themselves or use it for (district) heating and cooling, regardless of whether they are connected to the distribution grid. In order for these initiatives to develop without hindrance, Member States need to put in place an appropriate legal framework to allow these activities in the context of market restructuring.

Currently, more than 90% of intermittent renewable energy sources producing electricity are connected to the distribution grid. Following the integration of local generation, the grid charges paid by household consumers have increased accordingly. At the same time, the taxes and charges needed to finance grid extension and renewable energy investments have increased dramatically. The restructuring of the market and the revision of the Renewable Energy Directive provide a good opportunity to address these problems, which may disproportionately affect some household consumers.

If distribution system operators (DSOs) could at least partly address the challenges of fluctuating generation at local level (e.g. by managing flexible local energy resources themselves), grid costs would already be significantly reduced. However, as DSOs are often part of vertically integrated companies that are also active in the supply business, safeguards need to be put in place at the regulatory level to guarantee their neutrality in new functions, e.g. data management or the use of flexible resources to relieve local congestion.

Another important tool to stimulate competition and consumer empowerment is transparency of information. Previous consultations and studies carried out by the Commission have shown that consumers complain about the lack of transparency of information on electricity markets, which makes it difficult for them to benefit from the advantages of competition and to participate actively in the markets. They consider that they do not have enough information about other suppliers or new energy services, and complain that offers and switching procedures are too complex. The reform will also ensure data protection, given the high commercial value of energy data generated by the increased use of new technologies (in particular smart metering).

When it comes to putting consumers at the heart of the energy market, market restructuring must also focus on how to protect the most vulnerable groups in society and prevent more energy-poor households. As energy poverty

is on the increase and it is not yet clear how to reduce the vulnerability and energy poverty of consumers, the market restructuring proposal requires Member States to monitor energy poverty in an appropriate and regular manner, based on principles defined at EU level. The revised directives on energy efficiency in general and on energy efficiency in buildings include additional measures to tackle energy poverty.

b) Security of electricity supply

Security of electricity supply is vital in modern societies that are highly dependent on electricity and internet-based systems. It is therefore necessary to assess whether the European electricity system is capable of providing the generation and flexibility to ensure that electricity supply is always reliable (adequacy of energy sources). Security of energy supply is not only a national obligation but also an important pillar of European energy policy[143] . This is because security of supply can be organised more efficiently and competitively in well-functioning markets through a fully interconnected and synchronised network than on a purely national basis. The stability of the network in each Member State often depends to a large extent on the electricity flows from neighbouring countries and potential security of supply problems, and therefore usually has a regional impact. The most efficient way to solve national energy production problems is therefore at regional level, allowing Member States to use surplus generation from other countries. A coordinated European adequacy assessment based on a commonly agreed methodology should therefore be introduced in order to obtain a realistic picture of energy production needs, taking into account the integration of electricity markets and possible energy imports from other countries. If the coordinated adequacy assessment shows that capacity mechanisms are needed in certain countries or regions, they should be designed to minimise internal market distortions. Clear and transparent criteria should therefore be established to minimise distortions to cross-border trade, optimise the application of the user-side response and mitigate the impact on decarbonisation, while avoiding the risk that fragmentation of national capacity mechanisms creates new barriers to market functioning and competition.

c) Regional cooperation

The way EU Member States are interconnected through the common trans-European network is unique in the world and is a huge advantage for the efficient management of the energy transition. Without the possibility to use generation and demand resources from other Member States, the costs of the energy transition for consumers would be much higher. Today, cross-border

[143] *See*: Article 194(1)(b) TFEU

system operation is based much more on interdependence than in the past. This is due to the increase in variable and decentralised generation, closer market integration and, in particular, shorter market time intervals. Interdependence is also reflected in the fact that actions taken by regulators or network operators at Member State level can have a direct impact on other Member States. Experience shows that uncoordinated decisions taken at national level can lead to significant costs for European consumers.

For example, the fact that some interconnectors are only used up to 25% of their capacity, mostly due to uncoordinated national restrictions, and that Member States have so far been unable to establish appropriate price zones, illustrates the need for more coordination between TSOs and regulators. Successful examples of voluntary and mandatory cooperation between TSOs, regulators and governments demonstrate that regional cooperation can improve the functioning of the market and greatly reduce costs. In some areas, such as the EU-wide market coupling mechanism, TSO cooperation is already mandatory. The majority voting system has been very successful on some issues where voluntary cooperation (with veto rights for all TSOs) has not proved effective enough to solve regional problems. Based on this positive example, it seems appropriate to make cooperation mandatory in other areas of the regulatory framework. TSOs could decide within the regional operational centres on issues where fragmented and uncoordinated national measures would have a negative impact on the market and consumers (e.g. in the areas of system operation, interconnection capacity calculation, security of supply and risk preparedness).

d) Adapting regulatory supervision to regional markets

It also seems appropriate to adapt regulatory supervision to the new market conditions. Currently, all major regulatory decisions are taken by national regulators, even where a common regional solution is needed. While ACER has been successful in its role of providing a forum for coordination between national regulators representing different interests, its main tasks are currently limited to coordination, advice and monitoring. Although market players are increasingly cooperating across borders and deciding on certain issues concerning network operation and electricity trading by qualified majority voting at regional or even EU level[144] , there is no equivalent at regulatory level for these regional decision-making procedures. Regulatory supervision therefore remains fragmented, which can lead to conflicting decisions and unjustified delays.

[144] *See for example* Article 9 of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing guidelines on capacity allocation and congestion management *[OJ L 197, 25.7.2015, p. 24-72].*

Giving ACER greater authority to resolve cross-border issues requiring coordinated regional decision-making could make decision-making on cross-border issues faster and more efficient. The national regulators deciding on these issues by majority vote in ACER would remain full participants in the process.

3. Legal basis, subsidiarity and proportionality

a) Legal basis

The legal basis for the proposed measures is Article 194 of the Treaty on the Functioning of the European Union (TFEU), which sets out and consolidates the EU's competences in the field of energy policy. According to Article 194 TFEU, the objectives of the Union's energy policy are to ensure the functioning of the energy market, to guarantee security of energy supply in the Union, to promote energy efficiency and energy saving and the development of new and renewable energy sources; and to promote the interconnection of energy networks.

In the light of the legislation in force and the general trend of increasing integration of the energy market, this initiative should be seen as part of the ongoing work to integrate European energy markets and make them work efficiently.

The timeliness of this action is also justified by the recent calls for action at EU level by both the European Council[145] and the European Parliament to complete the European energy market.

b) Subsidiarity

The proposed amendments to the provisions of the Electricity Markets Regulation, the Directive concerning common rules for the internal market in electricity and the Regulation establishing an Agency for the Cooperation of Energy Regulators were necessary to achieve an integrated EU energy market, which could not have been achieved with the same effectiveness at national level. As described in detail in the assessment of the recast legislative acts, the fragmented approaches of Member States had led to delays in completing the internal energy market, suboptimal or inconsistent regulatory measures, unnecessary duplication of public intervention and delays in correcting market failures. When it came to issues such as energy trading, common grid

[145] In February 2011, the European Council set 2014 as the target date for completing the internal energy market and 2015 as the target date for removing the isolation of certain Member States from the grid in further developing interconnectivity.In June 2016, the European Council also called for a single market strategy for energy and for the Commission to present action plans with 2018 as the deadline for implementation.

operation and product standardisation, it would have been impossible to create an internal energy market that ensured competitive and sustainable energy for all, if fragmented national rules had been followed.

The increasing interconnection of EU electricity markets had required closer cooperation between national actors. National policy interventions in the electricity sector had also had a direct impact on neighbouring countries due to the interdependence of Member States' energy supplies and interconnections. Ensuring the stability and efficient functioning of the grid at Member State level alone had become an increasingly complex task, as the increase in cross-border trade, the spread of decentralised generation and the growing consumer participation had all tended to amplify spill-over effects. No single country had been able to take effective action – and the consequences of unilateral action had become even more pronounced. This general observation applied to all the measures introduced by the proposal at the time, regardless of whether they concerned energy trading, grid operation or improving consumer participation.

The economic impact of common regional issues requiring coordinated decisions on other Member States was considerable, and experience had shown that voluntary cooperation, which had proven its worth in many other areas, was not suitable in many cases for addressing technically complex conflicts with significant distributional impacts between Member States[146]. Existing voluntary initiatives, such as the five-stakeholder energy forum, had a limited territorial scope, as they covered only part of the EU electricity market and did not necessarily include all the most physically interconnected countries.

c) Proportionality

The policy decisions contained in the Electricity Regulation, the Electricity Directive and the ACER Regulation aimed to adapt the structure of the electricity market to the increasing decentralised generation and the technological developments of the time.

The proposed reforms were strictly limited to those measures that were essential to achieve the necessary progress in the internal market, leaving as many powers and tasks as possible to Member States, national regulators and other national actors.

Hence, the impact assessment did not favour any of the policy options that would have gone further towards harmonisation, i.e. introducing a single independent European energy regulator or a single integrated European TSO, or more consistently prohibiting any state intervention without allowing any exceptions. Instead, the proposals sought balanced solutions that limited the

[146] *See*, for example, the debate on tackling bottlenecks in central Europe, where market integration has suffered significant delays due to diverging national interests.

national scope of regulatory action only where coordinated action was clearly more beneficial to consumers.

The policy options adopted aimed to create a level playing field for all energy production technologies and to counteract market distortions so that renewables could compete on equal terms in the energy market. In addition, all market players had to take financial responsibility for grid balance. Factors that hindered grid flexibility services, such as user-side response, were to be removed. The measures also aimed to improve the liquidity of the short-term market, so that price fluctuations were adequately captured when energy was scarce, and to provide appropriate incentives to maintain network flexibility.

Member States were also expected to seek to phase out general price regulation at retail level, starting with below-cost pricing. Consumers in a vulnerable situation could be protected by temporary price regulation. In order to stimulate competition, the collection of termination fees was to be limited to make it easier for consumers to switch supplier. In addition, high-level principles ensured that energy bills were clear and comprehensible and that consumer data could be accessed in a non-discriminatory way, while maintaining general data protection provisions.

The institutional framework needed to be adapted to the need for coordination at regulatory level and to the new challenges arising from the development of cross-border trade in electricity and the gradual integration of the market. ACER's remit was extended, in particular in relation to the regional operation of the energy system, but the central role of national regulators in energy market regulation was maintained.

The impact assessment accompanying the proposal had carefully screened all options for proportionality. It is interesting to note that the proposed policy measures were a compromise between bottom-up initiatives and top-down market governance. The measures did not in any way take over the role of national governments, national regulators or TSOs in performing a number of critical functions in a proportionate manner. Rather, the aim was to ensure that national regulators met as effectively as possible at regional level, in formal or informal settings, to resolve issues relating to the management of the electricity system at a level appropriate to the scale of the problem.

Without advocating a one-size-fits-all "full harmonisation" approach, the measures aimed to create a level playing field for all market players, in particular with regard to market opportunities across national borders. Finally, a certain degree of standardisation of rules and products was also considered essential for the efficient cross-border marketing of electricity; if network operation decisions had had to be taken by Member States and regulators acting in isolation from each other, market outcomes would have been worse than expected. Direct experience since the 2009 Third Energy Package with the development and adoption of common network and trading rules (so-called

"network codes" and "guidelines") had shown that it was clearly positive when regulators and national authorities sat around the same table and agreed on common rules and methodologies, both at a high level and on technical principles.

The gap between the competitiveness of retail and wholesale markets was widening; retail markets were lagging behind in terms of both services and consumer benefits. By monitoring energy poverty, transparency, clarity of information provided to consumers and access to data, it was ensured that the proposed measures did not unduly restrict national competences.

d) Choosing the type of act

The proposal was intended to amend the key pieces of legislation that formed part of the Third Energy Package. These were the Electricity Regulation (714/2009/EC), the Electricity Directive (2009/72/EC) and the Regulation establishing ACER (713/2009/EC). The adoption of an amending act would have been less appropriate to introduce a number of new provisions. The choice of type of act therefore implied that rules already adopted and implemented needed to be revised – this corresponded to the natural "life cycle" of existing legislation.

XI. DIRECTIVE (EU) 2019/944 – RECASTING THE INTERNAL ELECTRICITY MARKET RULES

1. Grounds for and Objectives of the New Directive

Directive (EU) 2019/944[147] on common rules for the internal market in electricity was adopted as part of the EU's "Clean Energy for All Europeans" package to update the *Third Energy Package* in light of new challenges and policy goals. The previous framework (2009/72/EC) needed revision due to the rapid growth of renewable and distributed generation, emerging smart technologies, and a recognition that consumers should play a more central role in energy markets. The overarching objective of the recast directive was to ensure a more competitive, flexible and consumer-centric electricity market across the EU, with market-based pricing as the norm. It strengthens consumer rights and introduces new ones (placing "active consumers" at the heart of the market), provides a framework for energy communities, and compels Member States to monitor and address energy poverty as a policy priority[148]. At the same time, the directive aimed to safeguard security of electricity supply through better coordination, and to deepen regional cooperation and regulatory oversight at the European level, recognizing that electricity networks and markets transcend national borders. In sum, the new rules seek to empower consumers, integrate clean energy sources, and enhance the resilience of Europe's power system, all while respecting the principles of subsidiarity and proportionality in the EU energy policy framework. The key goals and motivations of Directive 2019/944 can be detailed as follows.

a) Adjustment of market rules

A core goal was to adapt EU electricity market rules to new market realities: notably the rise of intermittent renewable generation, decentralised energy resources, and advances in digitalisation. The directive and its companion regulation were designed to create a level playing field for all energy resources and to remove obstacles preventing flexible, efficient market functioning. This includes requiring that electricity prices be formed by supply and demand without structural price regulation (apart from limited exceptions), so that price signals can drive investment and demand response. All market participants, including renewable and distributed generators, are to bear

[147] 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,

[148] ERBACH, 2019.]

financial responsibility for keeping the grid in balance, which incentivises flexibility and efficiency. Rigid rules such as preferential dispatch for certain generators have been curtailed under the new design, instead encouraging short-term markets and cross-border trade to handle variability in supply. The reforms aim to improve resource adequacy through market-based mechanisms while limiting distortive state interventions. For example, if capacity remuneration mechanisms are needed to ensure security of supply, they must satisfy common EU criteria so as to minimize distortions to trade and competition.

In essence, Directive 2019/944 (together with Regulation (EU) 2019/943) updates the internal market rules to foster competition, integrate renewables, and enhance flexibility, thereby "adjusting" the electricity market design to the EU's decarbonisation and innovation goals[149]. Public service obligations (PSOs) and other market interventions are still permitted for reasons of general economic interest, but the directive clarifies that such measures (e.g. retail price regulation) must be transparent, targeted, and temporary, to avoid undermining the competitive market[150]. Overall, the new framework maintains the free choice of suppliers and promotes market-based retail prices, with any exceptions (such as regulated tariffs for vulnerable consumers) tightly defined and subject to EU conditions.

b) Consumers at the heart of the Energy Union.

The 2019 directive emphatically puts energy consumers in the center of the internal market reform, expanding their rights and opportunities to participate actively in the energy transition[151]. It reinforces existing customer protections and creates new forms of consumer empowerment unprecedented in EU energy law. For instance, every consumer has the right to freely choose or change suppliers with minimal switching costs, enabled by faster switching (within 24 hours by 2026) and a ban on unjustified termination fees[152]. The directive mandates that consumers must have access to at least one certified price comparison tool to transparently compare offers[153] [154]. Critically, consumers now have the right to a dynamic electricity price contract, meaning any household or small business with a smart meter can opt for tariffs linked to real-time wholesale prices, and larger suppliers (over 200,000 customers) are obliged to offer such contracts alongside fixed-price options. Consumers also gain the right to engage in demand response through independent aggregators

[149] ERBACH, 2019.
[150] EUR-Lex: Summary of Directive (EU) 2019/944 – Internal market for electricity
[151] ERBACH, 2019.
[152] Directive (EU) 2019/944 of 5 June 2019 on common rules for the internal market for electricity
[153] EUR-Lex: Summary of Directive (EU) 2019/944 .
[154] Directive (EU) 2019/944 of 5 June 2019

– they can sign up with an energy aggregator for load shifting services without needing their supplier's consent, and Member States must ensure aggregators can participate in all electricity markets on equal footing.

Another groundbreaking provision is the explicit right for consumers to produce, consume, store, and sell their own electricity, individually or jointly (often termed "prosumer" rights). In line with this, the directive introduces the concept of the "active customer", who may not only generate renewable electricity (e.g. via rooftop solar) but also store it (e.g. in a home battery or electric vehicle) and feed excess back to the grid, all while maintaining consumer protections. To facilitate active participation, smart metering is strongly emphasized: where not already rolled out, consumers have the right to request a smart meter and have it installed within 4 months[155]. Member States are obliged to deploy smart meters broadly (aiming for at least 80% coverage where cost-benefit analyses are positive) and to ensure minimum functionality standards for these meters, so that consumers receive accurate, near-real-time information and can access dynamic pricing and other services[156]. The directive's Annex II and related acts set out common functionalities for smart metering systems, reflecting the best available technology and the 2012 EU recommendations on smart meter capabilities[157]. Equipped with smart meters, consumers can better manage their energy use and bills, and even share energy data with accredited third-party service providers (for example, energy management apps), thanks to new rules on data interoperability and availability.

Consumer protection is also bolstered: electricity bills must be clearer and more frequent (at least every month if smart meters allow remote reading) to help consumers track consumption[158]. Member States must set up "one-stop shops" for consumers to get information on their rights and available energy offers, and ensure effective out-of-court dispute resolution mechanisms (such as an energy ombudsman or consumer body) for quick resolution of complaints[159]. Recognising the reality of energy poverty, the directive requires governments to monitor the number of households in energy poverty and report on measures to protect vulnerable customers[160]. National definitions of vulnerable customers must be in place, and disconnection of such customers should be a last resort – the directive stipulates that consumers in arrears be given information on alternative payment plans or support before being cut off. Energy poverty alleviation is also linked to other EU measures: for example, parallel revisions to the Energy Efficiency Directive and the Buildings Directive encourage energy

[155] EUR-Lex: Summary of Directive (EU) 2019/944
[156] European Commission: *Smart grids and meters*
[157] Directive (EU) 2019/944 of 5 June 2019
[158] ERBACH, 2019.
[159] Directive (EU) 2019/944 of 5 June 2019
[160] ERBACH, 2019.

efficiency improvements to reduce household energy costs. Importantly, while the directive presses for phasing out below-cost regulated prices, it permits social tariffs or price regulation for vulnerable consumers in the short term, so long as these schemes are targeted and temporary.

Beyond individual consumers, Directive 2019/944 empowers collective consumer activities. It formally recognizes Citizen Energy Communities as legal entities through which citizens can jointly engage in generation, distribution, supply, consumption, energy sharing, and energy services. Such communities (often cooperatives or local initiatives) are given rights to access all electricity markets and networks on a non-discriminatory basis, and members retain their rights as individual consumers (including the right to leave the community). Communities can share the electricity produced by their members, and even own or operate distribution networks if allowed by national law (subject to normal regulatory oversight)[161]. The directive thus paves the way for decentralized, community-driven energy projects to flourish, complementing larger suppliers and reinforcing local energy resilience. Finally, the directive anticipates the rise of electromobility and its integration with the grid: Member States must facilitate the roll-out of electric vehicle charging infrastructure and enable smart charging. While generally leaving EV charging services to the market, the directive permits DSOs to own or operate charging points only if no other party is willing to do so and with regulatory approval, ensuring that monopoly network operators do not crowd out competitive EV service providers[162]. In summary, the new directive places consumers – individually and collectively – at the forefront of the Energy Union, granting them unprecedented rights to actively shape and benefit from the electricity market transformation[163].

c) Security of electricity supply

Ensuring an uninterrupted and reliable electricity supply remains a fundamental objective, given modern society's acute dependence on electricity and digital systems. The directive affirms that security of supply is not merely a national concern but a European priority, especially as national grids are highly interconnected and cross-border electricity flows underpin network stability. A key insight driving the new rules is that a well-integrated internal market, with fully interconnected and synchronized networks, can guarantee security of supply more efficiently and at lower cost than isolated national approaches. Thus, one of the directive's aims (complemented by Regulation (EU) 2019/943 on the internal market for electricity and Regulation (EU) 2019/941 on risk preparedness) is to move toward a coordinated European resource adequacy assessment and a common approach to capacity mechanisms. Instead of each

[161] EUR-Lex: Summary of Directive (EU) 2019/944
[162] EUR-Lex: Summary of Directive (EU) 2019/944
[163] ERBACH, 2019.

Member State applying different methods to gauge whether future generation capacity is sufficient, the new framework provides for an EU-wide, objective adequacy assessment using a shared methodology. This gives a realistic picture of supply risks by accounting for the contribution of interconnections and cross-border energy imports. If such assessments identify a genuine resource adequacy concern, Member States may introduce capacity mechanisms (payments to ensure backup capacity), but these must conform to clear EU criteria to minimize distortion: for example, they should be open to cross-border participation (allowing excess capacity in one country to support another) and designed in line with the EU's decarbonisation goals (avoiding, for instance, subsidies to the most polluting plants).

In practice, the Clean Energy package places strict limits on capacity payments to high-emission generators and mandates that any capacity scheme not create unjustified barriers to EU market functioning. By requiring such alignment, the directive (together with the parallel Regulation) aims to preserve security of supply through market-based solutions and regional solidarity, rather than through fragmented national interventions. Additionally, the directive underlines that Member States must cooperate regionally in crisis situations: the separate Risk Preparedness Regulation compels governments to develop regional emergency plans and define *electricity crisis scenarios*, reflecting the principle that electricity shortages or blackouts often have cross-border effects and are best managed collectively. In summary, the new market design treats security of supply as a shared responsibility. By leveraging the interconnected European grid and setting common rules for adequacy and capacity tools, it seeks to guarantee reliability while avoiding an outdated, insular approach to keeping the lights on.

d) Regional cooperation

Deeper regional coordination is a cornerstone of the 2019 reforms. Europe's power system is uniquely interconnected – no Member State is electrically an island – and cross-border cooperation has proven essential for efficiency and reliability. The directive builds on the fact that sharing generation and network resources across borders reduces costs for consumers and facilitates the integration of renewable energy at scale. Prior to the new directive, voluntary cooperation between Transmission System Operators (TSOs), regulators, and governments had achieved notable successes (for example, the market coupling of day-ahead markets across Europe, which uses cross-border capacity efficiently, was implemented through voluntary TSO initiatives). However, experience also showed the limits of voluntary measures: uncoordinated national decisions – such as arbitrary rules limiting the use of interconnectors, or delays in creating appropriate bidding zones – have led to suboptimal outcomes and higher costs for consumers. For instance, some cross-border lines historically were used

at only a fraction of their capacity due to unilateral restrictions, illustrating lost opportunities for trade and solidarity. The Clean Energy package therefore sought to make certain forms of cooperation mandatory and institutionalized. Notably, it called for the establishment of Regional Operational Centres (ROCs) – later termed Regional Coordination Centres (RCCs) in the final legislation – to assist TSOs in tasks that have regional impact. These entities, created by Regulation (EU) 2019/943, bring TSOs from multiple neighboring countries together to jointly handle functions like coordinated capacity calculation for interconnectors, regional grid security analyses, and outage planning, among others. By pooling expertise and using majority voting for decisions within these centers, issues that one TSO alone could previously veto are now decided collectively for the regional good. The directive complements this by urging mandatory TSO cooperation in areas where fragmented national action would negatively impact other states. Similarly, on the regulatory side, the directive and the parallel revised ACER Regulation strengthen the framework for cooperation among National Regulatory Authorities (NRAs).

Cross-border infrastructure and trade require regulators to coordinate on approvals, grid codes, and market rules; hence, the package reinforces regional decision-making by regulators as well (for example, certain decisions are now taken by a majority of NRAs at EU level through the Agency for the Cooperation of Energy Regulators). Overall, the new directive enshrines the principle that regional solutions are often the most effective for an integrated market. By formalizing structures for TSOs and regulators to work together across borders, it seeks to minimize the costs of the energy transition and ensure that national policies do not unwittingly harm neighboring countries or the broader European consumer. The regional approach also enhances security of supply, as countries can draw on each other's resources in times of need, reflecting a spirit of *energy solidarity*.

e) Adapting regulatory supervision to regional markets

Hand-in-hand with regional operations is the adaptation of regulatory oversight to match the new market reality. Prior to 2019, even as energy companies and TSOs increasingly made decisions on a regional or EU-wide basis, regulatory powers remained almost entirely national, often leading to inconsistent or delayed regulatory actions in cross-border matters. The directive acknowledges that leaving all major decisions to individual national regulators can be problematic when those decisions have significant spill-over effects on other countries' markets. Therefore, a key objective was to empower ACER (the European Agency for Cooperation of Energy Regulators) with a stronger role in facilitating and even making certain regional decisions. The ACER Regulation (EU) 2019/942, revised alongside the directive, gives ACER new decision-making authority in areas like the approval of technical network

codes, the oversight of the new Regional Coordination Centres, and resolving conflicts where regulators cannot agree on cross-border issues[164]. Under the new framework, national regulators still retain primary responsibility for their domestic market (the principle of regulatory autonomy is preserved), but when issues extend beyond one country – such as how capacity on an interconnector is allocated, or how resource adequacy is assessed regionally – those decisions are now taken collectively, with ACER acting as the forum or decision-maker to ensure a coherent outcome. The NRAs participate in ACER's Board of Regulators and can vote on regional matters, making binding decisions by majority vote in certain cases rather than needing unanimity or separate national rulings. This model strikes a balance by adapting regulatory supervision to the integrated market while maintaining national involvement: ACER's enhanced authority speeds up and unifies regulatory action, but national regulators remain fully involved in the process, ensuring that local insights and interests are considered. The result is a more coordinated regulatory regime that can effectively oversee entities operating at regional scale (like RCCs or power exchanges) and enforce common rules, thereby supporting the single energy market. In summary, the directive's objectives include modernising the institutional framework – extending ACER's remit and intensifying inter-regulator cooperation – so that regulatory oversight is exercised at the appropriate scale (regional/EU) for issues that individual national regulators cannot address alone. This prevents fragmentation and conflicting decisions, contributing to a more seamless internal market for electricity.

2. Legal Basis, Subsidiarity and Proportionality

a) Legal basis

The legal foundation for Directive 2019/944 is Article 194 of the Treaty on the Functioning of the European Union (TFEU), which specifically empowers the EU to legislate in the field of energy to ensure the functioning of the energy market and security of supply, promote energy efficiency and renewables, and ensure interconnection of networks. Article 194 TFEU established a clear Union competence for energy policy (introduced by the Lisbon Treaty), enabling the EU to adopt measures like this directive under the ordinary legislative procedure. The directive, being a recast of an earlier directive, also formally amends certain related legislation – notably it amends Directive 2012/27/EU on energy efficiency in order to harmonize provisions on metering and billing with the new electricity market rules (for example, eliminating duplicative

[164] EUR-Lex: Summary of Directive (EU) 2019/944

or inconsistent requirements)[165]. The choice of a directive (as opposed to a regulation) was deliberate: while the parallel Electricity Regulation (EU) 2019/943 governs many wholesale market and system operation aspects with direct effect, the retail market and consumer protection rules in 2019/944 require national transposition to accommodate different national circumstances[166]. This approach reflects the twin aims of EU energy law – creating an integrated market *and* respecting Member States' rights (e.g. to choose their energy mix and public service measures) as guaranteed by Article 194(2) TFEU. In short, Article 194 provided a solid treaty basis, and the form of the act as a recast directive allowed the EU to update existing electricity market rules while giving Member States leeway in implementation details.

b) Subsidiarity

The directive complies with the subsidiarity principle, as the issues it addresses transcend national borders and cannot be solved by Member States acting alone. The Commission's rationale (supported by the European Parliament and Council) was that an integrated EU electricity market requires common rules and coordinated action, because purely national approaches had led to fragmentation, inefficiencies, and delays in tackling shared challenges. For example, uncoordinated national regulations on cross-border trade and renewable support were impeding the completion of the internal market. Issues like energy trading rules, grid operation standards, and product definitions for electricity are inherently transnational – if each country followed its own rules, trading electricity across Europe would be impractical and the benefits of competition and scale would be lost. The internal market goal ("competitive and sustainable energy for all Europeans") simply cannot be achieved by isolated national measures. The increasing interconnection of EU grids means that national decisions (e.g. on capacity mechanisms, renewables integration, network investment or even retail pricing) have direct impacts on neighbouring states. Therefore, EU-level legislation was necessary to provide a harmonised framework ensuring that Member States move in the same direction. The directive's provisions were carefully evaluated to ensure they only address matters where EU action adds value. Notably, where local or regional specifics are important, the directive allows flexibility – for instance, Member States can choose how to protect vulnerable consumers or organize their data management models, as long as they meet the directive's objectives. By setting common objectives and principles (e.g. consumers' rights, non-discriminatory network access, etc.) and leaving the implementation details largely to national authorities, the directive respects the diversity of national

[165] ERBACH, 2019.
[166] EUR-Lex: Summary of Directive (EU) 2019/944

systems while fulfilling subsidiarity. In sum, EU action was justified and indeed required because fragmented national policies had proven insufficient for creating the integrated, consumer-friendly and secure electricity market that Europeans need.

c) Proportionality

The measures introduced by Directive 2019/944 are calibrated to be proportionate to the objectives pursued, meaning they do not exceed what is necessary to achieve an effective internal electricity market. The legislative process (informed by an extensive impact assessment) explicitly avoided extreme options that would represent an overly centralized or one-size-fits-all approach. For example, more radical ideas such as establishing a single EU regulator or a single European system operator were considered but not chosen, since they would go beyond what is required and could unduly encroach on national prerogatives. Instead, the adopted measures are targeted and balanced: they enhance coordination and harmonisation only where clearly beneficial, while leaving as much responsibility as possible to Member States, NRAs, and TSOs at national level. The directive's provisions on consumer rights, for instance, set high-level outcomes (e.g. free supplier switching, clear billing, data privacy) but allow countries to implement them in line with national market conditions. Similarly, requirements to phase out general price regulation are paired with safeguards for vulnerable customers, ensuring that social policy goals can still be met in a proportionate way. The regulatory reforms – like expanding ACER's role or mandating regional TSO cooperation – are limited to what is necessary to fix coordination problems; they do not dismantle national authorities or create wholly new institutions except where needed to fill a clear gap. Crucially, the directive aims to level the playing field for energy resources (renewables, demand response, storage) so that market competition can drive efficiency and innovation, which is a proportionate means to achieve a cleaner and more secure energy system. Measures that might impose costs (like smart meter roll-outs or data hubs) are justified by the significant benefits to consumers and the system, and often come with flexibility or phase-in periods. The impact assessment confirmed that each chosen policy was cost-effective and less intrusive than other options. In practice, the directive's proportionality is visible in provisions such as allowing temporary price controls for vulnerable groups (instead of an outright ban on all price regulation), or in refraining from mandating a uniform model for data management (countries can have decentralized or centralized data hubs as long as core principles are met). The overall institutional adjustments – e.g. requiring national regulators to cooperate, rather than replacing them – likewise reflect a moderate approach that strengthens the EU framework without dismantling national structures. In conclusion, Directive 2019/944 was crafted to minimally intrude upon national

autonomy while maximally securing the benefits of a common market. Its provisions are proportional in that they target identified market failures (such as lack of consumer engagement, barriers to cross-border trade, and uneven playing fields for new technologies) with calibrated remedies, and they avoid any unnecessary centralisation or uniformity beyond what is needed for the market to function fairly and effectively.

d) Choice of the type of act

The recourse to a Directive (recast) as the legislative instrument was a conscious choice to fit the nature of the reforms. Rather than a mere amendment to the existing 2009 directive or the adoption of a regulation for all aspects, the legislators opted to recast the electricity directive to incorporate numerous new provisions while preserving the directive format. An amending act was deemed "less appropriate" because the extent of changes (new consumer rights, new market participant categories, etc.) was substantial and touching many articles; a recast provides a consolidated legal text for clarity. At the same time, a directive (as opposed to a regulation) allows each Member State to transpose the rules in line with national specificities, particularly in the retail and consumer domain where legal and market conditions vary across the EU. This was seen as more suitable for rules on public service obligations, consumer protection, and distribution network regulation, which often require integration with national law (e.g. civil law contracts, social policy measures). By contrast, aspects of wholesale market design and system operation that benefit from immediate uniform application (such as rules on capacity allocation, energy balancing, or the establishment of RCCs) were placed in the directly applicable Regulation (EU) 2019/943 adopted alongside the directive. Thus, the package combines a regulation for technical and trading rules with a directive for the more normative and consumer-facing rules, reflecting an appropriate division of labor between legislative instruments[167]. The choice also respects that certain member state competencies (for example, deciding the energy mix or designing social tariffs) should not be overridden by a fully harmonizing regulation. In summary, the recast directive as the chosen instrument follows the natural lifecycle of EU energy legislation – roughly every decade, the internal market directives have been revisited and updated – and it strikes a balance by updating the common rules while leaving room for national transposition. This approach facilitated political agreement as well, since Member States retained a sense of ownership over how to implement the new rules domestically. The directive was adopted under the ordinary

[167] EUR-Lex: Summary of Directive (EU) 2019/944

legislative procedure (co-decision) in 2019, and Member States were given until the end of 2020 to transpose its provisions into national law[168].

3. Main Provisions of Directive (EU) 2019/944

Directive 2019/944 repealed and replaced the previous Electricity Market Directive (2009/72/EC), bringing in a comprehensive set of modernized rules. Its provisions are organized into eight chapters (I to VIII), plus annexes, covering all aspects from definitions and market principles to consumer rights, network operation, and regulators' powers. The following is an overview of the main elements of the directive, structured by chapter, highlighting how it addresses the key areas of consumer empowerment, market design, regional cooperation, oversight, and public service obligations in practice.

- **Chapter I (General Provisions)** – This chapter sets out the *subject matter, scope, and definitions*. It underscores the central importance of consumers and reaffirms the main principles of the internal market. Many definitions were updated or added to capture new concepts introduced by the Clean Energy package. For example, the directive now defines terms like *'aggregation'*, *'independent aggregator'*, *'energy storage'*, *'dynamic electricity price contract'*, *'active customer'*, and *'citizen energy community'*, among others, which were absent in earlier legislation. Clarifying these terms provides legal certainty for new market activities (like energy storage and aggregation) and new actors (such as energy communities). Chapter I also explicitly states that the directive covers rules for the generation, transmission, distribution, supply, and energy storage of electricity, as well as consumer protection and retail market arrangements[169]. By framing the scope in this way, it integrates energy storage as a formal component of the market (recognizing that batteries and other storage facilities can buy, store, and resell electricity) and confirms that the directive's consumer rights apply across all EU Member States. Importantly, the directive's general principles affirm that electricity supply prices shall be market-based except in duly justified circumstances (tying back to the objective of competitive markets). Member States' ability to impose public service obligations (like price regulation or supply obligations) is maintained but tightened: any such obligations must be clearly defined, transparent, non-discriminatory and verifiably in the general interest, and if they involve price setting, they should be limited to vulnerable customers or temporary crises and be proportionate.

[168] ERBACH, 2019.
[169] EUR-Lex: Summary of Directive (EU) 2019/944

- **Chapter II (Internal Market Principles)** – This chapter lays down the key principles for a competitive, consumer-centred, flexible and non-discriminatory electricity market. It requires Member States to ensure that their regulatory frameworks and market structures align with an open internal market: no undue barriers to cross-border flows, consumer participation or investment are allowed. A foundational rule here is that customers have the freedom to choose their supplier and to switch without obstacles – reinforcing earlier liberalisation measures. Chapter II also reiterates that, as a rule, electricity prices are not to be regulated and must reflect market dynamics, though it spells out the exceptions where governments may intervene (such as for universal service or price caps for vulnerable households, subject to strict conditions). It further updates rules on public service obligations (PSOs): for instance, if Member States impose PSOs on energy companies (like requirements to source renewables or provide energy at regulated tariffs to certain consumers), these must be transparent and competitively neutral, and the directive now requires that any form of price regulation be accompanied by measures to ensure it does not distort the market beyond what is necessary. Chapter II also enshrines certain consumer rights as general principles – such as the right to have access to consumption data, the right to basic contractual information, and protection against unfair commercial practices – paving the way for the detailed consumer provisions in the next chapter. Additionally, it touches on authorisation procedures for new capacity: Member States must have transparent, non-discriminatory authorisation processes for building new power plants or undertaking new electricity activities, consistent with the internal market and security of supply needs (these stem from the directive's earlier iterations and continue here). In summary, Chapter II sets the tone that all national rules must be in service of an integrated EU electricity market, with competitive pricing and free consumer choice at its core. It preserves *universal service* obligations – i.e. the right of all household customers and small enterprises to be supplied with electricity of a specified quality at reasonable prices – but it modernizes their application to align with market opening. Any derogations (like regulated tariffs) are only allowed under the carefully circumscribed scenarios mentioned above, ensuring that market liberalisation is not rolled back while safeguarding equity and security considerations.
- **Chapter III (Consumer Empowerment and Protection)** – This is one of the most innovative parts of the directive, greatly expanding the rights of electricity consumers and detailing the measures for consumer-centric market design. It consolidates and strengthens rules on billing, switching,

and contractual rights from earlier directives, and adds entirely new rights reflecting the technological advancements of the past decade. Key provisions of Chapter III include:

- **Improved Billing and Information:** Bills must be clear, correct and easily comparable, with a minimum set of information provided so consumers can understand and manage their consumption. Consumers have the right to receive a final closing bill within 6 weeks of switching supplier, eliminating long waits. They are also entitled to access at least one independent energy comparison tool (website or app) accredited by authorities, to assess different supply offers[170][171].
- **Contractual Rights and Switching:** Suppliers must provide key information in contracts (tariffs, maintenance services, complaint handling, duration, renewal conditions, etc.), and consumers can terminate contracts with notice not exceeding 1 month. Switching fees are generally prohibited – suppliers cannot charge residential customers any termination fees except in the case of an early exit from a fixed-term fixed-price contract, and even then conditions apply. This ensures minimal barriers to switching[172]. Furthermore, the directive sets the ambition that by 2026, the technical process of switching suppliers should be completed within 24 hours on any working day, a significant improvement from the previous allowance of up to 3 weeks[173].
- **Dynamic Pricing and Smart Meters:** Any consumer with a smart meter has the right to choose a dynamic price contract (tied to spot market prices) from at least one supplier, and every large supplier (>200,000 customers) must offer a dynamic pricing option. This enables consumers to adjust consumption to price signals (e.g. using cheaper electricity at off-peak times or when renewable output is high) and potentially lower their bills. To support this, the directive requires Member States to roll out smart metering systems (subject to cost-benefit analysis). Where a universal rollout is not yet in place, consumers may request a smart meter and get one installed quickly (within 4 months)[174]. Smart meters deployed must meet minimum functional requirements (for example, providing near real-time consumption data to the user, remote reading for the supplier, support for advanced tariffs, and interoperability) as detailed in Annex II of the directive. These measures ensure that consumers can actively engage with the market and unlock demand-side flexibility.

[170] Directive (EU) 2019/944
[171] EUR-Lex: Summary of Directive (EU) 2019/944
[172] EUR-Lex: Summary of Directive (EU) 2019/944
[173] Directive (EU) 2019/944
[174] EUR-Lex: Summary of Directive (EU) 2019/944

- **Demand Response and Aggregation:** The directive firmly integrates demand-side flexibility into the market. It mandates that consumers have a right to participate in demand response either directly or through aggregators. Independent aggregators (third parties that pool consumer loads to sell as a resource) can enter the market without needing permission from the consumer's supplier. Member States must remove any unjust barriers for such aggregators and ensure that aggregation contracts are possible alongside supply contracts. To handle the interaction between suppliers and aggregators, countries are asked to develop fair compensation mechanisms only if an aggregator's activation causes imbalances and costs to a supplier, and any such compensation must strictly reflect costs while considering the system benefits of demand response[175]. This framework legitimizes *demand response* as a tradable resource in capacity, energy, and ancillary service markets.
- **Active Customers and Energy Communities:** Chapter III introduces the notion of "active customers", essentially prosumers, who generate, store or sell electricity (individually or via aggregation) while maintaining their rights as consumers. Active customers are allowed to install renewable generation (like solar PV) and energy storage, consume their self-generated energy, and sell excess back to the grid or through peer-to-peer trading, all without being subject to punitive procedures or unjustified costs. They can also share energy within an apartment building or local community under agreed conditions. Along similar lines, the directive formalizes Citizen Energy Communities: groups of citizens or local actors cooperating in the energy field. These communities have the right to produce, share, and sell energy, to access all electricity markets, and to arrange sharing of electricity among members behind the meter under fair rules. They must be allowed to operate in the market and on the grid without discrimination – for example, network tariffs and charges applied to them should reflect their real use of the system and not be punitive. By recognizing energy communities, the directive empowers collective action, which can drive renewable investment and public acceptance of clean energy at the local level.
- **Data Access and Protection:** The directive updates provisions on consumer data. Consumers must be able to access their consumption data easily and free of charge, and they can authorize any registered supplier or service provider (e.g. an energy management company) to access their smart meter data on their behalf. To facilitate this, Member States need to have transparent rules for data management – whether through a centralized data hub or other arrangements – ensuring that all eligible

[175] EUR-Lex: Summary of Directive (EU) 2019/944

parties (suppliers, aggregators, ESCOs, and the customers themselves) can access metering and billing data *under non-discriminatory conditions* and in a standardized format.[176] The Commission is empowered to develop interoperability requirements via implementing acts, essentially to standardize data formats and communication protocols across the EU. All data handling is of course subject to EU data protection rules (GDPR), and Chapter III reiterates that privacy must be safeguarded in smart metering and energy data processes[177].

- **Consumer Protection and Dispute Resolution:** The chapter reinforces protections for vulnerable customers and those in energy poverty – obliging Member States to define such terms and implement support measures (which may include social tariffs or benefits, energy efficiency improvements, ban on disconnection under critical circumstances, etc.). It maintains the requirement for *universal service* for household customers: i.e. the right to a basic electricity supply. It also requires that consumers be given adequate notice before any disconnection for non-payment and information on avenues to avoid disconnection (like debt assistance, alternative payment plans)[178]. Additionally, Member States must have fast and effective complaint handling and out-of-court dispute settlement for electricity customers.[179] Many countries use an Energy Ombudsman or similar body for this purpose, and the directive mandates that such bodies be independent and able to assist all consumers.
- **Additional Rights:** The directive gives consumers the right to receive a smart meter (under the conditions mentioned) and to benefit from dynamic pricing, as well as the right to be informed of their energy consumption and costs frequently (at least once monthly if automated meter reading is available)[180] [181]. It also introduces the concept of "single billing" in cases where one entity offers both supply and other services, though ensuring the electricity supply part of the bill is transparent. All these measures combine to make the consumer a fully informed and empowered actor in the electricity market, in contrast to the passive consumer model of the past. Chapter III's comprehensive scope is a testament to the EU's policy shift towards seeing the consumer as a driving force in the Energy Union, capable of making choices that collectively further competition, efficiency, and decarbonisation.[182]

[176] EUR-Lex: Summary of Directive (EU) 2019/944
[177] European Commission: *Smart grids and meters*
[178] EUR-Lex: Summary of Directive (EU) 2019/944
[179] Directive (EU) 2019/944
[180] EUR-Lex: Summary of Directive (EU) 2019/
[181] European Commission: *Smart grids and meters*
[182] ERBACH, 2019.

- **Chapter IV (Distribution System Operation)** – This chapter clarifies and expands the rules governing Distribution System Operators (DSOs), recognizing their pivotal role in a decentralised, smart energy system. DSOs are the entities managing the local electricity grids that deliver power to end-users, and the directive updates their responsibilities in light of new developments like distributed generation, electric vehicles, and smart grids. Key points in Chapter IV include:
- **DSO Tasks:** It establishes that DSOs are responsible for ensuring the long-term ability of their network to meet reasonable demands for electricity distribution, with an emphasis on cost-efficient integration of new resources (notably renewable generation).[183] They must operate, maintain, and develop the distribution system with due regard to efficiency, consumer needs, and energy efficiency. An important addition is that DSOs should now actively facilitate integration of distributed energy resources and demand response. For example, DSOs are expected to use *flexibility services* (like contracting with consumers or aggregators to reduce load at peak times) as an alternative to expanding network capacity, where it is more efficient[184]. The directive in fact requires Member States to enable DSOs to procure such flexibility services in a transparent and non-discriminatory manner, to defer or avoid costly grid reinforcements. This pushes DSOs to become "neutral market facilitators" rather than simply network owners – they must adjust to actively managing two-way flows and use market-based solutions for network congestion.
- **Smart Grids:** Member States are encouraged to promote the modernisation of distribution networks through smart grids. While not a binding obligation, Recital 51 of the directive highlights that smart grids should be introduced to encourage decentralised generation and energy efficiency[185]. In practice, DSOs are involved in many EU-wide smart grid projects, and the directive strengthens regulatory oversight of DSO performance in rolling out smart grid technologies. Notably, Article 59 requires regulators to track smart grid development through specific indicators, ensuring DSOs make progress toward a digitalised, intelligent network[186]. DSOs must also coordinate with TSOs and other DSOs on data exchange and network operation to enable smart grid functionalities across the whole system.
- **Electric Vehicles and Charging Infrastructure:** DSOs must plan for and facilitate the integration of electric vehicle (EV) recharging infrastructure.

[183] EUR-Lex: Summary of Directive (EU) 2019/944
[184] European Commission: *Smart grids and meters*
[185] Directive (EU) 2019/944
[186] CurrENT Europe: *Joint Statement: Europe's grid technology industry highlights need for urgent action on Europe's electricity networks*

The directive stops short of mandating DSOs to build charging points – on the contrary, it states that DSOs shall not own or operate EV charging points except if market actors are not willing to do so and subject to a regulatory derogation. This is to avoid conflicts of interest and ensure competitive markets for EV services. However, DSOs should provide sufficient network capacity or innovative solutions (like smart charging and vehicle-to-grid) to accommodate EV uptake. Member States have to create regulatory frameworks that ease the connection of public charging stations to the grid.

- **Data Management:** Many Member States assign DSOs the role of neutral data manager for metering data. The directive requires that whichever entity manages consumption data (often the DSO) must give timely access to that data to consumers and authorized parties, under clear data protection and security rules. DSOs, if they are data managers, must do so impartially and transparently, not favoring any particular supplier or service.
- **Unbundling and Independence:** The chapter reiterates the unbundling requirements for DSOs. If a DSO is part of a vertically integrated utility (one that also has generation or supply activities), it must be independent in terms of legal form, organisation, and decision-making from the other activities not related to distribution.[187] This is essentially the continuation of the Third Package rules to prevent conflicts of interest, ensuring the DSO acts neutrally with respect to all suppliers. Full ownership unbundling is not mandatory at the distribution level, but functional independence is – the DSO cannot share sensitive information with its supply affiliate, for example, and must have separate branding to avoid confusion.
- **Network Development and Transparency:** A new requirement is that larger DSOs (those serving more than 100,000 customers) must publish regular network development plans, usually every 2 years. These plans should outline the expected growth of demand and distributed generation, and detail the investments needed in the network (for the next 5-10 years) to maintain reliability and enable new connections, including charging infrastructure and renewable integration. The plans should be subject to consultation (e.g. with system users and the transmission operator) and approval or monitoring by the regulator.[188] This measure introduces more transparency and proactivity in distribution network planning, akin to how TSOs plan the transmission network.

[187] EUR-Lex: Summary of Directive (EU) 2019/944
[188] EUR-Lex: Summary of Directive (EU) 2019/944

- **Ownership of Storage and Services:** Crucially, Chapter IV sets limits on DSOs engaging in activities beyond their core distribution function to safeguard competition. DSOs are generally not allowed to own, develop, manage or operate energy storage facilities or provide ancillary services, since these are competitive activities. The rationale is that if a monopolist DSO were to own storage, it could distort the market by favoring its own asset or by discouraging independent storage providers. However, exceptions are allowed: if no market party is willing to invest in a needed storage facility after a transparent procurement, a DSO can seek regulatory approval to own/operate storage as a last-resort solution. Even then, the situation must be reviewed periodically (at least every 5 years) to see if a market alternative has emerged, in which case the DSO must exit the activity. Similar provisions apply to DSOs owning EV charging points as mentioned above. In summary, DSOs are steered to focus on their core role of enabling the flow of electricity and data, while leaving competitive segments to the market, except in demonstrably necessary cases.[189]
- Overall, Chapter IV transforms the role of DSOs for the future: from passive network operators to active system managers who must use smart solutions and market procurement to run efficient, flexible grids. It acknowledges the need for smart grids and sets the regulatory conditions for their deployment (neutrality, data access, competitive neutrality in services).[190] [191] This is central to the directive's goal of accommodating the green transition at the distribution level – where most renewables connect and where electric mobility and heat electrification will have their impact.
- **Chapter V (Transmission System Operation)** – This chapter consolidates rules for Transmission System Operators (TSOs) which were largely established under the Third Package, while introducing only minor tweaks, since the main TSO-related innovations (like the creation of Regional Coordination Centres and capacity calculation rules) are handled in the parallel Regulation. The directive maintains the unbundling regime for TSOs: each Member State must have designated one or more TSOs, and those TSOs must be unbundled from generation/supply companies according to one of the accepted models – ownership unbundling, ISO, or ITO (Independent System Operator or Independent Transmission Operator). The recast did not change these models; it kept the strict requirements that supply companies cannot control TSOs and vice versa. TSOs continue to be responsible for operating, ensuring the maintenance

[189] EUR-Lex: Summary of Directive (EU) 2019/944
[190] Directive (EU) 2019/944
[191] CurrENT Europe: *Joint Statement*

of, and developing the high-voltage network, and for securing the ability of the system to meet electricity demand. Chapter V emphasizes close cooperation with neighboring TSOs and with DSOs, reflecting the need for an interconnected system to function smoothly. TSOs must exchange data and coordinate notably on balancing and network security. A significant clarification in the new directive is that TSOs, like DSOs, are not allowed to own or operate energy storage facilities or new flexible resources, except under conditions mirroring those for DSOs (i.e. no willing market investor and regulatory approval)[192]. This was explicitly added to ensure TSOs remain neutral and do not extend their natural monopoly into competitive areas, such as large-scale batteries or power-to-gas facilities that could provide balancing services. Another provision touches on ancillary services: TSOs should procure services like frequency control or voltage support in a market-based manner wherever possible, and treat providers (including demand response and storage providers) fairly. The directive also alludes to the introduction of Regional Operational Centers: while their detailed governance is in the Regulation, Chapter V notes that TSOs are expected to cooperate through these new regional entities for certain functions. TSOs are furthermore obliged to develop a ten-year network development plan (TYNDP) at national level (in coordination with the EU-wide TYNDP under ENTSO-E) and ensure public consultation on those plans – this was already a practice and remains so, helping transparency and forward planning. In essence, Chapter V reaffirms the existing TSO regulatory framework (enshrining unbundling and third-party network access) and integrates the few necessary updates: mainly the prohibition on owning storage (with exceptions) and references to new cooperation mechanisms. The continuity here signals that the Third Package's TSO regime was deemed effective and is being carried over, with the new elements focused more on regional coordination and sector coupling (through market rules rather than directly in the directive's text).

- **Chapter VI (Unbundling of Transmission Systems)** – This chapter specifically details the unbundling requirements for transmission systems and TSOs, effectively carried over from the 2009 directive with minimal changes. It sets out the three unbundling models (Ownership Unbundling, ISO, ITO) and the conditions each must meet, as well as the certification and designation procedures for TSOs, which involve scrutiny by national regulators and an opinion from the European Commission. The recast did not reopen these rules, so the *"full ownership unbundling"* remains the default (and preferred) model for any new TSO or any

[192] EUR-Lex: Summary of Directive (EU) 2019/944

significant ownership changes, meaning the same person or company cannot control both a TSO and any energy production or supply company.[193] The ITO model (Independent Transmission Operator), which allows a vertically integrated utility to keep ownership of the grid but run it under strict independence rules supervised by regulators, is still available under stringent conditions (no influence of the parent company on the TSO's decisions, separate management, etc.). The *Independent System Operator* model (where the network is owned by the company but operated by an independent entity) also persists as an alternative, though it has been rarely used in practice. The directive's Chapter VI basically ensures these anti-vertical integration safeguards remain in force, which is critical for fair competition in generation and retail – a bedrock of the internal market since the Second and Third Packages. The recast only clarified a couple of points, such as explicitly allowing that a TSO may own storage or provide ancillary services *only under the exceptional conditions mentioned earlier* (to align with Chapter V). It also updated procedural aspects like deadlines for the European Commission's review in the certification process. All in all, Chapter VI confirms the EU's continued commitment to strong unbundling as a tool to prevent discrimination and ensure neutral network operation, which indirectly supports consumer interests and new market entrants (since a fully unbundled TSO has no incentive to favor an affiliated energy producer or supplier). No new unbundling model was introduced – the focus was on stability and consistency with the Third Package's approach, which by 2019 had largely been implemented across Member States.

- **Chapter VII (National Regulatory Authorities)** – This chapter updates the rules on the establishment, powers and duties of energy regulators, reinforcing their independence and expanding their responsibilities in line with the new market design. Key provisions include:
- **Independence:** The directive reiterates that national regulatory authorities (NRAs) must be legally and functionally independent from any other public or private entity, and their staff and leadership should act independently, without seeking or taking instructions from government or industry.[194] Regulators must have autonomy in their budget and decision-making. This principle was already in the Third Package, but remains crucial and is re-emphasized.
- **Regulatory Powers:** Regulators retain powers to set or approve network tariffs or methodologies for transmission and distribution, ensuring that

[193] EUR-Lex: Summary of Directive (EU) 2019/944
[194] EUR-Lex: Summary of Directive (EU) 2019/944

network charges are non-discriminatory and cost-reflective. They also continue to monitor unbundling compliance, handle complaints, and ensure consumer protection measures are effective. The recast updates the list of tasks to include new responsibilities, such as monitoring the development of dynamic pricing and switching, the implementation of smart metering and data sharing frameworks, and the level of market competition and transparency at the retail level (addressing the prior gap where retail markets had lagged behind wholesale in competitiveness)[195].

- **Regional and EU Coordination:** Importantly, Chapter VII strengthens the obligation for regulators to cooperate with each other and with ACER. It specifies that regulators must collaborate in cross-border matters, e.g. jointly ensuring that electricity trading across interconnectors is efficient and fair. With the establishment of Regional Coordination Centres (RCCs), regulators have a new role in overseeing these entities – the directive notes that NRAs have *revised oversight responsibilities for regional entities*, meaning they collectively supervise RCCs' proposals and operations. The directive also nods to regulators coordinating on risk preparedness (aligning with the Risk Preparedness Regulation) and on achieving adequate interconnection capacity between countries[196]. Overall, the mandate of ACER is expanded (by its own regulation) and national regulators are obliged to support ACER's mission by providing data and aligning decisions where needed. For example, if a decision on cross-border cost allocation for a new line involves multiple NRAs, ACER can step in if they cannot agree, and Chapter VII ensures NRAs will abide by such ACER decisions.
- **Consumer Affairs:** Regulators are given an explicit role in monitoring and enforcing the new consumer protection and empowerment provisions. They must ensure suppliers comply with rules on switching and billing, that aggregators and communities can access markets, and that consumer rights (like access to comparison tools or offers of dynamic contracts) are upheld. They also monitor the incidence of energy poverty and disconnections and advise governments on how to address shortcomings.
- **Sanctions and Enforcement:** Regulators must have the power to impose effective, proportionate and dissuasive penalties on companies that violate the directive's requirements or the regulations (for instance, if a DSO fails to grant network access or a supplier engages in abusive practices). This was maintained from the Third Package to ensure compliance.

[195] EUR-Lex: Summary of Directive (EU) 2019/944.
[196] EUR-Lex: Summary of Directive (EU) 2019/944

In summary, Chapter VII reasserts the central role of independent regulators in making the internal market work, and it updates their toolkit to oversee a more complex, decentralized and digitalized electricity system. It ensures that regulators are the watchdogs of consumer rights and market fairness, at both national and cross-border levels[197]. ACER's bolstered role complements this by providing a forum for regulators to make joint decisions when needed for the regional/EU level. The directive thereby solidifies a two-tier regulatory system: strong national regulators collaborating through a strengthened ACER, bridging the gap between national markets and the integrated EU market.

- **Chapter VIII (Final Provisions)** – The last chapter contains various general and transitional provisions. It includes clauses on derogations, allowing Member States to apply for temporary exemptions from certain provisions of the directive under specific circumstances (for example, for isolated microgrids or in case of severe implementation difficulties), subject to Commission approval. It also specifies the exercise of delegation and committee procedures: the Commission is empowered to adopt delegated acts or implementing acts for certain aspects (such as interoperability requirements for data exchange, or perhaps updating annexes), and Chapter VIII sets the conditions for that (following Regulation (EU) 182/2011 on comitology). Additionally, the chapter outlines the timeline for transposition – Member States had to transpose the directive by 31 December 2020, and it required them to communicate their transposition measures to the Commission. It also addresses the repeal of the old directive (2009/72/EC) and the continuity of measures taken under it. Moreover, Chapter VIII includes the directive's relation to other legislation: for instance, it amends Directive 2012/27/EU (Energy Efficiency Directive) in a limited way (adjusting a few articles on metering and billing to avoid overlap with the new consumer provisions). It likely also clarifies that obligations under this directive are without prejudice to EU competition law and environmental law. Finally, Chapter VIII lists the Annexes that are attached to the directive. In Directive 2019/944, the annexes are quite important, as they detail additional consumer information requirements and smart meter functionalities:
- **Annex I** provides requirements for consumer information and comparison tools (e.g. it outlines what information must be in electricity bills and billing communications, and what criteria a price comparison tool should meet to be considered reliable – such as including a broad range of offers, being transparent about its owner, etc.).
- **Annex II** sets out the minimum functional requirements for smart metering systems (if deployed): for example, smart meters should accurately

[197] EUR-Lex: Summary of Directive (EU) 2019/944

measure consumption, allow remote reading by the operator, provide the consumer with meaningful information on consumption near real-time, support bi-directional communication, and be secure and data-protective. It also references standards or best practices (like adhering to the 2012 Commission Recommendation on smart meter functionality)[198].

- **Annex III** (if present) might address issues like data management or cost-benefit analysis factors for smart metering (under the previous directive, an annex guided how to evaluate smart meter roll-out).
- **Annex IV** could concern implementation monitoring indicators, etc. (For instance, the directive might require reporting on how many consumers have smart meters, average switching times, and so on, to gauge implementation success).

These annexes form an integral part of the directive's consumer-centric approach, ensuring that the broad rights and obligations in the main articles are underpinned by concrete standards and metrics.

In conclusion, Directive (EU) 2019/944 represents a significant overhaul of EU electricity market rules, especially from the perspective of end-users and the technical operation of distribution networks. It tightens the market design to be more flexible and market-based, empowers consumers and new entrants to participate actively (through generation, demand response, and energy communities), and adapts regulatory and operational frameworks to a more interconnected regional grid. The directive works in concert with other components of the Clean Energy package – notably, Regulation (EU) 2019/943 on the internal market (which contains complementary rules on wholesale market and system operation, such as gate closure times, balancing responsibility, capacity mechanisms design, removal of price caps, etc.), Regulation (EU) 2019/941 on risk preparedness, Regulation (EU) 2019/942 on ACER, and Directive (EU) 2018/2001 on renewables (which introduces *renewable energy communities*) – all together aimed at advancing the Energy Union and the EU's 2030 climate and energy targets. The 2019 electricity directive thus must be seen as part of a broader framework driving the clean energy transition while completing the internal market. Notably, the directive has already been subject to subsequent refinements: for example, in 2024 it was amended by Directive (EU) 2024/1711 to accommodate new concepts like flexible connection agreements (allowing network connections that can be curtailed in peak times in exchange for faster or cheaper access) and to explicitly grant consumers the right to energy sharing (enabling groups of consumers to share self-generated electricity over the public grid under certain conditions)[199]. These developments, spurred

[198] Directive (EU) 2019/944
[199] EUR-Lex: Summary of Directive (EU) 2019/944 – Internal market for electricity

by the EU's heightened climate ambitions and the lessons from the 2021–2022 energy crisis, build on the foundation of 2019/944. Nevertheless, the core structure and spirit of the 2019 directive – a consumer-empowered, resilient and regionally integrated electricity market – remain firmly in place and are guiding Europe's ongoing energy market evolution towards sustainability, affordability, and security of supply for all citizens.[200]

[200] ERBACH, 2019.

XII. FIT FOR 55 AND REPOWER EU: CLIMATE TARGETS MEET MARKET REALITIES

1. Ambitious climate plans

In 2021, the European Union legally committed itself to an ambitious climate trajectory: reducing net greenhouse gas emissions by at least 55% by 2030 (from 1990 levels) and achieving climate neutrality by 2050[201]. To turn this target into action, the European Commission unveiled the Fit for 55 package – a comprehensive suite of legislative proposals aligning EU laws with the new 55% reduction goal.[202] This climate push soon met an unexpected challenge: Russia's 2022 invasion of Ukraine triggered a continent-wide energy crisis, testing the resilience of EU climate policies. In response, the EU introduced the REPowerEU plan, aimed at swiftly phasing out Russian fossil fuels while accelerating the clean energy transition.[203] This chapter examines the legal and regulatory measures of Fit for 55 and REPowerEU, and analyzes how EU climate targets have been recalibrated in the face of market realities like energy security and high energy prices. It focuses on the evolution of EU climate law and policy instruments, the interplay between climate ambition and energy markets, and the ongoing efforts to reconcile long-term **decarbonisation goals** with short-term economic and security imperatives.

2. The EU's Climate Targets and the Fit for 55 Legislative Package

Fit for 55 is the EU's flagship climate legislative package designed to implement the 55% emission reduction goal by 2030. Proposed by the Commission in July 2021 under the European Green Deal, Fit for 55 spans nearly all sectors of the economy. It amends existing regulations and directives and introduces new ones, fundamentally overhauling the EU's climate and energy legal framework. The package rests on several key pillars, each addressing a facet of the transition:

[201] Consilium – Council of the European Union: Fit for 55
[202] Consilium – Council of the European Union: Fit for 55
[203] European Commission: *REPowerEU*.

a) Strengthening Carbon Pricing (EU ETS and ETS2)

The EU's Emissions Trading System (EU ETS)[204] – the cap-and-trade carbon market covering power and heavy industry – is made more stringent, with a target to cut emissions in ETS sectors by 62% by 2030 (vs. 2005), higher than previous goals. To achieve this, the ETS cap (total allowances) will decline faster annually and free allowances to industries will phase out. Crucially, the ETS's scope is expanded: maritime shipping emissions are brought into the ETS for the first time, with a phased-in obligation for ship operators to surrender allowances for 100% of their emissions by 2026.[205] In parallel, a new separate ETS for buildings and road transport fuels (sometimes called "ETS2") is established to price carbon in those sectors not covered by the main ETS[206]. This new carbon market for heating and transport fuels is slated to start later in the decade, ensuring these diffuse sources also contribute to emissions cuts. By extending carbon pricing across the economy, the EU aims to *internalize the cost of* CO_2 and steer markets toward cleaner energy.

b) Carbon Border Adjustment Mechanism (CBAM)

Alongside tightening the ETS, the EU will introduce a Carbon Border Adjustment Mechanism, a novel trade measure to address "carbon leakage". CBAM will impose a carbon cost on imports of emissions-intensive products (like steel, cement, fertilizers, aluminium, etc.) equivalent to the EU carbon price, so that EU climate efforts are not undermined by production shifting to countries with weaker climate rules. CBAM is designed in compliance with WTO rules and will gradually replace the free ETS allowances currently given to EU industries at risk of carbon leakage. After a transitional phase starting 2023, CBAM will fully enter into force, ensuring imported goods bear the same carbon costs as domestic products. This *levelling of the playing field* legally protects the competitiveness of European industry while reinforcing the integrity of EU emissions cuts.[207]

c) Effort Sharing and National Targets

Not all emissions are covered by emissions trading. The Effort Sharing Regulation (ESR)[208] sets binding national GHG reduction targets for sectors outside the ETS (such as road transport, buildings, agriculture, small industry, waste). Fit for 55 raised the collective ambition of these targets from a 29% cut by 2030 (under previous law) to 40% by 2030 (vs. 2005) for the ESR sectors[209].

[204] Directive (EU) 2023/959, pp. 134–198.
[205] Consilium – Council of the European Union: Fit for 55.
[206] Consilium – Council of the European Union: Fit for 55.
[207] Consilium – Council of the European Union: Fit for 55
[208] Regulation (EU) 2018/842 , pp. 26–42.
[209] Ibid.

Each Member State has an updated target for 2030, ranging higher for wealthier states, ensuring a fair distribution of effort. These national targets are legally binding and enforceable, pushing countries to implement policies in non-ETS sectors (e.g. incentives for electric cars or building retrofits). Complementing this, a parallel law on Land Use, Land-Use Change and Forestry (LULUCF)[210] increases the EU's carbon sink goal – the EU must achieve net removals of at least 310 million tons CO_2e by 2030 through forests and land management[211]. Strengthening carbon sinks offsets emissions and helps reach the net –55% goal. The updated LULUCF regulation sets national forest carbon targets, integrating land-use policy into the climate framework.

d) Renewable Energy and Energy Efficiency

A core part of Fit for 55 is updating the EU's energy legislation to drive a shift away from fossil fuels. The Renewable Energy Directive (RED) is revised to mandate a significantly higher share of renewables. Under Fit for 55, the EU originally proposed a *40% renewable energy share by 2030*, but negotiations – influenced by REPowerEU's heightened ambition – yielded a binding target of 42.5% renewable share by 2030 (with an aspirational 45% goal). This nearly doubles the renewables share compared to 2020. The law also sets sub-targets for sectors like transport and industry to ensure broad uptake of wind, solar, hydro, and other renewables. Likewise, the Energy Efficiency Directive (EED) was tightened: EU countries must collectively achieve at least 11.7% reduction in final energy consumption by 2030 (relative to baseline projections). Annual energy savings obligations for Member States are increased, and the public sector is required to renovate buildings and cut its energy use more aggressively. These binding efficiency measures are crucial for reducing demand, lowering emissions, and easing the renewable deployment needed. Another piece, the Energy Performance of Buildings Directive[212], sets a path toward zero-emission buildings – all new buildings must be zero-emission by 2030 and existing buildings by 2050 – pushing national building codes and renovations to cut the 36% of EU emissions arising from buildings[213]. In sum, Fit for 55's energy legislation uses regulatory targets to green the power, buildings, and transport sectors through cleaner energy and efficiency gains.

e) Clean Transportation Standards

To decarbonize transport (responsible for a quarter of EU emissions), Fit for 55 deploys targeted regulations. The EU adopted strict CO_2 emission standards for vehicles, including a *100% emissions reduction requirement by 2035 for*

[210] Regulation (EU) 2018/841, pp. 1–25.
[211] Consilium – Council of the European Union: Fit for 55
[212] Directive (EU) 2024/1275, pp. 184–263.
[213] Ibid.

new cars and vans – effectively banning sales of new internal combustion engine cars after 2035. Interim targets in 2030 (e.g. a 55% cut for new cars) will drive automakers to ramp up electric vehicle production. For aviation and shipping – sectors largely outside the ETS historically – new initiatives were enacted. The ReFuelEU Aviation regulation[214] mandates increasing shares of sustainable aviation fuels (advanced biofuels and e-fuels) in jet fuel, to reach a significant percentage by 2030 and beyond. Similarly, the FuelEU Maritime regulation[215] requires ships to use more low-carbon fuels or technologies, aiming to cut the carbon intensity of maritime fuel by up to 80% by 2050. To support the rollout of electric and hydrogen vehicles, an Alternative Fuels Infrastructure Regulation compels Member States to expand charging and refueling networks (e.g. electric charging stations at least every 60 km on core highways by 2025, hydrogen stations in all urban nodes by 2030)[216]. These laws ensure that markets for electric cars, green hydrogen, and sustainable fuels are underpinned by adequate infrastructure and clear EU-wide rules, driving a technology shift in transport.

f) Social Climate Fund

Recognizing that carbon pricing and green transitions can disproportionately burden lower-income citizens, the Fit for 55 package established a Social Climate Fund as a novel solidarity mechanism. Financed in part by ETS revenues up to €65 billion, this Fund will help EU countries support vulnerable households, small businesses, and transport users facing cost increases from the new ETS on building and transport fuels. Uses include direct income support (e.g. offsetting higher heating fuel bills) and investments in energy-saving renovations or clean heating systems for vulnerable groups. The Social Climate Fund is thus a regulatory tool to ensure the transition is "just and socially fair", a principle enshrined in Fit for 55's objectives[217]. It exemplifies how EU climate law tries to balance ambitious targets with socio-economic mitigation measures.

g) Energy Market and Other Reforms

Fit for 55 also encompasses reforms in other carbon-intensive areas. A new Methane Emissions Regulation for the energy sector will require oil and gas companies to monitor and reduce methane leaks – the first EU law directly targeting methane, a potent greenhouse gas. The Hydrogen and Decarbonised Gas Market package updates gas market rules to accommodate renewable gases (like biogas and hydrogen), establishing a regulatory framework for hydrogen

[214] Regulation (EU) 2023/2405, p. 1–57.
[215] Regulation (EU) 2023/1805, p. 48–96.
[216] Consilium – Council of the European Union: Fit for 55
[217] Consilium – Council of the European Union: Fit for 55

pipelines, storage, and trading to facilitate a shift from natural gas to low-carbon gases. Finally, a proposed revision of the Energy Taxation Directive seeks to align fuel tax rates with carbon content and end tax exemptions for polluting fuels. However, tax changes require unanimous approval by Member States; as of 2025 this part of Fit for 55 remains under discussion, reflecting the political sensitivity of fiscal measures[218]. Most other Fit for 55 proposals were successfully adopted by 2024 after intensive negotiations, marking one of the most sweeping updates of EU climate-energy law in history. Together, these measures legally bind the EU to a faster emissions cut trajectory and mobilize markets towards green innovation, while providing mechanisms (like the Social Fund and CBAM) to buffer economic impacts and prevent leakage.

3. The REPowerEU Plan: Marrying Climate Policy with Energy Security

Even as the EU institutions were finalizing Fit for 55, geopolitical upheaval reshaped the context. The outbreak of the war in Ukraine in February 2022 precipitated a severe energy supply crisis in Europe, as natural gas exports from the region declined and energy prices rose to record levels. The crisis underscored the EU's dependence on imported fossil fuels and introduced a new urgency to reduce that dependence. In May 2022, the European Commission launched REPowerEU, a strategic plan to "phase out Russian fossil fuel imports" and accelerate the clean transition.[219] REPowerEU is not a single law but a package of emergency measures, investments, and regulatory adjustments that complement Fit for 55 with an energy security focus. Its key components include:

a) Diversifying and Securing Energy Supply

REPowerEU aims to rapidly wean Europe off Russian coal, oil, and especially natural gas. The EU imposed sanctions banning all imports of Russian coal (effective August 2022) and set a timetable to end Russian oil imports (by end of 2027). For natural gas – where the dependency was highest – REPowerEU set targets to fill this gap through alternative suppliers and energy savings. The EU coordinated joint gas purchases via a new Energy Platform, preventing Member States from bidding against each other in tight markets. A "demand aggregation and joint purchasing" mechanism (AggregateEU)[220] was established in 2023 to pool European gas demand and negotiate better prices collectively. Additionally, an EU regulation now requires Member States to fill gas storage

[218] Ibid.
[219] European Commission: REPowerEU
[220] Council Regulation (EU) 2022/ p. 1–16.

to 90% before winter, boosting resilience against supply shocks. These actions, while not directly reducing emissions, are regulatory tools to stabilize energy markets and ensure affordable supply – preconditions for sustaining the political consensus on climate action amid crisis. By 2023, gas prices had fallen sharply from their 2022 peak, thanks in part to the EU's coordinated response and demand reductions[221].

b) Accelerating Renewable Energy Deployment

REPowerEU explicitly links energy security with clean energy expansion: "Renewables are good for the climate and for the EU's energy independence". The plan raised ambition for renewables beyond the original Fit for 55 proposal. The Commission and co-legislators agreed to increase the 2030 renewable energy target to 42.5% (binding) with a push towards 45% – up from the 40% in the initial Fit for 55 draft[222] [. This was enshrined in the revised Renewable Energy Directive, which entered into force in 2023. REPowerEU also launched an "EU Solar Energy Strategy" to install 600 GW of solar PV by 2030, including a new mandate for rooftop solar on certain buildings. It called for doubling the rate of heat pump installations (to reduce gas heating) and accelerating wind power deployments. Critically, to achieve these goals, the EU moved to streamline permitting for renewable projects – identifying "go-to areas" with simplified and faster permitting procedures, and declaring renewable energy projects as an overriding public interest to curb permitting delays[223]. In late 2022, the Council adopted emergency legislation to shorten permitting times for solar and wind farms and battery projects, reflecting REPowerEU's urgency. These regulatory fast-tracking measures address a major market bottleneck (slow permitting) that was hindering the scale-up of renewables needed both for climate goals and to replace Russian gas.

c) Enhancing Energy Efficiency and Demand Reduction

Saving energy is a central plank of REPowerEU, captured by the slogan "Energy efficiency first." The plan set a more ambitious energy savings target of 13% by 2030, up from the 9% in the original Fit for 55 proposal[224]. While negotiations landed on a slightly lower 11.7% binding reduction in the final EED revision[225], the direction was clear: demand-side measures (building insulation, efficient appliances, conservation efforts) are to be prioritized as a quick way to reduce reliance on imported fuel. REPowerEU also introduced mandatory gas demand reduction targets – for example, a Council regulation in August 2022 asked

[221] European Commission: REPowerEU
[222] European Commission: REPowerEU e
[223] International Energy Agency, REPowerEU Plan
[224] International Energy Agency, REPowerEU Plan
[225] Consilium – Council of the European Union: Fit for 55

countries to cut gas use by 15% over winter. Through a combination of mild weather, high prices, and policies, the EU exceeded these savings, reducing gas consumption and helping refill storage. Lower demand not only contributes to climate goals but also eased the market pressure, demonstrating how efficiency serves both agendas. The revised Energy Efficiency Directive in 2023 entrenched the "energy efficiency first" principle in law for all energy policy decisions[226], ensuring that in future infrastructure or investment decisions, the option of saving energy must be considered before expanding supply.

d) Funding the Transition (Recovery and Resilience Facility)

To financially underpin REPowerEU actions, the EU turned to its post-COVID recovery fund. The Recovery and Resilience Facility (RRF)[227] regulation was amended in 2022 to add *REPowerEU chapters* to Member States' national recovery plans.[228] About €20 billion in new grants was mobilized for REPowerEU via the sale of additional ETS allowances and the EU Innovation Fund. These funds are allocated to projects like cross-border energy interconnectors, renewable energy parks, hydrogen production, and energy-efficiency renovations, as identified in each country's REPowerEU chapter. In total, roughly €300 billion (grants and loans) is being redirected to REPowerEU priorities[229]. This massive financing, governed by EU law, incentivizes countries to invest quickly in diversification and clean energy. However, analysts noted that much of the money is reallocated from existing recovery funds with "little new money on the table". The effectiveness of REPowerEU spending depends on rapid implementation at national level and on avoiding wasteful investments. Notably, EU rules limit RRF spending on fossil fuel infrastructure, aligning with climate objectives – for example, funding new gas pipelines via REPowerEU is generally not permitted, steering countries toward clean solutions[230].

e) Market Reforms and Industry Support

REPowerEU triggered a fresh look at energy market design and industrial policy to ensure Europe's clean transition remains on track under volatile market conditions. The surge in gas and electricity prices in 2021–2022 prompted the Commission to propose electricity market reform, decoupling consumer electricity bills from short-term gas prices. By mid-2024, an updated Electricity Market Design entered into force to make the power market more resilient and reduce exposure to fossil fuel price shocks. Moreover, to keep what is called green industries competitive globally (especially in light of the U.S.

[226] European Commission: REPowerEU .
[227] Regulation (EU) 2021/241, p. 17–75.
[228] JÄGER, 2023.
[229] European Commission: REPowerEU
[230] JÄGER, 2023.

Inflation Reduction Act), the EU in 2023 unveiled a Green Deal Industrial Plan alongside the Net-Zero Industry Act and Critical Raw Materials Act[231]. These initiatives, while not part of Fit for 55 per se, complement it by simplifying regulatory approval for clean tech manufacturing and enabling greater state aid for clean technology in Europe. They reflect a regulatory pivot to address "market realities" such as supply chain dependencies and the need for clean tech scale-up. In essence, REPowerEU broadened the scope of EU climate policy to explicitly tackle energy security and economic competitiveness, using legal tools to drive a faster and more self-sufficient transition.

4. Reconciling Climate Ambition with Market Realities

The dual rollout of Fit for 55 and REPowerEU has highlighted the constant interplay between climate targets and market realities. EU policymakers have had to adjust legal strategies to keep climate ambition credible amid economic turbulence, high energy prices, and geopolitical risks. Several key areas illustrate this dynamic tension:

a) Fossil Fuel Infrastructure vs. Climate Lock-In

The loss of Russian gas supply forced EU states to scramble for alternatives – new LNG import terminals, pipeline deals, and even temporary increases in coal power. While some new fossil infrastructure was arguably needed to avert acute energy shortages, there is a legal risk that Europe could build overcapacity that conflicts with its climate trajectory. Analyses show that planned LNG terminals across Europe could exceed future demand if climate policies sharply cut gas use, potentially wasting billions and locking in emissions. The EU's challenge is to coordinate these investments so they remain compatible with the 2030/2050 climate goals. However, energy infrastructure is primarily a national competence; the Commission cannot directly forbid a Member State from investing in, say, a new gas terminal with national funds. Instead, the EU has leveraged soft coordination through REPowerEU: in reviewing countries' REPowerEU funding plans, the Commission has pushed for transparency about new fossil projects and encouraged regional coordination to avoid redundant capacity. Moreover, any EU financial support is tied to clean energy (the legal basis of the RRF limits fossil fuel spending). This represents a careful regulatory balancing act – allowing short-term energy security measures while signaling a strictly temporary role for new fossil infrastructure, to be replaced by renewables in line with the Green Deal. Moving forward, the

[231] European Commission: REPowerEU

EU's regulatory framework may need to introduce clearer criteria or sunset clauses for gas investments to ensure consistency with the Paris Agreement and avoid stranded assets[232].

b) Infrastructure and Permitting Bottlenecks

Achieving a 55% emissions cut by 2030 requires an unprecedented rollout of renewable energy projects, electricity grids, and cross-border interconnectors. What is a market reality is that infrastructure build-out (e.g. new wind farms, high-voltage power lines, and hydrogen pipelines) has long lead times and faces local opposition or bureaucratic delays. Fit for 55 alone was not sufficient to address these bottlenecks. Realizing the gap, the EU used the momentum of REPowerEU to tackle permitting and grid planning. Regulatory steps – such as designating renewables as of overriding public interest, and the 2023 Action Plan to accelerate grid deployment – are legal attempts to streamline processes that markets had struggled with. Still, the effectiveness of these measures will be tested on the ground. The lesson is that setting ambitious targets in legislation (e.g. 45% renewables by 2030) must be accompanied by enabling measures to upgrade physical infrastructure. Otherwise, even the best-designed market tools (like ETS or subsidies) cannot deliver the needed projects in time. The EU's recognition of this is evident in the new focus on trans-European networks and funding for Projects of Common Interest that improve cross-border energy flows[233]. Strengthening the EU's TEN-E regulation and streamlining permitting may become as important as the Fit for 55 laws themselves in determining if climate goals are met.

c) Energy Prices and Market Interventions

The energy crisis drove home the point that public support for climate policy hinges on managing energy costs. As gas prices surged in 2022, electricity prices followed (due to the marginal pricing system), burdening consumers and industry. EU leaders faced pressure to intervene in markets – something largely outside the original climate policy toolkit. In late 2022, the EU adopted emergency regulations to cap excessive revenues of inframarginal (renewable and nuclear) power generators and to impose a windfall levy on fossil fuel companies, recycling those funds to consumers[234]. Additionally, a voluntary 10% electricity demand reduction target was introduced for winter evenings. These extraordinary market interventions were short-term and would have been hard to foresee in Fit for 55. They illustrate that market realities (extreme price spikes) can force policymakers to take ad-hoc regulatory actions to protect consumers while trying not to derail long-term climate measures.

[232] JÄGER, 2023.
[233] JÄGER, 2023.
[234] Climate Action Tracker

Notably, the Social Climate Fund within Fit for 55 was created with this sensitivity in mind – acknowledging carbon pricing will raise household costs, it provides a structured way to compensate vulnerable groups.[235] In essence, the EU's climate regime is evolving to include social and price-stability mechanisms, which are crucial for maintaining the political feasibility of high climate ambition.

d) Industrial Competitiveness and Carbon Leakage

Another reality check for EU climate policy is the concern from industry about uneven playing fields. As the EU imposes higher carbon costs on its producers (through ETS and vehicle standards, etc.), energy-intensive industries warned of competitive disadvantages, especially vis-à-vis regions with lax climate policies. Fit for 55's CBAM is the legal answer to these worries, ensuring imported goods carry equivalent carbon costs. By 2026, as free allowances begin to be phased out, CBAM will require importers of iron, steel, cement, fertilizer, aluminium and electricity to purchase certificates reflecting the EU carbon price. This was crafted to comply with WTO rules and is a pioneering use of trade policy for climate ends. However, CBAM's implementation will be closely watched by trading partners and could face legal challenges internationally. The EU argues CBAM is needed to prevent leakage and *incentivise foreign industries* to clean up, effectively extending the carbon market's reach[236]. In tandem, EU policymakers are working on measures to keep European industry competitive during the transition, such as free allocations during a phase-in, and support for innovation via the Innovation Fund (funded by ETS revenues). Furthermore, in response to the U.S. Inflation Reduction Act's generous subsidies for clean tech, the EU relaxed state aid rules and proposed a Clean Tech manufacturing support scheme (Net-Zero Industry Act).[237] These regulatory moves acknowledge that climate action does not happen in a vacuum – it interacts with global market forces. Thus, the EU's legal framework is expanding to cover trade, competition, and industrial policy dimensions so that climate ambition is economically sustainable.

e) Meeting Targets in Practice

Finally, the proof of "climate targets meeting reality" will lie in emissions data. Early indications are mixed. By 2023, the EU was on track to cut emissions roughly 52% by 2030 with the Fit for 55 policies adopted, close to the 55% target. The Climate Action Tracker finds that full implementation of Fit for 55 and REPowerEU would nearly achieve the EU's NDC (Nationally Determined Contribution) for 2030. However, it also flags that not all Fit for 55 proposals

[235] Consilium – Council of the European Union: Fit for 55
[236] Consilium – Council of the European Union: Fit for 55
[237] European Commission: REPowerEU

had been adopted by early 2024 (notably the Energy Taxation reforms), and that some national policies lag behind EU requirements[238]. Moreover, the turmoil of 2022 saw a temporary uptick in EU coal use and emissions in some Member States, even as renewable deployment hit record highs. This underscores that short-term market shocks can cause deviations from the planned trajectory. The EU's approach – doubling down on renewables and efficiency in response – suggests a confidence that the long-term trajectory can be met despite short-term setbacks. Indeed, by 2023 Europe generated more electricity from wind and solar than from gas for the first time, and wind alone surpassed gas in electricity generation[239]. These market shifts, propelled by high fossil prices and EU policy, indicate structural change. Nevertheless, to keep the 55% reduction goal within reach, the EU may need to continually course-correct its policies. This could mean strengthening measures if emissions do not decline fast enough, or offering flexibility if economic reality (e.g. a recession or supply chain shortage) threatens the timetable. The European Climate Law includes a mechanism to propose a new 2040 climate target and regularly review progress.[240] Such legal mechanisms ensure that the policy framework can be updated in light of real-world progress – an acknowledgment that hitting 2030 and 2050 targets is not automatic just because laws are on the books, but requires adaptive governance responding to outcomes.

5. The essence of realities

The Fit for 55 package and the REPowerEU plan together represent a profound transformation of the EU's climate and energy regulatory landscape. Fit for 55 translated a lofty emission target into dozens of concrete legal acts – from carbon pricing extensions and cleaner energy mandates to vehicle standards and social cushioning funds – demonstrating the EU's capability to leverage law and policy across sectors to drive decarbonisation. REPowerEU, arriving in an energy crisis, injected a dose of realism and urgency, refocusing EU policy on energy security and accelerating certain measures (higher renewables and efficiency targets, faster permitting, and emergency interventions) to align climate ambition with the pressing needs of markets and citizens. The interplay of the two has shown that climate policy cannot be static: it must respond to geopolitical and market changes. European climate law is thus evolving

[238] Climate Action Tracker
[239] European Commission: REPowerEU
[240] Climate Action Tracker

into a more comprehensive Green Deal framework that addresses emissions reduction and energy resilience, affordability, and industrial competitiveness in tandem.[241]

From a legal perspective, the EU's experience offers a few lessons. First, integrated policy packages like Fit for 55 can better manage trade-offs – combining strict environmental targets with supportive measures for fairness and competitiveness (e.g. Social Climate Fund and CBAM) increases the durability of the climate agenda. Second, flexibility and emergency tools are essential; the EU had to step outside its initial plans to tackle energy price spikes and supply shortages, showing that agility in regulatory responses is crucial when "market realities" diverge from expectations. Third, achieving long-term targets will depend on implementation and investment on the ground. The success of these initiatives will be measured by how swiftly Member States deploy renewables, build grids, renovate buildings, retrain workers, and so on. EU law has set the direction and raised the ambition; now the real economy must follow through. There are still challenges ahead – from ensuring sufficient funding and avoiding delays, to maintaining public support during the transition – but the combined thrust of Fit for 55 and REPowerEU has significantly strengthened Europe's hand. In summary, the EU has attempted to marry climate targets with market realities by embedding its 2030/2050 goals into binding legislation and updating those policies when confronted with crises. This adaptive yet legally-grounded approach will likely continue as the EU navigates the path to climate neutrality, proving a valuable case study in balancing environmental imperatives with economic and security considerations in lawmaking.[242] The coming years up to 2030 will test how well this regulatory framework performs in practice – whether Europe can indeed cut emissions sharply *while* keeping energy secure and affordable – and will inform the next steps of climate governance on the road to 2050.

[241] FAZAKAS, 2023.
[242] Climate Action Tracker

XIII. CONCLUSION: NAVIGATING THE INTERPLAY OF SMART GRIDS, GREEN TRANSITION, AND EU ENERGY LAW

The evolution of EU energy law over recent decades reveals a trajectory from market liberalisation to a digital, decarbonised future. This concluding chapter reflects on that evolution as detailed in the foregoing volume, emphasizing how smart grids, the green transition, and legal regulation interact. It offers a forward-looking synthesis of key themes without advocating for any particular stakeholder, focusing instead on broader trends. The discussion highlights the continuing digitalisation of the energy sector, the critical role of smart grids in Europe's energy transition, and emerging issues such as artificial intelligence (AI). It also summarizes how major EU initiatives – notably the Fit for 55 package, the REPowerEU plan, and the Electricity Market Directive 2019/944 – have sought to integrate ambitious climate objectives with the realities of the internal electricity market. The aim is not to prescribe specific legal reforms, but to offer general observations on regulatory trends, the importance of flexibility, and the ongoing need for legal adaptation in this dynamic field.

1. Evolution of EU Energy Law: From Liberalisation to the Green Digital Transition

EU energy law has undergone a remarkable transformation from its early focus on market integration and security of supply to its current role at the forefront of climate policy and technological change. In the 1990s and early 2000s, European energy legislation centered on liberalising national electricity markets – unbundling utilities, promoting competition, and building an Internal Electricity Market. These reforms were grounded in internal market principles and aimed to enhance efficiency and cross-border trade. Over time, and especially after the EU gained an explicit energy competence in the Lisbon Treaty (Article 194 TFEU), energy law expanded beyond economic liberalisation to embrace sustainability and innovation as equal pillars.

Today, EU Energy Law occupies a cross-cutting position in the legal system, bridging not only public and private law but also intertwining with environmental law, competition law, data protection, and technology regulation. This reflects the reality that issues once treated separately – such as climate change mitigation,

consumer rights, and technological R&D – are now deeply interconnected in Europe's energy sector.

A defining feature of this evolution is the alignment of energy law with the EU's escalating climate ambition. Under the European Green Deal, the EU set a legally binding goal of climate neutrality by 2050 and significantly raised its interim targets (at least 55% greenhouse gas reduction by 2030). Energy law has become the vehicle to deliver these goals, evidenced by sweeping legislative packages like the 2019 Clean Energy for All Europeans Package and the 2021–2024 Fit for 55 climate package. The traditional energy policy "trilemma" – balancing sustainability, security of supply, and affordability – now unfolds in the context of decarbonising the energy system. EU policymakers increasingly view market regulation as a means to achieve climate objectives, not an end in itself. Accordingly, internal market rules have been progressively adjusted to support the integration of renewable energy, energy efficiency, and new technologies alongside the free flow of energy across borders. Europe's internal electricity market, once primarily a tool for competition, now also provides the coordination mechanism for the green transition, enabling Member States to share clean energy resources and innovations under common rules that reflect climate priorities.

This final chapter traced that journey: from the foundational market directives of the 1990s and 2000s, through the Clean Energy Package 2019 (which reformed market design to empower consumers and renewable integration), and into the current Green Deal era of policy. The trajectory shows a clear progression – "from gradual liberalisation to today's highly integrated, consumer-centred, and decarbonisation-oriented electricity market". EU energy law has matured from niche status to a central field of EU policy, evolving at pace with urgent climate imperatives and disruptive technological advances. The legal frameworks governing Europe's power system are now tasked not only with ensuring competition and security, but with orchestrating an unprecedented transformation: a shift to a carbon-neutral, smart, and resilient energy system.

2. Smart Grids as a Cornerstone of the Green Transition

Smart grids have emerged as a linchpin in reconciling Europe's climate ambitions with the operation of its electricity market. Throughout this volume, smart grids are highlighted as advanced electricity networks that use digital technology to intelligently manage the production, delivery, and consumption of power. In practical terms, smart grids add a sophisticated information layer onto traditional infrastructure – sensors, smart meters, automation systems – enabling two-way communication between suppliers and consumers and real-time balancing of supply and demand. This intelligent coordination

is crucial for integrating large shares of variable renewable energy like wind and solar into the grid. Unlike a conventional grid, a smart grid can swiftly respond to fluctuations (for example, a sudden drop in wind output) by activating distributed storage, adjusting demand through price signals, or importing power across borders. In essence, smart grids increase the grid's flexibility and hosting capacity for renewables, making the electricity system more decarbonisation-ready.

EU institutions have explicitly recognized that without smart grids, the EU will fall short of its energy and climate objectives. Aging distribution networks and inflexible grids would lead to renewable curtailment, blackouts, and missed efficiency opportunities. The European Parliament recently underscored that electricity grids are "central to the Union's transition to a competitive net-zero emissions economy by 2050", and called for fully developing and modernising grid infrastructure across Member States. In the same resolution, Parliament highlighted the role of smart grids in improving congestion management and optimising the distribution of renewable electricity. This reflects a broad policy consensus: smart grids are not an end in themselves but an enabler of the green transition, the "backbone" of a decarbonised energy system.

Legally, the EU has taken steps to promote smart grids and require smarter network operation. The Electricity Directive (EU) 2019/944 – a focal point of this volume – introduced provisions on smart metering and demand response participation, mandating Member States to roll out smart meters (with certain functionalities) and ensure customers can benefit from dynamic pricing and energy management technologies. It also formally recognized new market actors like energy communities and aggregators, which rely on digital platforms to collectively generate, share, or trade energy. These measures illustrate how climate ambition is woven into internal market rules: by empowering consumers to become active participants (prosumers) and by facilitating decentralized clean energy resources, EU law seeks to harness the capabilities of smart grids for both market efficiency and decarbonisation. Moreover, EU network codes and guidelines increasingly incorporate smart grid aspects – for instance, standards for data exchange and requirements for distributed resources to support grid stability.

Despite this progress, deploying smart grids at scale also raises challenges. One is investment and cost-sharing: upgrading networks and installing smart devices require significant capital, and regulators must design tariff frameworks that fairly allocate costs and benefits among utilities, consumers, and producers. Another challenge is ensuring interoperability and common technical standards so that thousands of devices and systems across Europe can communicate seamlessly. The EU has addressed this through bodies like the Smart Grids Task Force (now the Smart Energy Expert Group) to develop technical standards and best practices for member countries. In sum, smart grids occupy a pivotal

place in EU energy law's evolution: they epitomize the convergence of the internal market and the green transition, and EU regulators have started to adapt the legal framework to unlock their potential. Going forward, continued attention will be needed to remove regulatory barriers to smart infrastructure and to incentivise innovation while protecting the public interest.

3. Digitalisation and AI: Opportunities and New Regulatory Challenges

Running parallel to the green transition is the digital revolution in the energy sector. Energy digitalisation – the proliferation of advanced sensors, automation, big data analytics, and AI – is rapidly transforming how electricity systems operate. The European Commission views digitalisation as a *"key enabler"* of the Green Deal objectives: smart software can optimize grid management, improve energy efficiency for consumers, accelerate renewable deployment, and facilitate the electrification of transport and heating. For example, utilities now use AI-driven forecasting to predict demand or renewable output more accurately, and Internet of Things (IoT) devices (from smart thermostats to electric vehicle chargers) can respond to price signals automatically to shave peaks or fill valleys in demand. These innovations make the system more flexible and efficient, reducing the need for backup fossil generation or expensive new power lines. The EU's 2022 Action Plan on Digitalising the Energy System explicitly aims to harness digital technology for the clean energy transition – by promoting data sharing, smart appliances, and even a forthcoming "digital twin" of the European electricity grid to improve real-time operations.

However, with these opportunities come significant regulatory challenges. As more data flows through the electricity system and more critical infrastructure is controlled by software, issues of data privacy, cybersecurity, and market fairness move to the forefront. Smart meters and connected appliances can generate highly granular data about household energy usage, raising questions about who can access or monetize this data and how to protect consumers' personal information. The EU's General Data Protection Regulation (GDPR) provides a strong baseline for privacy, but applying its principles to smart energy data (e.g. clarifying what usage data counts as personal data, and obtaining valid consent for data sharing) requires ongoing vigilance by regulators. Trust in smart grids will erode if consumers fear misuse of their energy profiles; thus data governance frameworks are crucial. In this vein, the EU is working on a common European energy data space to allow secure sharing of data among authorized parties, under clear rules that ensure consumer control and confidentiality[243].

[243] TÓTH A., 2023.

Cybersecurity is equally paramount. A highly digitalised grid is inherently more vulnerable to cyberattacks or software failures that could disrupt electricity supply. Recognising this, the EU has moved to establish uniform standards of cyber resilience for energy. Initiatives include a planned network code on electricity cybersecurity and the extension of critical infrastructure protections (such as the NIS Directive requirements) to energy companies. The Digitalisation Action Plan stresses the goal of a "secure, transparent and competitive market for digital energy services, ensuring data privacy and sovereignty". In practice, this means regulators must enable innovative services like demand response aggregators or peer-to-peer energy trading, but without compromising the stability and security of the grid or the rights of consumers. This balancing act is an evolving story – as new threats emerge, the regulatory framework must adapt (for instance, by mandating regular cybersecurity audits for grid operators or requiring robust authentication for any remote-control functions on the network).

Looking ahead, artificial intelligence may be the next frontier that will test EU energy law's adaptability. AI algorithms are already being used to optimise regional grid operations, manage congestion, and even trade energy on markets. Their role is set to grow as systems become more complex; for example, fleets of electric vehicles could one day autonomously act as grid batteries, guided by AI to charge or discharge at optimal times.

While AI promises enhanced efficiency and integration of renewables, it also raises novel legal questions. Issues of accountability and transparency in AI-driven decision-making will need to be addressed: if an autonomous grid management system makes a decision that leads to an outage or discriminates against certain consumers (say, by disproportionately reducing supply to a region), who is responsible and how can the process be reviewed? The EU's proposed AI Act will classify AI applications by risk, and those used in critical infrastructure like energy are expected to face stringent requirements for safety, oversight, and human control. Additionally, the energy footprint of AI is a concern – energy-intensive data centres powering AI can strain local grids and run counter to climate goals. Policymakers thus find themselves balancing the deployment of AI for grid optimisation against the need to ensure AI itself is sustainable and used responsibly.

The EU is beginning to proactively tackle these issues. A "strategic roadmap for digitalisation and AI in the energy sector" is in preparation (expected in 2026) to guide policy on integrating AI and big data into the energy system while managing their impacts. This indicates that even as existing regulations are implemented, new soft law and possibly hard law measures will emerge to keep pace with technology. In summary, continuing digitalisation and AI present a dual imperative for EU energy law: to leverage innovation for the green transition, and to continuously refine the regulatory safeguards so that this digital-green nexus remains secure, equitable, and aligned with European values.

4. Climate Ambition and Internal Market Dynamics: Fit for 55, REPowerEU and Directive 2019/944

The interplay between climate ambition and internal market dynamics has been vividly illustrated by recent EU legislative initiatives. Key among these are the *Fit for 55* package (2021), the REPowerEU plan (2022), and the recast Electricity Market Directive *2019/944*. Each of these measures demonstrates the EU's approach to integrating climate objectives into the fabric of energy market regulation – an approach characterized by coupling high-level targets with market-based tools and regulatory reforms, while allowing flexibility to respond to real-world crises.

Fit for 55 is the EU's flagship climate law package aimed at translating the new 55% emissions reduction goal for 2030 into concrete measures. It comprises a dozen major pieces of legislation that overhaul the EU's climate and energy rules. Notably, Fit for 55 tightened the EU Emissions Trading System (the cornerstone carbon market) and *extended carbon pricing* to new sectors like road transport and buildings. It also raised the ambitions of the Effort Sharing Regulation and the Renewable Energy Directive, imposing a significantly higher binding target for the share of renewables in EU energy (42.5% by 2030, up from 32% earlier) and more aggressive energy efficiency requirements. Crucially, what these climate measures were designed for is to work with the internal market rather than against it. The strengthened carbon pricing under Fit for 55 leverages market mechanisms to drive decarbonisation by internalising the cost of CO_2 emissions. At the same time, the package introduced flanking policies to preserve market integrity and fairness – for instance, a Carbon Border Adjustment Mechanism (CBAM)[244] to protect European industry from unfair competition by pricing the carbon content of imports, and a Social Climate Fund[245] to help vulnerable households cope with any energy price increases caused by carbon pricing. These measures illustrate the EU's effort to align climate ambition with internal market dynamics: using the single market's scale to implement uniform climate policies, while preventing carbon leakage and social hardship that could fragment the market.

Shortly after the Fit for 55 package was proposed, geopolitical developments in 2022 triggered a significant energy crisis in Europe, revealing vulnerabilities in supply and contributing to sharp increases in energy prices. The EU's response was the REPowerEU plan[246] – an emergency strategy to reduce dependence on Russian fossil fuels and accelerate the clean transition. REPowerEU pushed

[244] Regulation (EU) 2023/956of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism *[OJ L 130, 16.5.2023, p. 52–104].*

[245] Regulation (EU) 2023/955 of the European Parliament and of the Council of 10 May 2023 establishing a Social Climate Fund *[OJ L 130, 16.5.2023, p. 1–51].*

[246] European Commission (2022): REPowerEU *Plan*.

the climate-market interplay further by calling for even faster renewable deployment and infrastructure build-out. It set out measures to diversify gas supplies, but also to raise the 2030 renewables target beyond Fit for 55's original proposal (to 45%, later settled at 42.5% binding) and to streamline permitting for renewable projects. In essence, REPowerEU injected a dose of energy security urgency into climate policy, ensuring that the push for decarbonisation also enhanced resilience of the internal market. For example, it promoted coordinated gas storage rules and joint gas purchasing to stabilize the market in the short term, while doubling down on interconnections and trans-European Networks (TEN-E) for electricity to strengthen the market's physical backbone. Many of these interventions relied on regulatory flexibility – temporary state aid relaxations, emergency regulations to cap windfall energy profits during the crisis, and reprogramming of EU funds – demonstrating the Union's willingness to adjust market rules in extraordinary times. The dual rollout of Fit for 55 and REPowerEU highlighted a "constant interplay between climate targets and market realities". Ambitious decarbonisation laws were stress-tested by a supply shock, and the EU had to recalibrate by pairing climate measures with short-term market interventions and security provisions. This experience showed that the legal framework must be adaptive: high-level targets need on-the-ground enablers like infrastructure and may need course-corrections when circumstances change.

Meanwhile, the EU's earlier legislative efforts already laid important groundwork for integrating climate and market aims. The Electricity Directive (EU) 2019/944, part of the 2019 Clean Energy Package, recast the internal electricity market rules to make them fit for the emerging paradigm of decentralised, clean, and consumer-centric energy. Its guiding philosophy was to empower consumers and new entrants (with rights to demand response, to aggregate, to form energy communities) and to improve cross-border trade and investment in support of renewables. Directive 2019/944 illustrates the careful balance between EU-wide rules and national flexibility. It was crafted to minimally intrude on national autonomy while maximising the benefits of a common market. Member States retained control over their energy mix, but within a harmonised framework that, for example, caps how often governments can intervene in pricing and requires transparent, non-discriminatory grid access for all generators (including renewables). By updating market principles – such as requiring that markets reward flexibility and storage, and prohibiting unjustified barriers to renewable self-generation – the directive linked climate policy with market design. It ensured that national interventions (like capacity mechanisms to ensure security of supply) are compatible with EU climate goals and competition rules. In summary, Directive 2019/944, alongside related regulations (2019/943 on market integrity), laid the structural market foundations upon which Fit for 55 and REPowerEU later built additional climate-oriented

measures. All three – the directive, the Fit for 55 laws, and the REPowerEU adjustments – represent a continuum of legal integration, aligning Europe's decarbonisation trajectory with the operation of its internal energy market.

5. Future Outlook: Trends, Flexibility, and the Need for Continued Adaptation

Reflecting on the analysis in this volume, a recurring theme is the dynamic nature of the EU energy legal framework. The interplay between smart grids, green transition and regulation is *not static* – it demands continual fine-tuning as technology evolves and as external events test the system. Several broad trends and observations emerge for the future:

a) Continued Digitalisation and Innovation

The electricity sector of the future will likely be even more digital, automated and complex. Trends such as the rollout of millions of electric vehicles (acting potentially as both loads and storage), the integration of batteries and hydrogen into power grids, and the use of AI for everything from predictive maintenance to energy trading will accelerate. EU law will need to stay abreast of innovation and possibly adopt more principle-based or flexible regulatory approaches to accommodate new business models. The use of regulatory sandboxes – controlled environments to test innovations under regulatory supervision – may become more common to ensure that beneficial technologies can be trialled without full legislative overhaul. At the same time, the regulatory focus on consumer protection and cybersecurity will likely intensify, given that a more digital grid increases both the points of data exposure and the avenues for cyberattack. The EU's current efforts (like the Smart Energy Expert Group and the Energy Data Space) are likely just the start of an evolving governance architecture for a digital-energy ecosystem. In short, legal adaptation will be ongoing, as the law must facilitate cutting-edge solutions while safeguarding core values of privacy, security and fairness.

b) Balancing Climate Ambition with Market Stability

The experiences with Fit for 55 and the energy crisis have shown that strong climate laws must be coupled with mechanisms to ensure market stability and public buy-in. We can expect future policies to embed more adaptive tools – for instance, predefined review cycles (as seen in the European Climate Law's five-year progress reviews) to adjust targets or measures in light of new science and economic conditions. The EU has learned the importance of having contingency measures: the so called emergency energy instruments are now part of the toolkit, enabling swift action (such as price caps or demand curbs)

when market volatility threatens societal support for the green transition. At the same time, the overarching direction remains clear and firm – as evidenced by even higher 2030 renewables and efficiency targets agreed in 2023 despite the crisis. This suggests that EU energy law is becoming more robust yet flexible: it locks in long-term decarbonisation commitments, but with built-in flexibilities to handle short-term shocks. Going forward, one can anticipate continued legal refinements to address any gaps between climate ambition and reality. This might include measures to streamline permitting further (to avoid infrastructure bottlenecks), to refine market pricing mechanisms (for example, ongoing debates on electricity market reform to better shield consumers from gas price spikes), and to bolster cross-border solidarity in times of supply stress. The central lesson is that what is crucial is *agility in regulatory responses* – energy law will need to evolve iteratively as Europe progresses toward 2030, 2040 and 2050 goals.

c) Integration of Sectors and Holistic Planning

Another emerging trend is the blurring of lines between the electricity market and other sectors – often termed sector coupling. As the EU pursues electrification of transport (e.g. electric vehicles) and heating (e.g. heat pumps) and develops a clean hydrogen economy, energy law will increasingly take a holistic view. Future regulatory efforts may focus on coordinating electricity grids with gas networks, transport infrastructure (charging stations), and even telecommunications (for data). The internal market concept may expand to a more integrated energy system market. Legal frameworks like the Trans-European Networks (TEN-E) regulation are already being updated to plan infrastructure in a cross-sectoral manner. This integrated approach will require regulatory flexibility because technological and economic developments can rapidly alter which solutions are most viable. For example, if breakthroughs make green hydrogen cheap, laws must accommodate a shift toward hydrogen pipelines and storage; if instead battery technology leaps forward, grids must manage massive distributed storage – in each case, regulation should not unduly hinder the shift. The EU's inclination toward setting directional targets (e.g. emissions caps, renewable percentages) rather than micromanaging the choice of technology is likely to continue, as it leaves room for markets and innovation to determine the optimal path. But within that, adaptive regulatory guardrails will ensure that new solutions integrate smoothly – for instance, standards for vehicle-to-grid connections or certification schemes for renewable hydrogen are in development to allow these innovations to participate in the energy market on fair terms.

d) Enduring Importance of the Internal Market Framework

Finally, this book's exploration of EU energy law underscores that the Internal Energy Market framework remains the foundation upon which climate and digital policies build. The principles of non-discrimination, unbundling, third-party access, and cross-border cooperation have proven to be durable and will likely continue to govern the relationships between energy actors. These principles provide the stability and predictability necessary for investments in clean energy and grids. They also encourage an unification of effort – no Member State can fully realise the green transition alone, and the internal market provides platforms like ENTSO-E and ACER for technical and regulatory coordination. The push for market harmonisation will carry on in new forms, perhaps through enhanced regional coordination (as seen in the creation of regional coordination centres for grid operation) or through updated market rules to accommodate more renewables and storage. As one commentator noted, the internal market rules are "continually adjusted to meet new policy goals", serving as the "regulatory architecture for the green transition". We should expect that as policy goals evolve – e.g. increased emphasis on energy independence or on social equity in the transition – the internal market rules will likewise be refined. Yet their core function, to bind 27 national systems into one efficient, competitive and now sustainable market, will remain indispensable.

XIV. CLOSING REFLECTIONS

The interplay of smart grids, the green transition, and EU energy law represents one of the most dynamic and consequential areas of European law today. The stakes are undeniably high: Europe's ability to meet its climate objectives, ensure a secure and affordable energy supply, and foster innovation and economic efficiency all hinge on managing this nexus effectively. As this book has illustrated, EU energy law has shown a remarkable capacity to adapt and expand – from market liberalisation, to embedding climate imperatives, to grappling with digital age challenges. This adaptability will be its greatest strength going forward. Law and regulation must continue to learn and evolve in response to new technologies (such as AI and storage), new market conditions, and new geopolitical realities. The EU's approach of marrying ambitious targets with supportive measures, and of updating policies when confronted with crises, is likely to continue. It is an approach that requires careful balancing: balancing environmental imperatives with economic and social considerations, and balancing Union-wide coherence with national flexibility.

In conclusion, the journey towards a decarbonised, smart, and integrated European energy system is underway, but far from complete. Smart grids and digital technologies will be the nerve system connecting millions of clean energy assets, and EU legal frameworks will need to remain flexible yet firm – flexible in adjusting to the unknowns of the future, but firm in maintaining the direction towards climate neutrality and market integration. The coming years up to 2030 will be a crucial proving ground for the regulatory edifice put in place so far: it will test whether Europe can indeed cut emissions sharply while keeping the lights on at reasonable cost. The likely verdict is that further adjustments will be needed – and this is not a sign of failure, but of a living legal system responding to reality. The chapters of EU energy law are still being written, and they will undoubtedly continue to shape the future of Europe's internal electricity market in pursuit of a sustainable, secure energy future for all Europeans.

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