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# Driving Energy Transition through Integrated Forward Markets


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## 1. Introduction

The European Union's (EU) wholesale electricity market design has been the subject of debate. In particular, questions have arisen about the current market design and the need to adapt it to the goals of the clean energy transition. The EU's Agency for the Cooperation of Energy Regulators (ACER) focusses on long-term markets and improved hedging instruments as a way to manage systems with renewable, and by that intermittent, power generation (ACER 2023). The growing share of wind and solar photovoltaic (PV) in power generation is resulting in a loss of flexible capacity, which underscores the need for long-term mechanisms for resource allocation in order to maintain system reliability.

Two initial remarks are appropriate to understand the limited scope of the article. One, although there are many pending issues for the full integration of the electricity markets within the EU, this article focuses on options for increasing the liquidity and integration of the forward markets as an angular and poorly regulated building block for advancing toward full EU market integration. Two, the article seeks to elaborate on proposals and recommendations inspired in the following three documents published in 2023.

First the EC(2023) proposes amendments of the Electricity Regulation in order to improve the liquidity of the forward markets. They include new rules to clarify and promote the use of longer-term contracts as power purchase agreements and two-way contract for differences (CfD), long-term contracts agreed by public entities to support investments, prevent excessive windfall profits, top up low market prices and require generators to pay back an amount when the market price is higher than a certain threshold. In December 2023, the EU Council agreed to amend the EU's electricity market design, so that the Council presidency should start negotiations with the European Parliament for a final agreement. Linares and others (2024) reviewed EC(2023) and associated proposals, pointing out their advances and shortcomings. In particular, they emphasize the following broad issues.EC( 2023) recognizes the importance of long-term, market-based instruments to increase growth in renewables, but it fails to develop efficient European markets for their integration. They also point out that CfD are seen more as means of government support than as market tools accessible to all actors. Finally, the lack of


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standardization in capacity and flexibility markets allows member states to devise divergent approaches, potentially distorting the European single market.

Second, ACER (2023) observes that the existing electricity forward markets in the EU are ineffective and inefficient. One shortcoming is that they do not function as a single, integrated forward market. They are not designed to integrate into national forward markets efficiently and they suggest, among other changes, the modification of the allocation and the time-framework for interconnection transmission rights.

Third, Larsen and Ackere (2023) conclude that while generating capacity had not been an issue in Europe, the situation has changed quickly over the last decade and could soon become a major concern. They describe realistic scenarios where, in a not-too-distant future, supply shortages could occur, albeit occasionally, but which could require phased outages at peak demand or even other times.

This paper, while relying on the effective integration of the short-term electricity markets, makes some suggestions inspired by the above documents for an increased integration and liquidity of the EU forward markets, while ensuring the growth of renewables and the continuity of electricity supply. The remainder of the paper is organized as follows. Section 2 describes some failures of the EU electricity markets that need to be attended. Section 3 analyzes options for increasing the liquidity and efficiency of the forward markets. Section 4 considers pooling contracts by differences, as agreed by the EU Council, and transforming them into shorter-term forward contracts. Section 5 suggests conditions under which some retailers may improve liquidity in the forward market without requiring that all retailers hold forward contracts. Section 6 discusses the advantages of long-term transmission rights (LTTRs) to enhance forward markets. Finally, conclusions are presented.

## 2. Completing Electricity Markets for Renewable Deployment

The current design of the electricity market (single day-ahead and intraday coupling) has provided a relatively well-integrated market, as stated in ACER's 2022 report. In addition, short-term markets (for daily, intraday and ancillary services) are essential to ensuring economic efficiency. Therefore, they should be preserved; however, they should be complemented with other tools, as liquid and integrated forward markets, to deliver the goals of reliability, affordability, efficiency and renewable investment.

Over the coming decades, the most likely technologies to replace fossil fuel generation and retiring nuclear plants are wind and solar generation. These forms of generation are not suitable for traditional short-run, auction-based 'economic dispatch' protocols and associated market mechanisms which have been designed for systems that rely on flexible generation units. Rather, wind and solar generators are 'intermittent' power generating technologies whose output is driven by uncontrollable exogenous variability. Since electricity supply and demand must be balanced continuously to avoid blackouts, deeply decarbonized systems with wind and solar will also require storage and dispatchable plants.

Other elements should be explored to attend the reliability concerns of the energy transition in a market-oriented mechanism. The answers to the following questions are crucial to this end.

- How well do traditional capacity mechanisms guarantee the security of the system's supply when most renewable generation capacity is intermittent?
- What methodologies best measure the resource adequacy of renewable-dominated electricity systems?
- What measures best promote the required investments in renewable electricity ?
- What measures best increase the efficiency of long-term electricity markets?

### 2.1 How traditional capacity mechanisms guarantee the security of the system when most generation capacity is intermittent

Larsen and Akere (2023) note that adequate capacity resource has always been a concern in developing countries who, for various reasons, have been unable to build sufficient capacity. Europe has focused less on adequate resource and more on operational efficiency and decarbonization. Traditional EU electricity sectors were national monopolies characterized by relatively large reserve margins, as governments did not wish to face the embarrassment of electricity rationing, let alone blackouts. However, increasing environmental concerns have resulted in a push towards renewable energy sources, encouraged by significant subsidies in many countries (IEA, 2020). Current investments in renewables and in additional capacity will take place in a liberalized environment, very different from the environment in which the fossil fuel investments were made and hydro dams built.

The low marginal cost of renewable technologies puts a downward pressure on prices and the degree of uncertainty in the industry brough the attention of the Capacity Mechanisms. A capacity mechanism assigns a firm capacity value to each generation unit based on the amount of energy it can provide under stressed system conditions. Retailers are then required to buy sufficient firm capacity to meet their monthly or annual demand peaks. Having sufficient firm capacity typically means that the retailer has purchased firm capacity equal to between 1.10 and 1.20 times its annual demand peak. The exact multiple of peak demand chosen by a region depends on the mix of generation resources and the reliability requirements of the system operator. All capacity mechanisms rely on the credibility of the capacity measures assigned to generation units. This is easy for dispatchable thermal units, but not for intermittent renewable generation. Hence the following questions:

- Which firm capacity can be assigned to a solar and wind generation unit?
- How to assign the appropriate requirements to retailers?

Wolak (2022) points out that the primary challenge for reliability in a market dominated by intermittent, renewable energy sources is failing to provide sufficient capacity to meet the system demand peaks, that is, meeting demand during all the hours of the year even when there is no sun or wind.

Note that the capacity mechanisms ensure that demand is met during peak times based on two requirements concerning dispatchable generation units. One is that dispatchable generation capacity can be easily initiated, assuming a lack of failure. The second is that although dispatchable generation may fail, failures of the generating units are independent of each other. But with intermittent renewable generation, the unavailability of some units due, say, to a lack of sunshine is correlated to the unavailability of other units. Therefore, the lack of electricity may occur not only under peak demand but also in times of flat demand, which implies that traditional capacity mechanisms cannot ensure that supply matches demand all year round.

The CE (2023) proposal promotes peak shaving products to deal with peak hours. For this purpose, it defines 'peak hour' as an hour that combines the highest electricity consumption with a low level of generation from renewable energy sources, taking cross-zonal exchanges into account. However, the real challenge occurs in hours of low demand together with lower intermittent renewable energy. Although demand control and intelligent electricity transmission devices are helpful, this paper focus on how to promote a continuous supply.

## 2.2 Assessing Resource Adequacy of Systems with Renewable Resources

The methodologies for assessing the resource adequacy of systems with renewable resources are beyond the scope of this article. However, two conclusions of such methodologies suggest good paths for policies aiming to incentivize renewable investments. First, traditional reliability standards are not fit for purpose in the context of renewable-dominated power systems. Second, operational flexibility is a relevant variable for assessing resource adequacy in such electricity systems.

Several investigations deal with the shortcomings of existing adequacy metrics and how adequacy assessment methods could consider flexibility aspects in their analysis. For instance, Lannoye, E. and others (2010) proposed an adequacy metric integrating flexibility aspects when assessing power system adequacy. However, their proposed metric does not capture the flexibility challenges occurring on different timescales. Reviews of methodologies for assessing adequacy and flexibility is included in Lund, P.D. and others (2015) and Fulli, G. and others (2016). Its conclusion is that the major gap of existing methodologies and tools for analyzing flexibility and reliability is that they have primarily been developed separately. Recently , Huclin, S. and others (2023) review existing adequacy assessment methods and analyze critical aspects of power systems with significant participation of renewable electricity which are not adequately covered by these adequacy assessment methods. They establish the connection between the non-covered aspects of adequacy assessment methods and the field of flexibility. They also analyze the challenges of dealing with both capacity adequacy and flexibility requirements. Their proposed methodology addresses the requirement of the European Commission to analyze flexibility aspects on several time scales and responds to the requirement to consider flexibility when assessing power system adequacy.

In brief, the general consensus is that integrating resource adequacy and flexibility is key for guarantying supply security in electricity systems dominated by variable renewables. Furthermore, policies for promoting renewable investment must incentivize adequacy of demand and supply throughout the year, not only at the so called peak times. Wolak's (2022) proposal and the proposal included is section 3 of this article integrate adequacy and flexibility.

### 2.3 How to promote the required investments in renewable electricity?

Existing literature shows that introducing a carbon price which impacts power prices is insufficient to drive the decarbonization of the power industry and drive efficient investment in renewable resources (RES) for three reasons, as pointed out by Roques (2008).

First, although solar and wind generation are now mature technologies, other RES technologies as green accumulation devices are not, and RES plant manufacturers and investors cannot yet reap the benefits derived from cumulative learning. Consequently, this reduces the incentive to invest in non-mature technologies. Second, the RES and other low-carbon technologies are capital-intensive, and it would be challenging to expose them fully to market risks, in addition to the political and regulatory risks inherent to these technologies. Third, the carbon price from carbon markets, such as the European Emissions Trading System, lacks the credibility needed to provide a strong incentive for investors.

The literature concludes that to support investment in RES and other clean technologies, long-term risk transfer mechanisms are required, in addition to the implementation of a carbon price. These mechanisms should have a dual role, subsidizing the deployment of non-mature technologies, and de-risking the more mature ones. As the RES technologies become competitive, these long-term arrangements will have to change focusing mainly on the de-risking these capital-intensive investments.

The three main ways how RES has been implemented across the world are as follows:

- Feed-in tariffs, as they are presently deployed in some EU member states, as France, Germany, , which are defined by reference to the cost of each RES technology and guaranteed in the long term by the government.
- Auctioning of long-term contracts for RES projects as CfD to be established with a regulated entity.
- The renewables thresholds imposed on energy retailers. These mechanisms require retailers to buy from renewable units a portion of their sales.

Some retailers and generators within the EU voluntarily engage in fixed-price forward contracting for electricity as Power Purchases Agreements (PPAs) and other type of contracts with different agreements on prices. However, there are limitations to voluntary PPAs. First, as Wolak (2022) notes, consumers and retailers lack the appropriate incentives to contract their expected future energy needs, due to what he calls the reliability externality. Second, small retailers lack the financial capacity to guarantee the energy payments to generators. Therefore, only large retailers, usually integrated generators and retailers, have the financial capacity to warrant PPAs, which results in poor retail competition.

The EC (2023) establishes that Member States shall facilitate power purchase agreements (PPA) with a view to reaching the objectives set out in their integrated national energy and climate plans and shall provide the instruments to reduce the financial risks associated to off-taker payment. The EU Council agreement reached in October 2023 agrees that two-way CfD would be the mandatory model when public funding is involved in long-term contracts, with some exceptions.

- Two-way CfD would apply to investments in new power-generating facilities based on wind, solar, geothermal and nuclear energy, as well as hydropower without reservoir. This would provide predictability and certainty.

- The rules for two-way CfD would only apply after a transition period of three years (five years for offshore hybrid asset projects connected to two or more bidding zones) after the start of the regulation, in order to maintain legal certainty for ongoing projects.

The Council agreement added flexibility as to how revenues generated by the state through two-way CfD would be redistributed. Revenues would be redistributed to final customers, although they may also be used to finance the costs of the direct price support schemes or investments in order to reduce the electricity costs for final customers.

### 2.4 How to increase the efficiency of long-term electricity markets?

ACER (2023) identifies a number of inefficiencies in the functioning of the electricity forward market and distinguishes two categories. One includes the challenges pertaining to the EU electricity forward market in general. The other category includes the problems pertaining to cross-border hedging. A complete discussion of the impact of inefficiencies in the forward market can be found there, while we focus on two main situations:

- Supply and demand for forward and future contracts is fragmented into different bidding zones and trading venues.
- The Long-term Transmission Rights (LTTRs) are available only for a one year-term.

The EU's electricity forward markets in different bidding zones and venues operate largely isolated from each other without much arbitrage or integration between them. This affects in particular small bidding zones, which, in their isolation, cannot attract a critical mass of supply and demand for hedging purposes needed to achieve adequate liquidity. Increasing liquidity requires more forward market integration and larger availability of forward contracts in the whole EU. In addition to fragmentation, the lack of proper incentives for hedging complete the picture for the EU's electricity forward markets. ACER (2023) provides good examples of policies that remove the natural incentives of market participants to hedge their risk :

- Subsidies on renewable and nuclear investments, capacity remuneration mechanisms, retail and wholesale price regulation and any other measures aiming to make investments less risky or giving better prices to consumers.
- Collateral required by trading at exchanges. The European Market Infrastructure Regulation does not allow for uncollateralized bank guarantees requiring the market participants to place significant amounts in collaterals, which represent a disincentive to hedging at exchanges.
- Market structure has a significant impact on market liquidity. Large suppliers with high vertical integration on the supply side reduce competition in forward markets as the dominant market players, knowing that counterparties cannot hedge without them, can exercise market power and avoid hedging through organized markets.

Additional tools in the EU electricity markets are needed to increase the integration and liquidity of forward markets. For example, standardization and mandatory requirements of forward contracts in order to balance the lack of incentives of retailers to buy long-term contracts. The standardization of forward contracts may be the result of pooling CfD, as proposed by Neuhoff K. and others (2023). Another necessary condition for increasing the EU's integration of forward markets is the availability of long-term transmission rights (LTTRs).

## 3. Forward Contracts: Standardized and Compulsory

The policy goal of decarbonizing the electricity sector, while maintaining security of supply, has led to a revival of policy interventionism in electricity markets in many jurisdictions (see Roques and Finon, 2017). A variety of 'out-of-market' mechanisms have been introduced to support RES, ensure security of supply, and provide some form of long-term risk sharing arrangements to support investment. The countries of the EU have adopted a variety of rules and arrangements, which make the associated markets fragmented and poorly integrated with negative effects on competition and on maintaining a level-playing field.

This article suggests implementing across the EU common standardized forward contracts for retailers and large consumers for a portion of the expected electricity consumption during a period. These contracts may be offered voluntarily by existing generators or by the public sector via pooling together long-term CfD, in order to transform them into standardized forward contracts.

The efficiency features of these contracts rely on the 'two-step competition' regime, with an initial 'competition for the market' via the auctioning of long-term contracts on new capacities, followed by competition 'in the market' via the forward and spot energy markets. This two-step move towards a hybrid regime seems unavoidable as long as the EU ensures the RES targets for 2030-2050 and guarantees reliability .

### 3.1 European Standardized Forward Contracts

The central idea is that some or all electricity retailers and large consumers must hold standard forward contracts for proportions of the expected system demand for various points of time . Such forward contracts increase the liquidity of forward markets as they are standardized across the EU and would be traded in a European hub as required by article 19 of EC (2023). However, a more important feature would be its capacity to promote a smooth supply of electricity.

These contracts would be denominated ***European Standardized Forward Contracts*** *(ESFCs)*. Although the design rules of *ESFCs* require a detailed analysis beyond the scope of this paper, the following aspects are worth considering: Standardization, Continuity and Horizon, Generators' Obligations, Organized Markets, and Cross-Border Risk Mitigation.

- *Standardization.* Forward markets integration results, obviously, in less fragmentation but also in more liquidity. To achieve both features, the standardization of contracts across countries becomes necessary. Notice that an important dimension of a liquid market is the presence of many buyers and sellers willing to always transact. The standardization of products across countries increases the number of buyers and sellers and helps renegotiating and hedging in forward markets.
- *Continuity and Horizon*. *ESFCs* should impose quantitative commitments for supplying electricity at various future timepoints of delivery, for instance from one to three years, and should ensure a temporal structure. Horizons should be sufficiently far to allow the new generation units to compete with incumbent units. Notice that the requirement of ensuring a certain temporal structure of electricity supply is an inducement for the availability of electricity at peak hours and when there is no sun or wind.
- *Generators' Obligations*. Generation units or institutions issuing ESFCs must be obliged to supply the amount of electricity committed in the ESFCs on the day-ahead market. This obligation increases competition in the day-ahead markets as it increases the supply of physical electricity and reduces the ability of generating units to exercise unilateral market power in the short-term energy market. Buyers of these contracts are protected against short-term price movements, but more importantly, sellers of these contracts add competition to the spot markets. Notice that the owners of dispatchable plants may offer electricity for all periods of time, but non-dispatchable units cannot commit for the whole year. Therefore, agreements between dispatchable and non-dispatchable units are promoted.
- *Electricity Organized Forward Market.* Today, financial market regulations set capital, organizational and transparency requirements for participants in the markets for commodity derivatives, as well as requirements for counterparties that enter into derivative contracts. The ESFCs-organized electricity markets should have appropriate rules that in some respects may be different from the ones of the standard financial markets.
- *Cross-Border Risk Mitigation*. Negotiated energy prices are denominated per bidding zone which, in most cases, overlap with national borders. If a market party wants to hedge prices across bidding zones, long-term cross-zonal transmission rights need to be acquired separately on the Joint Allocation Office (JAO) platform. These rules need to be fully revised to ensure that ESFCs be traded in an EU-integrated market.

Other considerations are appropriate for the design of a proposal, namely:

First, the proportion of demand and number of years in advance that retailers and large consumers must buy through *ESFCs* are parameters to be set by regulators in accordance with the electricity demand and renewable targets.

Second, generators may have no interest or capacity, due for example to commitment with previous contracts, to issue *ESFCs*. Consequently, establishing an obligation to issue them may generate regulatory problems. One option when dealing with such lack of interest consists in making mandatory the issue of *ESCFs* by new generation units and link this obligation to the installation authorization. Another option is pooling the public sector CfD as discussed in section 4.

Third, mandatory *ESFCs* for all retailers and large consumers may prove difficult both socially and for regulatory reasons. One option is to select retailers with some features to require the obligation to hold forward contracts. This option will be discussed in section 5.

Fourth, a complementary action to promote liquidity through *ESFCs* is designating one or more agents as market-makers. ACER (2022) suggests stimulating market liquidity in long-term markets, particularly for products with a lead time of more than three years, through market-making. The authorities can create the figure of market-maker through, for example, an auction process, or by pushing generators to offer market-making services. Examples in Box 1 may guide how to implement this option.

**Box 1: Market-Makers Examples**

- EEX, Europe's largest trading platform, offers deals to companies interested in acting as market-makers, which are offered special arrangements in exchange for trading according to defined parameters such as maximum *spread* and number of offers/volumes offered.
- Spain, there are market-makers in Mibgas (Mercado Iberico de Gas) which are selected every six months through a public competition organised by Enagás and whose result is approved by the CNMC (Comision Nacional de los Mercados y la Competencia).
- New Zealand, which forces the four main electricity generators to sign a contract with the ASX (market exchange) to offer a minimum number of volumes in the long term with a maximum bid-ask spread of 3 per cent.

A final remark, although *ESFCs* may seem similar to the standardized fixed-price forward-contract (SFPFC) designed by Wolak (2022), two main differences should be noticed. First, the requirements of retailers and large consumers for holding *ESFCs* are smaller than their effective demand, while the holding of SFPFCs in Wolak's model would need to be equal to the effective demand. Second, *ESFCs* will not ensure resource adequacy, while SFPFCs do. The main goal of SFPFCs is resource adequacy, while the main purpose of *ESFCs* is to increase the liquidity in forward markets and promote investment for RES. SFPFCs directly ensure resource adequacy if all retailers meet all the requirements, but the supervision of the corresponding rules may be cumbersome. Moreover, the regulation of SFPFCs may be difficult to accept across all EU countries. ESFCs indirectly promote resource adequacy through developing and integrating forward markets. Consequently, regulatory constraints are softer and supervisory charge lighter.

## 4. Standardization and Pooling Long-Term Contracts for Difference (CfD)

The Council agreement on December 2023 pushes for additional harmonization when the public sector participates in long-term contracts. In particular, the Council agreed that two-way CfD would be the mandatory model used when public funding was involved in long-term contracts. If the public sector holds several CfD, it may pool and convert them into *ESFCs.* The pool and conversion is based on the proposal of Neuhoff K. and others (2023) and combines two goals: supporting new renewable investment by EU governments and increasing the liquidity and integration of forward markets. These public sectors *ESFCs* will complete the supply of such contracts when existing generators do not have enough appetite for them.

The pooling and conversion requires a set of conditions to coordinate the whole process, from the auctions to select new power plants to the distribution and assignation of *ESFCs*, to the forward markets. Although the design of the procedure for contracting, pooling and transforming is beyond the scope of this paper, the following guidelines are worth underscoring:

- The auction tender should make explicit the government purpose of pooling and converting the CfD derived from the auction into an *ESFC.* However, the final risk of the contract would rely on the public sector with the corresponding guarantees from retailers.
- The CfD needs to promote supply continuity, so the tenders should request offers for new wind and solar power projects, including green accumulation devices. However, the *ESFC* would not have the terms of the original CfD, as they are structured for successive periods of one-three years.
- The government combines all individual CfD-contracts into a standardized "Renewable Pool" and transform in *ESFCs* to be sold through auctions in the forward markets. For doing so, auction rules should give access to all relevant retailers.
- Government budget impacts. *ESFCs* from the pool provide a hedge for consumers and retailers against fluctuating prices according to the generation profile of the pool. For governments, the pool reduces budget impacts, except in situations of contract defaults.

Neuhoff and others (2023) assess whether a pooling and transforming CfD is suitable to address the five objectives of (i) incentivizing RE investment; (ii) lowering financing costs; (iii) reducing the volatility of RE supply; (iv) providing incentives for system-friendly installations; and (v) supporting the development of flexibility. Their assessment is that re-pool ensures the scalability of renewable installations. This is consistent with the analysis by Baringa (2022), who finds that only 14 per cent of German power demand from industrial and commercial customers can be satisfied by PPAs without affecting the off-taker's credit rating.

## 5. Retailers and Mandatory ESFCs

The central idea of *ESFCs* is that large consumers and retailers contract their expected future energy needs to correct what Wolak (2022) calls the 'reliability externality'. Therefore, the proposal is that some or all electricity retailers and large consumers must hold standard forward contracts for fractions of the expected system demand at various horizons of delivery. The question is how to select the retailers that need to hold mandatory *ESFCs.* Two options are considered below: retailers that have contracts with consumers with long-term prices; and retailers of last resort.

The provisional agreement reached on 14 December 2023, by the European Parliament and Council on the **reform of the EU's electricity market established that:**

- Consumers will get a **wider choice of contracts** and **clearer information** before signing contracts, so that they have the option to **lock in secure, long-term prices to avoid excessive risks and volatility**. At the same time, they will still be able to choose whether to have dynamic pricing contracts to take advantage of price variability to use electricity when it is cheaper.
- Retailers will be required to manage their price risks at least to the extent of the volumes under fixed contracts.

Therefore, the retailers that are required by regulation to manage their price risks are good candidates for being compelled to buy *ESFCs* to that end.

Another option are the last-resort suppliers. The above mentioned agreement also establishes that member states will have to regulate the suppliers of **last resort.** In particular, it is worth stressing the following mandates of the agreement:

- To ensure continuity of supply for consumers, particularly in cases of supplier failure, member states should implement a 'supplier of last resort' regime. It should be possible to appoint the supplier of last resort either before or when the supplier failure occurs. Such a supplier of last resort may be treated as a provider of universal services.

- Where a member state forces a supplier of last resort to supply electricity to a customer who does not receive market-based offers, some conditions must apply. In particular, this obligation involves regulated prices for customers.

If 'retailers of last resort' are entitled to supply electricity at regulated prices, two basic requirements are: stable prices for consumers; and risk management tools for last-resort suppliers. Although some regulators and authorities may think that the regulated prices of last-resort suppliers would be cheaper when closely following the spot markets, price volatility is a big problem for consumers that are unable or unwilling to manage price risks. As '*consumers* of last resort' are usually consumers who are unable or unwilling to choose providers, it would be difficult for them to manage their electricity price risks.

Volatility of the spot market is already high, but as pointed out by Barrera (2023), the further decarbonization of the power sector may increase it. The absence of coal as an power-generating energy source will cause the price to modulate less and volatility to increase. Due to spot-market volatility and the loss of well-being that arises from giving risks to those that are not able to manage them, it would be advisable to disconnect daily electricity prices from last-resort regulated prices. In other words, risks should be supported by the agents with capacity to manage and control them , not by the last resort consumers with poor market knowledge.

Although retailers of last resort are better prepared than those consumers who are unable to choose their retailer, they need tools for hedging volatility of the spot market at a reasonable cost. Integrated retailers usually have their own hedging products, but non-integrated retailers need to access the forward markets to find hedging tools. The lack of liquidity in forward markets leave non-integrated retailers with poor options. Offering incentives to last-resort retailers to buy *ESFCs* to manage their risks may increase the liquidity of forward markets without forcing all retailers to buy them.

## 6. Long-Term Transmission Rights (LTTRs)

Beato (2021) argues that LTTRs promote competition, fosters investments by new entrants and, therefore, helps the efficient renewable deployment across the EU member states, as well as the efficient use of interconnectors. However, EU regulations only require LTTRs of up to a year in length. The lack of longer-term transmission rights appears to be inconsistent with the EU's twin goals of electricity markets' integration and its ambitious renewable target. The reason is that as renewable investment costs are unevenly distributed across the EU (with northern Europe better for wind while southern Europe gets more sun), new interconnexions are needed, and LTTRs should be available in order to mitigate the long-term risks of efficient and renewable investments. An EU electricity network more integrated and complete with relevant tools of control of demand and supply would be the best option in the long run. However, promoting LTTRs is an excellent option in the short term for increasing the liquidity and integration of the EU forward markets.

The Florence Forum that designed the Target Model proposed that available forecasted transmission capacity should be sold for the following four years. In fact, it mentioned the indicative percentages of 10 per cent of forecasted transmission capacity for Y+3 (the third following year), 20 per cent for Y+2 and 40 per cent for Y+1. However, transmission rights with a time-frame longer than a year are neither available nor required under current EU regulations.

ACER (2023) points out that the major problem for LTTRs is that they do not facilitate market integration because LTTRs currently cannot combine the liquidity of small zones and large zones into one single integrated market. This is because current LTTRs are not very useful for continuous arbitrage between forward markets since they are not accessible continuously and do not have the same timeframes and maturities as futures contracts.

ACER (2023) proposes several options for regulating the LTTRs, the most appropriate one being mandatory intervention, which implies that LTTRs or equivalent measures should be available in all regions. It means that regulatory authorities cannot exempt transmission system operators (TSOs) from their obligations and, therefore, regional or national assessment and decisions of regulatory authorities are not needed. EC (2023) addresses the issue following the ACER recommendations. However, these mandates, and article 19, deserve some comments.

First, the time period given to the European Network of Transmission System Operators (ENTSO) to submit a proposal to ACER is too long. This means the impossibility of advancing forward market integration for more than two years until the new proposal is in place. In particular, the limited one-year maturities of LTTRs will remain for at least two years. Today, market participants can trade forwards and futures for several years in advance, but they cannot complement them with LTTRs since these are offered only one year ahead or one month ahead and just shortly before delivery starts. Such LTTRs fail to support forward markets and the proposal in CE (2023) allows keeping failures for at least two additional years.

Second, the regulations mandate that LTTRs maturities of up-to at least three years ahead. These maturities are well below what is needed to mitigate the risks of new renewable investments across different bidding zone. The recommendation of EFET (2022) seems more promising: "Member States can help promote PPAs by removing any local barriers to multi-year contracting, by endorsing the EFET standard PPA contract, and by ensuring that TSOs issue forward transmission rights up to five years ahead to start matching the contract duration of at least the shortest PPAs".

Making sure thar LTTRs can be used as hedging tool for *ESFC*, the liquidity and integration of the EU forward electricity market would be enhanced.

## 7. Final Remarks

The overall conclusion is that the energy transition requires to enhance the electricity market integration across the EU. Wholesale electricity spot markets were working for more than 25 years in the EU. These markets have achieved the test of time regarding efficiency in cost minimization. However, their ability to decarbonize the power systems raises questions about the efficacy of the existing markets. The challenge on the supply side is combining an increasing renewable capacity with ensuring the continuity of electricity supply in accord with demand. The paper suggests some interventions, build on recent documents mentioned in the introduction, which are:

First, establishing *ESFCs* for managing price volatility at different horizons. This will increase the liquidity of European forward markets. Such contracts may be mandatory for all retailers or only for retailers committed to supply electricity at fixed price during some time periods.

Second, pooling and transforming CfD for new renewable generation supported by the public sector. The pooling and transformation allows the public sector to emit standardized forward contracts to be assigned through auctions to retailers and large consumers.

Third, increasing the term of LTTRs. The volume of LTTRs should not be based only on decisions by TSOs. A regulatory mandate is needed sooner than later to promote the integration of Europe's long-term electricity markets.

Finally, it is relevant to have a comprehensive and coherent framework that integrates the design of auctions for new, green, renewable capacity, the possibility of pooling and transforming the contracts resulting from auctions into standardized forward products for retailers and consumers, and the long-term implications on cost and security of supply.

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