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CRE COMMISSION DE RÉGULATION DE L'ÉNERGIE

REPORT

September 2024

The monitoring and functioning of wholesale electricity and natural gas markets in 2023

SUMMARY

As part of its mission to monitor the wholesale electricity and gas markets, the CRE publishes an annual report on the monitoring and the functioning of these markets. This 17th edition, covering the year 2023, presents CRE's market monitoring activities and its main stakes. This report also highlights the insights that this monitoring provides on their functioning and developments.

Besides the energy crisis of 2022-2023 extensively covered in this report, wholesale energy markets, have undergone major changes in the past years. New trading practices, and the rise in the number and diversity of market participants have contributed to greater market efficiency while making them more sophisticated. The market monitoring carried out by the CRE is of particular importance and faces new challenges.

For its market monitoring missions, the CRE relies on a strong legal framework, particularly the French Energy Code and the European regulation no. 1227/2011 concerning the integrity and transparency of the wholesale energy market ("REMIT"). The year 2023 was marked by the reform of the REMIT regulation, which came into effect in May 2024. Although several implementing texts are still being developed, the main outlines of this reform are now established.

This extensive reform affected almost all existing provisions of the REMIT regulation and introduced new ones, expanding its scope to new markets, products, participants, and trading practices. These developments directly impact the CRE's market monitoring missions. In particular, the CRE's sanctioning powers are strengthened with the extension of the REMIT regulation to market abuse practices involving financial instruments related to electricity and gas.

The evolution of the markets and the legal framework in 2023 took place in the context of the exceptional energy crisis of 2022, which left lasting marks despite a gradual resolution observed in 2023. Indeed, 2022 was affected by two historical phenomena:

- the almost complete halt of Russian gas deliveries via pipeline, significantly impacting Europe's gas supply,
- the historic reduction of French nuclear generation due to stress corrosion affecting part of the nuclear fleet.

These two shocks led to very high wholesale prices for electricity and gas, difficult to bear for economic actors, leading governments, in France and in Europe, to step up.

The wholesale energy markets played a crucial role in resolving the crisis by sending signals leading to substantial and rapid changes in the supply and demand for natural gas, and by reflecting the significant tensions and uncertainties in the electricity market. The markets contributed:

- in the gas sector, to the substantial and rapid reorganization of supply flows (substituting pipeline supplies with LNG deliveries), while demand decreased due to rising prices and efforts towards energy sobriety;
- in the electricity sector, through high price differentials between France and its neighbours, to the import of missing energy quantities, while demand, similarly to what was observed for gas, decreased due to rising prices and sobriety efforts.

The resolution of supply crises led to a sharp drop in wholesale gas and electricity prices, particularly in the second half of 2023. Price levels stabilized in the first half of 2024, although price volatility remains higher than before the crisis. Market prices have returned to levels consistent with generation costs, which have otherwise increased.

The end of the regulated access to historic nuclear electricity (ARENH) mechanism at the end of 2025 will enhance the importance of wholesale electricity markets in France, particularly forward markets, becoming the main price reference for suppliers. This movement has already begun, with significant increase in trading volumes for deliveries in 2026 and 2027. This evolution represents an opportunity for the development of longer term markets, with less volatile prices and likely to give signals supportive for investments and more stability.

In this context of enhanced role for the wholesale market and its increasingly sophisticated functioning aiming at the end the better price formation, CRE's market monitoring is essential for the confidence that all stakeholders, from producers to consumers, can place in it. This CRE wholesale market monitoring, complementary to its actions on the retail market, requires an in-depth knowledge of energy markets specificities, strong legal and financial skills, and increasing data processing capabilities to monitor, detect, investigate, and prove any breaches, where necessary. CRE is organizing itself to support the growth of the wholesale market, ensure its transparency, and increase public and stakeholder confidence in its proper functioning.

CRE is aware of the importance of demonstrating effective and impartial action as far as market monitoring is concerned, to maintain trust, as well as contributing to a better understanding of the functioning of wholesale markets. This report, by transparently presenting numerous data and analyses, aims to contribute to these goals.

The year 2023 was marked by the gradual ending of the historic crisis of 2022.

The supply crisis in Europe reached its peak in the summer of 2022, where European gas prices hit historic levels, exceeding the threshold of €300/MWh. At the same time, under the dual impact of soaring gas prices and the reduction of nuclear generation, electricity prices in France for delivery in January and February 2023 (monthly products) rose to over €2000/MWh. The end of 2022 and the year 2023 saw the gradual resolution of the dual crisis affecting Europe’s gas supply and the French nuclear fleet.

Regarding gas, the gradual and almost complete halt of Russian gas supplies via pipeline, a consequence of Russia’s invasion of Ukraine in February 2022, notably transformed Europe’s gas supply pattern, which quickly reorganised to accommodate significant quantities of LNG. Thus, compared to previous gas supply pattern, gas flows were reversed from west to east and from south to north of the region.

On EDF’s side, the stress corrosion detected at the very end of 2021 not only reduced short-term nuclear generation due to the shutdown of several reactors but also continued to generate significant uncertainties about the long-term availability of the nuclear fleet. The quick return to service of the nuclear fleet from December 2022, eased the supply-demand balance and reduced the risks of supply disruptions perceived by market participants.

The wholesale gas and electricity markets played their role in 2023, sending price signals supporting both the development of supply, particularly LNG, and a moderation of demand.

In both gas and electricity, high prices and energy sobriety efforts led to a significant decrease in demand, facilitated by mild winter temperatures, reducing heating needs. This drop in consumption seems to persist and could reflect lasting changes in consumption behaviours.

CRE continued its enhanced wholesale markets monitoring, in collaboration with ACER and other European regulators.

The 2022-2023 crisis underscored the importance of CRE’s wholesale markets monitoring. In 2023, the scope monitored by CRE under REMIT included 11.5 million transactions carried out on the wholesale electricity and gas markets, with over 2,700 TWh traded and €211 billion in value. The number of transactions saw a sharp increase (more than double the number of transactions in 2023 compared to 2022), presenting a significant challenge for the effective market monitoring.

At the end of 2023, four investigations were ongoing by CRE services, and two sanction procedures were under enforcement by CoRDiS. In the first half of 2024, the CRE’s Chairwoman decided to open one new investigation.

To identify possible REMIT breaches cases, CRE relies on automated detection tools as well as notifications of suspicions received from various sources, notably from persons professionally arranging transactions (PPAT), who, being responsible of trading operations arrangements on their platforms, represent a valuable source of information. Under Article 15 of REMIT, PPAT are obliged to promptly notify the national regulatory authority if they suspect a breach of Articles 3 or 5 of REMIT. CRE maintains

active collaboration with PPAT and remains attentive to the proper exercise of their wholesale energy markets monitoring mission.

In 2023, CRE reinforced its internal tools to generate automatic alerts, analysed in near real-time. These alerts led to requests for information from the concerned parties, as well as to more in-depth analyses that could lead to the opening of formal investigations where necessary.

Additionally, CRE continues its efforts to further specify obligations arising from REMIT to facilitate their application by market participants. Thus, taken into account the ongoing development of new large-scale electricity production means in France and new electricity storage means, CRE, through a deliberation on 21 June 2023, reminded the obligations to publish inside information regarding the commissioning of electricity production or storage means.

At the European level, 2023 was particularly busy because of preparation of the European electricity market reform and the revision of the REMIT regulation. The work carried out in 2023 and early 2024 heavily involved all wholesale market stakeholders, particularly ACER, CEER, and national energy regulators, including CRE. CRE actively participated in the market reform and the REMIT regulation revision, providing its expertise and contribution.

The reform resulted in the revision of several European Union legislative acts in 2024, notably the electricity regulation, the electricity directive, and the REMIT regulation, which came into effect on 7 May 2024. The REMIT regulation revision notably extended the application of its Articles 3 and 5 (prohibition of insider trading and market manipulation) to wholesale energy products that are also financial instruments, while maintaining and strengthening cooperation provisions between the various concerned authorities. This modification was long-awaited by CRE, as financial and physical products jointly contribute to wholesale price formation and thus require the same monitoring framework.

Finally, CRE is actively involved in ACER's efforts to improve the quality of transactional and fundamental data reported by market participants under Article 8 of REMIT. The processing of market data, whose volume is increasing significantly, is indeed a major issue for market monitoring, particularly due to the development of algorithmic trading.

The European gas market was deeply transformed by the crisis. It showed resilience and found a new balance as early as 2023, although gas prices remain higher than before the crisis.

With the gradual and almost complete halt of Russian gas supplies via pipelines, the European gas market was deeply transformed. The replacement of pipeline supplies from Eastern Europe with LNG arriving mostly in Southern and Western Europe led to an unprecedent gas flows reconfiguration. This caused congestion in the European network, resulting in high price spreads between national markets, previously highly correlated.

A certain market stability came back during 2023, with a global decrease in gas prices across Europe and a reduction in price spreads between hubs, facilitated notably by the development of LNG import capacities in Europe and a significant drop in consumption for the second consecutive year, bringing the total reduction in European gas consumption to approximately -12% between 2021 and 2023. Thus, the price of the PEG M+1 product started at €71/MWh in 2023 and ended the year at €32/MWh. Nevertheless, gas prices are still high from a historical perspective: between 2013 and 2020, the PEG M+1 price averaged €19.7/MWh. The price spread between PEG and the Dutch TTF on the M+1 product narrowed significantly, averaging €1.4/MWh in 2023 (compared to €20.4/MWh on average in 2022 and €0.3/MWh in 2021).

In this new situation, France was the leading LNG importer in Europe in 2023 as previously in 2022. With the commissioning of the floating regasification unit in Havre, France now has five LNG terminals with approximately 450 TWh/year of reception capacity. For the first time, in 2023, LNG imports exceeded pipeline imports in the French TRF market area.

It is also worth noting that biomethane generation injected into the network increased by 28% in 2023, reaching 8.9 TWh, or 2.3% of French consumption.

The low level of European gas storage filling at the beginning of the winter of 2021-2022, notably due to the non-filling of storages held by Gazprom in Europe, had strongly strained the European market. In

response to this situation, the European Union adopted a regulation on 27 June 2022, requiring a minimum filling level of 90% by November 1st for each Member State, which ensured good gas storage filling for the winter of 2022-2023. In France, storages were filled to over 99% by November 1 in both 2022 and 2023. The filling of French gas storages by 1 April 2023 (end of the gas winter) reached 28%, already a high level, and a record level of 39% by 1 April 2024. These levels are mainly explained by mild winter temperatures, low demand, and high levels of French gas storages at the beginning of winter.

During the winter of 2022-2023, the new configuration of European flows generated congestion within the French gas transmission network from south to north, with a deficit in the north of TRF and a surplus in the south. French transmission system operators (TSOs) used localized spread mechanism and mutualised restrictions, while CRE had to make an emergency deliberation in December 2022 to respond to this unprecedented situation. The situation repeated with to a lesser extent during the winter of 2023-2024. Overall, the mechanism generated costs for the TSOs estimated at €54.6 million during the winter of 2022-2023 and €9.6 million during the winter of 2023-2024. These amounts remain low compared to the gains generated by the single market zone in France, which amounted to billions of euros during the crisis. However, CRE monitors the nominations of market participants related to the localized spread mechanism on the gas transmission network and has questioned several of them in this context; in-depth analyses are ongoing, which could potentially lead to formal investigations.

Finally, the volumes traded on the French wholesale gas market continued to rise in 2023 compared to 2022 (+33%), following the sharp increase in 2022 compared to 2021 (+59%), notably due to the growing prominence of LNG in French supplies. There has been a significant increase in the use of centralized clearing services on exchanges: the *share* of OTC transactions covered by these services rose from 3% in 2021 to 40% in 2023, with OTC transactions themselves accounting for about 67% of the total transaction volume. The price rise in 2022 heightened the market's perception of counterparty risk.

With the gradual resolution of the crisis in EDF nuclear fleet, the French electricity market regained its position as a net exporter in Europe in 2023. Wholesale electricity prices fell but remain higher than before the crisis.

The gradual resolution of the stress corrosion crisis affecting the French nuclear fleet led to a significant increase in French electricity generation between 2022 and 2023. Nuclear generation thus increased from 279 TWh in 2022 to 320 TWh in 2023. However, the total electricity generation in France, at 495 TWh in 2023, remains significantly lower than the average of 536 TWh between 2016 and 2019.

Additionally, seasonally adjusted consumption stood at 446 TWh in 2023, a decrease of 3.2% compared to 2022 (460 TWh) and a decline of 6.8% compared to the pre-crisis level of 2021 (average 2014-2019 at 481 TWh), which may reflect a lasting adaptation to higher prices and the persistence of energy sobriety efforts.

The improvement in the supply-demand balance led to a sharp drop in wholesale electricity prices. In 2023, daily electricity prices in France fell sharply, averaging €96.9/MWh, a 65% decrease compared to 2022 (€275.8/MWh), and an 11% decrease compared to 2021 (€109.2/MWh). This drop is particularly observed in France compared to other European countries. At the beginning price spreads with neighbouring countries were reduced, and from May 2023 onwards, French electricity prices were cheaper on a monthly average across almost all borders and months. However, daily prices remained well above pre-crisis levels (averaging €43.2/MWh between 2012 and 2019).

The significant relaxation of the supply-demand balance in France, particularly compared to its European neighbours, led to increased French exports, reaching an export balance of 51 TWh, consistent with the historical average of 2011 to 2021, contrasting with the import balance of 16 TWh in 2022, a year during which imports were essential to meet demand in France due to the decline in nuclear generation.

In the forward markets, prices remained high and volatile in the first half of the year, with the baseload price for 2024 fluctuating between €150/MWh and €240/MWh, before dropping significantly throughout the second half, reaching a low of €86/MWh on 19 December 2023. The spread with German prices followed the same trend, dropping from €30/MWh at the end of June to less than €5/MWh at the beginning of September. Nevertheless, these prices remain high compared to pre-crisis levels: the average forward prices for year-ahead baseload were €43/MWh between 2012 and 2019. The current

forward price levels are consistent with the general increase in generation costs, whether for nuclear power plants (estimated by CRE at around €60/MWh$_{2022}$ from 2026, compared to €42/MWh for ARENH), renewable energies assets (increasing from €55-60/MWh to €80-85/MWh for ground-mounted[1] photovoltaics and from €60-65/MWh to €85-90/MWh for onshore wind, mainly due to rising interest rates), or gas power plants due to higher gas prices than before the crisis.

From December 11 and till the end 2023, the French Y+1 electricity price dropped below German price, reflecting an improvement in fundamentals, especially in the forecasts for nuclear generation, as well as the disappearance of the specific risk to France. Since this date and until the publication of this report, French forward prices for the next four years have remained significantly lower than German prices and generally lower than prices in other European countries (except for the Iberian Peninsula and Scandinavia).

The volumes traded on the wholesale electricity market in 2023 increased compared to 2022, without returning to the levels reached before the crisis. This is due to the improvement in market conditions compared to 2022, and the arrival of new market participants, particularly in the short-term markets. In the forward markets, the use of physical delivery contracts has significantly decreased (-54% between 2022 and 2023) in favour of cash settled instruments. This trend continues and reinforces the trend of recent years, reflecting a greater consideration of counterparty risk since the crisis.

For more distant maturities, activity remained rather limited in 2023. EDF launched daily tenders in September 2023 for the sale of physical Y+4 and Y+5 baseload products , with a capped volume of 5 MW/day for each of the two products. These tenders, their attractiveness for market participants, and the access conditions are of particular interest to CRE. In the first half of 2024, there was a significant increase in liquidity for maturities up to Y+3, particularly for delivery years 2026 and 2027, due to the end of ARENH. There is also an initial, though limited, development of trading on the wholesale market for the year 2028. However, liquidity is non-existent for the year 2029.

Balancing mechanisms continued their evolution towards market mechanisms in 2023, with the start in November 2023 of activation according to merit order on the automatic frequency restoration reserve (aFRR) energy market, and the start in June 2024 of the aFRR capacity market. The balancing markets are also continuing their integration at the European level, particularly with RTE's planned connection to the European secondary reserve activation platform in 2025. The balancing markets are wholesale energy markets under the REMIT regulation and thus fall within CRE's market monitoring scope.

The prices resulting from the capacity mechanism auctions conducted in 2023 for the 2024 delivery year averaged €27.1k/MW for the year 2023, compared to €45.6k/MW for the 2023 delivery year in 2022. This price drop reflects a significant improvement in physical margins on the electrical system. The price of the last auction for the 2024 delivery year, at €6.2k/MW, is particularly low, explained on the demand side by the persistent sobriety efforts of consumers and, on the supply side, by more operators offering capacity guarantees.

[1] For more information, refer to the summary reports of CRE's instructions related to tenders for onshore wind and ground-mounted photovoltaic installations.

CONTENT

This report covers data for the calendar year 2023.
Where applicable, significant events of the market monitoring activity during the first months of 2024 are also mentioned. Unless specifically mentioned, this report does not take into account the amendments introduced to the REMIT regulation by European Regulation No. 2024/1106 of the European Parliament and of the Council of 11 April 2024.

CRE AND THE REMIT REGULATION: THE MONITORING OF WHOLESALE MARKETS, A EUROPEAN ISSUE

The Energy Regulatory Commission (CRE) has been responsible since 2006 for French wholesale electricity and natural gas markets monitoring. It publishes its annual monitoring report on the functioning of the French wholesale electricity and natural gas markets.

Since 28 December 2011, the mission the wholesale energy markets monitoring carried out by CRE falls within the framework of European Regulation No. 1227/2011 of the European Parliament and of the Council of 25 October 2011, on the integrity and transparency of the wholesale energy market (REMIT).

In application of Article L. 131-2 of the French Energy Code provisions, CRE monitors the wholesale electricity and natural gas markets and ensures compliance with Articles 3, 4, 5, 8, 9, and 15 of the REMIT regulation.

As such, CRE pays particular attention to the provisions ensuring the integrity and transparency of the wholesale energy markets by:

- prohibiting market manipulation and insider trading (Articles 3 and 5);
- requiring market participants to publish inside information they hold (Article 4).

CRE also ensures compliance by Persons Professionally Arranging Transactions (PPAT)[2] with their obligations to detect and report suspicions of insider trading or market manipulation under Article 15 of the REMIT regulation.

Finally, the application of certain articles of the REMIT regulation has been extended to the French capacity guarantee market. In application of Article L. 131-2 of the French Energy Code, CRE ensures compliance with the prohibition of insider trading (Article 3), the obligation to publish inside information (Article 4), and the prohibition of market manipulation (Article 5) within the framework of the capacity obligation mechanism.

The REMIT regulation is implemented at the European level under the provisions of Article 16 of the REMIT regulation, which notably provides for cooperation between ACER, the European Securities and Markets Authority (ESMA), the energy regulators of the EU Member States, and the financial and competition authorities.

[2] In English, *Persons Professionally Arranging Transactions* or PPAT, mainly exchanges, brokers, and some network operators.

CRE'S ACTIVITY IN 2023 AS PART OF ITS MONITORING MISSION

11.5 million transactions monitored

2732 TWh traded

More than **€211 billion** traded in value

1,891 market participants registered with CRE

About forty cases under analysis at monitoring stage

4 investigations in progress

2 sanction procedures under enforcement by CoRDiS

Wholesale Market in France in 2023

Electricity Prices

€96.9/MWh on average for day-ahead prices, i.e. a **65%** decrease compared to 2022

€162.1/MWh on average for forward calendar prices for the first year (CAL+1), i.e. a **56%** decrease compared to 2022

Natural Gas Prices

€38.9/MWh on average for day-ahead prices, i.e. a **60%** decrease compared to 2022

€50.5/MWh on average for forward calendar prices for the first year (CAL+1), i.e. a **53%** decrease compared to 2022

SECTION 1: MONITORING OF WHOLESALE ENERGY MARKETS BY CRE

1. CRE's monitoring of wholesale energy markets under the REMIT regulation in 2023

1.1. Overview of sources for detecting potentially suspicious behaviours

CRE's monitoring activities rely on ex-post detection of potentially suspicious behaviours, either through internal detection tools or from declarations submitted by external parties.

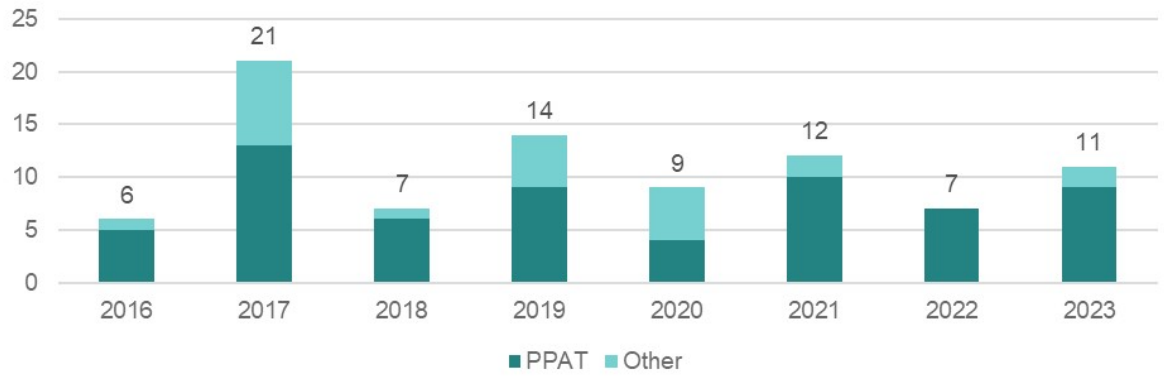
Internal detection relies on market and fundamental monitoring but mainly on automated tools aimed at monitoring market segments to detect specific scenarios and market participants behaviours. CRE's tools primarily aim to detect and analyse insider trading and market manipulation practices prohibited by the REMIT regulation. CRE also ensures the effectiveness of inside information publications and has analysis and detection tools in this area.

In 2023, CRE implemented an internal process for generating near-real-time automatic alerts, which can lead to information requests to the concerned market participants, more in-depth analyses, or, if necessary, investigations.

External detection relies on suspicion transaction reports received from various sources, primarily Persons Professionally Arranging Transactions (PPAT), who, as organizers of trading operations on their platforms, represent a valuable source of information for CRE. Under Article 15 of the REMIT regulation, PPATs are obliged to promptly notify the national regulatory authority if they suspect a breach of Articles 3 or 5 of the REMIT regulation. Breaches of this obligation can be sanctioned by the Dispute Settlement and Sanctions Committee (CoRDiS) under Article L. 134-25 of the French Energy Code.

Figure 1 shows the number of suspicion transaction reports on suspected breaches of the REMIT regulation notified to CRE by PPAT, other regulators or market players in recent years.

Figure 1: External reports by source of detection



External reports can involve similar cases over different periods and can be analysed jointly. They may also address more or less complex cases. Thus, the mere evolution in the number of reports does not directly reflect the underlying analysis activity.

The reports received in 2023 increased compared to 2022, despite a year marked by less volatility and fewer exceptional events than 2022. This can be explained by the nature of the reports received in 2022 and 2023, which mostly pertain to specific cases less affected by the general level of prices or volatility.

The low number of external reports, in absolute terms, can reflect a well-functioning market free of abuse suspicion but also a potential detection deficit by PPATs. In this regard, CRE maintains very regular exchanges with PPATs, reminding them of their monitoring duty and providing a critical view of the measures they implement. CRE considers the monitoring activities carried out by PPATs essential and remains attentive to the proper exercise of their monitoring mission.

ACER also transmits suspicion cases it detects, accompanied by its preliminary analyses, as well as alerts from its automated detection systems, without associated qualitative analysis. On this latter point, since the end of 2017, ACER has been transmitting alerts to national regulators pointing to transactions it considers suspicious, based on specific scenarios. Among these alerts, some pertain exclusively to

the French market under CRE's responsibility, while others involve cross-border exchanges and thus concern other regulators as well. At the end of 2022, ACER implemented new alerts, notably for detecting potential insider trading based on generation unit unavailability published by electricity producers. In this regard, technical exchanges took place in 2023 between CRE and ACER to improve these detection tools.

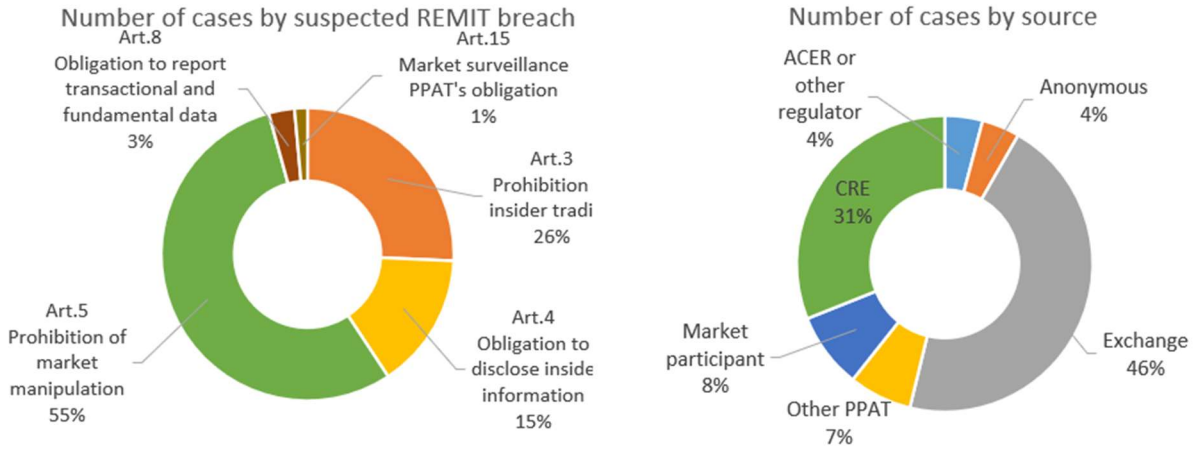
Similarly, other national regulatory and other competent authorities, both in France and abroad, transmit information on potentially suspicious behaviours to CRE.

CRE also receives information on suspicious behaviours from market participants. CRE encourages this vigilance and reminds that anyone with suspicions of REMIT breaches can report them, anonymously or not, to surveillance@cre.fr or on the dedicated European notification platform[3].

The detected suspicious behaviours, whether internally by CRE or through an external report, first undergo a verification of the reasonableness of the suspicion. To date, about forty cases are open by CRE and in the analysis phase. Two investigations were opened by CRE in 2023 and one in the first half of 2024, and three analyses were closed without leading to an investigation. CoRDiS, which can be referred to by the CRE's Chairwoman following such investigations, can sanction breaches of the REMIT regulation under Article L134-25 of the French Energy Code.

Figure 2 presents an overview of all cases analysed and shows that suspicions of REMIT regulation breaches most often concern Articles 3 and 5 (prohibition of insider trading and market manipulation), respectively in 26% and 55% of cases, and are most often opened following a report from an exchange.

Figure 2 : Cases opened by type of breach and source of detection



1.2. Monitoring of practices related to the management of inside information

The proper functioning of wholesale electricity markets requires that information regarding the state of the electrical system be made public by the various market participants. Otherwise, information asymmetries between market participants could create unjustified advantages and, consequently, harm the proper formation of prices and general confidence in the wholesale energy market.

In this context, the unavailability of electricity production facilities, whether accidental or planned, constitutes information that must be published under two European regulations:

- Regulation (EU) No 543/2013, known as the Transparency Regulation, which provides for the systematic publication of accidental and planned unavailability, with a certain power level set at 100 MW for the lowest threshold;
- Regulation (EU) No 1227/2011, known as the REMIT Regulation, which requires market participants to publish inside information under its Article 4(1). Information regarding the

[3] https://www.acer-remit.eu/np/home

availability of production facilities constitutes "information" within the meaning of Article 2(1)(b) of the REMIT Regulation.

Under Article 2(1) of the REMIT Regulation, information is considered as an inside information when four cumulative criteria are met: the information must (1) be precise, (2) not have been made public, (3) concern one or more wholesale energy products directly or indirectly, and (4) if made public, be likely to significantly influence the prices of those wholesale energy products.

Unlike the Transparency Regulation, the REMIT Regulation does not provide quantitative criteria for the publication of inside information.

The assessment by each market participant of whether information on the unavailability of an electricity production facility is an inside information must be based on the four cumulative criteria mentioned above, examined on a case-by-case basis, which can be complex.

CRE has repeatedly provided guidance to market participants on this subject. In its deliberation of 21 June 2023, on the publication of inside information relating to the commissioning of electricity production or storage facilities[4], CRE reminded that information on the availability of new electricity production or storage facilities, regardless of their stage of development, is likely to constitute information that must be published under Article 4(1) of the REMIT Regulation, and that this information must be systematically and timely updated.

Previously, in April 2022[5], CRE communicated that information related to operational errors in wholesale energy markets could, under certain circumstances, be qualified as inside information. In September 2021[6], CRE indicated that for electricity production facilities in France, the quantitative publication criteria for unavailability defined in Article 15 of the Transparency Regulation could generally be used to determine the threshold of unavailable volume below which the unavailability would not be likely to significantly influence the prices of wholesale energy products.

Furthermore, the platform for the publication of inside information operated by RTE was certified in 2023 by ACER as an Inside Information Platform (IIP)[7]. CRE welcomes this certification and closely monitors the RTE inside information platform's developments, particularly in terms of performance and publication speed. The revision of the REMIT regulation, which came into force in 2024, emphasizes the role of inside information publication platforms and ACER's role in their supervision. This certification constitutes a milestone for the operation of RTE's inside information publication platform in this new framework.

1.3. Supporting PPAT (exchanges, brokers, etc.) in their monitoring mission

Pursuant to Article 15 of REMIT regulation, *Persons Professionally Arranging Transactions* (PPAT) in wholesale energy products must establish and maintain effective arrangements and procedures to detect breaches of Article 3 or 5 of the REMIT regulation and promptly notify the national regulatory authority if they have reason to suspect that a transaction might breach Articles 3 or 5 of the REMIT regulation.

CRE considers the monitoring activities carried out by PPATs to be fundamental and maintains an active collaboration with them. This enables CRE not only to strengthen the monitoring of wholesale energy markets in France, but also to benefit from the expertise of each PPAT in the market segments they

[4] Consult deliberation no. 2023-169 of 21 June 2023 on the publication of insider information relating to the commissioning of electricity generation or storage facilities: https://www.cre.fr/fileadmin/Documents/Deliberations/import/230621_2023-169_Communication_MES.pdf

[5] Consult deliberation N°2022-113 of 14 April 2022 on the publication of information relating to operational errors on the wholesale energy markets: https://www.cre.fr/fileadmin/Documents/Deliberations/import/220414_2022-113_Communication_erreurs_operationnelles.pdf

[6] Consult deliberation N°2021-312 on the publication of inside information relating to the unavailability of electricity production facilities in France:

https://www.cre.fr/fileadmin/Documents/Deliberations/import/210930_2021-312_Seuil_Publication.pdf

[7] In English: *Inside Information Platform* (IIP). Consult the list of IIP platforms on the REMIT portal: https://remitportal.acer.europa.eu/portal/list-inside-platforms#

operate. To this end, in 2023, CRE maintained its collaboration with exchanges, brokers active in France, and RTE (the only network operator qualified as a PPAT in France). These exchanges make it possible to monitor the development and evolution of the monitoring tools and procedures implemented by the PPATs and to share the analyses of suspicious cases detected within their scope.

CRE reiterates the importance of good cooperation between NRAs and PPATs, especially in a context where a low number of STRs are reported by some PPATs. Even though no breach of Article 15 of the REMIT regulation has been identified at this stage, CRE will not hesitate, within the framework provided by the law, to open investigations against PPATs that do not properly exercise their market monitoring mission, and depending on the findings, refer the matter to CoRDiS, which may impose sanctions.

The revision of the REMIT regulation, which came into force in 2024, revises and complements the wholesale market monitoring activities to be exercised by PPATs and now by PPETs (*Persons Professionally Executing Transactions*). CRE remains vigilant to ensure that PPATs and PPETs comply with their obligations under this new framework.

2. Investigations and sanctions for breaches of the REMIT regulation

Under Article L.135-3 of the French Energy Code, investigating officers among CRE staff authorized by the CRE's Chairwoman carry out the necessary investigations to fulfil the CRE's missions. Therefore, in case of suspected breaches of the REMIT provisions, the CRE's Chairwoman can appoint an investigating officer to conduct an investigation.

Under Article L.135-12 of the French Energy Code, breaches of the REMIT provisions are analysed by the investigating officers mentioned in Article L.135-3. The investigating report established by an investigating officer at the end of its investigation must be notified to the concerned market participants.

Under Article L.134-25 of the French Energy Code, the CRE's Chairwoman may, if necessary, refer the investigated case to the Dispute Resolution and Sanctions Committee (CoRDiS) which is CRE's independent sanction body.

2.1. Investigations conducted by CRE

Between 2014 and 2023, CRE opened seventeen investigations under the REMIT regulation: two in 2014, three in 2016, two in 2017, one in 2018, one in 2019, four in 2021, two in 2022, and two in 2023.

All these investigations concern the prohibition of insider trading and market manipulation (Articles 3 and 5 of the REMIT regulation) as well as the obligation to publish inside information (Article 4 of the REMIT regulation).

As of the end of 2023, among these investigations:

- One was closed as the analysed behaviour occurred before the entry into force of Law No. 2013-312 of 15 April 2013, which entrusted CoRDiS with the power to sanction such breaches;
- One was closed in 2020 for reasons related to prescription;
- Two were closed as no breach was found, one of which was in 2023;
- Seven were closed by a CoRDiS decision, including two in 2023 (Table 1);
- Two are under enforcement by CoRDiS;
- For the remaining four investigations as of the end of 2023, the investigating officer's analyses were still ongoing.

As part of these investigations, the power to request information (accounting documents, invoices, and any useful document, including telephone recordings and existing exchanged data), under Article L.1354 of the French Energy Code and Article 13(2) of the REMIT regulation, was implemented.

2.2. Summary of the main decisions sanctioning breaches of the REMIT regulation issued by CRE and regulators in the European Union

ACER keeps an updated summary of public[8] decisions at the European level sanctioning breaches of the REMIT regulation on its website.

Among these decisions, CoRDiS issued two sanction decisions in 2023 for two companies following two investigations conducted by CRE. In its sanction decision of 27 July 2023, CoRDiS sanctioned TotalEnergies Electricité Gaz France with €80,000 for breaching Article 4 of the REMIT regulation. In its decision of 26 December 2023, Engie SA was sanctioned with €500,000 for breaching Articles 3 and 4 of the REMIT regulation.

[8] *Publication ACER Enforcement decisions – Overview of the sanction:* https://www.acer.europa.eu/remit/coordination-on-cases/enforcement-decisions

Table 1: Sanction decisions in 2023 at the European level related to breaches of Articles 3, 4, and 5 of the REMIT regulation

Date of Decision	Authority, Member State	Market Participant	Type of REMIT breach	Amount of Sanction	Status of Decision
26/12/2023	CRE (FR)	ENGIE	Articles 3 and 4	€500,000	Under appeal
27/07/2023	CRE (FR)	TotalEnergies Electricité et Gaz de France	Article 4	€80,000	Final
06/07/2023	ACM (NL)	Eneco Energy Trade	Article 5	€2,363,471	Final
23/03/2023	DKER (BG)	Energy Supply Eood	Article 5	165,238 BGN (approx. €84,486)	Appeal possible
14/11/2023	DKER (BG)	Most Energy AD	Article 5	2,114,052 BGN (approx. €1.08 million)	Under appeal
02/06/2023	MEKH (HU)	Prvo Plinarsko Drustvo d.o.o	Article 5	500,000,000 HUF (approx. €1.4 million)	Under appeal

2.3. Increased effectiveness in conducting investigations and the introduction of an administrative settlement procedure

Cooperation with French independent administrative authorities (IAAs), initiated in 2019, constitutes a privileged means of exchange with other French independent administrative authorities (ACPR, ADLC, AMF, ART, ARCEP, CNIL, HATVP)[9]. In this regard, CRE has long collaborated with AMF, particularly based on the memorandum of understanding signed in 2010 aimed at enabling the two authorities to benefit from their respective information and expertise and to ensure the full effectiveness of their respective missions, in accordance with the provisions of Article L.621-21 of the Monetary and Financial Code and Article L. 134-17 of the French Energy Code[10].

The inter-IAA working group constitutes a lever for innovation and exchange of expertise and experience, allowing CRE to question its monitoring and investigation methods. As an illustration, CRE exchanged with various IAAs on the implementation of the power to conduct hearings during investigations.

Furthermore, the Chairwoman and the Board of CRE, as well as the Chairman and the Board of CoRDiS, have jointly decided to propose[11] a reform of investigation, instruction, and sanction procedures, aiming to gain speed and efficiency, notably by introducing a negotiated sanction procedure. This reform project requires the introduction and modification of certain legislative and regulatory provisions of the French Energy Code.

[9] ACPR - Autorité de contrôle prudentiel et de résolution, ADLC - Autorité de la concurrence, AMF - Autorité des marchés financiers, ART - Autorité de régulation des transports (formerly ARAFER), ARCEP - Autorité de régulation des communications électroniques et des Postes, CNIL - Commission nationale de l'informatique et des libertés, HATVP - Haute autorité pour la transparence de la vie publique

[10] Formerly Articles 28 and 29 of Law No. 2000-108 of February 10, 2000.

[11] This reform initiative had been identified among the objectives of CRE's 2023-2024 roadmap: https://www.cre.fr/Documents/Publications/Rapports-thematiques/feuille-de-route-2023-2024-de-la-cre)

3. Monitoring of wholesale markets at the European level

3.1. ACER, CEER, and national energy regulators actively contributed to the preparatory work for the reform of the European electricity market and the revision of the REMIT regulation.

The year 2023 was particularly busy because of the preparation for the reform of the European electricity market and the revision of the REMIT regulation. In the context of unprecedented energy crisis faced by Europe, the substantial increase in energy prices, and market volatility that began in 2021, the European Commission and the co-legislators of the European Union committed to reforming the design of the European Union's electricity market.

The REMIT regulation was part of this reform, identified as a major component aimed at strengthening confidence in the proper functioning of wholesale markets, the resulting price formation, and protection against market abuse.

The work carried out in 2023 and early 2024 significantly involved all wholesale market stakeholders, particularly ACER, CEER, and national energy regulators, including CRE. CRE actively participated in the market reform and the revision of the REMIT regulation, providing its expertise and contribution within a constrained timeline.

The reform led to the revision in 2024 of several EU legislative acts, notably the electricity regulation, the electricity directive, and the REMIT regulation[12].

Regarding the European electricity market, its reform introduces provisions aimed at promoting long-term contracts or contracts for difference for certain producers and consumers.

Regarding the REMIT regulation, its revision is the first evolution since its entry into force in 2011.

The scope of the REMIT regulation has been expanded to cover additional products and markets to adapt to market changes since its implementation. Notably, the application of Articles 3 and 5 (prohibition of insider trading and market manipulation) of the REMIT regulation has been extended to wholesale energy products that are also financial[13] instruments, while maintaining and strengthening cooperation between the various relevant authorities. This modification is particularly welcomed by CRE, as financial and physical products both contribute to wholesale price formation and thus require the same monitoring framework to enforce obligations and prohibitions.

Modifications have been made to improve the quality of data to be reported under the REMIT regulation. The revision of the REMIT regulation introduces specific measures concerning the monitoring of algorithmic trading, the use of direct electronic market access, and new notification obligations. The revised REMIT regulation also strengthens the monitoring and enforcement framework

[12] A consolidated version of the texts is not available yet. The adopted texts can be viewed via the following links:

- Regulation (EU) No. 2024/1747 of the European Parliament and of the Council of June 13, 2024, amending Regulations (EU) No. 2019/942 and No. 2019/943 regarding the improvement of the organization of the Union's electricity market: https://eur-lex.europa.eu/legal-content/FR/TXT/?uri=OJ%3AL_202401747#:~:text=R%C3%A8glement%20(UE)%202024%2F1747,'int%C3%A9r%C3%AAt%20pour%20l'EEE
- Directive (EU) No. 2024/1711 of the European Parliament and of the Council of June 13, 2024, amending Directives (EU) No. 2018/2001 and No. 2019/944 regarding the improvement of the organization of the Union's electricity market: https://eur-lex.europa.eu/legal-content/FR/ALL/?uri=CELEX:32024L1711
- Regulation (EU) No. 2024/1106 of the European Parliament and of the Council of April 11, 2024, amending Regulations (EU) No. 1227/2011 and No. 2019/942 regarding the improvement of the Union's protection against market manipulation in the wholesale energy market: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401106

[13] Some wholesale energy products are financial instruments. As a result, Article 16 of the REMIT regulation provides for cooperation between ACER and ESMA, the energy regulators of other Member States, financial authorities, and competition authorities. In this regard, before the revision of the REMIT regulation in 2024, financial regulation aligned with the market abuse prohibition provisions of the REMIT regulation. This alignment between the REMIT regulation and financial regulation was presented by CRE in Section 1, §1.2 of its 2017 Wholesale Electricity and Natural Gas Markets Monitoring Report: https://www.cre.fr/fileadmin/Documents/Rapports_et_etudes/import/180717_Rapport_de_surveillance_marche_de_gros_2017-en.pdf

for certain cross-border cases by granting ACER new investigatory powers. Finally, the sanctions regime has been harmonized at the European level.

Following the revision of the REMIT regulation, its implementing texts, particularly its implementing regulation[14], will also need to be reviewed to outline the new reporting obligations.

3.2. Wholesale energy markets monitoring activities carried out or coordinated by ACER on

Several working groups dedicated to wholesale energy markets monitoring exist within ACER and the Council of European Energy Regulators (CEER). They contribute to the operational implementation of the REMIT regulation by national authorities in a coordinated and consistent manner, notably through regular exchanges sharing experience on monitoring cases and market abuse scenarios. They also participate in developing non-binding guidance on implementation of the REMIT regulation published by ACER.

CRE places great importance on the rigorous progress of REMIT work within the framework of constructive European collaboration and holds several mandates, including the chairmanship of the *REMIT Policy Task Force* since late 2018 and the vice-chairmanship of the *ACER REMIT Committee* since early 2021.

In the context of volatile wholesale gas prices in 2022 and the increased reliance on LNG replacing pipeline gas deliveries from Russia, European Regulation No. 2022/2576 of the Council of 19 December 2022, aimed at strengthening solidarity through better coordination of gas purchases, reliable reference prices, and cross-border gas exchanges, entrusted ACER with the mission of estimating LNG prices on a daily basis, accompanied by the necessary powers to collect the required data. Aiming to reflect the actual prices of LNG, this estimation, whose publication of results was implemented by ACER in 2023[15], seeks greater market transparency and can be used by interested stakeholders.

ACER and ESMA[16] have strengthened their cooperation through a revision of their cooperation agreement in March 2023. The two authorities have maintained a long-standing cooperative relationship. The first memorandum of understanding was signed in July 2013. In October 2022, in the context of the energy crisis, ACER and ESMA intensified their efforts to enhance the oversight of wholesale energy markets and notably created a new *task force*. [17]

The revised memorandum of understanding primarily covers the following aspects:

- Coordinated and consistent approach to the framework related to market abuse under the REMIT regulation and the *Market Abuse Regulation* (MAR)[18] to further strengthen the integrity of energy and energy derivatives markets;
- Technical cooperation on data and knowledge regarding the functioning of energy and energy derivatives markets;
- New areas of cooperation between ACER and ESMA under the regulation establishing a market correction mechanism (MCM)[19], which came into effect on 15 February 2023;
- Evaluations and benchmarks of LNG prices managed by ACER and other energy-related benchmarks relevant to the missions of ESMA or ACER;

[14] Implementing Regulation (EU) No. 1348/2014 of the Commission of 17 December 2014

[15] https://www.acer.europa.eu/news-and-events/news/acer-launches-its-lng-benchmark

[16] *European Securities and Markets Authority* (ESMA)

[17] https://acer.europa.eu/news-and-events/news/acer-and-esma-enhance-cooperation-strengthen-oversight-energy-and-energy-derivative-markets

[18] Regulation (EU) No. 596/2014 of the European Parliament and of the Council of 16 April 2014, on market abuse (market abuse regulation)

[19] Regulation (EU) No. 2022/2578 of the Council of December 22, 2022, establishing a market correction mechanism to protect EU citizens and the economy against excessively high prices

- Role of the recently created ACER-ESMA *task force*.

Concerning the functioning of the MCM, the two institutions published their respective assessments of the MCM's effects on the markets in March 2023[20].

3.3. Non-binding ACER Guidance on REMIT

The non-binding guidance published by ACER currently consist of four main documents:

- General Guidance on the application of the REMIT regulation, with the 6th edition published in July 2021[21],
- Three guidances focused specifically on practices likely to constitute market manipulation under Article 5 of the REMIT regulation:
    - A guidance on "*Wash Trade*" practices defined as agreements to buy or sell a wholesale energy product without involving a change in ownership of the value concerned or market risk, or involving the transfer of holding or market risk between participants acting in concert or collusion, published in June 2017[22];
    - A guidance on "*capacity hoarding*" in the intraday electricity market, defined as acquiring all or part of the available transport capacity without using it or without using it efficiently, published in March 2018[23];
    - A guidance on "*layering*" and "*spoofing*" practices in continuous wholesale energy markets, defined as issuing a large order or several orders on one side of the order book to carry out one or more transactions on the other side of the order book, published in March 2019[24].

ACER also publishes a list of questions and answers (Q&A) concerning the implementation of the REMIT regulation, with the latest update of this document published on 30 June 2023. This update concerns the interpretation of obligations and prohibitions arising from Articles 3 and 4 of the REMIT regulation when a company becomes aware of inside information from another company that has not itself published it.

ACER plans to provide further details by publishing and updating documents on the interpretation of the REMIT regulation throughout 2024 and 2025, particularly after the European Commission publishes the implementing texts of the REMIT regulation. The general Guidance on the application of the REMIT regulation and the Q&A will be affected.

CRE contributes to the development of common positions on the definition and regulation of market abuse practices under the REMIT regulation.

3.4. Progress on REMIT data exchanges with ACER

The centralized data collection by ACER under the REMIT regulation began in 2015. CRE has been receiving data concerning the French market since 2016. Given the importance of data quality for conducting its missions, CRE is actively involved in ACER's work on this subject.

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[20] ESMA Report: https://www.esma.europa.eu/sites/default/files/library/ESMA70-446-794_MCM_Effects_Assessement_Report.pdf

ACER Report: https://acer.europa.eu/sites/default/files/documents/Publications/ACER_FinalReport_MCM.pdf

[21] For more information: https://www.acer.europa.eu/sites/default/files/REMIT/Guidance%20on%20REMIT%20Application/ACER%20Guidance%20on%20REMIT/ACER_Guidance_on_REMIT_application_6th_Edition_Final.pdf

[22] For more information: https://www.acer-remit.eu/portal/document-download?documentId=u518na123yg

[23] For more information: https://acer.europa.eu/Media/News/Pages/ACER-publishes-guidance-on-capacity-hoarding-in-intraday-electricity-markets-that-could-constitute-market-manipulation.aspx

[24] For more information: https://www.acer.europa.eu/Media/News/Pages/ACER-publishes-guidance-on-layering-and-spoofing-in-continuous-wholesale-energy-markets-.aspx

ACER publishes documents to clarify the reporting requirements for transactional and fundamental data. The exchanges between ACER, reporting parties, regulators, and other stakeholders focus on updates to these documents. The main documents are the procedure manual for data reporting and the[25] *Transaction Reporting User Manual* (TRUM), with the latest versions published on 17 April 2023, and 13 March 2024, respectively. They are complemented by a *Frequently Asked Questions* (FAQ) document on the reporting of transactional data, updated on 13 March 2024, as well as another FAQ document concerning the reporting of inside information and fundamental data, with the latest version dating from 30 April 2021. The latest updates are particularly related to the reporting of contracts concerning LNG and long-term contracts with renewable energy producers (PPA).

As part of the revision of the REMIT regulation, the European Commission is tasked with revising the REMIT [26]implementing regulation to define new data reporting requirements by May 8, 2025. This will lead to updates of the aforementioned documents.

The work carried out by ACER, as well as by other regulators, regarding the improvement of data collection under Article 8 of the REMIT regulation and its use for monitoring activities, continued in 2023.

In 2023, CRE continued to improve the processing of data from REMIT collection and requests reporting parties to clarify or correct these transactional data reported to ACER when necessary. One of the challenges of this processing is adapting CRE's systems and processes to the significant increase in the volume of reported data since the end of 2022, shown on Figure 3, particularly related to the growth of algorithmic trading on French and European markets.

CRE maintains the national data collection system from organized marketplaces (exchanges and brokers) to have a basis for comparison to continue improving the quality of reported data and thus avoid any discontinuity or interruption in market monitoring.

CRE specifically calls on market participants to be vigilant regarding the correct reporting of transaction beneficiaries, which are often poorly recorded, as well as the proper identification of bilateral transactions, ensuring that the unique transaction identifier reported by both counterparties is identical. CRE encourages market participants to ensure the quality of data reporting made under Article 8 of the REMIT regulation.

[25] *Manual of Procedures on transaction data, fundamental data, and inside information reporting*: https://documents.acer-remit.eu/wp-content/uploads/ACER_REMIT_MoP-on-data-reporting_V7.pdf

[26] Implementing Regulation (EU) No. 1348/2014 of the Commission of 17 December 2014

Figure 3: Number of orders and transactions processed monthly by CRE through REMIT data collection (standard contracts "Table 1", all markets combined, electricity, and natural gas)

Source: REMIT data – Analysis: CRE

USEFUL REFERENCES

Regarding suspicions of market abuse

To ensure the most rigorous possible wholesale energy markets monitoring, anyone who suspects market abuse is asked to alert:

- CRE's wholesale energy market monitoring services at: surveillance@cre.fr
- Or ACER's wholesale energy market monitoring services by visiting the agency's dedicated notification platform: https://www.acer-remit.eu/np/home

Regarding the registration of market participants

For any questions related to registration, market participants can contact CRE's wholesale energy market monitoring services at: enregistrement.remit@cre.fr

Regarding the REMIT regulation

All public documentation related to the implementation of the REMIT regulation is available on the REMIT portal provided by ACER: https://www.acer-remit.eu/portal/home.

SECTION 2: CONTEXT OF ENERGY MARKETS IN 2023

1. A year marked by a rapid easing of commodity prices

After a record year in 2022 in terms of prices and volatility, commodity prices continued to ease in 2023, following the trend that began at the end of 2022, but remain above their pre-crisis levels.

In the gas market, the PEG Y+1 price dropped from €70/MWh on January 1, 2023, to €51/MWh on March 1, 2023, a decrease of about 27%, returning to early 2022 price levels. This was followed by a more volatile period with prices fluctuating in a range of €10/MWh around €50/MWh until early November, depending on events affecting supply and market uncertainties (breakdowns or extended maintenance on Norwegian gas installations, potential strikes at Australian liquefaction terminals, etc.). Ultimately, the price returned to a downward trend, reaching lower levels of around €33/MWh at the end of 2023, a 53% decrease over the year and 27% compared to early 2022. Such price levels had not been seen since late August 2021. Overall, despite continued market nervousness in 2023, abundant LNG supply, high storage levels, and falling European demand have significantly eased the pressure on gas prices. The PEG Y+1 gas price thus averaged €50.5/MWh in 2023 (compared to €107.3/MWh in 2022, i.e. a 53% decrease).

The PEG M+1 price averaged €39.9/MWh. It fell sharply in the first half of 2023, from €71/MWh on January 1, 2023, to €45/MWh on March 1 (a 37% decrease), then to €23/MWh on June 1, 2023 (a 69% decrease compared to the beginning of the year), returning to levels close to those prevailing at the end of May 2021. The price then recovered to fluctuate between €25/MWh and €40/MWh (€32/MWh on average) until October 1, 2023. After a bullish rebound in early October, reaching €53/MWh, the M+1 price finally resumed a downward trend towards the end of the year, settling at €32/MWh by the end of 2023.

The CO_2 market was marked by high volatility during the year before finally taking a downward trend in the fourth quarter of 2023. This decline is mainly explained by lower gas prices. Indeed, the CO_2 price is strongly influenced by the trade-off between using coal or gas for power generation. If gas prices fall relative to coal, gas-fired power generation may become more competitive than coal-fired generation, reducing[27] the demand for CO_2 allowances from fossil-fired power generators and thus exerting downward pressure on the price of CO_2. The CO_2 quota price eventually recovered during the last two weeks of trading in 2023, driven by investors building new positions for 2024 and anticipating a tightening of allowance supply. The price reached €80/tCO_2, slightly below the levels observed in early 2023 or early 2022. On average, the CO_2 price stood at €85.3/tCO_2 in 2023, slightly up from the 2022 average level (€81.3/tCO_2).

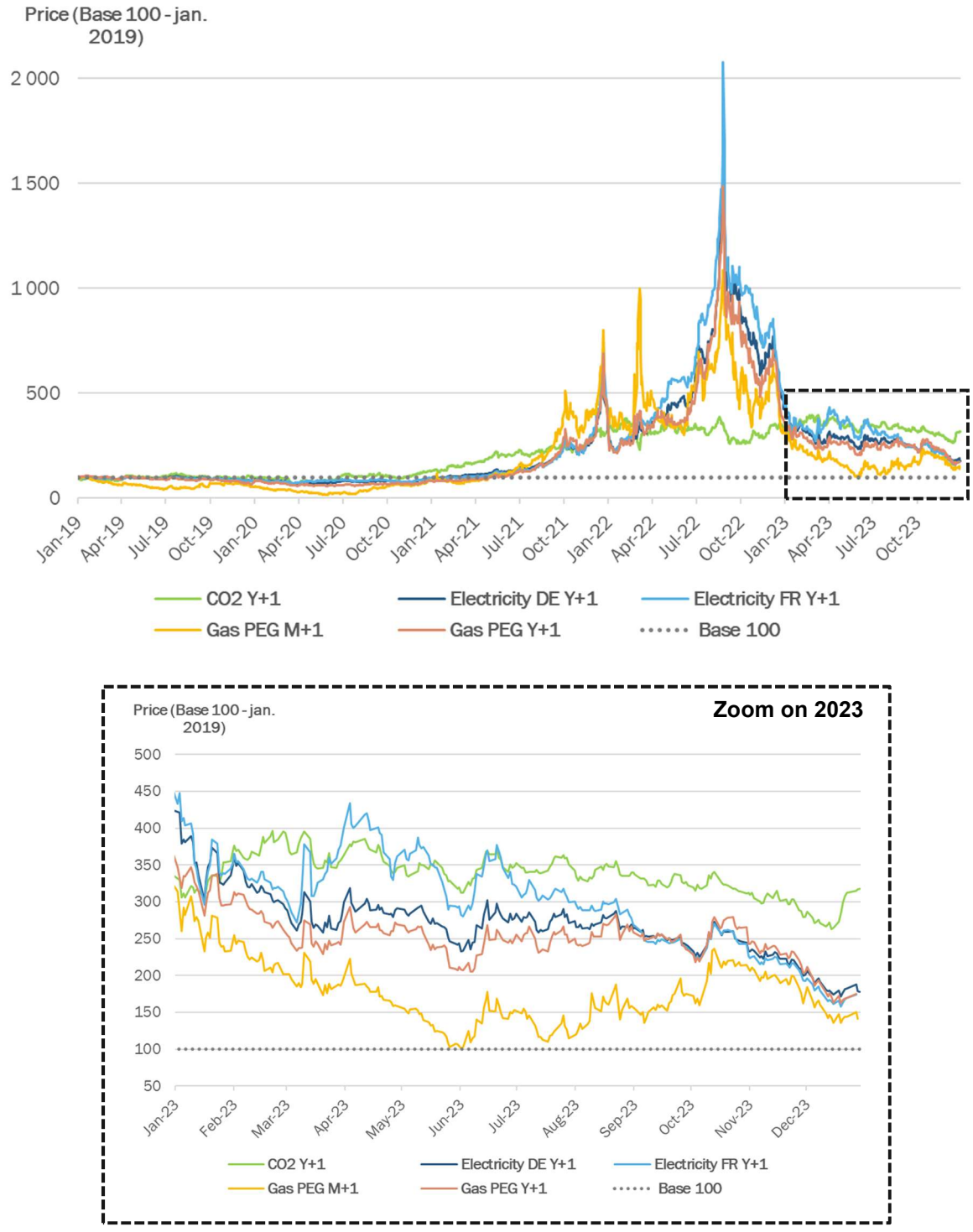
Y+1 forward electricity prices in France and Germany also fell sharply in 2023, continuing the price easing that began in September 2022 and following a trend broadly similar to gas prices, especially from the second half of 2023. Indeed, wholesale electricity prices vary in relation to the variable operating costs of the most expensive power plants needed to meet demand, which are often fossil fuel plants, especially in winter. Therefore, falling fuel and CO_2 quota prices have a direct impact on electricity prices. The availability of the French nuclear fleet also directly affects electricity prices in France and, to a lesser extent, in Europe due to the significant role of interconnections. Indeed, lower nuclear production implies greater reliance on fossil thermal production over a greater number of. The French Y+1 baseload product price thus averaged €162.1/MWh in 2023, more than half the average for 2022 (€367.6/MWh). The price of the Y+1 product fell by 61%, from €235.6/MWh on January 2, 2023, to €92.2/MWh at the end of the year, its lowest level since late August 2021.

The beginning of 2023 was marked by high volatility and a relative increase in French prices compared to its European neighbours. Market concerns about the availability of the French nuclear generation fleet affected electricity prices for the winter of 2023-2024, particularly in March when new cracks related to stress corrosion were discovered by EDF. Ultimately, the second half of the year was characterized by a significant drop in French prices, converging towards their German equivalent. This decline can be explained by a favourable energy context, characterized by an abundant supply of fuels (gas and coal) at falling prices, a reduction in CO_2 prices, a decrease in electricity consumption, and increased

[27] The CO_2 emission factor of gas-fired power plants is significantly lower than that of coal-fired power plants (more than twice as low).

electricity production. Moreover, the confirmation of the successful handling of stress corrosion by EDF and the improved availability of the nuclear generation fleet helped to reassure the French market.

Figure 4: Evolution of commodity prices on the Y+1 contract (base 100 as of January 1, 2019)



Sources: Argus, EEX – Analysis: CRE

Production margin of fossil thermal power plants

The production margin of coal and gas-fired power plants is determined by considering the potential revenues from electricity sales, the cost of fuels by process, the average efficiency of plants by process, the price of CO_2, and the emission factor of plants by process.

The production margin of a coal-fired power plant thus modelled is measured by the Clean Dark Spread (CDS). For combined-cycle gas turbine (CCGT), it is the Clean Spark Spread (CSS).

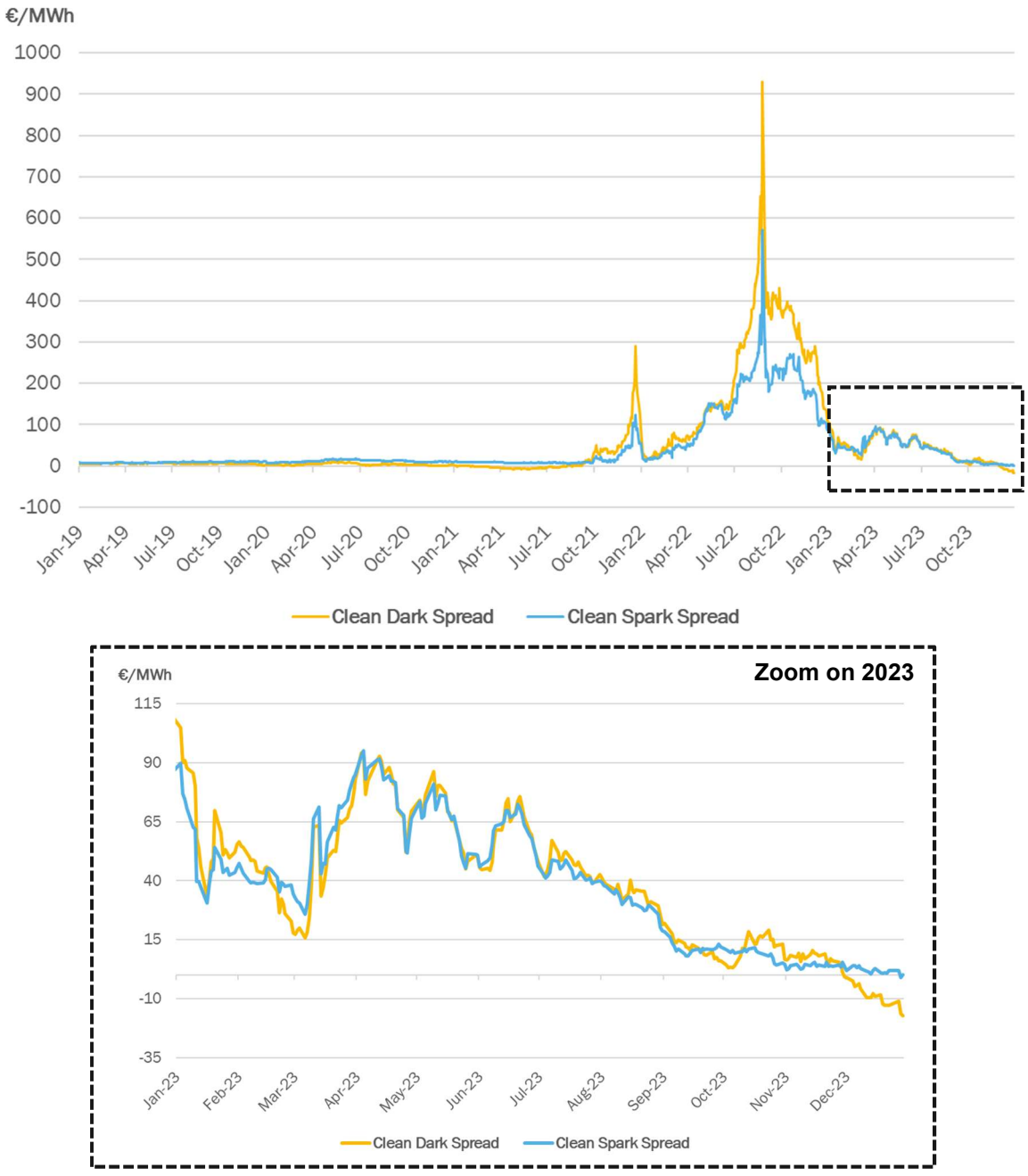
In 2023, the CDS and CSS indicators for the Y+1 product in France experienced a significant drop compared to the extreme levels observed in 2022. This downward trend in the production margins of fossil thermal production means suggests improved market expectations regarding supply-demand balance in France and a decrease in perceived risk premiums in 2023 for 2024 compared to 2022 for 2023. This easing is mainly due to the improved availability of the nuclear fleet in 2023.

On average in 2023, the CDS stood at €38/MWh, an 87% drop compared to the 2022 average (€213/MWh). The CSS averaged €37/MWh, a 74% decrease compared to the 2022 average (€142/MWh). This decline indicates a gradual return to normal with a return, from the fourth quarter of 2023, to pre-crisis levels observed in 2019 (average CDS of €5/MWh and average CSS of €8/MWh in 2019).

In the first half of 2023, the CDS and CSS indicators for the Y+1 product in France experienced high volatility at elevated positive levels (average CDS of €59/MWh over the first seven months of 2023 and average CSS of €56/MWh). Indeed, after following a clear downward trend in January and February 2023, the CDS and CSS saw a significant bullish rebound in March and remained volatile until mid-June. The rise in CDS and CSS in March shows that electricity prices increased more rapidly than fuel prices, suggesting that production margins for fossil-fired power are expected to be positive on average for the year Y+1 in baseload. This indicates that the market anticipates a greater use of fossil-fired plants to meet electricity demand and that electricity prices include risk premiums, given the uncertainties. This situation reflects market concerns about the availability of the French nuclear production fleet, as new cracks related to stress corrosion were discovered in early March 2023, impacting electricity prices for the winter of 2023-2024, regardless of fuel price evolution.

Finally, the improvement in market expectations regarding supply-demand balance in France, combined with the confirmation of successful handling of stress corrosion by EDF and the improved availability of the nuclear generation fleet, has led to an easing of French electricity prices in the second half of 2023. These prices fell more rapidly than fuel prices, leading to a significant decrease in anticipated production margins for fossil thermal power plants. By the end of 2023, the Clean Spark Spread stabilized around zero, while the Clean Dark Spread returned to negative levels.

Figure 5: Clean Dark Spread and Clean Spark Spread[28] for the Y+1 contract in France



Source: Argus – Analysis: CRE

[28] The Clean Dark Spread and Clean Spark Spread denote the profitability levels of coal and gas plants based on the variable cost of inputs (fuel costs, with a reference efficiency rate, and CO_2 prices included) and the revenues from electricity sales. The present graph is based on the following assumptions:

- For coal plants: efficiency of 35% and emission factor of 0.96 t_{CO2}/MWh. However, it should be noted that this efficiency corresponds to new reference installations and may thus be far from the efficiencies of existing installations, and that other costs, notably transport, are not taken into account here.
- For gas plants: efficiency of 53% and emission factor of 0.35 t_{CO2}/MWh.

2. High volatility of CO_2 prices around €85/tCO_2 in 2023

The EU Emissions Trading System (ETS) was established by the European Union in 2005 to reduce greenhouse gas emissions from its industry and electricity producers. The annual volume of allowances is defined by the European Commission and is made available either free or sold at auction. During the year, allowances can be freely exchanged by the market participants on the markets to adjust the coverage of their projected CO_2 emissions for the year within their scope.

The CO_2 price is strongly influenced by the choice between using coal or gas for electricity production. If gas prices fall relative to coal, gas-fired electricity production can become more competitive than coal-fired production[29], reducing the demand for CO_2 allowances from fossil fuel power producers and exerting downward pressure on the CO_2 price.

In 2023, the price of CO_2 allowances averaged €85.3/tCO_2, about a 5% increase compared to the average price of 2022, **fluctuating between €100.3/tCO_2** (a record high reached on February 21, 2023) **and €66.4/tCO2** (reached on December 15, 2023).

After an initial decline in January, following the trend of gas prices, the CO_2 price saw a significant increase of nearly 30% from late January to early March, repeatedly hitting the peak of €100/tCO_2. This trend can be explained by significant compliance purchases[30] before the deadline of April 30[31] and progress on the European carbon market reform "*Fit For 55*"[32] (voted by the European Parliament in early February 2023). However, in March, the banking crisis involving Silicon Valley Bank and Credit Suisse disrupted global financial markets, leading to a 13% drop in the CO_2 price (to €87/tCO_2 on March 16).

In April, market volatility increased as the compliance deadline approached but eventually dropped again in May (€80.5/tCO_2 on May 30) due to reduced demand for allowances in the electricity sector (reduced electricity demand, increased renewable energy production, and falling gas prices) and the European Commission's announcement of additional allowance sales in July to fund the REPowerEU plan[33].

In June, the CO_2 price rose again, following gas prices, before stabilizing in a range between €80/tCO_2 and €90/tCO_2 during the summer and until mid-October.

From late October, bearish sentiment prevailed until mid-December. The price fell by more than 15%, reaching €66.35/tCO_2. This decline is mainly due to the weakening gas market favouring the substitution of coal by gas for electricity production. Other bearish factors include the sale of additional allowances to fund the REPowerEU plan, reduced electricity emissions (down 18% in 2023), and the deteriorating economic climate (reduced industrial demand and even the sale of surplus allowances by struggling industries).

Finally, CO_2 prices recovered to €80/tCO_2 during the last two weeks of trading in 2023, driven by investors building new positions for 2024 in anticipation of a tightening allowance supply.

[29] The CO_2 emission factor of gas plants is significantly lower than that of coal plants (more than twice as low).

[30] Each year, operators must submit an emissions report. The data for a given year must be verified by an accredited verifier. Once verified, operators must surrender an equivalent number of emission units by the April 30 deadline. In the weeks leading up to the deadline, operators make their final CO_2 allowance purchases to ensure compliance.

[31] The deadline for surrendering emission allowances was April 30 until 2023. It is now September 30 in 2024.

[32] The reform was finally adopted in May 2023. This reform aims to strengthen climate ambition with a greenhouse gas emission reduction target of -62% by 2030 compared to 2005 for sectors covered by the EU ETS, up from -43% previously. Several significant measures were taken, such as the gradual phasing out of free allowances for certain industrial and aviation sectors, the gradual inclusion of the maritime transport sector, and the implementation of a Carbon Border Adjustment Mechanism (CBAM) aimed at setting a carbon price for imports of certain products.

[33] ERCST EXPLANATORY NOTE: EU ETS Auctioning & REPowerEU - ERCST

Figure 6: Evolution of CO_2 allowance prices

Source: Refinitiv – Analysis: CRE

3. 2023, the second hottest year after 2022

According to Météo France's climate report[34], 2023 was the second hottest year ever recorded in France since 1900, with an average annual temperature of 14.4°C, 1.4°C above normal[35] and 0.1°C below the previous record of 2022.

Although punctuated by a few cold spells and snowfalls in the plains, the winter of 2022-2023 was remarkably mild. This mildness continued into the spring, generally reducing electricity demand for heating needs.

2023 was also marked by an extended summer season, stretching from June to mid-October, with above-normal temperatures until late November and much of December. June thus ranks as the second hottest month ever recorded, summer 2023 ranks fourth, and autumn ranks as the hottest autumn since the early 20th century.

Furthermore, 2023 saw significant fluctuations in rainfall. The beginning of the year was characterized by very low rainfall, particularly in February, leading to a drought that directly affected hydroelectric stock levels and required cautious management of the hydraulic generation fleet. Thanks to a return to normal precipitation levels in the spring, particularly in March and May, stocks were replenished. The summer season was deficient until mid-October but generally in line with averages. Ultimately, the increased rainfall in November and December significantly enhanced hydroelectric production.

Weather conditions were favourable for wind power production in 2023, enabling a significant improvement of its load factor in France compared to 2022 and 2021 (26.2% in 2023 compared to 21.6% in 2022).

[34] https://meteofrance.fr/actualite/presse/bilan-climatique-de-lannee-2023-sur-le-podium-des-annees-les-plus-chaudes

[35] Reference average 1991-2020

SECTION 3: WHOLESALE GAS MARKETS

1. Evolution of gas supply and demand in France in 2023

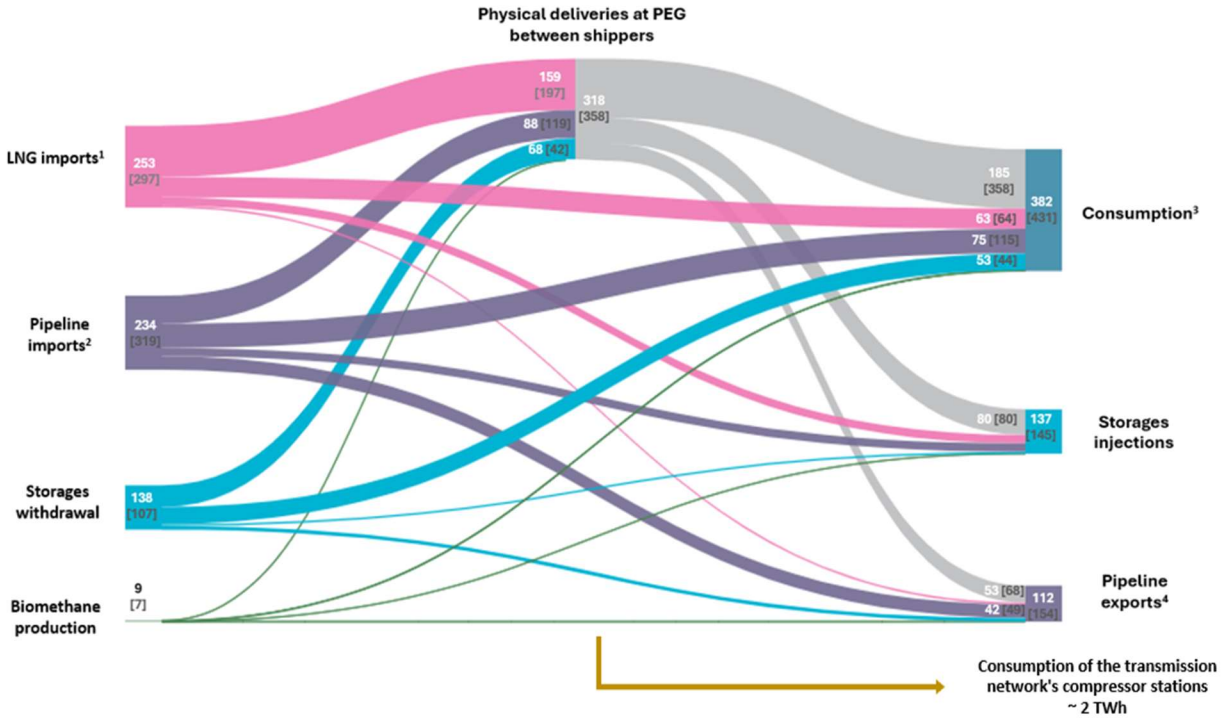
1.1. Balance of the French gas system

The change in the structure of French supply observed in 2022 continued in 2023. The share of LNG in imports for the French market increased to 52%, while pipeline imports accounted for 48% (2022: 44% LNG and 56% by pipeline).

Biomethane production injected into the network increased in 2023, reaching 8.9 TWh (+28% compared to 2022), representing 2.3% of French consumption.

Through significant exports, France confirmed its role as a *hub* for LNG arrivals in Europe. In 2023, for the second consecutive year, France was the leading entry point for LNG in Europe. The five terminals on French territory covered 22% of European LNG imports in 2023.

Figure 7: Supplies and outlets in the French gas system 2023 [2022] (commercial flows)[36]

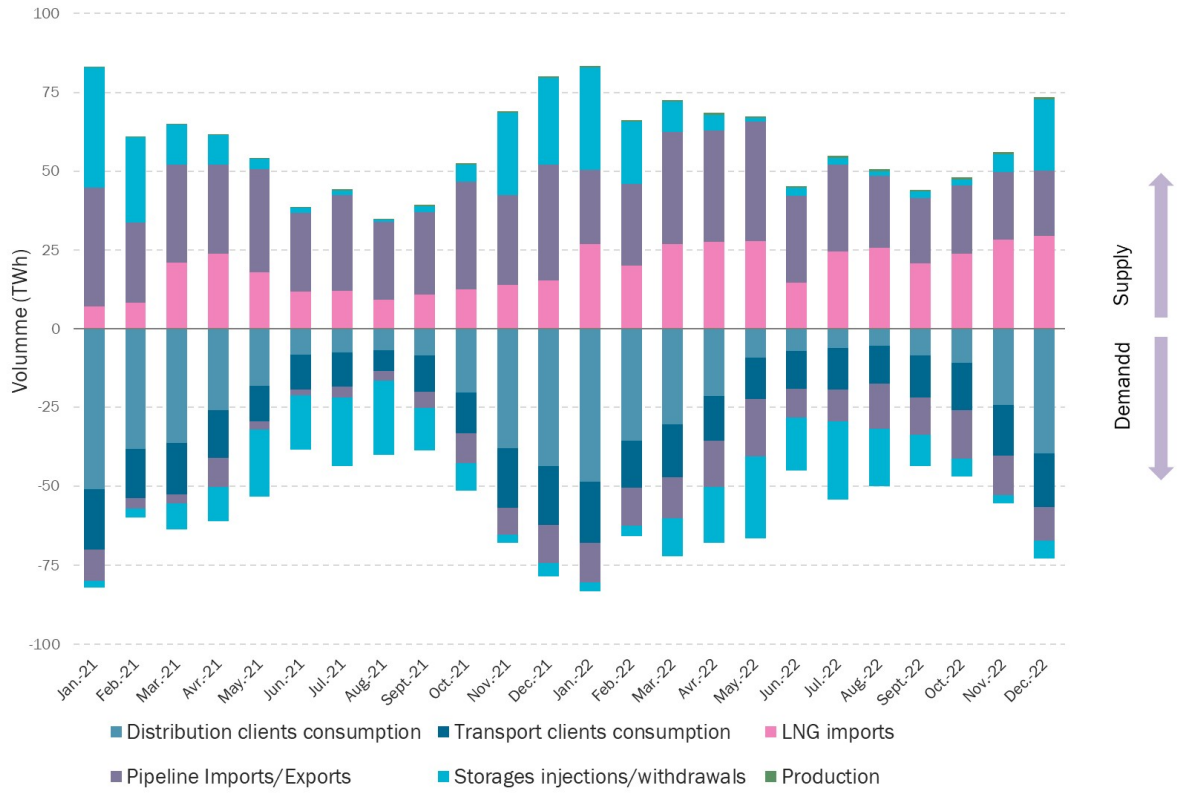


Sources: GRTgaz, Teréga - Analysis: CRE

[36] Details on the scope of the graph: (1) Excluding LNG received at the PITTM Dunkerque for the Belgian market;
(2) Includes gas B imports via the PIR Taisnières B;
(3) Biomethane production injected into the distribution network has been integrated into final consumption;
(4) Exports to PIRR (regional network interconnection points) accounted for in pipeline exports.

Figure 8 figure shows the monthly balance evolution of flows on the TRF.

Figure 8: Monthly balance of the French system 2022-2023 (commercial flows)



Sources: GRTgaz, Teréga – Analysis: CRE

1.2. Significant decrease in French consumption for the second consecutive year

Total gas consumption in France reached 382 TWh in 2023, a decrease of 13% compared to 2022. This is the lowest gas consumption level in France since 1995. To recall, consumption in 2022 (431 TWh) was already down 9% compared to 2021 (474 TWh).

This trend can be partly attributed to the mild climate of the past two years. 2022 and 2023 were the hottest years ever recorded in France since 1900. However, this decrease also reflects significant consumer sobriety, as they adapted their consumption in response to high prices since late 2021.

Consumption by customers connected to the distribution network (residential/commercial sector) decreased by 9%. Mild winter temperatures and restrained usage particularly contained gas consumption for heating.

2023 was also marked by a further decline in gas consumption by industrial customers connected to the transmission network (-7% compared to 2022). The effects of the energy price crisis continue to impact industrial activity, which is down in certain sectors (chemicals, fertilizer production, and construction materials). This decrease in consumption also reflects energy efficiency measures, the possibility of substituting natural gas (notably in refineries), and industrial efforts towards sobriety.

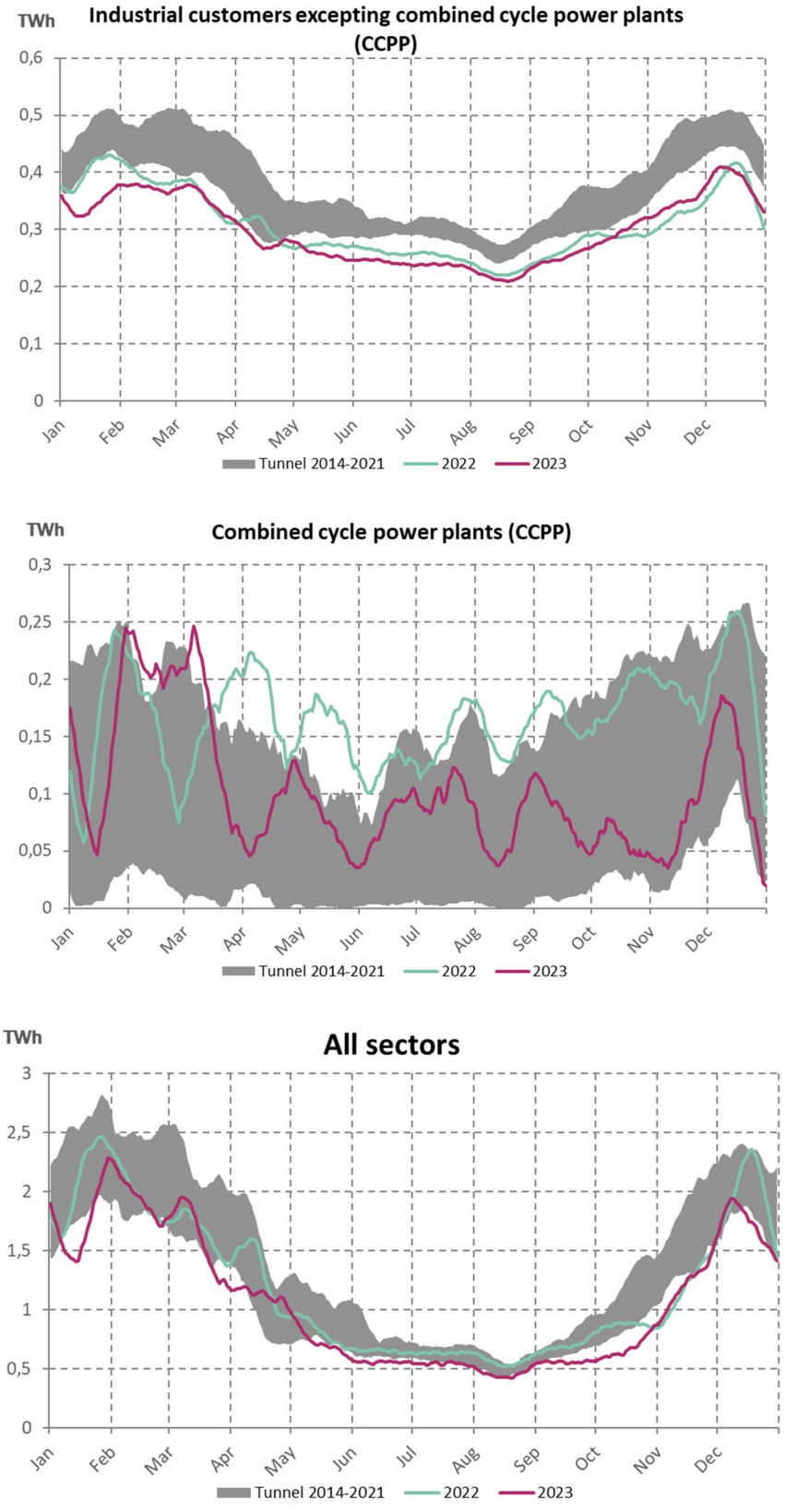
Gas consumption for electricity production decreased by 59% in 2023 compared to the previous year, returning to pre-2022 levels. This decline occurred in the context of improved availability of the French nuclear fleet, record renewable energy production, and observed sobriety in electricity demand.

Table 2: Evolution of French gas consumption between 2022 and 2023 [TWh]

	2022	2023	%
Distribution network (excluding PIRR)	253	230	**-9%**
Directly connected customers (excluding power plants)	117	109	**-7%**
Gas-fired power plants	61	36	**-41%**
Total consumption [37]	**431**	**375**	**-13%**

[37] Excluding consumption of biomethane injected directly into the distribution network, i.e. around 7 TWh.

Figure 9: Consumption of Combined Cycle Gas Turbines (CCGT), network customers excluding CCGT, and all sectors



Sources: GRTgaz, Teréga – Analysis: CRE

1.3. New supply patterns that emerged in 2022 continued in 2023, with a decline in arrivals due to decreased demand and high storage levels

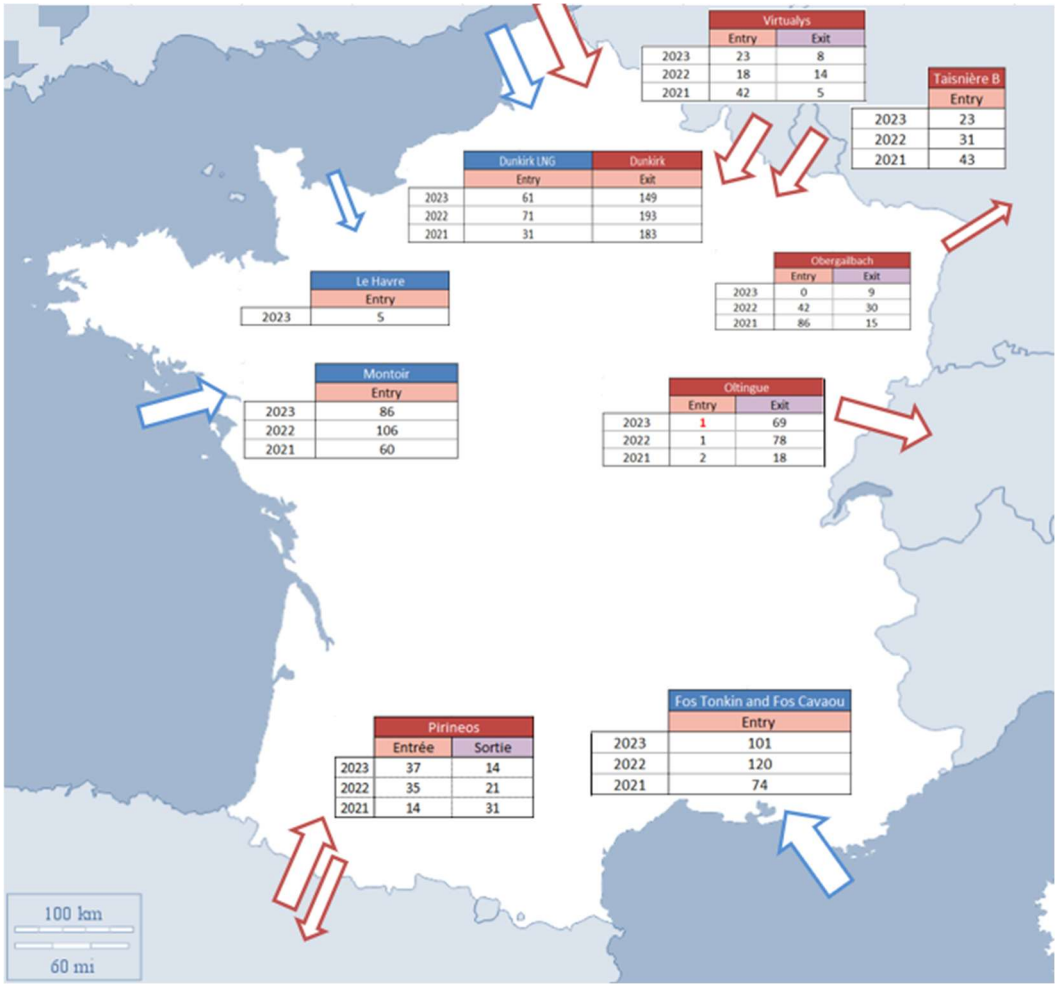
2022 was marked by the gradual decline in Russian gas flows to Europe following the invasion of Ukraine. The disruption of this major supply led to a structural reconfiguration of flows in Europe. Much of the Russian gas transported by pipeline was replaced by LNG, with a reversal of flows from West to East and from South to North. France was able to play a significant transit role thanks to its regasification and transport infrastructure. This situation did not change in 2023.

The volumes of gas injected from LNG terminals decreased in 2023 (-15%), linked to the decline in demand. However, the share of LNG in French imports increased to 52% in 2023.

Imports at French borders by pipeline also decreased in 2023 (-22%).

Exports decreased by 22% compared to 2022 but remained at high levels, notably to Switzerland and Italy. This decline can be attributed to the arrival of new regasification capacities, notably in the Netherlands and Germany, reducing the need for imports from France.

Figure 10: Utilization of French interconnections and LNG terminals (commercial flows) [TWh]



Sources: GRTgaz, Teréga – Analysis: CRE

At the interconnection with Spain, imports to France slightly increased while exports declined. This trend confirms the sustained reversal of flows at the Spanish border, where France serves as both a destination and transit country during significant LNG arrivals on the Iberian Peninsula.

Regarding entries from Germany at PIR Obergailbach[38], the possibility of reversing flows was introduced in October 2022. The exit capacities at Obergailbach allowed the export of 9 TWh in 2023.

The decrease in gas arrivals from Dunkirk can be explained by significant maintenance work on natural gas production facilities in Norway in May, June, and late summer. In September 2023, arrivals at the Dunkirk interconnection dropped to their lowest level in a decade.

Exports to Oltingue towards Switzerland and Italy slightly decreased but remain historically high.

Finally, exports to Belgium are down compared to 2022. In 2022 and 2023, the Netherlands and Germany commissioned five LNG terminals with an additional capacity of 21 billion m³. The commissioning of these infrastructures has notably helped reduce price differentials in Europe and decreased the need for these countries to source gas from France.

1.4. LNG supply is down compared to 2022, but LNG remains the primary source of supply in France

LNG imports into the TRF reached 253 TWh[39] in 2023, 15% less than in 2022.

This decrease, linked to low consumption, was even more significant for pipeline imports, which fell by 27%. For the first time, LNG imports exceeded pipeline imports in France.

Between 2022 and 2023, the number of cargoes received in France decreased by 12% to 352. This decline mainly concerned Russian deliveries, which fell by 38% between 2022 and 2023, returning to a level comparable to 2021. The share of American LNG, which had significantly contributed to the increase in LNG deliveries, remained substantial in 2023, accounting for 41% of imports.

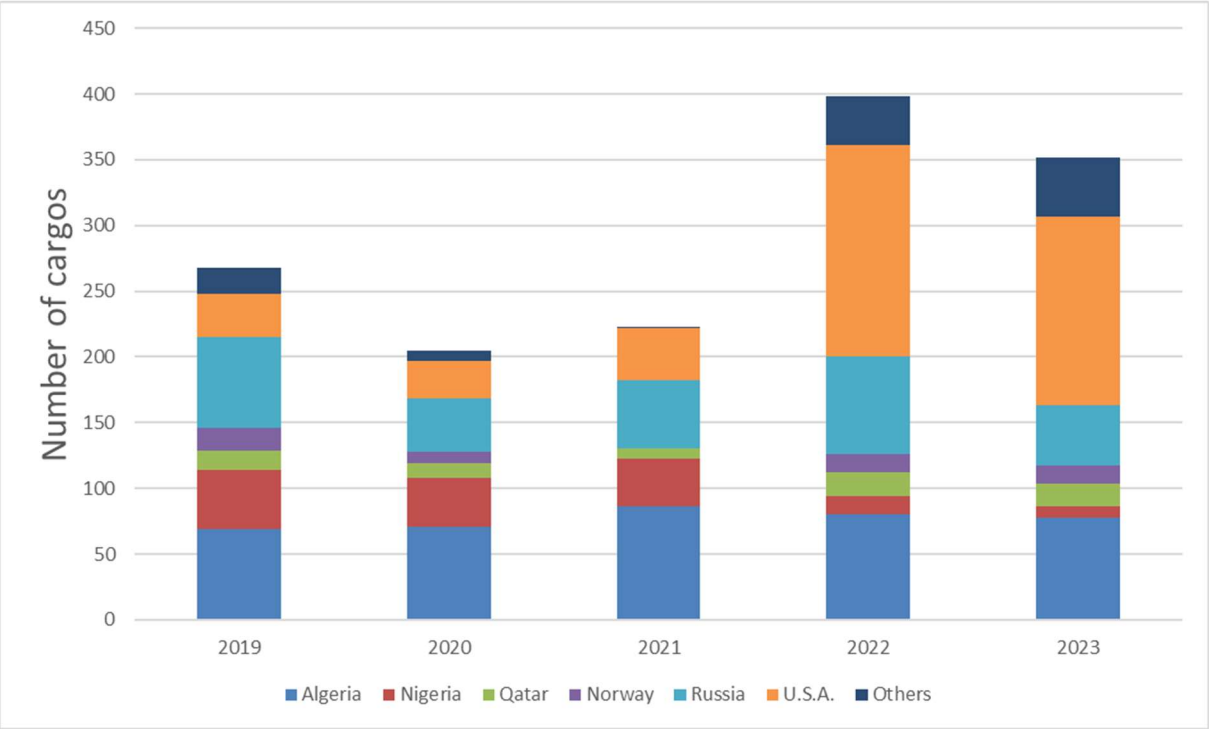
As in 2022, France was the largest European importer of LNG in 2023, with 30 billion m³. Imports at French LNG terminals accounted for 22% of Europe's LNG imports in 2022. This is followed by Spain (19%), which was the leading importer in 2021, and the United Kingdom.

The floating LNG terminal (FSRU) in Le Havre was commissioned in September 2023 and emitted 5 TWh in the last three months of the year.

[38] In 2021 and 2022, exits at Obergailbach corresponded to the commercial flow of virtual reverse flow with a *netting* system. Thus, when sufficient flow was nominated for entry, shippers could nominate in the opposite direction.

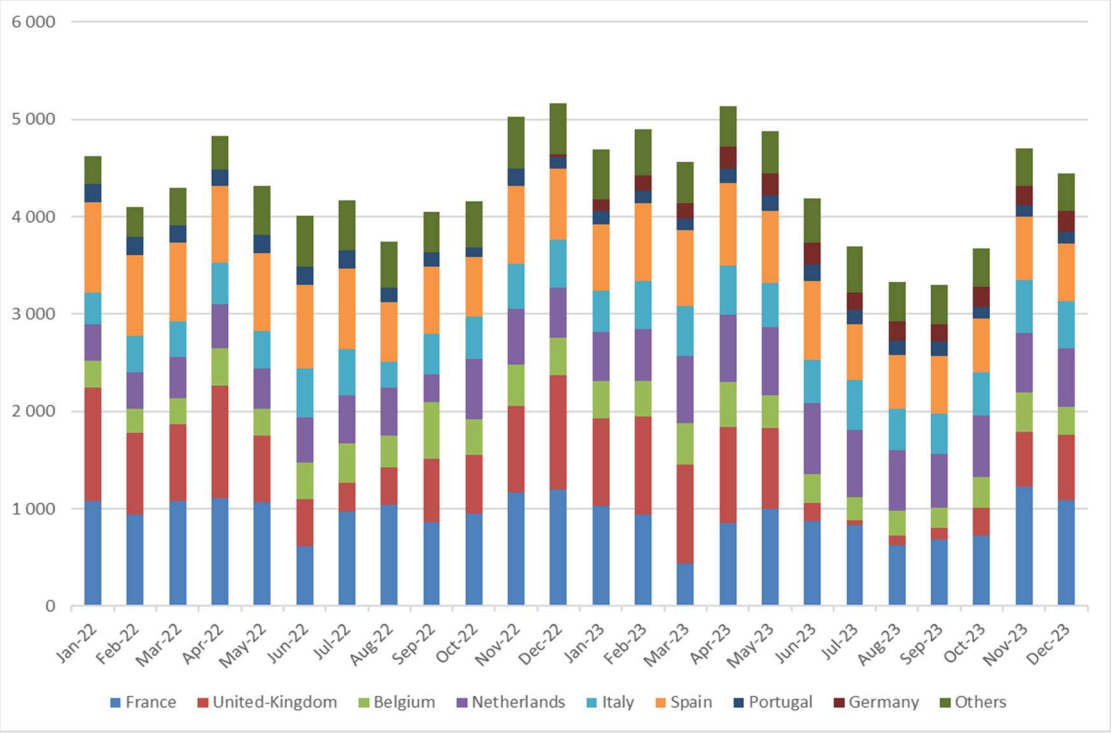
[39] This figure does not include LNG unloaded at the Dunkirk terminal destined directly for Belgium: 61 TWh in 2023.

Figure 11: Number of cargoes received in France in 2023 by country of origin



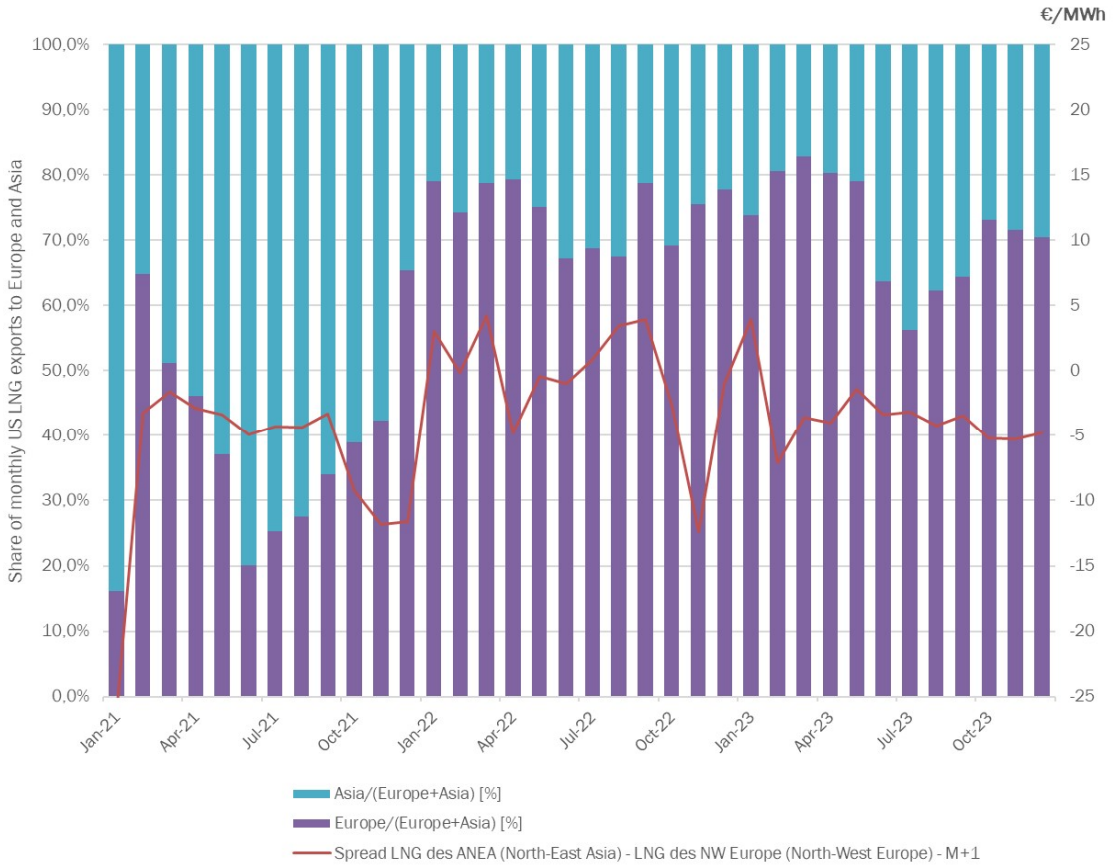
Source: Argus – Analysis: CRE

Figure 12: LNG imports by country (European Union and United Kingdom)



Source: Refinitiv – Analysis: CRE

Figure 13: Share of monthly US LNG exports to Europe and Asia

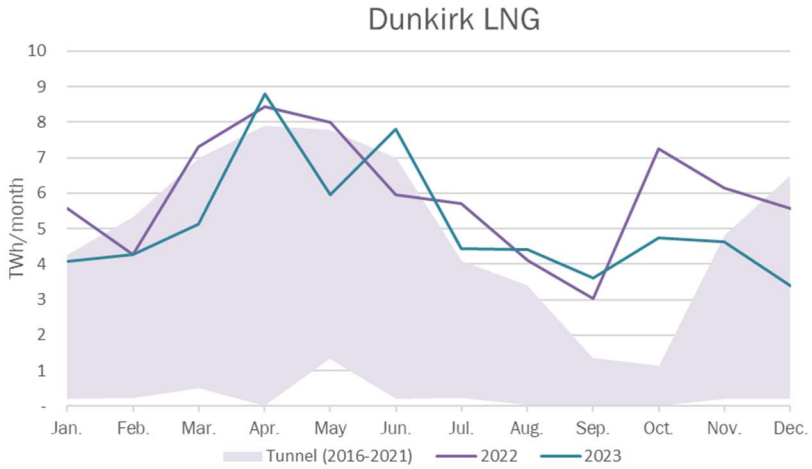


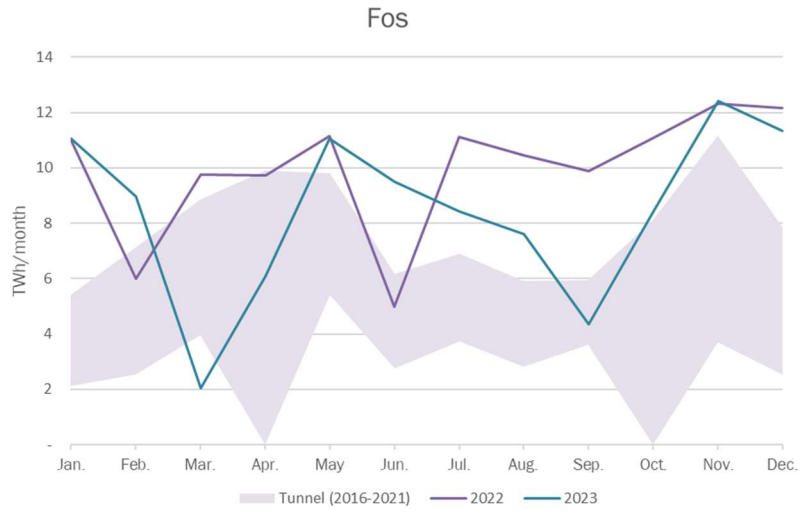
Source: Argus – Analysis: CRE

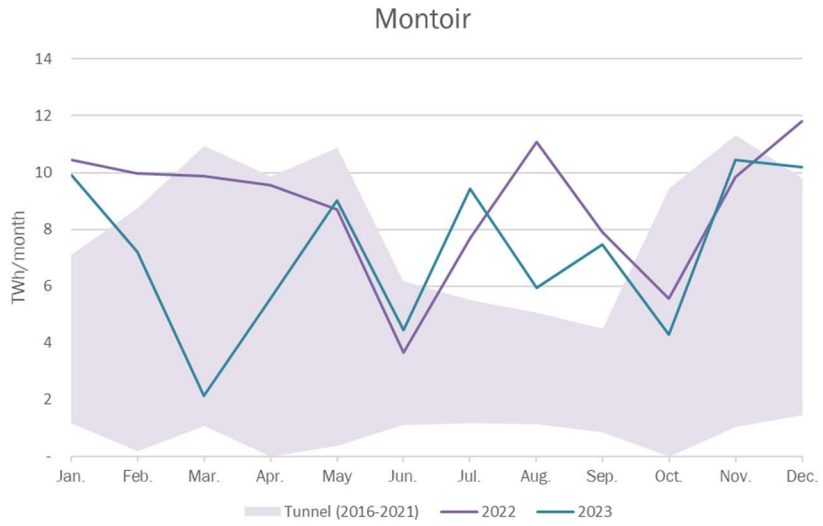
In 2023, French terminals operated at an average of 73% of their nominal capacity, compared to 90% in 2022. Despite the annual decline, this level remains high compared to the average of previous years.

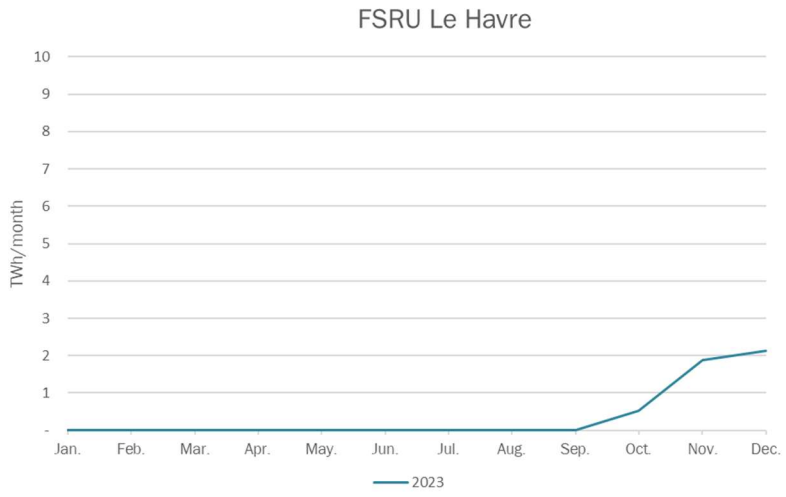
There was a significant increase in LNG emissions into the French network in 2022 compared to 2021 across all LNG terminals: +78% for Montoir, +62% for Fos, and +130% for Dunkirk.

Figure 14: Emissions from LNG terminals (commercial flows)









Source: GRTgaz – Analysis: CRE

1.5. Full stocks at the beginning of winter and limited withdrawals from storage due to mild temperatures

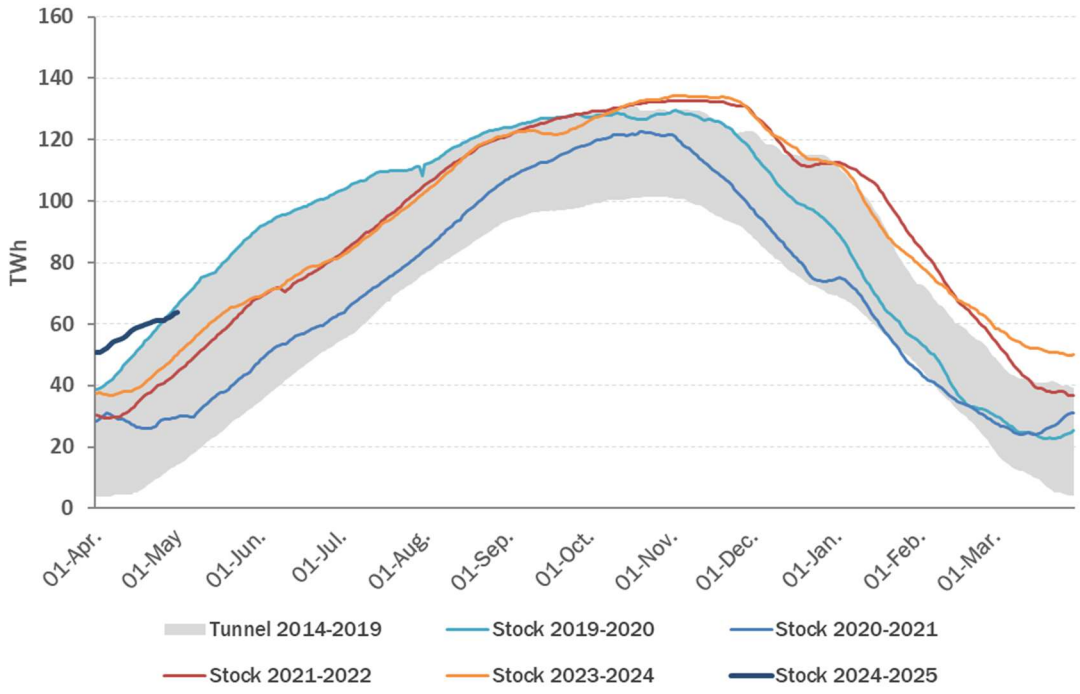
The low filling of European storages at the beginning of winter 2021-2022 (77% on average on 1 November 2021, compared to 94.5% for France) had contributed to tightening the gas market in Europe. The massive arrival of LNG and the decline in demand due to very high gas prices and sobriety efforts, combined with mild winter temperatures, ensured the continent's supply security. In response, the European Union adopted a regulation on June 27, 2022, requiring a minimum filling level of 90% by November 1 for each Member State.

At the end of the 2022-2023 gas winter, the stock filling rate on 1 April 2023, reached 28%, a near-record level over the past 10 years. This level is mainly due to mild winter temperatures, low demand, and high French stock levels at the start of winter.

Despite a difficult start due to negative summer-winter price differentials, the commercialization of storage capacities for winter 2023-2024 was a success, with 100% of the capacities sold. Due to high storage levels at the beginning of summer, the injection campaign was less intense than in 2022 but managed to reach a 99.8% filling rate by 1 November 2023, the start of the gas winter.

Winter 2023-2024 was also one of the warmest winters on record, and consumption remained limited. A decline in shipper withdrawals was observed at the beginning of 2024, coinciding with falling market prices. On 1 April 2024, French storage displayed a record filling rate of 39% at the end of winter.

Figure** 15**: Storage levels in France



Sources: Storengy, Teréga (from the GIE platform) – Analysis: CRE

1.6. The localized spread mechanism was regularly triggered during winter, but its cost is decreasing

The localized spread is a mechanism implemented in France since the winter of 2017/2018 to manage congestion on the French gas network. The principle is to allow the transmission system operator to call on market players to buy gas upstream of the congestion and sell it downstream.

Historically, congestions mainly occurred in the major flow direction: north to south. The most critical period for the network corresponded to the gas summer (April-October), characterized by shippers injecting into storage in preparation for the following winter. Summer being a period of low national consumption, the main gas exits from the French network correspond to injections into Atlantic and Lussagnet storages and transit flows to Spain, all three located in the south of the network, thus causing north-south congestion.

At the end of 2022, in the context of changing gas flow patterns in Europe due to the decline in Russian gas supplies, redirecting significant volumes of Norwegian gas from France to the United Kingdom led to a gas deficit in the north of the TRF and a surplus in the south. This situation resulted in unprecedented congestion from the south to the north of the gas transmission network.

The localized spread mechanism was triggered by GRTgaz and Teréga fifty-seven times in 2022, mainly in December, marking the highest number of annual activations since the mechanism's inception. In 2023, the initial congestion continued at the beginning of the year during winter and reappeared from late November. The localized spread mechanism was triggered one hundred times in 2023.

It should be noted that the South-North congestion episodes occurred during the gas winter, when the need for gas in northern France is the greatest.

The volumes activated during the winter of 2023-2024 (2,390 GWh) are significantly lower than those of the winter of 2022-2023 (5,145 GWh).

Additionally, between 2022 and 2023, the average transaction cost decreased significantly, mainly due to the drop in wholesale market prices. In total, the mechanism incurred costs for the TSOs estimated at €54.6 million in the winter of 2022-2023, and €9.6 million in the winter of 2023-2024.

The CRE reminds that market participants' behaviours and offers in response to the localized spread mechanism are regularly monitored. The CRE is particularly attentive to nominations that would exacerbate congestion, made at the beginning of the day by market participants active on the localized spread mechanism. Considering the activation conditions of the localized spread in late 2022 and the significant associated costs, the CRE has questioned certain market participants; analyses are still ongoing.

Table 3: Summary of the activation of the localised spread at the South/North limit during the gas winter:

	Winter 21-22	Winter 22-23	Winter 23-24
Number of activations	3	110	42
Total volume allocated (GWh)	68	5,145	2,390
Average transaction price (€/MWh)	1.0	10.6	4.0

Source: GRTgaz

2. 2023, a year of price reduction and greater stability

2.1. The decrease in European consumption and the abundant LNG supply allowed for an overall decrease in prices and volatility, though prices did not return to pre-crisis levels.

After a record year in terms of prices and volatility in 2022, prices began a gradual decline in 2023, signalling a return to a more stable market situation. Despite persistent market nervousness, the abundance of LNG supply, high storage levels, and reduced European demand significantly alleviated price tensions.

The PEG *month-ahead* started 2023 at around €70.7/MWh and ended the year at €31.9/MWh (averaging €39.9/MWh). However, prices remain higher than pre-crisis historical levels. For comparison, between 2013 and 2020, the *month-ahead* averaged €19.7/MWh.

The crisis fundamentally altered the gas market fundamentals, primarily through a significant reduction in European gas demand: approximately -12% between 2021 and 2023. This decline affected the residential/commercial sector, industry, and electricity production.

Following 2022, the share of LNG in supply remained very high compared to 2021 (42% of European supply in 2023 compared to around 20% in 2021[40]). Many LNG terminals are located in France and Spain, reversing the flow transit in Europe from West to East. 2023 marks the arrival of new LNG reception capacities, particularly in Eastern Europe. These new capacities, along with abundant LNG supply and limited European demand, contributed to narrowing price differentials between hubs and lowering prices across all maturities.

Prices evolved with reduced volatility but remained significantly above pre-crisis average levels. This situation reflects market nervousness about supply disruptions despite reassuring storage levels throughout the year.

2023 began with a significant price drop across all maturities in the first half. The PEG day-ahead, which started the year at €58.1/MWh (quote of January 3), continuously fell to €22.9/MWh on June 1, the lowest point of 2023.

This was followed by a more volatile and uncertain period between June and October, with successive price peaks and drops depending on supply-affecting events (outages or extended maintenance on Norwegian gas facilities, strike announcements at Australian liquefaction terminals, etc.). During this period, the PEG *front-year* averaged €50/MWh, and the PEG day-ahead averaged €32.6/MWh.

October also saw a price spike following the October 7 Hamas attacks on Israel (+10% on the Y+1 and +74% on the M+1). This temporary increase affected all energy commodities due to the risk of conflict spread and its impact on energy supply. The potential sabotage of the Baltic-connector pipeline in Finland and concerns about strikes in Australia also contributed to this upward movement.

From November onwards, PEG prices continuously fell until 29 December 2023, reaching €32.2/MWh for the PEG *front-year* and €30.9/MWh for the PEG *front-month*.

2.2. Short-term prices dropped significantly compared to 2022 but remained highly sensitive to supply constraints.

In 2023, the average price of the PEG day-ahead contract, at €38.8/MWh, was more than half of 2022's level (€98.1/MWh), and lower than the 2021 price (€46.5/MWh). Nevertheless, it remains nearly double the historical average level of around €20/MWh.

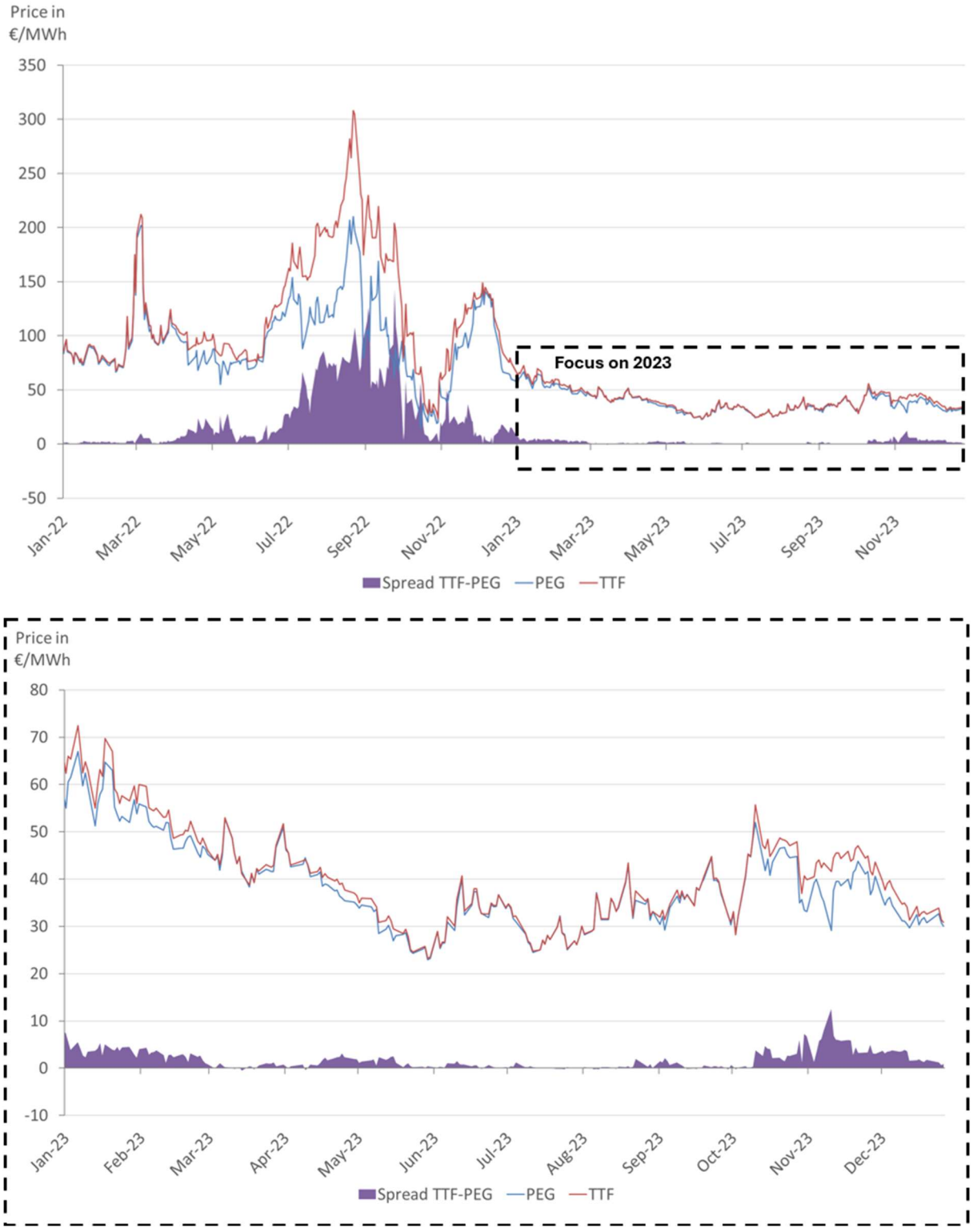
In 2023, the PEG day-ahead reached a maximum of €67.0/MWh on January 9 and a minimum of €22.0/MWh on June 1.

[40] https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_European_LNG_market_developments.pdf

The PEG-TTF *spread* on the day-ahead narrowed significantly to -€1.8/MWh on average in 2023 (compared to -€25.9/MWh on average in 2022 and -€0.4/MWh in 2021).

Price differentials between various trading points in Europe, historically highly correlated, had significantly increased in 2022 following the decline in Russian gas pipeline supplies, leading to a reversal of flows from west to east and significant congestion. The countries most dependent on it, located to the east of France, experienced higher prices than those less dependent, such as France, the Iberian Peninsula, or the United Kingdom. In 2023, the price differences narrowed significantly due to the reduction in market tension and the increase in LNG reception capacities in Eastern Europe. The narrowing of *spreads* between hubs indicates a decrease in the market's overall concern about supply security in all European countries.

Figure 16: Day-ahead gas prices in France and the Netherlands (respectively PEG and TTF)



Source: EEX – Analysis: CRE

Figure 17: Day-ahead gas prices in Europe

PEG: France | TTF: Netherlands | ZTP: Belgium | THE: Germany | PSV: Italy | NBP: United Kingdom

Source: EEX – Analysis: CRE

2.3. Decline in forward prices with easing supply concerns

Forward gas prices, widely used to index supply contracts, fell sharply in 2023. The average price of the *front-year* contract dropped from €107.3/MWh to €50.4/MWh, a decrease of 53%. Despite this decline, the calendar contract is still very high compared to pre-crisis prices: €17.5/MWh on average between 2017 and 2020. Long-term contracts also saw significant decreases, settling at €44.7/MWh for 2025 and €36.0/MWh for 2026.

In line with 2021 and 2022, the forward price structure was in *backwardation* for almost all of 2023, meaning that shorter-term contracts were more expensive than those with more distant maturities. Compared to 2022, prices and the differences between various maturities decreased in 2023, with a convergence of prices at the end of 2023 as contracts expired.

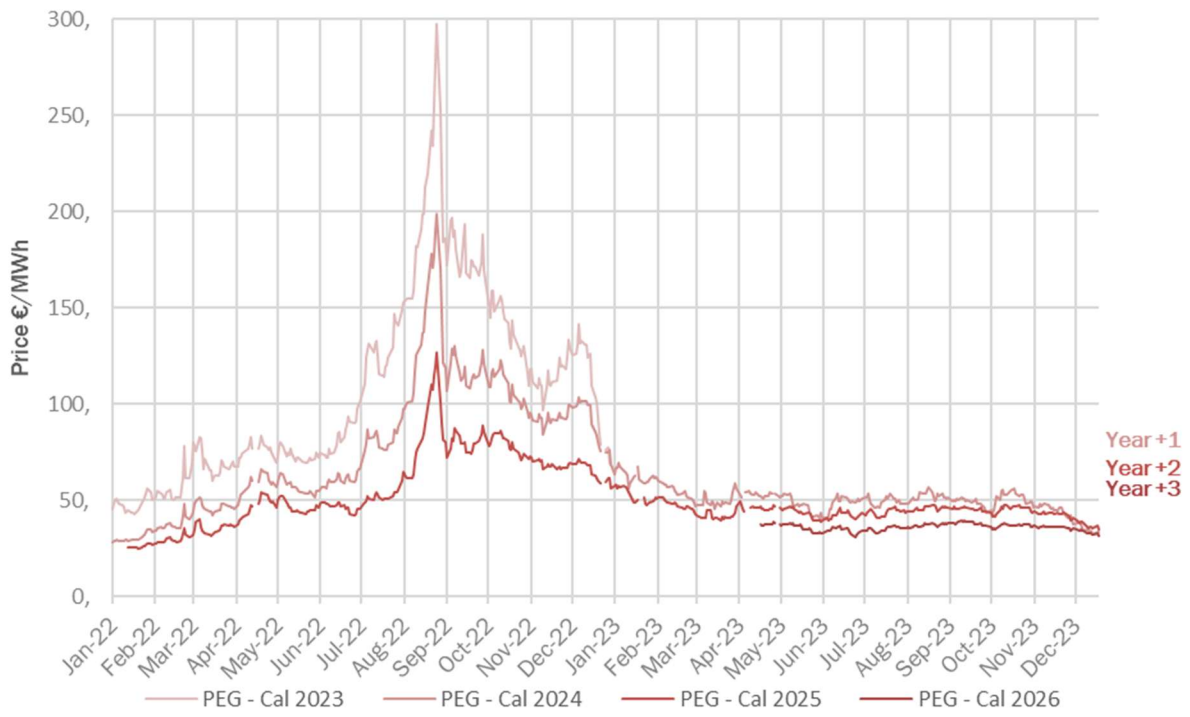
For monthly contracts, the *month-ahead* contract delivered at PEG recorded an average price of €39.9/MWh in 2023 compared to €112.8/MWh in 2022, almost three times lower.

Globally, there is still competition between European and Asian prices to attract LNG cargoes. Thus, the price spread between Europe and Asia continued to fluctuate throughout the year. Nevertheless, in 2023, there were three times fewer days when the PEG *month-ahead* price was higher than the Asian LNG (JKM) price compared to 2022. Also, on the *month-ahead*, the JKM was on average €4.3/MWh higher than the TTF in 2023. This situation illustrates a gradual return to the pre-crisis situation where LNG delivered to Asia generally had a premium over that delivered to Europe.

In 2022, the global LNG price surge driven by European demand and China's zero-Covid policy had curbed Asian demand. It picked up again in 2023, especially in China, but with less robust growth than during pre-Covid years. High prices compared to historical levels also slowed demand in South Asia.

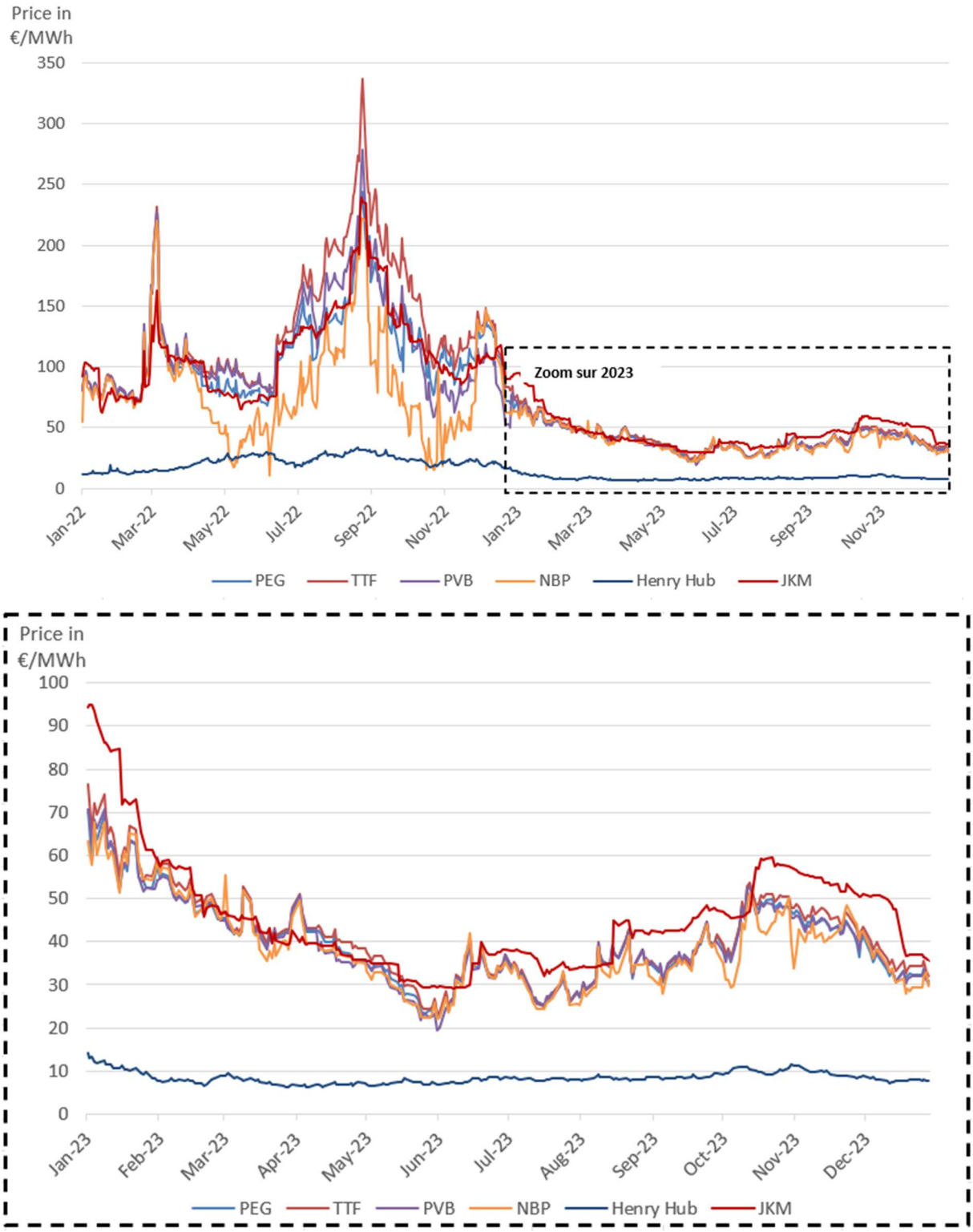
Henry hub prices, which were less impacted by the crisis, quickly fell at the beginning of 2023 to stabilize around their historical level, between €15 and €20/MWh.

Figure 18: Forward prices at PEG



Source: EEX – Analysis: CRE

Figure 19: Global month-ahead gas prices



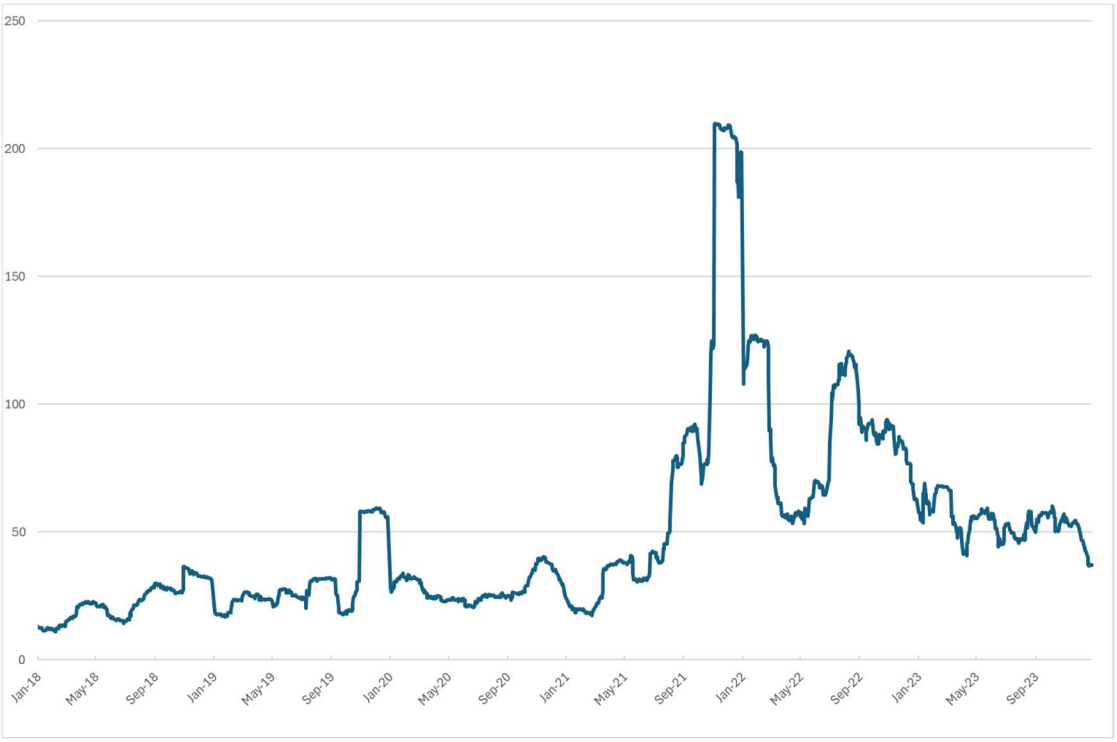
Source: Refinitiv – Analysis: CRE

Volatility of prices decreased but still high compared to historical levels

In 2023, price volatility fell compared to 2021 and 2022: 54% on average on the Y+1 against 80% on average in 2021-2022. After a second peak in August 2022, following Gazprom's announcement of the cessation of gas deliveries via the Nord-Stream 1 pipeline, volatility gradually decreased until April 2023, stabilizing around 50%. At the end of 2023 and the beginning of 2024, there was a further decrease in price volatility on the Y+1.

However, prices across all maturities remain significantly more volatile compared to the pre-Covid-19 pandemic historical average (20% volatility on average for the Y+1 over the 2012-2019 period).

Figure 20: Volatility[41] of the Y+1 calendar product at PEG (%)



Source: EEX – Analysis: CRE

2.4. Price differentials between winter and summer were particularly favourable in 2023, leading to exceptional auction results for storage capacities in France

Forward gas prices generally show seasonality, with prices for winter delivery being higher than those for summer delivery. This seasonality of forward prices adds to the difference between shorter-term and longer-term prices described previously.

Unlike 2022, summer-winter price differentials in 2023 were particularly favourable for subscribing to storage capacities.

Capacities for the winter of 2023-2024, marketed between October 2022 and March 2023, were subscribed to 99% with an average auction price of €2.4/MWh. After a difficult start to the campaign

[41] In other words, $x_n = \ln(Prix_n) - \ln(Prix_{n-1})$
Volatility= $100 * \sqrt{252 * var(\{x_1, x_2 \dots x_{40}\})}$;

between November and December 2022 due to negative summer-winter price differentials, market conditions were ultimately more favourable from mid-December 2022 to February 2023.

This also resulted in exceptional 2024-2025 auction results, with 98% of the proposed capacities (126 TWh) subscribed at an average auction price of €3.6/MWh.

For comparison, since the implementation of storage regulation in 2018, the average annual auction price of storage capacities has been €2.2/MWh on average.

These results were particularly enabled by the changes in marketing methods decided by the CRE in its deliberation of 7 October 2022[42]. The deliberation allowed storage operators to maximize subscription opportunities when market conditions are favourable.

Figure 21: Winter/Summer Price Differential in France

Source: ICIS – Analysis: CRE

3. Trading volumes at PEG are increasing significantly with the strong development of clearing for OTC transactions.

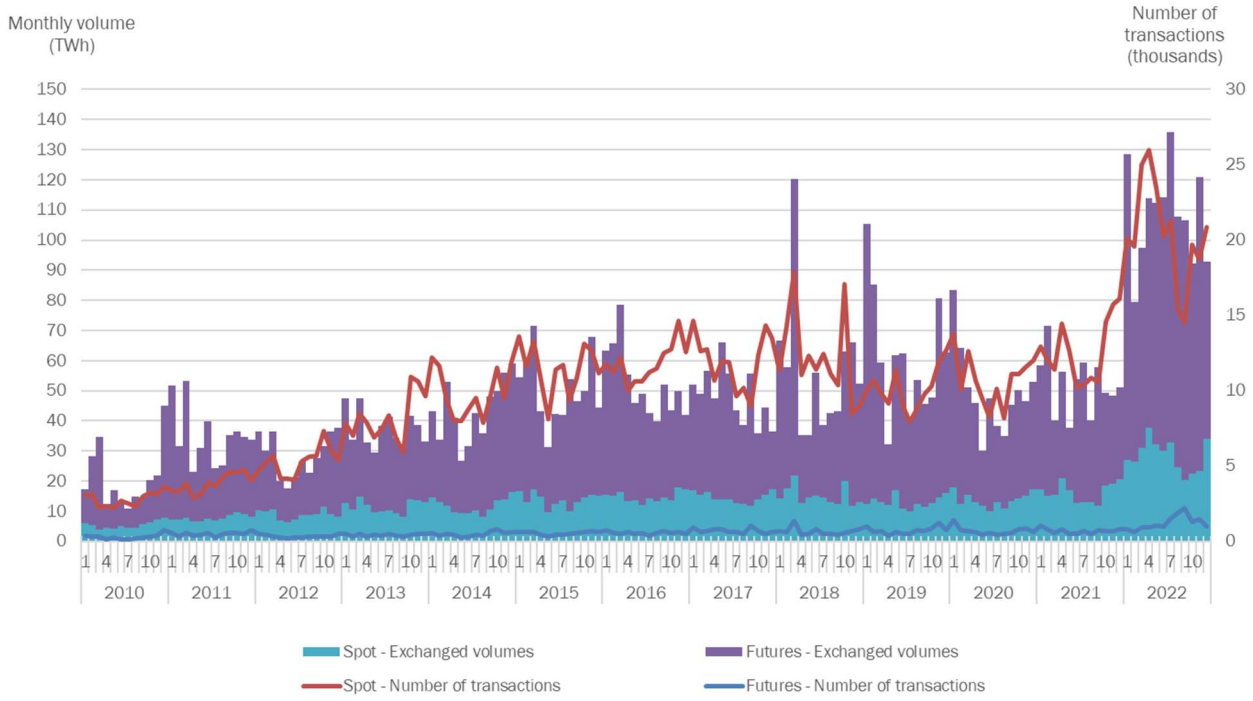
In 2023, the volume of spot contracts traded increased by 33% compared to the previous year. As a reminder, in 2022, spot trading volumes saw a sharp rise (+59%) compared to 2021 and the previous years. The number of transactions for these contracts also increased by 20% compared to 2022.

The volume of futures contracts traded also recorded an increase: +37% year-on-year.

Seasonal contract trading volumes saw the highest increase in absolute value terms (+48%), followed by monthly contracts (+34%) and quarterly contracts (+12%). The traded volume of yearly contracts increased by 150%. The number of futures contracts traded increased by 24%.

Clearing services for over-the-counter (OTC) transactions have also seen a significant rise since 2021: the share of OTC transactions covered by clearing services increased from 3% in 2021 to 40% in 2023. The price increase in 2022 particularly reinforced the market's perception of counterparty risk.

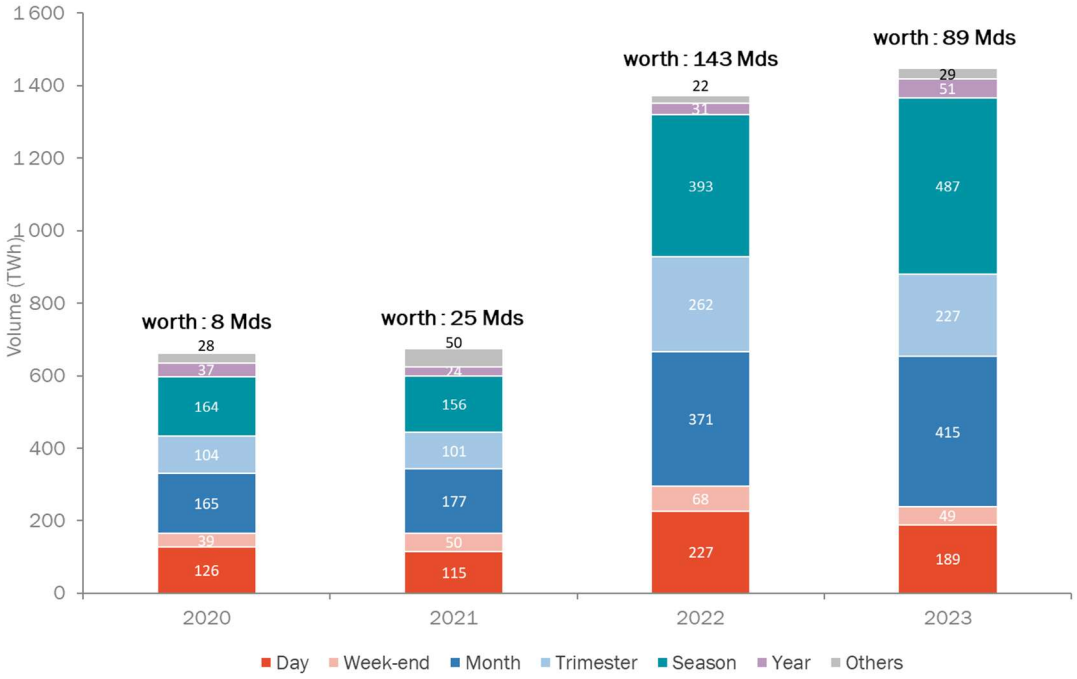
Figure 22: Evolution of traded volumes and the number of transactions on the French intermediated market



Source: REMIT data – Analysis: CRE

The price decline that began in 2023 was reflected in the total amount in euros of transactions carried out over the year. This amount is down by 45% compared to 2022, despite the significant increase in traded volumes.

Figure 23:Volumes and values traded by product on the intermediated market



Source: REMIT data – Analysis: CRE

The total trading volume significantly increased in 2022 and 2023 compared to the average of the past three years (+132%). This increase covers all maturities but is particularly significant for monthly, seasonal, quarterly, and daily contracts, which now represent 86% of traded volumes.

4. Assessment of the functioning of the wholesale natural gas markets in France in 2023

The year 2023 saw a significant decrease in prices and a return to greater stability following the gas supply crisis in Europe and the historic price increases of the previous two years.

The price decline was made possible by the decrease in demand in Europe and France due to mild weather conditions and consumer sobriety, as well as the diversification of European supply, particularly with liquefied natural gas (LNG).

In this new balance, France remains, as in 2022, the leading importer of LNG in Europe. With the commissioning of the FSRU in Le Havre, France now has 5 LNG terminals with a reception capacity of approximately 450 TWh/year. For the first time, in 2023, LNG imports exceeded pipeline imports on the TRF.

French transport infrastructure has maintained significant export levels to neighbouring countries, thus contributing to the overall price decline and improving price convergence between European countries.

Throughout 2023, the high levels of French storage filled contributed to the price decline. The easing of marketing conditions introduced by CRE in its October 2022 deliberation on the modalities of marketing natural gas storage capacities allowed a high level of capacity subscription for the next winter and helped improve their attractiveness to the market.

Finally, French biomethane production injected into the network increased in 2023, reaching 8.9 TWh (+28% compared to 2022). This now represents the equivalent of 2.3% of French consumption.

During the winter of 2022-2023, the reconfiguration of European flows generated significant congestion on the French gas transport network, with a deficit in the north and a surplus in the south. French network operators resorted to localised spread mechanisms and mutualised restrictions, and CRE had to take a deliberation in December 2022 and October 2023 to address this unprecedented congestion. This situation recurred in the winter of 2023-2024, but to a lesser extent, thanks notably to corrective measures implemented on the TRF in consultation with gas operators. CRE monitors shipper nominations linked to the localised spread mechanism on the gas transport network and has questioned several market participants in this context; in-depth analyses are underway.

The wholesale gas market functioned without interruption and generated the necessary price signals to restore the balance between supply and demand. This allowed, on the one hand, the continuous delivery of gas where it was most needed, and on the other hand, the achievement of the European objective of a 15% reduction in gas consumption.

SECTION 4: WHOLESALE ELECTRICITY MARKETS

1. Evolution of Supply and Demand in France in 2023

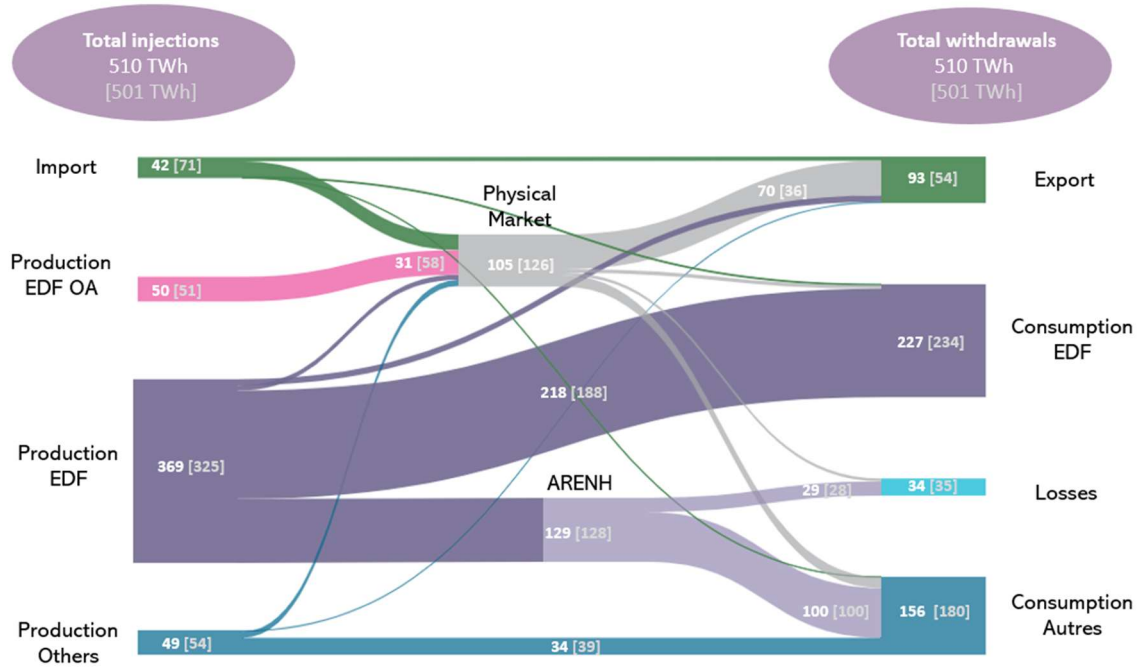
1.1. Balance of the French Electric System: France regains its position as a Net Exporter of Electricity

The French electric system in 2023 was marked by the resolution of the dual crises of 2022, which concerned both the gas supply to Europe and the production of the French nuclear power fleet.

Figure 24 presents a simplified view of the main flows for 2023 in the French electric system. This diagram incorporates several assumptions that need to be clarified for full understanding:

- The balance includes only the flows recorded by balance responsible entities, not purely financial flows.
- The physical market includes the daily and intraday markets operated by EPEX SPOT and Nord Pool, as well as the block exchange programs between balance responsible entities, reflecting over-the-counter (OTC) physical delivery transactions.
- The link between each item in the balance is made in proportion to the supply of each balance responsible entity for each half-hour.
- Figures for imports and exports refer to commercial exchanges registered in balancing responsible parties perimeters, over different maturities, and do not correspond to physical exchanges at the borders (net balance, however, is the same).
- unlike other generation and consumption data sources used in this report, Corsica is not included, and the pumping of energy storage facilities (STEP) is not considered.

Figure 24: Balance of injections and withdrawals in 2023 [2022] (TWh)



Source: RTE, Analysis: CRE

Injections into the network remained stable, with a slight increase (+1.8%) between 2022 and 2023, rising from 501 TWh to 510 TWh.

ARENH[43] subscriptions for delivery in 2023 remain stable[44] at 129 TWh (including 29 TWh for hedging network losses) due to reaching the 100 TWh cap for final customer suppliers.

EDF's electricity production is used almost entirely for its own customers: 59% of this production is for EDF customers, 27% for the customers of alternative suppliers, 7.8% for hedging network losses, 3.4% for exports, and 2.8% is sold on the markets.

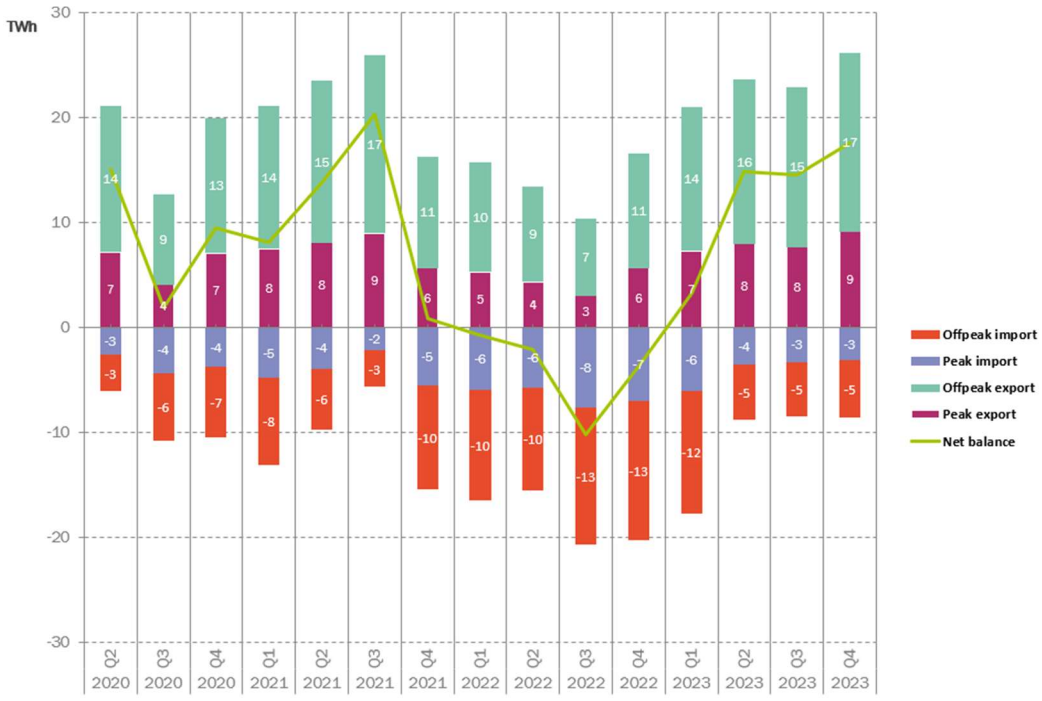
EDF's electricity production, which in 2022 had been affected by a significant number of maintenance works on its nuclear production facilities following the discovery of stress corrosion, returned to pre-crisis levels, increasing by 44 TWh compared to 2022; this enabled France to regain its historic position as a net exporter of electricity. Therefore, France observed an export trade balance at the borders of 51 TWh in 2023, continuing the historical trend between 2011 and 2021, contrasting only with the import balance of 2022 (-16 TWh).

Table 4: Evolution of France's Export Trade Balance

France's Export Trade Balance (TWh)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	56	44	47	65	62	39	38	60	56	43	43	-16	**51**

Source: RTE

Figure 25: Quarterly commercially traded volumes at the borders



Source: RTE, Analysis: CRE

[43]The Regulated Access to Historic Nuclear Electricity (ARENH) scheme, which came into effect on 1 July 2010, requires EDF to sell part of its nuclear electricity to alternative suppliers at regulated prices of €42/MWh in 2023.

[44]Decree No. 2022-342 of 11 March 2022 provided for the allocation of 20 TWh of ARENH to alternative suppliers at a price of €46.2/MWh in 2022. The observed stability of volumes between 2022 and 2023 does not include the additional 20 TWh of ARENH in 2022, which did not go through the balance of the responsible entities. The additional 20 TWh volume was not renewed in 2023.

1.2. Declining Consumption, following 2022 trend

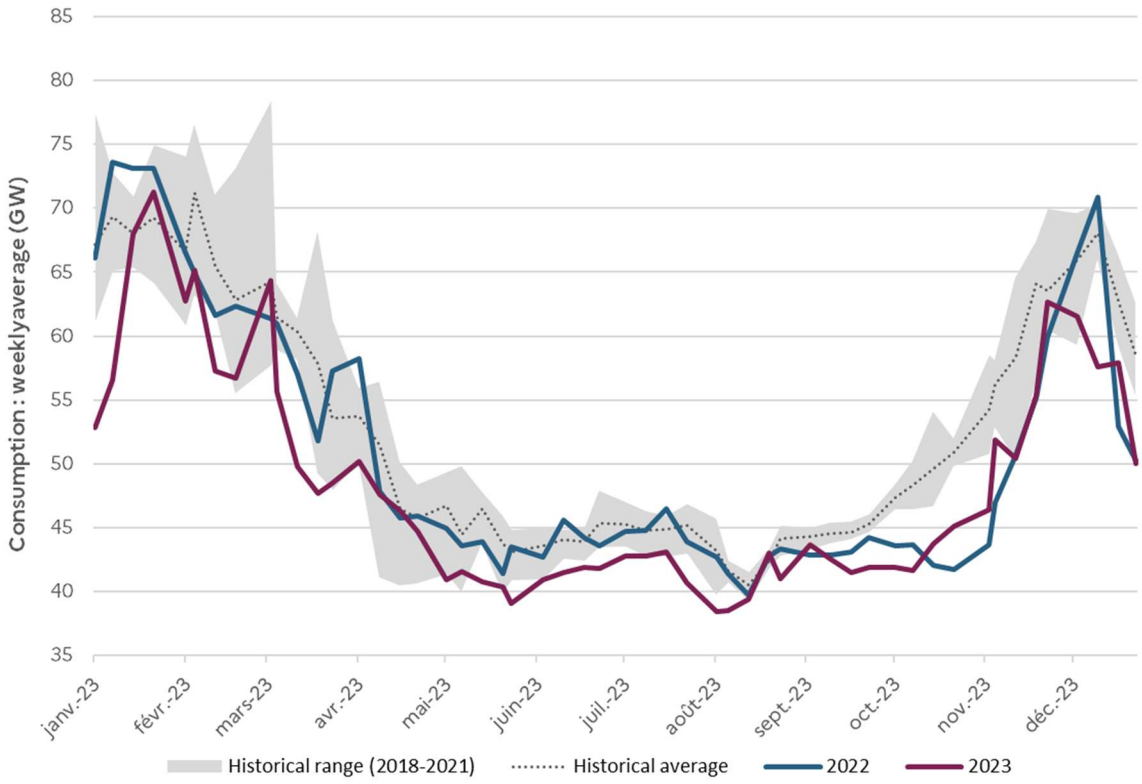
The decline in French electricity consumption that began in autumn 2022 continued in 2023. Consumption stood at 438.6 TWh in 2023, a decrease of 3.3% compared to 2022 (453.4 TWh) and a 7% decrease compared to the pre-crisis level of 2021 (471.6 TWh).

Climate and calendar-adjusted consumption[45] shows a similar decrease of around 3.2% compared to 2022 (446 TWh[46] in 2023 and 460 TWh in 2022).

The decline in consumption in France in 2023 can be explained by several cumulative effects:

- High temperatures led to a significant reduction in electricity demand for heating, especially during autumn and winter months, which was much more substantial than the increase induced by cooling needs during the summer (see section 2, §3).
- In response to concerns about energy supply security and high prices, efforts for sobriety and energy savings intensified in 2022. These efforts continued in 2023, reflecting a lasting change in consumer behaviour.

Figure 26: Consumption in France (weekly average)



Source: RTE – Analysis: CRE

[45]To facilitate structural year-on-year comparison, RTE adjusts consumption considering weather and calendar variations. Indeed, in France, electricity consumption is strongly dependent on temperatures. Electricity is used for heating in winter (France has a significant number of electric heaters) and for air conditioning in summer (though the effect is more marginal). Additionally, as the number of days in a year varies (e.g., leap years), an adjustment is applied to compare years on a 365-day basis.

[46]See the RTE 2023 electricity balance.

1.3. Increased Production Due to the Resumption of Nuclear Production and, to a Lesser Extent, Hydroelectric Production

Electricity production increased significantly in 2023 compared to 2022 due to the resumption of nuclear production and the increase in hydro and wind energy production.

Total production amounts to 495 TWh, compared to 446 TWh in 2022 (Table 5). This figure, however, remains significantly lower than in previous years (an average of 527 TWh between 2016 and 2021). The reduction in production is mainly due to the nuclear sector, which has not reached previous levels.

Table 5 : Annual Total Electricity Production

Year	2016	2017	2018	2019	2020	2021	2022	2023
Production (TWh)	530.6	528.3	547.6	536.1	499.7	522.4	445.8	494.7

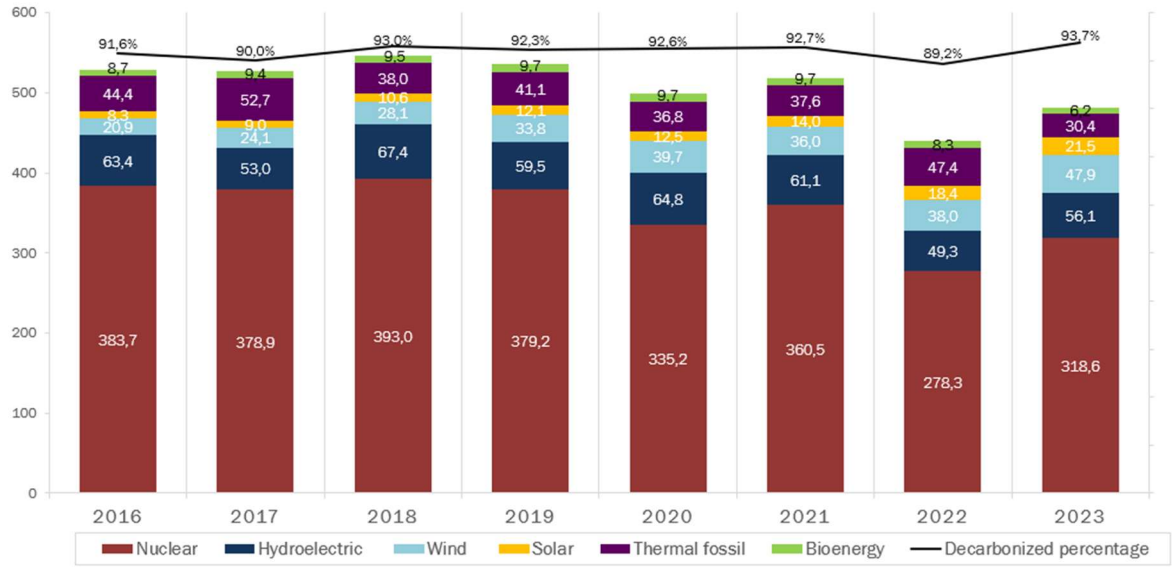
Source: RTE

In 2023, 93.4% of electricity produced is decarbonised, a figure higher than the 2016-2021 average (92.0%) and a substantial increase from 2022 (89.0%).

In terms of the electricity mix, the share of electricity produced from fossil thermal sources (mainly gas) decreased by 4.4%, from 11.0% to 6.6% of the total. Decarbonised production increased, primarily due to nuclear (+2.2%) and, to a lesser extent, wind (+1.6%), hydroelectric (+0.8%), and solar (+0.2%). Biomass production saw a slight decrease, from 1.9% to 1.3%.

Hydroelectric production included in the total production is gross of consumption related to pumping.

Figure 27: Annual Electricity Production by Energy Source

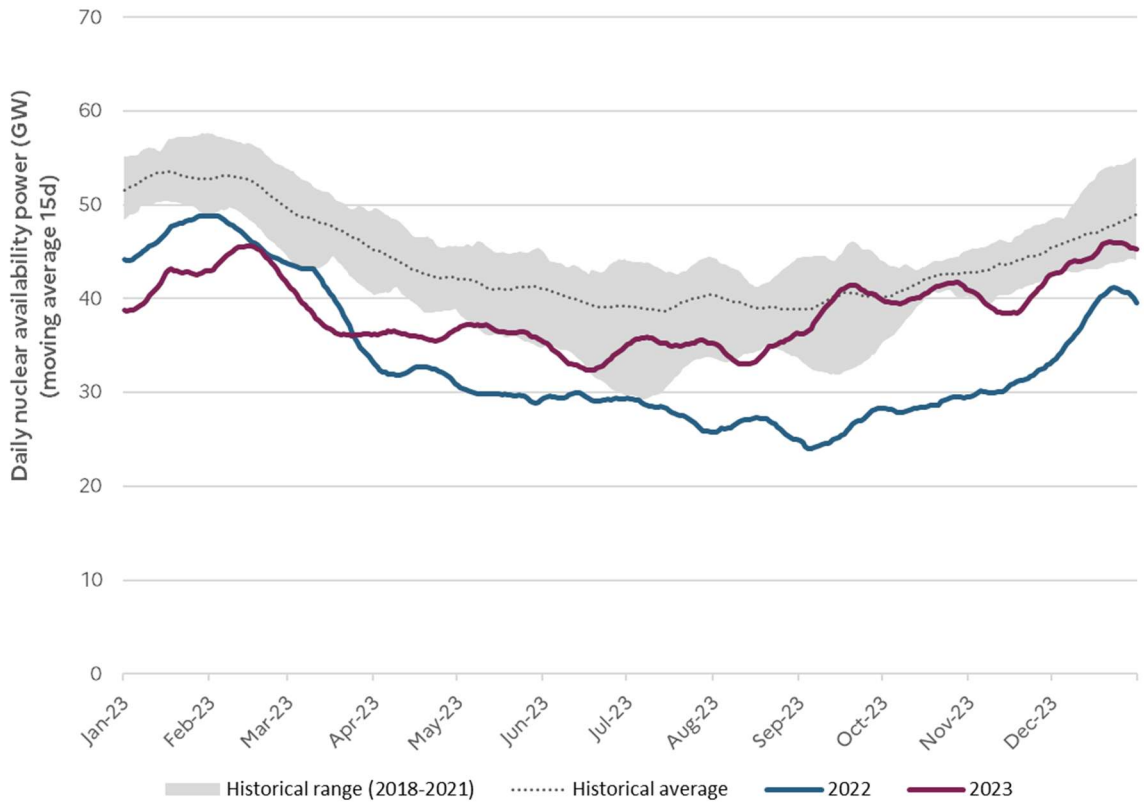


Source: RTE – Analysis: CRE

1.3.1. Recovery in nuclear production driven by gradual improvement in availability

In 2023, nuclear production in France showed a significant improvement compared to the previous year, with a 15% increase in production volume, namely 41.5 TWh more than in 2022. This brought the total nuclear production volume to 320.4 TWh, representing 64.8% of total French production, compared to 63% in 2022, while total electricity production rose by 11% in 2023. However, this figure remains 18% below the 2015-2019 average of 390 TWh.

Figure 28: Smoothed daily average availability of the French nuclear fleet



Source: RTE – Analysis: CRE

The recovery in production is mainly due to the reduction in unavailability related to stress corrosion, as a result of the repair and inspection works carried out by EDF.

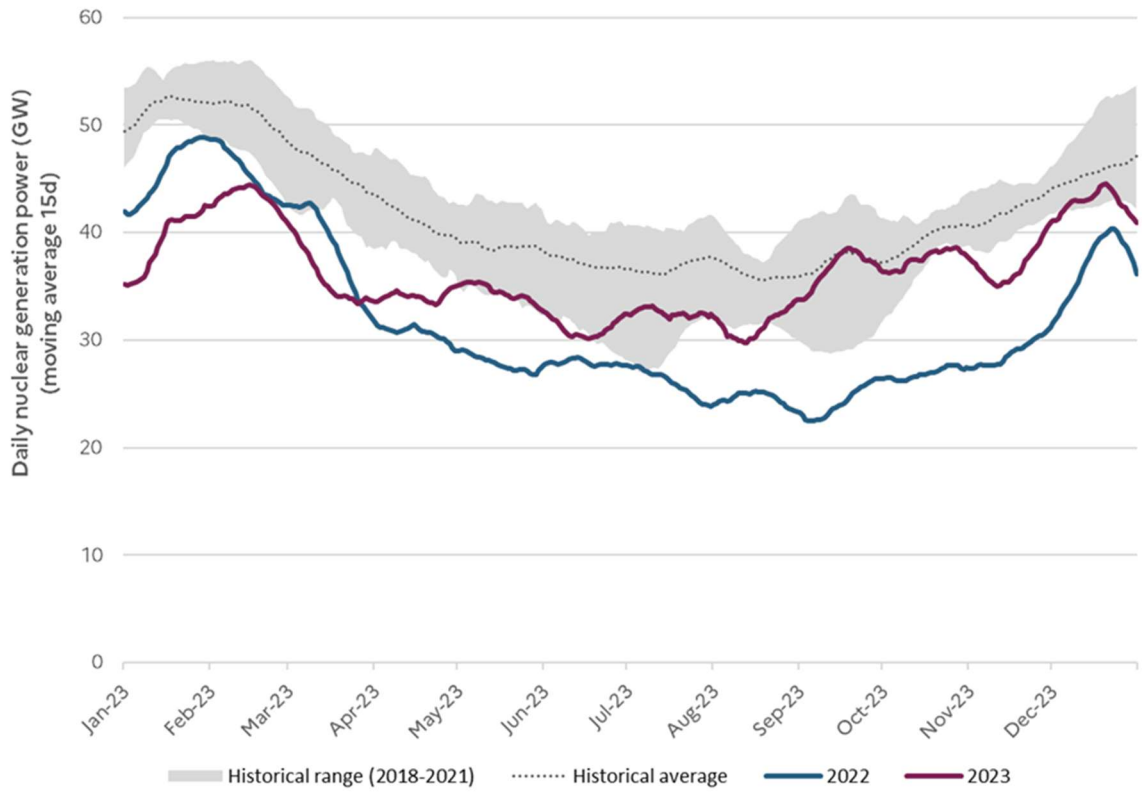
In 2022, this generic phenomenon had exceptionally and unpredictably affected the availability of the French nuclear fleet, reaching historically low levels (minimum at 22 GW at the end of August 2022 and an average of 33 GW for the year). In 2023, the average availability of the nuclear fleet recovered by just over 5 GW compared with 2022 (38.6 GW on average for the year, with a minimum of 32.4 GW in mid-June 2023), but still remains well below the historical average (46.5 GW between 2015 and 2019).

This improvement in availability was gradual throughout 2023. The availability of the nuclear fleet remained very low in the first quarter of 2023, in line with the end of 2022 (on average 5.8 GW lower, or 12.5%, compared to the minimum of the 2018-2021 period). Additionally, EDF announced on 7 March the discovery of deep cracks at Penly 1. This discovery led to a revision of EDF's inspection strategy,

consisting of accelerating the inspection of certain priority welds (welds of the RIS[47] and RRA[48] systems that had been repaired when the reactor was built). This strategy was validated by ASN on April 24, 2023. Following ASN's publication, EDF announced on April 26, 2023 that it would maintain its nuclear production estimate at 300-330 TWh in 2023[49,50].

From May onwards, availability gradually returned to the lowest levels of the historical 2018-2021 period, reaching an average of 36.6 GW over the month. Availability improved significantly in September due to the return to service of numerous reactors, bringing availability levels back close to the 2018-2021 average for the period (close to 40 GW). Availability then deteriorated again in November (delays in some planned outages, fortuitous shutdowns related to Storm Ciarán and stops for fuel savings) before recovering in December. Finally, according to EDF's estimates, made public in December 2023[51], annual nuclear production is expected to range between 315-345 TWh in 2024 and 335-365 TWh in 2025.

Figure 29: Smoothed daily average production of the French nuclear fleet



Source: RTE – Analysis: CRE

[47]The safety injection system (RIS) allows, in the event of an accident causing a significant breach in the reactor's primary circuit, the introduction of borated water under pressure into the circuit to quench the nuclear reaction and ensure core cooling.

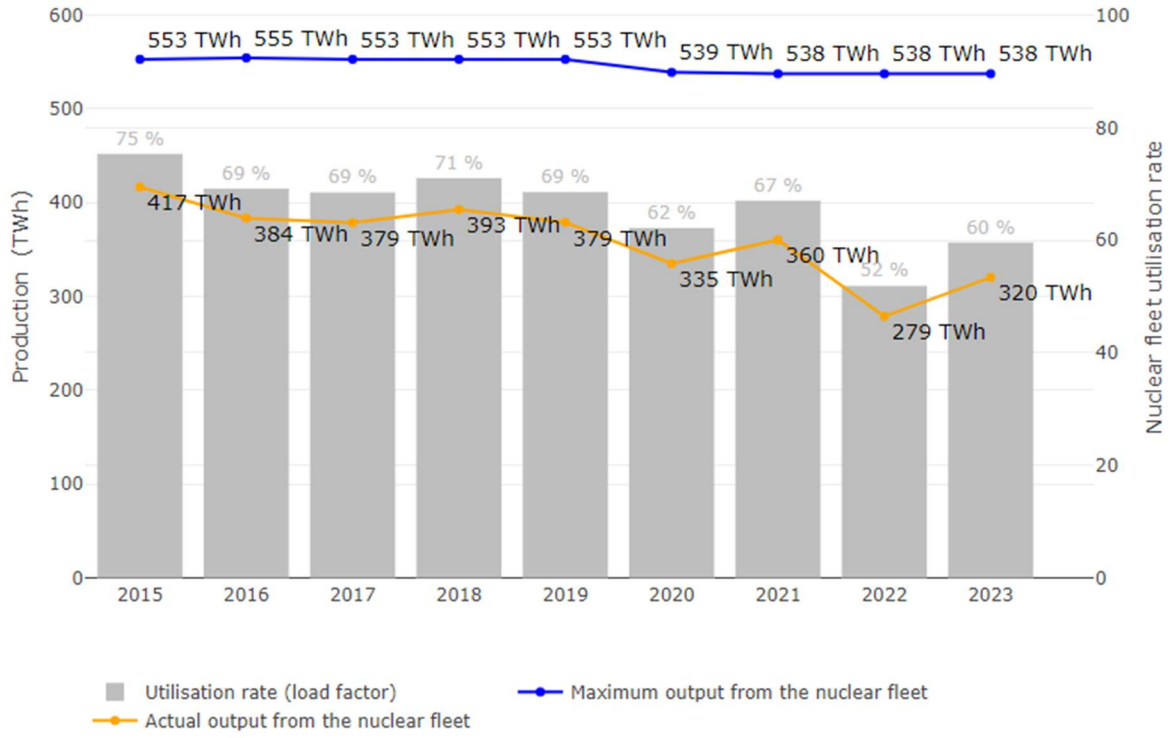
[48]The reactor cooling system (RRA) evacuates residual power generated by the fuel when it is still in the vessel during shutdown periods.

[49]EDF Communications on 8 March 2023, 16 March 2023 (CSC note), and 26 April 2023 (CSC note).

[50]ASN Communications on 7 March 2023, 16 March 2023, and 25 April 2023.

[51]EDF Press Release on 21 December 2023

Figure 30: Maximum capacity and actual production of the French nuclear fleet



Source: RTE – Analysis: CRE

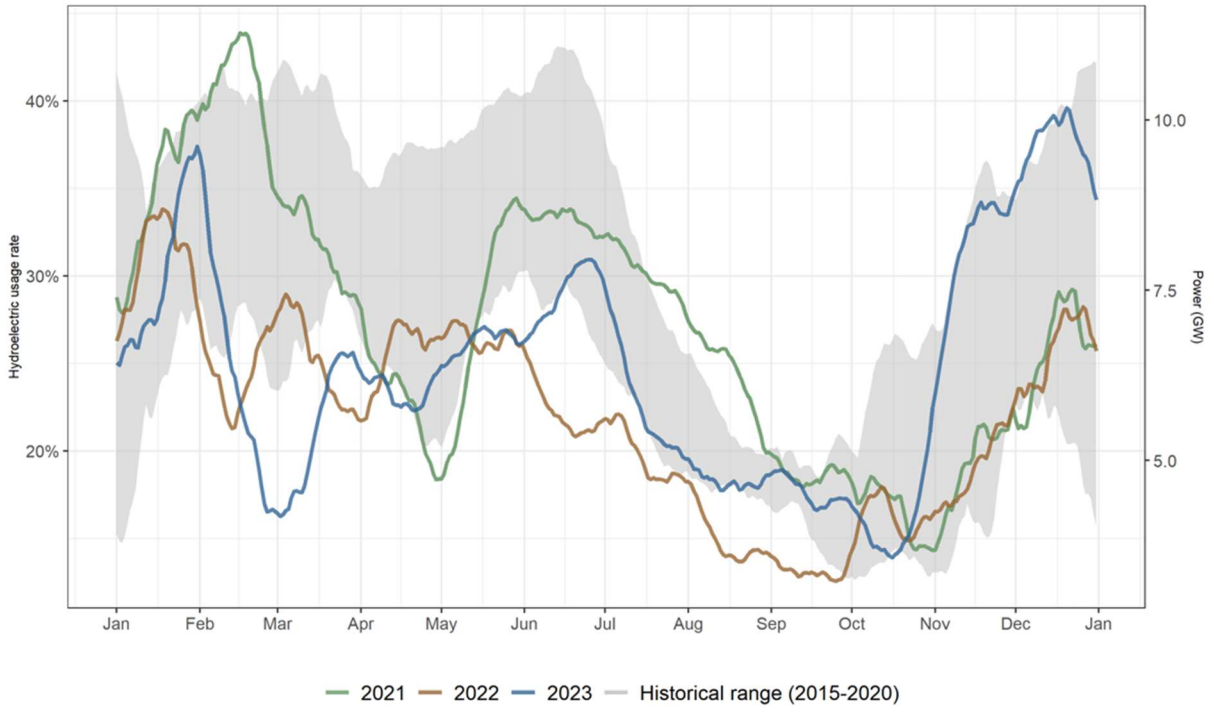
1.3.2. Hydroelectric Production: Significant Growth in the Last Months of the Year Due to Resumed Precipitation and Prudent Use of Stocks

In 2023, the hydroelectric sector produced 56.1 TWh (+6.5 TWh compared to 2022, an increase of 13%). However, production remains lower than the 2017-2021 average (61.2 TWh), with installed capacity still at 25.7 GW.

Production was significantly lower in the first half of the year, especially between mid-February and the end of June, due to the prudent use of hydroelectric stocks because of low precipitation (section 2, §3). Production then was average during the summer months and higher at the end of the year due to abundant autumn rains.

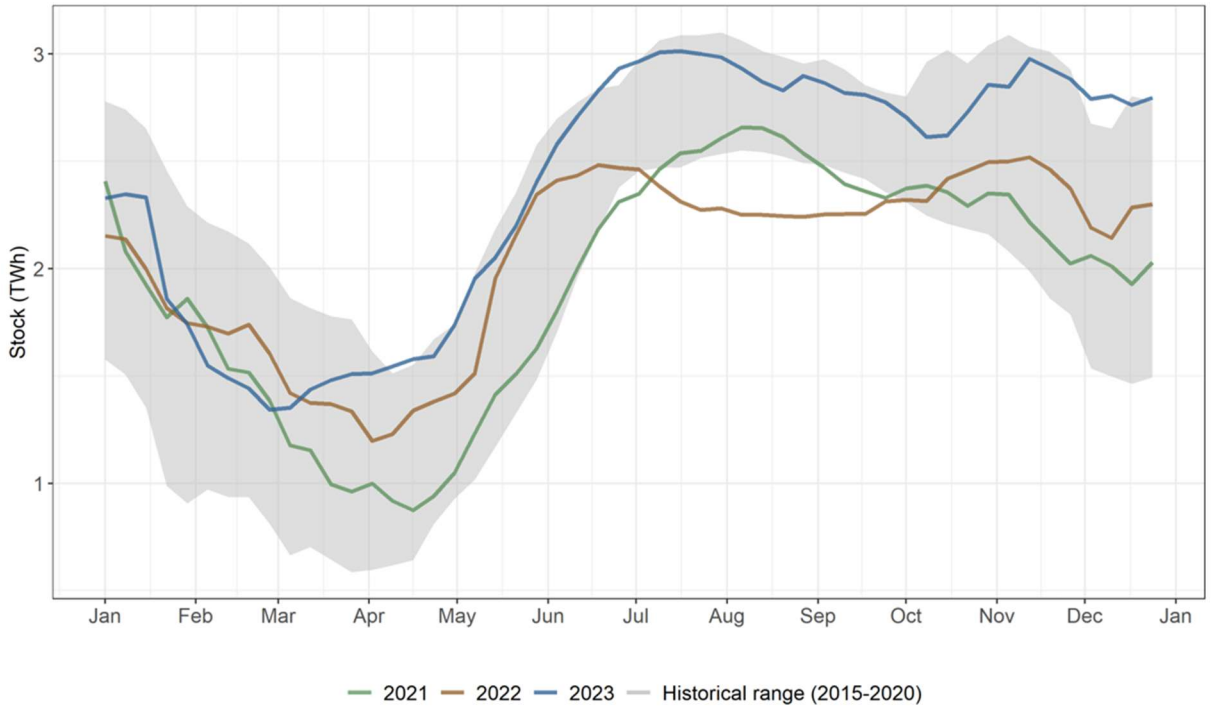
Despite low precipitation, hydro stocks (Figure 32) remained high since April, reflecting prudent management.

Figure 31: Utilisation Rate (left axis) and Power (right axis) of Hydroelectric Energy, 15-Day Moving Average



Source: RTE – Analysis: CRE

Figure 32: Weekly Evolution of Hydro Stocks



Source: RTE – Analysis: CRE

1.3.3. Wind and Solar: Current Growth Rate of Capacities Aligns with PPE Goals for 2028

In 2023, the French solar fleet increased by 3.2 GW, a rise of 20%, equivalent to the increase between 2021 and 2022. The development rate remains above the historical average for the third consecutive year, at +15.1%/year (Table 6).

The wind fleet saw an additional 2.1 GW of capacity in 2023 (+9% compared to 2022), while the increase was 2.4 GW in 2022. A significant part of the installed capacity comes from the partial commissioning of the offshore parks of St Brieuc (Brittany) and Fécamp (Normandy).

The total increase in solar and wind parks is 5.3 GW in 2023, compared to 5.1 GW in 2022. By the end of 2023, the total installed photovoltaic capacity was 19.0 GW, and the wind capacity was 23.2 GW.

Table 6: Evolution of Installed Wind and Solar Capacity

	2015	2016	2017	2018	2019	2020	2021	2022	2023	TCAM[52] 2015/2023
Wind (GW)	10.3	11.8	13.5	15.1	16.5	17.6	18.8	21.2	23.3	+10.7%
Solar (GW)	6.2	6.8	7.7	8.5	9.6	10.4	13.1	15.8	19.0	+15.1%

Source: RTE

Table 7: Evolution of Wind and Solar Production

	2015	2016	2017	2018	2019	2020	2021	2022	2023	TCAM 2015/2023
Wind (TWh)	21.1	20.9	24.0	28.1	33.8	39.7	36.9	38.9	50.8	+11.6%
Solar (TWh)	7.4	8.4	9.1	10.4	12.0	12.7	14.2	18.5	21.6	+14.3%

Source: RTE

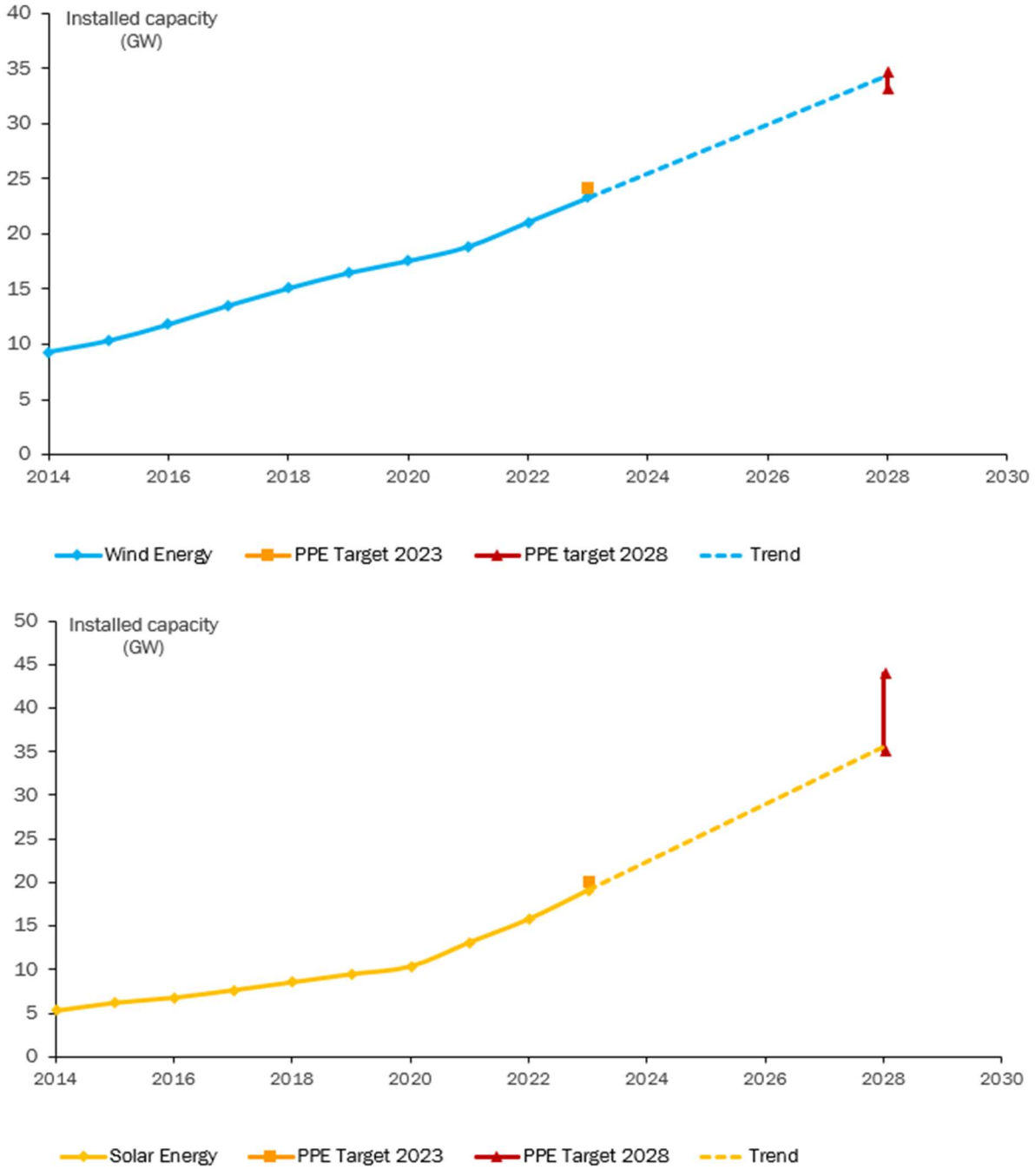
Multiannual Energy Programming (PPE)[53] targets for 2023 were not achieved. The capacity of wind farms is 0.8 GW below the target of 24.1 GW, while solar capacity is 1.1 GW below the target of 20.1 GW (Figure 33).

The increase in capacity observed between 2022 and 2023, however, is in line with the PPE targets for 2028 if maintained. The PPE sets targets of 33.2-34.7 GW for wind and 35.1-44.0 GW for solar by 2028.

[52]Average Annual Growth Rates

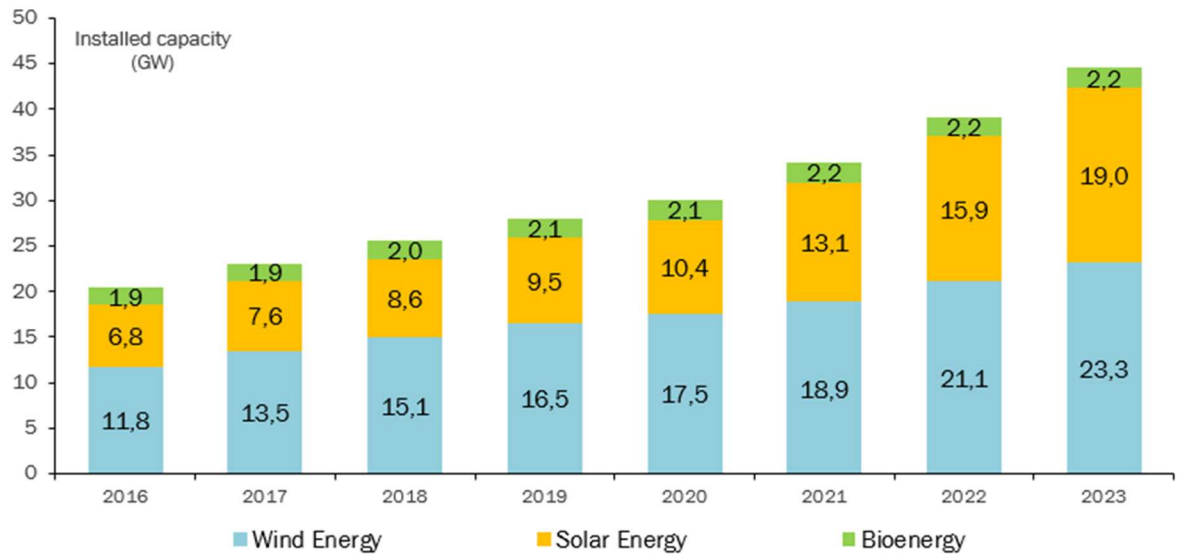
[53]Multiannual Energy Programming (PPE): https://www.ecologie.gouv.fr/programmations-pluriannuelles-lenergie-ppe

Figure 33: Comparison of Solar and Onshore Wind Farm Development with PPE Targets



Source: RTE – Analysis: CRE

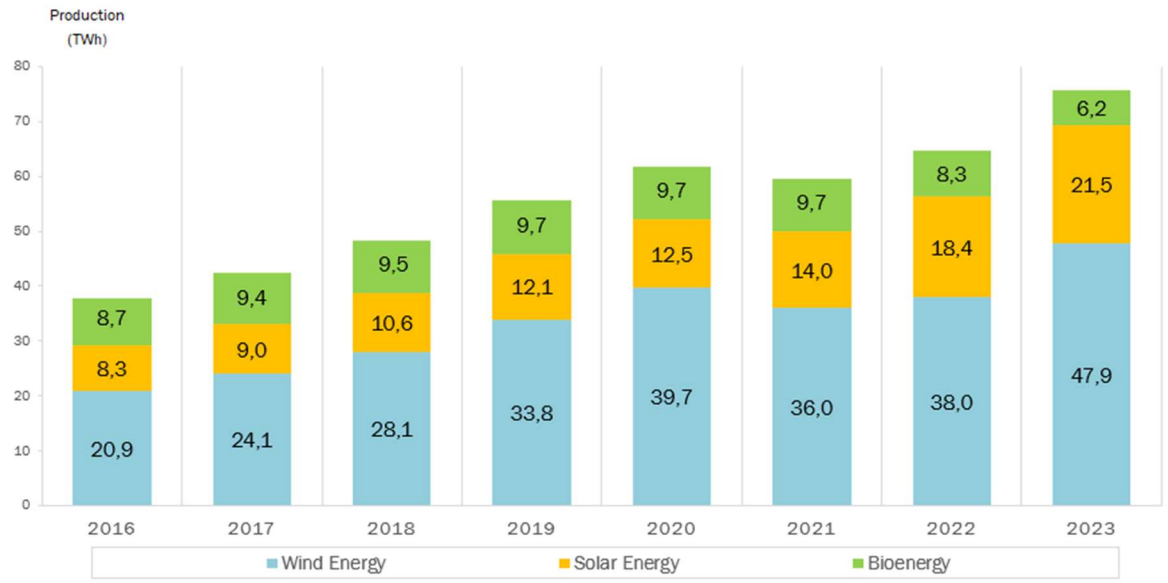
Figure 34: Evolution of Installed Renewable Capacities (Excluding Hydropower)



Source: RTE – Analysis: CRE

Renewable energy production (excluding hydropower) increased by 21% in 2023, reaching 82.8 TWh compared to 68.0 TWh in 2022 (Figure 35). A significant reason for this increase in production is the rise in the wind capacity factor, which was 25.4% in 2023 compared to 21.9% in 2022 (39 TWh) and 22.9% (37 TWh) in 2021. Thus, wind power production increased by 23.5% despite an 11.3% growth in installed capacity. Conversely, the solar capacity factor decreased (13.2% versus 13.7% in 2022).

Figure 35 Annual Production of Renewable Energy Sources (Excluding Hydropower)



Source: RTE – Analysis: CRE

1.3.4. Significant Decrease in Fossil Fuel-Based Electricity Production

Electricity production from gas, coal, and oil decreased significantly compared to 2022, by -16.6TWh (-33.7%) and compared to the 2016-2021 historical average by -9.8 TWh (-23.1%). The stark contrast with 2022 is explained by the relatively high thermal production in 2022 to compensate for weak nuclear production.

Electricity production from coal was very low, at 0.9 TWh in 2023, making it almost negligible in the French energy mix, at less than 0.2% of total production.

1.4. Marginality of Different Production Sectors in 2023: French Electricity Prices Less Dependent on Border Markets than in 2022

A production type is considered marginal when the last production unit called to meet demand belongs to that type. Its marginal production cost theoretically determines the wholesale electricity price at that moment. The marginality of a sector can be very different from its share of annual production.

However, identifying the marginal sector is practically challenging. The main problem is the proximity of variable costs of different production sectors. Moreover, producers are not obliged to offer a bid at the day-ahead auction that is strictly equal to their variable cost: for example, they may include their start-up costs, the opportunity costs of fuel or the primary resource (see below), or agree to sell at a loss over an hour to avoid restart costs or to participate in the balancing reserve markets.

The definition of "marginal technology" can also be problematic because multiple means (possibly of different technologies) may need to adjust their production to face even a small demand variation. This can be due to: (i) the European market coupling and (ii) when the management, even marginally, of one means impacts others. For instance, "block" offers in the market that cover several time steps and are accepted or rejected simultaneously can create threshold effects.

Finally, it should be noted that "stock" production means participate in the market based not on their variable production cost but on their opportunity cost, calculated considering the value of future production. This applies particularly to reservoir hydropower and, to a lesser extent, nuclear power for plants without sufficient fuel to operate at full power until their planned refuelling date.

Thus, determining the marginality rates of different sectors is normative. The stacking of production means and marginality at a given hour is only an "illustrative" way to understand the optimisation of the electric system.

To better address these challenges, CRE has developed a new method for determining marginal sectors in 2020. The new method allows considering several technologies as marginal at the same hour. CRE's calculations are based on marginal costs directly submitted to CRE by producers. The method description for each hour of the year is as follows:

1. If the daily price equals that of at least one other border country (coupling threshold of €0.01/MWh), and there is no production means in France whose marginal cost is within €1/MWh of the spot price, then the border is part of the marginal means.
2. Production means[54] whose marginal cost is close to the spot price are also part of the marginal means. The contribution of each means to marginality decreases exponentially with the difference between the spot price and its marginal cost[55].
3. If France is not coupled with at least one border country, and there is no French production means with a marginal cost close to the spot price, then marginality is defined as "other."

The results presented here are based on more complete marginal cost data than in the 2022 report and may, therefore, differ slightly.

[54] Provided for in the call programme

[55] The formula has been adapted to account for price increases, so the contribution now decreases more slowly with the difference between the spot price and its marginal cost.

Use Value of hydropower and nuclear

The usage values of water submitted by producers to CRE, defining the variable costs of hydroelectric production, can reach high values, although intuitively, water in reservoirs might appear as a free resource for producers. This is due to the "opportunity cost" management of hydroelectric production means with limited water stocks: to reserve hydro production for periods when prices are highest, producers define a "usage value" of water, reflecting anticipated prices during the most expensive periods. Thus, prices proposed by hydro dam operators can be very close to the anticipated marginal costs of gas plants.

A part of the nuclear fleet is optimized in usage value, not linked to fuel costs, when the fuel stock is constrained. Hence, some plants can sometimes be more expensive than CCGTs. Several factors can lead to high usage values, such as very high forward prices or changes in the outage planning of reactor units.

As mentioned above, high usage values reflect the need to conserve fuel until the next refuelling. Conversely, negative values are possible to reflect the need to operate at maximum power regardless of price when the fuel must be consumed before the next scheduled shutdown.

Opportunity cost management is essential to ensure the flexibility of limited stock means (hydroelectric, battery, and sometimes nuclear) is available during peak hours of the electrical system and that all producible stock is not unnecessarily consumed at the beginning of the year.

The French market was significantly less dependent on imports in 2023 compared to 2022, which explains the considerable reduction in the marginality of border countries, dropping from 30% of hours in 2022 to 10% in 2023.

The decrease in border marginality is compensated by that of CCGT (from 19.1% to 29.6%) and hydroelectricity (from 21.4% to 32.5%). These two sectors, which represent only 16% of electricity production in France, are marginal during 62% of the hours. This highlights the importance of these dispatchable energy sources in balancing the electrical system.

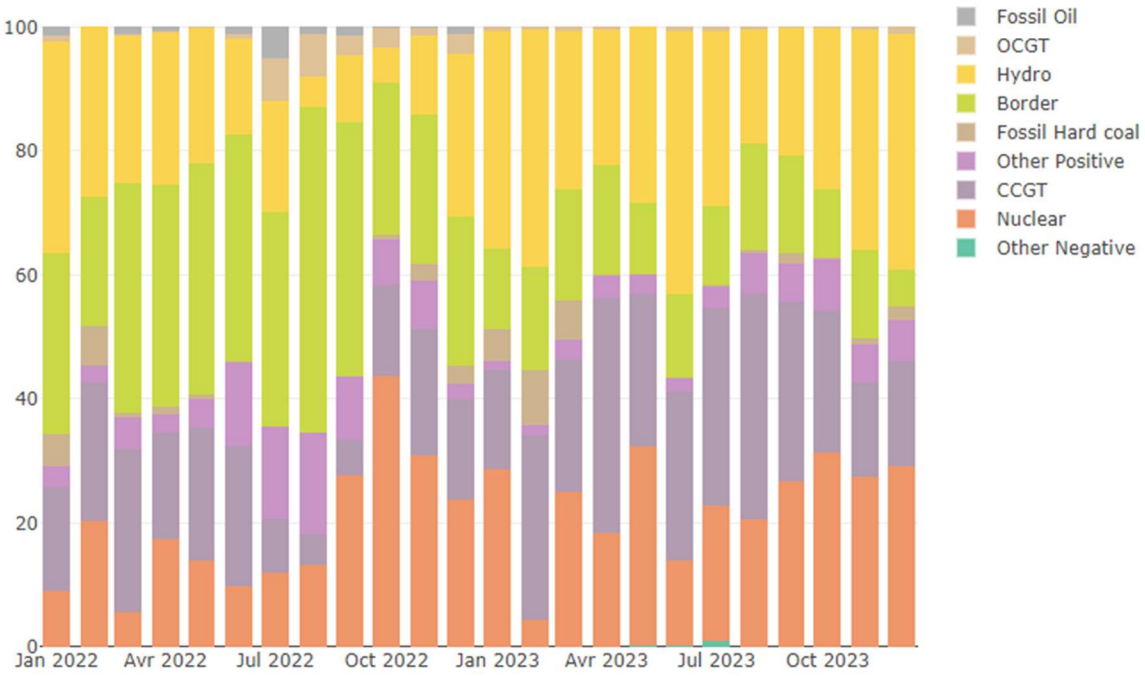
The marginal costs of all sectors decreased significantly compared to 2022, due to the return of fossil fuel costs to levels close to those before the crisis and the consequent decrease in the opportunity costs of hydroelectricity and nuclear, correlated to the fall in fossil fuel prices.

Figure 36: Marginality of Different Production Sectors in 2022 and 2023

Sources: EPEX SPOT, Producers – Analysis: CRE

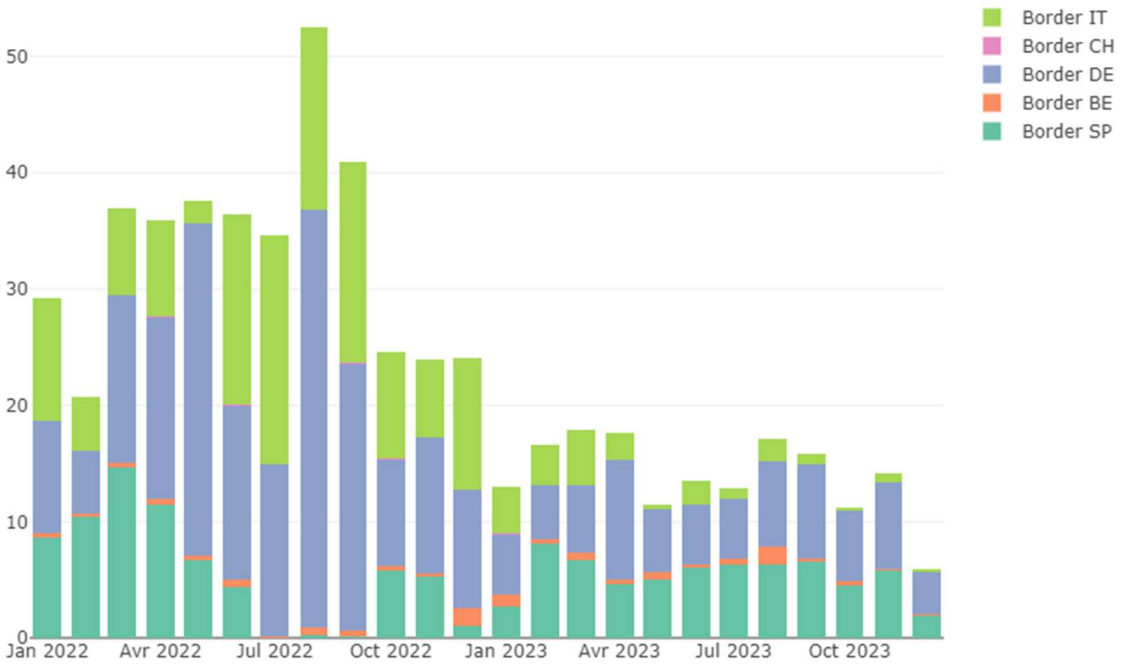
Figure 38 below gives details of the borders that have contributed to price formation in France. Since January 2023, the borders have been much less marginal, with a significant drop in the marginality of the German and Italian borders in particular.

Figure 37: Marginality of Different Production Sectors in 2022 and 2023 by Month



Sources: EPEX SPOT, Producers – Analysis: CRE

Figure 38: Marginality of Different Borders in 2022 and 2023 by Month



Sources: EPEX SPOT, Producers – Analysis: CRE

2. Wholesale electricity prices

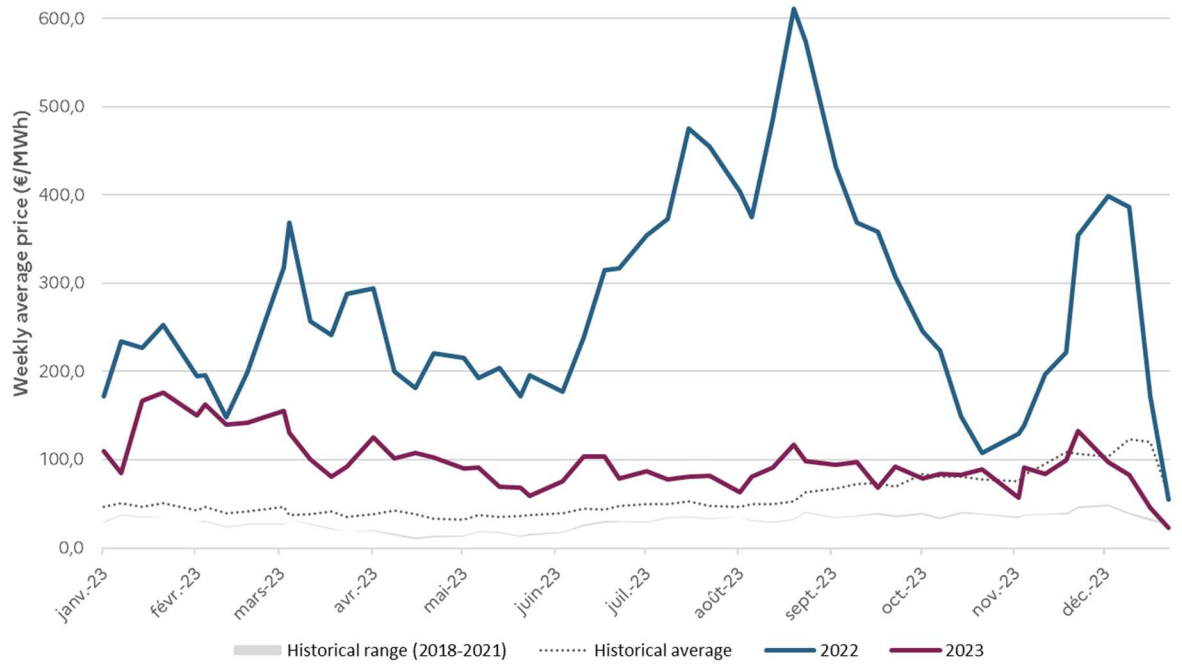
2.1. Spot prices down sharply but remain above pre-crisis levels

Spot prices play an essential role in the smooth operation of the European electricity system, by determining in a coordinated way at European level the day before for the following day, hour by hour, the generation mix used to meet forecasted consumption. In addition, the prices of forward products are established by reference to expectations of future spot prices over the period in question.

In 2023, spot prices decreased significantly, averaging €96.9/MWh, a 65% drop compared to 2022 (€275.8/MWh). Although this value is 11% lower than the 2021 average (€109.2/MWh), it remains well above pre-crisis levels (e.g., €39.4/MWh in 2019).

Moreover, the average spot price for 2023 was significantly lower than the annual forward prices for delivery in 2023, observed on average in 2022 (€368.5/MWh) and over the previous two years (€218.1/MWh on average over 2021 and 2022). The marked difference between the average spot price in 2023 and the corresponding forward prices reflects the decline in fossil fuel prices and a favourable evolution of fundamentals compared to market expectations in 2022[56].

Figure 39: Evolution of daily prices in France compared with previous years (weekly average)



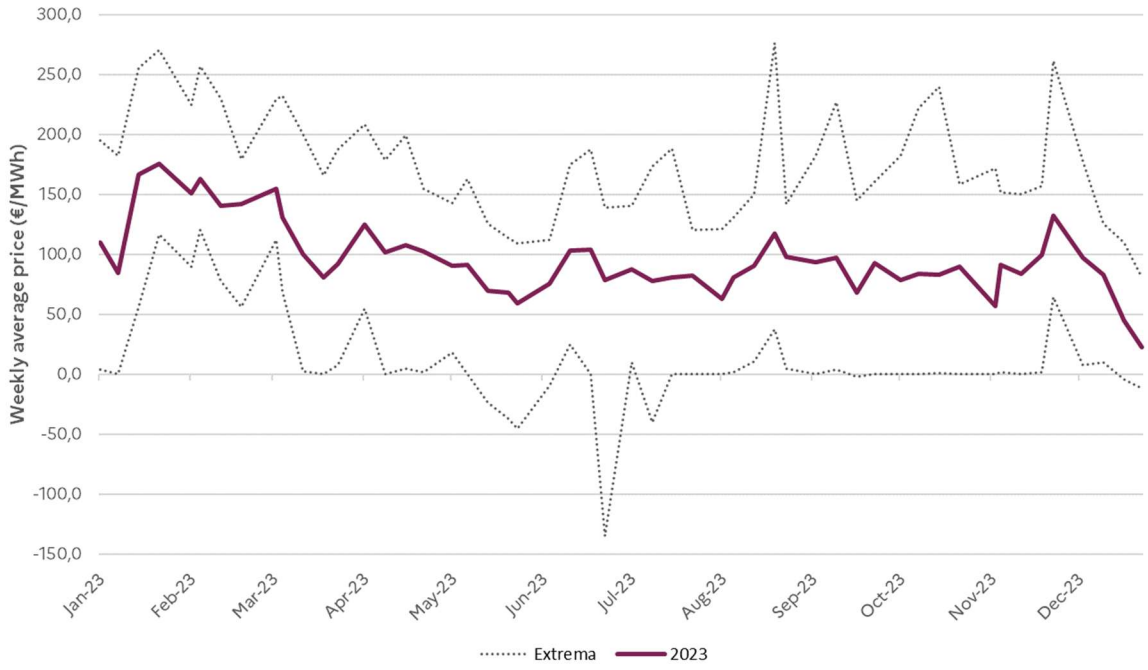
Sources: EPEX SPOT, Nord Pool – Analysis: CRE

In addition, although 2023 was characterized by a general decline in price levels, it was also highly volatile. This instability manifested itself in the high variability of hourly prices within the same day and from one day to the next (see Figure 40 and Figure 42) Furthermore, significant price differentials were observed between the day-ahead and intraday markets (see Figure 43). Although the volatility was lower than in 2022, it resulted in a high number of hours with negative prices and three-digit prices in 2023.

[56]CRE reports: 26/07/2022, 13/12/2022 and 2022 monitoring report

The difference between the weekly minimum and maximum prices increased in 2023 compared to the previous period from 2018 to 2022. In 2023, a median difference of €155/MWh was observed between the lowest and highest day-ahead prices in a week. In relative terms, this represents a median difference of approximately 176%, about 47% higher than in 2022 and 50% higher than the 2018-2021 period.

Figure 40: Evolution of daily prices in France in 2023 (weekly average and extremes)

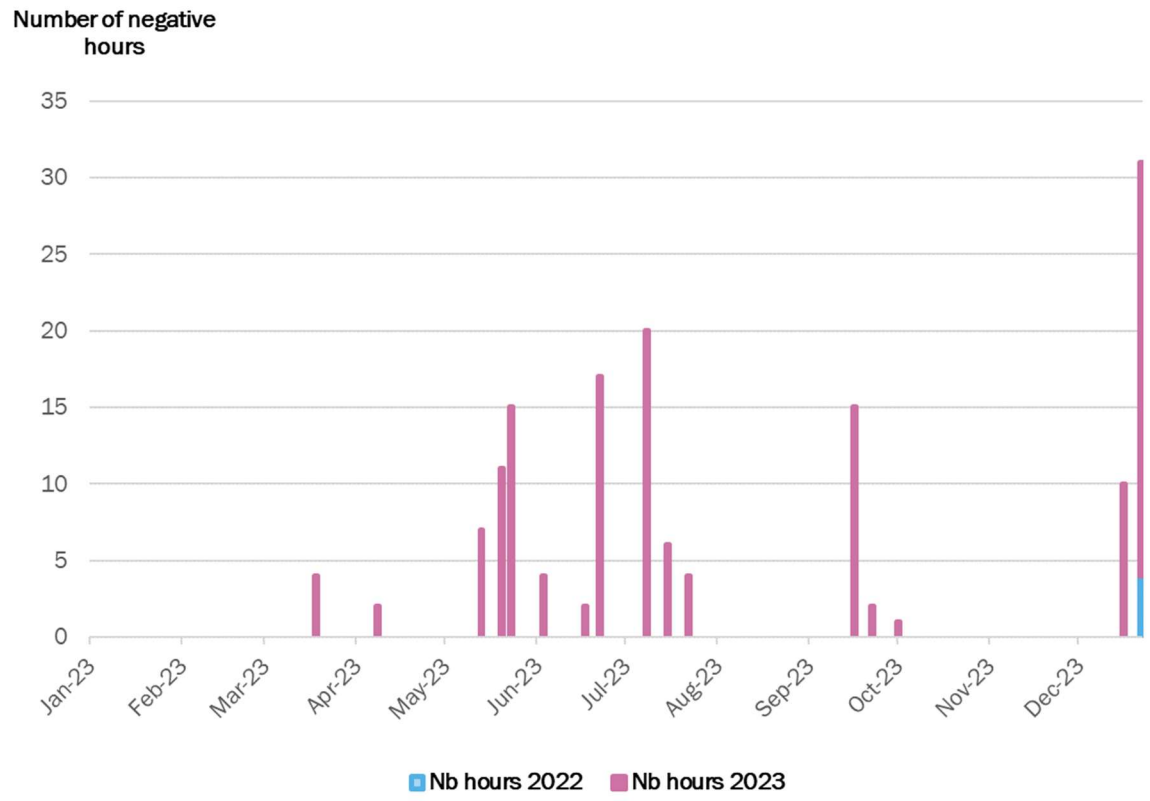


Sources: EPEX SPOT, Nord Pool – Analysis: CRE

A record number of 147 negative hours were recorded in 2023 (compared to 4 in 2022 and 102 hours in 2020). However, among these negative hours, 61% (90 hours) had a price between -€0.01/MWh and -€1/MWh. The negative hours were mainly concentrated in May, July, September, and December.

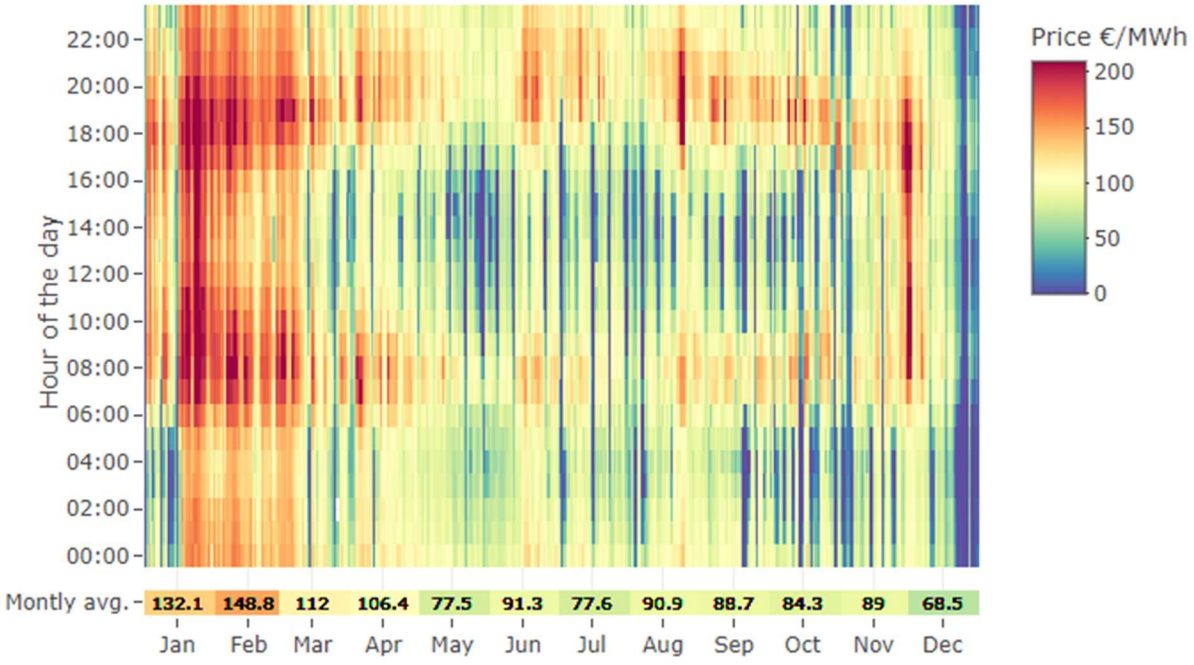
Figure 42 presents the day-ahead prices observed for all hours of 2023 (hours on the y-axis and days on the x-axis). It highlights the significant fluctuations in day-ahead prices from hour to hour and day to day. Notably, it shows the impact of daily consumption peaks around 8 AM and 6 PM, and seasonal variations.

Figure 41: Number of hours with negative daily prices in France in 2022 and 2023



Sources: EPEX SPOT, Nord Pool – Analysis: CRE

Figure 42: Daily prices in France for all hours of 2023 (hours on the Y-axis and days on the X-axis)

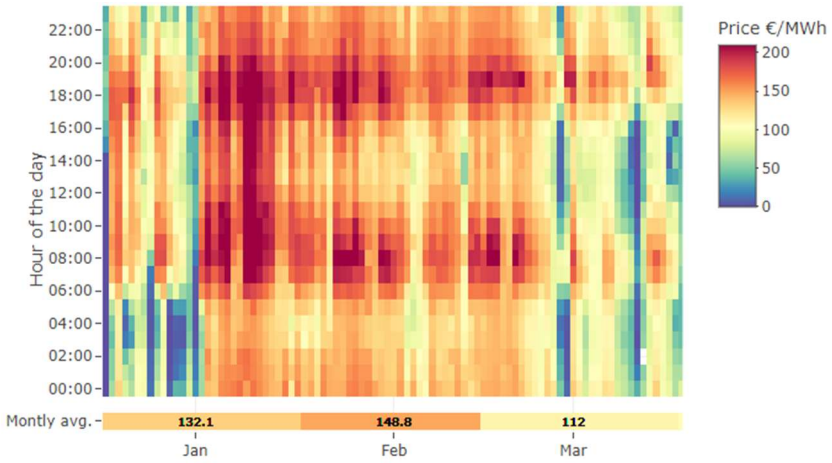


Sources: EPEX SPOT, Nord Pool – Analysis: CRE

January-March: The year began with persistently high spot prices

In the first quarter of 2023, after the end of 2022, traditionally marked by low demand and spot prices during the holiday season, spot electricity prices were relatively moderate until January 16, with very low prices at night even on weekdays, particularly the week of January 8. From January 16, prices quickly rose due to a cold snap (see section 2, §3) and did not fall below €90/MWh in January. Many price peaks above €200/MWh, even €250/MWh, were regularly observed during peak hours, around 8 AM and 6 PM. From mid-March, prices gradually decreased, reaching lows close to zero.

Over the quarter, prices remained very high (€130/MWh on average) due to higher winter demand and restricted production. The low availability of the nuclear fleet, combined with reduced hydroelectric production due to insufficient precipitation, especially in February (see section 2, §3), led to increased reliance on the gas sector. Although fuel prices were declining, they remained high, impacting electricity production costs. The cold snaps at the end of January and February also caused price spikes, with a weekly maximum of €175/MWh in the last week of January and an hourly peak of €270/MWh on January 23 at 9 AM. However, these prices remain lower than the average spot prices of 2022



April-May: Favourable fundamentals leading to price ease

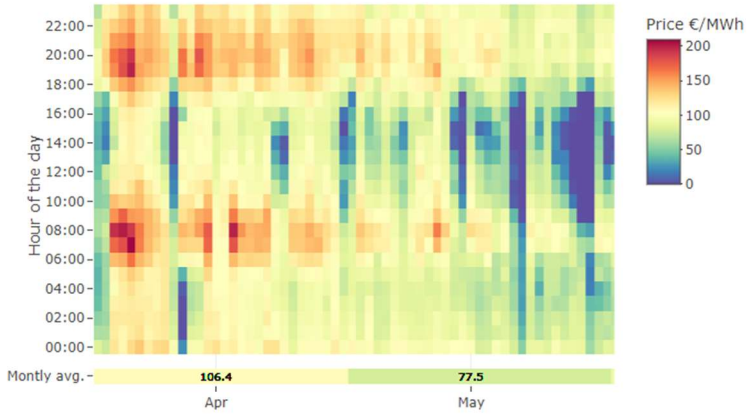
In April and May, spot electricity prices eased, with an average of €90/MWh and a weekly low of €58.9/MWh reached in the last week of May, coinciding with a peak in wind production. May also saw a significant number of negative prices[57] during the day (33 negative hours recorded in the second half of the month), compared with only 4 negative hours in the entire year of 2022, and 64 hours in total in 2021.

This price drop is the result of favourable fundamentals, such as falling consumption and improved production.

Consumption significantly decreased, primarily due to milder spring temperatures, even above normal in 2023. At the same time, electricity production improved thanks to a marked increase in the availability of nuclear power plants from spring onwards, surpassing 2022 levels. Hydroelectric production also benefited from abundant precipitation, enabling water stocks to be replenished (stocks above historical averages in May) (see section 2, §3). Consequently, fossil-fired thermal generation reached its lowest level in two years in May 2023, at 1.4 TWh.

[57]Negative prices are rare but increasingly frequent episodes, occurring when consumption is low, and the production of must-run sources like wind, solar, or run-of-river hydro is high. If other production means in operation are inflexible and cannot reduce or modulate their output except at high costs, the wholesale price can then drop significantly, even becoming negative, signalling the market's need to reduce production or increase consumption. At such times, the price no longer reflects the variable cost of production means over a given period but rather the producers' trade-off between shutdown and restart costs with the cost of selling their energy at a negative price. The increasing penetration of intermittent renewable energies significantly increases the number of negative price occurrences in Europe.

From April onwards, the balance of French commercial exchanges, already positive in the first quarter, saw a significant increase. It reached 3 TWh in April and then 7.1 TWh in May, its highest level since August 2021.

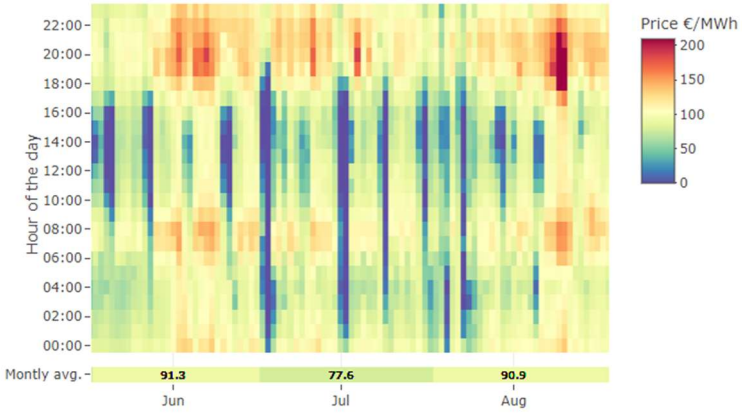


June-August: Unstable prices during summer with sharp falls and occasional spikes

June was particularly hot, leading to an increase of consumption for air conditioning, while gas prices rose again in mid-June (due to unexpected outages). As a result, the spot price rose, exceeding €100/MWh on a weekly average in mid-June.

From the end of June until early August, prices significantly dropped, averaging €79/MWh, with many negative hours (47 hours over 5 weeks) and a minimum hourly price of -€175/MWh reached on 2 July at 3 PM. This decrease is explained by reduced consumption during summer while renewable production was high.

In August, prices rose again, reaching an extreme of €275/MWh on 23 August at 8 PM. This increase was mainly due to rising gas prices amid concerns over LNG supply security (strikes at liquefaction plants in Australia) and a heatwave at the end of the month that increased electricity consumption.



September-December: Gradual return to pre-crisis price levels

An overall decline in prices was observed at the end of the year, with a weekly average spot price even reaching €56.9/MWh at the beginning of November. Prices thus approached the levels historically observed at this time of year, indicating a gradual return to normal.

This trend can be explained by an autumn that was particularly warm compared to normal, thus limiting demand. Additionally, winter was also generally mild. The only notable exception occurred at the end of November, with an intense cold snap (significant increase in consumption and increased gas production), leading to a weekly price peak of €132/MWh (with peaks of €250-260/MWh reached on 29 and 30 November at 5 PM) before falling sharply again until the end of the year (large number of negative hours at the end of December).

Production remained high, thanks to improved nuclear production (from September onward, consecutive restarts of numerous reactors restored availability levels close to those of 2021, and a peak in availability at 49 GW was reached on Monday, December 18). Heavy rainfall in October also favoured hydropower. High wind generation also contributed to the formation of negative price hours, with 18 negative hours at the end of September and 37 hours at the end of December.

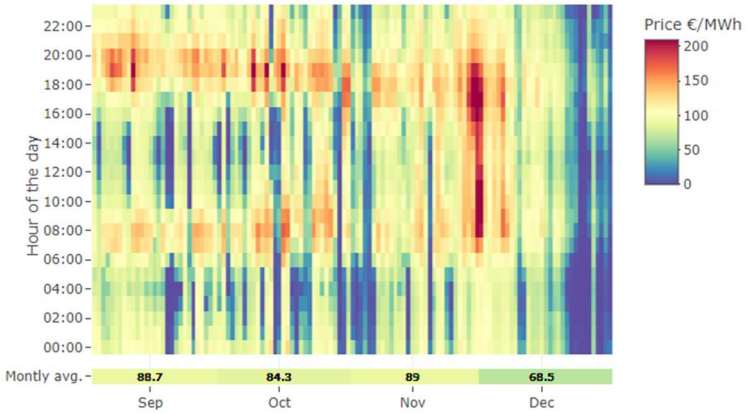


Table 8: Average day-ahead and intraday prices in France

Period	Average day-ahead price	Average intraday price
2018	€50.2/MWh	€50.9/MWh
2019	€39.5/MWh	€39.7/MWh
2020	€32.2/MWh	€32.9/MWh
2021	€109.2/MWh	€109.7/MWh
2022	€275.8/MWh	€276.3/MWh
2023	**€96.9/MWh**	**€98.4/MWh**

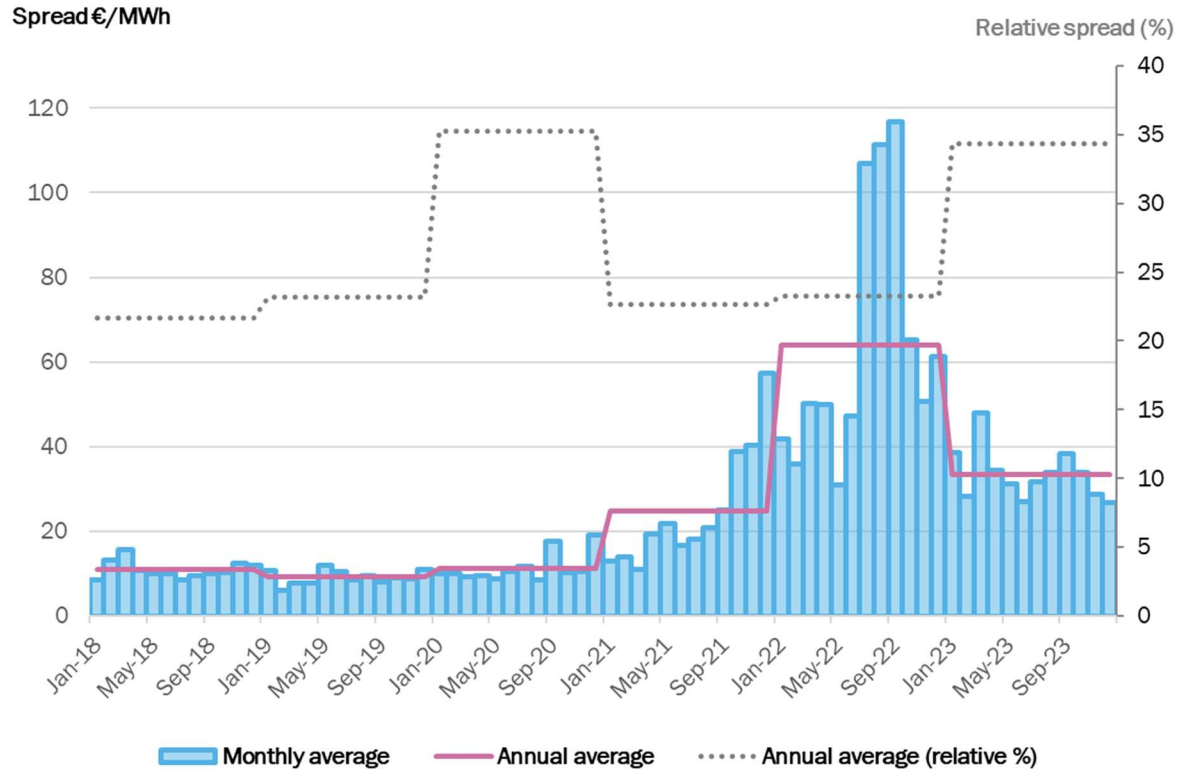
Sources: EPEX SPOT, Nord Pool – Analysis: CRE

Intraday prices (weighted average prices) were logically very close to spot prices, averaging €98.4/MWh in 2023.

However, intraday prices varied considerably within their trading period (i.e., from 3 PM the day before delivery) compared with the day-ahead prices. Figure 43 shows the monthly and annual averages of the price intervals in which a given product is traded for delivery at a specific hour, i.e., the differences observed between day-ahead prices and intraday extremes for the same hourly product[58]. There was an average annual gap of around €33.5/MWh in 2023, approximately 34% relative to the annual average day-ahead price (relative gap). This level, although lower in absolute terms compared to 2022, is higher in relative terms. It is also higher both in absolute and relative terms compared to the years 2018, 2019, and 2021. The average annual relative gap reached levels close to those of 2020, which was particularly marked by significant differences between day-ahead prices and intraday extremes during the first lockdown from 17/03/2020 to 11/05/2020, in a context of low prices resulting from reduced demand.

[58] i.e., the difference between the maximum day-ahead price and the maximum intraday price for a given product, and the minimum day-ahead price and the minimum intraday price for the corresponding product.

Figure 43: Monthly and annual averages of gaps observed between day-ahead and intraday price extremes



Sources: EPEX SPOT, Nord Pool – Analysis: CRE

In summary, 2023 was marked by a significant drop in spot prices in France and Europe, reflecting a substantial improvement in market conditions compared to 2022. France benefited from an increase in electricity production due to the gradual return of nuclear power plants and good hydroelectric and renewable production, while consumption remained particularly low. Additionally, electricity prices in Europe also benefited from lower fuel prices such as gas and coal.

Despite the price drop, volatility remained high in 2023, alternating between three-digit prices and negative prices. A record number of 147 negative hours was recorded in 2023, 45 hours more than in 2020, a year that was already marked by an exceptional number of negative hours due to lockdowns. This trend is expected to continue with the growth of renewable energies in the European energy mix.

2.2. Difference between spot prices and EDF's marginal costs

Regarding spot price formation, CRE analyses the differences between spot market prices and the marginal costs declared by EDF based on the calculations of its daily optimization models.

Since 2017, the indicator presented by CRE is determined as the arithmetic monthly arithmetic average of the differences between the spot price and the marginal cost[59] of EDF's generating plants fleet, divided by the average spot price.

$$Ecart\ moyen = \frac{1}{12}\sum_{m=1}^{12}\frac{\sum_{h\epsilon m}(prix_{spot,h} - cout_{marginal_{EDF,h}})}{\sum_{h\epsilon m}(prix_{spot,h})}$$

[59] This means the cost for EDF to produce 1 MWh more from its electricity generation fleet. EDF declares this figure for each hour to CRE.

On average, the price-cost spread in 2023 was 3.0%, the highest level since 2018, without being exceptional. This figure can be explained by the fact that the monthly terms of the sum described above were all positive, i.e., a marginal cost lower than the spot price. In previous years, some terms were negative, i.e., a marginal cost higher than the spot price. In 2023, the monthly spreads, although within the norm, resulted in an average spread slightly higher than in past years.

The various spreads reported in successive monitoring reports[60] are shown in the table below.

Table 9: Evolution of EDF's price-cost spreads

Year	Price-cost spread
2008	6.0%
2009	6.5%
2010	3.2%
2011	5.0%
2012	2.2%
2013	4.5%
2014	5.5%
2015	5.3%
2016	2.9%
2017	1.5%
2018	3.5%
2019	1.5%
2020	1.5%
2021	2.6%
2022	1.2%
2023	3.0%

Source: National Data Collection CRE – Analysis: CRE

CRE emphasizes that this indicator is based on declarative data and does not prejudge the appropriate level of EDF's marginal costs. Moreover, the average spread does not reflect the occurrences of exceptional deviations, for which CRE may implement additional controls. Finally, the indicator considers all market periods, including those when EDF might not be a marginal market player in the spot market.

Without prejudging further controls, CRE considers that the average spread measured in 2023 does not reflect the exercise of clear market power by EDF.

2.3. Level of convergence of French spot prices compared to neighbouring countries

The coupling of European day-ahead markets optimizes the use of interconnections, production means, and flexibility on a European scale through an "implicit" allocation of interconnection capacity[61]. This allocation simultaneously assigns the energy demanded or offered by market participants and the

[60] The calculation method of the average spread evolved in 2017.

[61] The transmission capacity needed to exchange energy is allocated "implicitly" in the auction system. Since 2015, the CWE zone coupling is done using a multi-border optimization method based on "flow-based" flows. There are special cases where capacity can be allocated "explicitly", instead of or in parallel with "implicit" allocation.

transmission capacity, equalizing prices in different European markets when transmission capacities are not saturated.

Market coupling is essential for interconnected European countries, as it leverages the complementarities between national production and consumption structures, promotes the integration of renewable energies, and strengthens the resilience of national electrical systems. France benefits greatly from this European integration, enabling it to export its surplus electricity production to Europe and ensure crucial imports for its supply security.

In 2023, France returned to normal by becoming a net exporter of electricity again, after facing a production deficit in 2022. This situation led to a significant drop in French spot prices in 2023, the largest among European countries, with a 65% decrease compared to 2022. French prices thus approached the average Belgian and German prices, while remaining slightly higher by 0.5% to 2%. The French price also fallen back to around 11% below the UK price, and has significantly increased its spread compared to Italy (average French price 32% below average Italian price versus 11.6% in 2022) and to a lesser extent with Switzerland (average French price 11% below Swiss average price versus 2% in 2022).

This situation contrasts sharply with that of 2022 when France had to increase its electricity imports and rely on more expensive foreign production means to meet its demand, which led to a sharp rise in French spot prices, placing them among the highest in Europe (10% to 15% higher than the average Belgian and German prices, and approaching Italian prices).

Spain continued to stand out from other European countries with an average price of €87.1/MWh in 2023, about 10% lower than Germany (€95.2/MWh). This situation is due to the implementation of a subsidy mechanism for gas consumption for electricity production in the Iberian Peninsula on May 13, 2022[62].

Table 10 below presents the monthly average differences in European spot prices compared to the French spot price. It reveals that the French price saw a significant drop compared to its European neighbours from September until the end of 2023. This downward trend can be attributed to the improvement in French production, particularly nuclear, during this period.

Figure 44 illustrates the distribution of differences between French spot price and those of neighbouring countries. It shows that in 2023, the French spot price was lower than the Belgian price 36% of the time, 28% for Germany, 28.5% for Spain, and 83% for Italy (of which 69% of the time when the French price was more than €10/MWh lower), 67% for Switzerland, and 68% for Great Britain. Additionally, the French price was equal (coupled) to the Belgian, German, and Spanish prices for about 30% of the time. This percentage drops to 16% for Italy and is almost nil for Switzerland and Great Britain, the latter two not being EU members and thus not included in the single day-ahead coupling.

The evolution of this coupling rate of the French price with its European neighbours is shown in Figure 45 on a quarterly basis. It can be seen that there is a progressive decrease in the convergence of the French price with its Italian neighbour compared to 2022. This decrease is particularly marked in the fourth quarter of 2023, approaching the rates observed in 2019, explained by the sharp drop in the French price in 2023. The convergence of the French price with Belgium and Germany is also decreasing compared to 2022 and remains lower than the levels observed in the 2019-2021 period.

Lastly, Figure 46 highlights the closest European countries by price level and season in 2023. It visually brings together countries with the highest coupling rates (defined for this graph as an absolute price difference of less than €1) between them. Thus, it can be observed that in winter 2023, France had a higher coupling rate with Belgium and Germany compared to 2022 (coupled about 43% of the time versus 33% in 2022). During the summer, the coupling rate of France increased significantly with Belgium, Germany, and the Netherlands while decreasing with Italy and Spain.

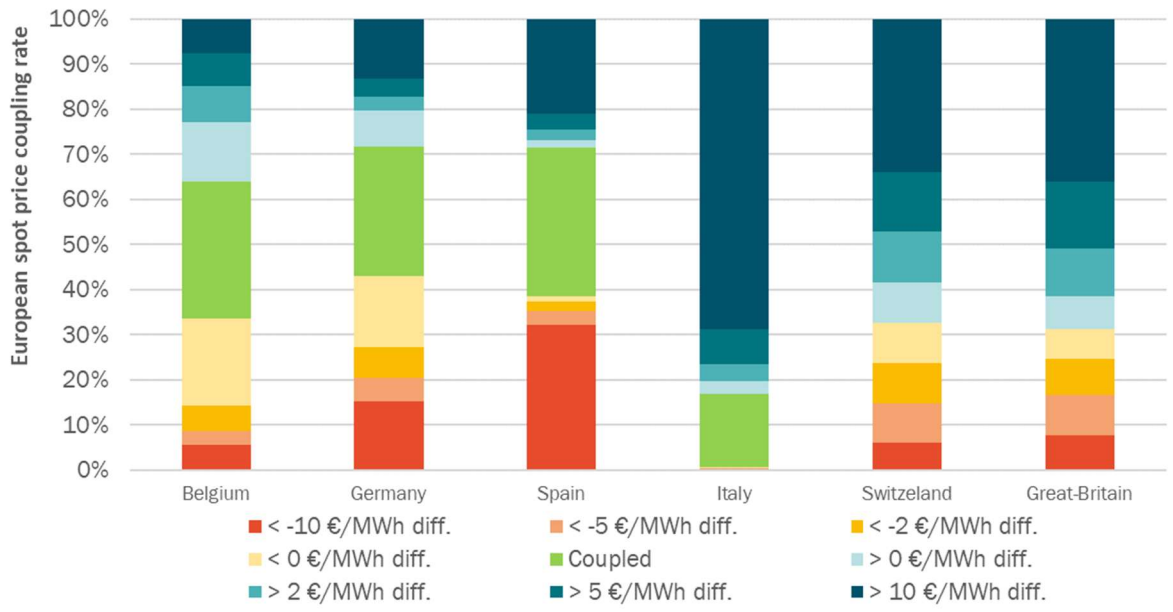
[62]On 13 May 2022, the Spanish and Portuguese governments introduced an intervention mechanism on the Spanish and Portuguese electricity markets, capping the price of gas at €40/MWh, to lower the wholesale market price and thus reduce the electricity bill for households and businesses in the respective countries.

Table 10: Monthly European spot prices differentials with French spot price between 2019 and 2023 (country price – French price)

	Germany					Belgium					Switzerland				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
January	-11,8	-3,0	-6,7	-43,7	-14,3	-0,7	-0,1	-2,0	-20,0	-1,4	1,2	4,5	1,0	7,9	25,2
February	-3,8	-4,3	-0,3	-56,7	-20,5	1,0	2,1	-0,4	-22,9	-5,3	2,1	7,9	4,9	23,1	5,0
March	-3,2	-1,3	-3,1	-43,2	-9,4	3,8	0,2	-3,6	-29,5	-2,4	1,9	2,3	6,0	10,8	12,6
April	-1,1	3,6	-9,5	-67,4	-5,6	-0,2	1,3	-6,1	-46,5	-0,8	0,6	3,8	0,5	-5,6	9,8
May	0,6	2,7	-1,9	-20,0	4,2	0,8	0,5	0,4	-20,8	2,6	0,9	2,0	2,5	-0,4	8,3
June	3,3	0,4	0,6	-30,4	3,5	-1,8	-0,2	0,9	-29,3	1,9	2,6	-0,1	0,1	6,4	0,9
July	2,0	-3,3	3,0	-85,9	0,0	0,1	-3,6	-1,0	-79,5	-2,3	0,2	-0,6	2,6	-17,8	4,8
August	3,5	-1,9	5,4	-27,3	3,4	0,3	-1,2	2,2	-44,4	1,1	0,5	-1,2	5,2	-4,8	3,6
September	0,2	-3,5	-6,9	-48,6	12,0	-2,0	-3,0	0,9	-48,2	5,6	1,9	-1,3	2,7	10,0	8,3
October	-1,9	-3,9	-32,8	-26,2	3,1	-1,0	1,5	-7,2	-21,4	2,1	1,3	0,4	26,1	5,1	21,2
November	-4,9	-1,3	-40,9	-18,2	2,2	-1,5	-0,2	-14,9	-11,5	2,5	0,0	1,3	9,8	27,2	14,2
December	-4,5	-4,9	-53,6	-19,3	0,0	-0,1	-1,0	-29,2	-1,6	0,9	4,4	2,9	7,6	9,2	12,6
Average price	**37,6**	**30,5**	**96,8**	**235,4**	**95,2**	**51,3**	**31,9**	**104,1**	**244,5**	**97,3**	**40,9**	**34,0**	**115,0**	**281,6**	**107,5**
	Great-Britain					**Spain**					**Italy**				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
January	7,4	4,1	29,1	7,7	17,3	0,8	3,1	0,7	-9,7	-62,5	6,5	7,9	2,0	15,5	44,8
February	10,8	10,2	12,6	10,4	5,4	7,4	9,6	-20,5	14,7	-15,3	10,7	12,5	8,5	27,6	13,4
March	17,8	11,7	15,9	6,0	18,8	15,0	3,9	-4,8	-11,8	-22,3	19,7	7,6	9,9	16,3	29,0
April	12,5	14,2	11,9	-21,2	9,7	12,3	4,2	1,9	-41,6	-32,6	15,2	11,0	6,0	16,8	29,2
May	10,4	10,2	30,3	-47,1	14,2	11,2	6,4	11,8	-10,3	-3,3	12,5	6,2	14,2	31,7	28,0
June	15,3	3,7	17,2	-59,5	6,9	17,9	4,8	9,8	-78,8	1,7	15,6	1,3	8,9	24,8	14,1
July	8,0	-0,9	30,0	-112,9	3,0	13,8	1,2	14,0	-258,2	12,8	13,0	2,6	22,0	50,5	33,0
August	8,2	3,5	48,0	-55,6	4,9	11,6	-0,6	28,6	-337,6	5,2	11,8	1,2	28,5	55,1	20,3
September	5,0	0,9	84,2	-85,8	7,6	6,6	-5,2	20,8	-253,6	14,6	15,1	0,5	23,3	41,3	27,4
October	3,5	9,8	41,5	-40,7	12,1	8,6	-1,3	27,4	-51,6	5,8	13,5	4,2	46,2	34,1	49,2
November	5,8	9,0	4,7	-30,1	19,8	-3,7	1,8	-23,6	-76,3	-25,5	2,1	7,4	9,3	35,7	33,1
December	9,7	12,2	15,2	20,1	11,8	-2,7	-6,5	-35,5	-173,9	3,7	5,8	5,3	12,2	33,0	47,3
Average price	**49,0**	**39,6**	**137,7**	**241,6**	**107,9**	**47,7**	**34,0**	**111,9**	**167,5**	**87,1**	**51,3**	**37,8**	**125,2**	**307,8**	**127,8**

Sources: EPEX SPOT, Nord Pool, ENTSOE – Analysis: CRE

Figure 44: European spot prices differentials with French spot price in 2023 (country price – French price)

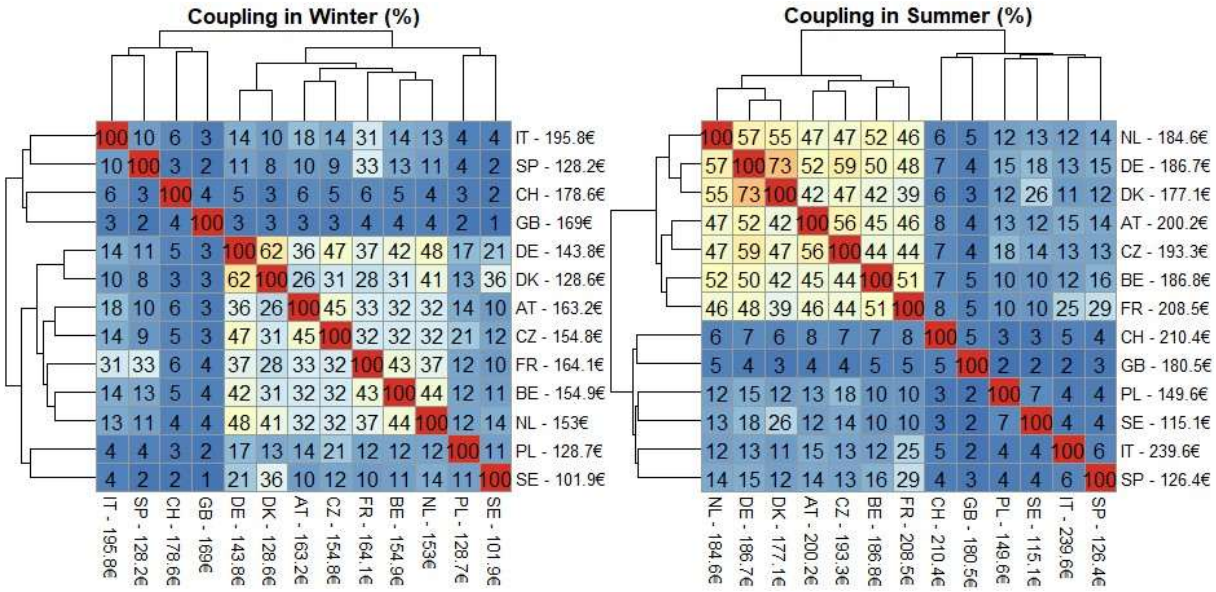


Sources: EPEX SPOT, Nord Pool, ENTSOE – Analysis: CRE

Figure 45: Quarterly convergence rates of French spot prices with its European neighbours

Sources: EPEX SPOT, Nord Pool, ENTSOE – Analysis: CRE

Figure 46: Matrices of coupling rates between countries on the spot market in winter and summer 2023; average price per season and country is given for information



AT: AT: Austria, BE: Belgium, CH: Switzerland, CZ: Czech Republic, DE: Germany, DK: Denmark (DK1 zone), FR: France, GB: Great Britain, IT: Italy, NL: Netherlands, PL: Poland, SE: Sweden (SE4 zone), SP: Spain

Sources: EPEX SPOT, Nord Pool, ENTSOE – Analysis: CRE

2.4. Reduction of the risk premium on French forward price from the second half of 2023

Wholesale forward prices, particularly the annual product, play a major role in the economics of the electricity system: they largely determine the price paid by consumers, especially in retail markets dominated by fixed prices or regularly changing prices like the French market, and also constitute a large part of producers' revenue.

Forward markets allow the trading of electricity in advance for given future delivery periods. They group together products for different time horizons ranging from a few days to several years in advance. A market participant requiring physical delivery at a given time can adopt two approaches: a purchase on the spot market, hedging the price risk with a financially settled future product, or a direct purchase of a physical product on the forward markets.

For financial delivery products, settlement prices are assessed daily until the last delivery day of the contract and correspond ultimately to the average of spot prices achieved over the contract delivery period. These contracts are used by market participants to hedge against price variation risks.

For example, a producer can secure a volume and price before delivery, or a supplier can determine a supply price for consumers or secure a supply margin. In the longer term, forward prices are a signal for investment and can be used as a reference when negotiating long-term contracts.

In 2023, forward electricity prices in French continued the downward trend that began in September 2022. The Y+1 baseload price in France averaged €162.1/MWh, more than half the 2022 average (€367.6/MWh), but still high compared to historical levels (e.g. Table 11, €46/MWh on average over the 2017-2019 period). The Y+1 price dropped by 61%, from €235.6/MWh on January 2, 2023, to €92.2/MWh at the end of the year, reaching a minimum of €86/MWh on December 19, 2023, its lowest level since August 26, 2021.

After a volatile start in early 2023, characterized by a relative increase in French prices compared to its European neighbours, the second half saw a sharp decline in French prices, eventually converging towards their German equivalents. This evolution reflects improved expectations, lower risk premiums, and market stabilization in France.

High volatility and rising forward prices in the first half of 2023

In the first half of 2023, the French electricity market was marked by high volatility and rising forward prices. This was mainly due to concerns raised by the discovery of new stress corrosion cracks[63,64], which had a major impact on electricity prices for the winter 2023-2024 (see Figure 50).

After a decline at the end of 2022 and until mid-January, the forward contract price for delivery in France in Q1 2024 France initially stabilized around €260/MWh.

However, following the announcement of a significant stress corrosion crack at Penly 1, the price peaked at €350/MWh around March 10, 2023. Thereafter, the price continued to rise, reaching a maximum of €453/MWh on April 3, an increase of 104% compared to the early March level (€222/MWh on March 6).

From April 18, a downward trend began to manifest. On April 25, ASN approved EDF's control and repair strategy, while EDF maintained its nuclear production target at 300-330 TWh, which may have contributed to reassuring the market. After a brief rebound in early May, prices eventually fell.

The France-Germany price spread followed a similar trend, peaking at €274/MWh on April 3. This increase reflected heightened market concerns regarding the French market.

Collapse of forward prices in the second half of 2023

The second half of the year was marked by a sharp easing of prices in Europe, and particularly in France.

[63]EDF Communications on 8 March 2023, 16 March 2023 (CSC note), and 26 April 2023 (CSC note).

[64]ASN Communications on 7 March 2023, 16 March 2023, and 25 April 2023.

This decline was due to a favourable energy context, characterized by an abundant supply of fuels (gas and coal) at falling prices, lower CO_2 prices, reduced electricity consumption, and increased electricity production. Furthermore, the confirmed progress of EDF's treatment of stress corrosion and the improved availability of the nuclear fleet helped to reassure the French market. As a result, French prices of both 2024 yearly contract and contract for delivery in Q1 2024 have progressively aligned with German levels. For example, the France-Germany price spread for the 2024 yearly contract narrowed from €30/MWh at the end of June to less than €5/MWh in early September. From December 11, the French price even fell below the German price until the end of the year.

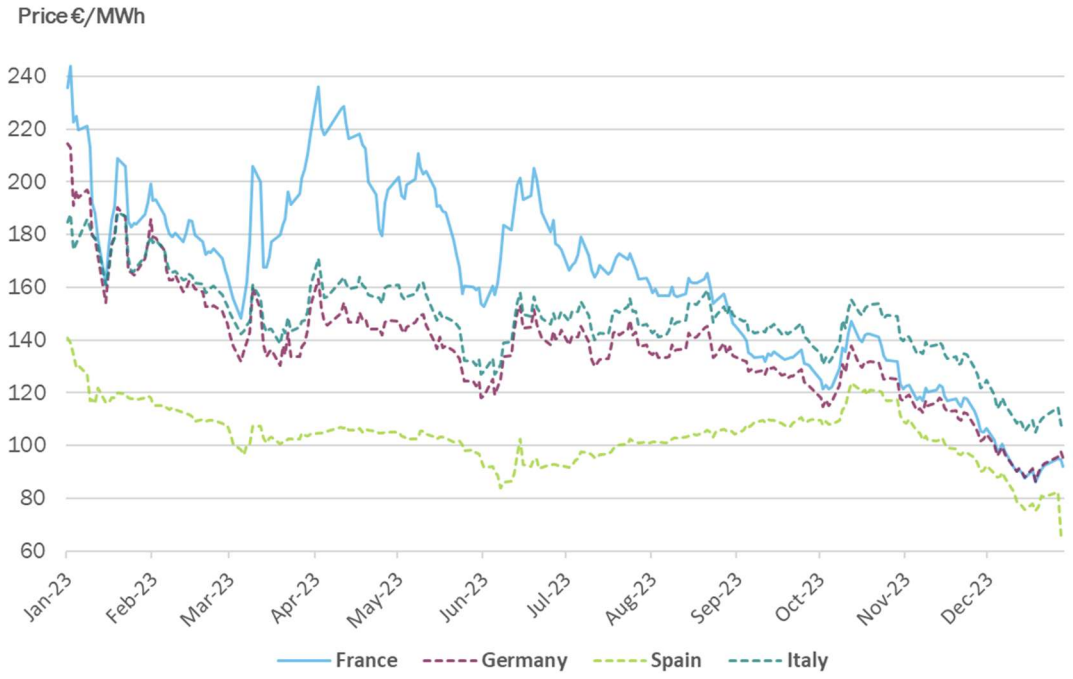
Volatility remains high in 2023

Although volatility decreased compared to late 2021 and 2022 (85% on average), it remained high in 2023 (55% on average) compared to 2018 and 2019 (20% on average) (see Figure 48).

The first half of 2023 was particularly marked by the highest volatility (around 75%), with a day-to-day variation if the Y+1 price of around €6.2/MWh on average until May 15, 2023. The greatest variations were observed between March 8 and 14, 2023. From March 8 to 10, the price increased by €43.75/MWh (+27%) in 2 days, following EDF's communication about stress corrosion detection on Penly reactors. Then, between March 13 and 14, 2023, the price dropped by €32.2/MWh (-16%), following the transmission to ASN of EDF's revised strategy for stress corrosion inspection of its reactors.

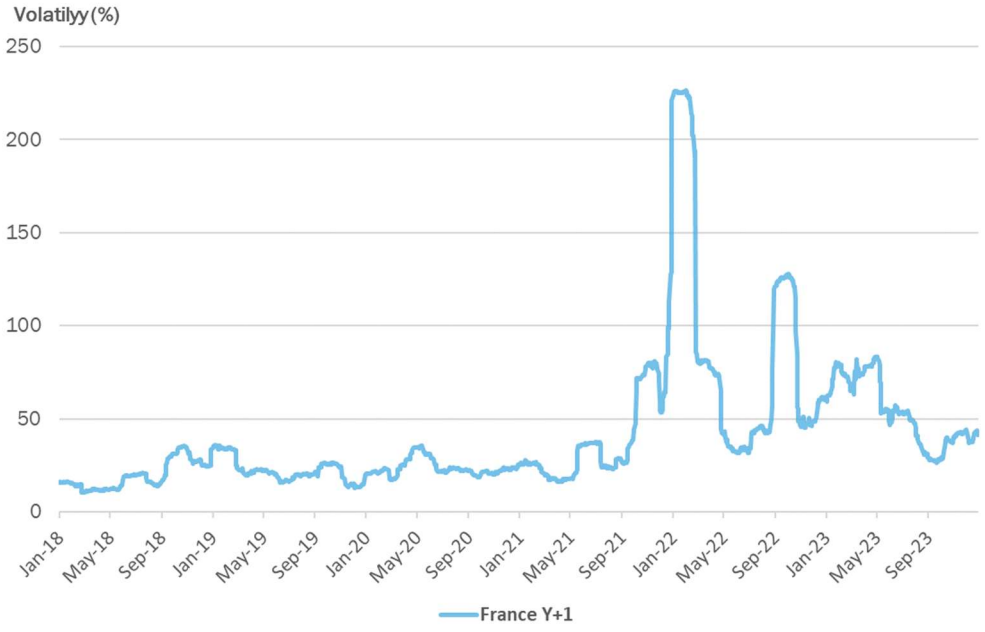
Finally, the easing of prices during summer and early autumn led to a significant decrease in volatility, which fell below 30%, before rising back to around 40% at the end of the year.

Figure 47: Prices of Y+1 baseload products in Europe



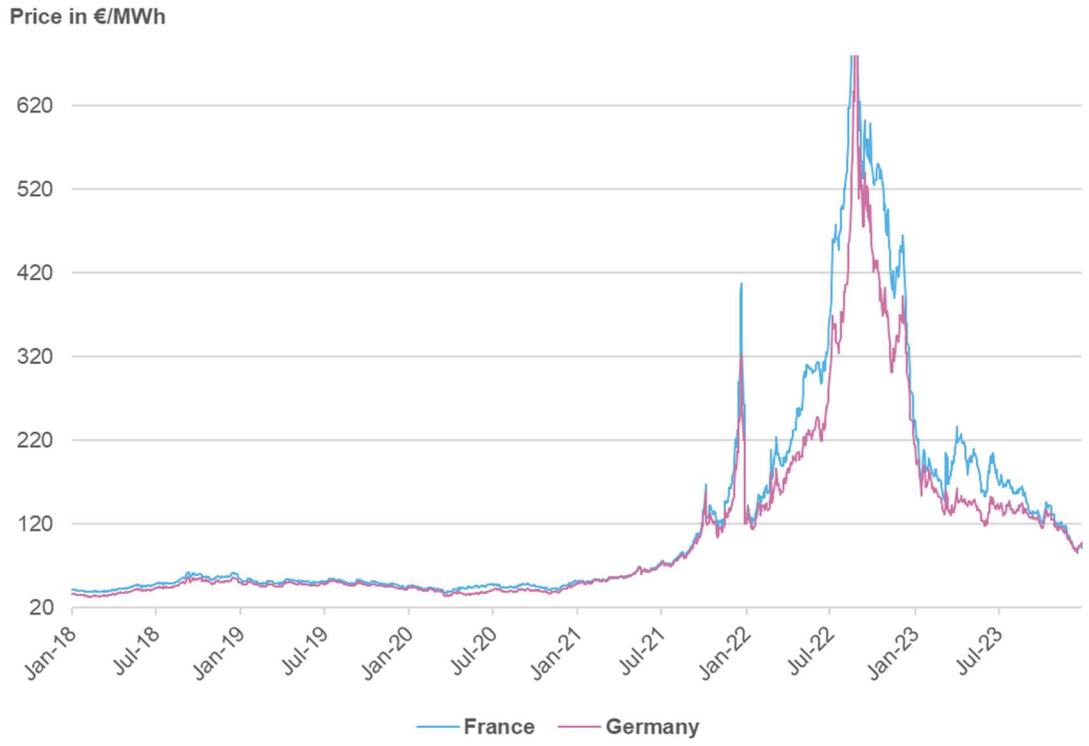
Source: Argus – Analysis: CRE

Figure 48: Volatility[65] of the Y+1 Baseload product in France



Source: Refintiv – Analysis: CRE

Figure 49: Historical prices of French and German Y+1 baseload products (monthly average)



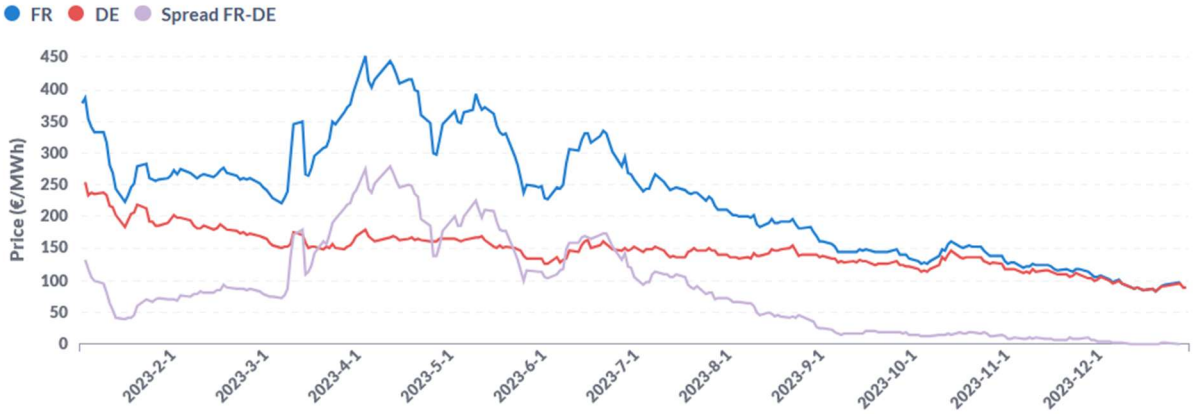
Source: Argus – Analysis: CRE

Table 11: Evolution of the annual average price of the French and German Y+1 baseload product since 2013

Year	France	Germany	FR-DE spread	Relative spread
2013	€43.0	€38.7	€4.4	10.1%
2014	€42.4	€35.1	€7.3	17.3%
2015	€38.1	€30.9	€7.2	18.8%
2016	€33.3	€26.6	€6.7	20.2%
2017	€38.3	€32.4	€5.9	15.3%
2018	€49.0	€43.9	€5.1	10.4%
2019	€50.8	€47.8	€3.0	6.0%
2020	€44.9	€40.3	€4.6	10.3%
2021	€94.7	€88.5	€6.1	6.5%
2022	€367.6	€298.3	€69.3	18.9%
2023	**€162.1**	**€137.2**	**€24.9**	**15.4%**

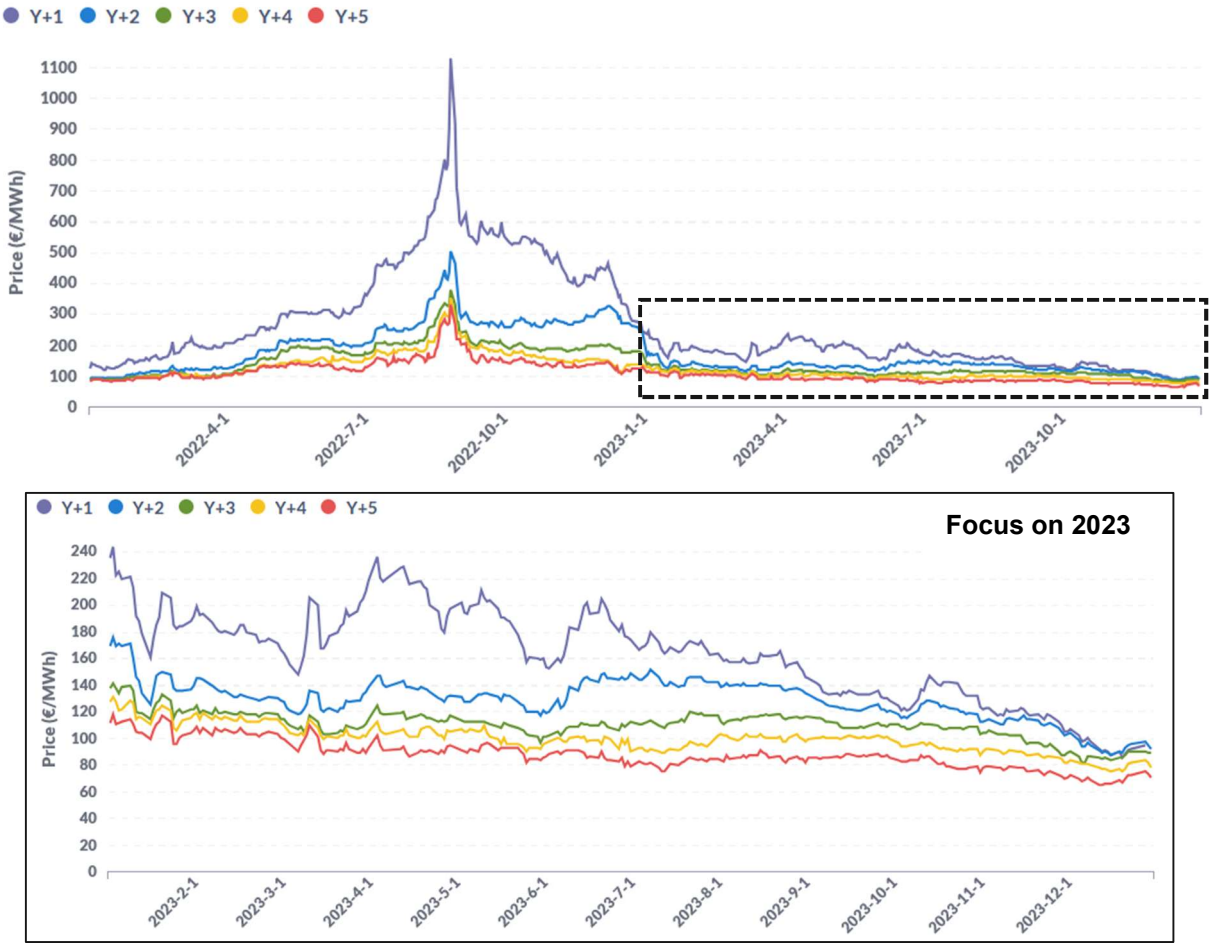
Source: Argus – Analysis: CRE

Figure 50: Evolution of French and German baseload contracts for delivery in Q1 2024



Source: EEX, Argus – Analysis: CRE

Figure 51: Evolution of Y+1 to Y+5 French baseload products since January 1, 2022



Source: EEX - Analysis: CRE

3. Traded volumes, and especially the number of transactions and orders, increase with the arrival of new market players

Trading on wholesale markets takes place either over-the-counter (OTC) or on an exchange. Most OTC trades are intermediated by brokers. The traded products can be settled physically or financially. On the French market, financially settled products can be traded directly on exchanges (mainly EEX) or intermediated by brokers and then registered with an exchange for clearing through the clearing house (mainly EEX). Physically settled products are mostly intermediated by brokers but can also be traded bilaterally.

Auctions organized by EDF on a platform dedicated to the forward sale of "almost-certain" volumes of energy acquired under state-guaranteed purchase obligation contracts also represent significant volumes of energy.

On forward markets (OTC, EEX exchange), the primary products traded in France range from a 3-year horizon (Y+3 product) to one day prior delivery. Most of the day-ahead and intraday trading takes place on the EPEX SPOT and Nord Pool exchanges, the designated operators in France for European day-ahead and intraday market coupling. Day-ahead trading is conducted via daily auctions (Single Day-Ahead Coupling – SDAC); intraday trading is conducted on a continuous market (Single Intraday Coupling – SIDC – and national market).

On forward markets, traded volumes on the French electricity market increased by 23% in 2023 (673 TWh) compared to 2022 (548 TWh) but decreased by 10% compared to 2021 (746 TWh).

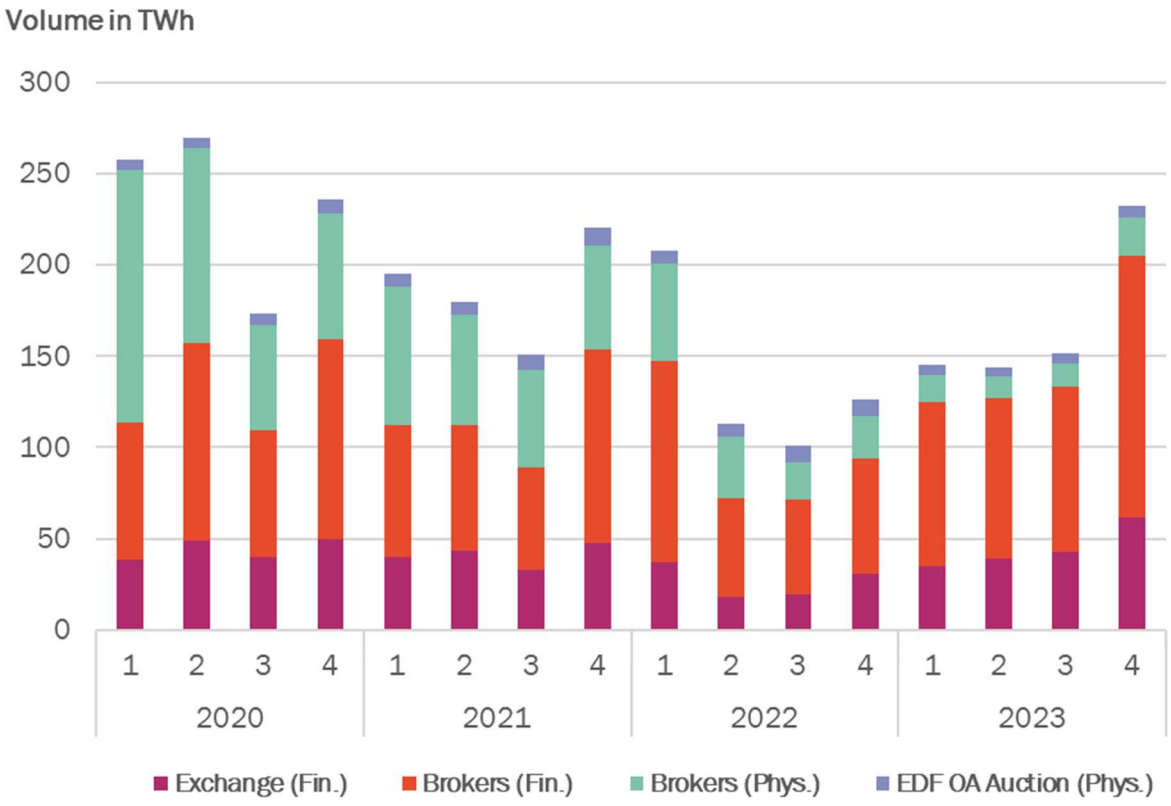
The trend shows an increase in volumes of financially settled products against a decrease in physically settled products. There was a:

- 70% increase in volumes traded on the EEX exchange (178 TWh in 2023 compared to 105 TWh in 2022),
- 474% increase in OTC volumes for financial products (411 TWh in 2023 compared to 280 TWh in 2022),
- and a 54% decrease in OTC volumes for physical products (60 TWh in 2023 compared to 130 TWh in 2022).

Forward markets continue to financialize, reinforcing the trend seen since the second quarter of 2022. This growth in financially settled products may reflect a preference for reducing counterparty risk in forward market trading. Indeed, while the terms of collateral and margin calls can vary for physically settled products, financially settled products eliminate counterparty risk through the clearing house.

It should be noted that the volumes sold at EDF auctions for energy under purchase obligation are not directly comparable to others, as they do not involve in "back-and-forth" trades but only sales from EDF.

Figure 52: Volumes traded on the EEX exchange or through brokers on forward markets, and volumes sold at EDF auctions for energy under purchase obligation



Sources: EEX, REMIT data, EDF OA – Analysis: CRE

Figure 53 shows all the volumes traded on the wholesale markets by maturity, on the futures markets as well as the day-ahead and intraday markets. Between 2022 and 2023, volumes of monthly, weekly, and intraday product grew significantly, while volumes of other products decreased slightly:

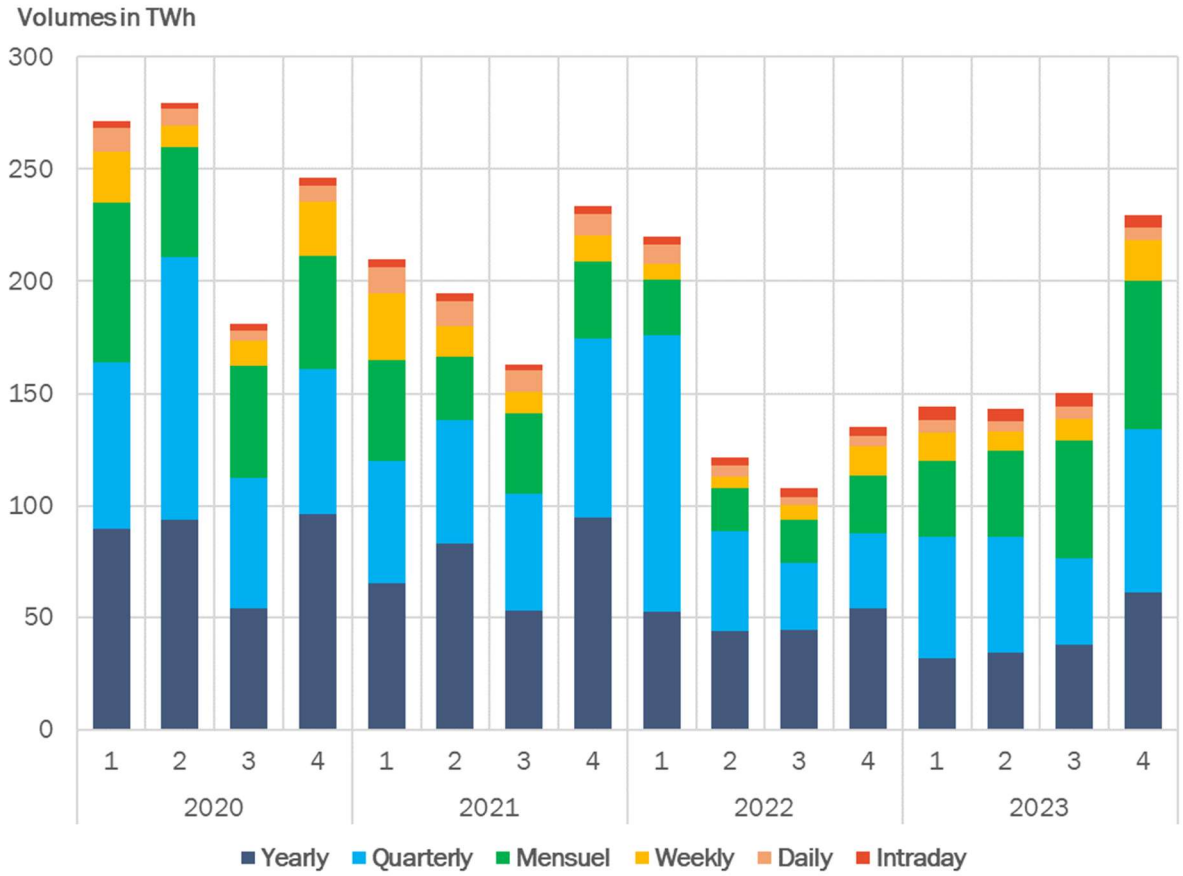
- Annual products: down 15%, from 194 TWh traded in 2022 to 165 TWh in 2023,
- Quarterly products: down 6%, from 233 TWh traded in 2022 to 219 TWh in 2023,
- Monthly products: up 115%, from 89 TWh in 2022 to 190 TWh in 2023,
- Weekly products: up 58%, from 31 TWh in 2022 to 50 TWh in 2023,
- Daily forward products[66]: down 4%, from 22 TWh in 2022 to 21 TWh in 2023.
- Coupled daily market (day-ahead): down 3%, from 124 TWh in 2022 to 120 TWh in 2023,
- Intraday market: up 51%, from 14 TWh in 2022 to 21 TWh in 2023.

Forward products represent the largest share of traded products on the wholesale electricity markets, as market participants primarily hedge their medium to long-term exposure and adjust this hedge over time. Shorter-term markets, coupled daily and intraday markets, are essential for optimizing electricity generation fleet and the use of interconnections, even though they represent smaller trading volumes. The daily market nonetheless represents significant volumes, mainly because it can be used to buy or

[66] Daily forward products are one-day products that can be delivered even several months after the transaction, while coupled daily (day-ahead) products are hourly spot products that are traded every day for the following day.

sell electricity whose price has already been hedged by the purchase or sale of a future financially settled contract.

Figure 53: Traded volumes on wholesale markets by maturity (physically and financially settled products combined)



Sources: REMIT data, EEX, Nord Pool, EDF OA – Analysis: CRE

Figure 54 and Figure 55 illustrate the evolution of market participants' open positions by category, for yearly baseload contracts for delivery in France in 2024 and 2025 (physically and financially settled products combined). It should be noted that this is the evolution of open positions over the years preceding delivery.

The categories of market participant have been constructed as follows:

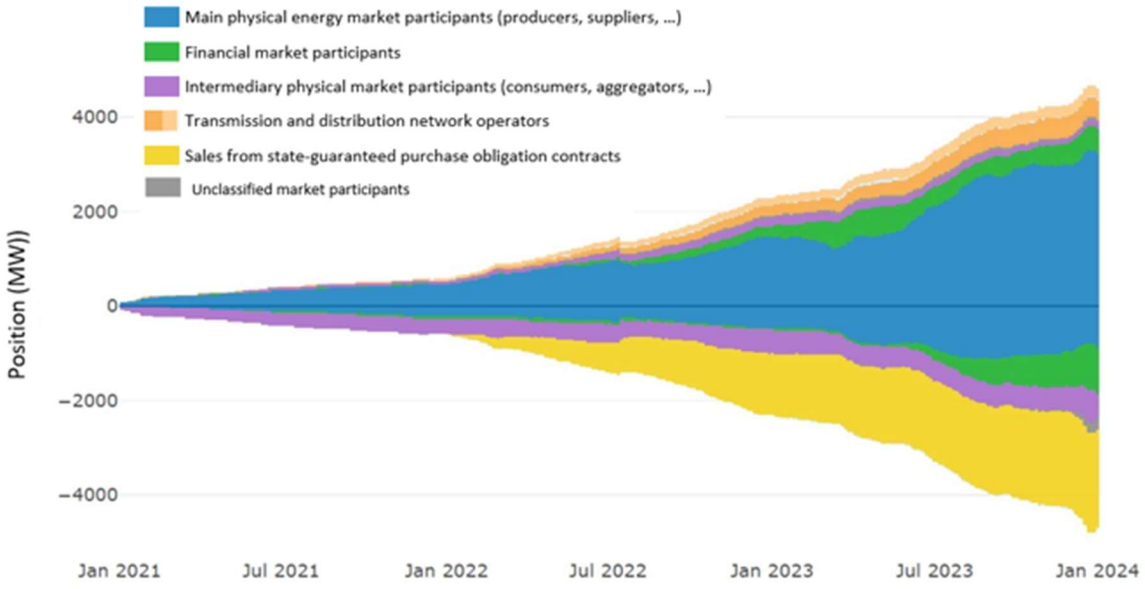
- the main physical energy market participants, consisting of energy suppliers and producers,
- financial market participants, including investment funds, trading houses, etc., active in the French electricity market,
- intermediary physical market participants, comprising consumers, aggregators, etc,
- transmission and distribution network operators who purchase electricity losses from the grid,

- EDF OA, which sells electricity bought under state-guaranteed feed-in tariffs contracts, sold in the forward market in accordance with the procedure established by the CRE[67].

Physical market participants account for a large majority of open positions on the yearly baseload products for delivery in 2024 and 2025. It should be noted that EDF OA remains the main seller for these maturities.

Financial market participants have taken selling positions in 2024 and buying positions in 2025. However, the size of the positions held by financial market participants have been significantly lower than it could have been in 2022 and 2023 (positions that had been heavily buyer at the time, in a context of concerns about security of supply).

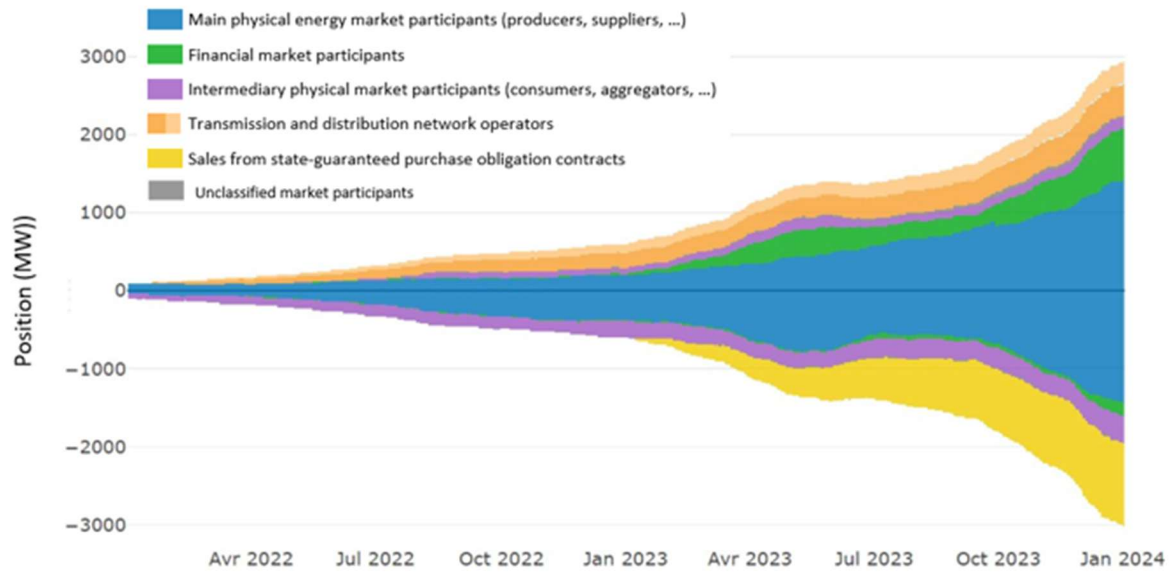
Figure 54: Evolution of open positions by market participants category, for the yearly baseload product for delivery in France in 2024 (physically and financially settled products combined), since January 1, 2021



Sources: REMIT, EEX, EDF OA data - Analysis: CRE

[67] CRE Deliberation N°2019-259 of November 28, 2019, ruling on the methodology for calculating the avoided cost of electricity produced under purchase obligation.

Figure 55: Evolution of open positions by market participants category, for the yearly baseload product for delivery in France in 2025 (physically and financially settled products combined), since January 1, 2022



Sources: REMIT, EEX, EDF OA data - Analysis: CRE

Record trading volumes on the French intraday market

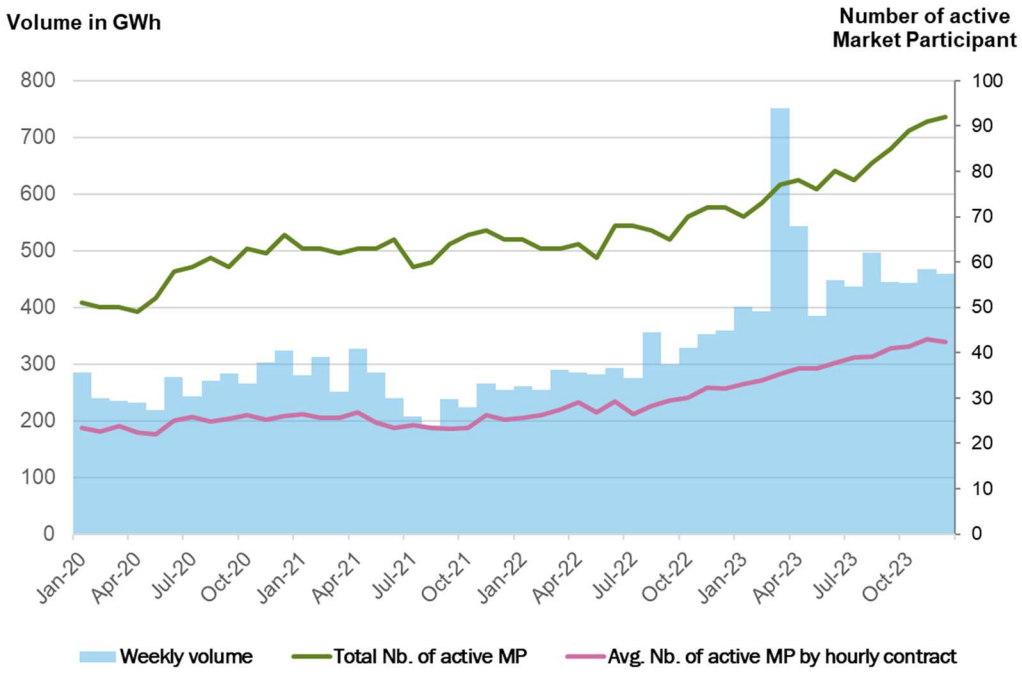
Volumes traded on the French intraday electricity market rose sharply in 2023, reaching a record level of 21.4 TWh, an increase of 51% compared with the previous record of 14,2 TWh in 2022.

This rise can be explained by a significant growth in trading at European level, as well as by the continuous arrival of new market participants on the markets.

Figure 56 shows that in December 2023, 92 different market participants were active, 22 more than in January 2023 (an increase of 31%). In addition, on average, 42 different market participants were active per hourly contract in December 2023, which represents an increase of 27% compared with January 2023 and confirms that a significant number of different market participants are regularly active. The arrival of these new market participants on the French intraday market has led to a reduction in trading concentration, as shown by the fall in the HHI concentration indices presented in Figure 57 .

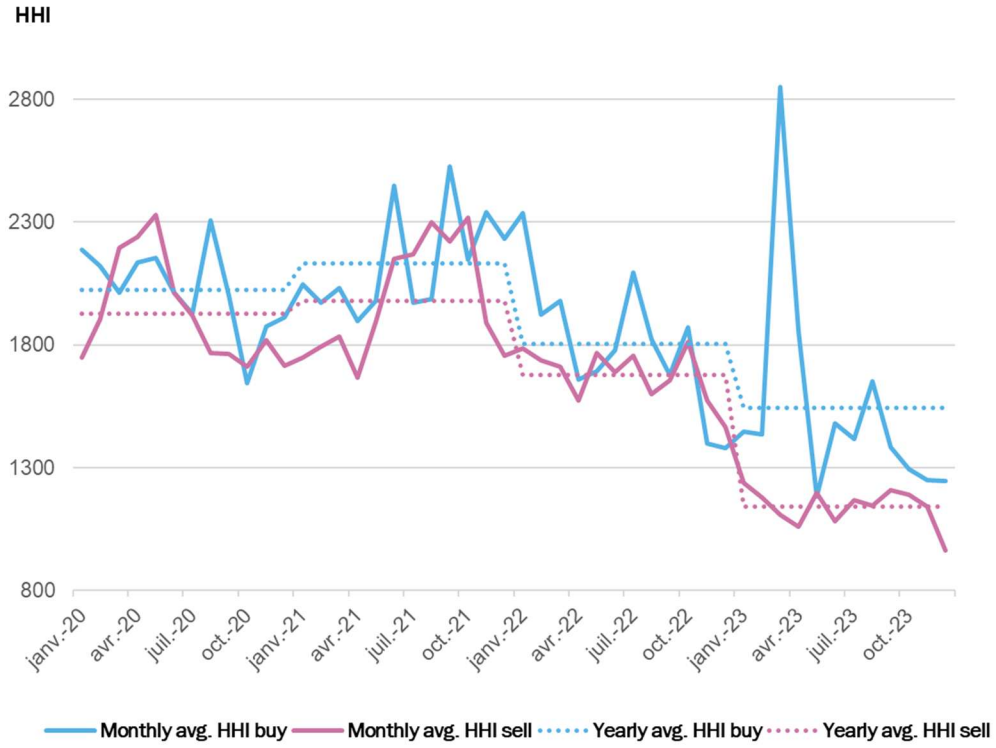
In addition, a peak in traded volumes of 752 GWh and an increase in the HHI purchasing index can be seen at the beginning of March 2023, which can be explained by a context of significant strikes movements affecting the availability of the generating fleet at this period.

Figure 56: Weekly volumes traded on the French intraday market and monthly change in the number of active market participants



Source: REMIT data – Analysis: CRE

Figure 57: Herfindahl-Hirschman Index (HHI) concentration indices on hourly contracts traded on the French Intraday market (monthly and annual averages)



Source: REMIT data – Analysis: CRE

More and more financial market participants using trading algorithms

Most of the new entrants to the French electricity markets are financial market participants, conducting proprietary trading and increasingly using trading algorithms to improve the efficiency and responsiveness of transactions and seize market opportunities.

The use of these algorithms led to an exceptional increase in the number of weekly order events (insertion, update, execution, cancellation) in 2023 compared with previous years (see Figure 58). This increase has been particularly visible since July 2022, when prices and volatility reached record levels.

Although this increase mainly affected the intraday market, the futures markets also followed a similar trend, especially from June 2023 onwards, with an increase in the number of financial market participants entering the markets and concentrating a large majority of order events (particularly on the most liquid contracts: M+1, Q+1, M+2 and Y+1).

In December 2023, 25 million order events were recorded monthly on the French intraday market, more than twice as many as in December 2022 and almost 8 times as many as in December 2021. On futures markets, a peak of 4 million order events can be observed in October 2023, almost 35 times more than in October 2022.

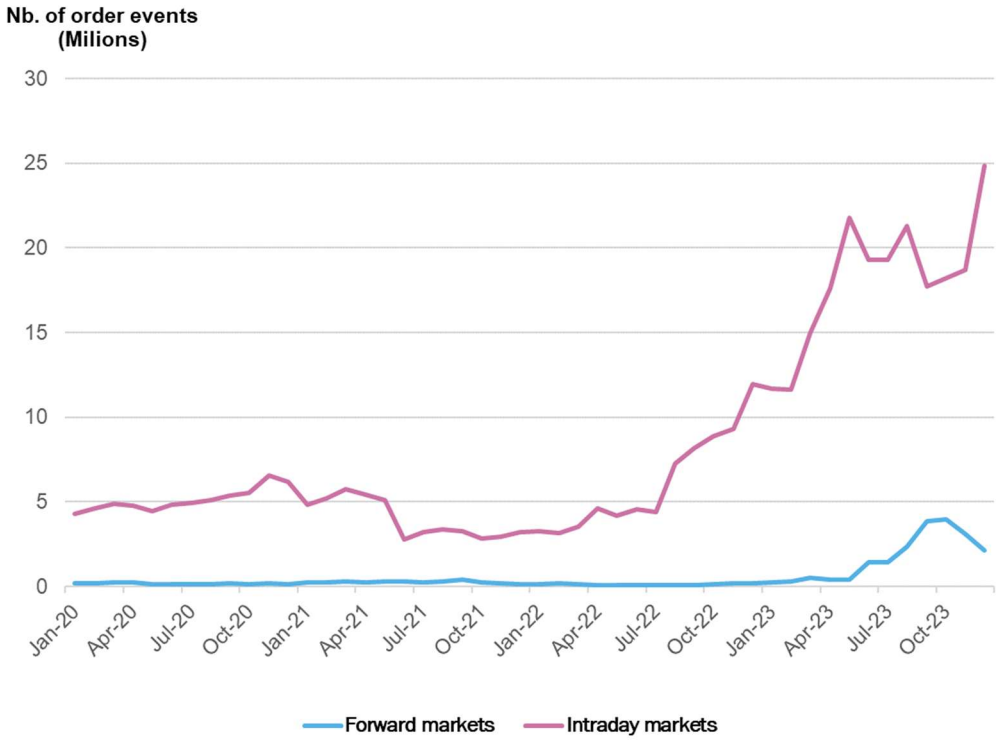
This increase in order events reflects growing market activity, but also raises a new challenge for the regulator, which has to handle ever-increasing volume of data.

Proprietary trading involves trading on the markets in order to make a profit, for example by taking advantage of favourable price movements. Market players can follow different strategies:

- directional (or speculative) strategies: these involve "betting" on future price movements, often based on forecasting models, and generating a gain or loss depending on the actual price changes
- arbitrage between similar contracts (e.g., location spreads between two countries, commodity spreads, time spreads, etc.)
- market making: this involves providing liquidity and depth to the markets. To do this, the market participant continuously places orders on both sides of the orderbook (buy and sell orders) and is remunerated through the spread between the buy price and the sell price (bid-ask spread).

Proprietary trading plays a crucial role in the proper functioning of the market. It provides three essential elements for the effective operation of markets: liquidity, risk sharing and price discovery. By being present on the markets, proprietary traders enable physical market participant (producers and consumers) to execute transactions quickly and at a lower cost. In addition, these same physical market participants can rely on these counterparties to hedge themselves, thereby sharing the risks. Finally, proprietary traders' buy and sell orders contribute to the price discovery process. By interacting with other economic market players, they provide information and help to ensure that the fundamentals for the delivery date are reflected in prices.

Figure 58: Number of monthly order events (insertion, update, execution, cancellation) on the electricity futures and intraday markets



Source: REMIT data - Analysis: CRE

Limited development of trading for Y+4 and Y+5 maturities

The energy price crisis in 2022 has highlighted the need for electricity consumers to have stable and predictable prices over the medium and long term (three to five years) to protect themselves from the volatility associated with short-term cyclical effects (see Figure 51).

However, liquidity for maturities beyond two years was very low or even non-existent in France (see Figure 59).

In this context, on September 27, 2023, EDF launched daily tenders[68] for the sale of physical baseload products for delivery over the years Y+4 and Y+5 with a volume capped at 5 MW/d for each of the two products.

Although a slight increase in trading volumes for the Y+3 and Y+4 maturities was observed in the fourth quarter of 2023, trading volumes remains very low, especially when compared with the volumes traded for Y+1 and Y+2.

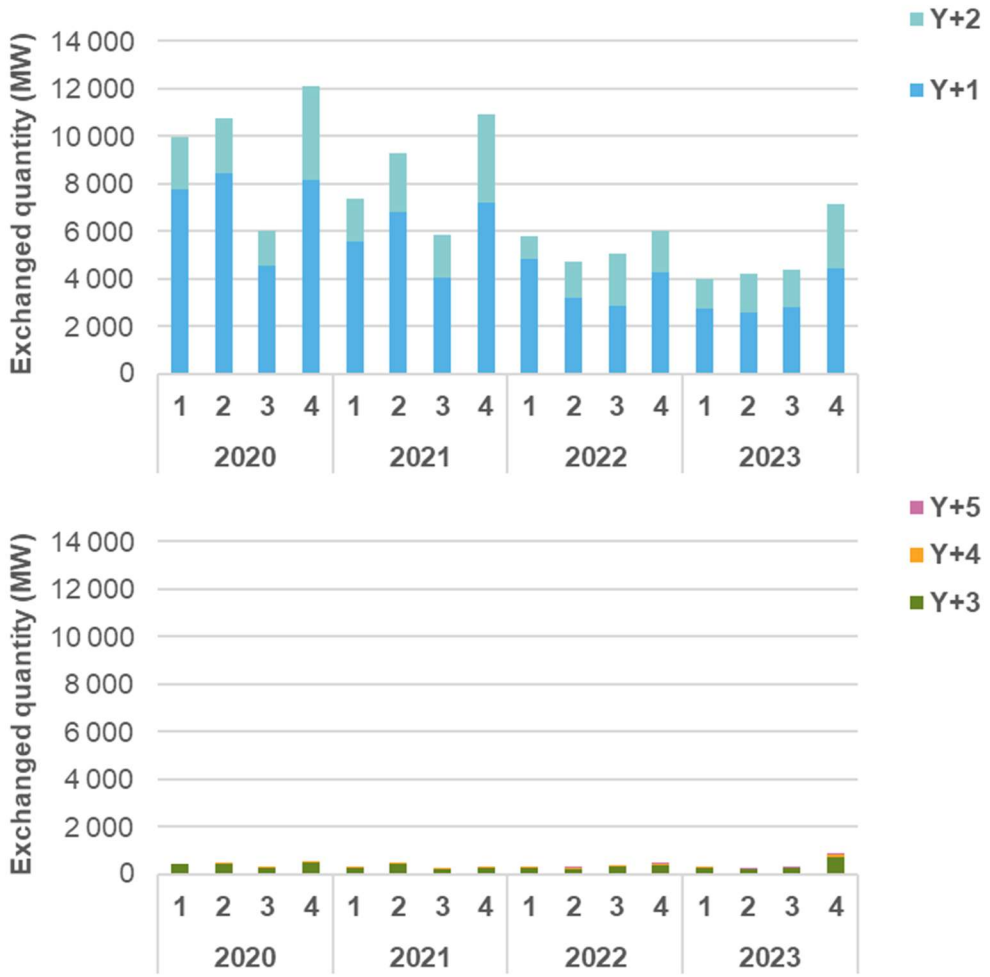
Finally, on May 29, 2024, EDF announced the extension of these tenders until at least December 2024. Beyond this deadline, EDF will continue to provide at least 5 MW/d of each of the Y+4 and Y+5 products available through tender or any other market mechanism, until the end of 2026.

As part of its mission to monitor wholesale markets, CRE pays particular attention to trades on these illiquid maturities, and closely monitors the operation of EDF's auctions. Furthermore, in its deliberation

[68] https://www.edf.fr/groupe-edf/edf-en-bref/optimisation-et-trading/appels-doffres-sur-des-rubans-annuels-delectricite-a-horizon-y4y5 & https://opendata.edf.fr/explore/dataset/prix-de-vente-suite-aux-encheres-rubans-d-edf-sa/table/?sort=-tri

no. 2024-10[69], CRE also stresses the importance of improving transparency and liquidity on wholesale markets, particularly for these longer-term maturities.

Figure 59: Quarterly sum of quantities exchanged on French Y+1 to Y+5 baseload contracts (in MW)



Source: REMIT data - Analysis: CRE

[69] Deliberation N°2024-10 of January 18th, 2024: https://www.cre.fr/fileadmin/Documents/Deliberations/import/240118_2024-10_Projet_Loi_Souverainete_energetique.pdf

4. Balancing markets: ancillary services, balancing and reserves

Products traded on balancing markets are considered under the REMIT regulation as wholesale energy products. As such, CRE is responsible for monitoring these markets. In addition, pursuant to the European regulation on balancing[70] (the "*Electricity Balancing*" regulation, hereafter "EB regulation"), and of article L. 321-11 of the French Energy Code, CRE approves the operating rules for these markets.

4.1. General principles and future developments of balancing markets

In order to always balance consumption and production, RTE, as the party responsible for the stability of the electricity network, requests services from balancing services providers to modulate power generation or consumption. Different types of reserves can be mobilized to ensure this balance. This includes frequency regulation services, which consist of frequency containment reserves (FCR) and automatic frequency restoration reserves (aFRR), activated automatically. In addition, replacement reserve can be mobilized through manual activation. Moreover, balance responsible parties (BRP) are financially incentivised to balance their injections and imports on one hand, and their withdrawals and exports on the other, ahead of real-time, in order to limit imbalance volumes.

The activation and procurement of balancing reserves is evolving towards a generalization of market-based mechanisms, particularly in the context of European integration of balancing markets. The CRE is actively involved in these developments, aiming to improve system efficiency for the benefit of consumers, and ensure the proper functioning of these new markets.

4.1.1. Frequency containment reserve (FCR)

Frequency containment reserve aims to contain frequency imbalances on the interconnected continental European network by modulating the injection or withdrawal of participating units in response to real-time frequency imbalances. RTE contracts FCR capacity from French and foreign balancing service providers through the "FCR" (*Frequency Containment Reserve*) cooperation, which RTE joined in early 2017. This cooperation involves daily auctions conducted jointly by TSOs from eight countries (Germany, Austria, Belgium, Denmark, France, Netherlands, Slovenia, Switzerland, and Czech Republic).

Only the FCR capacity is subject to a market-based mechanism. Because of the way this reserve is activated (automatic and decentralized based on frequency imbalances), there is no competition for energy activations. Furthermore, exchanges between countries resulting from FCR activation are never constrained by transmission capacities at the borders, as these exchanges have already been provisioned within the safety margins of the interconnections.

4.1.2. Automatic frequency restoration reserve (aFRR)

Automatic frequency restoration reserve is automatically activated by RTE through a signal sent to all participating units. Its purpose is to balance any deviations between scheduled and actual commercial exchanges at interconnections.

Historically, the activation of this reserve consisted in sending a single signal to all participants, without any competitive selection. Since November 2023, aFRR activation is subject to a market mechanism based on an economic merit order. Activations are now based on bids submitted by participants near real-time, with the selection optimized by RTE at the French level. The modalities implemented in France are designed as an extension of those provided by the European platform for aFRR activations, PICASSO ("*Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation*"), operational since June 2022. This platform integrates all submitted bids in Europe, the real-time needs of each TSO, and the transmission capacity available at the borders. Currently,

[70] Commission Regulation (EU) 2017/2195 of 23 November 2017 on a guideline for balancing the electricity system.

German, Austrian, and Czech TSOs are connected to PICASSO. RTE's connection is scheduled for 2025.

In France, the activation of aFRR by RTE is also optimized through the European IGCC ("*International Grid Control Cooperation*") platform, which compensates opposing needs among member countries, thereby limiting simultaneous aFRR activations in opposite directions across borders. RTE joined the project in 2016, and to date, TSOs from 24 countries participate in the IGCC platform.

Regarding the modalities of contracting aFRR capacity by RTE ahead of real-time, currently done through a regulated prescription, these will evolve towards a daily auction open to all certified participants. In November 2021, this major change was implemented for the first time but was suspended after several weeks due to a structural malfunction in this new market.

In 2022, the CRE granted RTE a three-year exemption for contracting aFRR capacity via auction, in compliance with national and European regulations. The CRE also specified conditions required for early termination of this exemption.

In January 2024, noting a significant improvement in the competitive situation of the aFRR market in terms of certified volumes, number of engaged participants, and the diversity of assets able to participate in this market, the CRE deliberated[71] to reopen contractualization of aFRR capacities by tender in June 2024.

4.1.3. Replacement Reserve (RR)

Replacement reserve is mobilised by RTE through the balancing mechanism, a market organised by RTE since 2004, and through the European platform for the exchange of standard products for balancing energy (hereinafter referred to as "TERRE platform"), to which RTE connected on 2 December 2020.

The TERRE platform is the result of cooperation initiated in 2014 by European TSOs that use replacement reserve products to balance their zones, including RTE. All TSOs using replacement reserve products must participate, in accordance with Article 19 of the EB regulation.

Any balancing market participant with balancing capacities that can be mobilised in less than 30 minutes can participate, starting from 1 MW. The TERRE platform enables, within the limits of available cross-zonal capacities after the closure of intraday trading, to exchange ”standard" replacement reserve offers, i.e., with certain predefined technical characteristics harmonised between the TSOs participating in the platform. The offer selection algorithm optimizes every hour, for the next four quarters of the following hour, to select the appropriate offers to be activated. Balancing offers are remunerated at the marginal price of the zone in which they are activated.

The platform was officially launched on 15 January 2020 and, by the end of 2022, 6 TSOs were connected to it. RTE has been connected since 2 December 2020 and has increased its participation throughout 2021 and early 2022. Since 21 March 2022, the initial controlled operation period has ended, and RTE has been participating in the TERRE platform on a continuous basis.

The participants in the balancing mechanism, known as " balancing service provider", submit bids to RTE, either for contracted or non-contracted units. These balancing service providers may utilize sites located in France (such as withdrawal, injection, or storage facilities), as well as sites located abroad that are called through interconnections. Bids define the technical conditions for activation, a price for activated energy, and, where applicable, a start-up price. RTE activates this reserve according to its needs and respecting a so-called "techno-economic" precedence, which takes into account not only the price of the bids but also their technical characteristics. RTE activates offers to manage the supply-demand balance in France, but also to resolve any congestion on the network, to increase the provision of system services, or to restore a sufficient level of flexible means available in the system.

[71] Deliberation of the Commission de Régulation de l'Énergie of 25 January 2024 on the decision to terminate the derogation granted to RTE under Article 6 of Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market in electricity

The European platform for exchanging standard rapid reserve products (hereinafter referred to as "MARI platform") was implemented in October 2022. The CRE granted RTE a derogation until July 2024 for connecting to the European MARI platform[72]

All production units connected to the transmission network are legally required to offer their available upward flexibility through bids submitted on the balancing mechanism. Part of the tertiary reserve is also subject to a capacity reservation by RTE. For 2023, RTE has contracted half of the manual frequency restoration reserve and replacement reserves (hereinafter "mFRR-RR") through an annual call for tenders launched on 28 July 2022, with submission of bids by 16 September 2022. The remaining has been contracted through a daily call for tenders. The mFRR-RR enable RTE to have at its disposal at any time 1,000 MW activable in less than 13 minutes (mFRR) and 500 MW additional activable in 30 minutes (replacement reserves).

The deliberation of 26 May 2023 validated, for the year 2024, to maintain the share of mFRR-RR capacities contracted at the daily call for tenders at 50% of contracted capacities[73].

4.1.4. The Balance Responsible Party (BRP) system

The balance Responsible Party (BRP) system incentivises market participants to balance electricity consumption and production within their perimeter as closely as possible, with each grid connection point assigned to the perimeter of a Balance Responsible Party. Imbalances (energy deficit or surplus for a given 30-minute period) are paid according to the value of the balancing energy that RTE had to mobilise to compensate for these imbalances. The imbalance settlement period will change from 30 minutes to 15 minutes on 1 January 2025, in accordance with Article 53(1) of the EB regulation.

Up to one hour before real-time, production schedules can be modified, and market participants can import or export energy through cross-border markets, thereby modifying the BRP's balance and the "physical" position of the French zone. After this moment, and up to five minutes before real-time, French market participants can continue to trade energy with each other on the French intraday market, without being able to modify production or import/export schedules. These exchanges thus impact the balance of the BRPs but not the physical balance of the French zone. During this period, RTE is the only entity taking "physical" balancing actions.

[72] CRE Deliberation of 21 July 2022 on the Decision to Grant Derogations for RTE's Connection to European Platforms for the Exchange of Balancing Energy from Secondary and Tertiary Reserve

[73] Deliberation by the Energy Regulatory Commission of 26 May 2023 approving the terms and conditions of the 2024 call for tenders for fast and additional reserves

4.2. Balancing markets in 2023

4.2.1. Overview

Table 12 presents the physical and financial summary of the balancing reserves contracted by RTE and the balancing energies activated.

Table 12: Balancing reserves contracted by RTE, balancing energies activated, and associated costs in 2023

2023	Contracts (paid for by TURPE)			Activations (paid for by BRs)			
				Upwards		Downwards	
Reserve	Direction	Avg MW	M€	GWh	M€	GWh	M€
FCR	Up & Down	514	33.7	544	51.4	539	-49.9
aFRR	Up & Down	699	133.2	1,155	131.4	1,251	-113.1
mFRR	Up	1,500	242.4	1,731	765.7	1,338	-210.5
RR				983		2,600	
Total		**2,713**	**409**	**4,414**	**948.5**	**5,728**	**-373.4**

Source: RTE – Analysis: CRE

The costs of contracting are covered by the public transmission system access tariff (hereinafter "TURPE").

The contracting cost of the primary reserve decreased by €67 million in 2023, partly due to the general decline in wholesale prices in 2023, and partly due to the continued deployment by operators of certified battery storage fleet to provide this reserve at a lower cost, as detailed below.

The secondary reserve was contracted in 2023 based on a prescription at a regulated price of €22.1/MWh and was more expensive than the primary reserve (€133 million). This arrangement will evolve towards a daily tender settled at marginal price starting from June 2024 (see §4.1.2).

The contracting cost of manual frequency restoration reserve and replacement reserves increased significantly by €218.5 million in 2023. This increase was driven by the annual tender conducted by RTE at the worst moment of the wholesale price crisis in early September 2022, with prices multiplied by 30 compared to 2022.

Activation costs are paid by balance responsible parties through the settlement of imbalances, apart from additional costs related to activations for non-balancing reasons, which are paid by consumers via the TURPE.

Activations of balancing reserves on the balancing mechanism and the TERRE platform represented a net cost of €555 million in 2023, down from €671 million in 2022. This difference is explained by the decrease in the price of activated upward bids, which follows the downward trend in wholesale electricity prices.

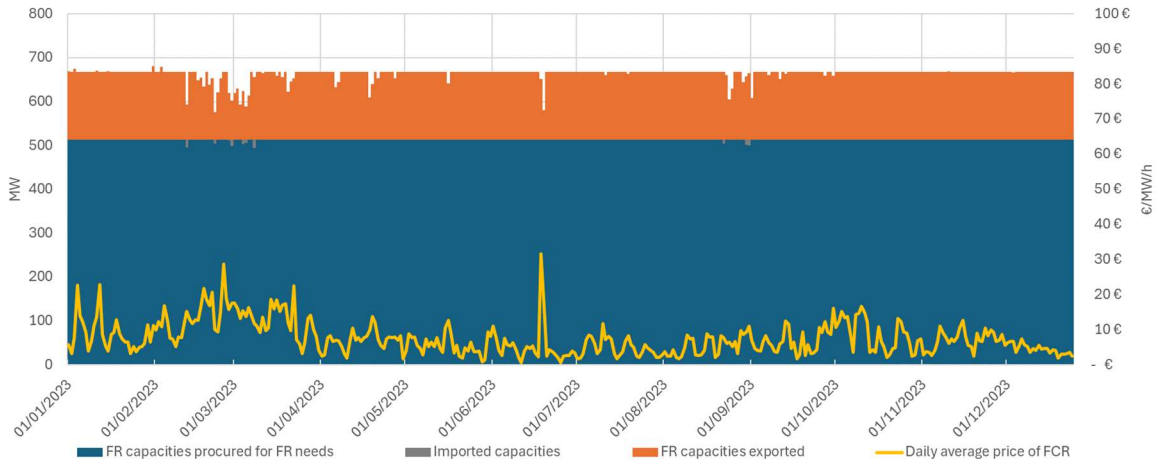
Energy activated from the primary reserve is valued at the spot price. This was also the case for the energy from the secondary reserve until November 2023, when France switched to a market-based system for activating this reserve. As activations of these two reserves are on average centred around zero, the net value of activated energy from primary and secondary reserve was therefore low in 2023. From 2024, the first year of fully operational energy market for the secondary reserve, a rise in the net cost of activating this reserve could be observed, as operators can now freely reflect their constraints and thus their costs in each direction of activation, independently of the spot price.

4.2.2. The FCR cooperation

Since 1 July 2020, FCR has been contracted through a daily tender conducted at 8 a.m. each day for the following day, divided into six four-hour slots constituting six different products.

Figure 60 shows the weekly average prices and volumes of primary reserve contracted, imported, and exported in France. RTE's demand is constant over a year. The volume contracted in France corresponds to the sum of RTE's demand and the export-import balance with other cooperating countries. In 2023, the FCR contracted in France was massively exported to other cooperating countries, often reaching the maximum export levels.

Figure 60: FCR prices and volumes in France (daily average)

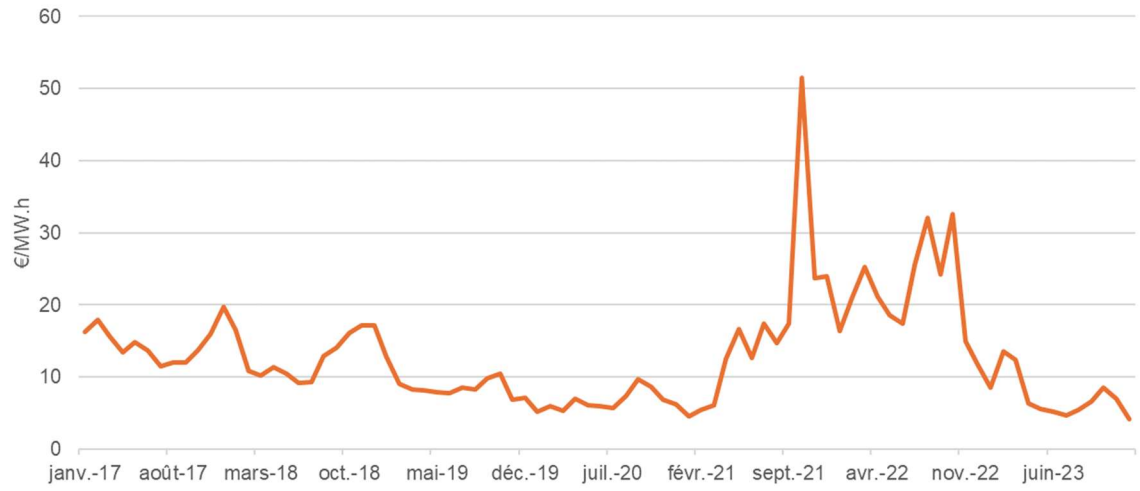


Source: FCR Cooperation (www.regelleistung.net) – Analysis: CRE

The average daily price of FCR varied significantly in 2023 but was mostly below €10/MWh (76% of hours in 2023). In 2023, the average price of FCR was €7/MWh, representing a sharp decrease compared to the average prices observed in 2022 (€22/MWh). Therefore, the total contracting cost of FCR in 2023 is lower than in 2022. In the longer term, the price of FCR has followed a downward trend since the beginning of the cooperation, as shown in Figure 61, except for the crisis period between the end of 2021 and the end of 2022. This trend can be explained by the abundance of supply, particularly in the battery segment: by the end of 2023, the volume of batteries certified for the primary reserve reached around 500 MW (compared with around 100 MW at the beginning of 2021) and continues to grow, demonstrating the success of market opening to attract investments in this type of asset.

Due to these low contracting costs, France was also the main exporter of primary reserve capacities in the FCR cooperation in 2023, with an average export balance of around 134 MW (compared with 45 MW in 2022).

Figure 61: Monthly average prices of contracted FCR in France since the beginning of RTE's participation in the FCR cooperation



4.2.3. aFRR capacity

As part of the construction of an integrated European balancing market, the contracting and activation modalities of aFRR capacity, which historically operated under regulated modalities, are undergoing structural transformations to evolve towards market-based systems open to all assets certified for this reserve (see §4.1.2).

Since the end of November 2023, energy activations of aFRR have been optimised in real-time by RTE through a market mechanism that ranks French market participants' bids according to merit-order at the national level. The transition from a national market for aFRR activations to an integrated European market is planned for 2025, with RTE's connection to the European PICASSO platform. The modalities for contracting the capacities of aFRR by RTE ahead of real-time will also evolve towards a market-based mechanism from June 2024.

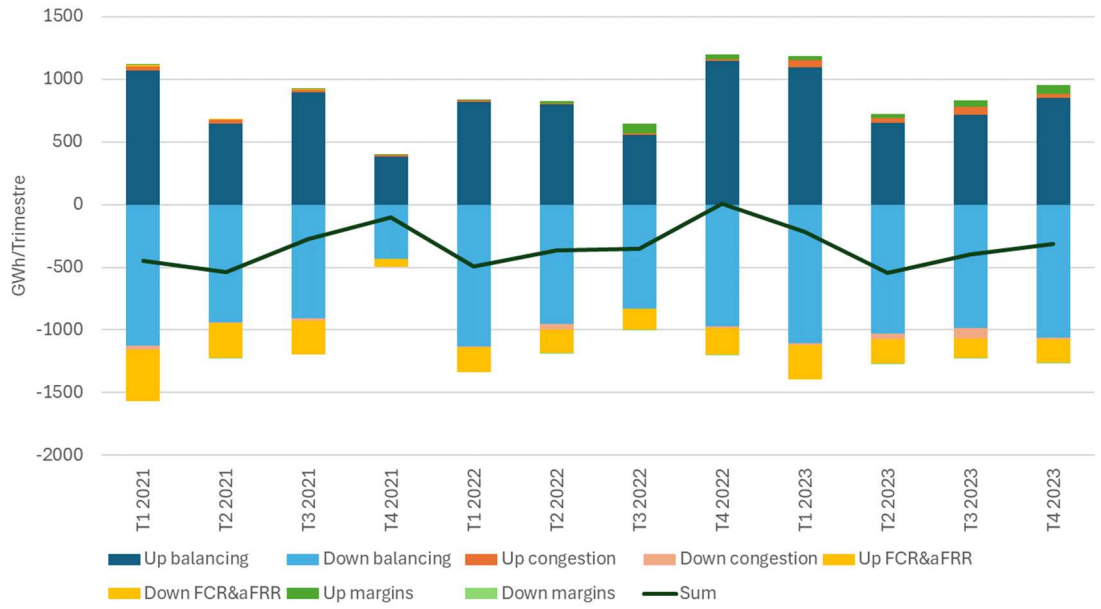
These structural changes to the methods of contracting and activating aFRR will be closely examined by the CRE during 2024 and will be part of the analysis of the balancing markets for the year 2024.

4.2.4. The balancing mechanism

Figure 62 presents the volumes energy activated upward and downward by RTE since 2020 for various reasons.

Activations to manage supply-demand balance ("balancing" reason) represent the majority of activations, but the reconstitution of frequency ancillary services ("FCR & aFRR") is a significant cause of downward activation (16% of downward activated volumes in 2022 and 2023). Activations for congestion ("congestion") and margins ("margins") represent small volumes. Net activated volumes are on average negative, indicating a tendency from balance responsible parties to over-cover themselves to avoid having to pay high price from the settlement of negative imbalances.

Figure 62: Monthly activated volumes by reason and net volume

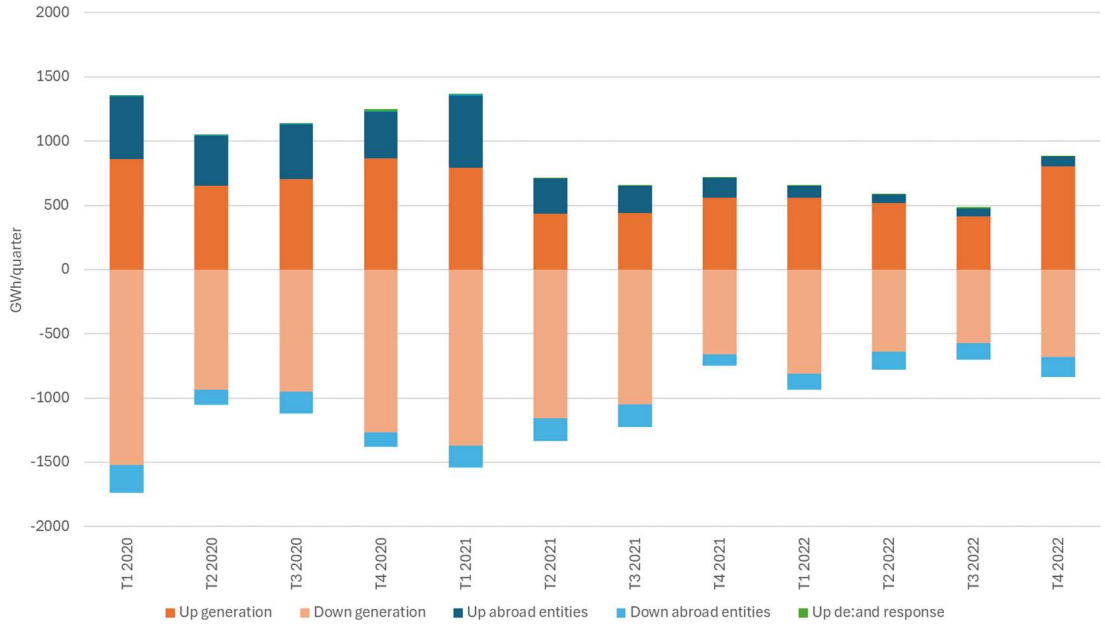


Source: RTE – Analysis: CRE

Figure 63 presents the average volumes of balancing by entity type and direction of activation.

There is a predominance of injection-type balancing entities (generation groups), representing 72% of upward activations and 85% of downward activations in 2023. RTE's activations of load reductions are limited, accounting for 0.3% of volumes activated by RTE in 2023. Balancing entities located abroad ("exchange points") constitute a significant portion of activations on the balancing mechanism, increasing from 12% in 2022 to 28% of upward activations in 2023. This rise is due to decreased balancing needs covered by the TERRE platform, as well as by a drop in the volumes of bids submitted on the balancing mechanism due to the increase of the share of generation located on the public distribution network, for which participation in the balancing mechanism is not mandatory.

Figure 63: Balancing volumes by entity type and direction of activation

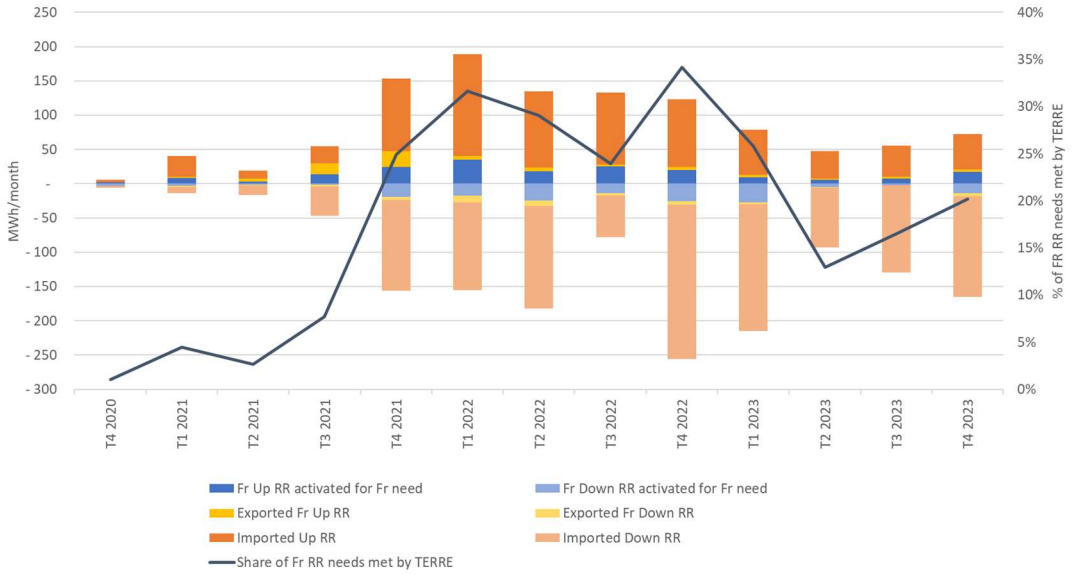


Source: RTE – Analysis: CRE

4.2.5. TERRE Platform

In December 2020, when it first connected, RTE was using the TERRE platform for only 4 hours a day. RTE's participation in the TERRE platform has been gradually increasing, reaching a usage on every time slot since 21 March 2022. The following figure presents the monthly volumes activated by RTE on the TERRE platform.

Figure 64: Volumes activated on the TERRE platform by RTE



Source: RTE – Analysis: CRE

RTE significantly increased its participation on the platform since August 2021, and this is particularly visible in the volumes activated to meet RTE's needs. In 2023, RTE activated on average 20% of its replacement reserve needs on the TERRE platform. Despite increased participation by RTE, liquidity of French bids on the platform remains low, and the majority of French demand is met by foreign bids, which are currently priced lower on average than those from French market participants.

4.3. CRE's monitoring of balancing markets

Balancing markets represent less significant financial stakes than spot and forward energy markets. However, they play a very important role for the proper functioning of the electricity system and are evolving rapidly.

CRE regularly analyses the functioning of RTE's balancing mechanism. In this context, CRE reminds market participants operating "exchange point" balancing entities on the French-Swiss or French-German borders that it is prohibited to source power on the French intraday market to respond to an activation from RTE on the balancing mechanism. This behaviour is explicitly contrary to the RE-MA rules (article 4.2.1.2): "*Activation of an offer from an exchange point balancing entity must not lead to purchase (for upward offers) or sale (for downward offers) by the balancing market participant on the French intraday market, whether through explicit flow or an implicit nomination.* "

Finally, CRE reminds market participants that balancing markets are considered to be wholesale energy product trading markets. Actions on these markets are therefore subject to obligations and prohibitions defined in the REMIT regulation. Specifically, ACER has communicated[74] examples of practices that may, in certain circumstances, be considered abusive under the REMIT regulation.

[74]ACER communicated on these practices in the 24th edition of the ACER REMIT Quarterly Q1 2021 newsletter: https://documents.acer-remit.eu/wp-content/uploads/REMITQuarterly_Q1_2021_1.0.pdf.

5. The capacity market

In its decision on 8 November 2016, following a year-long investigation, the European Commission authorised the French capacity mechanism under EU state aid rules. The practical implementation of the mechanism began in December 2016 for a first delivery year (AL) in 2017.

5.1. Key principles of the French capacity mechanism

The provisions of articles L. 335-1 and the followings of the French Energy Code establish a capacity obligation mechanism. It stipulates that *"each electricity supplier contributes, based on the consumption characteristics of their customers, in terms of power and energy, on the continental metropolitan territory, to the security of electricity supply."* Each supplier is thus required to procure capacity guarantees to cover the consumption of their customer portfolio during national peak consumption periods. These guarantees can be obtained by investing in new production or load reduction means, or by procuring them from capacity operators and on the market. The cost of this obligation, introduced to ensure the security of supply for consumers, is passed on by suppliers to their customers.

Obliged parties and operators can trade capacity guarantees bilaterally, on the over-the-counter (OTC) market, or through the EPEX SPOT organised market in the form of auctions. These auctions are organised on continuous basis, with 15 auctions ahead of a given delivery year.

The price of capacity guarantees is determined by the market's meeting of supply from operators, who commit to the availability of their production means, and demand from obliged parties, corresponding to their consumers' contribution to the risk of system's failure.

In theory, the price of capacity should be set at the cost of the cheapest production means used to meet the security of supply criterion. The rules defining the mechanism's ceiling price are aligned with the tension that should arise if the generating plants fleet is undersized: "*The [ceiling price] corresponds to the minimum annual capacity revenue needed to ensure the economic viability of developing or maintaining in service the capacities required to meet the security of supply criterion, defined by public authorities over the medium-term horizon in the projected supply estimates report.*"

The decree of 5 October 2023 amends the capacity mechanism rules. Specifically, the duration of the last delivery year of the mechanism is shortened from January to March 2026 to enable the implementation of a future capacity mechanism from November 2026. Consequently, CRE has set the administered price at €44,000/MW for the "*shortened*"[75] AL 2026, to account for potential capacity remuneration at the end of 2026 via the new capacity mechanism. The administered price is maintained at €60,000/MW for AL 2025.

Additionally, the decree now provides a framework for early termination of purchase obligation contracts to limit financial impact and accelerate the certification process. Participation in the mechanism by facilities subject to CO_2 emission thresholds as per Regulation (EU) 2019/943 of the European Parliament and Council of 5 June 2019 is also specified in the decree, allowing operators to submit a compliance plan outlining the measures taken to ensure that the facility meets the emission thresholds in the absence of the production history required for certification for AL 2025 and 2026.

All changes to the rules and parameters of the capacity mechanism are described in the dedicated CRE deliberation[76].

[75] CRE Deliberation No. 2023-308 of 28 September 2023, approving the ceiling price used in the financial settlement of imbalances in the capacity mechanism for the years 2025 and 2026.

[76] Deliberation No. 2023-309 of 28 September 2023, providing an opinion on the draft rules of the capacity mechanism.

5.2. Capacity price for the delivery year 2024 reflected a significant improvement in margins for the electricity system.

The year 2023 was mainly marked by auctions for the delivery years 2024 and 2025.

Table 13: Clearing prices and volumes traded for auctions for the delivery year 2024

AL 2024	02/03/2023	27/04/2023	22/06/2023	21/09/2023	16/11/2023	07/12/2023
Price (€/MW)	29,899.1	34,499.8	35,000.0	32,799.1	35,379.5	6,200.2
Volume (MW)	4,288.0	4,486.4	4,357.9	4,591.1	4,771.4	7,923.2

Source: EPEX SPOT – Analysis: CRE

Table 14: Clearing prices and volumes traded for auctions for the delivery year 2025

AL 2025	26/10/2023	16/11/2023	07/12/2023
Price (€/MW)	25,500.3	25,000.3	9,368.3
Volume (MW)	4,187.8	4,982.5	6,572.4

Source: EPEX SPOT – Analysis: CRE

The average capacity price for AL 2024, which is used as a reference price for additional capacity in the regulated electricity tariffs, is €27,094/MW, compared to €45,622/MW for AL 2023. Therefore, the capacity price returns to the level of AL 2022 (€26,250/MW).

The price set by the last auction before the delivery year, €6,200/MW, is the imbalance settlement price (PREC), which serves as a reference for:

- Settlement of rebalancing costs when operators or obliged parties reassess their level of certified capacity or capacity needs;
- Imbalance settlement that occurs in AL+3 based on actual values;
- The capacity portion of the TRVE capping[77] ;
- Long-term and load reduction tenders (AOLT and AOE) for calculating additional remuneration of carbon-free flexibilites.

This price is particularly low compared with the price of other auctions for AL 2024 or previous PRECs (€60,000/MW for AL 2023 and €23,900/MW for AL 2022). During this last auction, the supply greatly exceeded demand (13.8 GW versus 9.2 GW), which can be explained on the demand side by persistent consumer sobriety and on the supply side by more operators offering capacity guarantees at low prices.

After an AL 2023 particularly affected by low nuclear availability, the capacity market balance for AL 2024 returns to levels observed in the past. The gradual return to normal of nuclear availability and the ongoing effects of consumption sobriety improve the system's margins for AL 2024 compared with AL 2023.

[77] Before AL 2024, only the last auction before the AL was considered for the capacity share. For AL 2024, to account for market participant anticipation, the average of the last two auctions was used.

Despite the decline in electricity prices since spring 2023, which reduced the profitability of thermal power plants, CRE observes that the "*missing money*"[78] for all thermal technologies is zero for 2024, particularly coal and oil-fired combustion turbines, as they benefited from the very high prices observed in 2022.

Table 15: Certification levels of capacities for AL 2023 and AL 2024

Sector	December 2022 (AL 2023) (GW)	March 2024 [79](AL 2024) (GW)	Evolution (GW)
Nuclear	39.9	43.9	+4.0
Lac/STEP	10.4	10.2	-0.2
Renewables + others *of which batteries*	15.8 *0.4*	16.6 *0.7*	+0.8 *+0.3*
Load shedding	3.1	3.5	+0.4
Gas	7.2	7.1	-0.1
Coal	1.6	1.4	-0.2
Oil/fuel	1.9	1.8	-0.1
Total – excl. interconnections	**80.3**	**84.6**	**+4.3**
Interconnections	8.4	7.7	-0.7
Total – incl. interconnections	**88.7**	**92.3**	**+3.6**

Source: RTE Register – Analysis: CRE

Table 16: Estimated capacity obligation updated by RTE in December 2022 for AL 2023 and December 2023 for AL 2024

	Estimation of obligation for AL 2023 (GW)	Estimation of obligation for AL 2024 (GW)	Evolution (GW)
Low trajectory	90.4	90.0	-0.4
Central trajectory	91.8	91.0	-0.8
High trajectory	93.4	93.8	+0.4

Source: RTE – Analysis: CRE

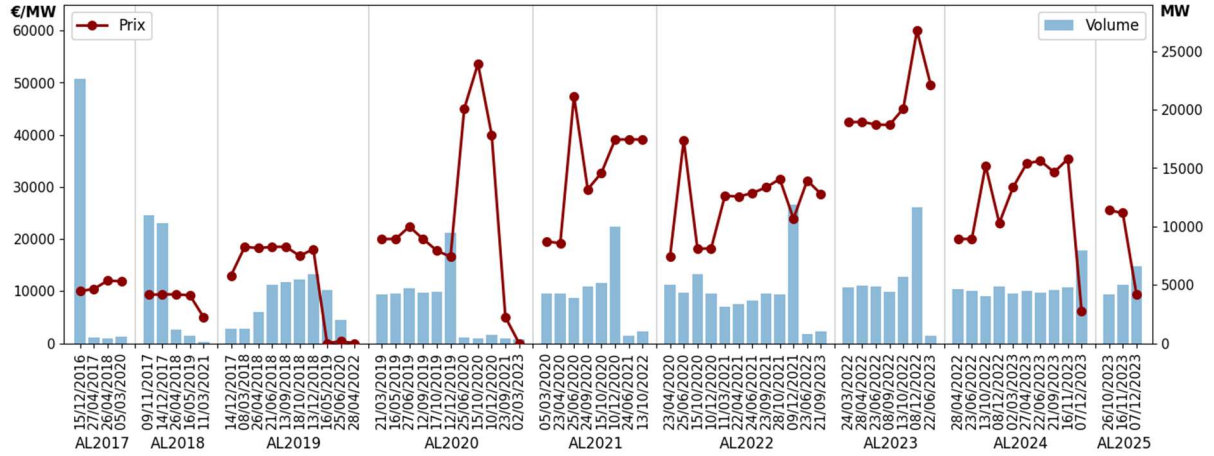
The level of capacity certification (Table 15) compared with the estimated capacity obligation (Table 16) shows how the supply-demand imbalance of the capacity market for AL 2023 is being reduced for AL 2024, mainly due to nuclear (excluding EPR Flamanville 3) and new decarbonised capacities (renewables, batteries, and load reduction). Although the capacity mechanism rules provided for a stable

[78] For a given capacity, the revenue needed to maintain its operation (if existing) or to build it (for new capacity) but not provided by the energy market. The methodology is detailed in the 2019 and 2018 wholesale market monitoring reports.
[79] The state of the register of capacity guarantees has not enabled CRE to establish a vision for December 2023. CRE publishes a vision for March 2024, after correction of the inconsistencies detected by its departments, on the basis of the data produced by RTE.

contribution of interconnections between AL 2023 and AL 2024 (-0.1 GW from 2023 to 2024), unavailabilities led to a lower level of certification for these ALs. A rebalancing occurred during AL 2023, taking into account lower-than-anticipated availability at the Spanish and English borders, which also affected AL 2024. As a result, certification levels for interconnections are comparable between the two ALs.
Given the decline in consumption, which does not seem to be returning to pre-crisis levels, the capacity market is likely to be slightly "long" *a posteriori*. Therefore, the capacity price for AL 2024 should remain low during rebalancing auctions.

Regarding AL 2025, the system seems to have comfortable margins, thanks to continued progress in nuclear certification, notably with the connection and ramp-up of the Flamanville 3 EPR (46.6 GW view in December 2023 for AL 2025 compared to 43.9 GW for AL 2024 at the same date), ongoing development of renewables, and increased interconnection contributions[80]. However, the anticipated profitability of fossil thermal means could deteriorate with the decrease in wholesale prices. To date, the capacity guarantee prices observed during the first auctions for AL 2025 were at intermediate to low levels, between €9,000/MW and €25,000/MW.

Figure 65: EPEX SPOT capacity auction prices



Source: EPEX SPOT – Analysis: CRE

[80] Deliberation No. 2023-309 of 28 September 2023, providing an opinion on the draft rules of the capacity mechanism, forecasts an interconnection contribution of 11.1 GW for AL 2025.

6. Summary of the functioning of wholesale electricity markets in France in 2023

Electricity markets in 2023 were marked by the gradual resolution of the two crises that affected them in 2022: firstly, the gas supply crunch in Europe and the resulting extremely high gas prices, and secondly, the detection of stress corrosion phenomenon affecting the availability of the French nuclear fleet.

Prices observed in 2023, although declining, remained significantly higher and more volatile than before the crisis, mainly due to gas prices remaining high compared to historical levels. Electricity consumption continued to decrease in 2023 compared to 2022, possibly indicating a lasting change in consumption habits, resulting from energy-saving efforts and high prices.

Production increased significantly between 2022 and 2023, driven by the recovery of nuclear production, which rose from 279 TWh in 2022 to 320 TWh in 2023. Total production in France, at 495 TWh in 2023, remains significantly lower than the average of the years 2016-2019, which was 536 TWh. Renewable electricity production increased by 21% between 2022 and 2023, mainly due to a significant increase in wind production relative to its installed capacity. Installed capacities of wind and photovoltaic grew at a pace compatible with the PPE targets for 2028. Fossil thermal production decreased in 2023, as it had compensated for weak nuclear production in 2022. The marginality of the different production sectors returned in 2023 to a more historically consistent distribution, after the exceptional year of 2022, which saw imports influence daily prices in France more significantly, as interconnections were essential to meet French demand.

In 2023, daily electricity prices in France fell sharply, averaging €96.9/MWh, a decrease of 65% compared to 2022 (€275.8/MWh), and 11% compared to 2021 (€109.2/MWh). However, these price levels remain significantly higher than pre-crisis levels (for example, €39.4/MWh in 2019). Daily prices were also more volatile than before the crisis, and 2023 marked a record for the number of negative price hours. However, for 61% of these negative price hours, prices did not drop below -€0.01/MWh, indicating that there is a downward production flexibility that limits truly negative prices.

On forward markets, prices remained high and volatile in the first half of the year, with the price for baseload delivery in 2024 oscillating between €150 and €240/MWh, before falling sharply throughout the second half of the year, reaching a low of €86/MWh on 19 December 2023. The spread with German prices followed the same trend, narrowing from €30/MWh at the end of June to less than €5/MWh at the beginning of September. From 11 December, the French price even became lower than the German price until the end of the year. This sharp decrease in French prices, both in absolute terms and relative to German prices, reflects improved fundamentals, especially in nuclear production expectations, as well as the reduction of the risk perceived by the market.

Volumes traded in the markets in 2023 increased compared to 2022 but did not return to pre-crisis levels. This is due to some improvement in market conditions compared to 2022 and the arrival of new market participants, especially in the short-term markets. In the intraday market, there was a very strong increase in orders placed, and to a lesser extent in traded volumes, partly due to the intensification of algorithmic trading practices. This development is positive and favourable to liquidity growth in these markets.

On forward markets, the use of physically settled contracts significantly decreased (-54% between 2022 and 2023), in favour of financially settled instruments. This trend has been ongoing and strengthening in recent years and may reflect a greater consideration of counterparty risk since the 2022 crisis experience. Regarding open positions on forward markets, OTC sales by EDF of the production under purchase obligations still represent a large share of selling positions (nearly 50% at the end of 2023 for the annual product 2024). On longer maturities, activity remains limited. In September 2023, EDF launched daily tenders for the sale of physical products for baseload delivery in the years Y+4 and Y+5, with a capped volume of 5 MW/day for each of the two products.

Balancing mechanisms continued their evolution towards market mechanisms in 2023, with the start in November 2023 of energy activation for secondary reserve according to economic precedence. Balancing markets are also continuing their integration at the European level, with RTE's connection to the European aFRR activation platform planned for autumn 2024, and the CRE's derogation regarding RTE's connection to the European mFRR activation platform valid until July 2024. Balancing markets

are considered wholesale energy product trading markets under the REMIT regulation and therefore fall within the scope of CRE's monitoring mission.

The prices resulting from the capacity mechanism auctions conducted in 2023 for the delivery year 2024 reflected a clear improvement in margins on the electricity system, averaging €27.1k/MW in 2023, compared to €45.6k/MW for the delivery year 2023 in 2022. The price of the last auction for the delivery year 2024, at €6.2k/MW, is particularly low, explained on the demand side by continued consumer sobriety efforts and on the supply side by more operators offering low-priced capacity guarantees.

KEY FIGURES

1. Gas markets

Table 17: Fundamentals of the gas market in France

Market fundamentals	Yearly values			Yearly variation 2023/2022	
	2021	2022	2023	In percentage	In value
Entry and exit flows					
Supply (TWh)	685	731	625	-14%	-106
Storages withdrawals	155	107	138	29%	31
Imports	526	617	487	-21%	-130
Pipeline	361	320	234	-27%	-86
LNG	164	297	253	-15%	-44
Production	4	7	0	-100%	-7
Demand (TWh)	685	731	0	-100%	-731
Storages injections	137	145	137	-6%	-8
End consumers demand	474	431	382	-11%	-49
Distribution consumers	303	253	237	-6%	-16
Consumers connected to the transmission system	171	178	145	-18%	-33
Exports	72	154	137	-11%	-17
Other	2	2	2	12%	0
Deliveries at PEG (TWh)	854	931	949	2%	18

Sources: GRTgaz, Teréga – Analysis: CRE

Table 18: Gas prices in France

Price	Yearly values			Yearly variation 2023/2022	
	2021	2022	2023	In percentage	In value
Spot prices (€/MWh)					
PEG day-ahead (avg.)	46,5	98,1	38,8	-60%	-59,3
Day-ahead PEG Nord/TTF Spread (avg.)	-0,2	22,3	1,8	-92%	-20,5
Forward prices (€/MWh)					
PEG M+1 (avg.)	47,4	112,8	39,9	-65%	-72,9
PEG Y+1 (avg.)	33,7	107,3	50,5	-53%	-56,8
M+1 PEG/TTF spread (avg.)	0,18	6,86	1,68	-76%	-5,2
Summer-ahead/Winter-ahead spread (avg.)	0,9	6,9	8,1	17%	1,2

Sources: EEX, ICIS – Analysis: CRE

Table 19: Gas trading in France

Trading activity	Yearly values			Yearly variation 2023/2022	
	2021	2022	2023	In percentage	In value
Natural gas exchanged at PEG* (TWh)	674	1302	1674	29%	372
% of national consumption	156%	302%	438%		136%
Trading volumes in the French intermediated markets					
Spot market (TWh)	206	328	407	24%	80
Intraday	40	52	59	13%	7
Day Ahead	111	163	197	21%	34
Exchange (DA, WD, WE, other spot)	199	287	322	12%	34
Brokers (DA, WD, WE, other spot)	7	31	39	28%	9
Forwards market (TWh)	468	975	1199	23%	224
M+1	103	206	225	9%	19
Q+1	46	107	130	22%	23
S+1	72	149	175	18%	26
Y+1	6	6	16	156%	10
Exchange (all maturities)	35	63	100	59%	37
Brokers (all maturities)	432	912	1074	18%	162
Number of transactions in the French intermediated markets					
Spot market	157 874	244 163	0	-100%	-244 163
Intraday	38 901	47 584	50 779	7%	3 195
Day Ahead	98 887	133 495	143 121	7%	9 626
Exchange (DA, WD, WE, other spot)	154 981	234 352	249 637	7%	15 285
Brokers (DA, WD, WE, other spot)	2 893	9 811	12 435	27%	2 624
Forwards market	5 663	15 354	17 373	13%	2 019
M+1	2 396	6 279	6 328	1%	49
Q+1	377	1 110	1 339	21%	229
S+1	288	819	1 266	55%	447
Y+1	55	69	163	136%	94
Exchange (all forward maturities)	1 586	5 635	5 825	3%	191
Brokers (all forward maturities)	4 077	9 720	10 960	13%	1 240

* Deliveries from exchanges on intermediated markets in France

Sources: EEX, brokers – Analysis: CRE

2. Electricity Markets

Table 20: Installed generation capacities in France

	Yearly values			Yearly variation 2023 / 2022	
	2021	2022	2023	In percent	In value
Installed capacity (GW)	**139,2**	**143,8**	**149,1**	**3,7%**	**5,3**
Nuclear	**61,4**	**61,4**	**61,4**	**0%**	**0**
Hydro	**25,7**	**25,7**	**25,7**	**0%**	**0**
Fossil-fuel	**18,0**	**17,5**	**17,5**	**0%**	**0**
Coal	1,8	1,8	1,8	0%	0,0
Oil	3,4	3,1	3,1	0%	0,0
Gas	12,8	12,6	12,6	0%	0,0
RES (excluding hydro)	**34,1**	**39,2**	**44,5**	**14%**	**5**
On-shore Wind	18,8	21,2	23,3	10%	2,1
Solar	13,1	15,8	19,0	20%	3,2
Biomass	2,2	2,2	2,2	0%	0,0

Source: RTE – Analysis: CRE

Table 21: Electricity generation by type in France

	Yearly values			Yearly variation 2023 / 2022	
	2021	2022	2023	In percent	In value
Generation (TWh)	**519,7**	**439,6**	**480,8**	**9,4%**	**41,2**
Nuclear	**360,5**	**278,3**	**318,6**	**15%**	**40,3**
Hydro	**61,1**	**49,3**	**56,1**	**14%**	**6,8**
Fossil-fuel	**38,5**	**47,4**	**30,5**	**-36%**	**-16,9**
Coal	3,8	2,9	0,9	-69%	-2,0
Oil	1,9	1,6	1,7	8%	0,1
Gas	32,8	42,9	27,9	-35%	-15,0
RES (excluding hydro)	**59,6**	**64,7**	**75,6**	**17%**	**10,9**
On-shore Wind	36,0	38,0	47,9	26%	9,9
Solar	14,0	18,4	21,5	17%	3,1
Biomass	9,7	8,3	6,2	-25%	-2,1
Cunsumption including network losses (TWh)	**472,0**	**453,0**	**439,0**	**-3,1%**	**-14,0**

Source: RTE – Analysis: CRE

Table 22: Imports and exports in France

	Yearly values			Yearly variation 2023 / 2022	
	2021	2022	2023	In percent	In value
Balance at border (TWh)					
CWE	-10,1	-27,4	2,5	-109,1%	29,9
Italy	17,6	17,9	20,0	11,7%	2,1
Spain	6,1	-9,1	-1,9	-79,2%	7,2
Switzerland	15,6	12,1	16,4	35,9%	4,3
Great Britain	13,9	-9,9	13,3	-233,9%	23,2
Total (TWh)	**43,1**	**-16,5**	**50,3**	**-404%**	**0,0**

Source: RTE – Analysis: CRE

Table 23: Balance at borders

	Yearly values			Yearly variation 2023 / 2022	
	2021	2022	2023	In percent	In value
Import (TWh)	**43,8**	**72,9**	**43,3**	**-40,6%**	**-29,6**
Import Peak (TWh)	16,3	26,2	15,9	-39,3%	-10,3
Impork Offpeak (TWh)	27,5	46,7	27,4	-41,3%	-19,3
Export (TWh)	**87,0**	**56,4**	**93,6**	**66,0%**	**37,2**
Export Peak (TWh)	30,3	18,4	32,1	74,2%	13,7
Export Offpeak(TWh)	56,6	37,9	61,5	62,1%	23,6
Export balance (TWh)	**43,1**	**-16,5**	**50,3**	**-**	**66,8**

Source: RTE – Analysis: CRE

Table 24: Injection – Withdrawal balances of the French electrical system

	Yearly values			Yearly variation 2023 / 2022	
	2021	2022	2023	In percent	In value
Physical injections into grids (TWh)	481	510	516	**1,1%**	6
Generation Excluding ARENH	309	309	345	12%	-36
ARENH generation	128	128	129	1%	1
Commercial Imports	44	73	42	-42%	-31
Physical withdrawals from grids (TWh)	560	510	516	**1,1%**	6
End-user consumption	430	411	383	-7%	-28
Water pumping	6	7	6	-19%	-1
Commercial Exports	87	56	93	65%	37
Grid losses purchased on markets	37	36	34	-4%	-2

Source: RTE – Analysis: CRE

Table25: Spot and forward prices of the French electricity market

	Annual values			Annual variation 2023/2022	
	2021	2022	2023	Percentage	Value
Short-term market prices					
Intraday price France €/MWh	109,7	276,3	98,4	-64%	-177,9
Day-ahead price France €/MWh	109,2	275,8	96,9	-65%	-178,9
Peakload day-ahead price France €/MWh	127,4	317,1	109,6	-65%	-207,5
Day-ahead France-Germany spread €/MWh	12,4	40,4	1,7	-96%	-38,7
Peakload day-ahead France-Germany spread €/MWh	11,9	49,7	3,4	-93%	-46,3
Day-Ahead France-Germany convergence rate %	49%	34%	29%	-16%	-0,1
Forward market prices					
M+1 price France €/MWh	133,9	394,4	108,9	-72%	-285,5
M+1 France-Germany spread €/MWh	25,2	108,4	0,2	-100%	-108,2
Q+1 price France €/MWh	136,2	539,6	128,2	-76%	-411,4
Q+1 France-Germany spread €/MWh	25,3	202,9	8,2	-96%	-194,7
Y+1 price France €/MWh	96,4	367,7	162,7	-56%	-205,0
Y+1 France-Germany spread €/MWh	7,4	69,5	20,8	-70%	-48,7

Sources: Argus, EEX, EPEX SPOT, Nord Pool – Analysis: CRE

Table 26: Spot and forward volumes on the French electricity market

	Annual values			Annual variation 2023/2022	
	2021	2022	2023	Percentage	Value
Intraday market - TWh					
Buy	10,5	12,9	20,4	58%	7,5
Sell	10,6	13,2	19,0	44%	5,8
SPOT market - TWh					
Buy	128,5	122,4	117,6	-4%	-4,9
Sell	127,5	119,6	117,8	-2%	-1,8
Forward market					
Volumes TWh	**797,6**	**568,8**	**672,6**	18%	103,8
Exchange (financier)	166,8	108,6	178,7	65%	70,1
Brokers (financier)	319,0	294,5	411,9	40%	117,3
Brokers (physique)	280,0	133,0	58,9	-56%	- 74,1
EDF OA Auction (physique)	31,7	32,7	23,1	-29%	- 9,6
Y+1 product					
Volumes TWh	100,0	60,1	123,2	105%	63,1
Q+1 product					
Volumes TWh	98,1	72,2	82,1	14%	9,9
M+1 product					
Volumes TWh	197,6	127,3	106,0	-17%	- 21,3

Sources: REMIT data – Analysis: CRE

Table 27: Concentration index (HHI) of the different segments of the wholesale electricity market in France

	HHI - Concentration de marché	
	2022	2023
Livraison		
Forward markets (Physical) - purchases	1117	785
Forward markets (Physical) - sales	639	656
Futures markets (Financial) - purchases	954	886
Futures markets (Financial) - sales	895	891
EPEX - purchases	2015	850
EPEX - sales	1737	2645
Injections		
Generation	5874	6252

Sources: REMIT data, RTE – Analysis: CRE

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