

PEXAPARK

┌ EUROPEAN



MARKET OUTLOOK 2024

➤ Preparing for impact:
The silver lining after the clouds

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1. EXECUTIVE SUMMARY

Key findings from our [European PPA Market Outlook 2024 report](#):

The PPA Market entered its Golden Era with record activity – Following a stabilising environment in the fundamentals of deal-making, over the past twelve months our PPA Tracker recorded a hefty 16.2GW of disclosed contracted volumes – an increase of more than 40% vis-à-vis 2022. Deal count peaked at 272 PPAs – an increase of an impressive 65% from 2022!

The balance between corporate and utility offtakes improved – Corporates maintained the lead position in driving the PPA market, but there was an uptick in utility offtake activity. Reduced volatility levels, and strong corporate demand were the key drivers behind utility appetite.

Corporate showed preference to PPAs directly with projects – Out of the 216 Corporate PPAs that disclosed the seller, 44% were contracted with a utility, with the remaining 56% having a developer/IPP/Fund Manager as the counterparty. We believe the data show the preference of corporates to contract directly with projects to illustrate additionality more clearly, especially when taking into consideration that many utilities contract with corporates on the back of own generation.

The role of utilities in the PPA Market evolved – Tracking only the offtake activity of utilities does not paint the complete picture of their impact in the PPA space. As core risk managers, the contributions of utilities to the market have expanded through back-to-back

PPAs, and services in both buyers and sellers managing their risks.

Spain and Germany accounted for 50% of 2023's volumes – Even though we saw vivid activity across Europe, 8.4GW were concentrated in Spain and Germany, accounting for 51% of the total 16.2GW. The Mediterranean Queen kept its Top position for a fifth consecutive year, but its throne was challenged for the first time ever. In deal count, the picture is more balanced.

Iberdrola was the Top Seller both by volume and deal count – The gold medal comes due to nine deals with corporates, amounting to 908MW. Six took place in Germany on the back of Iberdrola's offshore wind capacity in the country, followed by two solar deals in Spain, and one onshore wind deal again in the land of Energiewende. Statkraft was the most active seller with 19 deals.

Mr Bezos is back to the Top Buyer position – In 2023, Amazon's activity returned to the European continent, leading the IT conglomerate to contract a bulky 1.87GW across seven deals. The corporate also tops the list by deal count.

Information Technology still on top – IT conglomerates maintain their top ranking, with a total of 3.6GW across 25 deals. Consumer Staples also maintained its leading position in terms of deal count while also jumping to the second position volumes-wise.

Volatility headaches made corporates more risk-aware – Last year proved that volatility led to a permanent shift in procurement strategies, as many energy intensives made corporate PPAs a prominent and consistent hedging tool. We also noted increased awareness of price and profile risk, which translates to how different PPA volumes are priced. Due to 2022's volatility, some deals were priced under wrong valuation assumptions, potentially leaving corporates paying higher than market prices for a long term.

Solar PPA volumes quadruple both onshore and offshore wind – Solar PV was by far more popular in PPA deal-making, holding the lion's share with a total of 10.5GW – or, almost 65% of the year's 16.2GW PPA volumes across 160 deals. Onshore wind saw 2.3GW across 58 deals, while offshore wind saw 2GW across 20 deals.

Balancing contracts are becoming pivotal in a revenue's stack – In 2023, the pricing of balancing agreements mirrored the downward trajectory of power prices, but despite dropping to approximately EUR 3/MWh, they still remained at higher than the long-term average. Amid tightening margins, both Balancing contract and GoOs sales optimisation become important priorities.

Hybrid PPAs entered the scene – The momentum around renewables-plus-storage increased significantly over 2023, as most players are looking at either introducing storage in their portfolio or increasing capacity. The impetus also manifested in the European PPA market through the emergence of the first Hybrid PPAs for large-scale subsidy-free solar assets.

Grid connection savings are a core attraction for co-location. Still, the combination of value creation from grid-level services alongside optimisation of asset-level revenues epitomises the driver behind the promising land of the business model.

PPAs for Green H2 Production showed early signs – Another notable trend in 2023 was the rapid growth of PPAs destined to power upcoming green hydrogen and ammonia plants, with a mix of nuances painting the whole picture. PPAs linked to green hydrogen and ammonia production were announced in Norway, France and Germany, leveraging new and existing capacity.

Renewable energy is heavily needed to feed any Power-to-X project. However, the sweet spot lies in the delta between project economics and PPA prices – and this landscape is still evolving.

Multi-buyer PPAs increased – Multi-buyer PPAs, also known as Aggregated PPAs, are not new to the European PPA Market, as such deals, in principle, emerged in 2016. However, 2023 saw the concept maturing in an accelerated manner with a total of four such announcements.

In spite of increased interest in the concept, we believe government-backed credit guarantee schemes would be a more impactful tool to increase the pool of SMEs willing to buy. The sophistication of sellers and inclusive guarantee schemes could be the main two drivers of the trend.

The concept of 24/7 Green Energy Purchasing advanced – The more niche trend to energy procurement is driven by corporates interested in hourly matching of consumption in lieu of the prevalent annual consumption matching model. Latest studies showed that on top of improved green credentials and more impactful additionality, such an approach also illustrates price hedging benefits. An optimised portfolio of wind and solar PPAs could be enough to start a 24/7 journey and achieve 60-75% hourly matching.

Volatility and prices en route to stabilisation –

The year 2023 was characterised by a consistent downward trajectory of gas and electricity prices, resulting in reduced volatility levels in power markets compared to the year before. When looking at the big picture, it seems that Europe has entered a new era of prolonged volatility, for now mostly driven by fossil fuel pricing risks and macroeconomics, with cannibalization risk close to entering the conversation.

The PEXA Euro Composite dropped 35% year-on-year –

From the first day of January at 78.7 EUR/MWh to the last day of December 2023 at 50.1 EUR/MWh, the EURO Composite decreased by 35% - with the average throughout the year standing at 58 EUR/MWh.

Decreased volatility reduced risk discounts –

On the back of lower volatility and high corporate demand, risk discounts factored into PPA pricing to compensate for market, technology, and structure-specific risks have decreased substantially compared to 2022 levels. Spain and Germany are prime examples. Nonetheless, cannibalization risk is factored more aggressively in Pay-as-Produced (PAP) PPAs.

Market fundamentals shook up financing costs –

Following the progressive settling of the pricing and regulatory turmoil, the renewables industry was confronted by a snowball effect of changes in market fundamentals, resulting in higher-than-average construction, operational, and funding costs for renewable assets. Challenges in financing costs and capex are catalysing interest in squeezing return margins, as market players are looking to make the most of their portfolio.

Short-term PPAs showed mixed movements –

Short-term PPAs differ largely in tenor. Their range spans across weeks, months, or up to five years. On the back of that note, the picture in 2023 was both positive and negative. PPAs of 1-year > tenor, part of a dynamic selling strategy comprised of weeks-long and months-long PPAs, took the biggest hit due to the

implementation of revenue caps. We believe that some players viewed this approach highly opportunistically and not as a strategic risk management tool, despite the evident upside even in a less extreme pricing environment.

Baseload PPAs were in more trouble –

Over 2023, the appetite for Baseload PPAs was mixed – with most sellers being increasingly cautious despite the price premium of the volume structure. Certain bankruptcies linked to Sweden's created further uncertainty in the market. There were times when we saw a rearrangement of how some market participants view the risk profile of BL PPAs, classifying it as riskier than a merchant approach.

However, we believe BL PPAs could be one of the most cost-optimal hedging instruments on a case-by-case basis, if they are structured in a risk-adjusted manner. BL PPAs need to be approached with a monitoring approach, contrary to the 'sell-and-forget' mindset of PAP sellers.

The regulatory pendulum swung back –

Following the abrupt return of regulatory risk, in 2023 the picture changed significantly due to the expiration of most windfall tax mechanisms and the emergence of supportive regulation for many aspects of the PPA market. EU's Delegated Act catalysed infant activity of renewable PPAs for hydrogen production. France introduced its first credit guarantee scheme with more countries set to follow suit under EU's directives.

However, even though EU has given the PPA market its blessing and support, there's no market consensus on whether aggressive deployment of CfD schemes can go hand in hand with PPAs.

Top predictions for 2024:

- ① **Germany will topple Spain in PPA activity**
- ② **The PPA Market will surpass 20GW**
- ③ **The geographical scope of Hybrid PPAs will expand beyond GB**
- ④ **The share of Utility PPAs will increase**

EUROPEAN PPA MARKET 2023

 16.2GW

 272 deals



10.5GW
#160



2.3GW
#58

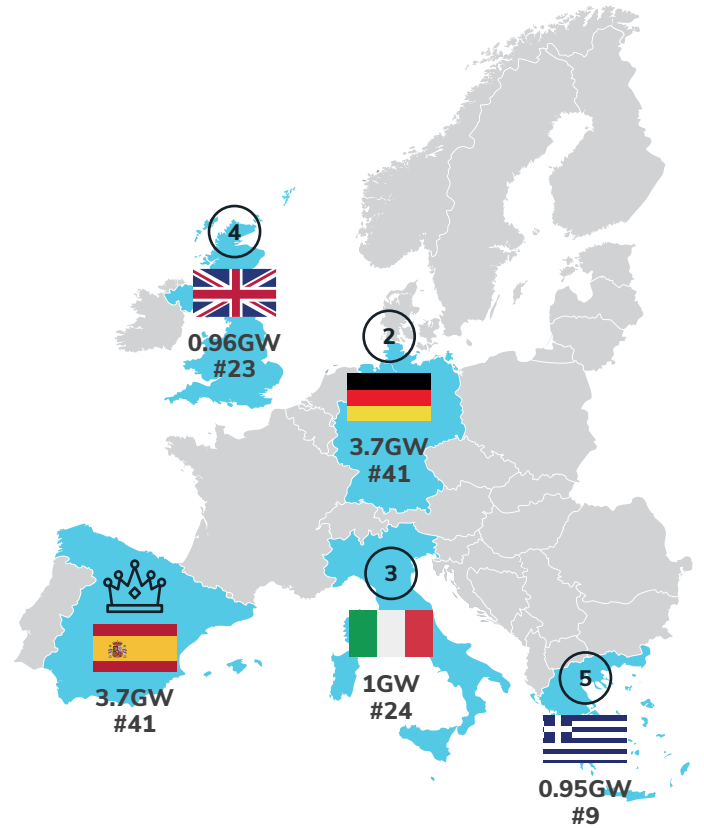
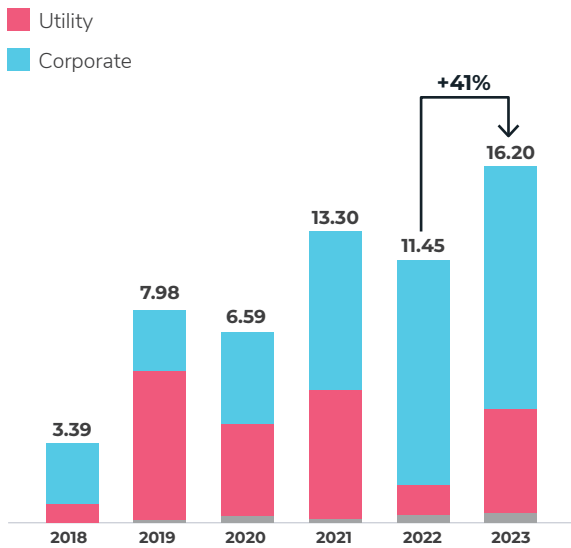


2GW
#20

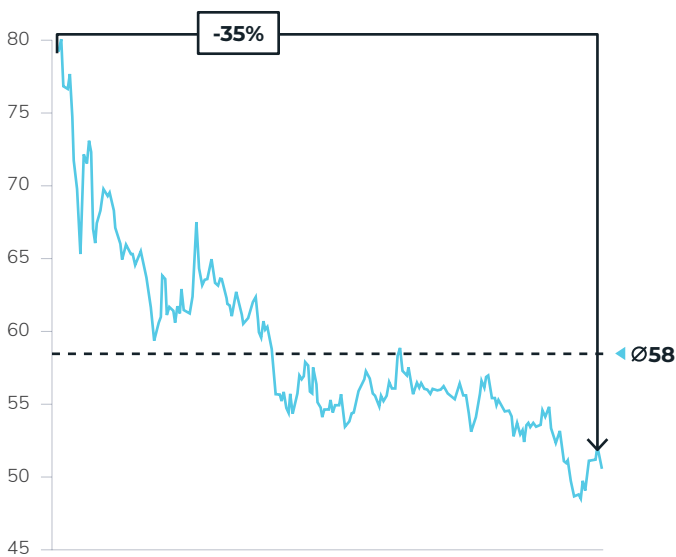
TOP BUYER 

TOP SELLER 

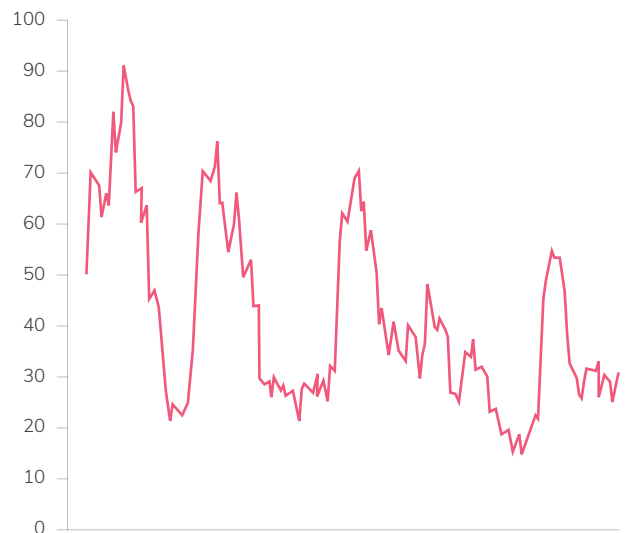
PPA deal flow by disclosed contracted capacity, 2018-2023 (GW)



EURO Composite (EUR/MWh), 2023



Volatility of DE Y+1 Futures (%), 2023



2. INTRODUCTION

Here comes the sun

The signs that the air of 2023 was different appeared since its early days. It seems that hard lessons from the year before; an unstoppable corporate army athirst for green energy; and the non-negotiable mandate to push through a smart energy transition catalysed a fresh mindset, mostly.

Over 2023, Europe's PPA universe entered its Golden Era. The shadows of the peaks of the energy pricing and availability crisis were still visible throughout the year. Sometimes in a tough way – like the dramatic increases in financing costs – sometimes just enough to remember the pain, in a constructive way. In a sense, this may have been the driving force of the industry's achievements.

During this thorough analytical exercise, we had fun discovering exciting data insights, challenged each other, and spent long periods trying to crack the code to understand the market's challenges – which were not absent from the scene, at all.

Our recipe is simple: understand what happened, put it in context, and brainstorm our future expectations. Following the success of previous years, we're thrilled to present the fourth edition of our signature series, Pexapark's European PPA Market Outlook 2024.

Last but not least, together is always better. If you feel inspired, we are looking forward to hearing your thoughts at hello@pexapark.com.

Once again, enjoy the dive!

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ACT I

CHAPTER 1: APPROACHING THE GOLDEN PPA ERA

The European PPA Market never ceases to impress. Since the beginning of the year, the arrival of the rainbow after the storm had become evident. But not without some clouds. What's the final verdict?



> PPA Tracker Methodology

Before we start the big dive, let's do a memory refreshment on how to read Pexapark's PPA analysis. Not all PPAs are equal, and we know first-hand. Our PPA Tracker includes agreements that meet specific criteria.

Price risk: Pexapark's primary criterion lies in a PPA carrying price risk. Route-to-market (RTM) or balancing services PPAs do not make it to our PPA Tracker, even if they are concluded for long periods (i.e. RtM PPAs for projects under the UK CfD scheme that may need contracts to market their power, while it's the UK government that takes the price risk by offering a floor price).

Tenor: Our rule of thumb is to track long-term PPAs of at least a 5-year tenor. Nonetheless, initial PPAs linked to new projects and have played a role in the financing of the assets, are being added no matter the tenor length. It is worth noting that our data illustrate that publicly available Short-term (ST) PPAs for new projects are still rare (4 in total across 2023). Post-subsidy PPAs such as post-EEG in Germany prolonging the life of an asset, or PPAs linked to any existing assets (i.e. optimisation PPAs for assets initially commissioned under subsidy schemes) need to have a tenor longer than 5 years.

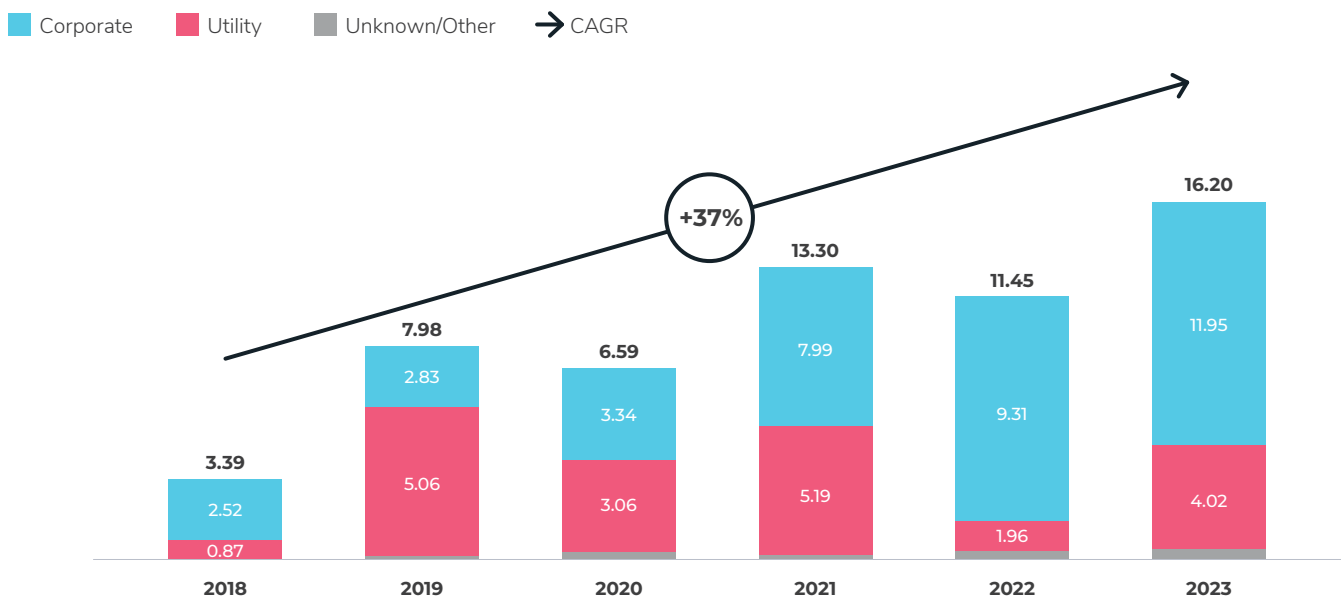
PPA Size: We calculate the deal flow volumes based on the PPA Size in MW and not the Project Size. At the beginning of 2023, we updated our methodology to account for deals with no information on the PPA Size in MW, which were left blank before. Thanks to 'Mission Lucia' (which further enlightened the quality of our data), whenever we know a) volumes in GWh b) geography c) technology of the PPA, we proceed to a capacity factor-based estimation of the PPA size. Lucia was retroactively applied to all the existing entries, which is why some numbers from last year are slightly different, but more reflective of PPA activity. The megatrends of yearly volume activity and deal count remained unchanged.

You can find our PPA Tracker on Pexapark's PPA price reference platform PexaQuote, alongside more information on our methodology. For these stringent rules and the extra mile we go when reviewing PPA activity, our findings could be dissimilar to other data-driven insight providers. To ensure your deals are included in our analysis, you're invited to use the 'Report a PPA Deal' function of PexaQuote or email maritina.kanellakopoulou@pexapark.com.

1.1 THE BIG PICTURE: 2018–2023 YEAR-BY-YEAR EVOLUTION

The past year has been busier for the European PPA market than ever before, with multiple records being broken one after the other. Be patient; we're only getting started! **Over the past twelve months, our PPA Tracker recorded a hefty 16.2GW of disclosed contracted volumes – an increase of more than 40% vis-à-vis 2022.** According to the updated data, the European PPA Market volumes have been growing at a 37% CAGR since 2018.

PPA deal flow by disclosed contracted capacity, 2018- 2023 (GW)

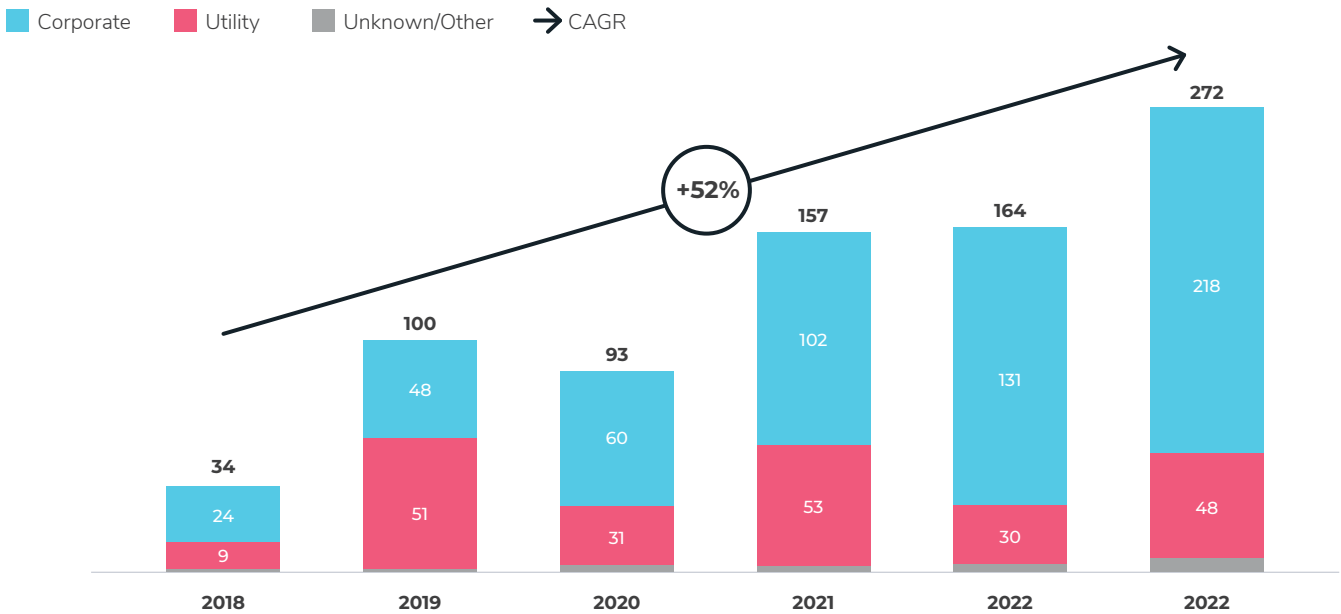


Source: PexaQuote, PPA Tracker Note: 'Other' mostly refers to electrolyser developers

Looking at the deal count, the year-on-year increase appears even more radical. In total, **2023 saw 272 PPAs – an increase of an impressive 65% from 2022!** Even though volumes make the biggest headlines, deal count is equally important. That's because the value illustrates the times sellers and buyers sat at the table whether the offtake needs were 20GWh or 1,500GWh per annum (yes, there was such a mammoth deal, and the offtaker will not come as a surprise).

The fact that offtakers transacted 65% more times than the year before truly illustrates the appetite not just from large offtakers that could potentially 'distort' the big image with individual large offtakes, but also from small and medium corporates and industrials that want to be part of the revolution in energy procurement.

PPA deal flow by deal count, 2018-2023 (# deals)

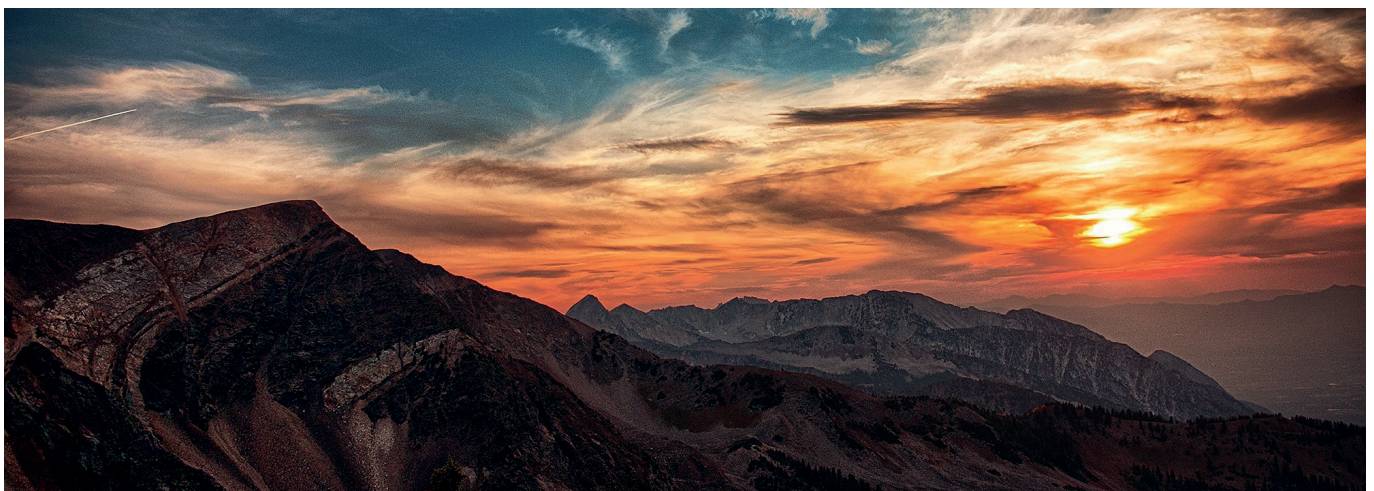


Source: PexaQuote, PPA Tracker **Note:** 'Other' mostly refers to electrolyser developers

Hedging against volatility and securing lower-than-market rates through a green PPA has become the primary reason for many corporates contracting PPAs, alongside ESG targets. A key element that enabled a significant ramp-up of activity was relatively **smoothed-out regulatory concerns**.

As will be analysed in more detail later in this report, the pricing landscape of 2023 was defined by a **stable downward trajectory of both power and gas** futures prices. Consequently, PPA prices across European countries mimicked the movement at different levels, increasing buyers' confidence in taking long-term price risk.

Overall, renewable players entered 2023 with a refreshed mindset and a relatively increased sense of stability, significantly increasing certainty on long-term PPA deal-making.



➤ **A sneak peek of the other side of the coin**

Pricing environment required adjustments of expectations from sellers – Despite exceptionally high deal-making catalysed by less volatility, some deals did not go through because some sellers modelled revenues based on last year's pricing levels. Disconnection from realistic prices and overly ambitious expectations have always been reasons for deals to fall through, and this 'category' of deals temporarily or permanently moving to the vault has always existed. In our view, it comes down to the ability to distinguish **pricing and valuing** a PPA.

Windfall taxes did not have a major impact on long-term transactions – Over 2023, the **sea of complex regulation and revenue caps through windfall taxes appeared to be** better digested by market participants. Despite the scars from last year and the wait-and-see period, buyers and sellers were better equipped to manage regulatory risk during negotiations. On the other hand, Short-term (1-4y) PPAs took a bigger hit, as will be analysed later in this report.

High financing costs tested certain deals – Regulatory uncertainty was replaced by persisting changes in market fundamentals for the investment community. The cost of debt, primarily due to rising base rates, remained at significantly elevated levels in line with the increases witnessed in 2022 (where the 10-y Euro swap started at 0.28% and ended at 3.19%). 2023 was the first full year with a challenging financing environment, and certain assets did not manage to make the economics work, with some PPA negotiations for these projects having paused for the time being.



1.2 DATA-DRIVEN HEADLINES PAINTING THE 2023 PICTURE

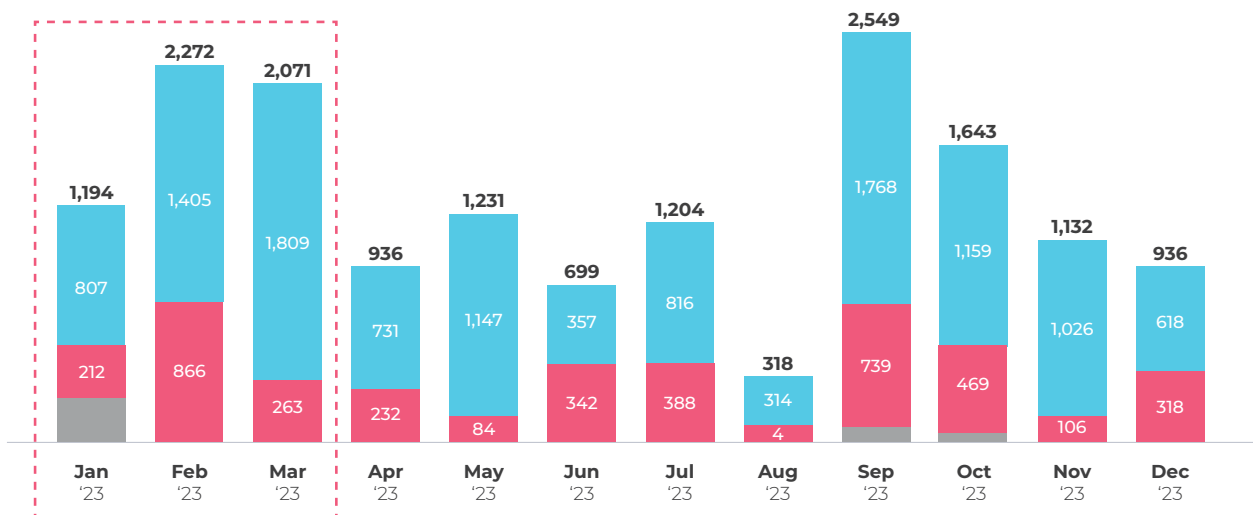
Q1 SET THE RHYTHM FOR A RECORD YEAR

Contrary to the patterns of past years, where Q4 usually depicts the most robust activity, Q1 2023 saw the highest activity in terms of volumes, with a total of an unprecedented 5.5GW.

We believe the timing of the closing and announcement of these deals was not random. Over 2022, despite European energy markets undergoing the most turbulent year in their recent history, PPAs exhibited remarkable resiliency. Despite the impressively stable activity last year, our gut feeling was telling us that corporate ambition was much larger than the deal flow numbers indicated. Turns out, the real appetite revealed itself in Q1 2023, as we believe many of these deals were leftovers from negotiations that were delayed due to the volatility and unfavourable-for-the-buyers pricing levels.

Monthly PPA activity in 2023, disclosed volumes in MW

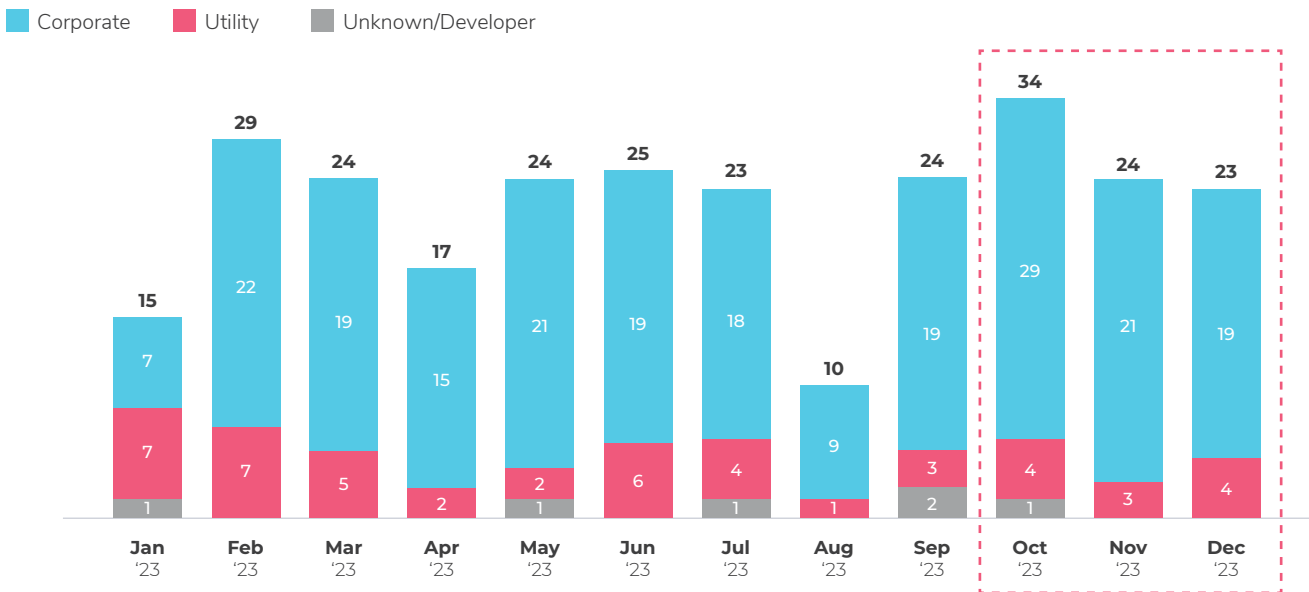
■ Corporate ■ Utility ■ Unknown/Developer



Source: PexaQuote, PPA Tracker Note: 'Other' mostly refers to electrolyser developers

Even so, the historical pattern hasn't wholly deviated from the reality, because Q4 was indeed the strongest in terms of deal count, with 81 deals. In fact, October '23 did not only constitute the month with the most PPA announcements over the year, but ever! Such data confirm the high deal activity in Q4 over all the past years, as many negotiations are rushing to wrap up deal-making ahead of the year-end.

Monthly PPA activity in 2023 by deal count (# deals)



Source: PexaQuote, PPA Tracker Note: 'Other' mostly refers to electrolyser developers



For a monthly commentary on PPA activity; PPA pricing trends; alongside spotlight analysis on key trends and community insights, subscribe to our monthly publication, **PPA Times** [here](#).

THE BALANCE BETWEEN CORPORATE AND UTILITY OFFTAKES IMPROVED

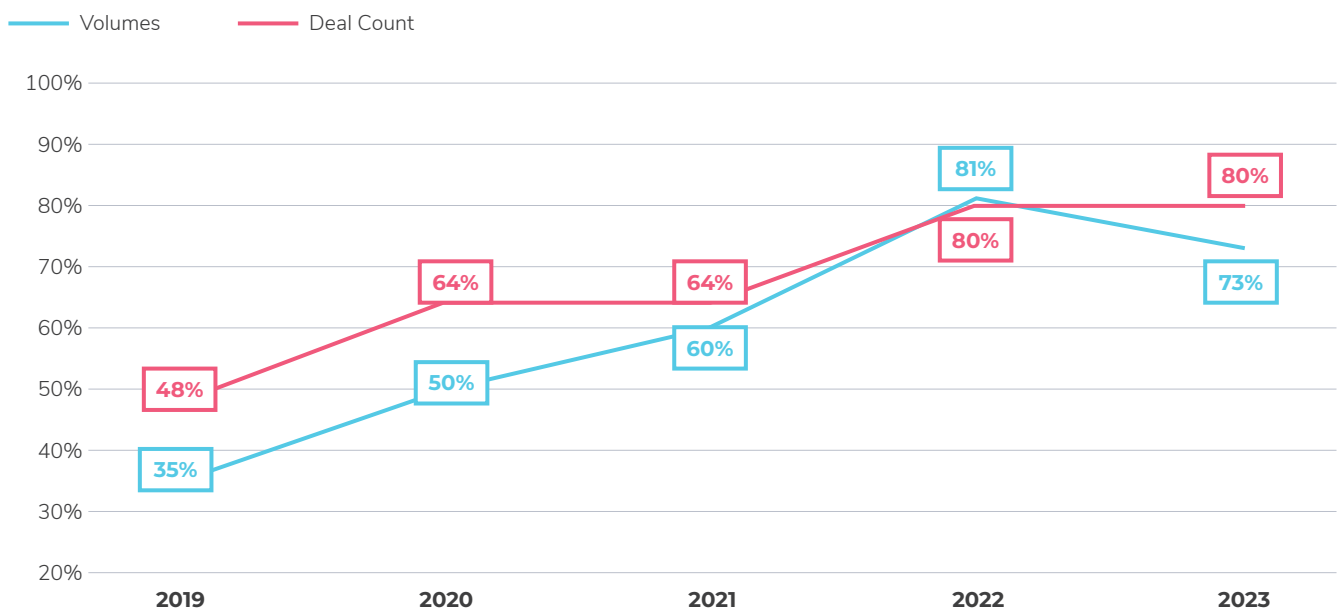
Corporates maintained the lead position in driving the PPA market, but there was an uptick in utility offtakes. The numbers reveal that in 2023, **corporates accounted for 73% of volumes and 80% of deal count**. Worth reminding that even though the percentage share remained the same, the pie was actually much larger. **In effect, corporates contracted 11.95GW – 28% increase from 2022, across 218 deals – 66% uptick year-on-year!**

On the other hand, **utilities' stake stood at 23% of the volumes – an increase from last year's 18% share, and 18% of deal count**. This translates to **4.02GW – more than double the 1.96GW of 2022, across 48 deals – a 60% increase from last year's 30 deals**. In 2022, the dire straits posed by volatility levels sometimes disarmed even the most risk-savvy trading agent, resulting in reduced utility offtake appetite.

But as we've repeatedly observed in our digital magazine PPA Times, our monthly PPA activity digest, the stabilising pricing environment and volatility levels dropping to more manageable levels made utilities again ready to onboard some risk in their books.

The fact that corporate appetite was much larger this year also made it feasible for utilities/traders to perform more **back-to-back deals**, offtaking risk from projects and managing that risk through long-term volume sales to corporates straight after.

Corporate PPA share, deal count and PPA size, 2018-2023



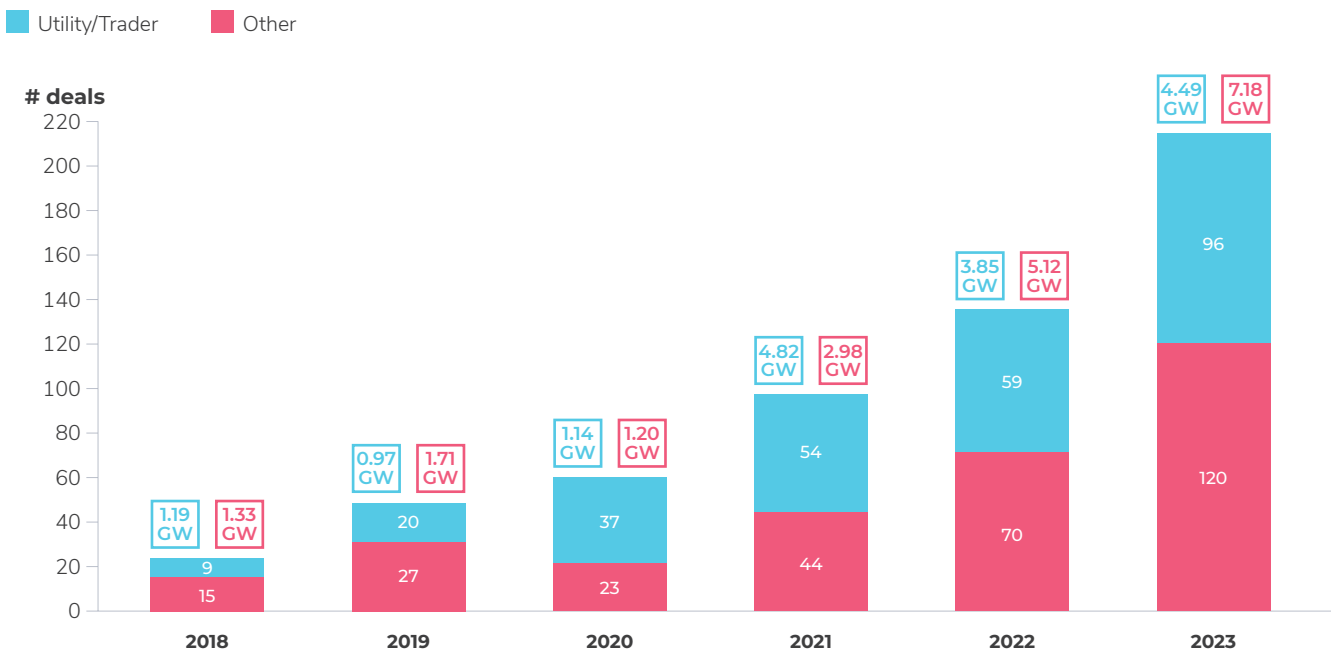
Source: [PexaQuote](#), [PPA Tracker](#)

CORPORATES CONTRACTED MORE DIRECTLY WITH PROJECTS

According to our analysis of Corporate PPA activity by seller type, **out of the 216 PPA that disclosed the seller, 44% of these deals were contracted with a utility, with the remaining 56% having a developer/IPP/Fund Manager as the counterparty.** In terms of volumes, this translates into 4.49GW and 7.8GW, respectively.

It's important to note that many trading-based utility players own generation and pursue transactions linked to specific projects. In addition, most offshore wind deals are transacted with utilities since they are the primary project owners in the offshore space, such as RWE. Nonetheless, in our analysis, both these deal classes fall under the utility category because of the sellers' risk management capabilities.

Corporate PPAs by seller type, deal count and volumes, 2018-2023



Source: PexaQuote, PPA Tracker **Note:** 'Other' includes developers, IPPs, Funds, Fund Managers. Utilities with generation portfolio such as Statkraft, RWE count as utilities.

Through this high-level analytical exercise it becomes clear that corporates enjoy the benefits of transacting directly with projects. We believe the underlying force behind this trend is the **additionality** requirements of many corporate buyers, which are more clearly demonstrated by a direct PPA that has enabled new renewable capacity to come online. When a utility offtakes the volumes from a project, and offloads to a corporate through a back-to-back deal, additionality may not be as straightforward to demonstrate.

On the other hand, corporate PPAs with non-utility parties typically take longer to negotiate, as the risk management of the electrons occurs between two parties with more limited capabilities of this type. They also increase in contractual complexity because in cases of sleeved PPAs (aka Physical), there's always the need for a third party to take over the physical delivery of the volumes, the RtM for the project and the balancing services agreements.

➤ The evolved role of utilities in the PPA Market

As the PPA market matures, the role of utilities evolves accordingly. Tracking only the offtake activity of utilities does not paint the complete picture of their impact in the PPA space, which is much larger and critical than what the numbers illustrate.

At their core, energy utilities are risk managers, as their primary business model lies behind buying and selling energy while managing the risks associated with energy commodities to make a profit. Such kind of players rely strongly on the liquidity of the forward markets to manage their position, and the more liquidity there is, the more PPAs they can handle (alongside the capacity to warehouse risks, such as cannibalization risk, that cannot be hedged with market instruments).

At the outset of the European PPA market, when corporate appetite was limited, utilities catalysed PPA deal-making by offloading risk from subsidy-free projects. Up until then, all risks were assumed by governments through subsidies. A utility long-term PPA with a project on the sell side creates a long position, usually managed in chunks through the stack-n-roll hedging method (which is why liquidity in the forward markets is important).

As part of risk management, a trading utility must strip away the risks inherent to a PPA by finding a 'new owner' for them. Some ways to 'digest' the volumes are a) placing the volumes to the forward market incrementally b) progressively selling back to corporates through a mix of deals, or c) selling back to a corporate the entire volumes at once through a back-to-back PPA. This is why utilities are both buyers and sellers in PPA agreements.

Extreme volatility levels in 2022 were the first signs that **the risks of the stack-n-roll method are becoming more and more challenging to manage** because of the high financing costs (almost prohibitive in a high volatility environment) associated with managing the position. That's because hedging inefficiencies when the forward curve does not move in sync across tenors can be very costly, creating cashflow challenges.



Even though **utility offtakes picked up** (because of reduced volatility), in 2023, we observed that **utilities are increasingly reluctant to keep the full risk on their books, and there's a preference for back-to-back PPA deals**. Under these arrangements, utilities enter into PPAs as buyers but then leverage their own origination teams to match the project volume with corporate demand.

Then, the utility enters into a back-to-back PPA with a corporate. In doing so, the utility shifts some risk (which would otherwise need to be kept on its books and managed in the wholesale market) to the corporate buyer. Ideally, the volumes and the tenor would mirror the initial agreement with the generator as closely as possible, but the volumes can also be split across multiple deals. We saw the practice in markets such as Spain and GB, where certain utility players have demonstrated such capabilities, and we expect this trend to develop further.

Utilities have an opportunity to provide additional services to the buyers (on top of the ones provided for the sellers), such as shaping the delivery profile of the PPA and balancing (services often offered by utilities to corporates who enter physical PPAs directly with renewable projects). For corporates, the benefit lies in a potentially smoother negotiation process and offers an alternative way of securing renewable energy from utilities that, unlike traditional bundled green supply deals, also have the potential to meet their additionality requirements.

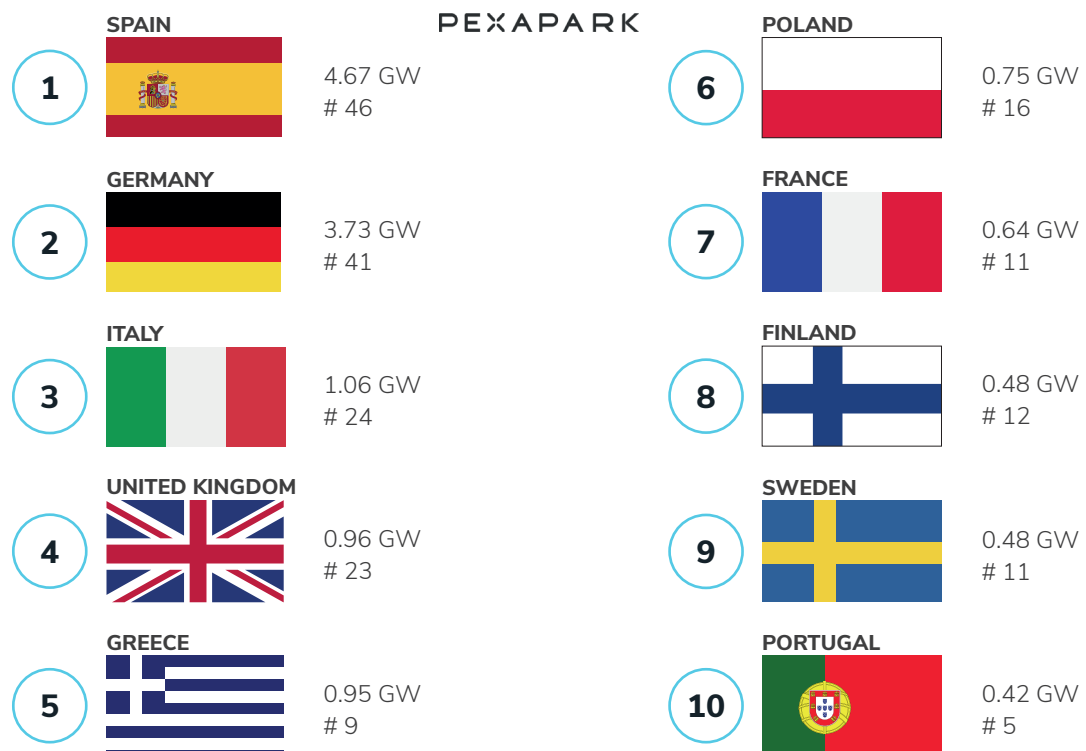
We believe the increased prevalence of back-to-back PPAs, where project owners, utilities and corporates join forces to leverage each other's strengths will catalyse further activity in the PPA market. Lastly, building upon the silent role of utilities/trading agents as 'sleeving parties' to all Physical PPAs, we see these players further leveraging their risk management expertise to facilitate more novel corporate energy purchasing approaches, such as 24/7 green supply, as well as Baseload PPAs.



SPAIN AND GERMANY ACCOUNTED FOR 50% OF 2023'S VOLUMES

Spain remained the top country by volumes and deal count for the fifth consecutive year, with a total of 4.67GW. An impressive 4.3GW across 37 deals came from the country's solar sector which is reclaiming its reign, with merely 260MW attributed to onshore wind. Last year, the country's top position (3.9GW) was mostly due to Alcoa's two onshore wind PPAs of a total 1.8GW with Greenalia and Endesa, which blew the country's winds.

Germany climbed one position and was awarded the silver medal for contracted volumes in 2023, with a total of 3.73GW. Impressively, solar pv (1.77GW across 18 deals) and offshore wind (1.73GW across 14 deals) played an equal role in this achievement, bringing the country's solar sector back to the top of interest.



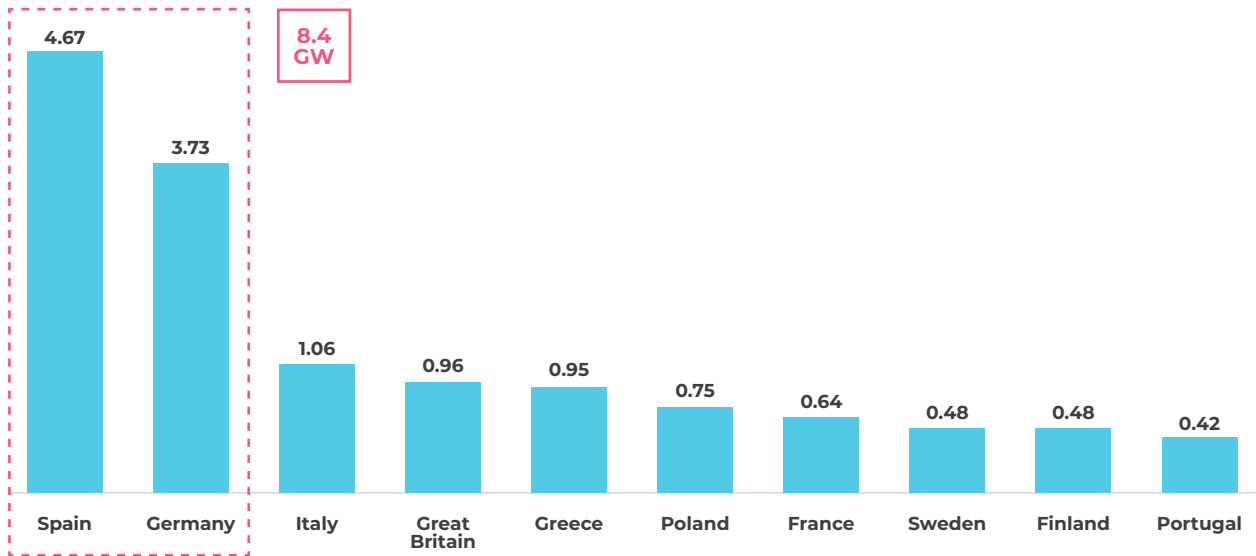
Italy, which jumped six positions to receive the bronze medal with a total of 1.06GW is well below the first two positions. With the rest of the Top10 at similar spread patterns. This shows a high concentration of 2023 activity in terms of volumes in two geographies: Spain and Germany accounting for 51% of the total 16.2GW.

However, it's interesting to note that **Spain's throne could be shaking** for the first time ever. Usually, Spain outperforms the volumes and deal count of the second position by multiple times. In contrast, Germany's solar and offshore sector, alongside exceptionally high demand from industrials are finally giving the country the spot we always believed it deserved. Better late than never!

Greece, Portugal and Sweden are the new entries to the Top 10 rankings for contracted volumes, with the first two claiming a position for the first time ever!

Top countries in 2023 by disclosed contracted volumes (GW)

■ Disclosed contracted capacity in GW



Source: PexaQuote, PPA Tracker

In terms of deal count, the picture appears more balanced. **France's** activity comprising 28 deals stands out, jumping four positions since last year. The **Netherlands** is the single new entry in the Top 10 Ranking by deal count, mostly due to solar and offshore wind deals.

Top countries by deal count, 2023 and 2022 comparison (# deals)

RANKING	COUNTRY	2023	YEAR-ON-YEAR MOVEMENT	COUNTRY	2022
1 (gold medal)	Spain	46	=	Spain	31
2 (silver medal)	Germany	41	=	Germany	23
3 (bronze medal)	France	28	▲	Great Britain	15
4	Italy	24	▲	Poland	14
5	Great Britain	23	▼	Finland	12
6	Poland	16	▼	Denmark	12
7	Sweden	12	▲	Italy	10
8	Finland	11	▼	Sweden	8
9	Denmark	11	▼	France	7
10	Netherlands	11	*	Norway	5

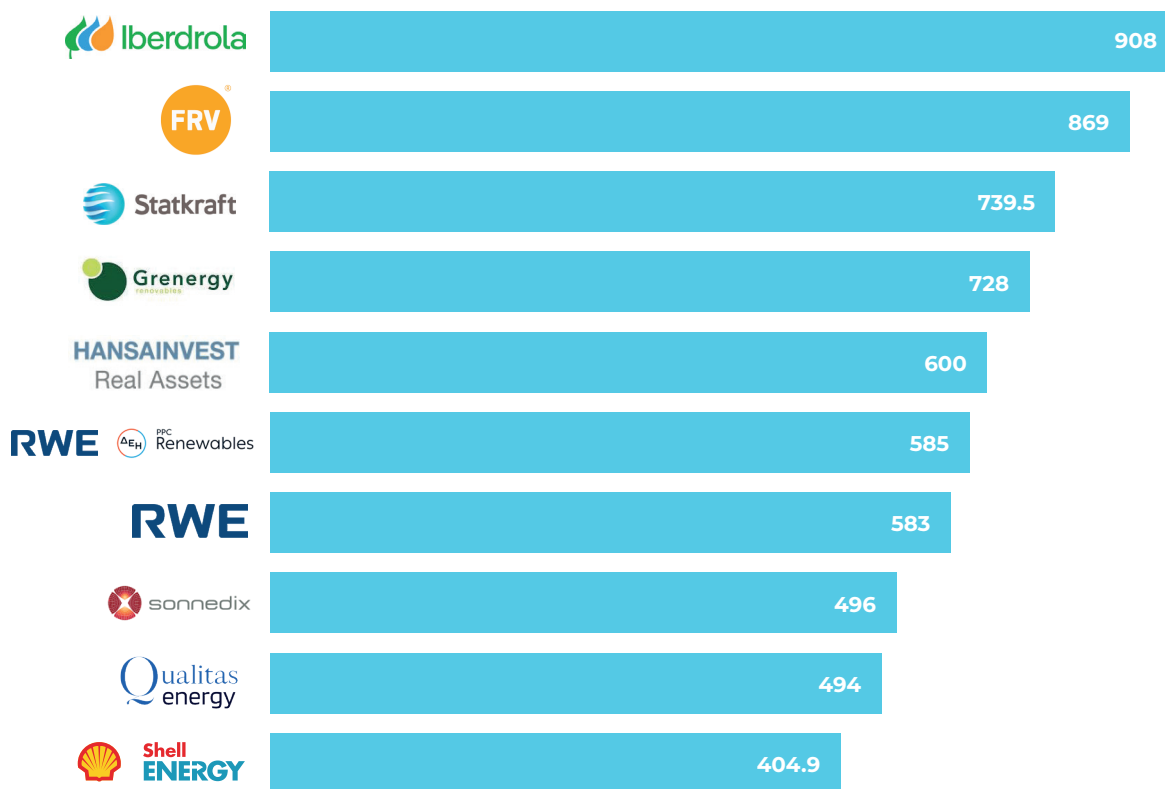
Source: PexaQuote, PPA Tracker

TOP SELLERS: IBERDROLA TAKES GOLD BOTH BY VOLUMES AND DEAL COUNT

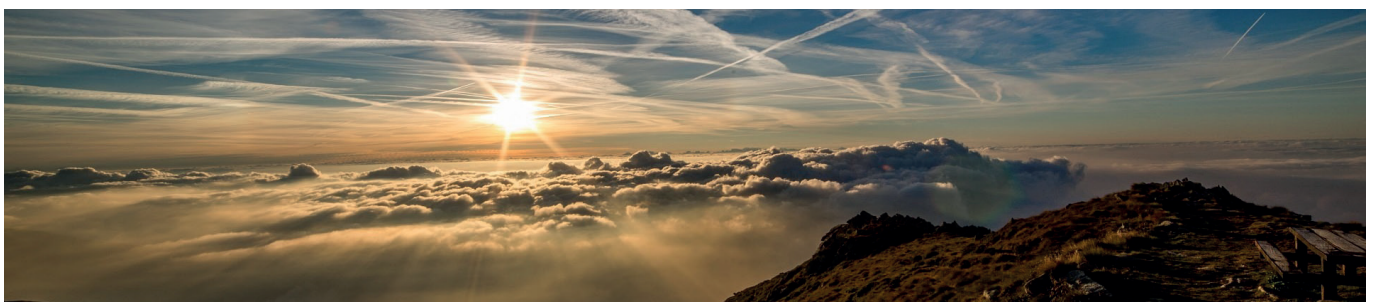
Spanish utility **Iberdrola** emerged the Top Seller for the year, which falls under 'Utilities' in our seller categories. The medal comes due to **9 deals with corporates, amounting to 908MW**. Six took place in Germany on the back of Iberdrola's offshore wind capacity in the country, two solar deals in Spain, and one onshore wind deal again in the land of Energiewende.

Norway's **Statkraft** was the most active seller with **19 deals**. The utility spread activity across eight jurisdictions leveraging a mix of hydro, solar pv, onshore wind portfolio.

Top Sellers in 2023 by volumes (MW)



Source: PexaQuote, PPA Tracker

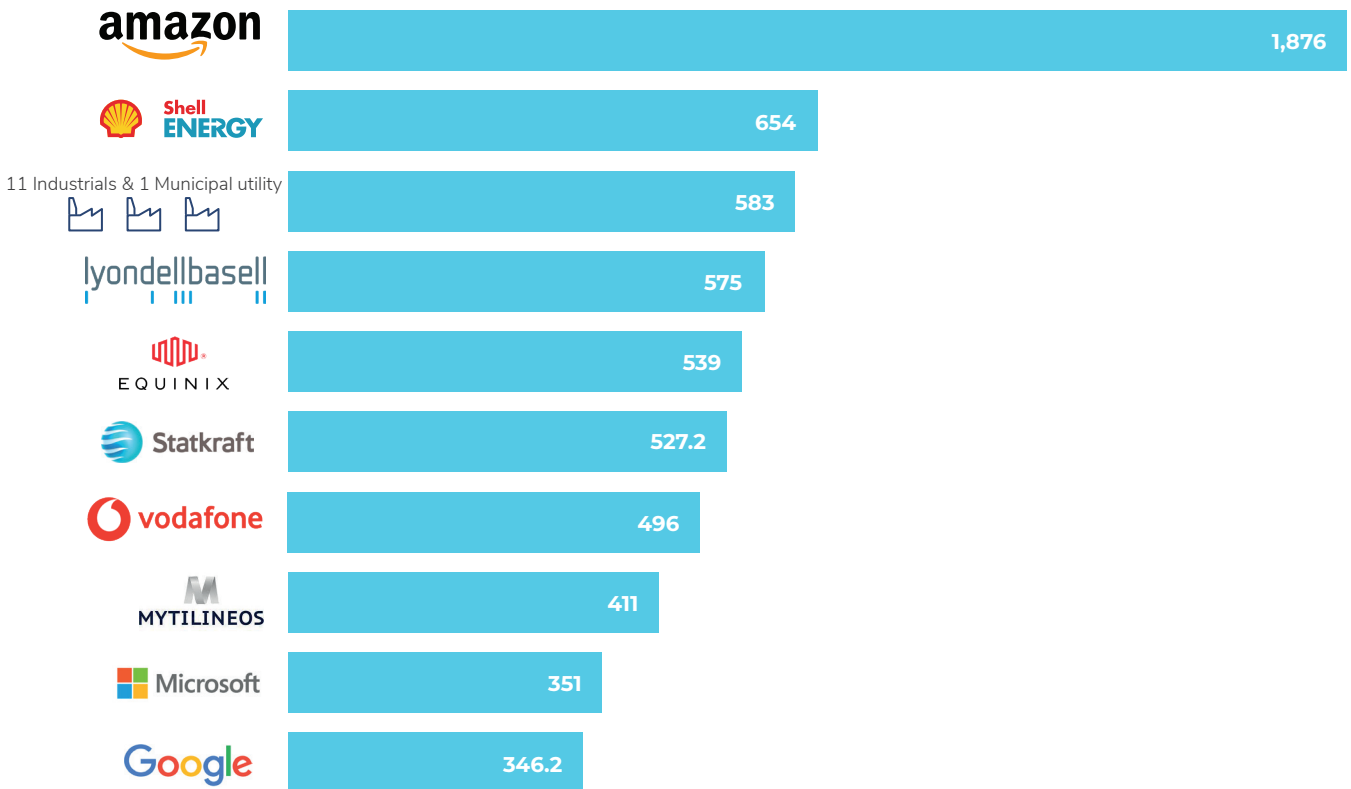


TOP BUYERS: MR BEZOS, WELCOME BACK!

In 2023, **Amazon**'s activity returned to the European continent, leading the IT conglomerate to contract a bulky 1.87GW across seven deals. According to identifiable data (details are not given for all deals), the corporate employed 1.3GW of solar in Spain, 199MW onshore wind in Finland, 268MW offshore wind in Germany, 47MW solar pv in Great Britain, and 24MW solar pv in Greece.

In terms of deal count, **Amazon** maintains the summit with seven deals. **Google** follows suit with six deals, and mining industrial **Umicore** comes third with five deals.

Top Buyers in 2023 by volumes (MW)



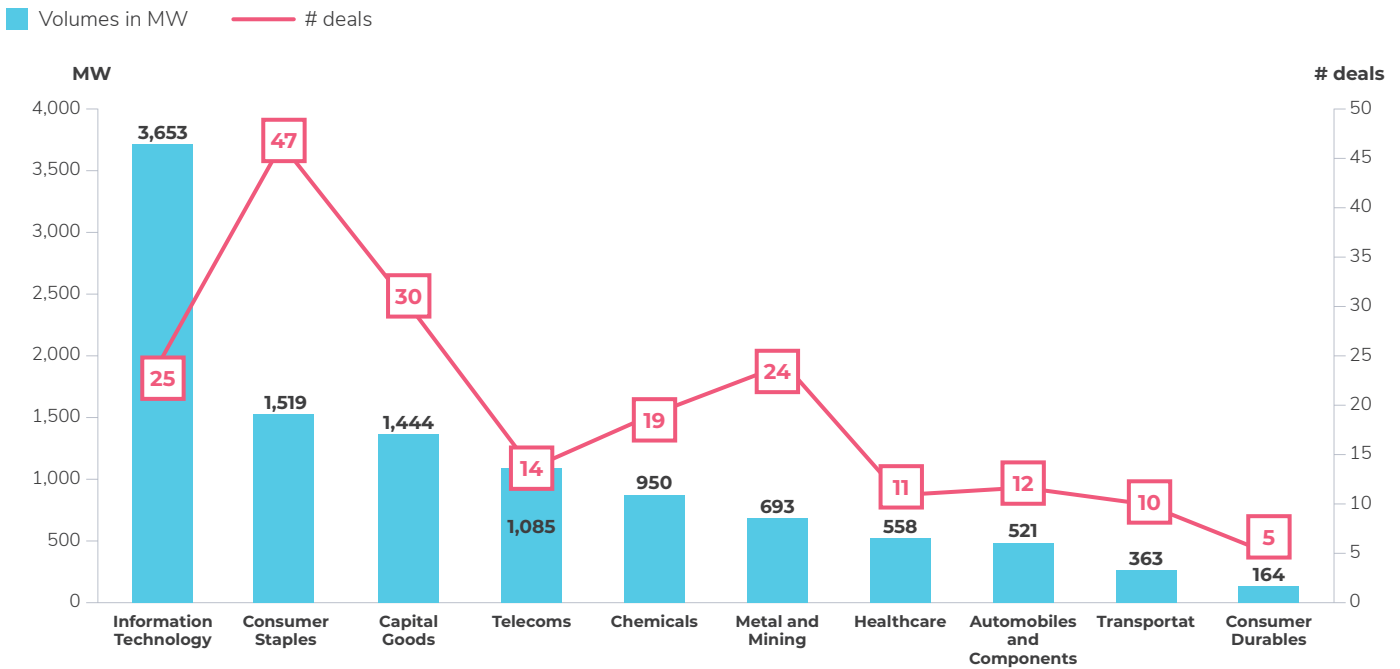
Source: PexaQuote, PPA Tracker

INFORMATION TECHNOLOGY STILL ON TOP

IT conglomerates maintain their top ranking, with a total of **3.6GW across 25 deals**. Amazon dominated with 1.89GW, Equinix procured 539MW and the likes of Microsoft, Google, Meta, and Digital Realty followed suit.

Consumer Staples also maintained its leading position in terms of deal count while also jumping to the second position volumes-wise indicating high appetite from the retail, foods, drinks, electronics etc, that fall under this category. The segment contracted a total of 1.51GW – 120% increase vis-à-vis last year, across 47 deals – an equal 120% increase.

Top corporate offtake segments in 2023, by volumes and deal count



Source: PexaQuote, PPA Tracker



› Thoughts on the Corporate PPA market

Volatility led to a permanent shift in procurement strategies: In 2022, many referred to some corporate deals as ‘panic buying’; indeed, some energy intensives were abruptly forced to lean against renewables for some form of price hedging. However, the data and our observations prove that this was not a temporary trend, but a strategic shift in procurement strategies, for which PPAs won a prominent role. Large industrials, especially ones where energy plays a critical part in the cost of goods they produce, are set to procure at least a certain percentage of their energy needs through PPAs on a sustained basis.

Corporates are becoming more firm counterparties in negotiation tables: PPAs are a vastly new concept to most corporates, but their sophistication organically increases over the years. In 2023, we observed multiple patterns that illustrate how far they have come. Firstly, there was more **awareness of price and profile risks**. In essence, this translates to how different PPA volumes are priced, and the risks that are associated to these structures. For example, Pay-as-Produced (PaP) PPAs carry significant profile risk due to renewables price cannibalization. In some markets, such risk has become prominent, and it plays a role in the price's engineering in the form of discounts. Corporates are firmer in negotiating a fair price and discussing these discounts, where they apply, especially after some underpricing of cannibalization risk in the past years.

Secondly, we noted a heightened focus on **performance guarantees**. Guaranteed availability translates into some form of certainty in relation to the volumes delivered to the consumer, and there needs to be a discussion on how underperformance will be treated contractually. This is a particular requirement for PPA for Green H2 Production because of how critical sufficient volumes are for electrolyzers to perform well. Still, corporates are equally focused on how exposed they are in the market. This has also led to interest in a PPA portfolio of different technologies that reduce this risk.

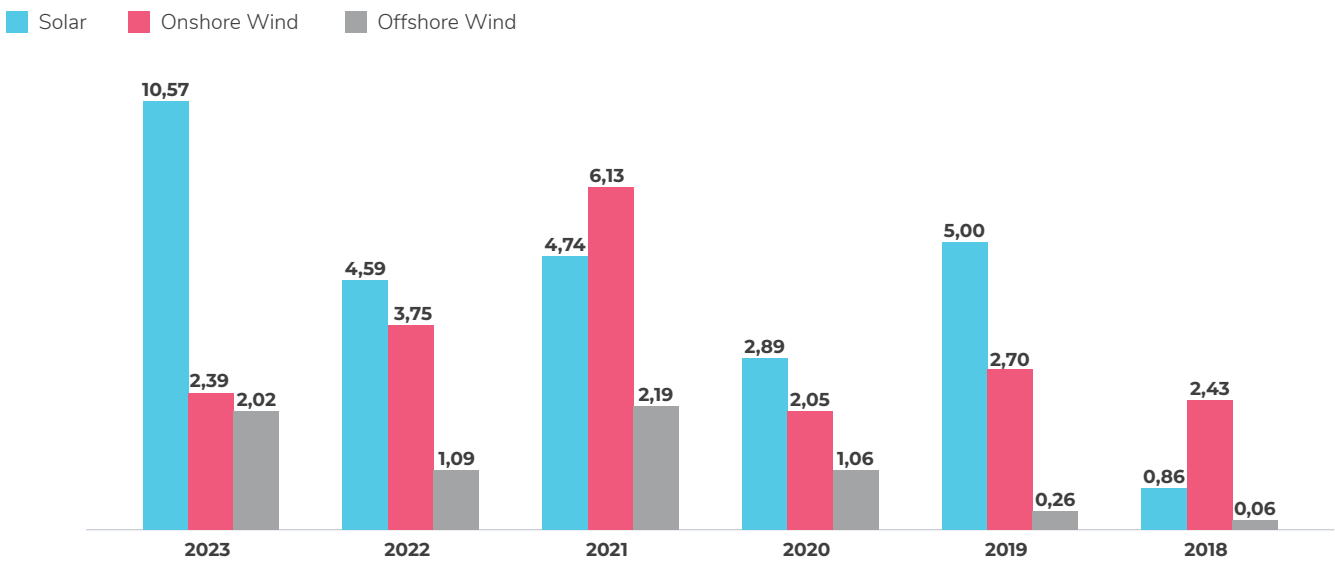
There are more diverse corporate profiles in the market: IT conglomerates are no longer the main drivers of the PPA market, and this has become clear over the past years. New names and profiles are constantly coming into the mix, which increases the market's healthy competition and liquidity of offtakers. In terms of deal count, the IT sector accounted for around 9% of deal count, and 21% of volumes.

SOLAR PPA VOLUMES QUADRUPLE BOTH ONSHORE AND OFFSHORE WIND

In 2023, solar PV was by far more popular in PPA deal-making, holding the lion’s share with a total of 10.5GW – or, almost 65% of the year’s 16.2GW PPA volumes across 160 deals. Sunshine-thirsty solar panels outperformed their onshore and offshore wind counterparts at all ends by four times. Onshore wind saw 2.3GW across 58 deals, while offshore wind saw 2GW across 20 deals.

In total, since 2018 the European PPA market has seen 28.4GW of solar, 19.4GW of onshore wind, and 6.7GW of offshore wind. Spain is the top solar country with 14.2GW of PPAs, and Germany is second with multiple levels down at 3.6GW. Sweden is the top onshore wind market with 4.5GW, followed by Spain at 3.8GW. Germany dominates offshore wind with 2.8GW, with Great Britain second at 1.7GW.

Evolution of PPA technologies by yearly additions, 2018-2023 (GW)



Source: PexaQuote, PPA Tracker Note: Hydro, mixed technologies, and unknown technologies have been excluded from the analysis



➤ **Balancing contracts are becoming pivotal**

Over the past two years, as more intermittent power joined the grid, imbalance prices have increased steadily, resulting in often elevated balancing costs. In 2022, as high electricity price volatility exacerbated these market fundamentals, the prices quoted by vendors serving as Balancing Responsible Party (BRP) spiked to EUR 7/MWh. In 2023, despite prices dropping to approximately EUR 3/MWh, they still remained higher than the long-term average.

For renewables' owners and operators, such development has manifested through augmented route-to-market expenses and balancing costs, which play a critical role in an asset's revenue stack. Given the state of the energy transition, elevated system costs will only persist further, becoming a staple consideration for a PPA's additional cost.

“

Given the state of the energy transition, elevated imbalance costs will persist for a considerable time. We saw that after 2022's volatility and pricing levels, many renewable producers entered 2023 very cautious about balancing agreements, which are now considered a material contracts in an asset's revenue stack. Amid tightening margins, both Balancing contract and GoOs sales optimisation constitute the low hanging fruits towards achieving portfolio excellence. We anticipate the trend to continue to grow further in 2024

”

— Jonas Nihoej, Head of Portfolio & Trading Services at Pexapark



CHAPTER 2: PPA ADVANCEMENTS AND INNOVATIONS

2.1 HYBRID PPAS ENTERED THE SCENE

The momentum around renewables-plus-storage increased significantly over 2023, as most players are looking at either introducing storage in their portfolio or increasing capacity. The impetus also manifested in the European PPA market through the emergence of the first Hybrid PPAs for large-scale subsidy-free solar assets.

Leveraging successful and well-understood standalone storage business models centred around grid services in pioneering markets such as Great Britain, Hybrid PPAs are set to be an impactful next frontier. The idea is to combine the best of two worlds, **grid services** and generation **asset performance** boost through profile shaping, **in a structured contractual manner**. It's not random that the first bankable Hybrid PPA for a purely subsidy-free solar project emerged in Great Britain.



40MW/80MWh



55MW

BUYER



SELLERS



10-y Solar PPA



10-y Optimisation Agreement

In June '23, equity fund DIF Capital Partners signed a Hybrid PPA with Engie covering a 55MW solar PV project co-located with a 40MW/80MWh battery storage asset, in Bedfordshire, UK. The Hybrid PPA mirrors **Renewable PPA & Storage Capacity agreement (CSA)/Optimisation agreement** contractual set-up, where there's a 10-year PPA for the solar asset, and a 10-year optimisation agreement for the battery element.

Pexapark's Storage and PPA Transactions team collaborated leveraging quant-driven capabilities to advise on one of the first bankable purely subsidy-free Hybrid PPAs in the country. **Such a structure is ready to be exported in further EU markets.**

“

Grid connection savings are a core attraction for co-location.

Still, the combination of value creation from grid-level services alongside optimisation of asset-level revenues epitomises the driver behind the promising land of the business model. Valuing hybrid assets is a core challenge to accelerate investment decisions, as modelling available market opportunities can often be a moving target. Across key markets in Europe, a significant pipeline of hybrid assets is ready to take if contractual arrangements can make the financial model bankable. We believe Hybrid PPAs for merchant assets will move beyond Great Britain. Due to cannibalization risk, Spain's solar-plus-storage segment is expected to spike in a few years.

”

— Brian Knowles, Director of Storage & Flexibility

We also noted a Hybrid PPA in **Lithuania**, although the structure differs. Under an Energy-as-a-Service PPA with Carlsberg's Svyturys-Utenos Alus (SUA), Green Genius will offer two solar-plus-storage plants to cover 100% of the corporate's demand. The first project is an on-site system in a brewery in Utena (COD by May 2024). It will build upon an existing 1MW rooftop installation, bringing its total capacity to 2.5MW plus 2MWh battery. The second project, a 5MW solar plus 4MWh battery storage (DC and AC set-up), will comprise an offsite system in Butrimonys (COD Jan 2025).

Different risk-profile Hybrid PPAs have emerged in Germany since 2022. The country has pioneered government-backed partial subsidy schemes resulting in a solar-plus-storage pipeline of more than 1GW. Through its Innovation Tenders, Germany is the only country that has created a tangible route-to-market for hybrid assets. The **partial subsidy scheme leaves further room for contractual innovation**, as the premium tariff is applied on top of the merchant revenues the projects can achieve. As the winning projects will seek out further contractual arrangements, the outlook for Germany's Hybrid PPA activity is very positive.



Find out more about the topic in our dedicated report “Renewables-plus-Storage Co-location Trends: Hybrid PPAs and More” [here](#).

2.2 EARLY SIGNS OF PPAs FOR GREEN H2 PRODUCTION

Another notable trend in 2023 was the rapid growth of PPAs destined to power upcoming green hydrogen and ammonia plants, with a mix of nuances painting the whole picture. PPAs linked to green hydrogen and ammonia production were announced in **Norway, France and Germany**, leveraging new and existing capacity.

EU's first Delegated Act acted as a key regulatory driving force behind nascent activity. Although not fully defined, the Act shed enough clarity on the requirements for hydrogen to be considered a renewable fuel to lead to the trend's emergence. Commissioned assets were able to exploit some regulatory flexibility around additionality exceptions.

Norway's abundant – and baseload – hydropower offers a competitive advantage to green fuel plants requiring hefty TWh of power annually. The country has seen offtake activity by aspiring green hydrogen producers such as **Fortescue Future Industries** and **Aker Horizons** (both with Statkraft), even though the PPA technology remained undisclosed.

France was not only a surprise for its increased corporate appetite, but also for the innovation in the market. Green hydrogen producer Lhyfe signed two PPAs of a total 28.2MW capacity to feed green hydrogen plants in Brittany and Occitanie – one of which being a 15-year Repowering PPA linked to a 17-year-old onshore wind farm.

A share of **Germany's offshore wind** was also re-directed towards green fuels production, with the emergence of deals linked to both new capacity (Iberdola's 476MW Baltic Eagle), as well as existing assets.



180MW

From: **288MW**
Butendiek
offshore wind



Opt-out from EEG scheme



PPA for Hydrogen

One of Germany's first offshore wind assets commissioned in 2015 under the EEG subsidy scheme, **opted out 80% of its output** from the support mechanism to cater to the increasing needs of PPA offtakers.

Given the market landscape of 2023, PPAs often offer more attractive revenues than EEG. Butendiek, similar to other assets commissioned in the same period under the national support scheme, would soon enter EEG's low-end price tier. To this end, Pexapark assisted the project's investors in finding the right offtakers, resulting in two long-term PPAs. Both agreements will enter into force in July 2024:

- Nov '23: An unnamed utility will offtake 750GWh annually, 62.5% of the project's total output to feed upcoming hydrogen production plants
- Dec '23: Swiss utility BKW Energie will offtake 200GWh annually, 18% of the project's total output
- The remaining 20% of the volumes will still benefit from EEG arrangements

“

In PPAs for Green H2 Production, **regulatory risk** is one of the largest hurdles. The EU Delegated Act guidelines, which drive electrolyser investment at the moment, are a moving target with many uncertainties. One of the biggest challenges was making many assumptions around where regulation would be going, and coming up with a scenario accordingly. Regarding the strategic nature of the deal, for existing offshore wind assets under EEG in the country, we believe the **optimisation route through opting out of the subsidy scheme** is a small risk with a major revenue impact. The level of opportunity in the future will depend on how PPA prices will evolve, and whether they can offer more attractive returns than the low-tier price.

”

— Mathieu Ville, Head of PPA Transactions at Pexapark

We also observed some **‘framework agreements’**, which indicate an alternative sourcing strategy for securing the potentially huge electricity volumes required for Green H2 production. For example, Spanish O&G company Cepsa signed a framework agreement with Grupo Ibereólica Renovables for up to 5GW of solar and wind for the former’s future H2 projects in Andalusia. Likewise, Sweden also saw H2 Green Steel signing two frame PPAs with Fortum for CO2- free electricity, although renewable energy is not explicitly referenced in the announcement.

All in all, in 2023 the European PPA market started playing a greater role in facilitating the uptake of green hydrogen, and we believe the trend will continue in 2024 depending on some critical factors. Our analysis indicates that out of at least 120GW of project announcements floating in the market, only 1% has achieved final investment decision (FID). We believe 2024 will be the ultimate test of whether investors are convinced by project economics, with the business case not fully clarified yet.

The situation could be more straightforward for projects coming off the first auctions (therefore enjoying a form of state subsidies), and we hope to see some acceleration both in development and financing activity on that front. Lastly, more regulatory clarity and support are needed on renewable fuels of non-biological origin (RFNBO) compliance. For example, there’s a lot of uncertainty around the function of ‘intermediaries’ such as utilities/traders who often facilitate deals between sellers and buyers.

Renewable energy is heavily needed to feed any Power-to-X project. However, the sweet spot lies in the delta between project economics and PPA prices – and this landscape is still evolving. Even though the trend of PPAs for Green H2 Production emerged quicker than mainstream expectations, the viability and robustness of the concept will consolidate with the signing of more non-conditional PPAs.

2.3 AGGREGATING DEMAND: MULTI-BUYER PPAs

Multi-buyer PPAs, also known as Aggregated PPAs, are not new to the European PPA Market, as such deals, in principle, emerged in 2016. However, 2023 saw the concept maturing in an accelerated manner.

First things first: A multi-buyer PPA is one contract selling to multiple aggregated offtakers under the same umbrella agreement. The idea is to pull together the demand of smaller-sized corporates with lower consumption volumes annually, and enable them to form a coalition to buy as one party.

It's worth noting there's a significant distinction between Multi-buyer PPAs and large assets selling to multiple buyers through separate agreements. For example, at the beginning of the year RWE signed PPAs with eleven industrials and one municipality for a hefty 1,500GWh per annum from the 295MW Nordsee Ost and 288MW Amrumbank West offshore wind farms in Germany. In this case, each contract's length, start date, and volume structure are independent.

In a Multi-buyer PPA, there's a joint negotiation of corporates that want to buy together. Typically, there's creditworthy anchor offtaker which is creditworthy to balance out non-investment grade corporates. Still, the allocation of default risk is one of the largest discussion points.

However, requirements from the market are evolving, and sellers appear to be standardising and simplifying the contract structure. For example, in Nov '23 Lightsource bp invited corporates to join a collective due to offtake solar energy from Spain, aiming to launch collective PPA opportunities regularly. The year also saw a record number of Multi-buyer PPAs in Denmark and Spain.

Multi-buyer PPAs announced in 2023

DATE	COUNTRY	PPA SIZE	BUYER	SELLER	TECHNOLOGY	TENOR (YEARS)
June '23	Denmark	n/a	7 corporates	Reel	Solar	5
Aug '23	Denmark	29.00	4 kitchen manufacturers	Better Energy	Solar	10
Nov '23	Spain	n/a	The Fashion Pact	Lightsource bp	Solar	n/a
Dec '23	Spain	127.00	Thermo Fisher Scientific, Eurofins Scientific	ib vogt	Solar	n/a

Source: [PexaQuote](#), [PPA Tracker](#)

While other European jurisdictions such as France, Finland, Great Britain and Netherlands have seen similar deals in the past, the largest deal count ever was observed in 2023. In spite of increased interest in the concept, we believe government-backed credit guarantee schemes would be a more impactful tool to increase the pool of SMEs willing to buy. The sophistication of sellers and inclusive guarantee schemes could be the main two drivers of the trend.

2.4 **NEXT FRONTIER:** **24/7 GREEN ENERGY PURCHASING**

A 24/7 carbon-free energy (CFE) procurement approach effectively makes greater and greener contributions to the energy transition, as has been proved by several studies. The more niche trend to energy procurement is driven by corporates interested in *hourly matching of consumption* in lieu of the prevalent annual consumption matching model. This trend is linked to the increased sophistication of corporates, this time seen by the pioneering ones, and the heightened focus on profile and shape risk and additionality.

The benefits are threefold. First, more robust **green credentials** through hourly matching give green claims greater credibility than an annually-based approach. Secondly, this more granular approach results in **greater deployment of renewables**, as in effect demand drives the deployment of 24/7 green energy, aka a 100% renewables grid. This increases the **additionality** impact of the agreement.

Very importantly, more granular matching of renewable energy PPA volumes with demand increases the **effectiveness of PPA hedging** by reducing the buyer's exposure to the wholesale market for the deficit and excess volumes. Therefore, a 24/7 procurement can be a very impactful approach to sourcing renewable energy. We often hear requests for 'smarter renewables' typically addressing the supply side. But what if a procurement approach is in the driving seat to request smarter renewables?

Until this year, studies around the concept had demonstrated that >90% hourly matching is technologically possible, but comes at a high cost primarily because of the over-procurement to meet the hours that are harder to serve. However, these studies didn't analyse the hedging benefit of reduced exposure to market prices in such an approach.

On behalf of Eurelectric, Pexapark conducted a publicly available study that proved that a 24/7 approach improves the hedging impact of a PPA. While previous studies have used estimated technology costs, the Pexapark study used a market-based approach to provide a view of the hedging cost and benefit for a 24/7 CFE supply portfolio using PPAs with existing renewable technologies.

Consistent with previous studies, the Pexapark and Eurelectric study found that high levels of hourly matching are possible with current technologies. An optimised portfolio of wind and solar PPAs is enough to start a 24/7 journey and achieve 60-75% hourly matching. Storage plays a key role in this approach, since portfolios that include co-located renewables-plus-storage assets can provide up to 90% hourly matching based on the latest configurations we see today (100% power ratio with 4h duration).



Our study demonstrated that a 24/7 strategy based on existing technologies including co-located battery storage can provide both a high level of hourly matching and a positive financial hedging benefit under a range of market conditions. However, implementing and managing the approach requires a high degree of sophistication. Therefore, market players with energy risk management capabilities such as utilities can play an important role in facilitating corporate 24/7 green supply commitments.



— John Dallimore, Head of Corporate PPA & H2 at Pexapark

➤ **Read more on our 24/7 renewable PPA study on behalf of Eurelectric [here](#).**

We believe the 24/7 clean energy procurement approach will be the next big frontier in the medium term, and we may see a few intentions to mirror this approach in 2024. Demand

for 24/7 will also allow utilities to facilitate such agreements, having access to multiple generation and profile technologies. So, there's very much a role for utilities and asset owners with that risk management capability to play to enable the growth and development of this PPA segment.

Finally, as 24/7 PPAs share similar benefits and challenges to Baseload PPAs, a risk-adjusted diversified portfolio by geographies and technologies will play a positive role to asset owners interested in tapping this new opportunity in the market. In our view, understanding the risk principles and the associated portfolio tools to manage the risks of Baseload PPAs is a core pre-requisite for the next step of 24/7 PPAs.

➤ **Last but not least**

Spanish Virtual Cross-border PPAs: Spain saw 520MW of Cross-border PPAs linked to solar assets across seven deals. The Mediterranean Queen is the prime choice of corporates attempting to offset pan-European consumption (or part of it) through one deal. However, the structure could unravel significant levels of risk when generation does not sit in the same price zone with consumption due to the uncertainty around whether the two (or more) prize zones correlate. We believe Cross-border PPAs are mainly driven by ESG considerations (through the use of GoOs to offset consumption), without always prioritising price hedging aspects.

Nuclear PPAs: Nuclear has been attempting to find its place in the energy trilemma, mostly leveraging strengths around environmental sustainability and energy security. The discussion has led to the possible emergence of Nuclear PPAs not only within the borders of France, where the narrative goes in line with the country's historical energy mix, but also across more European countries due to innovations around SMRs (Small Modular Reactor). The feasibility of the concept will depend on the delta between the economics of emerging technologies, power prices, and the positioning of nuclear power in the energy transition.

ACT II

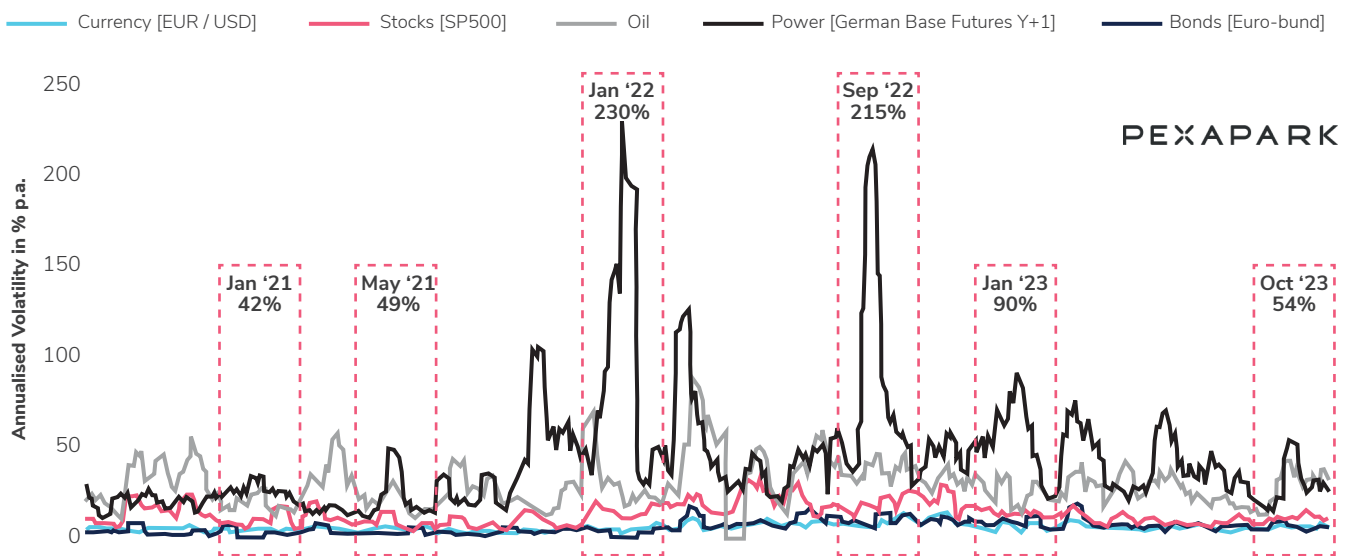
CHAPTER 3: PROMINENT EVENTS OF 2023

3.1 VOLATILITY AND PRICES EN ROUTE TO STABILISATION

The year 2023 was characterised by a consistent downward trajectory of gas and electricity prices, resulting in reduced volatility levels in power markets compared to the year before.

Taking as a reference example volatility in the German 1-year future contracts, from the peak 230% volatility in January '22, last year's peak was experienced in January '23 where volatility stood at 90%. By Q4, volatility had dropped to lower levels below 54%. Even though volatility is reduced, it is still exceptionally high vis-à-vis other commodities, and above historic average.

Historic evolution of annualised realised volatility across asset classes (Jul 2020- Nov 2023)



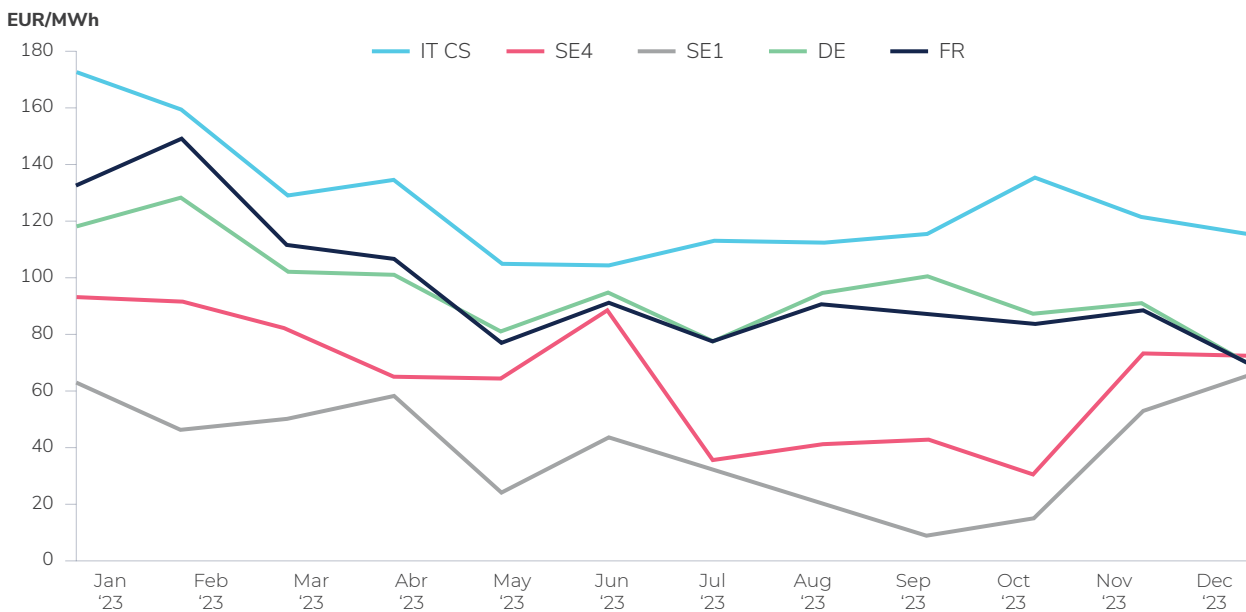
Source: Pexapark calculations

Note: 'German Power' refers to front-year BL contracts traded on EEX. SP500 is a stock market index tracking the performance of large listed US companies. 'Brent' tracks volatility of the rolling front-month contracts of North Sea grades of crude oil. 'German Bunds' refers to volatility rates of German bonds with an 8,5- 10.5y residual tenor range.

Utilities and trading houses thoroughly monitor volatility due to its central role in assessing and managing financial risk. In a typical year before 2020, annualised volatilities of front-year contracts were moving at 15-35% levels for extended periods, still displaying a manageable level of risk for trading agents. Today, all PPA sellers and buyers are impacted as the newest 'trading parties' of green electrons and volatility's effect on pricing. **The historic numbers indicate that we have entered a new era of prolonged volatility, for now mostly driven by fossil fuel pricing risks and macroeconomics.**

On the pricing front, power prices across Europe dropped generously from last year's peaks of 700 EUR/MWh, but remain higher than historic levels.

Monthly average day-ahead prices in selected European countries

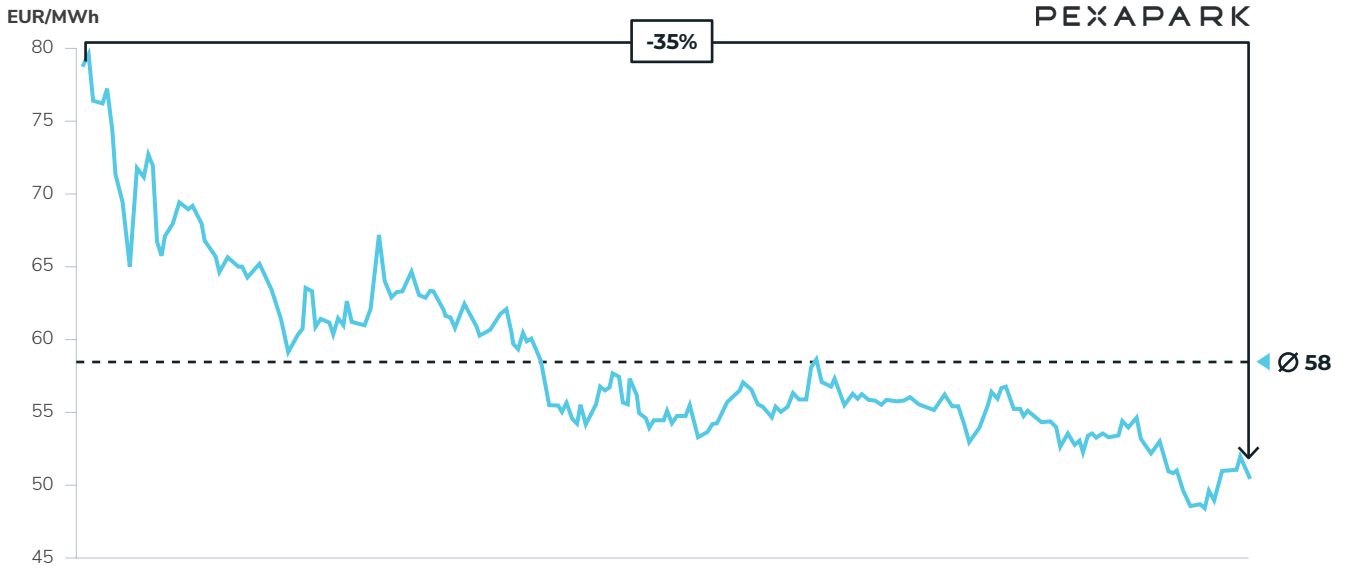


Source: Entso-e, Pexapark **Note:** IT CS stands for Italy's Central South bidding zone; SE1 and SE4 are Sweden's northern and southern bidding zones, respectively.

As PPA prices partly derive from forward curves determined from traded forward contracts, they are continuously subject to fluctuations and volatility. **From the first day of January at 78.7 EUR/MWh to the last day of December 2023 at 50.1 EUR/MWh, the EURO Composite decreased by 35% - with the average throughout the year standing at 58 EUR/MWh.** Despite increased futures trading activity through 2023, power liquidity remains well below pre-2021 levels.



Daily evolution of PEXA EURO Composite, 2023

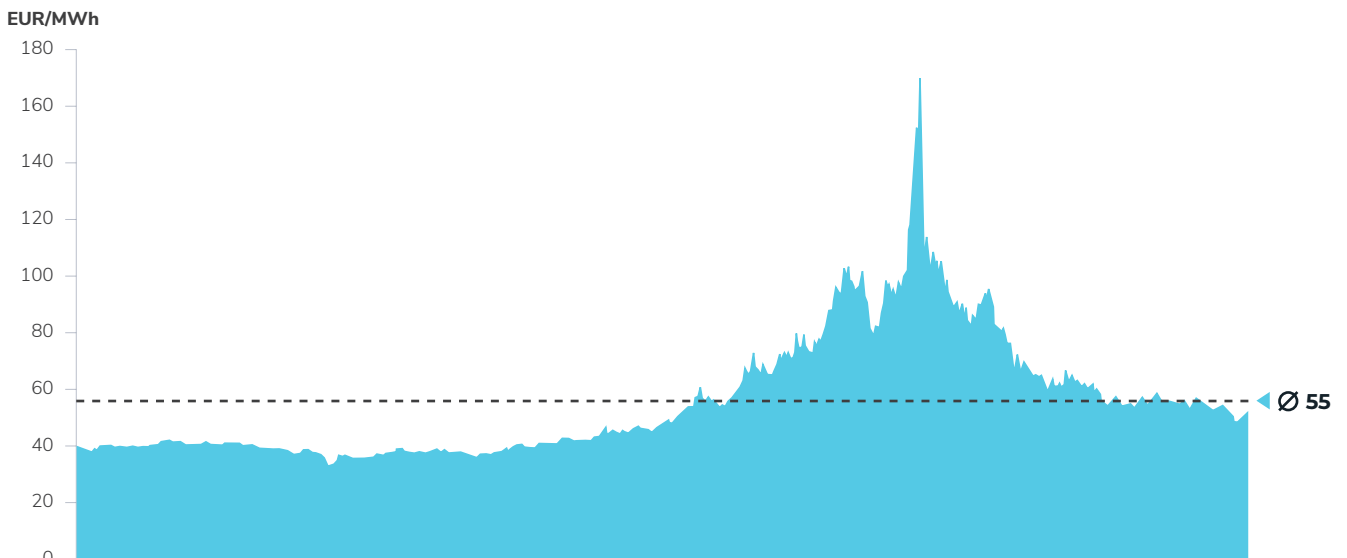


Source: PexaQuote, PPA Trends **Note:** The EURO Composite is an average of 10-year solar and wind pay-as-produced PPA prices across Europe, for a commercial operation date in Y+1 and Y+2 (rolling average)

When we put the past year in perspective, it derives that the average 2023 PPA prices lay just above the 58 EUR/MWh average since 2019. This value is heavily influenced by the spikes witnessed from Q4 2021 onwards, but are still higher than the 'old normal'.

➤ If you would like to find out more about PPA benchmark prices for a specific European market on PexaQuote, please click [here](#) to book an introductory call.

Daily evolution of PEXA EURO Composite, 2019- 2023



Source: PexaQuote, PPA Trends

On the back of lower volatility and high corporate demand, risk discounts factored into PPA pricing to compensate for market, technology, and structure-specific risks have decreased substantially compared to 2022 levels. For example, as part of an ongoing assessment of PPA prices, Pexapark has observed notable shifts in mature markets such as Spain and Germany, where robust corporate demand for large volumes has substantially reduced risk discounts. This is also a result of many utilities shifting their focus towards back-to-back PPAs with corporates rather than warehousing and managing large risks.

On the other hand, some markets are depicting an increasing perception of **cannibalization risks**, with offtakers responding by pricing in substantial discounts into Pay-as-Produced (PAP) structures, as will be further explained later in this chapter.



Although risk discounts from offtakers are decreasing, there might be some 'hangovers' from 2022's high volatility. Offtakers who signed PPAs when the market was distressed could now be sitting with an expensive PPA, highlighting the importance of understanding the difference between valuing and pricing a PPA. Even though awareness is increasing, we are still seeing corporate offtakers focusing on the outright price of the PPA, meaning they are foregoing markets where they can achieve a higher return, as the PPAs have a higher value.



— Romero Carrillo, Director of Business Development at Pexapark

➤ A note on natural gas pricing and availability

Gas prices fell significantly in 2023 compared to the previous year, mainly due to demand levels well below norms, while LNG and pipeline supply remained strong. EU storage fullness hit new records in 2023, reaching mandatory targets well ahead of schedule.

A potential escalation of the Israel-Hamas war has sparked fears of supply shocks to oil markets in particular. However, despite disruptions to shipping routes in the Red Sea, supply has not been adversely impacted, nor have energy prices been as bullish as previously anticipated by the market.

Throughout 2024, gas and power demand is expected to recover slowly, as demand is still beneath pre-crisis levels. Increasing consumption levels will likely be met by rising renewables and French nuclear outputs, squeezing thermal plant revenues. Gas consumption will likely slowly grow through the year, with most of that extra demand being met through LNG.

David Battista, PPA Price Reporter & PPA Market Editor at Pexapark

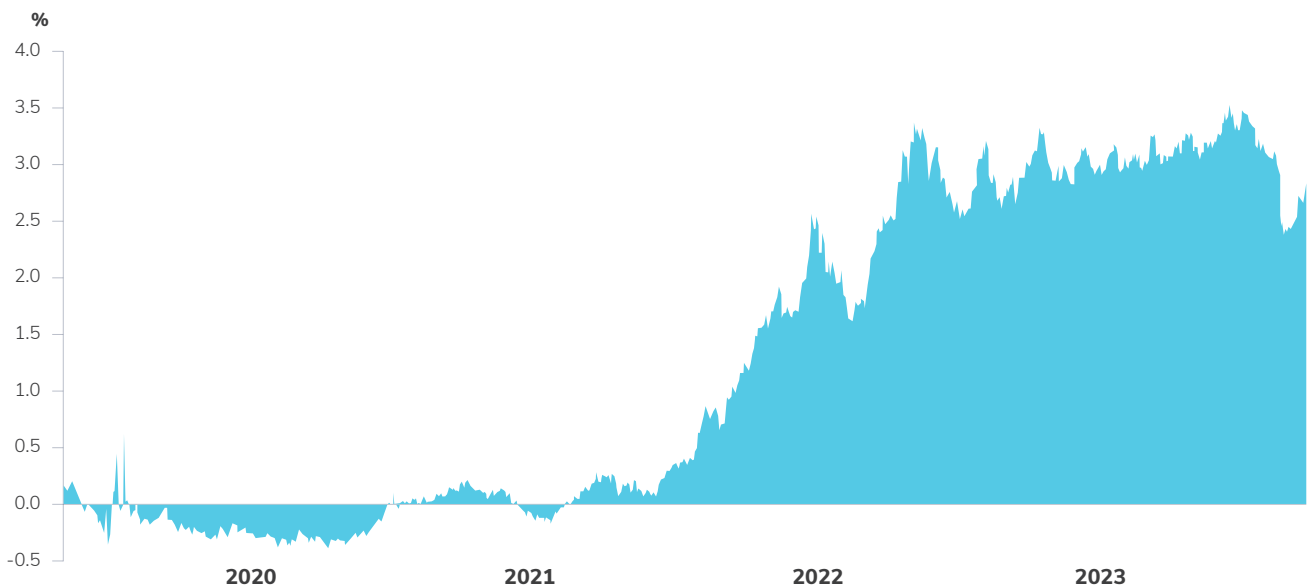
3.2 MARKET FUNDAMENTALS SHOOK UP FINANCING COSTS

The past year has been the 'rainbow after storm' in many aspects, but not all. Following the progressive settling of the pricing and regulatory turmoil, the renewables industry was confronted by a snowball effect of changes in market fundamentals, resulting in higher-than-average construction, operational, and funding costs for renewable assets.

The **cost of debt** has risen primarily due to rising base rates. The 10-y Euro swap rate surged to a peak of almost 3.9% following a continued upward trend over the past 18 months, to end the year at around 2.5%. Such rates present a drastically different environment than the renewables financing community has learned to operate in.

Lender margins are reportedly largely unchanged, indicating continued bank appetite for the sector. The rising cost of debt and equity capital then served a further blow by increasing the discount rates at which assets are valued.

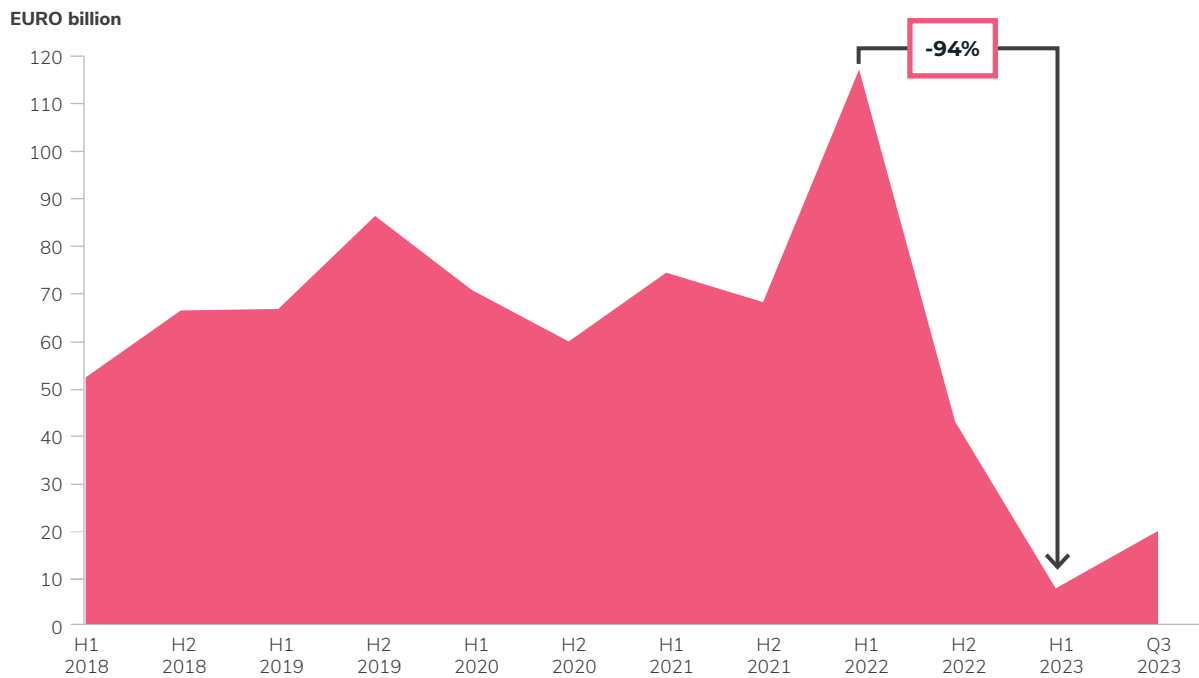
10-year Euribor swap rate, 2020- 2023 (%)



Source: [investing.com](https://www.investing.com)

The most immediate effect of high financing costs was a sharp decline in fundraising for private infrastructure funds. According to data from Infrastructure Investor, fundraising plummeted from an annual EUR 140 billion in 2022 to EUR 27 billion in the first nine months of 2023.

Fundraising activity, 2018- Q3 2023



Source: Infrastructure Investor

“ Challenges in market fundamentals are catalysing interest in squeezing margins, as market players are looking to make the most of their portfolio. Even in a scenario where financing costs go down, portfolio risks associated with system costs and volatility will further contract margins, and investors will push for higher risk-adjusted returns than a bond yield. Economies of scale will play a critical role in this trend, which we believe is linked to the consolidation we see in the market, as the larger the portfolio, the larger the resources to focus on the details. We observed a new appreciation for the complexities around structuring a risk-adjusted hedging strategy, but interest remains among large players for now. ”

— Itamar Orlandi, Senior Risk Advisory Manager at Pexapark

Optimisation of revenue for subsidised assets

Under the mega trend of operational excellence, which is unfolding in stages and is pioneered by players with the largest portfolios in the market, we believe that more assets will seek **optimisation of their government-backed revenue**. In the past, limited hedging sophistication knowledge instilled the mindset that government-backed assets receiving a stable revenue throughout the term years of the scheme had little leeway to proactively increase captured revenue.

As renewables are unravelling the mysteries of the open electricity markets, there's increased appetite to see what value is hidden in their operational portfolio. There's an **à la carte menu of opportunities in the market**, and the most utilised tools are two: a) Optimising the merchant exposure within the subsidy scheme and b) opting out part or whole annual volumes from the subsidy remuneration (subsidy-opt out) to achieve better pricing in the PPA market.

Nonetheless, the extent of the opportunity will depend on the pricing environment, and the regulatory flexibility of the schemes. Germany, especially in the offshore sphere, Denmark, Netherlands, France and Poland are some of the opportunities we've seen the market pursuing.

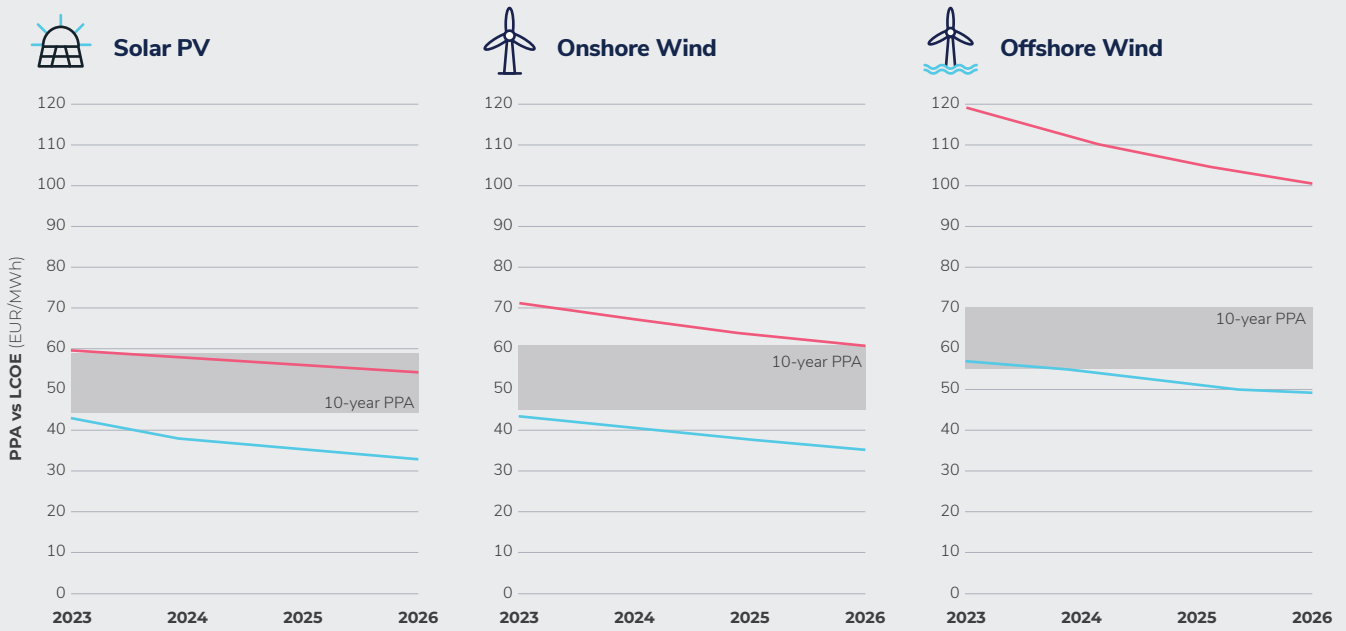
> **Offshore wind LCOE troubles**

High financing costs impacted offshore wind, in particular. Over 2023, we saw a series of events – high interest rates, lowering power prices and increased cost of materials – affecting offshore wind LCOE in impactful ways. Headlines did not only come from across the pond, with several US offshore wind projects in development requesting re-negotiation of their allocated CfD, but also from the European continent.

In GB, Europe’s largest offshore wind market by installed capacity, Vattenfall put a pause on the development of its 1.4GW Norfolk Boreas, and will re-evaluate the investment strategy of the entire Norfolk zone (in total 4.2GW), which held a £37/MWh from the country’s AR3 CfD allocation round in 2019. In addition, UK’s AR5 tender did not receive a single bid for the 5GW that were up for grabs.

The environment also affected some PPA negotiations for new offshore wind projects that halted because of development recalibration. For example in Germany, offshore wind LCOE jumped to new highs at more than 110 EUR/MWh while PAP PPA prices in the range between 60-75 EUR/MWh.

Comparison of LCOE and PPA Prices across different technologies, Germany



Source: PexaQuote (January 2024), BNEF (2023). Note: Average prices throughout January for a 10-year Pay-as-Produced (PaP) PPA in Germany with a PPA start date of 1 January 2025.

— LCOE - Low — LCOE - High

Nonetheless, good news came from Germany, as the country’s 7GW offshore wind tender proved oversubscribed, leading to negative bids. At the same time, GB is already adapting the rules for the next tenders while increasing ceiling prices for offshore wind by 66%. Even though this is not directly relevant to the PPA market, a common practice in the GB offshore wind market is to put forward part of an offshore wind development to the CfD rounds to achieve a level of inflation-linked revenues, so that they have more leeway to leverage opportunities in the market-driven open environment. This way, more capacity becomes available for the PPA market.

Germany holds the lion’s share of 2023’s 1.85GW offshore wind PPAs across 16 deals, with activity also noted in the GB and Netherlands markets. The picture is different from 2022, where activity was more balanced.

3.3 SHORT-TERM PPAs SHOWED MIX MOVEMENTS

Short-term PPAs differ largely in tenor. Their range spans across weeks, months, or up to five years. On the back of that note, the picture in 2023 was both positive and negative.

Although most ST PPAs do not meet the criteria of our PPA Tracker, we keep our notes when ST PPAs are publicly disclosed to see if they are signed for new projects. If they do – which is still rare – it means they have played a role in the project coming online, and therefore are qualified for the PPA capacity we're interested in tracking. As this is a very nascent market, with some lenders still reluctant to accept such term years for financing at attractive rates, we were particularly excited by some announcements.

In Great Britain, OVO ENERGY signed three different **3-year PPAs linked to projects still to be commissioned**. The utility signed a 3-year PPA linked to the 50MW Skeeby solar pv project in Richmond, North Yorkshire with an expected COD in March 2024. ROOF was on the sale side. OVO Energy signed two more 3-year PPAs for smaller projects with Ambition Community and Genatec.

At the same time, activity of **1-5 year PPAs for existing assets** increased significantly year-on-year, with almost half of deal count in Germany. Other countries include France, Italy, Ireland, Denmark and Spain.

Selection of ST PPAs announced in 2023

DATE	COUNTRY	PPA SIZE	BUYER	SELLER	TECHNOLOGY	TENOR (YEARS)
Feb '23	France	12MW [post-subsidy]	Mint (retail utility)	Kallista Energy	Onshore Wind	2-year
July '23	Germany	27.8MW	Deutsche Bahn	Re:cap	Solar	2-year
Nov '23	Ireland	n/a	Merrion Hotel	Flogas	Onshore Wind	1-year
Sept '23	Germany	38.4GWh p.a.	Axpo	Sunnic Lighthouse	Solar	4-year

Source: [Pexapark research](#)

On the other hand, the more sophisticated optimisation through a **dynamic selling** strategy comprised of weeks-long and months-long PPAs took a significant hit by the implementation of the windfall taxes. PPAs of 1-year > tenor enjoy particularly low discounts, and are priced the highest. The regulatory complexity and the revenue caps across Europe vastly stiffened the market.

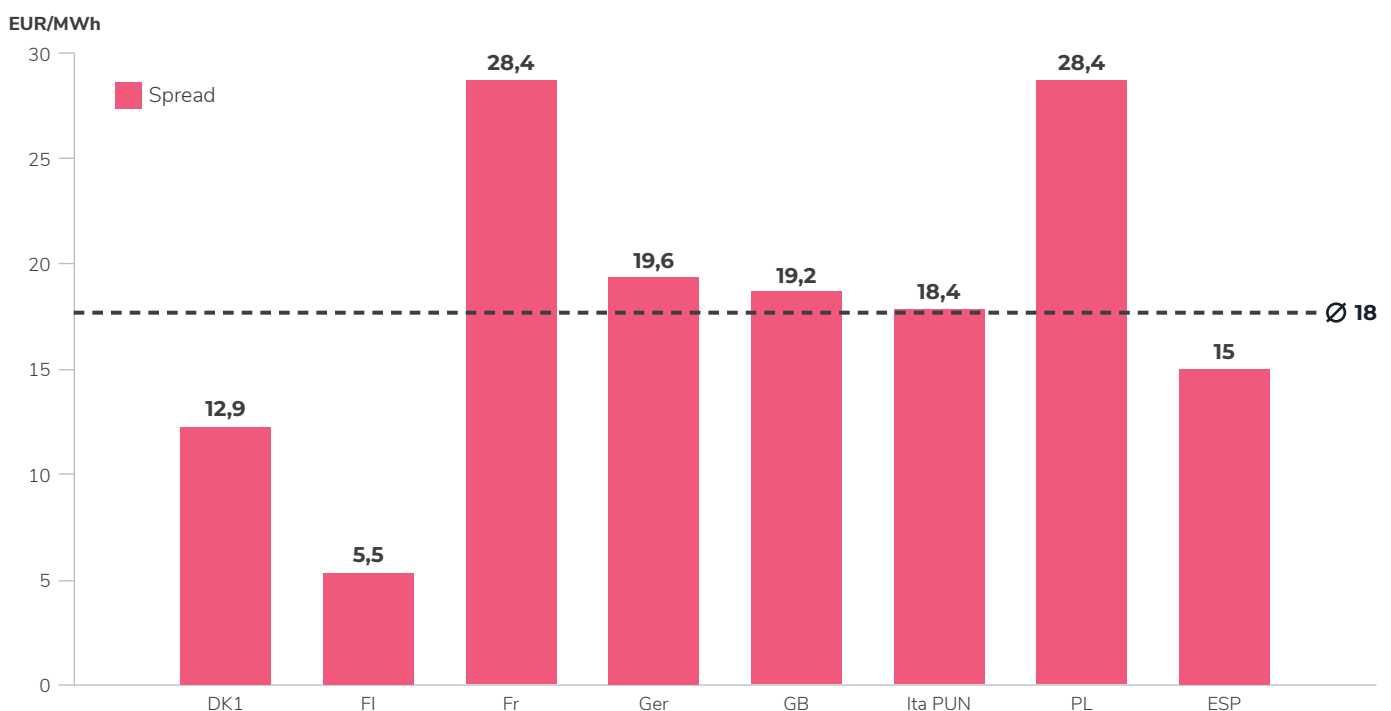
This segment of the ST PPA market (rarely publicised) is largely driven by its high reward profile, which often outperforms the resources required. Despite 2023 still comprising a higher-than-average pricing year, it seems that the appetite for a rolling hedge decreased.

We believe that some players viewed this approach **highly opportunistically and not as a strategic risk management tool, despite the evident upside**. One of the reasons could be that many players focused more energy on fundraising hurdles and less on short-term optimisation of existing assets, especially the small and medium players.

We believe that the fundamentals for revenue optimisation through a mix of long-term and short-term PPAs remain, as the spreads between ST and LT will proportionally persist – and even 0.5 EUR/MWh can make a large difference, especially in economies of scale. Our expectation for 2024 is that the trend of 1-5-year PPAs will accelerate further because the benefits are multiple, irrespective of market conditions.

Leveraging a medley of term years can unlock a larger pool of offtakers, particularly corporates, whose buying need typically is skewed to shorter tenors and hence are excluded or do not participate in the 10-year PPA market. Similarly, historically utilities have had mandates to trade up to 5-years ahead. Hence, there is also a structural advantage in speed and scalability if shorter tenors are more embraced by sellers and financiers alike.

Spreads between 5- and 10-year PPAs in key markets (EUR/MWh)



Source: PPA Prices, PexaQuote (as of Nov 2023)

3.4 MORE TROUBLE WITH BASELOAD PPAs

➤ What is a Baseload PPA?

In a Baseload volume structure, a seller commits to a fixed set of MWh, either monthly or annually. Depending on the generation profile, at times, the asset will end up with a **long position** (when it produces more than committed volumes and sells surplus to the market) or a **short position** (when it produces less than what's committed and missing volumes need to be managed in the markets). The corresponding sale and purchase is typically administered through a professional third party. Such risk is engineered in the pricing in the form of discounts based on the state of the market. That's one of the main reasons Baseload PPAs command a price premium compared to Pay-as-Produced PPAs.

Over 2023, the appetite for Baseload PPAs was mixed – with most sellers being increasingly cautious despite the price premium of the volume structure.

Since the European PPA market entered its high-volatility era, there has been an evolving narrative around the opportunities and risks of Baseload PPAs. The trend was initially driven by the Nordics' onshore wind sector due to demand from corporate offtakers. Later, in the rest of Europe, cannibalization increased risks for PAP PPAs (as analysed in the above section) due to price discounts challenging expected revenues. However, an opportunity emerged for BL.

Just when momentum started taking off, in Q4 2021, a perfect storm of high prices, low capture factors and unforeseen deviations from production forecasts led to eye-popping cash outflows and losses because of unmanaged open positions in the Nordics region – which continued throughout 2022.

Fast forward to 2023, certain bankruptcies linked to Sweden's onshore wind were publicised, creating further uncertainty in the market. There were times when we saw a rearrangement of how some market participants view the risk profile of BL PPAs, classifying it as riskier than a merchant approach.

Nonetheless, we noted three new Baseload deals – two leveraging a mix of technologies – in Italy, Poland and Germany.

Baseload PPAs announced in 2023

DATE	COUNTRY	PPA SIZE	BUYER	SELLER	TECHNOLOGY	TENOR (YEARS)
May '23	Italy	200GWh p.a.	TIM (cPPA)	ERG	Mix: Solar pv, onshore wind, hydro	9-year
Oct '23	Poland	n/a	Cemex Polska (cPPA)	Statkraft	Mix: Solar pv, onshore wind	8-year
Nov '23	Germany	76.5MW	BP (uPPA)	Sunnich Lighthouse	Solar	10-year

Source: PexaQuote, PPA Tracker **Note:** the list comprises PPAs where volume structure was publicly disclosed.

The volumes are fundamentally lower than 2022's 2GW – which were mainly contracted by Alcoa's two PPAs with Greenalia and Endesa leveraging 1.8GW of new onshore wind capacity in Spain. Throughout the year, we also noted some appetite for **restructuring existing Baseload contracts**, although it was too late for some cases.

In principle, we believe BL PPAs could be one of the most cost-optimal hedging instruments on a case-by-case basis, if they are structured in a risk-adjusted manner. BL PPAs need to be approached with a monitoring approach, contrary to the 'sell-and-forget' mindset of PAP sellers.

The two essential elements of a BL contact need to be: a) hedging ratio, which differs based on the technology and whether volumes are committed on a monthly or annual basis and b) ongoing monitoring and management of performance. The risk of an open position is reduced when adapting the hedging ratio of the PPA.

Baseload PPAs are like stock trading – everyone can do it, but it's all about who does it well.

Equity trading can trickle away little by little, so depending on the investment horizon and risk-adjusted return expectations, respective adjustments are in order. The same principle applies to managing inflows and outflows of the agreement in a timely manner.

More timely foreclosure of losses and risks allows for a more balanced discussion with lenders, when new financing to manage losses or restructuring of the loan is needed. Financing banks typically receive a bi-annual update, where losses may have accumulated losses of millions. When the market changes, sellers need to follow up on past assumptions.

“

The financing environment for Baseload PPAs varies based on the technology and the country. Onshore wind BL PPAs still attract some interest, especially when underpinned by the right risk management approach. But for solar PV it's more challenging. Last year, we held a large study in the Iberian market across the financing community, where all participant lenders disclosed they were not comfortable with BL + PV, but they were willing to discuss onshore wind either on a monthly or annual basis.

”

— David Willemssen, Head of Risk Advisory at Pexapark



> **The other side of the coin: Cannibalization & Pay-as-Produced**

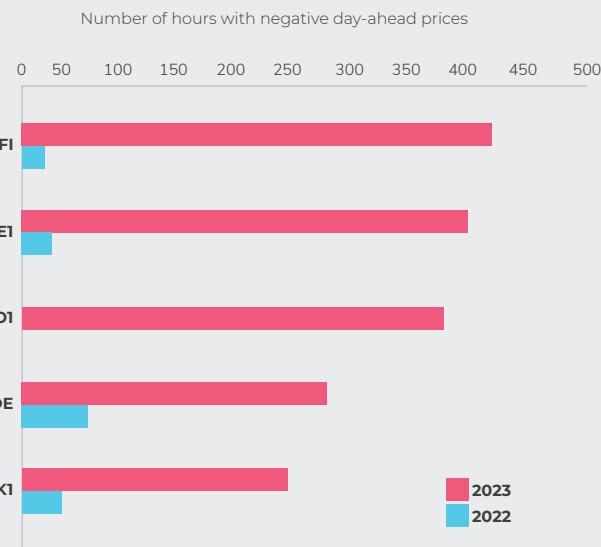
Over 2023, the frequency of **negative pricing** rose severely in multiple European countries. Negative pricing occurs when there's a vast imbalance between supply and demand, especially oversupply of generation when demand is lower. Finland saw the largest number of hours with negative prices in Europe, totalling over 400 across the year. At the same time, Norway's NO1 zone saw the largest increase from 0 to over 350, with Germany and Denmark following suit.

At the same time, the monthly **capture factors** (capture price divided by the baseload price illustrating the synergies between the two) of solar and onshore wind assets saw significant decreases in many price zones. Price cannibalization is linked to the generation seasonality of renewable energy and the fact that they cannot capture 24/7 hourly prices (baseload prices).

As a result, whether they will be able to capture high-pricing hours (peak) depends on their generation profile. For example, some analytical evidence of hourly distribution of negative prices across Europe in 2023 shows that they occurred during solar generation peaks.

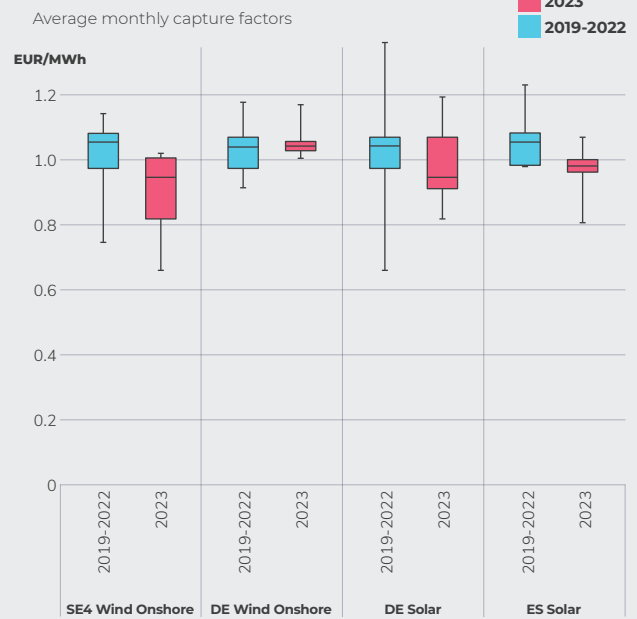
Dropping capture rates and record-high number of negative prices are impacting PPA pricing

Negative price hours in a selection of markets



Source: Pexapark Analysis, EEX and Nordpool data

Monthly capture factor trends in EU



Source: PexaQuote, Capture Factors

Increasing evidence of price cannibalization continues to push down Pay-as-Produced (PAP) PPA pricing. Nonetheless, PAP is still King across sellers, as less than 1% of 2023's PPAs cited Baseload as the volume structure. Due to the challenges we analysed with BL PPAs, **we anticipate that PAP will still be the number one preference** for sellers, but demand will continue from utilities (due to excess cannibalization risk in their books and the simplicity of managing a BL vs a PAP PPA), and energy intensives with time- and availability-sensitive energy requirements.

3.5 THE REGULATORY PENDULUM SWUNG BACK

Overall, in 2023 the tide of regulation across EU and individual member states notably changed compared to the year before.

In 2022, the renewables market experienced the full return of regulatory risk in highly abrupt ways. This was not only through the deployment of revenue caps and windfall taxes but also through a lengthy and heated discussion on whether the fundamental electricity market design assumptions were fit for purpose. Fast forward to 2023, and the picture changes significantly due to the expiration of most windfall tax mechanisms and the emergence of supportive regulation for many aspects of the PPA market.






Firstly, the EU unleashed hydrogen-related PPAs by defining the requirements for **green hydrogen and PPAs** as one of the central options for electricity procurement in a Delegated Act, thereby creating clarity in the market. Positive signals were also sent after some conclusions about the discussions on the electricity market design. Contrary to what was discussed during the peak of the energy crisis, Brussels eventually opted for a **soft reform** rather than a complete overhaul of the market design, and has further strengthened PPAs as a decarbonisation instrument. Additionally, we saw the introduction of new **government credit guarantee schemes**, such as France's recently introduced one, which could greatly expand the potential pool of offtakers entering the PPA market. Corporate appetite for PPAs was further strengthened from a regulatory point of view by more **stringent sustainability reporting** requirements, such as the EU Corporate Sustainability Directive, which came into force in January 2023.



— Dominique Hischier, Head of Analysis at Pexapark

Details on Guarantee Schemes across Europe

	SPAIN 	NORWAY 	FRANCE 
Who issues guarantee?	CESCE , a public company owned by the Spanish State	Export Finance Norway (Eksfin) , part of the Norwegian Ministry of Trade, Industry and Fisheries.	Bpifrance , a French public sector investment bank
Which offtakers are eligible?	EIIs (energy-intensive industry): <ul style="list-style-type: none"> • > 1 GWh/year in two of the previous three years • consume ≥ 50% of their energy during off-peak hours 	Guarantees are issued to power suppliers, banks or other lending institutions. Requirement for offtakers: <ul style="list-style-type: none"> • Registered in Norway • Active in the timber, wood products and processing, chemical or metal industry • Yearly consumption of > 10 GWh and PPA volume > 35 GWh 	Industrials in the extractive and manufacturing sectors , with a head office and consumption in France (no resale of electricity).
PPA requirements	PPA tenor ≥ 5 years and cover ≥ 10% of the EII's demand	Physical or financial , with a tenor of 7 to 25 years.	Physical PPAs with a tenor of ≥ 10 years and a yearly volume of ≥ 10 GWh
Guarantee structure	CESCE could indemnify up to 80% of the contract termination value to the seller , and CESCE could become the offtaker ("step-in")	In the case of default of an offtaker, Eksfin disburses the difference between the PPA- and the annual mean spot market price , up to a maximum of 80% of the remaining payments under the PPA or up to 80% of any loss that occurs.	The guarantee covers the difference between the value of the monthly production on the market and 80% of the remuneration under the PPA. If the market price falls below an optional floor price, the difference between the floor and 80% of the PPA price is paid.
Financing & size of the pot	FERGEI was endowed with EUR 200m and can cover guarantees of up to EUR 600m in its first three years	The guarantee scheme is self-financed , a guarantee premium which is depending on the covered risks must be paid	EUR 67m to guarantee 500MW of contracts. Additional revenue derived from producers' annual commissions linked to the guarantee parameters such as a floor price, the buyer's risk profile and the outlook for the electricity market.

Source: Pexapark Analysis, CESCE (2023), Eksfin (2023), Bpifrance(2023)

Contracts for Difference vs PPAS

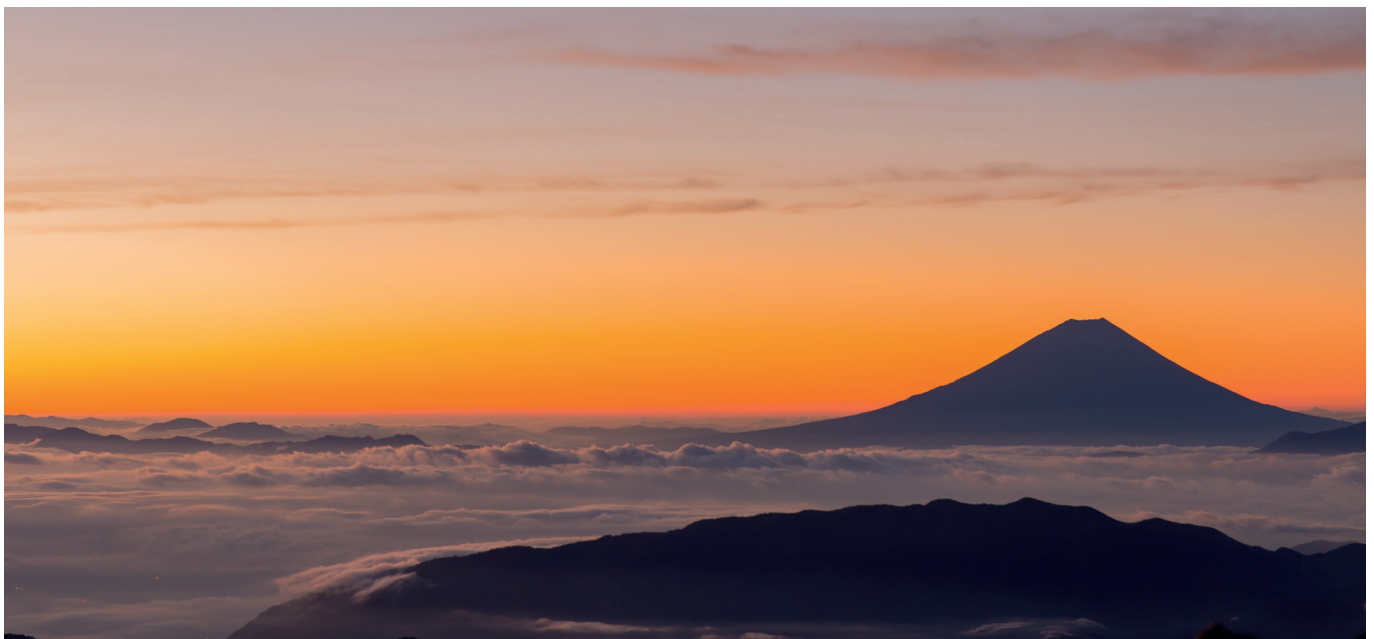
EU's Electricity Market Reform states that all **public support schemes** shall be structured as two-way Contracts for Difference (CfDs). When assets are underpinned by public spending, investors under CfDs can no longer capture extra profits from bursts of price volatility – a measure that appears fair.

Those who want to structure their cash flows with more upside are allowed to pursue market-based and flexible opportunities in the PPA market. Last year, our only hope was that any decision was well thought through, enabling renewables to reach their full potential and not limiting it, and it seems such a measure achieves this goal!

However, certain nuances tell the full story around possible competition of routes to market, and **there's no market consensus on whether aggressive deployment of CfD schemes can go hand in hand with PPAs**. For example, some governments – such as Great Britain – adapted their CfD ceiling prices to account for inflation, elevated financing costs, and high electricity prices. Depending on the PPA pricing environment, CfD may offer more attractive opportunities at times. Great Britain is also considering annual tenders, which squeezes the lead time between communication of budget and auctions, leading to even more abrupt decision-making from sellers.

Across 2023, we noted that some sellers withdrew from corporate tenders for long-term PPAs because CfD prices appeared more attractive than given time. In addition, some support schemes that were structured in a one-way CfD manner allowed for PPA deal-making to capture upside, without penalisation. A core example is the PPAs on the back of Germany's zero-bid offshore wind assets, or solar and wind capacity under a market premium. If sellers need to make a definitive decision on which route-to-market to pursue, it will all come down to the pricing environment.

However, strong corporate demand should not be underestimated, as the number one economic rule is that **pricing is a result of supply and demand**. The pricing factor will always be the prime determinant of business models, and corporates appear more educated and ready-to-transact than ever before.



CHAPTER 4: TOP PREDICTIONS FOR 2024

➤ Back-testing 2023's predictions

The Popularisation of Short-term PPAs: We predicted that managing renewable revenue with a mix of ST and LT PPA will become the norm. All in all, we believe the trend materialised, although not to the extent we expected. We were excited to see the emergence of 3-year PPAs underpinning projects that are still to be commissioned, and 1-5-year PPAs linked to existing assets remained at the same levels. But dynamic selling hedging strategies tapping high-reward 1-year opportunities took a significant hit due to the implementation of windfall taxes capping the revenues. Nonetheless, more and more sellers adopt a 'tenor flexibility' approach. This is not only a revenue optimisation strategy to reduce reliance on long-term PPAs and their associated discounts since the core fundamentals for ST PPAs are still prominent but also to attract a wider pool of corporates that feel more comfortable with short-term price risk.

The Evolution of the Tripartite PPA: YES! We are certain we got that right, as such structures practically mirror the evolved role of utilities in the PPA market. Our prediction was that project owners, utilities and corporates will join forces leveraging each of their individual strengths and competencies to conquer the PPA market. The prophecy materialised through the emergence of **back-to-back PPA deals**, where utilities/traders alleviated risk from projects and managed that risk through long-term volume sales to corporates straight after – a practice that was possible due to hungry corporates being ready to transact. Also, utilities were more active in leveraging their role as risk managers positioning themselves as 'market integrators', and we believe that such a player facilitated every physical PPA.

The Coming of Age of Co-location & Flexibility: Also, YES! It was not long before 2018 when the term energy storage started floating among industry discussions, with the standalone business model taking off rapidly in Great Britain. In a parallel universe, co-location was deemed great in theory, but there were always challenges around valuing the benefits. But as market dynamics evolved, so did available tools to build a robust business case, and the surface of the first Hybrid PPAs for subsidy-free asset was the ultimate testament to the progress in the market.

Approaching the grand finale, after a thorough review and expectations commentary of all the major developments in the European PPA market, this is our pick of our Top Predictions for 2024. This year, we decided to go bolder and pick specific micro-trends to make back-testing more measurable (and exciting!).

4.1 GERMANY WILL TOPPLE SPAIN IN PPA ACTIVITY

We have long waited for Germany's strong PPA market fundamentals to shine, and it seems the word is out for good. The land of Energiewende has some of the most robust liquidity in forward trading among its European peers, making price discovery less challenging than in vastly illiquid markets. The availability of large volumes of different technologies is also making the market highly interesting, as the headlines are moving away from an exclusive focus on the country's vibrant offshore wind segment.

2023's solar deal count and volumes indicate that the sector means business and synergies with energy storage are spicing up expectations. Exceptionally high demand from industrials will drive activity, but we'll keep an eye on regulatory developments around the country's government-backed subsidy schemes and potential competition with the PPA market.

4.2 THE PPA MARKET WILL SURPASS 20GW

The Golden Era of the European Market has arrived. Based on the offtake appetite driven mainly by corporate hedging needs, we believe the long-term PPAs market will surpass 20GW across around 350 deals. Spain and Germany will continue to be key markets for the year, although their share of overall volumes could decrease because more up-and-coming jurisdictions could claim a larger stake.

For example, France could consolidate its Top 3 position by deal count in 2023, again depending on synergies with subsidy schemes and the country's nuclear availability for large consumers. France's newly implemented credit guarantee scheme can potentially attract a larger pool of Small & Medium corporates, enhancing deal count even with smaller PPAs. We also expect growing activity in Southeastern European markets, with multiple eyes, particularly in Greece and Romania.

4.3 THE GEOGRAPHICAL SCOPE OF HYBRID PPAs WILL EXPAND BEYOND GB

Advanced grid services, industry maturity and expertise around commercialisation of energy storage assets resulted in the first Hybrid PPA for a subsidy-free asset to emerge in Great Britain. The outlook for the country is very positive, as the vast majority of solar permit applications in the country include co-location with storage. Besides, we believe the concept will be exported to new jurisdictions. Spain is a prime candidate due to increased solar cannibalization risk, making portfolio owners seek out physical hedges against volatility and depressed wholesale prices when more than 19GW of solar is injected into the grid at the same time.

Germany's solar-plus-storage projects under its Innovative Tenders amount to more than 890MW of hybrid capacity. Part of this pipeline could seek out further contractual arrangements, albeit with an enhanced risk profile due to the price premium of the subsidy. The Nordics could see the emergence of wind-plus-storage Hybrid PPAs due to cannibalization risk mostly linked to onshore wind.

4.4 THE SHARE OF UTILITY PPAs WILL INCREASE

Reduced volatility in 2023 created a more favourable environment for utility offtakes, which translated to 4.02GW – more than double the 1.96GW of 2022, across 48 deals – 60% increase from last year's 30 deals. Market fundamentals around volatility seem to be improving, although substantial risk remains. Nonetheless, with a more stabilising environment and robust corporate demand, we expect that the share of utility offtakes will increase further in 2024.

As extensively analysed in our special note on the evolving role of utilities in the PPA market in Chapter 1, utilities are pursuing innovative routes to reduce reliance on the stack-n-roll method to manage risks. The primary example is back-to-back PPAs with corporate offtakers, which fall under an umbrella set of offerings to help buyers and sellers manage price volatility, intermittency and higher green standards. Project owners, utilities and corporates will continue joining forces to leverage each other's strengths, and the role of more structured PPAs will become more prominent. Risk managers such as utilities have an opportunity to evolve further into 'market integrators', unlocking significant innovation in the market.

CONCLUSION

Could it be that the lessons we've learned from the ever-evolving peaks and valleys of the energy transition make the complexities more intriguing than concerning? Revolutionising the energy system has always been an exciting task, but this day a year ago, the sentiment was closer to the danger zone. But **renewables are learning how to swim in the ocean's deeper end**, unleashing a whole new sparkle in the market. We concluded this analytical exercise with feelings of optimism, but also in awe of the magnitude of the energy transition's kaleidoscope. A set of key mirrors reflecting a plethora of colours resulting in ever-changing patterns. Sometimes positive, sometimes gloomy.

But in the end, what matters is not the expertise we build. But the ability to build more, and level up the riddles (and the respective rewards when solving them). **Our key concern is the spread of the Ostrich Syndrome**, commonly known as hiding our heads under the sand. **Lessons learned the hard way are lessons never forgotten – and they shouldn't.** We are looking forward to what 2024 will bring! Together is always better, so if you'd like support in your endeavours, click [here](#) to book a coffee chat. Onwards and upwards!



ABOUT PEXAPARK

Pexapark is an award-winning market intelligence, software and advisory company, specialised in renewable energy. With more than 30,000 MW of renewable PPA transactions supported, Pexapark is the reference for buying, selling and managing renewable energy. Pexapark's PPA reference prices increase transparency across 19 markets. Our advisory team and software suite enable leading companies to close successful PPA transactions, manage their market risk and monetise their renewable energy investments.

Pexapark was founded in 2017 with the purpose of accelerating the energy transition towards net zero by creating an efficient market for renewable energy. For more information, please visit www.pexapark.com or get in touch with us at hello@pexapark.com

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