Inspiratia

EUROPEAN PPA OUTLOOK

ENERGY AND INFRASTRUCTURE ANALYST
Chendwa Chintu

CONTACT

CHENDWA CHINTU

Energy and Infrastructure Analyst

c.chintu@inspiratia.com

NICHOLAS DAVIES

Managing Director

n.davies@inspiratia.com

VIKAS MAKWANA

Head of Product

v.makwana@inspiratia.com

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INTRODUCTION

INSPIRATIA'S COVERAGE OF GLOBAL PPA MARKETS COMES FULL CIRCLE WITH A REVIEW OF 2022 EUROPEAN PPA ACTIVITY.

Europe ended 2022 as the third most active PPA market with a grand total of 9GW, behind North America and Asia Pacific which totalled contracted capacities of 16GW and 13GW respectively. Europe's 9GW total is a 3GW downturn from the 11GW haul in 2021.

This slightly reduced PPA activity has come off the backdrop of a year riddled with volatility. Price volatility in the energy market caused by a supply/demand imbalance as the European economy recovered from the COVID-19 pandemic was exacerbated by the invasion of Ukraine in February 2022.

These major events drove up the price of natural gas in the main organized European markets and the price of electricity in wholesale markets to levels never before recorded. To illustrate this, on March 8, 2022, the average price of electricity in the daily market in Spain amounted to €544.98/MWh (£478.27/MWh US$577.08/MWh), reaching its maximum hourly value of €700/MWh (£615/MWh US$741/MWh) that same day at the peak of consumption. That was more than 10 times the average price for electricity at peak consumption since 1998 - €45/MWh (£40/MWh US$48/MWh).

The high electricity prices coupled with price volatility create a strong sellers' market and thus ushered in an era in which flexibility of offtake became the priority for buyers. Sellers had the incentive of capturing the upside of high energy prices. This mismatch of desire from buyers and sellers influenced various changes in the PPA market and brought to light other options for offtake.

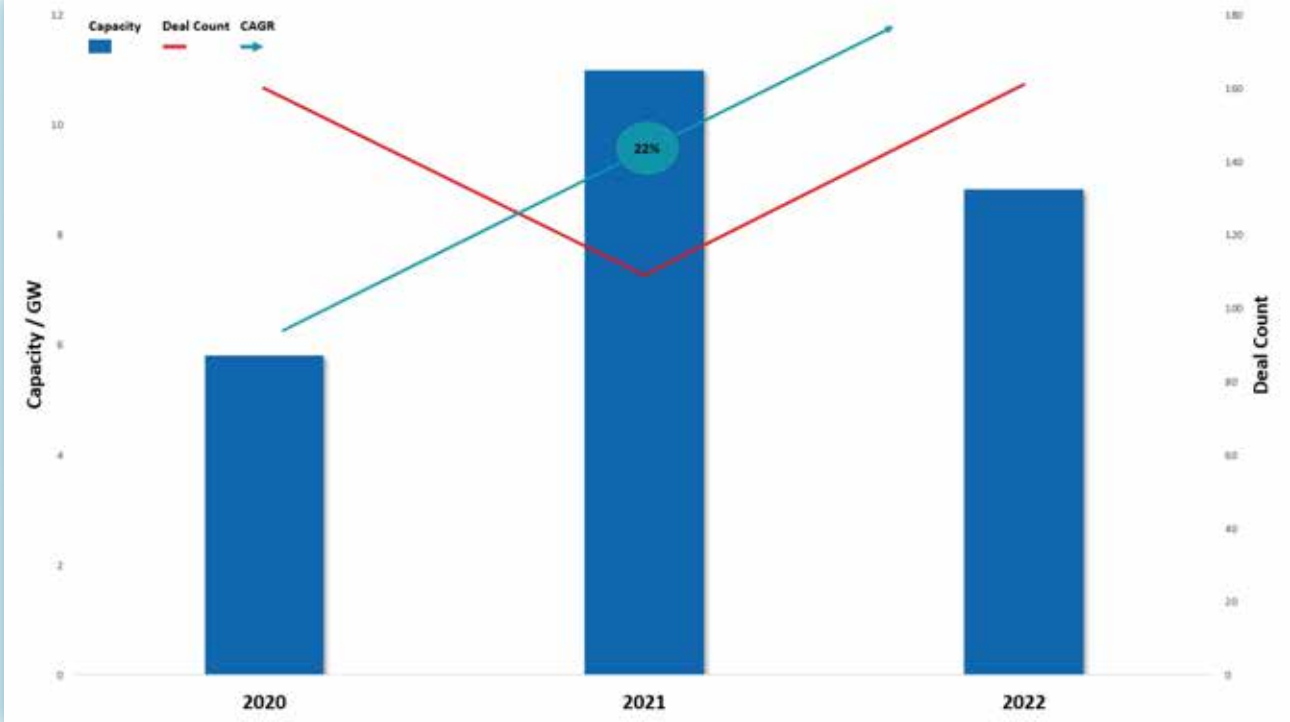
INSPIRATIA INSIGHTS:

- Flexibility of offtake has become a key factor for renewables operation with PPAs
- The contract length of PPAs is decreasing, signalling flexibility is a priority for buyers
- The Spanish PPA market is the most popular, holding the largest volume, largest deal count and lowest prices due to high solar penetration
- Finland shines as an attractive wind market with growth expected in offshore wind PPA activity
- Hydrogen projects may boost the corporate PPA market as these projects come to fruition, similar to how data centres are synonymous with PPA deals.

REVIEW

All in, the disclosed volumes of European PPA capacity in 2022 totalled 9GW, representing an 18% decrease from the 11GW in 2021. This decreased volume was coupled with a 53% rise in deal count from 105 deals in 2021 to 161 deal in 2022. Since 2020 the European PPA market has experienced a 22% Compound Annual Growth (CAGR), indicating overall growth despite the slight downturn.

PPA DEAL FLOW 2020 TO 2022



Source: inspiratia PPA Database 2023

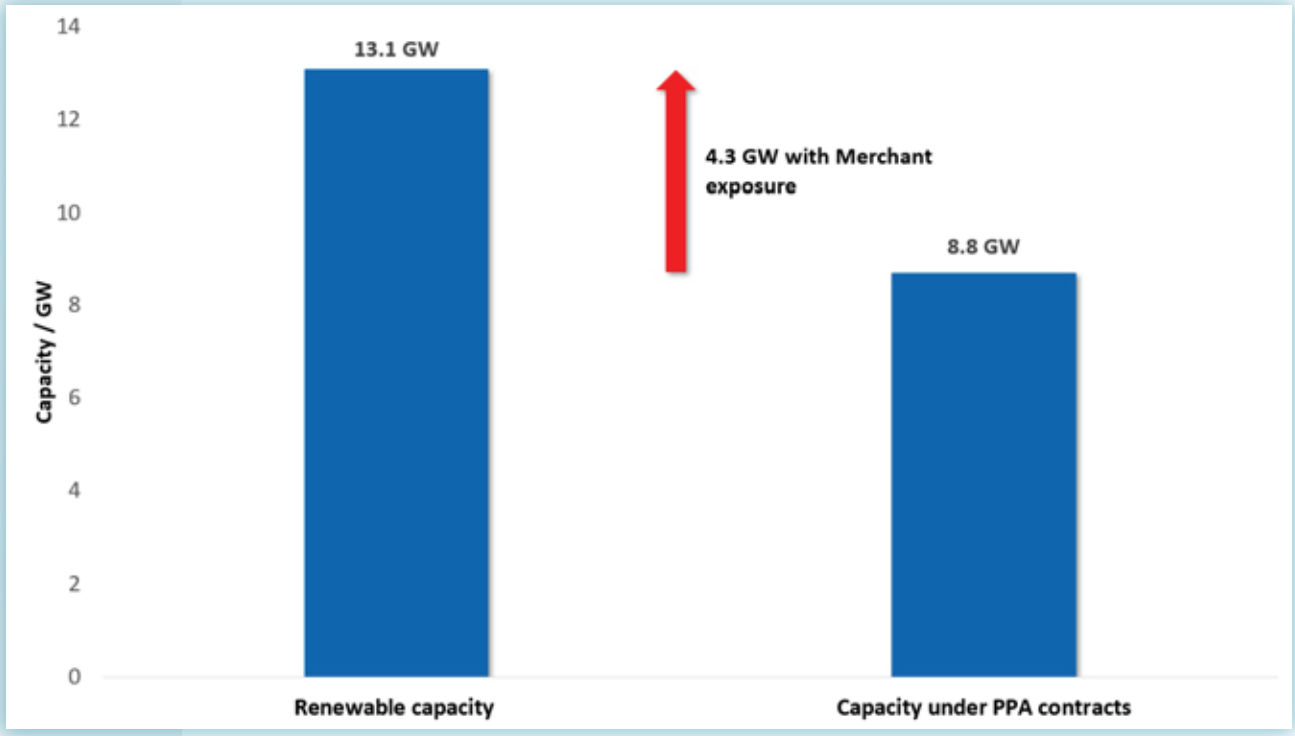
Part of the reason for the downturn in volume but high deal count is the frequency of low volume deals. The weighted average volume in 2022 came to 72MW – 60% of the disclosed volume was 100MW or less.

The reduced volume of 2022 is also a result of the increasing desire for flexibility of offtake and the ability to capture the upside of the high energy prices experienced during the year. For 2022, the 9GW contracted may not be the most interesting figure.

Renewable capacity available for PPA contracts in 2022 amounted to 13GW, with only 9GW contracted. This remaining 4.3GW was reserved for merchant exposure. Various generators risk appetite heightened as the frequency of higher prices on day ahead markets presented profit opportunities on a merchant basis for renewable projects across Europe.

MARKET OVERVIEW

TOTAL 2022 CAPACITY WITH MERCHANT EXPOSURE



Source: inspiratia PPA Database 2023

Naturally, short term merchant power exposure has become favourable in various regions across the continent. Spain, the Nordics, Germany and parts of Eastern Europe prove favourable for sellers with larger risk appetites. With flexibility also being a priority, the extent to which projects have merchant exposure has varied. Two highlighted deals can be seen below.

SELECTED PPA DEALS WITH MERCHANT EXPOSURE

Country	Technology type	Project Name	Year	Month	Capacity (MW)	Seller	Buyer	Contracted Capacity (MW)
CROATIA	Onshore Wind	ZD6 and ZD2&3	2022	August	46	Professio Energia	Danske Commodities	46
ESTONIA	Onshore Wind	Silute & Ciuteliai Wind farms	2022	August	99	Enefit Green	Undisclosed	59.4

Source: inspiratia PPA Database 2023

The ZD6 and ZD2&3 Wind farms in Croatia are among the first wind assets in Croatia to voluntarily leave the Feed-in Tariff (FiT) scheme. Developers Professio Energia opted to increase the value and competitiveness of their assets by entering a route-to-market arrangements (RTMA) PPA.

The core offering of an RTMA is an ability for a generator to utilise a licensed electricity supplier's forward electricity market access, and in many instances, expertise. In this Case the full output of the Wind farms has been handed over to Danske Commodities to trade on day ahead markets in accordance with the agreed parameters.

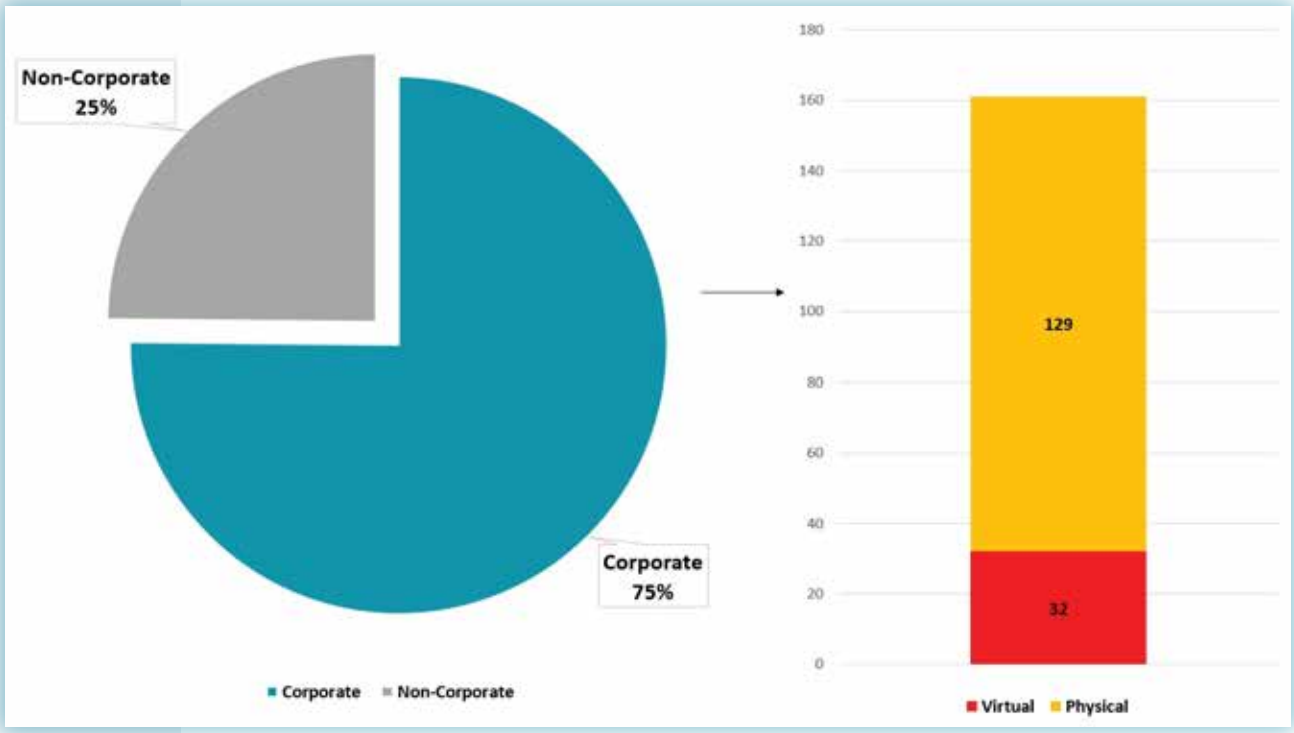
Similarly, in Estonia, the Silute and Ciuteliai have been receiving a fixed-price FiT payments of €69.51/MWh (£61.03/MWh US$73.61/MWh), while Ciuteliai has been selling power for €86.89/MWh (£76.29/MWh US$92.03/MWh). Both Wind farms will earn more than that under their fixed-price PPAs, which will support 60% of their power production. The remaining 40% of production will be sold on merchant terms on the Nord Pool day-ahead market. It is clear that Enefit Green has taken advantage of the close proximity the very lucrative energy markets in the Nordics.

Various others have done the same or seek to do so. As energy prices have yet to completely stabilise, more of such deals are expected in 2023.

PPA STRUCTURE BREAKDOWN

The Corporate PPA remains dominant in Europe. Overall, 75% of PPA deals in 2022 were corporate PPAs. Non-Corporate PPAs saw less action and accounted for 25% of all deals.

PPA STRUCTURE BREAKDOWN 2022



Source: inspiratia PPA Database 2023

We have also noticed a high proportion of virtual PPAs (VPPAs) in 2022. Since we began to distinguish between virtual and physical within our PPA Database in 2022, the European market has seen the highest share of VPPAs. The 32 VPPA deals in Europe surpasses the 22 in North America, which is considered the home of the VPPA.

MARKET OVERVIEW

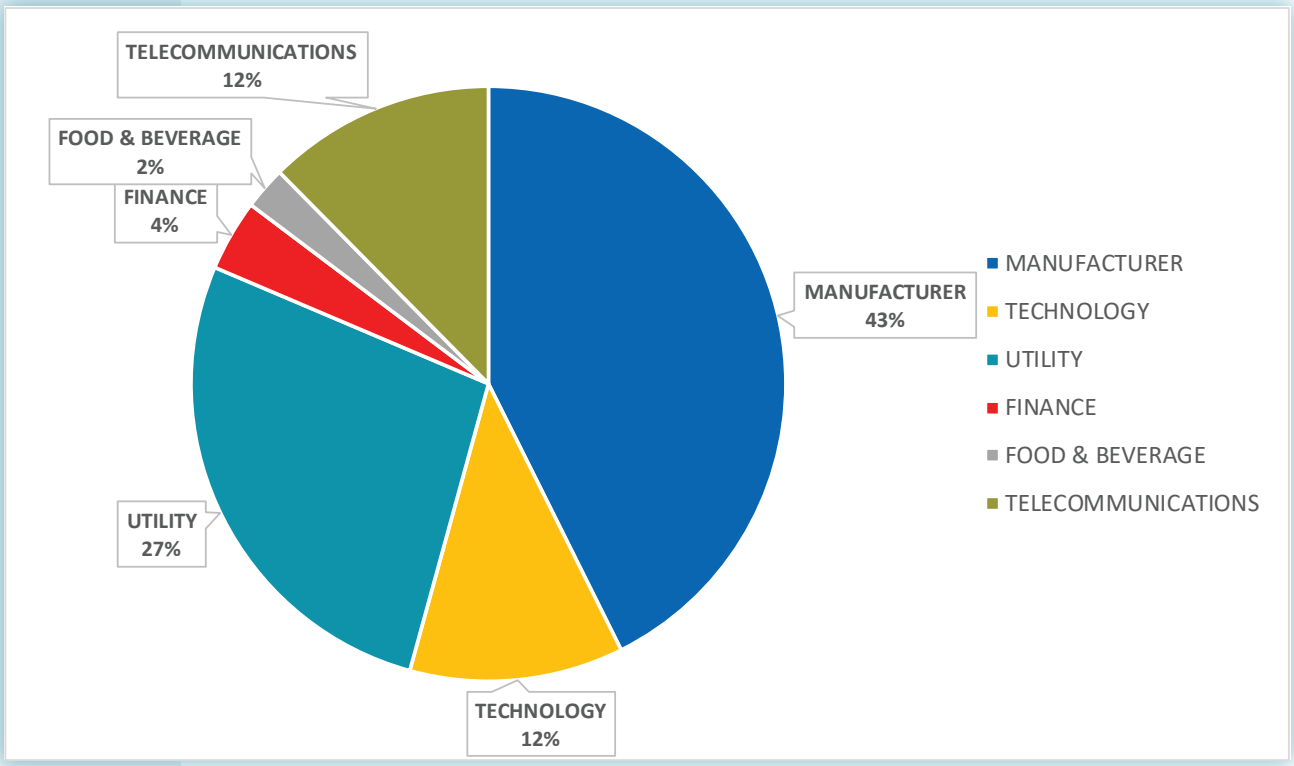
This is a symptom of the rise in corporate PPAs in the midst of a highly volatile energy environment. Various entities with high exposure to the energy market sought to their electricity costs by purchasing relatively cheaper renewable electricity through PPA contracts.

Also, as sellers chased higher gains on day ahead markets, buyers searched for the best prices through flexible deals. This meant buying electricity from foreign countries and wheeling the electrons to a local grid. This was often facilitated through VPPAs.

Naturally, the top participants in the European PPA market have been manufacturers - mainly aluminium and steel. Following closely behind are the utilities. Various utilities now offer 100% renewable electricity to their customers or are in the process of increasing the share of renewable electricity in their portfolios.

Technology and Telecommunications firms who have been building data centres across the continent have made the development of data centres synonymous with the signing of PPAs.

PPA BUYER DEMOGRAPHIC 2022



Source: inspiratia PPA Database 2023

TOP PLAYERS

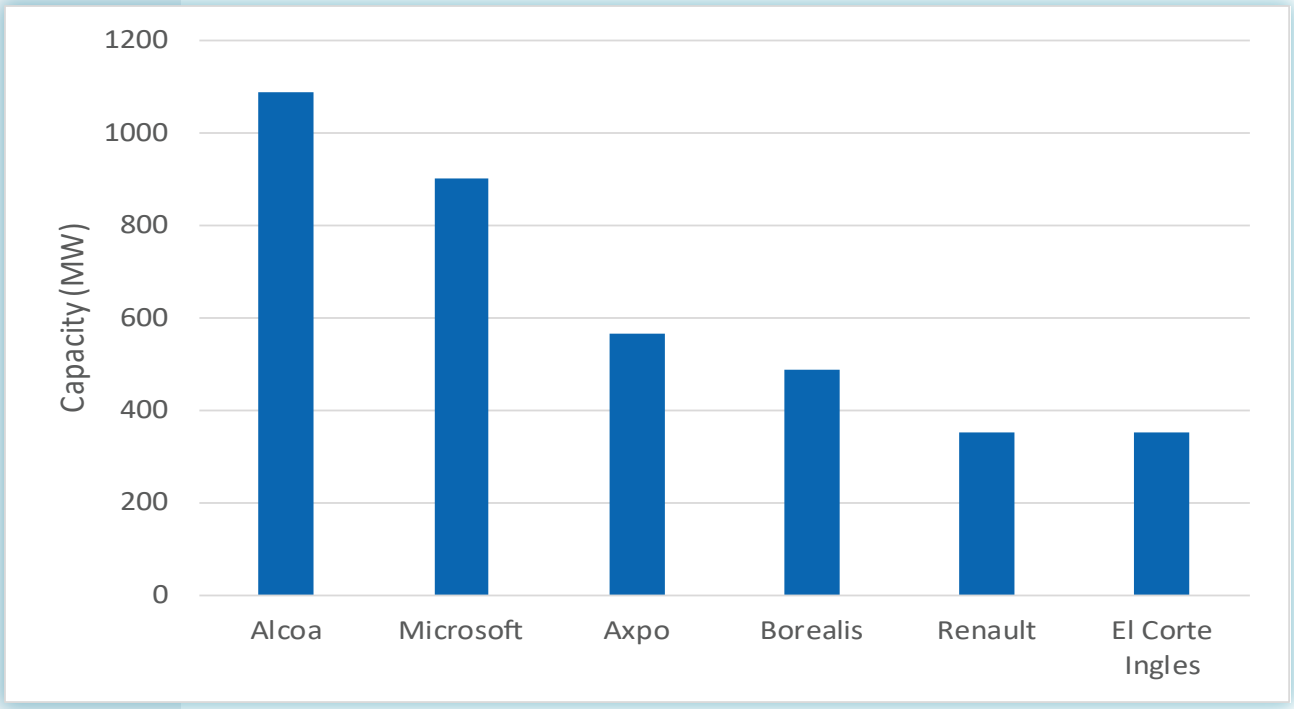
TOP BUYERS

Pittsburgh-based Aluminium producer, Alcoa, ended the year as the top buyer of renewable power. Alcoa signed two major PPAs with Endesa and Greenalia, both linked to its San Ciprián aluminium smelter.

The first deal, in May, with Endesa was for a 10-year deal with a disclosed volume of 906MW. This deal was of particular importance because it helped Alcoa reactivate its San Ciprián aluminium smelter. The smelter was closed in 2020 in response to the increasing cost of powering the plant. The PPA gives Endesa access to cheaper, stable electricity prices, ensuring competitiveness in the aluminium production industry. The smelter at the industrial complex produces about 228,000 metric tons of aluminium annually.

Following this, Alcoa signed a PPA with Spanish IPP, Greenalia to provide 183 MW of baseload electricity for the same San Ciprián industrial complex. This PPA will link 29 wind projects being developed by Greenalia at a cost of €1 billion (US$ 1.02bn £851m). The projects have a combined capacity of 924MW. Watson Farley & Williams served as advisor on this PPA, continuing a strong presence in PPA advisory in Spain.

TOP BUYERS 2022



Source: inspiratia PPA Database 2023

TOP PLAYERS

Tech giant, Microsoft, slots in at second place thanks to three major deals concluded towards the end of 2022 in Ireland. Microsoft signed long-term deals with Renewable Power Capital, Energia Group and Statkraft for 314MW, 220MW and 366MW respectively. A total of 900MW.

The power will be sourced from a mix of solar and onshore wind projects – these projects will provide 100% renewable electricity for its data centres in Ireland. DLA Piper advised Renewable Power Capital on the delivery of 220MW and Statkraft on the 366MW deal.

Rounding up the top three is Swiss IPP, Axpo. Axpo signed four major deals in 2022. The highlight was a four-year PPA with Polish IPP RPower to supply its Warsaw-headquartered subsidiary, Axpo Polska, with 300MW of green electricity sourced from a portfolio of RPower solar plants. As part of the PPA deal, Axpo Polska is responsible for balancing the solar portfolio while RPower will receive price hedging instruments from Axpo to ensure project bankability. The remaining deals are listed below. A total of 623.8MW.

SELECTED AXPO PPA AGREEMENTS 2022

Country	Technology type	Project Name	Month	Capacity (MW)	Seller	Buyer	Contracted Capacity (MW)	Comments
POLAND	Solar	Undisclosed	January	300	RPower	Axpo	300	
ITALY	Solar	Axpo Italia & Canadian Solar	March	84	Canadian Solar	Axpo	58.8	Becomes largest solar developer in Italy via this deal
POLAND	Onshore Wind	Bialy Bór and Dębnica Kaszubska Wind farms	May	165	Mirova Eolska	Axpo	165	
GREECE	Solar	Prosotsani Drama Solar farm	July	100	Cero Generation	Axpo	100	First private Greek utility scale PPA

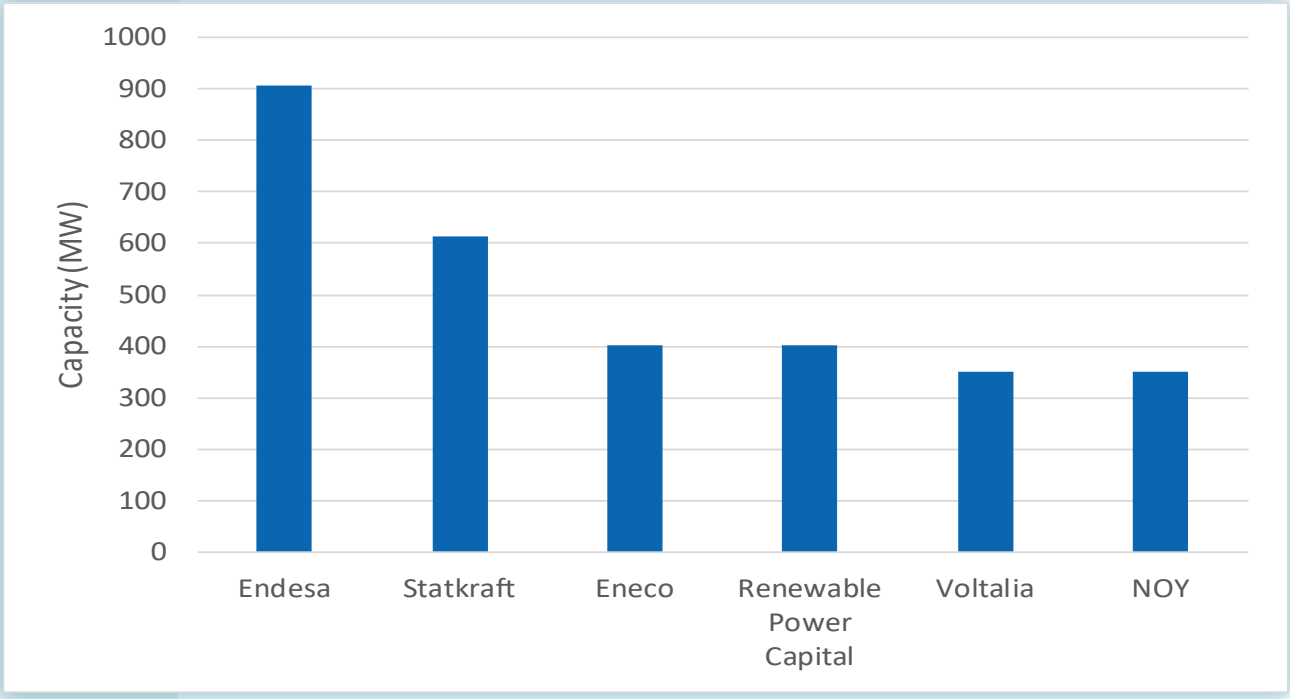
Source: inspiratia PPA Database 2023

TOP PLAYERS

TOP SELLERS

Spanish utility, Endesa, was the top seller of green electricity last year thanks to its deal with Alcoa, as above.

TOP SELLERS 2022



Source: inspiratia PPA Database 2023

Oslo-based renewable energy producer, Statkraft, ranks second. Statkraft was prolific in 2022, signing 11 PPAs across the continent. Statkraft ranks highly thanks, in large part, to its 366MW Irish wind and solar deal discussed above.

Through its 150MW PPA with Deutsche Telekom, Statkraft is now able to continue operating 16 Wind farms that no longer receive EEG subsidies. This is a much deeper trend we have noticed and will be discussed in the Top Countries section. Also, Umicore purchased the entire output of the subsidy-free Kokkola onshore Wind farm in Finland.

Rotterdam-based energy company, Eneco rounds up the top 3. Eneco signed five deals in 2022, three of which were linked to the 487MW SeaMade Offshore Wind farm. The three PPAs Eneco concluded with Borealis, Aurubis and INEOS for 235MW, 12MW and 65.5MW respectively accounts for 64% of the output of the SeaMade Offshore Wind farm.

Eneco also began supplying 350GWh annually to the Chemelot industrial park in the Netherlands from the Fryslân Wind farm. This corresponds to 90MW.

TOP PLAYERS

The energy company also signed a 200GWh per annum PPA with Dutch Telecommunications company, KPN. This deal is of particular interest because the contract allows Eneco to provide electricity as nominated. This means that KPN will purchase electricity as and when it is produced from Hollandse Kust West. A total of 402.5MW.

SELECTED ENECO PPA AGREEMENTS 2022

Country	Technology type	Project Name	Month	Contracted Capacity (MW)	Seller	Buyer	Tenor
THE NETHERLANDS	Offshore Wind	Hollandse Kust Zuid	December	Undisclosed	Eneco	KPN	15
BELGIUM	Offshore Wind	SeaMade Wind farm	December	235	Eneco	Borealis	10
GERMANY	Offshore Wind	SeaMade Wind farm	July	12100	Eneco	Aurubis	10
THE NETHERLANDS	Offshore Wind	Wind Park Fryslân	February	90	Eneco	USG	15
BELGIUM	Offshore Wind	SeaMade Wind farm	January	65.5	Eneco	INEOS	10

Source: inspiratia PPA Database 2023

TOP REGIONS

Since our last European PPA review, Spain has climbed up one position to become the most attractive PPA market, attracting the most deals and volume across the continent.

TOP COUNTRY OVERVIEW 2022

Country	PPA Capacity / MW	Deal Count	Movement
SPAIN	3112.3	27	↑ +1
UK	2125.8	26	↓ -1
GERMANY	1625.13	22	↑ +1
POLAND	1155.8	12	↑ +8
FINLAND	777.7	17	↑ +1

Source: inspiratia PPA Database 2023

SPAIN

The Spanish renewables market sits between particularly slow moving but far-reaching policy and some of the most attractive sites and resources for greenfield renewables development.

In 2021 Spanish government introduced the 17/2021 Royal Decree-Law to protect consumers from high electricity prices. The decree was structured such that projects operating under indexed PPAs were liable to a temporary reduction in remuneration received via a clawback mechanism which required assets to pay the government a certain amount based on excess profits received.

This was a catalyst to a change of approach with regards to renewable project financing in Spain. Fewer PPA contracts than expected closed since the release of the 17/2021 Royal Decree-Law. As a result, projects started under the previous 'reasonable profitability regime' of the 413/2014 Royal Decree, that benefit from feed-in tariff remuneration of July 14, 2013, became the most attractive. However, there were only very few of those projects that needed financing.

With the energy prices skyrocketing in 2022, the low availability of 413/2014 Royal Decree projects and lower than usual desire for PPA projects, merchant projects became of interest in Spain. In 2022, most greenfield renewable projects adopted the merchant model. In fact, Spain's 4th Renewable Energy Auction held towards the end of the year was largely undersubscribed.

Only 45.5 MW of onshore wind power capacity awarded, despite 3.3GW of solar and wind capacity available and an allowance of up to 15% market exposure for solar projects. The average price in these auctions increased from €24.47/MWh (£21.08/MWh US$ 25.87/MWh) in 2021 to €42.78/MWh (£37.60/MWh US$45.25/MWh) in 2022.

An example of the push for merchant projects is the primary financing of Spear. Spear is a portfolio of 14 solar PV plants in Spain. Finergreen advised institutional investor Umbrella Solar Investment. It reached financial close in July [2022] with a disclosed transaction volume of US$107 million (£89m €106m). This was highlighted in inspiratia's Q3 2022 Renewables Financial Advisor Rankings.

Despite this, appetite for PPAs in the region were kept afloat by local manufacturing firms, Independent Power Producers and technology outfits in a large way. Collectively these two demographics of buyers accounted for 80% of all PPAs signed in 2022 with an average volume of 130MW per deal. This includes the Endesa and Alcoa 906MW PPA and Google's 149MW PPA with IB Vogt.

The virtual PPA played a leading role in facilitating baseload contracts in the region. 30% of PPAs concluded were baseload PPAs that were offered synthetically. Unless the PPA landscape changes, the merchant model in Spain will remain dominant. In the current market the risks of a baseload PPA are two pronged.

From the Sellers perspective, disparity from production forecasts causes losses due to large cash outflows. On the other hand, buyers are growing increasingly concerned over price cannibalisation risk as the solar buildout accelerates .

SELECTED SPANISH PPA AGREEMENTS 2022

Country	Technology type	Project Name	Month	Contracted Capacity (MW)	Seller	Buyer	Lenght of PPA
SPAIN	Solar	Garnacha solar plant	November	149	IB Vogt	Google	12
SPAIN	Onshore wind	Undisclosed	May	183	Greenalia SA	Alcoa	10
SPAIN	Onshore wind	Undisclosed	February	906	Endesa	Alcoa	10

Source: inspiratia PPA Database 2023

Short-term high priced PPAs may present themselves as a competitor for the merchant model in the short term. The consortium PPA where multiple parties share a PPA deal broadens the demographic of buyers who may be interested in long term deals. For now, the Spanish PPA market is thriving due to manufacturing firms seeking more cost-effective electricity deals.

UNITED KINGDOM

The UK provides for an interesting case study as to how a country must approach the energy transition on hardcore mode. As an island nation, the UK must bring new renewable capacity online on its own – there is limited capacity of interconnectors to bring electricity to a nation as thirsty for energy as the UK.

As such, discourse around the UK's approach to it 2050 Net Zero target attracts attention. Boosting energy security, attracting private investment and revitalising industrial centres are key to this target. With this backdrop, the UK boosted its support for renewable energy by converting the Contracts for Difference (CfD) scheme to an annual instead of the previous bi-annual regime.

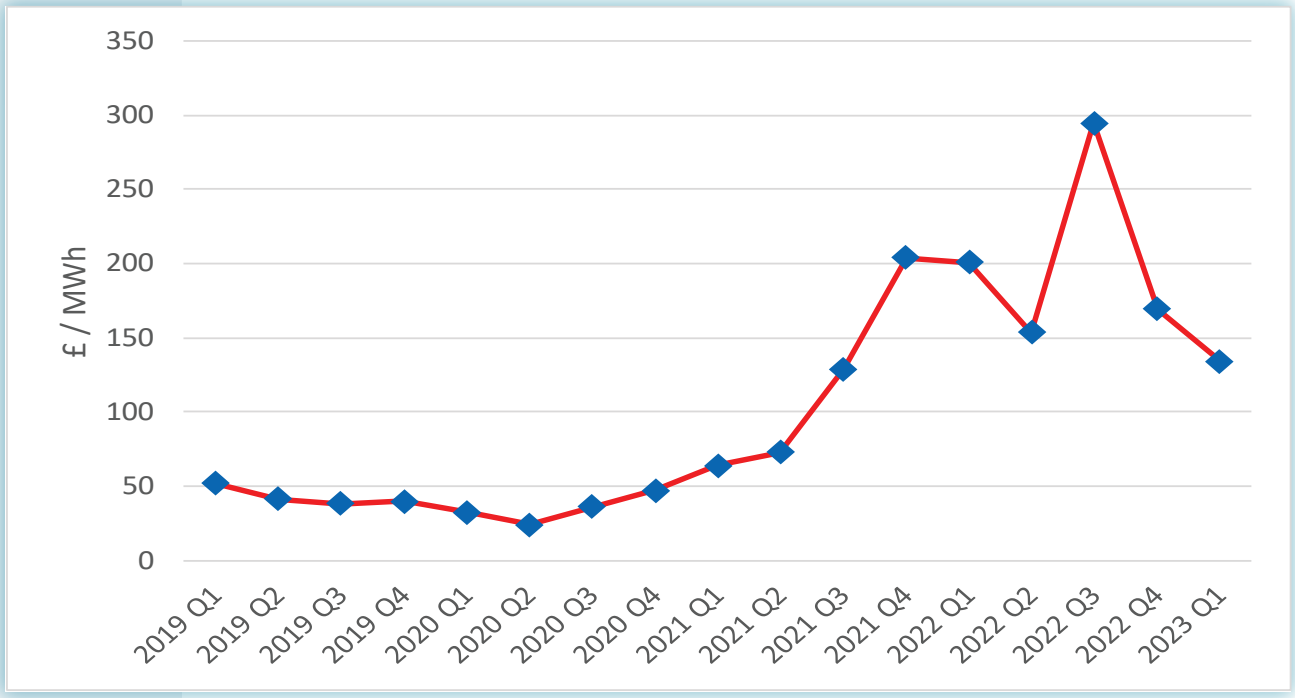
TOP REGIONS

Since inception in 2014, the scheme has attracted £90 billion (€102bn US$109bn) of private investment. Successful CfD applicants receive a fixed price 15-year contract with the Low Carbon Contracts Company (LCCC).

As such, the LCCC has become exceptionally good at pumping out CfDs which is fantastic for renewable penetration in the electricity market but may compete with the corporate PPA market. As more capacity goes to government auctions, via the CfD auctions, less is available for corporate buyers – leading to price increases in the corporate PPA market.

This pressure on the Corporate PPA market comes off the backdrop of high energy prices. As a reference how much the price of electricity has increased in the UK, shown below is the Intermittent Market Reference Price (IMRP).

AVERAGE INTERMITTENT MARKET REFERENCE PRICE UK 2019 TO 2022



Source: Low Carbon Contracts Company

In line with wholesale market price increases and the reduction of new capacity available for corporate PPA deals, the prices of corporate PPAs have increased in the UK. The UK now has the highest corporate PPA prices in Europe. Average Wind PPA prices reached €65/MWh (£57/MWh US$69/MWh) while this was €76.84/MWh (£67.51/MWh US$81.27/MWh) for Solar.

2022 proved to be a popular year for Solar projects and PPAs in the UK. 69% of PPAs signed in the UK were linked to solar assets. Despite this, the fully merchant model has become a particularly lucrative model for a limited timeframe in the UK.

TOP REGIONS

Last year, inspiratia noticed that the majority offshore wind projects from the CfD allocation round two made use of the flexibility embedded in the CfD and postponed the commencement of their subsidy allocation to this year [2023]. Those projects have therefore benefited from the fully merchant model.

As various developers attempted to capture the upside of the wholesale market in 2022, the PPA market in the UK took a slight downturn. However, because the UK cannot simply wheel in all the renewable power it needs for its net zero ambition, renewables developments in the UK will continue to be vigorous and on the back of this, the PPA market will benefit.

SELECTED UNITED KINGDOM PPA AGREEMENTS 2022

Country	Technology type	Project Name	Month	Contracted Capacity (MW)	Seller	Buyer	Lenght of PPA
UK	Solar	Hultsfred solar project	December	90	Neoen	H&M Group	
UK	Onshore wind	Dalquhandy Wind farm	October	36	BayWa	BT	10
UK	Solar	Undisclosed	March	110	Mytilineos	Vodafone	10

Source: inspiratia PPA Database 2023

GERMANY

The 20-year funding under the Erneuerbare-Energien-Gesetz (EEG, or Renewable Energy Act) expired for the first turbines in Germany last year and around 15 GW of wind turbines will follow by 2025. Adopted in 2020, the EEG-levy framework covered the difference between the market price and the market premium paid to electricity producers. This reform favoured the expansion pathways for renewables and committed to the continuation of onshore wind subsidies while increasingly pushing solar towards unsubsidised growth.

The regulation was abolished early this year to relieve the burden on consumers amid rising electricity prices. Several thousand wind turbines in Germany are affected by the end of EEG and could have to close in the coming years because they will no longer receive any subsidies.

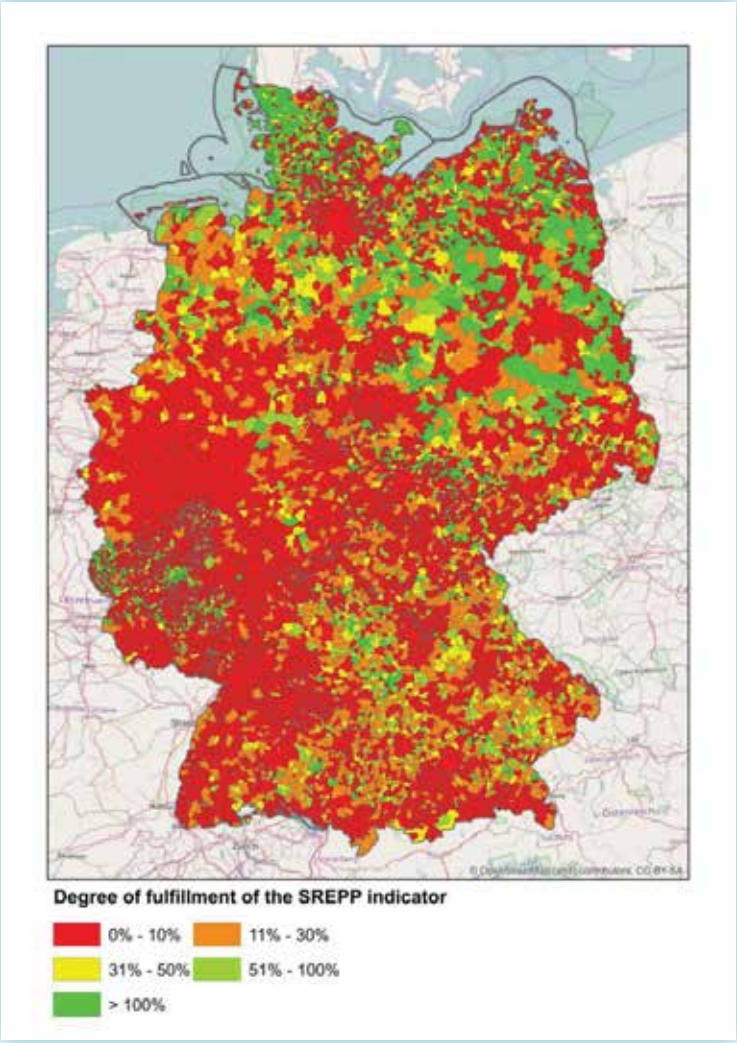
There is currently no consensus on what the next steps are for a renewable energy project when it approaches decommission. Even without subsidies, the Wind farms preserve their operating permit, meaning they can continue to generate power if it is profitable. The current norm is to run the project and exploit the energy it produces until decommission is inevitable. Like all older technology, after 20 years of wear and tear, wind turbines are prone to repairs and are more maintenance-intensive than new products, with high operating costs too.

However, the key desires to decarbonise fast and achieve energy security explain why old projects continue operations even after their subsidies expire. The continued operation of German wind

assets is notably guaranteed by entering the CPPA market. Sellers like BayWa and EnBW take advantage of Germany being a manufacturing hub and by offering baseload PPAs for manufacturing firms. As German manufacturers (notably those involved in producing aluminium, steel and chemicals) typically have larger balance sheets and longer-term outlooks, this gives them the ability to sign long-term, high-volume PPAs. This shift to PPAs post EEG will play an essential role in reaching the climate goals of the federal government by 2030.

Another issue comes from Germany's generation/consumption divide. Renewable generation is located primarily in the north of the country, while most industry is predominant in the south. European energy-intensive companies are migrating to where they can be done most efficiently, next to the sources of renewable energy. An example includes Vestas, the world's biggest turbine-maker, closing a factory in China to open one in Poland instead, to be closer to new Wind farms on the Baltic Sea. However, it is evident that the German grid requires a significant update to handle the greater distribution needs of renewable electricity.

DISTRIBUTION OF GREEN ELECTRICITY GENERATION, GERMANY



Source: Helmholtz Centre for Environmental Research (UFZ)

A lacklustre approach grid infrastructure improvements policy support for manufacturers might induce a slight industry exodus to more favourable markets, which may affect PPA demand in Germany. However, for now the country remains a strong market for high-volume, long-term deals.

SELECTED GERMANY PPA AGREEMENTS 2022

Country	Technology type	Project Name	Month	Contracted Capacity (MW)	Seller	Buyer	Comments
GERMANY	Onshore wind	BayWa Wind farm portfolio	July	Undisclosed	BayWa	Bosch	Post EEG
GERMANY	Onshore wind	Undisclosed	August	150	Statkraft	Deutsche Telekom	Post EEG
GERMANY	Offshore wind	He Dreiht Wind farm	November	100	EnBW	Evonik	Subsidy-free Wind farm

Source: inspiratia PPA Database 2023

EASTERN EUROPE

In June last year, Nord Pool launched its Flow-Based Market Coupling in the core region. The Nord Pool core region consists of Austria, Belgium, Croatia, the Czech Republic, France, Germany, Hungary, Luxembourg, the Netherlands, Poland, Romania, Slovakia and Slovenia.
inspiratia recently covered Flow-Based Market Coupling or Nodal Pricing and discussed the following benefits it has for the energy transition.

The nodal pricing model is viewed as being able to offer flexibility from demand, storage and generation to complement the variability of renewables. It removes financial transfers from consumers to generators curtailed due to transmission constraints. Due to the granularity of nodal markets, the full cost of resolving transmission constraints is embedded in wholesale energy prices, whilst guaranteeing the lowest cost of energy balancing across the system and boosting investor confidence.

Under such model, local tariffs change dynamically depending on the grid congestion. In general, the more congestion in the grid, the more significant the price spreads between individual nodes. This can improve monitoring and control at the distribution level while reducing the cost of managing congestion on the transmission network.

In addition, nodal pricing provides accurate locational signal for flexible assets to optimise in near-real time, avoiding the need for redispatch.

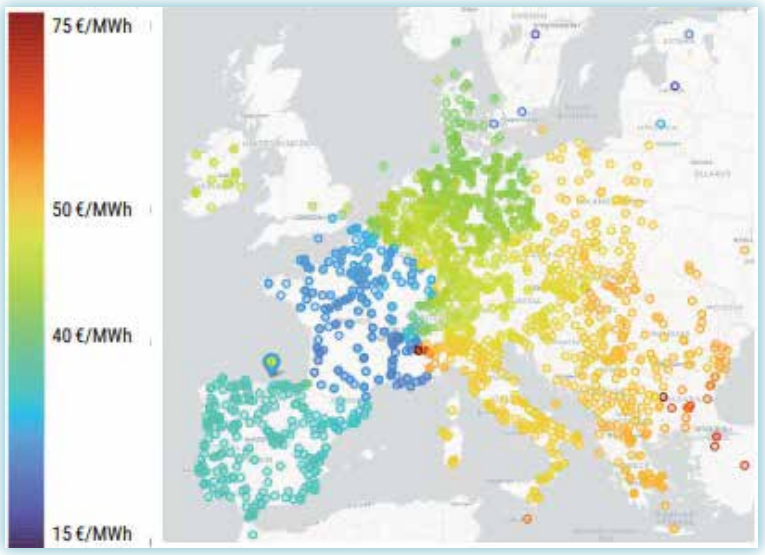
With the Flow-Based Market Coupling model, Nord Pool's western and central Europe day-ahead market (covering Austria, Belgium, France, Germany, Luxembourg, The Netherlands and Poland) achieved 111.1 TWh – an increase of 63% on 2021's figure.

TOP REGIONS

Nodal Pricing enhances the grid's ability to manage fluctuations in the supply of wind and solar by shifting demand to periods of high local supply. For instance, the resulting lower power generation by Europe's northern Wind farms can only be compensated by solar power generated in Southern Europe if grids and markets of these different zones are fully integrated, both physically through interconnections and in terms of their markets.

The new Flow-Based Market Coupling Mechanism optimises the capacity to exchange power between bidding zones within the Core region.

AVERAGE NODAL PRICES IN CENTRAL EUROPE, JUNE 2022



Source: European association for the cooperation of transmission system operators (ENTSO-E)

Nodal pricing also allows developers to visualise where grid constraints or inefficient generation (high marginal cost) are located. These, as seen above, are located in the East. In Poland, this is mainly coal generation.

Developers can take advantage of a lower CAPEX and of lower marginal costs to construct more competitive projects within the more efficient Flow-Based Market Coupling Mechanism and simultaneously aid in Eastern Europe's transition, which is critical for Europe's Net Zero target.

SELECTED POLISH PPA AGREEMENTS 2022

Country	Technology type	Project Name	Month	Contracted Capacity (MW)	Seller	Buyer	Comments
POLAND	Solar	Undisclosed	January	300	R.Power	Axpo	
POLAND	Solar	Resko Solar	January	36	Better Energy	Statkraft	First subisdy-free utility based PPA in Poland
POLAND	Onshore Wind	Undisclosed	September	51.8	Tion Renewables	Saint-Gobain	VPPA

Source: inspiratia PPA Database 2023

TOP REGIONS

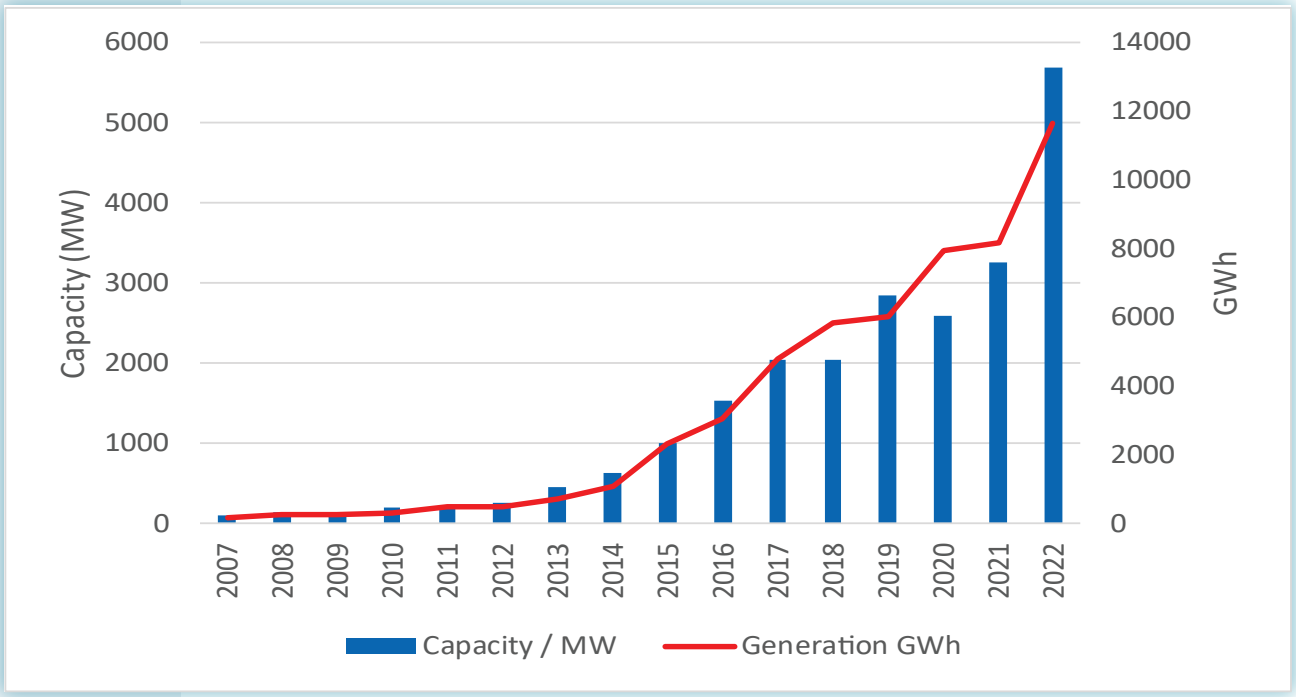
The last couple of years witnessed a growing appetite for merchant projects in the region – a trend that has been affecting the Iberian Peninsula too. Investors are finding that Eastern Europea offers new greenfield project opportunities, with attractive returns on investment that enable a faster deployment of capital in renewable energy projects.

Typically, the rate of return in the region is high for a risk that is perceived as less important than across the rest of Europe. These advantages, on top of a great availability of land, play a key role in attracting developers who seek to build greenfield renewables projects.

FINLAND

Finland rounds up the top five with a total volume of 778MW from 17 PPA deals in 2022. Interestingly, all these PPAs were linked to onshore wind assets. Overall wind power has been the fastest growing in Finland in recent years, experiencing a CAGR of 30% since 2007. In 2022 alone, 5.7GW of new wind capacity was installed.

WIND CAPACITY AND PRODUCTION, FINLAND 2007 TO 2022



Source: Finnish Wind Power Association

Since 2020, electricity trading has become lucrative in the Nordics. In 2020 the average system price in the Nordics was 10.95 €/MWh (£9.70/MWh US$11.70/MWh) while in that rose significantly to 135.86 €/MWh (£120.34/MWh US$145.17/MWh). With these electricity prices, the opportunity for greenfield projects to be constructed without public support is great.

TOP REGIONS

Since 2019, a considerable number of projects have been constructed without public support. The environment in Finland is dynamic - some of these projects are also implemented through the Mankala collaborative model.

The Mankala financing structure is a form of corporate finance where a consortium of investors pay for and form a limited liability company. In turn, the limited liability company commits to transfer all power produced to the investors or shareholders, likewise in proportion to their shareholding.

Alternatively, the limited liability company can acquire outside funding for the building of the power production facility. Funding mainly originates from institutional investors. Interestingly, the winner of Top Subsidy-Free Projects for 2022 at inspiratia's Energy and Sustainability Awards, was project Viiatti. This was a fully merchant project sale incorporating the Mankala financing structure to deliver a new record valuation per MWh.

PPAs are also a popular route for Finish energy assets, therefore its not a surprise that all the PPAs we have tracked in Finland since 2020 were linked to onshore wind assets. With offshore wind now entering the fray through Ilmatatr Energy, PPAs from both onshore and offshore wind are expected in 2023.

SELECTED FINNISH PPA AGREEMENTS 2022

Country	Technology type	Project Name	Month	Contracted Capacity (MW)	Seller	Buyer	Tenor
FINLAND	Onshore Wind	Storbotet Wind farm	December	61.9	Neoen	TDF	Undisclosed
FINLAND	Onshore Wind	Kokkola Wind farm	September	97	Statkraft	Umicore	10
FINLAND	Onshore Wind	Pajuperän-kangas Wind farm	March	86.8	ABO Wind	Statkraft	10
FINLAND	Onshore Wind	Merkkikallio Wind farm	February	82.5	Renewable Power Capital	Alpiq	UNdisclosed

Source: inspiratia PPA Database 2023

RISE OF FLEXIBLE OFFTAKE AND THE SHORT TERM PPA

European energy players witnessed a liquidity crisis in 2022. The recurring theme of record high power prices driven up by the cost of gas as Russia choked supply to Europe caused European utilities a major problem. Despite selling electricity at record soaring prices, they were also running out of cash because of rapidly increasing collateral requirements.

Utilities often de-risk their electricity sales with short positions in futures markets before offloading the physical electrons to customers. This way, gains are made in the case of low prices via profit from the short position and profit from physical delivery in the event of the short position being eliminated by high prices.

To maintain their short positions, utilities are required to post collateral to their exchange in the event of price increases. As electricity prices soared, so did the collateral requirements – which left utilities at risk of exhausting credit lines.

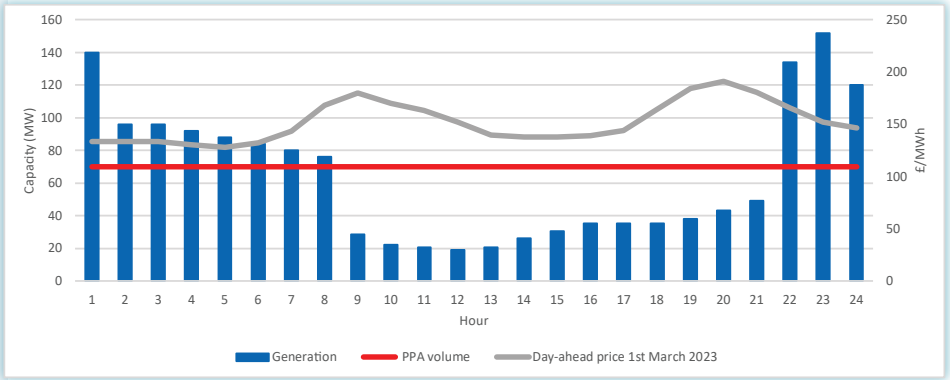
During last year's [2022] price peaks, British utility, Centrica, sought billions of pounds in extra credit to meet its collateral demands. Similarly Finnish utility, Fortum, reported its collateral on the Nasdaq power exchange had risen by €1 billion (£879m US$1.06bn) within a week to €5 billion (£4.39bn US$5.29bn).

As such, trading volumes on European exchanges took a downturn. Power trading volume on EEX decreased 27% from 2021 with Spanish and German futures down 27% and 52% respectively.

Observations from EEX show that British and German power futures up to Cal-27 are trading well above €100/MWh (£88/MWh US$106/MWh); pricing levels similar to Q1 2022. On the bright side this is a downtrend from what was experienced through 2022, however the cost of purchasing power years in advance is still relatively high.

From the seller's perspective, futures for Cal+1 and Cal+2 generally are settling above the €150/MWh (£131/MWh US$159/MWh) mark. With PPA pricing linked to energy futures, a short term PPA can be priced much higher than a long term PPA in these conditions. Also, determining a 'fair price' for a PPA in this environment may prove to be difficult.

GENERIC 200MW UK ONSHORE WIND ASSET WITH 70MW BASELOAD PPA



Source: inspiratia model

OUTLOOK

We witnessed various short term PPAs in 2022. For the mean time, we expect this trend to continue through 2023 as a short-term higher price PPA is currently acceptable. We also expect the 'merchant head' ideology to be adopted in the short term to give projects short term merchant exposure before beginning long term PPA deals in the coming years.

SELECTED SHORT-TERM PPA AGREEMENTS 2022

Country	Region	Technology type	Project Name	Month	Contracted Capacity (MW)	Seller	Buyer	Tenor
POLAND	Europe	Onshore Wind	Krobia I Wind farm	March	63	Acciona	Brembo	5
GERMANY	Europe	Solar	Sunnic Solar Portfolio	June	198	Sunnic	Uniper	5
GERMANY	Europe	Hybrid	Undisclosed	October	Undisclosed	Engie	SCHOTT	3

Source: inspiratia PPA Database 2023

Additionally, the long term PPA is not dead, it is only in hibernation. It will take much longer than a year for cash strapped utilities to rebuild liquidity. When this happens and prices recover to a more favourable level, the long term PPA will return more favourably.

Indeed, in markets where futures have come down more rapidly, we see this happening already. Two long-term deals were recently executed on the EEX Spanish Power futures market totalling 1.1TWh from Cal-27 to Cal-31.

We also expect to see more deals in which a portion of project output is reserved for merchant exposure while the rest is allocated for PPA deals.

CONSORTIUM PPA

Corporate demand for green electricity is and will continue to be remarkably high. 75% of PPAs signed in 2022 were with corporate buyers. However, this interest only stems from larger organisations.

Current market conditions necessitate evolution of the PPA product. The PPA model as we know it is based on a subsidised energy market which is becoming less so every day. Volatility in the market is driving buyers to become more sophisticated as they are now forced to take in more information about market movements. Therefore, more flexibility and new PPA products are expected soon.

inspiratia sat down with Chris Bowden, Adam Clarke and Tim Foster, to discuss how PPAs can innovate to meet the ever changing needs of sellers and buyers. Making PPAs more attractive to a wider range of corporate consumers was a key point of discussion. Pooling together a consortium of buyers helps reduce the cost of participation from buyers who may not have the resources to sign a bespoke PPA.

We saw this in the UK when 20 universities signed a consortium PPA in 2019. This was also noticed in the Nordics when Neoen and a consortium of 4 corporates banded together to sign a 126MW deal. Most recently, at the 2022 Energy and Sustainability awards, inspiratia recognised Voltalia's consortium PPA deal with ten corporates in France as the standout deal of the budget year.

The uni-buyer/uni-seller will still remain attractive for larger corporates. As smaller corporates join the PPA market, the consortium PPA will become ever more popular.

Also, the concept of de-linking from the wholesale trading market may also prove to be an industry defining prospect. Due to the inflationary pressures of the current energy volatility, the collateral that must be put up to procure energy via the whole sale market has increased severely. Cutting out the middleman and having generators and buyers directly negotiate power procurement saves a substantial amount of funds. If high energy prices linger, this prospect may become ever more popular, leading to an increase in PPAs being signed.

THE HYDROGEN PPA

On 10 February 2023, the EU published the long-awaited Delegated Act which specified the rules that will apply to the production of 'Renewable liquid and gaseous transport fuels of non-biological origin'. These rules will specify if an electrolytic hydrogen or derivative fuel project will qualify as 'green' and therefore if it is eligible for subsidy and price support.

Recent changes to these rules allow for the provision for grid connected projects with low carbon intensity to have an avenue for green classification, provided that the fuel producer tops-up their energy usage with renewable energy PPAs. This is incredibly important for France's high nuclear reliant grid which will allow for green hydrogen producers to use low-carbon nuclear power in conjunction with renewable PPAs.

These PPAs can be sourced from anywhere within the EU member states that share a grid network, so long as the production and generation take place in the same calendar month. This long window is a temporary measure until an hour-by-hour system can be established in 2030. In the meantime, the case for a hydrogen PPA in France just got a lot stronger.