

EnergyTag



Response to Call for Evidence on Barriers to PPAs

20 February 2026



Executive Summary

- **Renewables Dominate:** Solar and wind increasingly dominate Europe's power system; however, this leads to negative pricing and the declining value of renewable generation, shifting focus and value to flexibility.
- **Market Stagnation:** Despite policy calls for more PPAs, market volumes are declining - particularly in heavy industry - because single-technology PPAs (like solar-only) no longer provide an effective hedge against price volatility.
- **Shift to Hybrid PPAs:** Hybrid PPAs, which blend wind, solar, storage and clean-firm technologies, can boost the value of PPAs.
- **Superior Cost & Hedging:** Hybrid portfolios can meet up to 80% of baseload demand at competitive prices, providing a "firmed" power profile that more effectively shields buyers from market volatility.
- **Accelerating the shift:** While the economic fundamentals for hybrid PPAs are clear, their growth is slower than required. Policymakers should focus on removing barriers and enabling these products.

Barrier	Recommendations	Benefits
Declining PPA Value	<ul style="list-style-type: none"> • Focus policy on hybrid PPAs with firmer profiles. • Provide EU guidance on hybrid PPAs. 	<ul style="list-style-type: none"> • Competitiveness: Affordable power that hedges volatility • Volume Recovery: Closes the buyer-seller price gap.
Outdated Guarantee of Origin	<ul style="list-style-type: none"> • Implement Granular Guarantees of Origin • Explicitly recognize and reward energy storage. 	<ul style="list-style-type: none"> • Transparency: Align green claims and market realities. • Flexibility: Values energy storage and flexibility
Low Industrial Demand	<ul style="list-style-type: none"> • Support de-risking mechanisms for hybrids • Utilise ETS revenues to support firming of PPAs with clean flexibility. 	<ul style="list-style-type: none"> • Competitiveness: Reduces the cost burden for industry to match stable demand profiles. • Clean Firming: Develops clean flexibility to tackle gas-driven volatility on the margin.
Low Credibility Carbon Accounting	<ul style="list-style-type: none"> • Include credible market-based carbon accounting in EU policies. • Harmonise approach based on physical delivery for consumption claims. 	<ul style="list-style-type: none"> • Credible Policy Basis: Allows PPAs while preventing claims that lack credibility. • Hybrid Premium: Rewards the premium value of hybrid PPAs.

Section 1 - The Transition to the Hybrid PPA Era

Renewables Now Dominate EU Power Markets

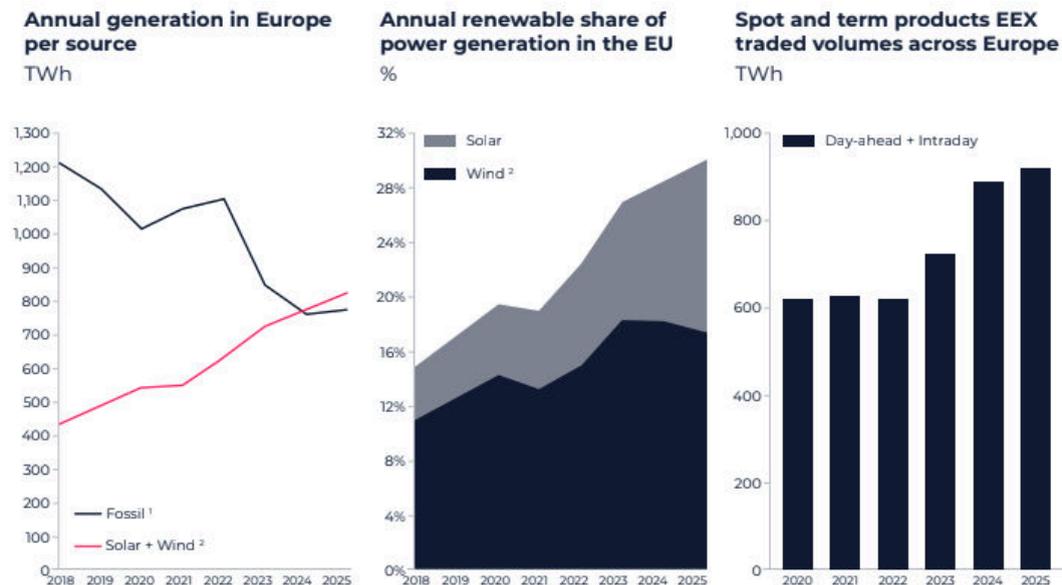


Figure 1 - (Source: Pexapark, 2026).

Renewables have achieved a **dominant position in the European power system**. In 2025, solar and wind generation overtook fossil generation. This signifies that the transition is no longer just an ambition but a reality. It also means that the **challenge now becomes increasingly about integrating more renewables with clean flexibility** rather than simply adding more capacity. This is a critical context for the next phase of the PPA market - the products and approaches that supported the growth of renewables in the past decade will not necessarily work to continue advancing decarbonisation in the next decade.

As **Europe finds itself in a competitiveness crisis**, in part related to electricity prices, **PPAs have been highlighted as a key solution** by European policymakers. During an address in Antwerp, European Commission President Ursula von der Leyen said we *"must make greater use of power-purchase agreements"...**"Because locking in energy prices protects you from volatility and lets you plan for the long-term."* (European Commission, 2026b)

PPAs have the promise to protect buyers from market volatility, but traditional single-technology PPAs are becoming less effective at doing that. This **submission will focus on the challenges of today's PPAs markets and how hybridising solar, wind and storage is essential to developing the next generation of high-value renewable portfolio or "hybrid PPAs"**. These PPAs can truly deliver on the wishes of President von der Leyen to help European Industry

hedge volatility and improve its competitiveness. There are many crucial elements, such as guarantees, permitting, grid updates and more that will also help boost the PPA market, however this submission focuses on hybridisation.



Figure 2 (Source: Pexapark, 2026).

While the European Commission correctly identifies PPAs as essential for achieving the 2030 renewable energy targets, the **market has declined by 10-20% for the past three years**. While some markets and sectors showed signs of growth, the general trend is downward. Heavy industry demand is a particular concern. Data from the Re-source platform (Re-Source, 2026) shows PPA demand for heavy industry softening significantly in 2025, down **80% to just 0.6 GW**.

Reigniting growth in the PPA market is essential for renewable deployment. Alongside Contracts for Difference (CfD), they are the most important tools Europe has to finance new renewable deployment. A recent report (European Parliament, 2026) found that at the current rate of PPA and CfD rollout, **“about 67% of RES capacity must be supported via other means if the EU is to meet its RES targets,”** in part due to *“signs of stagnation in traditional PPAs”*. Given the lack of robust alternative options available, stimulating PPAs is crucial.

The Value Decline of Traditional PPAs

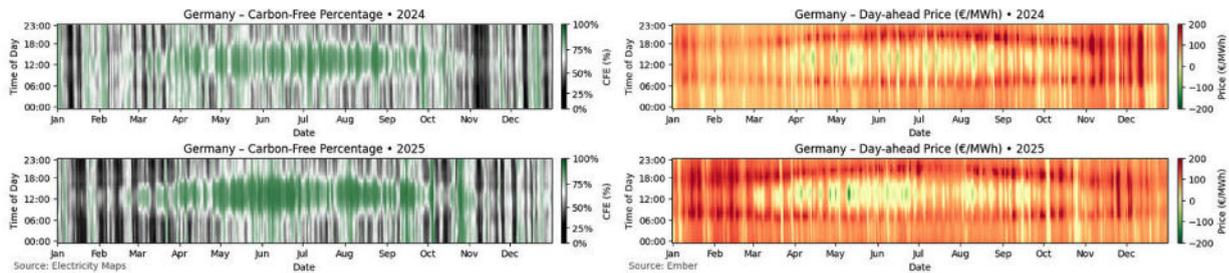


Figure 3 - German Hourly Clean Power and Electricity Prices (Source: EnergyTag, 2026).

As illustrated in the EnergyTag analysis above on hourly clean power penetration (left) and electricity prices (right) in Germany over the past couple of years, the **timing of PPA production determines the value that buyers receive** under the PPA. For example, a Solar PPA producing electricity during the day when power is already cheap and not producing when power is expensive (i.e. after sunset) is not an effective hedge against spot market volatility and high electricity prices. This is one of the main reasons why markets with solar saturation have seen PPA volumes slow down, **solar PPAs are not attractive investments when the alternative is low-cost market power in solar hours and little protection when prices spike**. This graphic also highlights that claims to be “100% renewable” based on matching annual demand with solar production obscures a company’s continued reliance on expensive fossil fuels throughout much of the year.

A Customer Buying a 150 GWh/Year Solar PPA To Cover Their Total Consumption

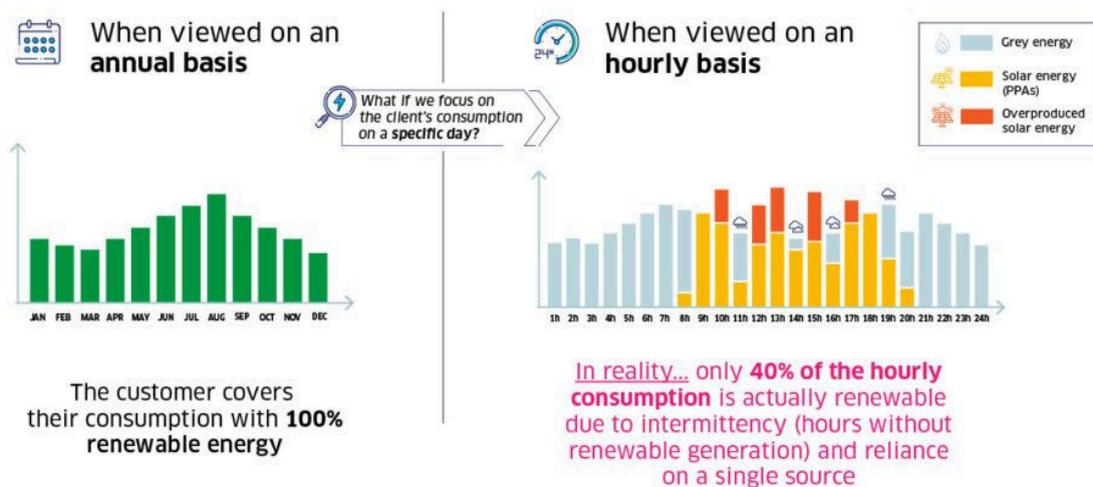


Figure 4 - Source: (Engie, 2026).

The graphic above from Engie illustrates this same concept, where a Solar PPA procured by a consumer to match a “100 renewable energy” claim on an annual basis (equivalent to claiming to be solar powered at night), actually delivers only 40% hourly matching to consumption. This Solar PPA does little to protect the buyer against the most expensive hours and leads to significant shaping costs.

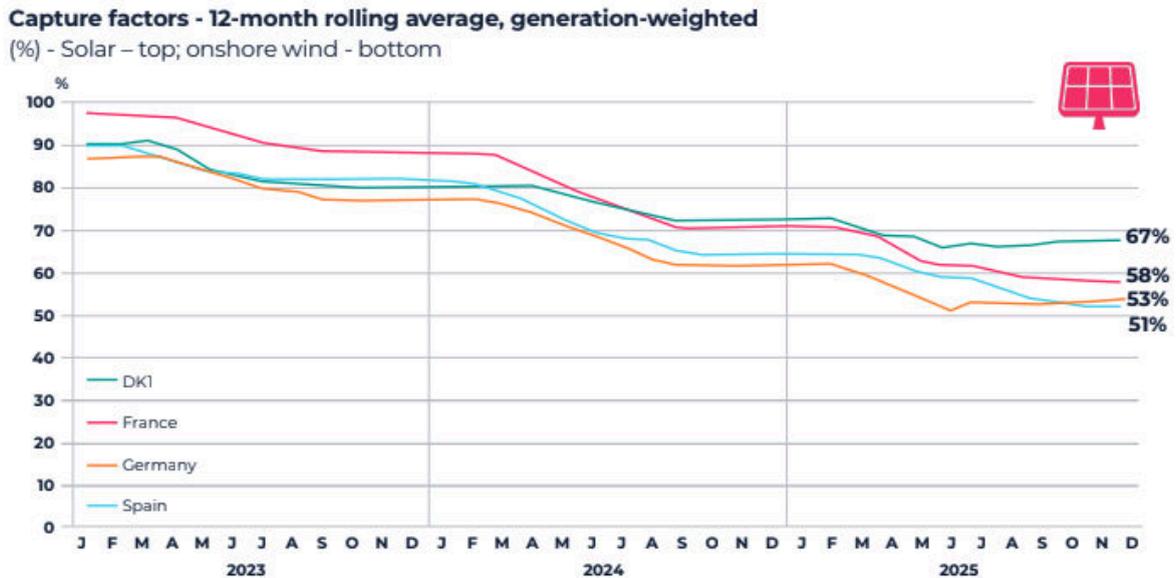


Figure 5 - Source: (Pexapark, 2026).

The graphic above illustrates the rate at which the value of solar PPAs is decreasing relative to the baseload price of power, a trend that mirrors the overall drop in PPA volumes. Similar trends are also evident for wind PPAs.

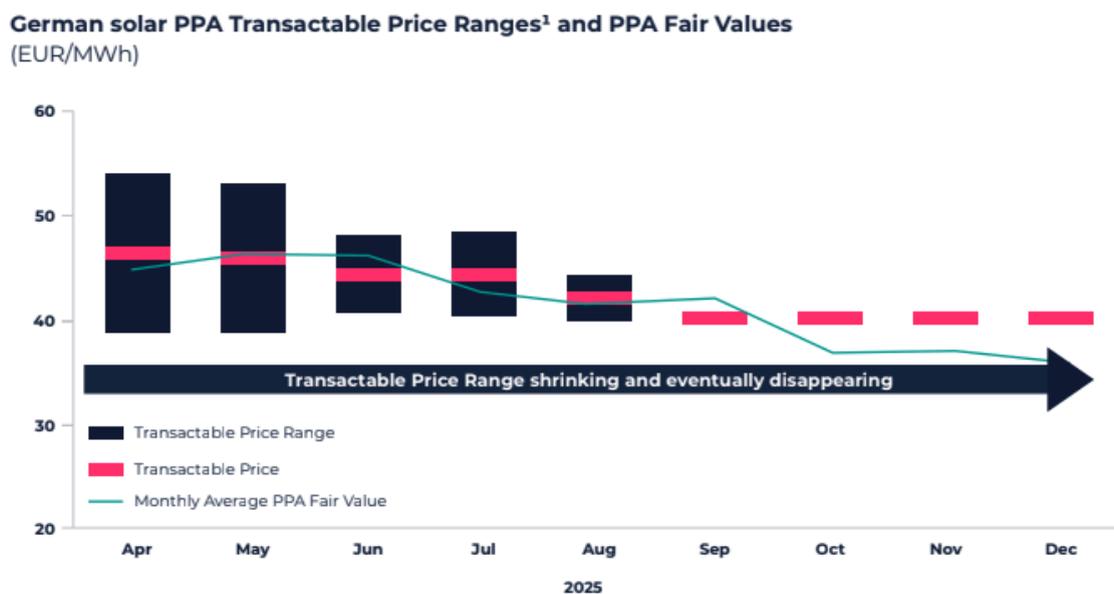


Figure 6 - Source: (Pexapark, 2026).

In some markets, like Germany, the **acceptable price range between buyer and seller has become too large to support new transactions.**

Storage Remains A Minor Part of PPAs

Europe storage PPA and tolling contracts form less than 2% of the total signed capacity

This is set to change drastically with more exposure of renewable projects to actual wholesale power price volatility across the region

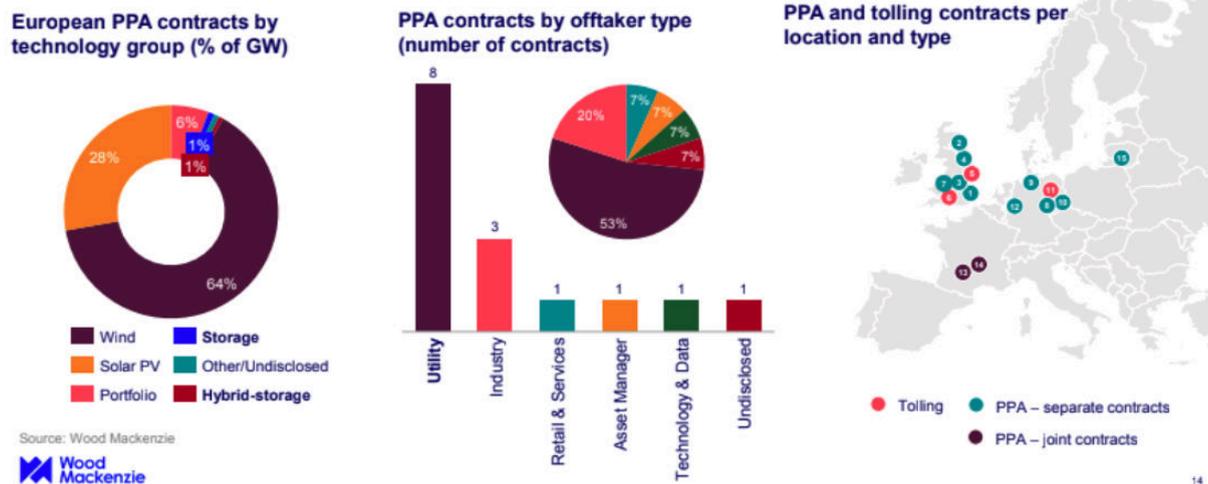


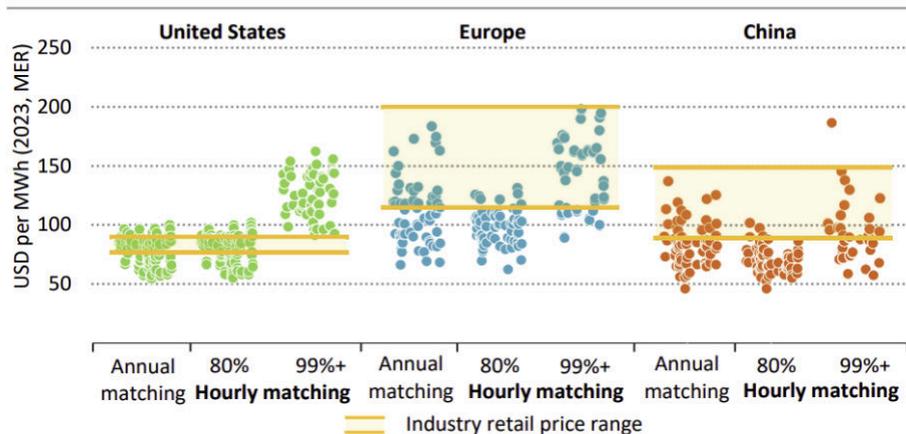
Figure 7 - Source : (WoodMackenzie, 2025).

One obvious tool to help PPAs deliver more power in the highest-priced hours is storage. However, PPA volumes continue to be dominated by Solar and Wind-only PPAs. These made up over 90% of contracted capacity in 2025 (Re-Source, 2026). Analysis from WoodMackenzie (WoodMackenzie, 2025) further underlines this trend, showing that **storage makes up only 1-2% of contracted PPA volumes.** Given the critical role of storage in helping firm renewables, it's crucial that the role of storage in PPAs is increased.

Hybrid Renewables Offer a Pathway to Competitiveness

Hybrid renewable portfolios have rapidly become economically competitive. Analysis, shown above, from the IEA concludes that **“Hybrid wind, solar PV and battery portfolios can meet 80% of baseload demand at an average cost competitive with industry retail prices in the United States, Europe and China”.** Given particularly high prices in Europe, even cases of 90% hourly matching rates are already competitive today on an LCOE basis.

Figure 2.19 Total cost of electricity per unit consumed for hybrid options of wind, solar PV and battery in the United States, Europe and China



IEA. CC BY 4.0.

Figure 8 - Source: (International Energy Agency, 2025).

However, as shown above from RE-source data, hybrid PPAs remain niche despite the economic benefits.

Hybrid PPAs Better Hedge Against Volatility

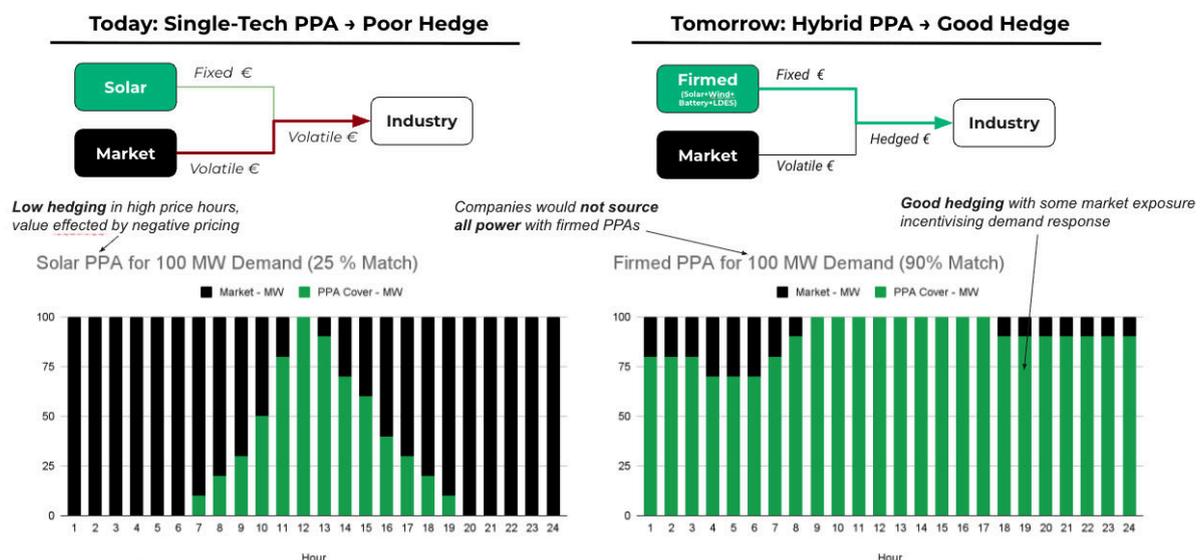


Figure 9 - Source: (EnergyTag, 2025).

Hybrid portfolio PPAs, where renewables and clean flexibility are combined to deliver a firmer, more round-the-clock profile to buyers, **provide a far better hedge against increasingly volatile short-term electricity prices.**

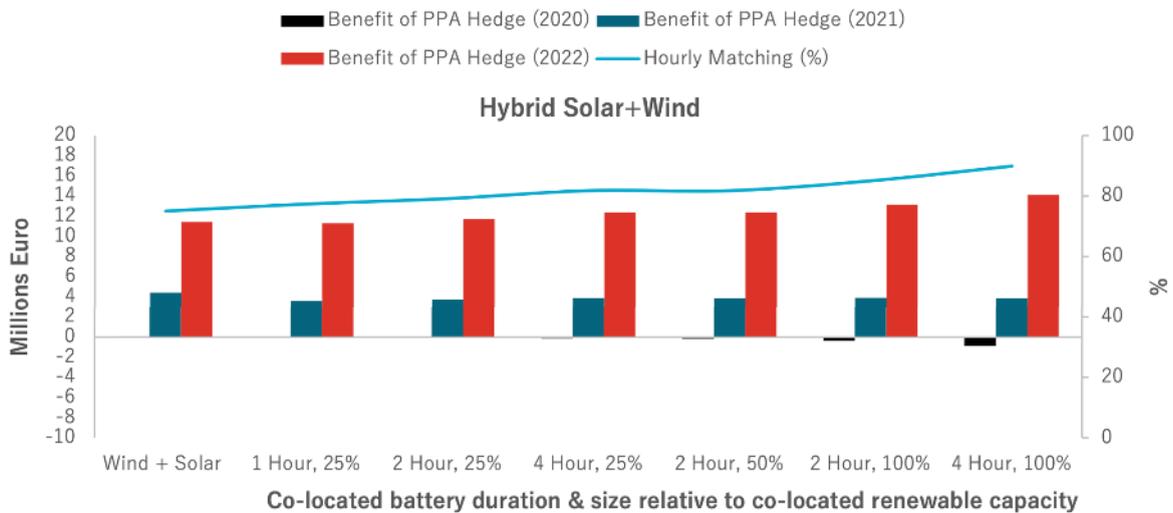


Figure 10 - Source: (Eurelectric & Pexapark, 2023).

A Eurelectric and Pexapark study modelled hybrid PPA portfolios (combining wind, solar, and storage) in Germany and Finland. The analysis showed that higher hourly matching increases PPA hedging effectiveness. This reduces a buyer's exposure to volatile spot market prices when renewable generation is low, and spot prices are typically high. While this firmness increases the PPA price, the study found it delivers greater absolute hedging benefits by protecting consumers from extreme price spikes, so it also increases PPA value. For example, the retrospective analysis for Germany showed that for a high-priced year (2022) and medium priced year (2021), there are significant financial benefits from hybrid PPAs compared to an unhedged portfolio. **In 2022, a 10 MW baseload consumer could have saved €10 million by achieving a 90% hourly match.**

The Move the Hybridization Is Starting

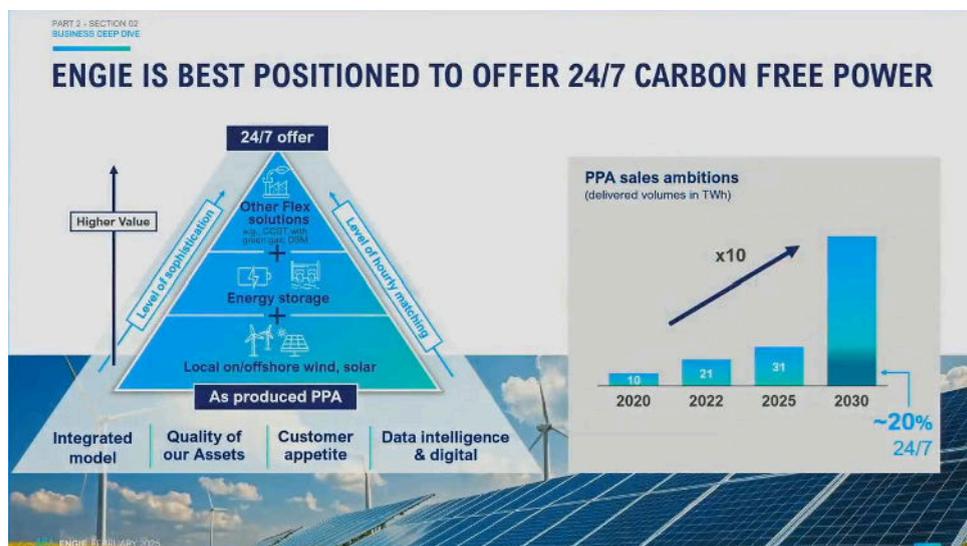


Figure 11 - Source: (Engie, 2024).

Hybrid PPAs are emerging. For example, as illustrated above, Engie has announced that it aims to have 20% of its PPA being 24/7 by 2030, as they move their offer from the lower value single-technology portfolios to structured offers that include renewables and storage. **CEO Catherine MacGregor says that Engie customers are increasingly asking them to provide PPA power “when they want it, not just when we produce it”.** (Engie, 2024). However, while growing, these structures are still limited as a share of the overall market.

Figure 35: Top corporate clean energy sellers in EMEA in 2025, by sector

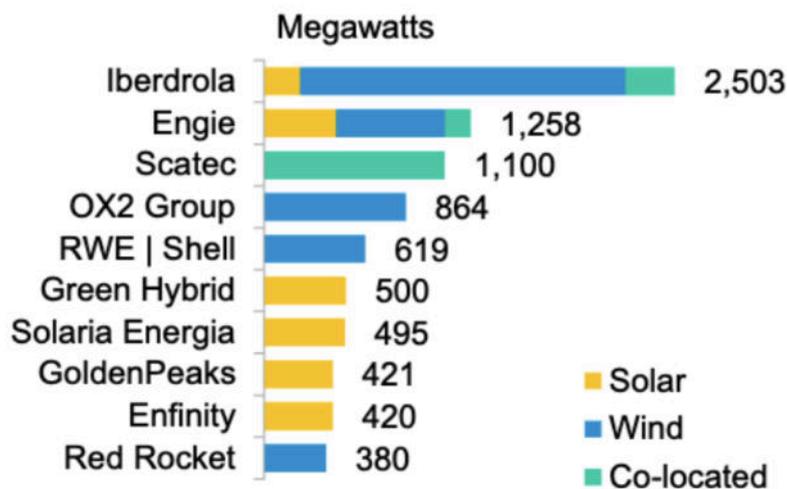


Figure 12 - Source: (BNEF, 2026).

The deployment of hybrid PPAs is growing in the EMEA region, as shown by the BNEF analysis above. Leading providers like Iberdrola and Engie are starting to have co-located PPAs in their portfolios. However, these hybrids remain niche. In fact, one solar and battery 1.1 GW PPA signed by Egypt Aluminum (Scatec, 2025) made up more volumes than all other hybrid PPAs combined in EMEA.

BNEF says *“Standalone solar and wind accounted for 82% of corporate PPAs offered by the top developers in 2025, or 94% if Scatec’s 1.1GW deal is excluded. A likely contributor to falling volumes in the region is the lack of competitive hybrid or co-located PPA offerings”* (BNEF, 2026).

The promise and need for hybrid PPAs is clear, and deals are emerging showing that the structure is possible. However, barriers to these structures need to be removed; the next section will discuss how to scale hybrid PPAs.

Section 2 - Enabling Hybrid PPAs

Firming is a Key Barrier to PPAs for Industry

PPAs can offer a way to boost industrial competitiveness by reducing energy price volatility. The Draghi report specifically highlights the potential benefits of PPAs: *“More stable long-term contracts, such as Power Purchase Agreement (PPAs), have the potential to reduce the exposure and hedge industry against high and volatile prices, providing price certainty for large industrial players.”* The report also highlights the importance of **“mitigating costs of matching industrial demand with variable renewable generation profiles.”** (Mario Draghi, 2024)

For PPAs to move beyond a niche industrial product and become central to bolstering European industrial competitiveness, they must reliably deliver generation profiles that closely match demand. A major obstacle, identified by industry associations across Europe, **is the cost associated with 'shaping' these agreements to ensure firm delivery.**

“Provide support mechanisms that encourage the uptake of long-term PPAs between renewable energy generators and industrial consumers, starting with providing a solution for matching profiles.” (Eurometaux, 2025)

“In many Member States, the prices derived from stabilizing intermittent supply of renewables known as “firming costs/shaping costs” are one of the main obstacles for industries to engage in the signatures of PPAs.” (Eurofer, 2021)

““We recommend providing de-risking mechanisms that encourage aluminium producers to sign PPAs, starting with addressing the risks and costs of the need to match the variable renewable energy sources (RES) electricity to the more stable industrial consumption profile.” (European Aluminum, 2025)

“Facilitate access to aggregation services also for industrial consumers to reduce shaping costs and facilitate the matching of PPA profiles to different consumer needs” (CEFIC, 2026)

Recommendation - Support Hybrid PPAs for Industry

- Issue guidance on enabling Hybrid PPA structures, including for industry.
- Use ETS revenues to financially support PPA clean firming
 - This could potentially involve mechanisms similar to the Clean Flexibility Instrument, proposed by the European Commission as part of the Clean Industrial Deal, which could provide financial support for firming costs of hybrid PPAs.

Move to a More Granular Guarantee of Origin System

Europe's Guarantee of Origin (GO) system is important for preventing double-claiming of renewable energy, making it a key mechanism for PPAs. However, the current system allows GOs to be used irrespective of the time or location of generation in Europe. This approach assumes renewables can be stored easily over a year and that European grids are perfectly interconnected. Consequently, a consumer can claim "solar powered at night," and countries can claim imports far exceeding physical capacity - Germany, for instance, imported three times more GOs than physical electricity in 2023. (EnergyTag, 2025b).

Broad market design rules have led to a GO market that is oversupplied, with prices below 1 €/MWh (EEX, 2026). These **ultra-low prices offer a low priced option for consumers to claim green consumption, drawing volumes away from higher impact options like PPAs**. A European Commission report recently found that the GO market generates very low overall revenues for renewable generators *"an overall volume of about (only) €140 million is reached for producers across Europe...Comparing this to the estimated investment needs and actual investments, this is much less than 1% for Germany alone, investing about € 37.3 billion into renewables in 2023"*. (European Commission, 2025).

To the best of our knowledge, only one or two European countries currently issue GOs for energy storage. This issue has been raised by Solar Power Europe as a significant gap in the GO framework: **"Current systems fail to track renewable energy flowing through storage, leading to gaps in GO certification."** (Solar Power Europe, 2025). The GO system must evolve to identify and reward the value of energy storage in shifting renewables to enable hybrid PPA structures.

ENTSO-E has also raised concerns with the GO market design: *"The current system does not provide sufficient incentives for the development of RES and the consumption of green electricity at the right time and in the right geographical location."* and advocates for *"The introduction of temporal matching"* and *"the introduction of market boundaries"* (ENTSO-e, 2022). A broad coalition of actors from across the electricity sector, including Eurelectric, Smart-en and Energy Storage Europe, **has called for the rapid "implementation of Granular Guarantees of Origin (GOs)"** to enable the hourly energy tracking needed in Europe to reward storage and flexibility. (EnergyTag, 2024)

Recommendation - Require a Granular GO system

- Move to an hourly Granular GO system.
- Ensure that storage systems can access GOs to enable hybrid PPAs.

Ensure Carbon Accounting that Values Hybrid PPAs

The Current Credibility Crisis

Current carbon accounting practices for electricity have been heavily criticised. Annual matching removes the incentive for storage investment by assuming lossless year-long storage of renewables. Furthermore, the assumption that GOs can flow without limits across Europe is flawed, as the EU's 15% interconnection target between countries is not on track to be met (Ember, 2025).

Energy Analyst Michael Liebreich succinctly discusses the dominant carbon accounting standard used by companies, the Greenhouse Gas Protocol, which “allow companies to claim they use 100% renewable power on the basis of annual matching – which means they can offset night-time coal use with extra purchases of daytime solar power. It’s absurd and destroys public confidence. The rules are currently under review and need to be tightened.” (Liebreich, 2025)



Figure 13 - Source: (Financial Times, 2024).

The credibility gap has also been criticised in major business press. The Financial Times shows how many companies use current carbon accounting practices to under-report their emissions, often relying on certificates that are detached from their real power demand. For example, as shown above, many major tech companies report little to no emissions under status quo "market-based" accounting despite significant load growth, solar-dominated procurement and little investment in clean flexibility to date.

There has been **extensive analysis of the benefits of various carbon accounting methodologies for PPAs in the Scientific literature.** EnergyTag maintains a full list (EnergyTag, 2026b) of **over twenty studies** demonstrating the benefits of increased granularity of carbon accounting. A review paper from the Denmark

Technical University of the peer-reviewed literature stated *“Our results suggest that assuming the implementation of recent government policies, annual volumetric and emissions matching do not lead to significant emission reductions relative to a counterfactual without a REC market. This is because investments are almost exclusively made in the cheapest available renewable energy resource, thereby cannibalising market-driven projects that would also have been built without a REC market. On the other hand, **we find that hourly matching (with PPAs involving local and new RE generators) leads to significant reductions in system emissions.**”* Moving to more accurate carbon accounting is vital to ensure buyers genuinely aid decarbonisation, particularly during the year's hardest hours.

Policy Moves to Increase Carbon Accounting Credibility

Recognising the issues with relying on current carbon accounting, we have **started to see policy move away from broad annual matching to credible hourly matching.** For example, in Europe, the RFNBO Delegated Act (European Commission, 2023) and the Carbon Border Adjustment Mechanism (European Commission, 2026) require PPAs to be physically deliverable and hourly matched in order to be valid for consumption claims. This aligns PPA accounting with the realities of electricity markets, which are based on time-matching (i.e. 15-minute settlements) and physical delivery (i.e. in Bidding Zones). Crucially, these rules are simply to clarify what can be counted as zero-emissions electricity consumption; they are not a specific requirement to consume only clean power in 100% of hours.

However, **some EU policy frameworks have suggested a move away from market-based accounting entirely.** For example, the Battery Regulation initial delegated act proposal excluded PPAs as a valid method of proving renewable energy consumption. This is the wrong approach as it completely removes crucial incentives for a green supply chain, where credible market instruments can be used to drive PPA volumes. The answer is not to get rid of market-based accounting, but to improve market-based accounting to reflect the physical reality of electricity systems and ensure higher integrity clean energy claims.

Recommendation - Maintain Credible Market-based Accounting in Policy

- EU policymakers should harmonise electricity carbon accounting methodologies to permit the use of PPAs for clean power consumption claims, provided that the generation is physically deliverable and hourly matched to consumption.

Global Standards Going Granular



Figure 14 - Source - (GHG Protocol, 2026).

The GHG Protocol, the world's leading electricity carbon accounting standard, is proposing updates to the rules for how companies measure and report their electricity emissions. Under the proposed updates (summarised above), in order to claim to consume electricity from a zero-carbon electricity source, a company would have to demonstrate that the power is physically deliverable and hourly matched to demand. There are also crucial feasibility measures proposed:

- This is for more accurate accounting; it's not a 24/7 requirement.
- Exemption thresholds for smaller consumers will exempt most companies from hourly matching requirements.
- In cases where hourly data is not available, load profiles can be used.
- The new rules will be implemented after a phased-in period, allowing the market to prepare for changes
- Long-term PPAs are set to be grandfathered under today's rules, protecting initial investments.

Importantly, the proposed rules do not set a procurement requirement for companies, but rather require companies to account for their electricity emissions more accurately, improving the integrity and impact of corporate clean energy purchasing. In addition to improving accuracy, the proposed changes will provide much-needed incentives for storage and firm clean energy portfolios.

Notwithstanding these benefits, some have criticized the proposed changes, arguing they will harm the growth of the PPA market. On this point, context is warranted. **The European PPA market is dominated by physical PPAs**, making up ~83% of market volumes in 2025 (Pexapark, 2025). Therefore, under the proposed Scope 2 updates, these PPAs would continue to receive credit in

corporate Scope 2 inventories. The proposed Scope 2 changes could also make PPAs more valuable for companies. . Indeed, as demonstrated above, PPAs with higher levels of physical matching are more effective long-term hedges for buyers. The proposal will likely benefit hybrid PPAs, as noted by Pexapark *“the proposed changes could help increase the attractiveness of hybrid PPAs or multi-technology PPAs and help to increase the willingness to pay a premium for hybrid PPAs,”* (Pexapark, 2025)

The rules clarify that Virtual PPAs signed for projects on grids that do not correspond to a consumer’s electricity consumption would no longer receive Scope 2 inventory credit since they are outside of a company’s value chain. Companies could still sign these contracts, however, and receive credit as an electricity offset under future methodologies to estimate avoided carbon emissions under the Greenhouse Gas Protocol revision process. However, vPPAs are likely to remain a limited share of overall PPAs in most geographies; the market for multi-year contracts for power that companies actually consume will always be deeper than power that companies don’t need.

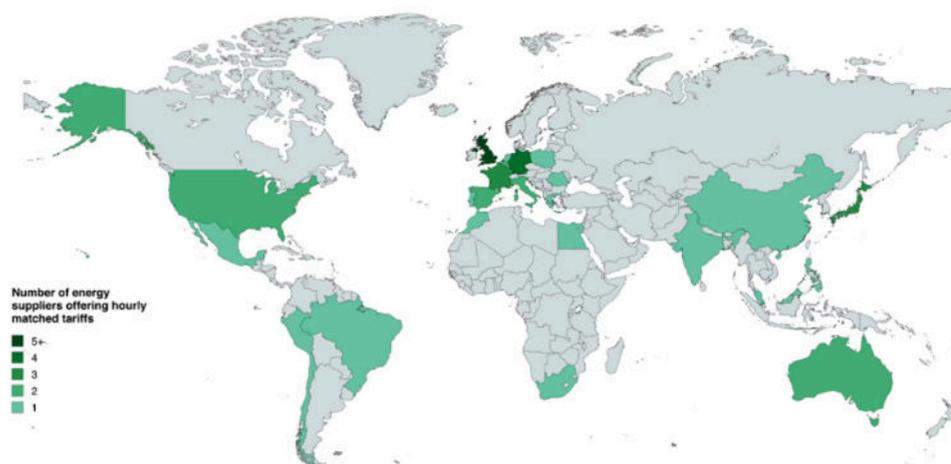


Figure 15 - Map of Energy Supplier Hourly Tariff Options (Baringa & Granular Energy, 2026).

In terms of feasibility, hourly matching is not novel in power markets. EU markets now trade power on a 15-minute basis. Electricity suppliers are well placed to enable this next level of transparency. A recent study from Baringa and Granular Energy (Baringa & Granular Energy, 2026) found that over 50 suppliers globally already offer hourly matching tariffs, including across all major European markets.

Recommendation - Align with and enable Granular Accounting

- Best-in-class EU policy on carbon accounting is already moving to Granularity. As global frameworks also move in this direction, it’s critical that Europe removes barriers to companies accessing hybrid PPAs.

About EnergyTag

To achieve a truly decarbonised and affordable energy system, we need clean power, delivered round-the-clock. EnergyTag is an independent non-profit accelerating this transition. We do this by enabling and advocating for reforms to clean energy markets and carbon accounting systems that reward clean power when and where it's needed. Our work enables better incentives for round-the-clock renewables, clean-firm power, storage, and flexible demand - key decarbonisation tools that are often overlooked in today's clean energy frameworks. We have teams in the EU, the US and Asia Pacific working on this goal. Our team members have years of practical experience working on PPAs. We have worked on approximately 1 GW of PPA deals in previous roles.

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