FEVE
The European Container Glass Federation

Powering green glass

Addressing barriers to uptake of renewable PPAs in the container glass industry

Executive summary

The container glass industry faces persistent energy-related challenges. As an energy-intensive industry, container glass manufacturing depends heavily on stable and affordable energy supplies. The recent energy crisis has sharply raised energy prices, putting the industry's competitiveness under strain and creating an urgent need to find solutions to keep costs under control.

The industry is also firmly committed to decarbonising in line with the EU's 2050 carbon neutrality target. Electrification of furnaces and production processes is emerging as a one of the promising pathways towards this objective[1]. However, successful electrification will require not only stable, low-carbon electricity supplies but also long-term price certainty to manage investment risks. The significant cost gap between electricity and fossil sources further represents a barrier to this transition: in the EU, retail electricity prices per MWh for industry are typically 2 to 3 times higher than for gas[2].

In the recent electricity market design reform, Power Purchase Agreements (PPAs) were put forward as key tools to address these challenges. The rationale is that by securing long-term renewable energy supplies directly from producers, PPAs can help stabilise electricity costs, reduce exposure to market fluctuations, and provide assurances of green power sourcing—thereby supporting both competitiveness and decarbonisation ambitions.

However, PPAs are not a panacea and the uptake of renewable PPAs within the container glass industry remains limited.

- **The predominant model available – physical pay-as-produced PPAs – implies excessive complexity, cost and risk for buyers with baseload electricity demand such as our sector.** As this model offers no control over the amount of electricity received, surpluses and deficits must be dealt with on wholesale electricity markets. This not only involves significant costs but increases exposure to volatility – the very thing PPAs are supposed to help avoid. Until models and services more suited to the industry's needs become more widely available, easily accessible and cheaper, PPAs will remain a marginal part of our sector's procurement toolbox.
- **The growth and maturity of PPA markets is highly dependent on structural issues, such as the development of renewable energy projects, grids, and storage solutions.** These factors vary significantly across the EU and take time to evolve. These disparities are also not easily addressed by cross-border PPAs, which come with their own set of structural and regulatory challenges. Consequently, there are few Member States where the offer for PPAs is susceptible to be attractive for the industry in the short to medium term.
- **Regulatory barriers can also hamper PPA market development,** such as the design of national support schemes for renewable energy in the form of two-way contracts for difference (CfDs).
- Even where a suitable PPA is identified, **our industry faces major difficulties in providing the credit guarantees required to enter such long-term agreements.** Targeted support to address this issue is not yet available in most Member States.

This position paper explores these barriers, recommends measures to address them, and highlights some potential solutions.

About FEVE

FEVE is the association of European manufacturers of glass containers. Glass packaging is the largest sector of the European glass industry, generating 125 000 direct and indirect jobs thanks to 162 container glass production sites in Europe, including plants in 23 EU Member States. We serve a wide number of sectors crucial for EU international competitiveness from food and beverages to pharmaceuticals, perfumery and cosmetics, together representing a value added of ~1% of EU GDP. See more on www.feve.org.

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Recommendations

Adapt State aid frameworks for industrial decarbonisation

- Innovative schemes involving PPAs such as the "Green Pool" or the "Energy Release Platform" (see Section 4) can address some our sector's main challenges with PPAs and help ensure access to affordable renewable energy while accelerating the energy transition.
- A revision of the current state aid framework is necessary to enable these innovative solutions to be implemented or further deployed. The upcoming review should therefore:
    - Integrate new solutions to provide targeted support for energy-intensive industries, for example by adapting and prolonging the Temporary Crisis and Transition Framework (TCTF)
    - Enable support for both capital expenditure (CAPEX) and operational expenditure (OPEX) linked to decarbonisation, such as shaping and firming costs.

Provide appropriate guarantee schemes

- Fully implement the Electricity Market Design reform requirement to ensure that public or private guarantee schemes are available to help energy-intensive industries access PPAs
- Provide additional support at EU level, including through specific financial guarantees from the EIB.

Avoid crowding out by CfDs

- Ensure two-way CfD schemes leave sufficient renewable capacity available for PPAs, at minimum by fully implementing the EMD requirement to allow project developers covered by CfDs to reserve part of their capacity for PPAs.
- Different CfD designs can achieve this[3]:
    - Defined capacity: the CfD is awarded for a certain proportion of the project capacity. For some technologies (e.g. wind) it may not be practical to do this based on physical capacity due to the level of variability, in which case the nameplate capacity of the installation could be used as reference.
    - Defined volume: the CfD applies until a total amount of electricity is sold on the market, beyond which the generator can opt to sell with full merchant risk (either on the market or via PPA) even if this occurs before the term of the CfD. The Spanish 2-way CfD scheme follows this model.
    - Notice period: generators covered by the CfD can exit after a certain notice period. The Irish 2-way CfD scheme follows this approach.
    - Partial suspension: the CfD can allow generators to temporarily suspend the CfD on a part of their generation and sell power via PPAs, and later re-enter the CfD once the PPA ends if they cannot find new buyers. The Belgian 2-way CfD scheme takes this approach.
- The Draghi report on the future of European competitiveness proposes to require renewable energy producers to supply a predefined minor share of their publicly subsidised production through PPAs at 'production cost plus mark-up' to specific industries exposed to international competition.[4] This recommendation should however be viewed with caution as it might have the effect of disincentivising participation from producers, hindering development of renewable projects.

Address renewable energy bottlenecks

- Ensure sufficient supply of renewable energy and accelerate the rollout of the necessary infrastructure by fully implementing the revised Electricity Market Design, the Renewable Energy Directive and the Grids Action Plan.

- Greatly intensify efforts to achieve the 70% cross-border interconnection target.
- Review requirements on long-term transmission rights to enable booking of cross-border transmission capacity over longer time horizons.
- Ramp up investment in flexibility assets and implement supportive policies for dispatchable renewable capacities, to better support energy-intensive industries with baseload demand

[1] For a detailed overview of technologies deployed for decarbonisation of the container glass industry, see: FEVE (2024), *One destination, multiple pathways: How the European container glass industry is decarbonising glassmaking*.
[2] Eurostat, Natural gas price statistics – Natural gas prices for non household consumers; Electricity price statistics – Electricity prices for non household consumers, data extracted in October 2024.
[3] See e.g., Trinomics (March 2024), *Design principles for 2-way CfDs for solar-PV & onshore wind*. Available at: https://open.overheid.nl/documenten/96452a71-e692-4069-8de4-0fb255952088/file
[4] M. Draghi (September 2024), *The future of European competitiveness – Part B | In-depth analysis and recommendations*, p.37

What is a PPA?

The Electricity Market Regulation defines a PPA as "a contract under which a natural or legal person agrees to purchase electricity from an electricity producer on a market basis"[1]. In recent policy discussions at EU level, the term is generally used to refer to long-term contracts (10-20 years) where the customer buys renewable electricity at a pre-negotiated price either from the producer directly or an intermediary.

This broad notion can therefore refer to a wide variety of contractual arrangements with very different parameters. Each of these models presents its own advantages and risks, and not all models will be appropriate for different kinds of electricity consumers. See Annex III for a typology of PPAs.

Main barriers to PPA uptake in the container glass sector

Shaping and firming costs

A significant barrier to PPA adoption for the container glass industry arises from the fact that the glass production process requires a constant and stable supply of energy (see Annex II), whereas renewable energy is mostly variable and intermittent.

Most PPAs currently available in the EU are "pay-as-produced"[i]. Under this model, the buyer must take delivery of all (or a pre-defined share) of the energy produced, if it is produced, and when it is produced. Making this consistent with the baseload demand of a container glass installation involves certain costs:

- **Shaping costs**: "shaping" (also known as "profiling") refers to adjusting the variable, mostly weather-dependent, output of renewable energy to align it with the demand profile of the consumer. If the buyer receives more energy than needed, either they or an intermediary will have to sell it on the spot market. Conversely, extra energy must be purchased when the producer does not deliver enough to cover demand. The shaping cost is the difference between the income from selling surplus energy and the cost of buying additional energy to meet demand.
- **Firming costs**: renewable energy output can be forecasted to a certain extent, but is always subject to some unpredictability. When the renewable energy produced falls short of forecasts or is unexpectedly interrupted, the buyer or their intermediary will need to adjust their position the balancing markets. Put differently, shaping costs relate to the difference between the projected production and the demand, whereas firming costs concern the difference between forecasted and actual production.

The buyer can assume the risk of these shaping and firming operations or pay an intermediary to carry them out, but in both cases will bear the cost. For baseload operations like glass manufacturing, these costs make up a significant proportion of the total PPA price. The unpredictability of these costs due to the increasing volatility of electricity markets also in itself represents a major obstacle. Indeed, in recent years, frequency of both peaks in electricity price and negative prices have increased considerably[2].

Therefore, contrary to the aim of price stability, this type of PPA in reality exposes glass manufacturers to a higher degree of market volatility. This also means glass manufacturers cannot viably rely on this kind of PPA for sourcing large amounts of their demand for renewable electricity, since the risk increases with the volume of demand covered.

[i] See Annex III

The long duration of most PPA contracts (10+ years) also creates significant risks for the buyer due to the difficulty of predicting how shaping costs will evolve over this period. It can however be noted that, as the energy transition progresses, shaping costs will likely rise along with the share of renewable electricity. As the share of renewable energy rises, the surplus energy delivered under the PPA during times of high production will fetch progressively lower (and even occasionally negative) prices on the spot market. Meanwhile, any deficit would still need to be purchased at comparatively high prices.

Some PPA models can potentially limit shaping and firming costs by bringing together multiple sellers and/or technologies to average out production profiles[ii]. However, despite increasing interest for such models, their availability on the European market remains very limited[3]. These instruments are also generally more complex and therefore more challenging to negotiate and manage, which entails additional costs.

Creditworthiness

To be able to sign a PPA, an offtaker must be able to demonstrate financial stability and reliability to renewable energy developers, lenders, or intermediaries. PPAs are long-term contracts (often 10–20 years), requiring robust guarantees that the off-taker will fulfil its payment obligations over the contract term.

Energy intensive industries such as the container glass sector often operate in sectors with tight margins and high exposure to market volatility, leading to higher perceived counterparty risk. Moreover, although energy intensive industries have a high enough electricity demand to warrant a PPA, they are often not rated by any major credit rating agency[4].

Moreover, the duration of PPAs (10+ years) usually significantly exceeds that of the contracts container glass manufacturers have with their clients (3-5 years). Glass manufacturers therefore have no guarantee that the level of demand from their clients will be sustained over the duration of the PPA. This is especially the case since these clients can also more easily divert their demand to other packaging materials than is the case for other industries (e.g. cement, steel) where few or no alternatives exist for downstream sectors. This discrepancy causes difficulties for the industry's balance sheets, as their liabilities then extend beyond their revenues.

Consequently, container glass companies wishing to enter a PPA will usually have to undertake higher liability or restrict the contract volumes. This diminishes their attractiveness for project developers who prefer to contract larger volumes to single clients, avoiding the complexity and cost of multiple PPA negotiations.

In principle, multi-buyer PPAs[iii] can help address these issues by diversifying the credit risk and increasing the contract volume. However, this type of PPA is not available in most Member States and is in any case not evident to apply for the container glass industry. Joint negotiation could indeed raise anti-trust issues given the relatively small number of companies in the sector. Pooling demand with other industries presents other challenges, as different industries will often have different priorities when negotiating a PPA depending on their specific goals and needs. Concluding this type of arrangement via an aggregator could address these issues, but again the offer for this type of product is currently limited.

Supply-side bottlenecks & disparities in PPA market liquidity

The number of renewable projects in a country is a critical factor for PPA availability. A greater number of renewable energy projects creates a larger pool of electricity supply and increases the number of contracts available for off-takers to negotiate. The presence of diverse renewable technologies – as well as flexibility

[ii] See Annex III
[iii] See Annex III

assets such as batteries – also conditions whether products can be offered on the PPA market to balance out variable production.

Delays in connection or permitting and lack of grid capacity impede renewable energy deployment and therefore hamper the development of the PPA market. An important motivation for glass companies in signing PPAs can also be to demonstrate their contribution to the energy transition by encouraging development of new renewable energy projects. However, other than through on-site consumption or with a dedicated connection, this demand for additionality can only be met if enough new projects can be connected to the grid and the grid can absorb the additional capacity.

The availability of renewable energy also varies considerably between Member States. Spain, the Nordics and Germany are particularly advanced in this respect, and their PPA markets are correspondingly more mature. Nordic countries additionally have significant hydropower capacity which, as a dispatchable form of renewable energy, can be used to balance out the variability of wind and solar. This results in greater availability of baseload products and thereby increases the liquidity of their PPA markets.

Challenges for cross-border PPAs

One could be tempted to assume that the disparities in PPA market liquidity between different Member States could be addressed by simply concluding PPAs with renewable energy producers in other Member States. However, the reality is that such arrangements face several important difficulties.

Insufficient cross-border transmission capacity. For physical PPAs, a major challenge relates to lack of transmission capacity between certain Member States. The EU has set a target for Member States to ensure 70% of their physical transmission capacity is available for trade with their neighbours by end-2025. However, levels of interconnectivity still vary significantly across the EU and fall way short of the mark in key Member States such as Spain (13%), France (23%), Italy (13%) or Germany (31%)[5]. On a related note, there is also a mismatch between the long duration of a PPA and the time horizon for which it is possible to book capacity of cross-border interconnectors. Indeed, Transmission System Operators (TSOs) currently only offer long-term transmission rights up to 1 year ahead of electricity delivery. This therefore introduces uncertainty regarding whether the contracted electricity will be able to be imported, as well as regarding the cost of the transmission capacity.

Basis risk. In addition, even non-physical (i.e. financial) cross-border PPAs must still manage significant basis risk. "Basis risk" here refers to the mismatch between the price reference in the PPA contract and the actual market price at which electricity is bought or sold. This risk is particularly relevant in cross-border agreements where electricity prices can differ due to variations in local market dynamics or regulatory frameworks. Pricing structures between bidding zones can indeed vary significantly, based on the characteristics of the supply and demand, grid infrastructure, or applicable energy charges and taxes.

Lack of harmonisation for guarantees of origin. GOs are essential for industrial offtakers to track and prove the renewable origin of the electricity purchased and demonstrate compliance with their decarbonisation targets. While the Renewable Energy Directive mandates the issuance of GOs for renewable electricity, its implementation differs across Member States. Divergences in requirements on GO issuance, registration, tracking or cancellation between the country of the buyer and seller can therefore introduce additional risks and costs. For example, several Member States do not issue GOs for projects receiving state support, meaning that they will have to be bought separately on the market.

Accounting treatment

Companies are required to report on all their contracts (including PPAs) in their financial statements in line with the International Financial Reporting Standards (IFRS). The value of PPAs is tied to variable renewable energy production, which creates specific accounting challenges.

Virtual PPAs[iv] (VPPAs) offer several advantages for industries with baseload demand in comparison to physical ones, notably since they avoid the issues discussed above with regards to shaping and firming. However, their uptake in the EU is limited in part due to the consequences of their classification as derivatives under IFRS 9.

Classification as a derivative implies the VPPA must be reported in the company's financial statement at its **'fair value'**. Fair value represents the current worth of the VPPA, considering factors like future electricity prices and the terms of the contract. This value must be continually assessed and determined, which is made particularly challenging by the difficulty of forecasting renewable energy production and the volatility of electricity market prices. The company's income statements will then reflect this instability, for reasons outside its operational control. This can have serious consequences for financial planning, securing loans and financing, and taxes, well as impact on investor confidence and stock price.

This volatility can be reduced by applying **hedge accounting** to the VPPA. This special accounting method moves the fair value changes to a separate financial section (rather than the income statement) until the actual purchase of energy occurs. The International Accounting Standards Board (IASB) has recently amended IFRS 9 to better reflect the characteristics of renewable PPAs and simplify the hedge accounting requirements for VPPAs[6]. However, it remains the case that qualifying for and maintaining hedge accounting is highly complex and requires accounting teams with specialised knowledge of IFRS 9, energy markets, and financial derivatives.

Crowding out of PPAs by national renewable support schemes

Following the recent reform of the electricity market design (EMD), two-way contracts for difference (CfDs) will become the mandatory support mechanism for new renewable (and nuclear) power projects as of 17 July 2027. In a two-way CfD, the State and the producer agree on a price for the electricity generated ('strike price'). If the market price for the electricity is below the strike price, the State will pay the electricity producer the difference, and vice-versa if the market price is higher.

This mechanism encourages the development of renewable energy capacity by providing price stability to project developers, while also reducing the burden on the State budget. However, if improperly designed these schemes run the risk of crowding out the market for PPAs as developers may prefer the relative security offered by state-backed support mechanisms.

Price cannibalisation

"Cannibalisation" refers to the risk that increased penetration of renewable energy in electricity markets drives down wholesale electricity prices during periods of high renewable generation. Corporates may hesitate to sign PPAs if they expect wholesale prices to decrease in the future, as a fixed PPA price might appear less advantageous compared to buying from the market. This dynamic also relates to the discussion above regarding the expected evolution of shaping costs.

[iv] See Annex III

[1] Article 2(77), Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity
[2] GridX (September 2024), *Time of Use Tariffs Report 2024*. Available at: gridX+Time+of+Use+Report+2024.pdf
[3] See e.g.: RE-Source, Regulatory & PPA model tracker (accessed January 2025). Available at Regulatory & PPA model tracker - RE-Source Platform
[4] Baringa (March 2023), *A Market Study including an assessment of potential financial instruments to support renewable energy Commercial Power Purchase Agreements*, p. 18
[5] ACER (July 2024), *Transmission capacities for cross-zonal trade of electricity and congestion management in the EU*, p.5
[6] IFRS, Power Purchase Agreements. Available at: IFRS - Power Purchase Agreements

Innovative solutions

Innovative schemes employing PPAs have been proposed to address some of the issues described above and deliver affordable renewable energy to energy-intensive industries while accelerating the energy transition. However, changes to the current state aid framework are necessary to enable these solutions to be implemented or further deployed.

"Green Pool" proposal

The Green Pool proposal is a scheme put forward by the Greek government in July 2022, aimed at supporting the decarbonisation of electro-intensive industries by lowering the shaping and firming costs of PPAs[1].

- Energy intensive industries negotiate PPAs with renewable project developers for the required amount of new renewables capacity, either bilaterally or in a consortium.
- A central entity (the Green Pool) virtually aggregates these PPAs, which reduces the need for shaping and firming due to the diversity of projects and technologies pooled (e.g. wind and solar).
- The Green Pool is responsible for the remaining balancing. The costs involved can be partly subsidised via public funds, whether EU or national (or a combination thereof). The remainder of the costs is distributed among the consumers based on their consumption patterns, maintaining an incentive to improve their efficiency.
- Participating energy-intensive industries enter a procurement contract with the Green Pool and receive electricity in proportion to the capacity they have financed, as well as GOs.

The European Commission (DG COMP) however rejected the proposal in October 2023[2]. An official decision is not available, but the grounds for rejection seem to relate to incompatibility with State aid rules. Indeed, current EU State aid frameworks for industrial decarbonisation only address investments towards process electrification or to enable use of renewable or low-carbon hydrogen[3]. Put otherwise, support is provided for capital expenditure (CAPEX) towards physical assets addressing emissions for which the industry is directly responsible ('Scope 1'). Support for PPAs would however involve subsidising operational expenditures (OPEX) to target indirect emissions arising from the energy used by the industry ('Scope 2'). Another point underpinning the rejection appears to have been that some of the energy purchased on the spot market for shaping and firming could come from fossil sources.

A revision of the EU State Aid framework would therefore be required to enable energy-intensive industries to unlock the significant decarbonisation benefits from improved access to affordable renewable electricity via PPAs.

Energy Release Platform 2.0

The Energy Release Platform is a scheme established by the Italian government in July 2024 and operated GSE (state-owned energy service system operator), under which energy-intensive industries finance new renewables capacity in exchange for access to electricity at prices less than half those of wholesale[4].

- Eligible EIIs can apply, either individually or via an aggregator, to conclude a 'withdrawal contract' with the GSE. This contract is a CfD under which they receive a specified amount of electricity at €65/MWh for a term of 36 months, along with the corresponding GOs.
- In return, the companies undertake to finance new renewable plants (photovoltaic, wind or hydroelectric) with a minimum power of 200 kW each, with a total capacity at least double that of the energy purchased from GSE. This new capacity must be developed either through investing in a new plant or by signing a new PPA within a 40-month period after signing the agreement with GSE.

- Within the 40-month period, the participating EIIs must sign a 'return contract' in the form of another CfD. Under this agreement, they must return the same volume of electricity and corresponding GOs received under the withdrawal contract over a period of 20 years, at the same price of €65/MWh.

This initiative was approved by the Commission under the state aid provisions for accelerating rollout of renewable energy of the Temporary Crisis and Transition Framework (TCTF). The TCTF will expire at the end of 2025, so an extension of this framework would be necessary should other Member States wish to follow this example in future.

[1] Enervis (2021), *The Green Pool – A concept for decarbonizing the electro-intensive industry of Greece.*
[2] See e.g. Energypress, *Brussels rejects Greek proposal for Green Pool model*, available at Brussels rejects Greek proposal for Green Pool model | ENERGYPRESS; Euractiv, *Dismay after EU rejects "Green Pool" for industrial energy users in Greece*, available at Dismay after EU rejects 'Green Pool' for industrial energy users in Greece - Euractiv.
[3] See Section 4.1.2.2, point 88 of the Guidelines on State aid for climate, environmental protection and energy 2022 and Section 2.6. of the Temporary Crisis and Transition Framework.
[4] GSE, Energy Release 2.0. Available at Energy Release 2.0: the energy anticipation measure

Annexes

I. Legislative framework

Electricity Market Regulation[1], Article 19a

- Member States must promote uptake of PPAs, including by removing unjustified barriers and disproportionate or discriminatory procedures or charges.
- Member States must ensure availability of instruments to reduce financial risks, such as:
    - State-backed guarantee schemes at market prices. These guarantees must include provisions to avoid lowering electricity market liquidity and cannot provide support to fossil of fossil fuels.
    - Private guarantees
    - Facilities pooling demand for PPAs
- Public support schemes must allow participating project developers to voluntarily allocate a portion of their production capacity for sale through PPAs or other market-based arrangements.
- When designing support schemes for renewable energy, Member States shall endeavour to make use of evaluation criteria to incentivise bidders to facilitate the access of customers that face entry barriers to the PPA market, provided that this does not negatively affect competition in the market

II. Technological profile of the container glass industry

The production process in the container glass industry operates on a 24/7 basis during more than 12 years, with furnaces required to maintain extremely high temperatures, around 1,500°C. Precise temperature control is required to ensure consistent glass quality and durability. The uninterrupted operation of these furnaces is critical; any disruption in energy supply not only risks halting production but would also lead to costly equipment damage and reduced product quality. In the worse case scenario, a shutdown of the furnace can cause the molten glass inside to solidify and require complete dismantling of the furnace and its replacement.

Currently, for conventional fossil-fuelled furnaces, ~85% of the heat supply for a furnace comes from natural gas, with the ~15% remaining being provided by electrical boosting. However, the industry's demand for electricity is set to increase significantly as electrification has been identified as one of the promising pathways for decarbonisation, with new hybrid furnaces using up to 85 % electricity.

III. Typology of PPAs

For a detailed overview of PPA models see: RE-Source (January 2020), *Introduction to Corporate Sourcing of Renewable Electricity in Europe*. Available at: RE-Source-introduction-to-corporate-sourcing.pdf

Main categories

- **Physical PPAs**: the producer physically delivers the electricity covered by the agreement to the buyer in exchange for payment of the agreed price. The production facility can be situated either on the same site as the consumer ('on-site PPA') or somewhere else but connected via a private wire or the public grid ('off-site PPA')
- **Virtual (or financial) PPAs**: The producer and the buyer enter a contract for difference (CfD) whereby they agree on a pre-determined price ('strike price') for the electricity, and a reference price

based on the spot market. The producer and the buyer then respectively sell and buy electricity on the spot market, without any physical transfer of electricity occurring. If the price at which the electricity is sold is higher than the strike price, the producer pays the difference to the buyer, and vice vice-versa if the price falls below. The producer also transfers guarantees of origin (GOs) corresponding to the electricity purchased to demonstrate its renewable credentials.

Many different modalities are possible within these two categories.

Common billing models

- **As-produced:** the buyer receives all or part of the renewable generators' actual production. The amount received can vary significantly depending on weather conditions. This is the most common model on the European market.
- **As-consumed:** the buyer only takes delivery for a volume corresponding to their actual consumption. The producer assumes the risk relating to any discrepancy in volume, which increases the cost. This product is therefore uncommon on the EU market.
- **As-forecasted:** the buyer purchases electricity from a renewable energy generator based on their day-ahead or intra-day forecasted output, rather than actual production. This provides greater budget predictability for buyers, who can plan shaping operations arising from the PPA as well as the volumes necessary from their supplier. As this model places the imbalance risk on the generator, it is mostly found in countries with mature renewable energy markets where producers are more likely to have advanced forecasting tools.
- **Baseload PPA:** the PPA is structured to deliver a fixed amount of electricity, independent of production level. The producer takes on the risk arising from the variability of renewables, increasing the cost. This product is therefore rare on the EU market

Innovative models

- **Multi-seller PPA**: an independent aggregator combines multiple renewable assets into one portfolio and contracts the supply for an energy-intensive buyer. This setup is advantageous where an industrial offtaker cannot meet its energy demand from one producer and can help ensure supply is adequate for the demand, removing the need to sign multiple PPAs and reducing balancing costs. The buyer must however cover the aggregator's fee.
- **Multi-technology PPA:** several renewable energy technologies – such as wind, solar, biomass, hydropower, geothermal, storage or any combination thereof – are brought together under one PPA. In principle, the different production profiles of each technology can then compensate each other to deliver less variable supply to the buyer. In practice however, the variability of the renewables
- **Multi-buyer PPA:** multiple companies pool their energy demand to purchase renewable energy through a shared contract. By increasing the number of counterparties, the producer diversifies their offtaker risk and can cover a larger portion of their production through a single contract. This model however involves higher complexity and longer negotiation times.

IV. Existing guarantee schemes

- **France** – In October 2023, a guarantee fund managed by Bpifrance was set up to facilitate the establishment of Power Purchase agreements (PPAs) between industry and developers of new or repowered solar and wind installations. The mechanism was expanded in September 2024 to cover PPAs with a volume of at least 5 GWh (down from the initial 10 GWh) and will now also cover multi-buyer PPAs[2].

- **Spain –** in June 2020, Spain set up a counterparty risk guarantee fund for renewable energy project developers to cover risk of default of electricity-intensive PPA buyers, financed by the Reserve Fund for Electro-intensive Guarantees and managed by CESCE (Spanish export credit insurance company)[3]. Two types of coverage are provided under the guarantee. The first is aimed at financial entities issuing a guarantee derived from the signing of a PPA, covering up to 80% of the value of the guarantee in case of default of the industrial offtaker. The second modality covers the energy seller for the risk of non-payment by the industrial offtaker.
- **Norway** – The Norwegian Export Credit Guarantee Agency (EKSFIN) has set up a credit risk guarantee fund to support electro-intensive industrial companies to conclude PPAs. The guarantee is available to the power seller, power buyer or lender for power contracts concluded with buyers in Norway[4].

[1] Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast). EUR-Lex - 02019R0943-20240716 - EN - EUR-Lex
[2] Bpifrance, Garantie Electricité Renouvelable (GER) (page accessed in January 2025)
[3] Spain. (2020). *Real Decreto-ley 24/2020, de 26 de junio, de medidas sociales de reactivación del empleo y protección del trabajo autónomo y de competitividad del sector industrial*. Boletín Oficial del Estado, núm. 178, de 27 de junio de 2020, páginas 46348 a 46387. Retrieved from https://www.boe.es/eli/es/rdl/2020/06/26/24/con
[4] EKSFIN, Power guarantee | Get help with long-term power contracts | Eksfin (page accessed in January 2025).