



• Vol.19

# Powering the Future: Assessing the state of Power Purchase Agreements in Greece and Europe



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## Main types of PPAs

Off-taker	Form	Volume
Corporate	Physical	As produced
Utility	Sleeved	Fixed profile
Municipal	Financial	Baseload

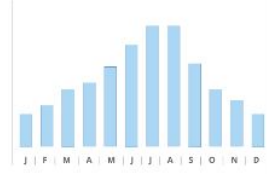
Pay-as-Produced



Annual Baseload



Monthly Baseload



### Physical PPAs:

Power Purchasing contract, associated with renewable energy. The energy is delivered physically, through the electricity grid.

### Sleeved PPAs:

The utility works as an intermediary, handling the transfer of funds and energy to and from a RES project, on behalf of the buyer.

### Financial PPAs:

Financial arrangement between seller and buyer, which enables both to hedge against price volatility. Also known as a virtual PPA, such agreements do not affect the company's energy consumption sources. Instead, they are used as a "green agenda" enabler.

### Guarantees of Origin (GOs):

Certificates of green origination of energy. The producer can either deliver the guarantees of origin to the off-taker or sell it to another party. Guarantees of Origin are presently exchangeable across national borders. The imminent development involves the transformation of GOs into a commodity.

## Benefits

### Producer – Sell side



**Financial:** The producer secures long-term revenue streams, eliminating the exposure to the market risk. Having secured revenues, the project can be financed from the banks.

### Off-taker – Buy side



**Financial:** The PPA is an effective hedging against the electricity price fluctuations. The consumer secures certain prices over the contracted duration.



**Environmental:** The off-taker receives the Guarantees of Origin, helping achieve the sustainability goals of the enterprise

## Risks



**Market price risk:** The buyer may overpay electricity and the seller may lose revenues.



**Credit risk:** the possibility that a party will not be able to pay the amounts due. Since the PPA is a revenue-related contract, this risk is usually considered primarily in terms of ability to pay the purchaser.



**Profile risk:** RES production is mostly stochastic while the consumption is most probable at the baseload level.

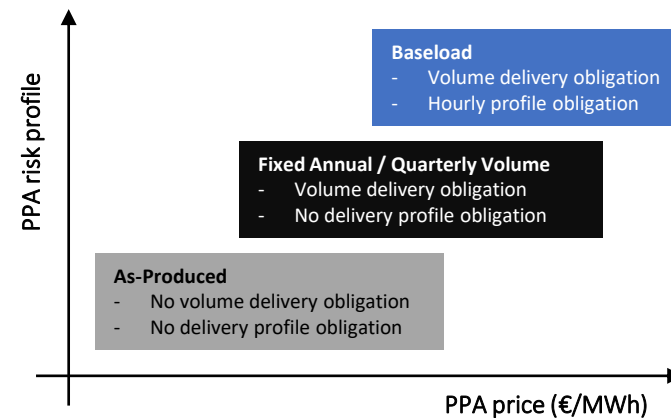


**Regulation:** Legislation changes or extraordinary measures.



**Force Majeure and Natural Disasters:** Natural disasters or other events beyond the control of the counterparties

### Risk-Price Profile of different PPA structures



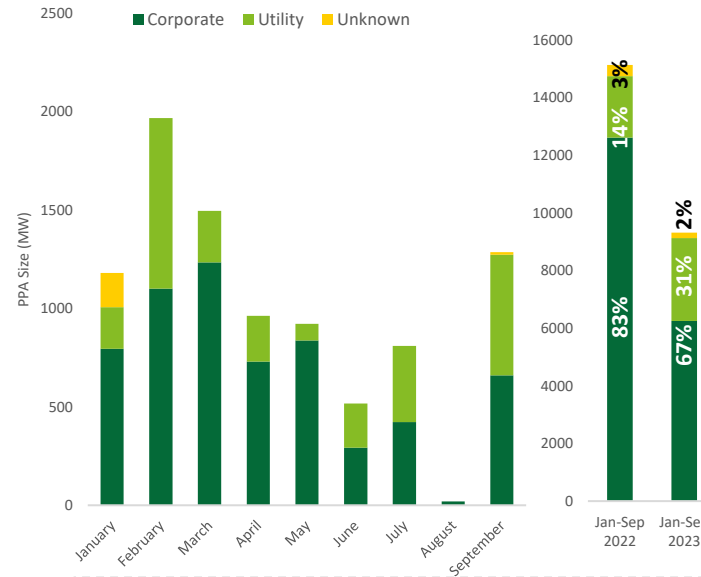
# Power Purchase Agreements

**Feb-2021: 1<sup>st</sup> PPA in Greece**  
**Corporate PPA – 200 MW**  
**One of the largest deals in Europe.**

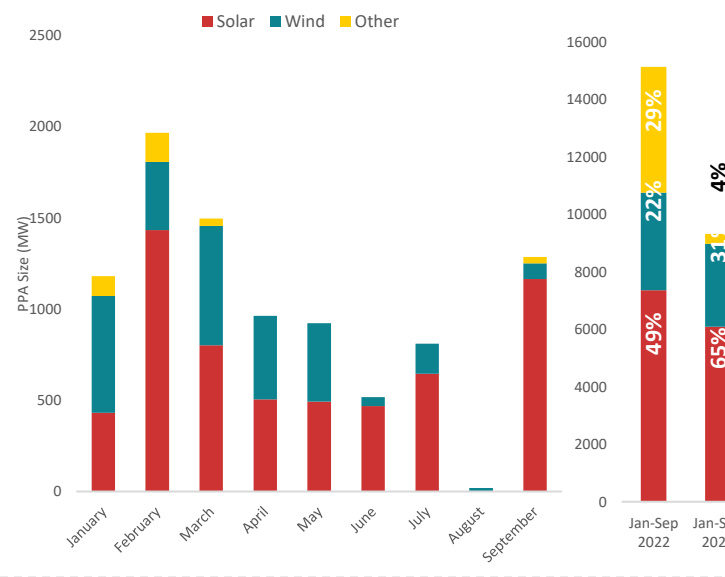


**With ~45% annual electricity generation from RES, Greece transitions to a land of opportunity for PPAs**

**Monthly PPA size (MW), in Europe per off-taker type in 2023 (as of September 2023) and comparison between Jan-Sep of 2022 and 2023**



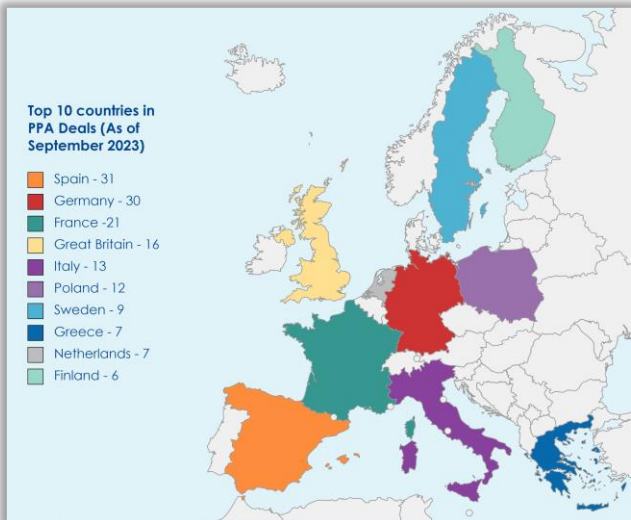
**Monthly PPA size (MW) in Europe per technology in 2023 (as of September 2023) and comparison between Jan-Sep of 2022 and 2023**



**Average PPA Price (€/MWh)**

Date	Europe
H1 2019	39.43
H2 2019	40.48 ↑
H1 2020	36.59 ↓
H2 2020	37.72 ↑
H1 2021	42.39 ↑
H2 2021	54.58 ↑
H1 2022	81.42 ↑↑
H2 2022	98.59 ↑
H1 2023	62.64 ↓↓
H2 2023	55.42 ↓

*\*all values presented here refer to the disclosed deals. There is a growing interest for PPAs as the models shift away from the Feed-in-Tariffs and the developers seek PPA. Numerous not publicly disclosed PPAs have been concluded both in Greece and abroad in 2023.*

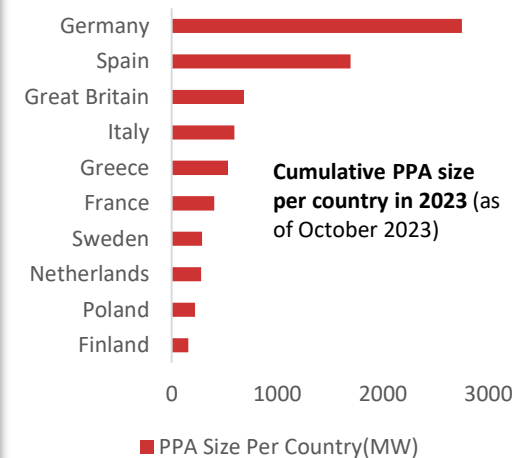


## Top 5 PPA Deals in Greece in MW

- (2023) – Solar 280 MW – Utility
- (2021) – Solar 200 MW – Corporate
- (2023) – Solar 175 MW – Offtaker Undisclosed
- (2023) – Solar 78 MW – Corporate
- (2022) – Solar 70 MW - Utility

## Top 5 PPA Deals in Europe in MW

- (Germany 2023) – Solar 600 MW – Utility
- (Germany 2023) – Offshore Wind 583 MW – Corporate
- (Spain 2023) – Solar 494 MW – Utility
- (Spain 2023) – Solar 469 MW – Corporate
- (Germany) – Solar 323 MW - Corporate



## Hybrid PPA Options

### Option I: Renewable PPA & Storage Capacity agreement (CSA)/ Optimization agreement

- Two separate contracts:
  - One for the generation asset
  - One for the storage asset
- Easily identifiable value from each asset
- Straightforward and manageable financing

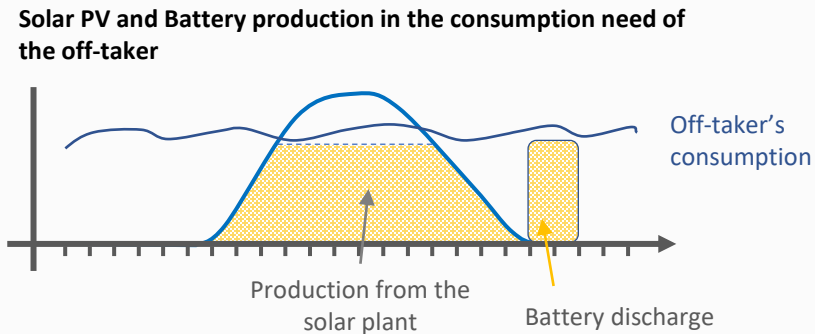
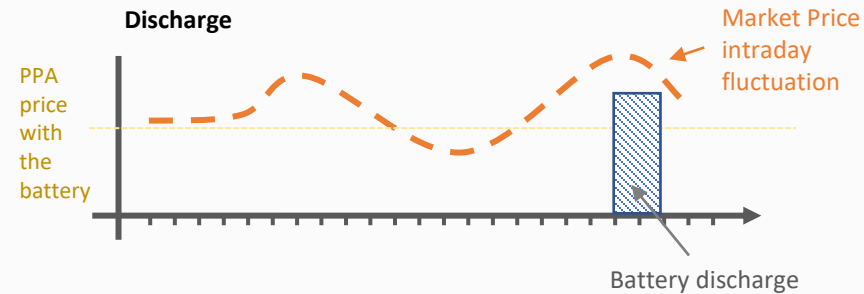
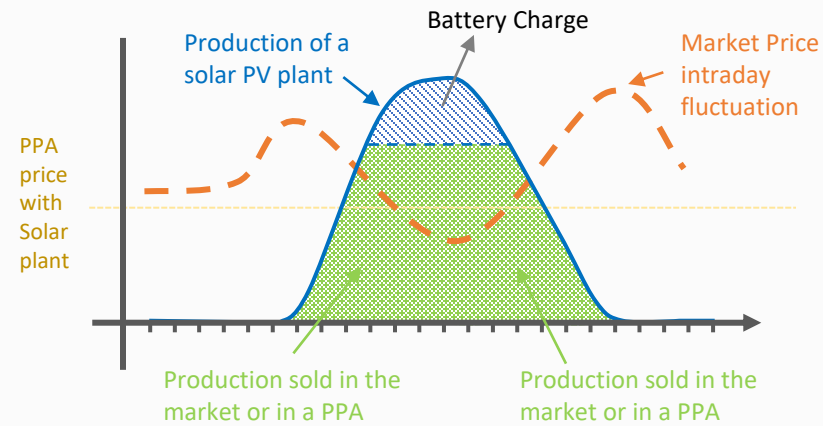
### Option II: Hybrid PPA with Aggregators

- The aggregator manages electricity from various renewables energy sources
- The off-taker can benefit from a hybrid – PPA, optimizing the matching between the production from RES with the profile of consumption.

### Option III: Combination of RES to produce Green hydrogen Cost-optimization agreement for the green hydrogen producers

- Hedging against the market prices, securing electricity for the green hydrogen production through electrolyzers

### Indicative function of a hybrid PPA – Solar PV and Battery

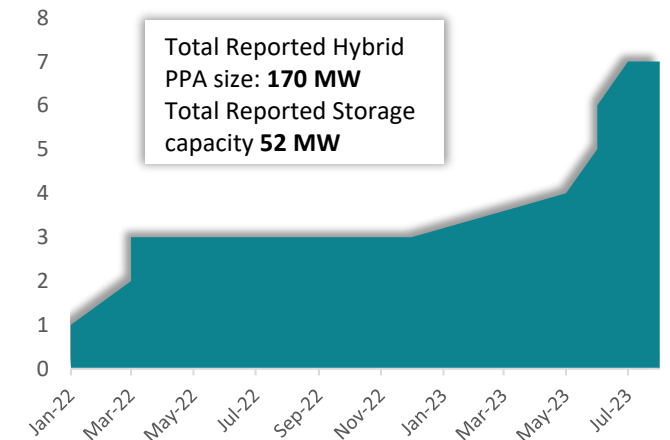


Battery is charged at lower prices and releases the load at a certain price when the solar production is lower, and prices are higher.



- The Off-Taker **takes additional benefit** from the discharge of the battery **during the pricier hours**.
- The battery owner **benefits from the arbitrage**, having purchased the power in lower prices and releasing it in higher

### Cumulative Number of Hybrid PPA deals that have been reported in the period August 2019 - August 2023



In 2023 Europe, the majority of documented PPAs were **corporate**, at **67%**, with around **30%** of PPA deals falling in the **Information & Technology** industry.

Out of all power generation technologies, **Solar is the leading technology with 65% of PPAs**

The interest for PPAs in Greece is growing significantly, with numerous deals (disclosed and non-disclosed) concluded in 2023 and many more underway.

**~90%** of PPAs signed in **Greece** in **2023** are based on Solar Power Production.

**Spain** and **Germany** continue to be the **leading players** in the 2023's **PPA** landscape.

This considered, **Spain** is the leading force in the PPA per Project ratio, with **PPAs covering almost all MW** capacity

In Europe, there has been a growing interest in Hybrid PPAs (Production & Storage)

Between **2019–2023**, the **Hybrid PPA market** evolved to a Total Reported Size of **170 MW** with **52 MW storage capacity**.



# Meet the Team

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