

A practical guide to PPAs

*Take a step into the world of the Power
Purchase Agreements*

2023



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What are PPAs?

PPAs, or “**Power Purchase Agreements**”, are contracts between a **renewable energy producer** and a **consumer**.

PPA contracts set the terms for selling renewable electricity from a producer to a consumer over a long period of time. They can last anywhere from 3 to over 25 years.

Although it can technically apply to power purchase contracts for any type of energy, a “**Power Purchase Agreement**” typically refers to buying **renewable energy**.

The rest of this document will focus exclusively on PPAs aimed at guaranteeing a supply of renewable electricity.



SOME SEMANTIC REMINDERS

Consumer: individual or entity that purchases and uses energy, commonly known as the Offtaker.

Producer: entity that operates renewable energy production infrastructures and markets this energy.

Aggregator: intermediary actor which allows market access for both consumers and producers.

Corporate PPA: PPA signed between a consumer and a producer.

Utility PPA: PPA signed between a producer and a utility provider; i.e. corporation or public entity that provides a service used by the public (water, electricity, gas, etc.).

Greenfield: refers to a PPA involving a newly developed energy asset.

Brownfield: refers to a PPA involving a pre-existing energy asset.

Physical PPA: refers to a PPA where the output of electricity produced is integrated into the consumer’s consumption.

Virtual PPA: refers to a PPA where the transaction is financial – the consumer pays the difference between a negotiated reference price and the current market price.

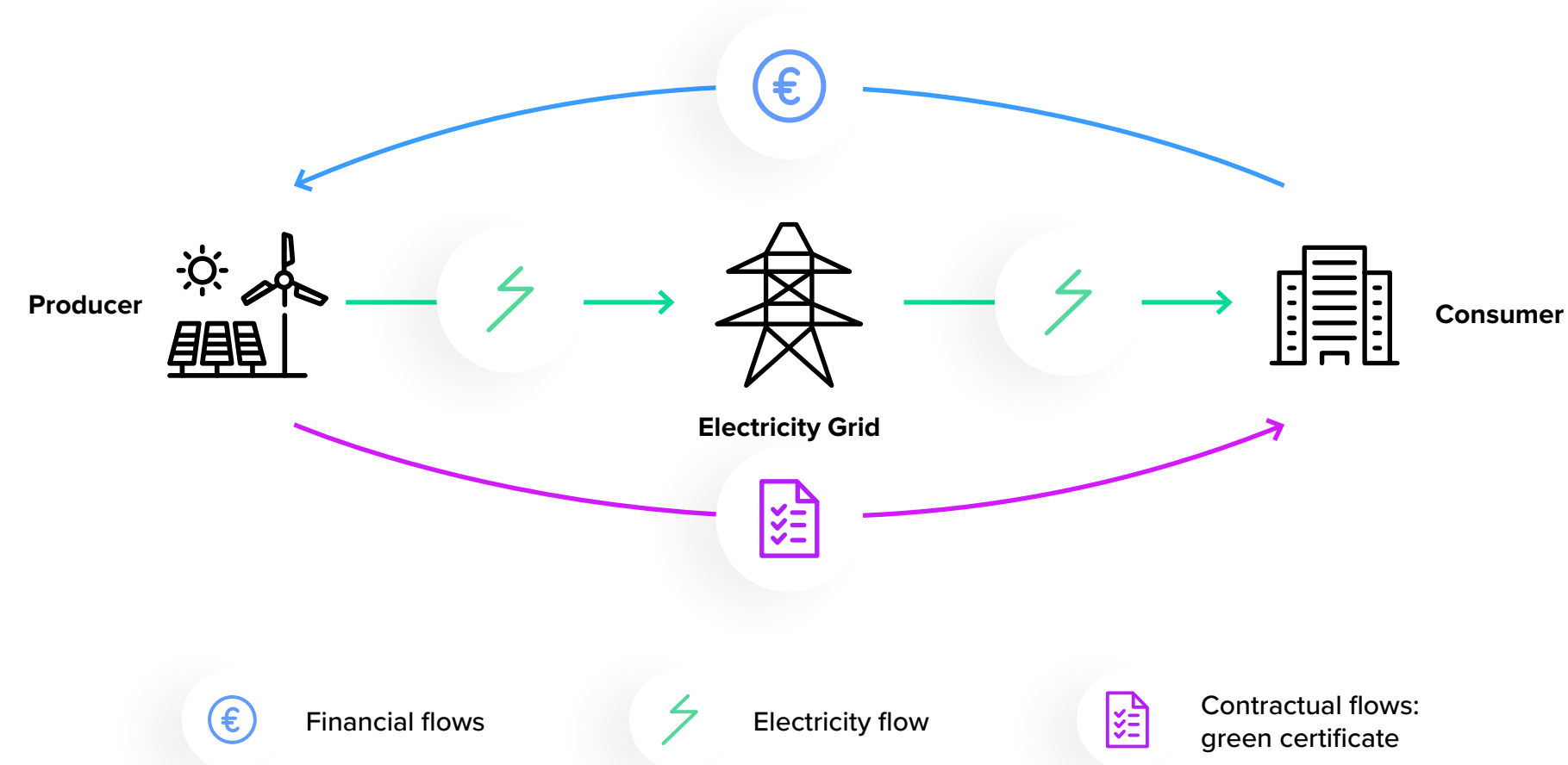
RE: acronym for Renewable Energies.

Technology: in the context of PPAs, “technology” refers to the type of asset utilized for energy production, such as wind power on land or at sea, solar, biomass, and hydraulics.

LCOE: Levelized Cost of Energy – represents the updated cost per kilowatt-hour, considering all equipment costs over its lifespan.

Green certificate: certificate which guarantees that the electricity has been produced from renewable sources. Its designation changes based on the geographical region: Guarantee Of Origin in Europe, Renewable Obligations in the UK, Renewable Energy Certificate in the United States and Canada.

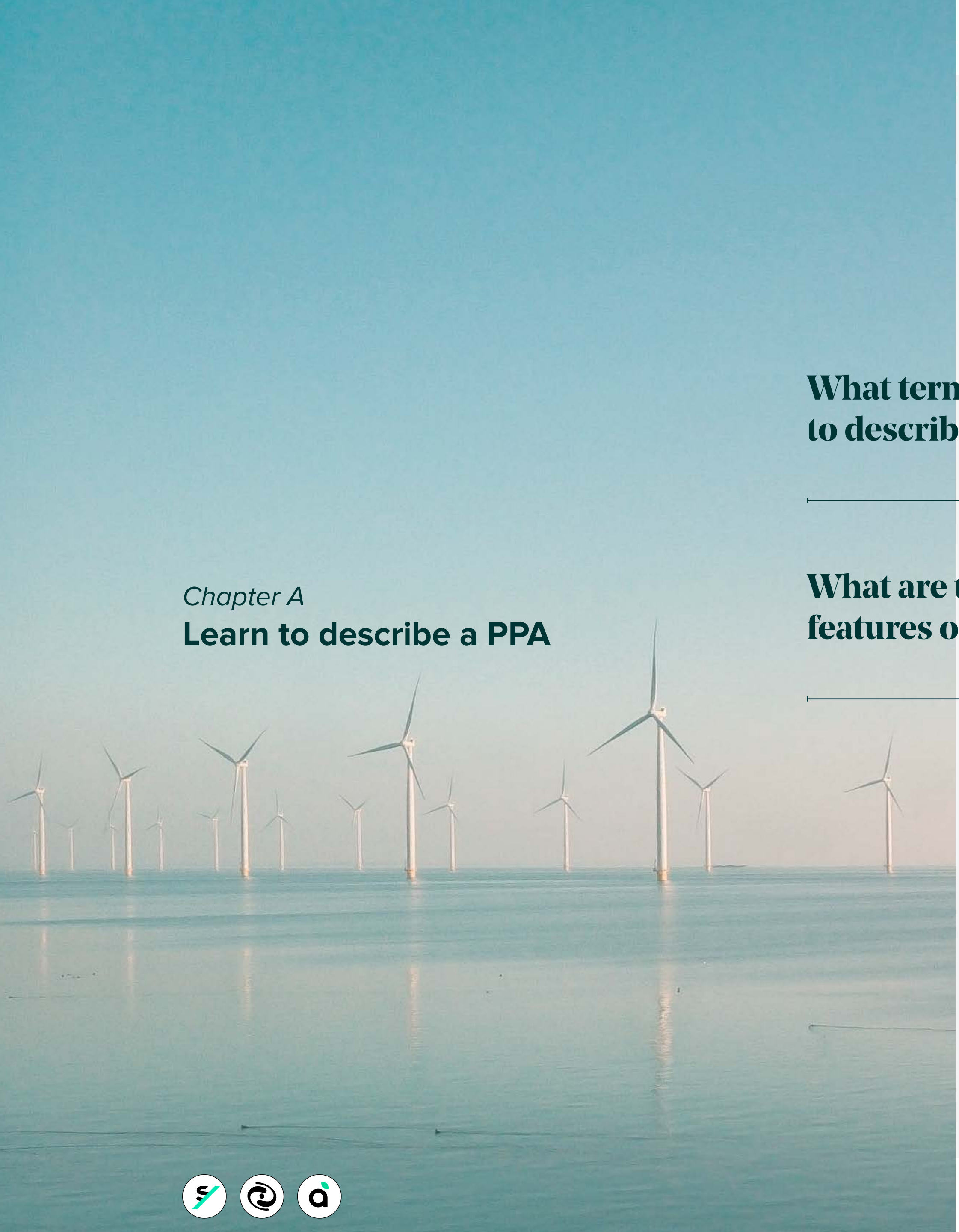
Contract for difference (CfD): a contract aimed at providing long-term revenue visibility for renewable producers. The agreement outlines a strike price; if the market price drops below, the producer is compensated by the counterparty for the difference, and the CfD counterparty receives the surplus when the market price exceeds the strike price.



Part 1

Demystifying the World of PPAs





Chapter A
Learn to describe a PPA

What terminology is used to describe a PPA?

→ PPA Framework

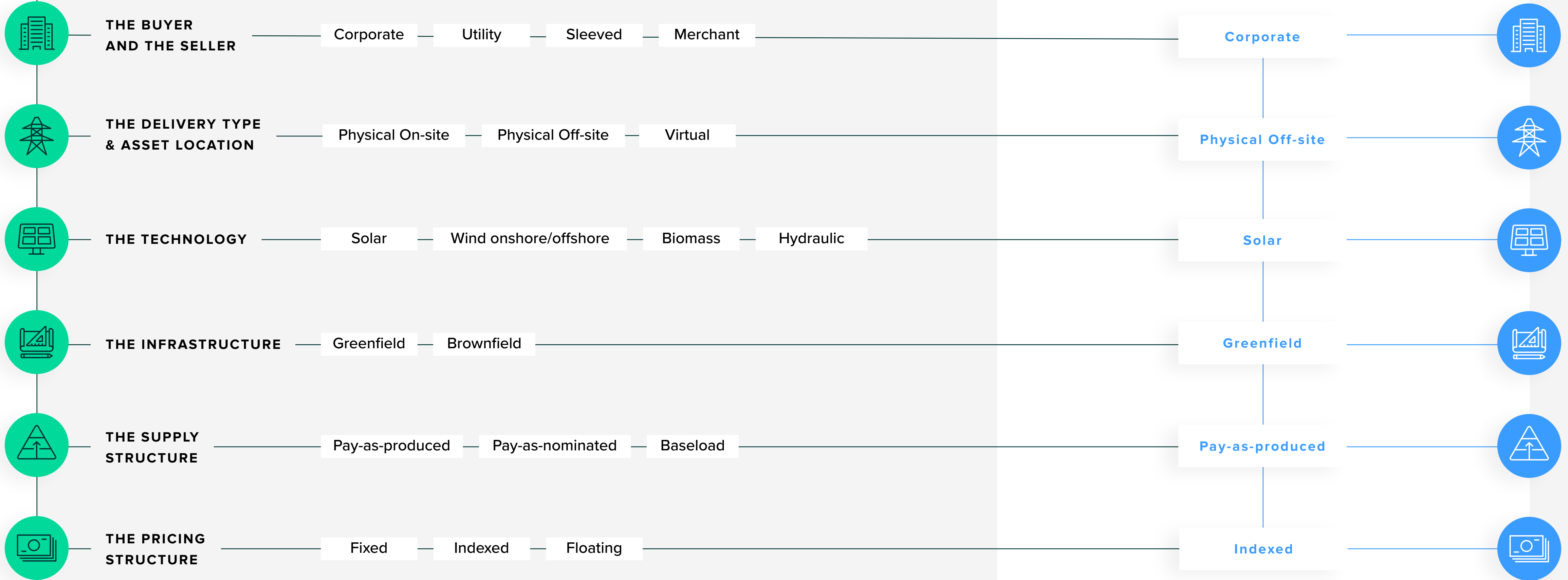
What are the distinctive features of a PPA?

→ The Buyer and the Seller
The Delivery Type and Asset Location
The Technology
The Infrastructure
The Supply Structure
The Pricing Structure

What are the terms used to describe a PPA?

Our PPA Framework

DECATHLON USE CASE
CONSULT THE DECATHLON USE CASE PAGE 54



Various criteria contribute to the classification of a PPA

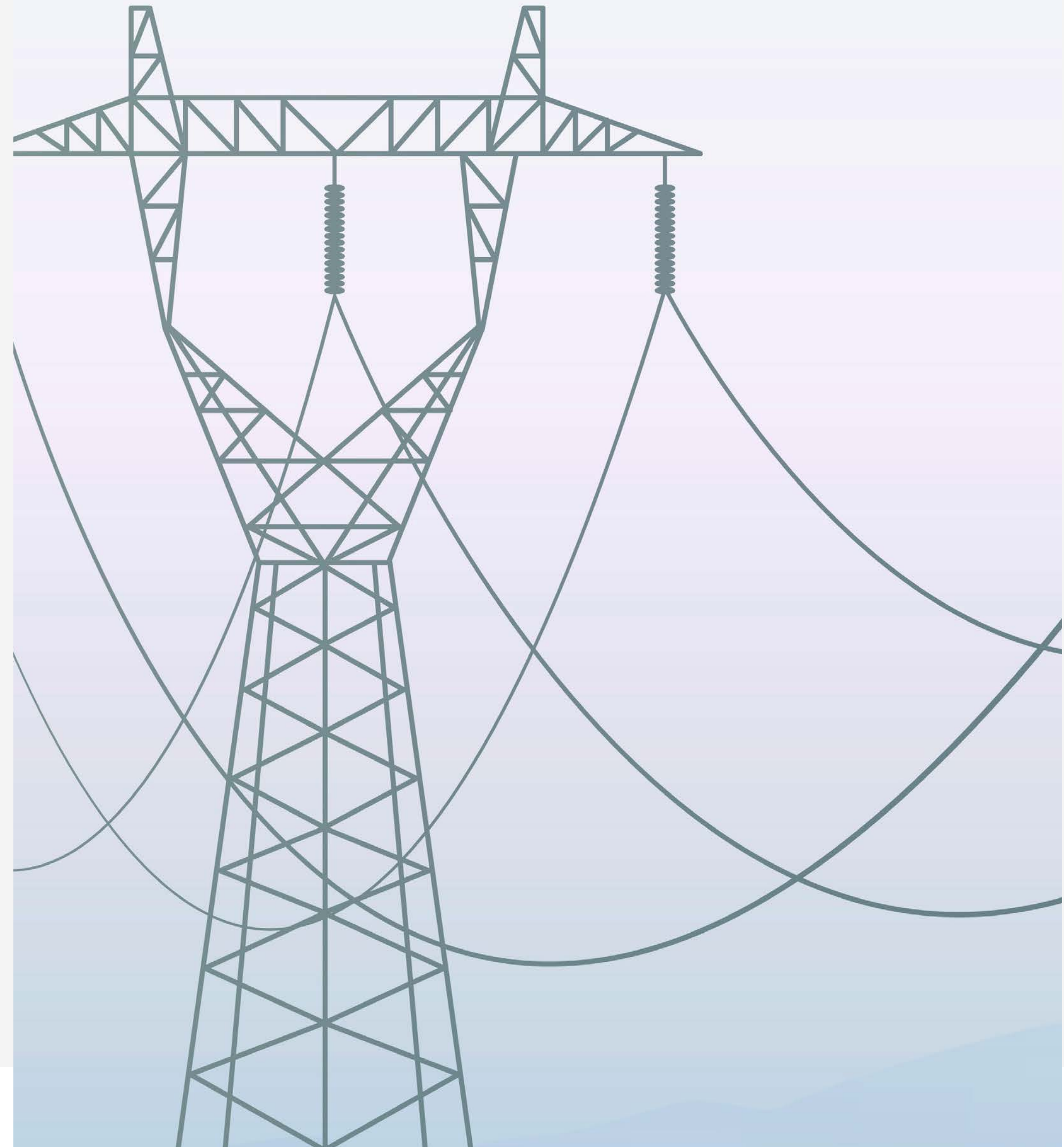
The Buyer and the Seller

Buyer side

- A **Corporate PPA (CPPA)** is an over-the-counter PPA between a producer and a company or a local government that consumes electricity.
- A **Utility PPA** is an agreement between a producer and a utility company that provides public services (water, electricity, gas, etc.).
- A **Merchant PPA** is a contract between a producer and an intermediary. In this agreement, the intermediary sells the electricity on the markets for the producer when the producer is unable to do so.

Seller side

- When the seller acts as a Supplier or an Aggregator, connecting the producer and the Consumer, it's called a **Sleeved PPA**.



The Delivery type and Asset location

Physical PPA

Physical PPA are contracts where the electricity produced is used directly by the consumer:

- **On-site PPA:** the asset is **directly connected to the consumer**. The land and/or asset may be owned either by the consumer or by a third party.
- **Off-site PPA:** the asset is **connected to the consumer via the electricity grid**, the power plant can then be located a few hundred meters from the consumer or in another country.

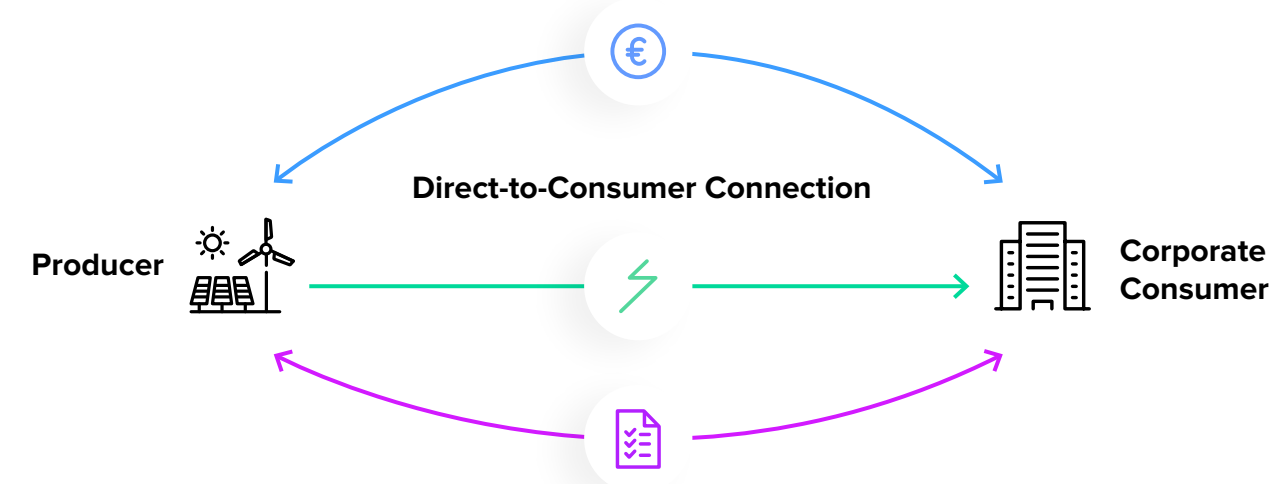
Virtual or Financial PPA

Virtual or Financial PPAs are **financial instruments** accessible via the spot market. Virtual PPAs are contracts for difference by which the consumer commits to pay the difference between a negotiated reference price and a market price. The consumer does not directly use the electricity from the producer.

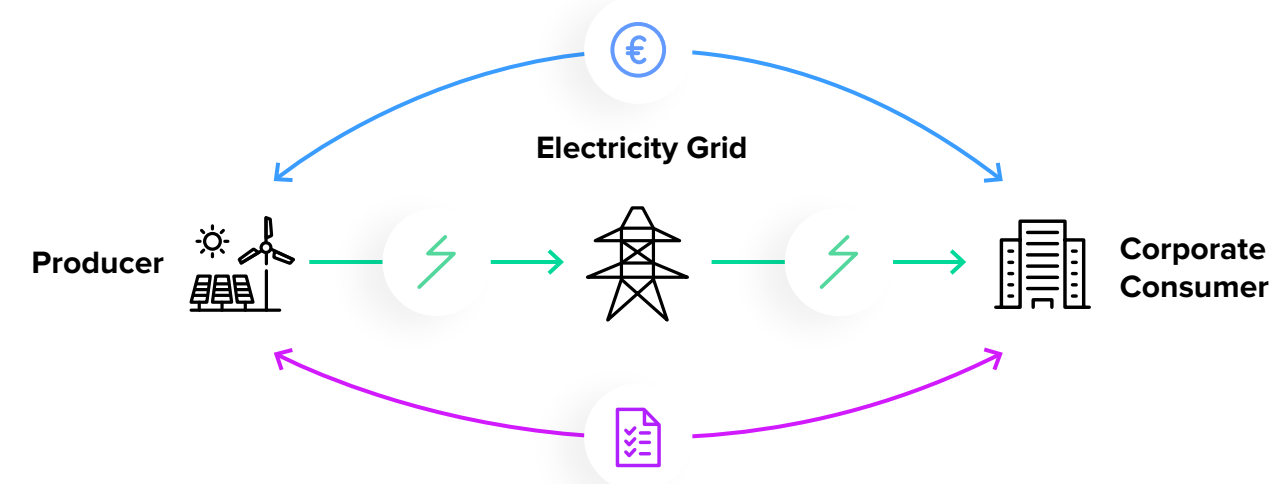
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To simplify, we have decided to only show examples of Corporate PPAs. A Utility PPA works in a similar way to the situations illustrated opposite, but a key distinction is that the customer at the end of the process is a utility provider, like an electricity supplier.

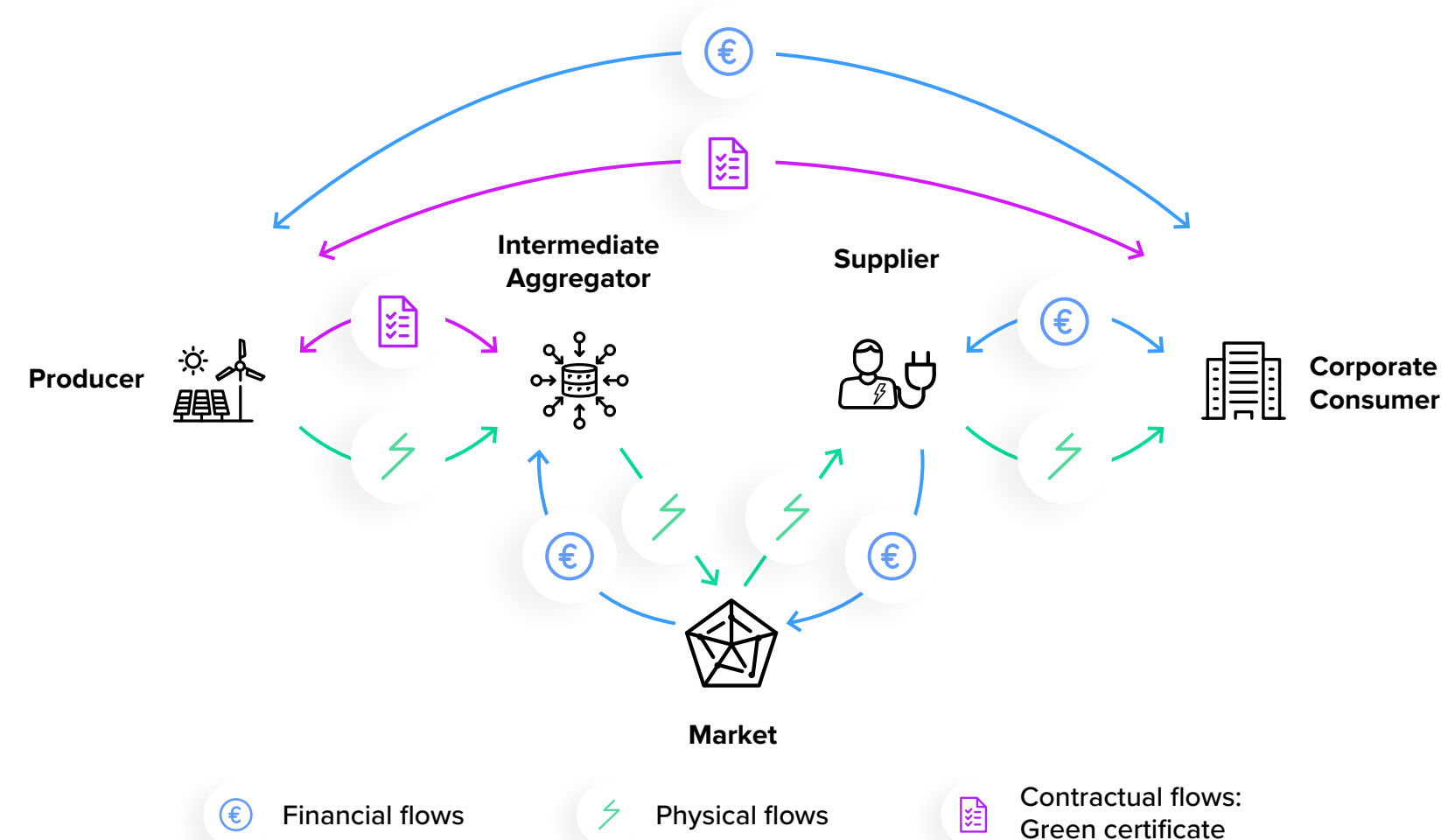
CORPORATE PHYSICAL PPA ON-SITE



CORPORATE PHYSICAL OFF-SITE PPA



CORPORATE VIRTUAL / FINANCIAL PPA



FURTHER DETAILS

Virtual PPAs safeguard the consumer and the producer against price changes in the electricity market by fixing the PPA price at an amount agreed upon by both parties.

If the PPA price is lower than the market price, the consumer commits to paying the difference; conversely, if the market price falls below that of the PPA, the producer will reimburse the difference.

The Technology

Solar

The amount of solar power generated changes with **day/night cycles** as well in **seasonal cycles**. Another key factor in solar production is location. In France, for instance, solar production costs are 50% higher in the north than in the sunnier south⁽¹⁾.

(1) "Analysis of the costs of the production system in France" Cour des comptes, 2021.

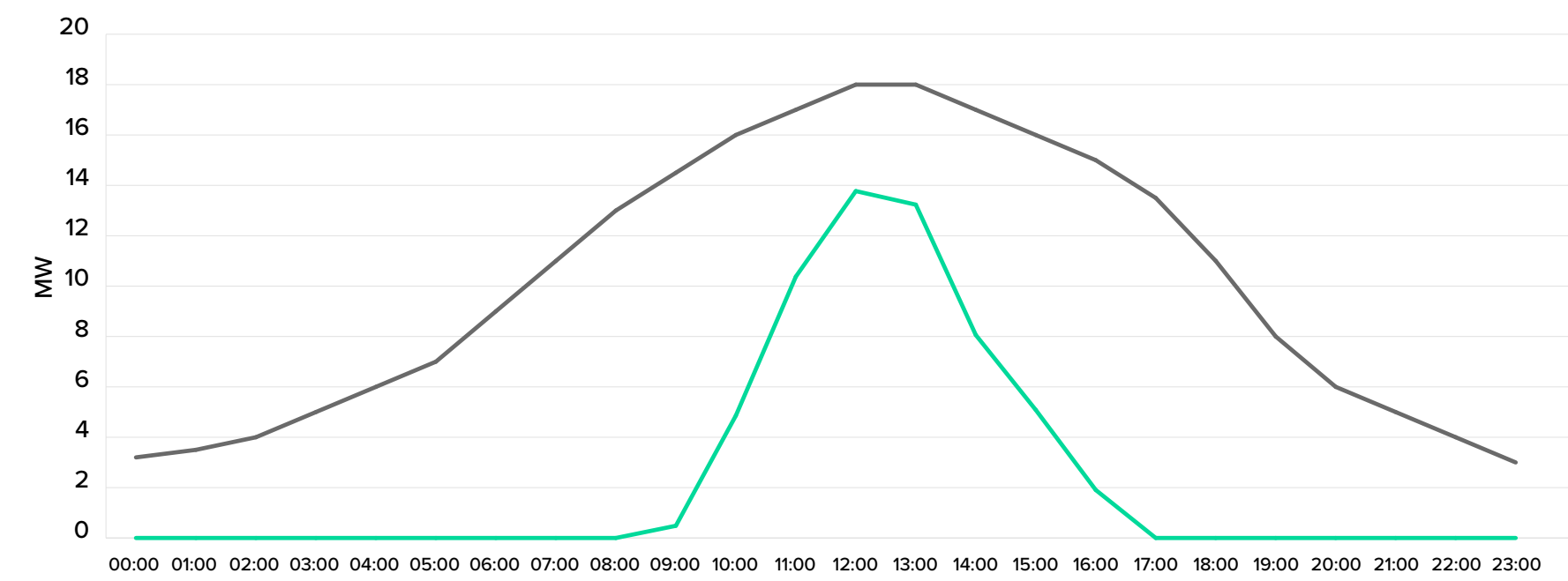
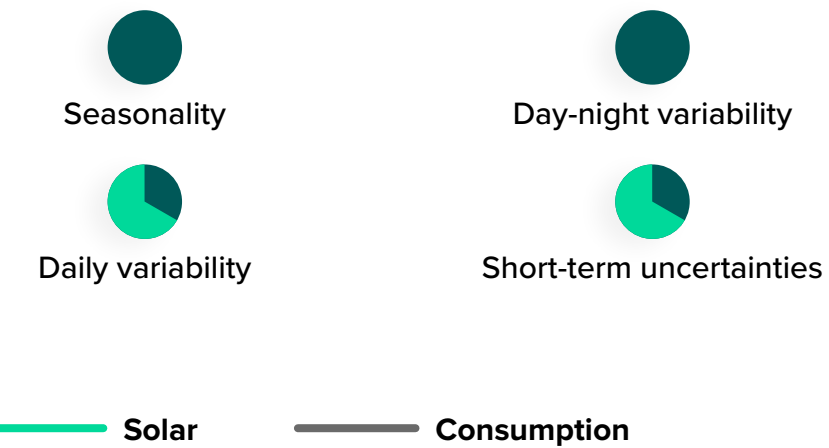
Wind

A wind turbine's output is influenced by the **turbine technology used** and **wind speed**. Generally, wind power production is higher in winter months, and there is typically more wind during the day than at night.

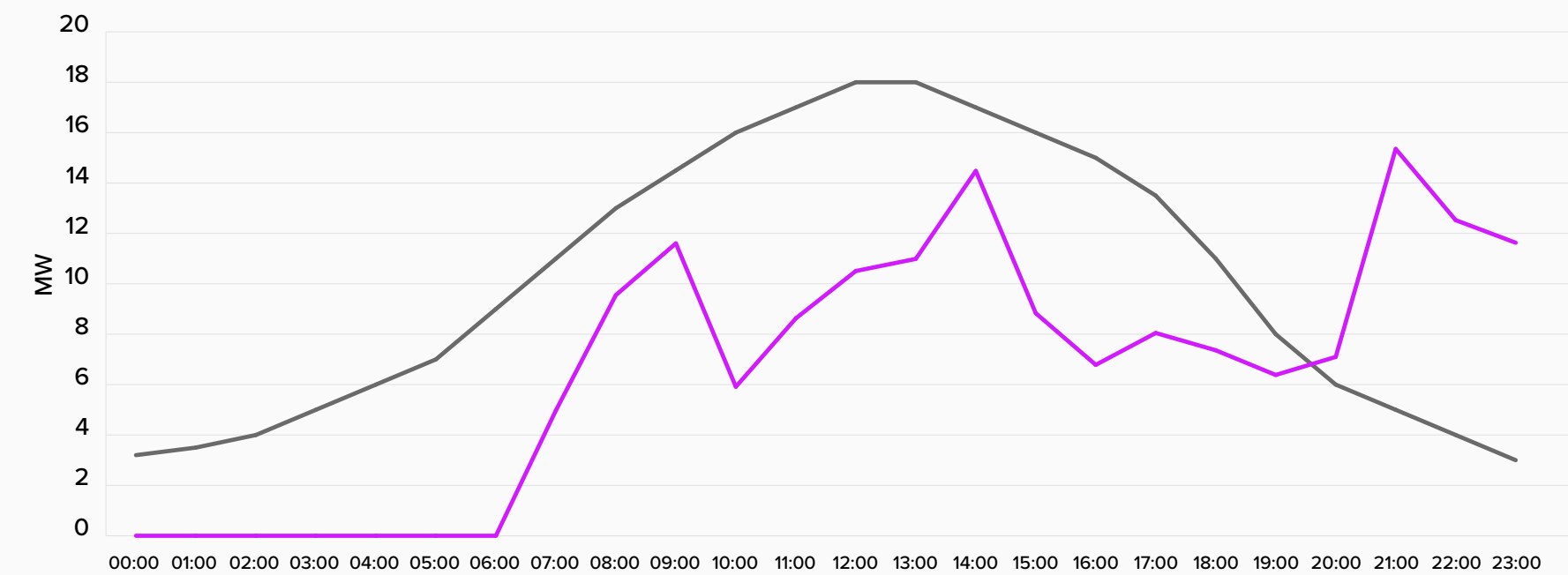
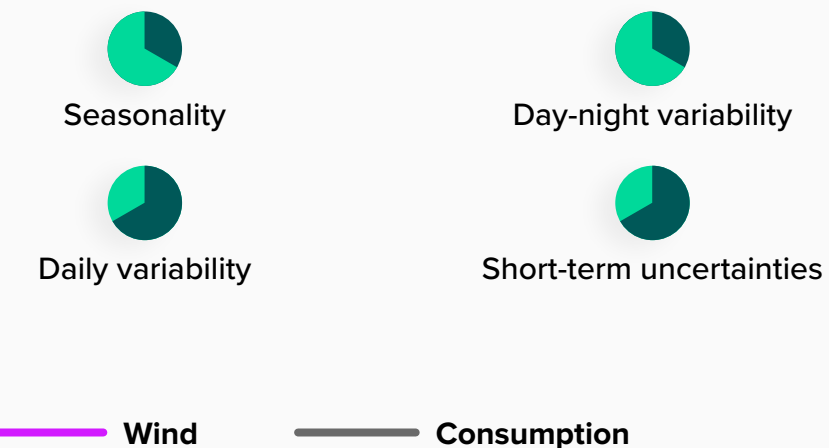
Biomass - hydroelectricity

Unlike some technologies, generating electricity from biomass or hydropower remains **stable and controllable over time**, except for specific summer assets. It is **not affected by weather conditions, seasonal changes, or the day-night cycle**.

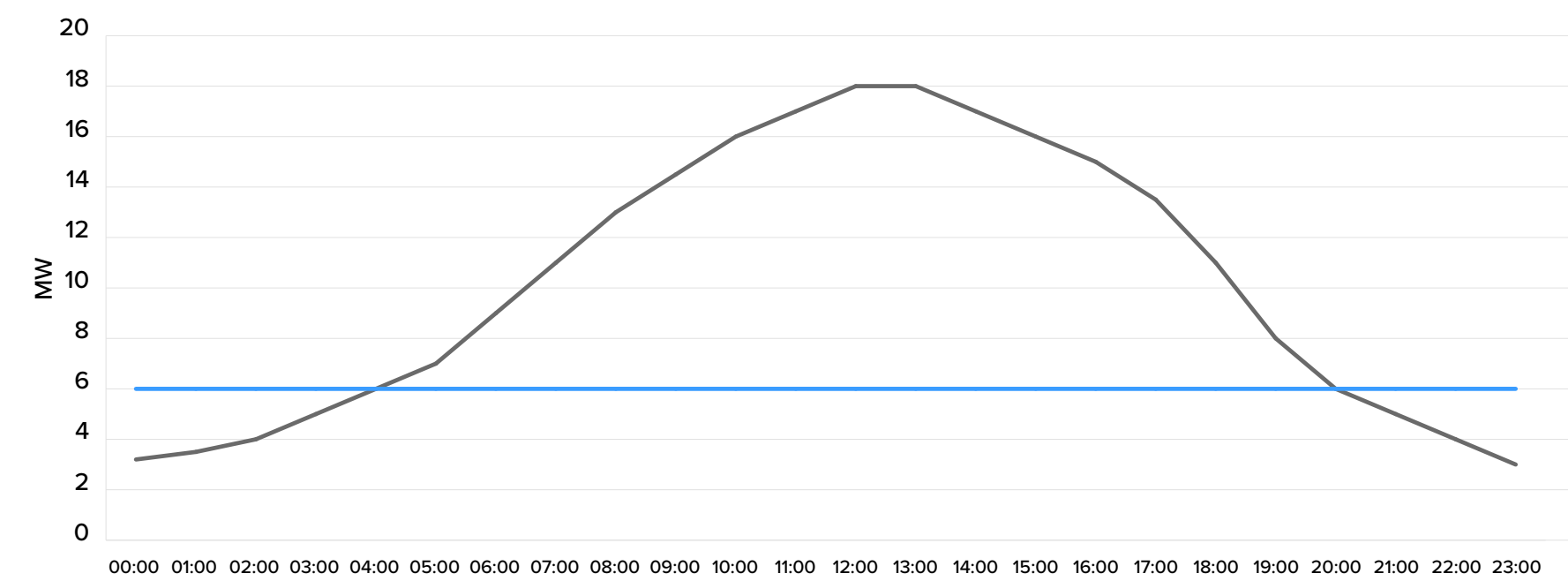
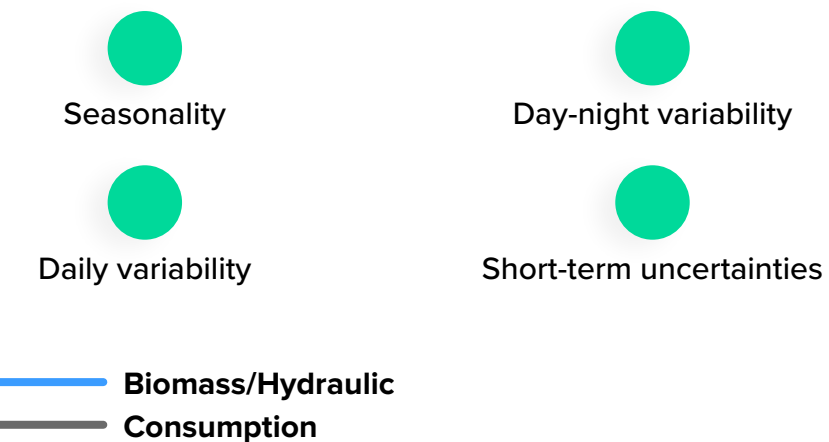
SOLAR PRODUCTION PROFILE
(over 24 hours)



WIND PRODUCTION PROFILE
(over 24 hours)



PRODUCTION PROFILE
BIOMASS/HYDRAULIC
(over 24 hours)



The Infrastructure

Greenfield

A **greenfield PPA** is an agreement that contributes to the creation of a **new renewable asset**.

For such agreements, two parties agree to engage in a PPA despite the asset being in an early development stage. Typically, a project becomes operational 2 to 5 years after development begins.

Because the PPA is a contract that legally binds the parties, it ensures a secure income over the long term. This serves as a substantial guarantee from the perspective of financial institutions, enabling them to provide loans for financing new renewable projects.

Brownfield

A **brownfield PPA** involves an **existing renewable asset** and is particularly valuable when the previous PPA attached to the asset is coming to an end.

The brownfield PPA may extend the lifespan of an existing infrastructure, a process known as repowering.

Brownfield assets are typically wind turbines nearing the end of their operational life. Given that the lifespan of a wind turbine ranges from 20 to 30 years, and that the average duration of a PPA is 18 years, a new brownfield contract can easily be placed on an existing wind farm project.

New Assets

Repowering

What is additionality?

When a PPA leads to the construction of a new asset or leads to the repowering of an existing asset, it offers **additionality**. This kind of PPA **boosts or prolongs renewable energy production on the grid**, contributing to the grid's decarbonization.

Here PPAs represent a concrete and traceable means of reducing GHG emissions. This is where the **ecological potential** of PPAs takes on its full meaning.

KEY INSIGHT

Power Purchase Agreements are a catalyst for developing new renewable energy projects. While a brownfield PPA may seem less restrictive for an end customer due to shorter commissioning times, signing a greenfield PPA is a way to actively contribute to the energy transition while getting a customized solution. Brownfield PPAs rely on aging assets and typically have shorter durations than greenfield PPAs.

The Structure of supply



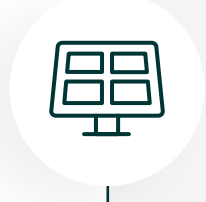
Pay-as-produced

The consumer commits to buying **all or part of the actual electricity produced** by the renewable asset. This type of contract benefits the producer because it involves almost no risk: all production will be sold at the agreed-upon price.



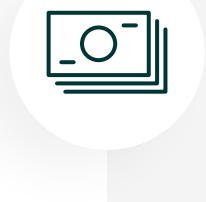
Pay-as-nominated/Pay-as-forecasted

The consumer commits to purchasing the electricity from the asset based on the hourly **production forecasts** provided by the producer on the previous day.



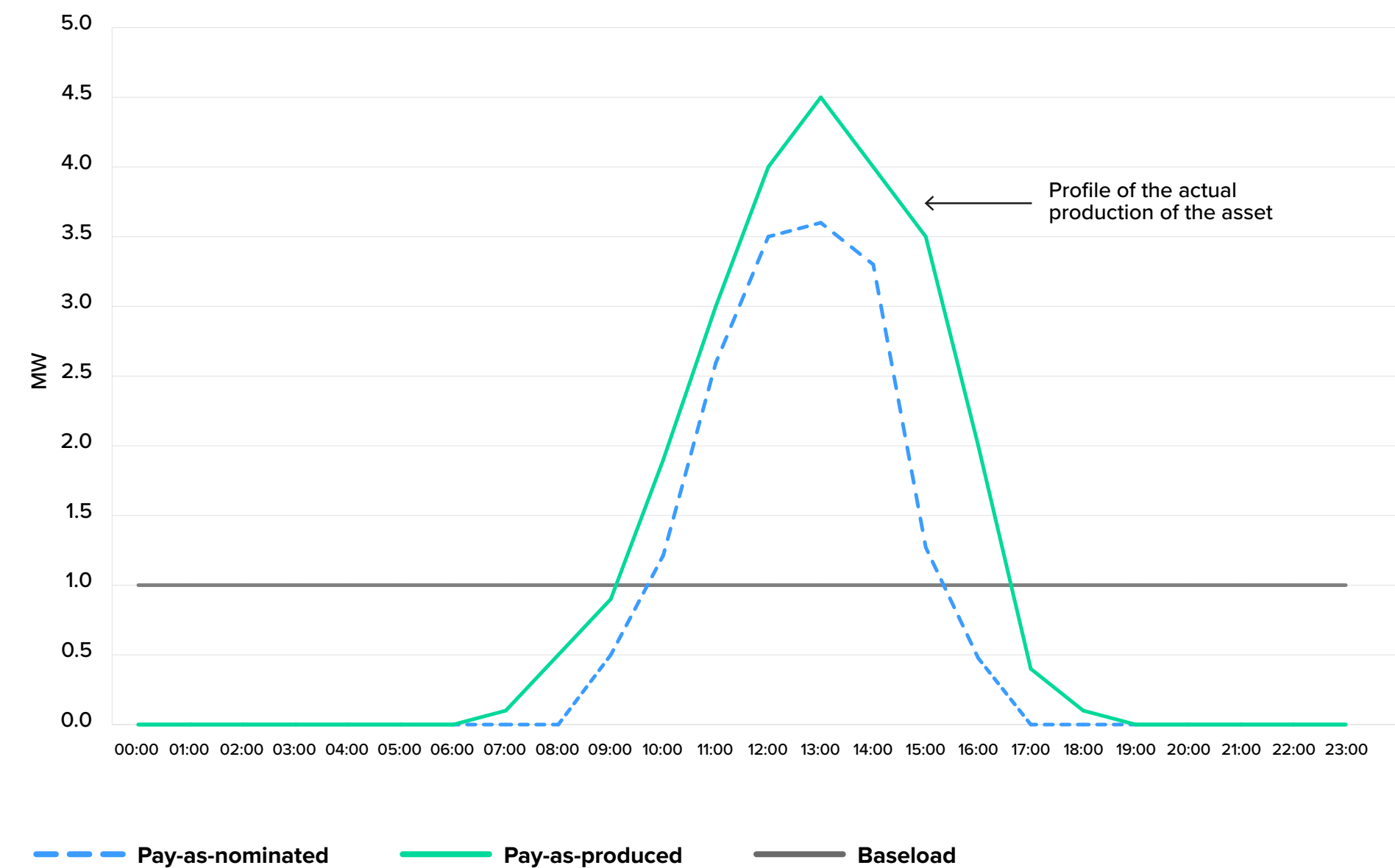
Baseload

The consumer agrees to purchase a **fixed output** defined on an hourly, monthly, quarterly or annual basis. In the case of under or over production, the producer must buy or sell the difference on the wholesale market.



In the case below, “pay-as-produced” and “pay-as-nominated” both refer to the same solar plant. The term “baseload” represents either a biomass or hydraulic plant.


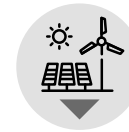
COMPARISON OF PROFILES BY SUPPLY STRUCTURE
Illustration based on a theoretical renewable production asset (24 hour window)



The Pricing structure

The formula for deciding the electricity price over the contract's duration is freely negotiated between the seller and the buyer. There are various pricing models for PPAs, but the ones described below are those most used in the market.



	 Consumer		 Producer		Comments
	Benefits	Disadvantages	Benefits	Disadvantages	
FIXED PRICE (FLAT & ESCALATED) The price and how it will evolve are predetermined at the start of the contract.	<ul style="list-style-type: none"> • Perfect long-term visibility • Total price coverage 	<ul style="list-style-type: none"> • Risk of setting the PPA price above the market 	<ul style="list-style-type: none"> • Perfect financial projection 	<ul style="list-style-type: none"> • Risk that the price does not track plant operating costs 	<i>A fixed price can be the same over time (flat) or increase gradually according to a predetermined formula (escalated).</i>
INDEXED PRICE The initial price is set and then linked to a specific index when the contract is made (inflation, energy price index, or another).	<ul style="list-style-type: none"> • Good long-term visibility • Alignment in relation to a specific indicator 	<ul style="list-style-type: none"> • Risk of having fixed an initial price above the market • Risk linked to the evolution of the index 	<ul style="list-style-type: none"> • Very good financial projection 	<ul style="list-style-type: none"> • Represent a moderate risk for the producer 	<i>The price update is determined contractually (weekly/ monthly/annually).</i>
FLOATING PRICE The price is determined by market spot conditions with an attached discount.	<ul style="list-style-type: none"> • Offers a guaranteed discount towards the market 	<ul style="list-style-type: none"> • Difficulties in contracting linked to the weak appetite for the share of producers 	<ul style="list-style-type: none"> • Few advantages, better to sell spot without discount 	<ul style="list-style-type: none"> • Absence of minimum income • Uncertain financial projection 	<i>Floating price conditions can be more acceptable for the producer if they include a floor price.</i>

KEY INSIGHT

- There is no preferred pricing structure for PPAs. Choosing a good price structure is all about assessing the benefits/risks of each model.
- The price structure is crucial for financial institutions when they assess viability of greenfield PPAs.

In the case of indexed or floating prices, **fluctuations can be controlled by lower or upper thresholds** determined during the negotiations of a PPA. This allows the consumer to be certain that their PPA will not exceed a specific price, and the seller is assured that their price will not fall below a certain threshold.

Chapter B
Understand PPA pricing

How are PPA prices determined?

→ Factors influencing PPA prices

What are the risks?

→ Risk allocation between contracting parties
Risk identification when choosing a supply structure

What factors influence the price of PPAs?

During the contracting phase, the price of a PPA is negotiated between the producer and the consumer. It is expressed in \$, £ or €/MWh. As the PPA is an over-the-counter contract, the laws of supply and demand plays a big role in the negotiation. Numerous other factors - whether associated with the nature of the asset or negotiable elements within the contract - influence the minimum price that the producer can agree to.

FURTHER DETAILS

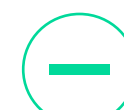
In the case of a greenfield project, the price of PPAs may be impacted by additional factors, such as the availability of feedstock, protection of fauna and flora, terrain type, soil quality or the distance from a viable connection to the electricity grid.

Therefore, a PPA for wind power, given its more expensive infrastructure, generally incurs higher costs than solar projects.

However, a wind project situated in a flat area with a lot of wind entails lower costs than a solar project located in an area with limited sunlight and steep terrain.

Price impact

Impact on the increase



impact on the decline

Contractual Factors

Factors related to the underlying asset

Duration of the contract	Starting date of the supply	Supply structure	Energy source	Capacity
Short-term contract	Date of supply close to signing	Baseload	Biomass	Low output
				Large output
Long-term contract	Date of supply far from the signing	Pay as nominated	Wind	
		Pay as produced	Solar	



Sharing risks between co-contractors

A PPA entails shared risks between two stakeholders, namely the producer and the consumer. Depending on the type of contract, the risks will be distributed differently between both, thereby impacting the overall price.

KEY INSIGHT

To address all the risks associated with a PPA, various kinds of contracts with different terms and conditions are needed. These contracts need to consider the details of how electricity is used, produced, and the technologies involved.

It is crucial to carefully study each risk during the contract design and negotiation to lessen the impacts and make sure the contract is viable.



VOLUME RISK

Volume risk is the **uncertainty related to how much electricity the asset produces each year**. If there are significant drops in production, it can expose the consumer to the market, causing the consumer to lose income and the producer to face potential penalties.



PROFILE RISK

Profile risk is the **uncertainty about when and how electricity is used or produced daily**. Changes in how electricity is produced can lead to losses for the consumer, who might need to buy electricity from the markets temporarily, or for the producer, who has to make up for deficits to meet the consumer's needs.



PRICE RISK

Price risk refers to **shortfalls for both parties in relation to market opportunities**.











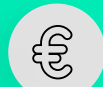






COUNTERPARTY RISK

Counterparty risk relates to the **creditworthiness of the consumer and the risk of default payment obligations**. Unlike other risks, this one is somewhat separate from how the supply is arranged. It is also crucial in securing financing for a greenfield project.

Identify risks when choosing your supply structure

Risk distribution

Impact on the price

	 Risk carried by the consumer	 Risk carried by the producer		
Pay-as-produced	  		<ul style="list-style-type: none"> In this setup, both parties share the volume risk (whether there is too much or too little production) because no specific amount has been agreed upon in advance. The consumer carries the price and profile risks, while the producer is not obligated to have a set output or a specific production profile. 	<p><i>In this setup, the producer only commits to fulfilling their responsibilities as an operator, putting most of the risk on the consumer. This structure allows for the cheapest PPAs. This type of PPA is the most standard and the most liquid option on the market⁽¹⁾.</i></p>
Pay-as-nominated / Pay-as-forecasted	  		<ul style="list-style-type: none"> For volume and price risks, it is the same as in a pay-as-produced supply structure. However, the producer takes on the risk of variability and differences between the production forecast on day 1 and the actual production. 	<p><i>The risk carried by the producer is slightly more costly: +3% to +5% compared to the pay-as-produced supply structure⁽¹⁾.</i></p>
Baseload	  	 	<ul style="list-style-type: none"> The producer transforms the production of the asset into a “ribbon”, committing to providing the buyer with the same amount of electricity at the same price. Here, the producer takes on the entire output and profile risk in production. Price risk is equally shared between both parties. 	<p><i>The producer carries almost all the risks. The price of this PPA is noticeably costlier than the price of other supply structures.</i></p>

(1) Analysis of Sia Partners & Alterna Energie



Chapter C

Discover the actors of the PPA ecosystem

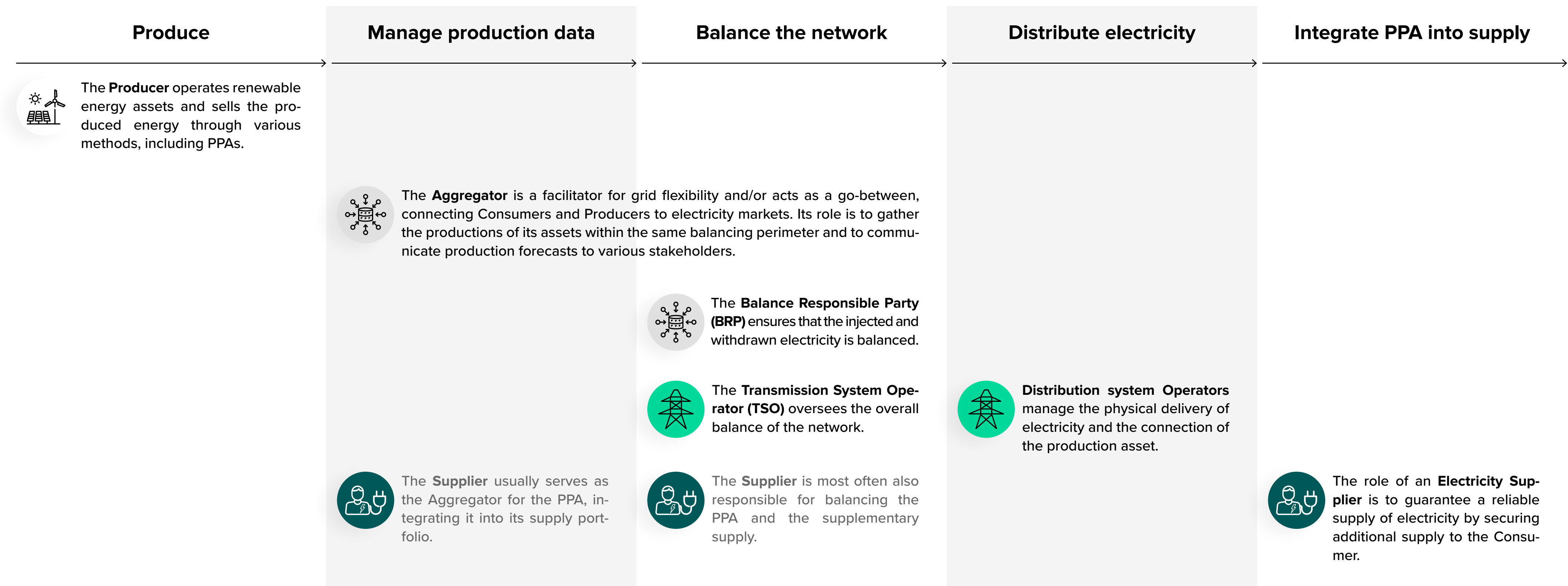
Who are the actors of the PPA ecosystem?

→ The roles of the different actors in the PPA value chain
The Producer and the Developer
Focus: The development of a project within the framework of a greenfield PPA
The Aggregator, Balance Responsible Party and Transmission System
Manager
The DSO
The Supplier
Other Actors Involved

How does a PPA work?

→ Illustration: the case of an off-site physical Corporate PPA

Mapping actors along the PPA value chain

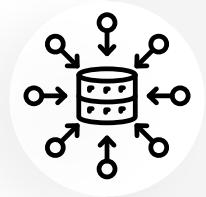


It can be a good idea to negotiate a PPA with a player that combines the roles of Producer, Aggregator, BRP, and Supplier.

The Producer and the Project Developer



The Producer operates renewable energy production facilities and can sell this energy using various methods, including PPAs.



In the early stages of the project, the Developer is responsible for **project planning and building the renewable infrastructure**. More specifically, their role involves advancing the development of a renewable asset by securing land and necessary permits and conceptualizing the production plant for construction. Usually, there is some overlap of roles between the Producer and the Project Developer.

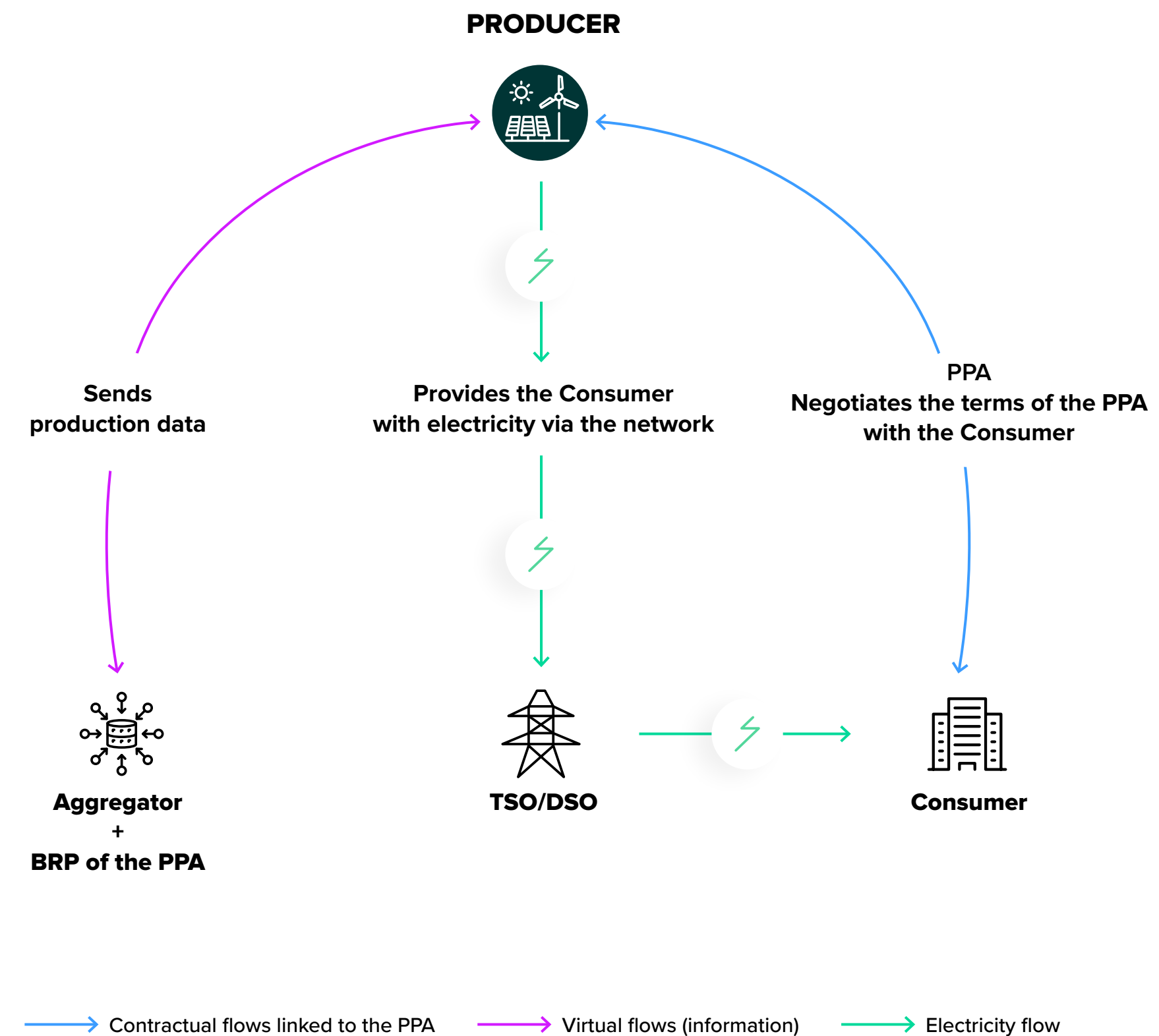


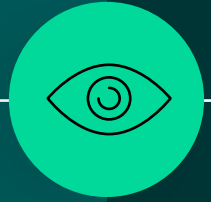
Both Producers and Developers can be either public or private entities. They can be large energy companies or smaller players, ranging from a few hundred employees to a small group of expert individuals.



“ For the Producer-Developer, signing a PPA with a Consumer is a guarantee of future income, which is essential for obtaining financing for their project.

THE ROLE OF THE PRODUCER IN THE CASE OF AN OFF-SITE PHYSICAL PPA



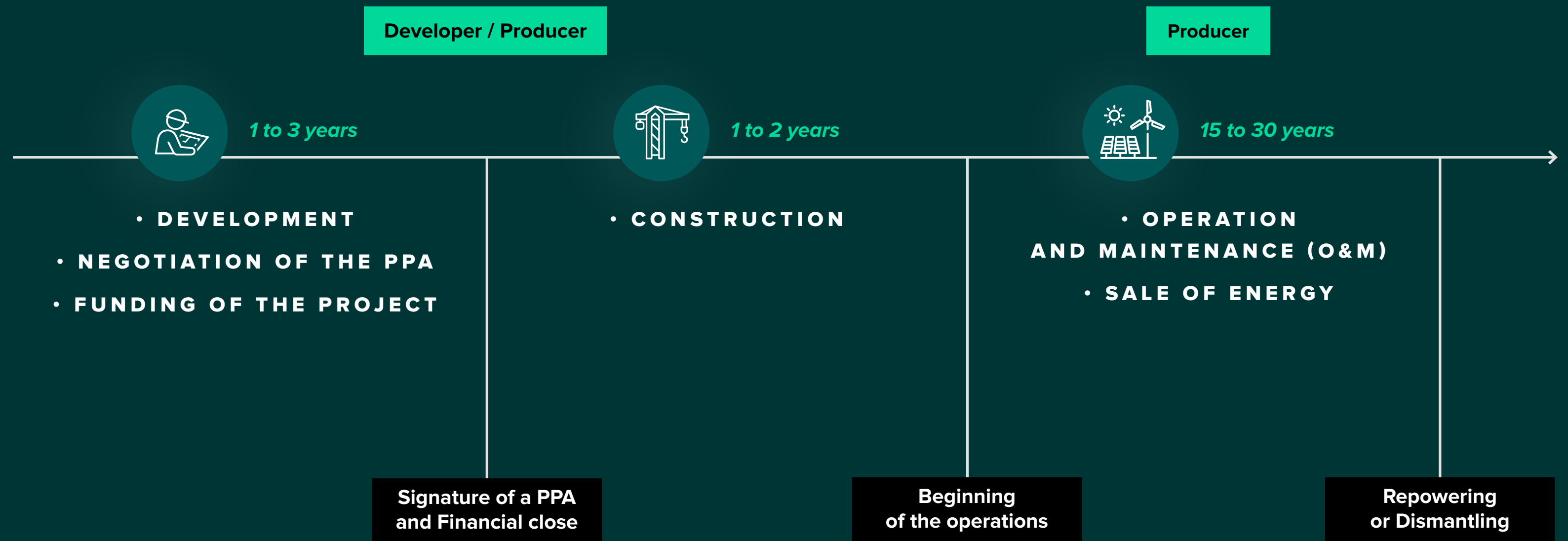


IN FOCUS

The development of a Greenfield PPA

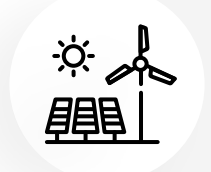
It is common practice to study PPAs for an asset that has not yet been built. In greenfield projects, business discussions between Producers and Consumers begin several years before the project is operational. Contractual negotiations for the PPA emerge naturally in this process.

DEVELOPMENT PROCESS OF A PPA PROJECT:

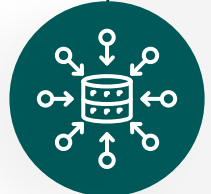


During the initial phase of a project, the Developer conceptualizes the future asset, looks for a plot of land and conducts studies to secure all necessary permits. Simultaneously, the Developer seeks a Consumer with which to sign a PPA. Identifying a Consumer is a crucial step to show the project's potential to Investors and to get funding for building the asset.

The Aggregator and the Balance Responsible Party (BRP)



An Aggregator is a **flexibility operator** and an intermediary who allows the Consumer and the Producer to access electricity markets.



In a CPPA, its role is to **bring together the production of assets within the same balance perimeter** and to communicate production forecasts to its stakeholders.

By combining different assets, the Aggregator pools production and **transforms the production curve into a baseload** (fixed output at hourly intervals) which can be more easily managed by the Supplier.



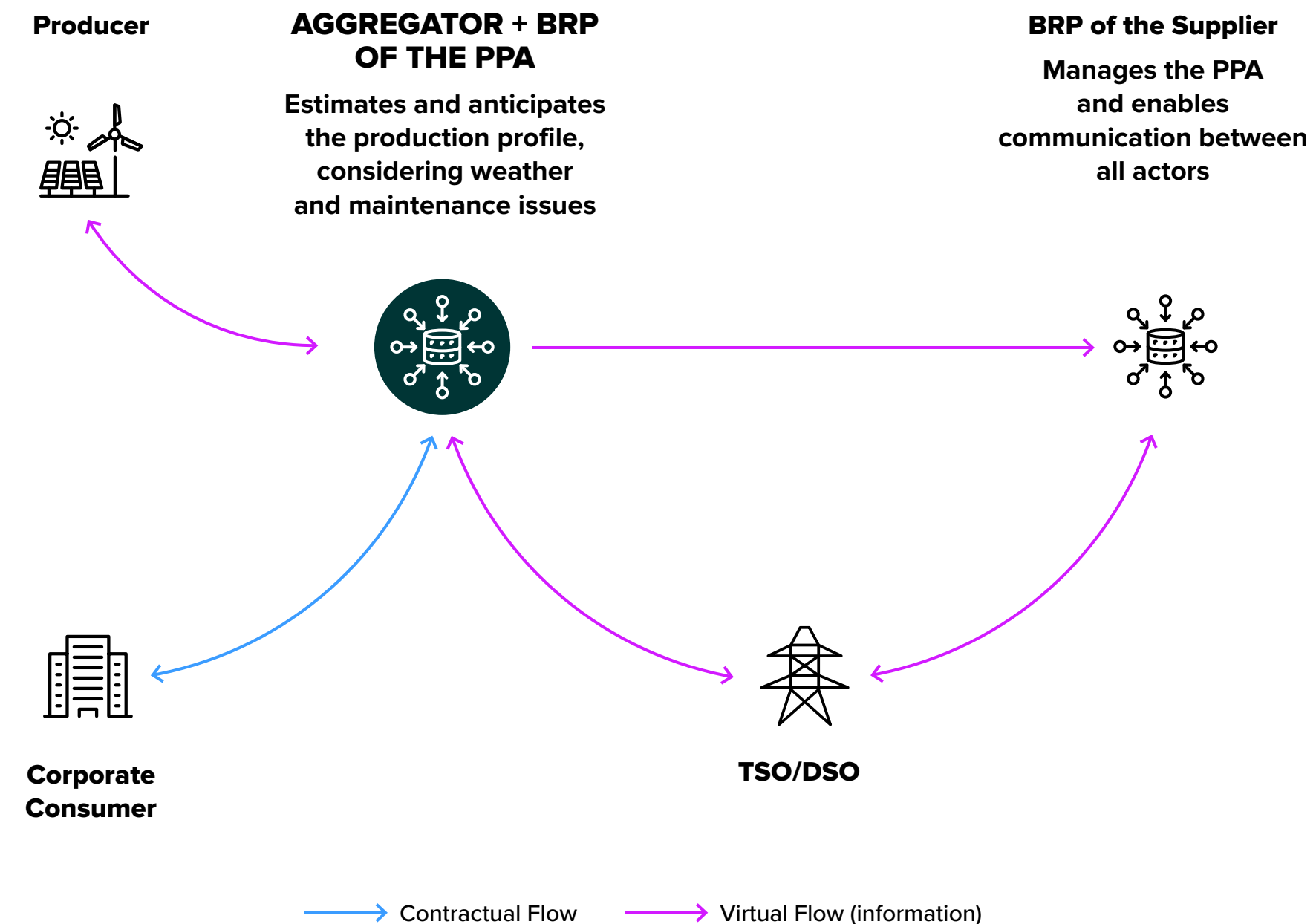
The BRP compensates for **gaps between planned and real production** and takes on all associated financial consequences.

Often an Aggregator is also a BRP, but not always. The BRP may operate independently but in some case the Supplier takes on the role. In some cases, a BRP can even act as both an Aggregator and a Supplier.



“The Aggregator needs all the right information to accurately predict production in its portfolio. They play a key role in exchanging physical and financial flows between different actors in a PPA.”

THE ROLE OF THE AGGREGATOR/BRP IN A PHYSICAL OFFSITE PPA

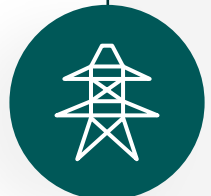
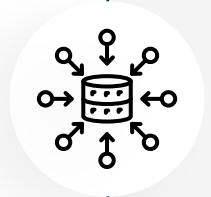
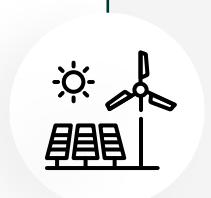


The distribution system operators (DSO)

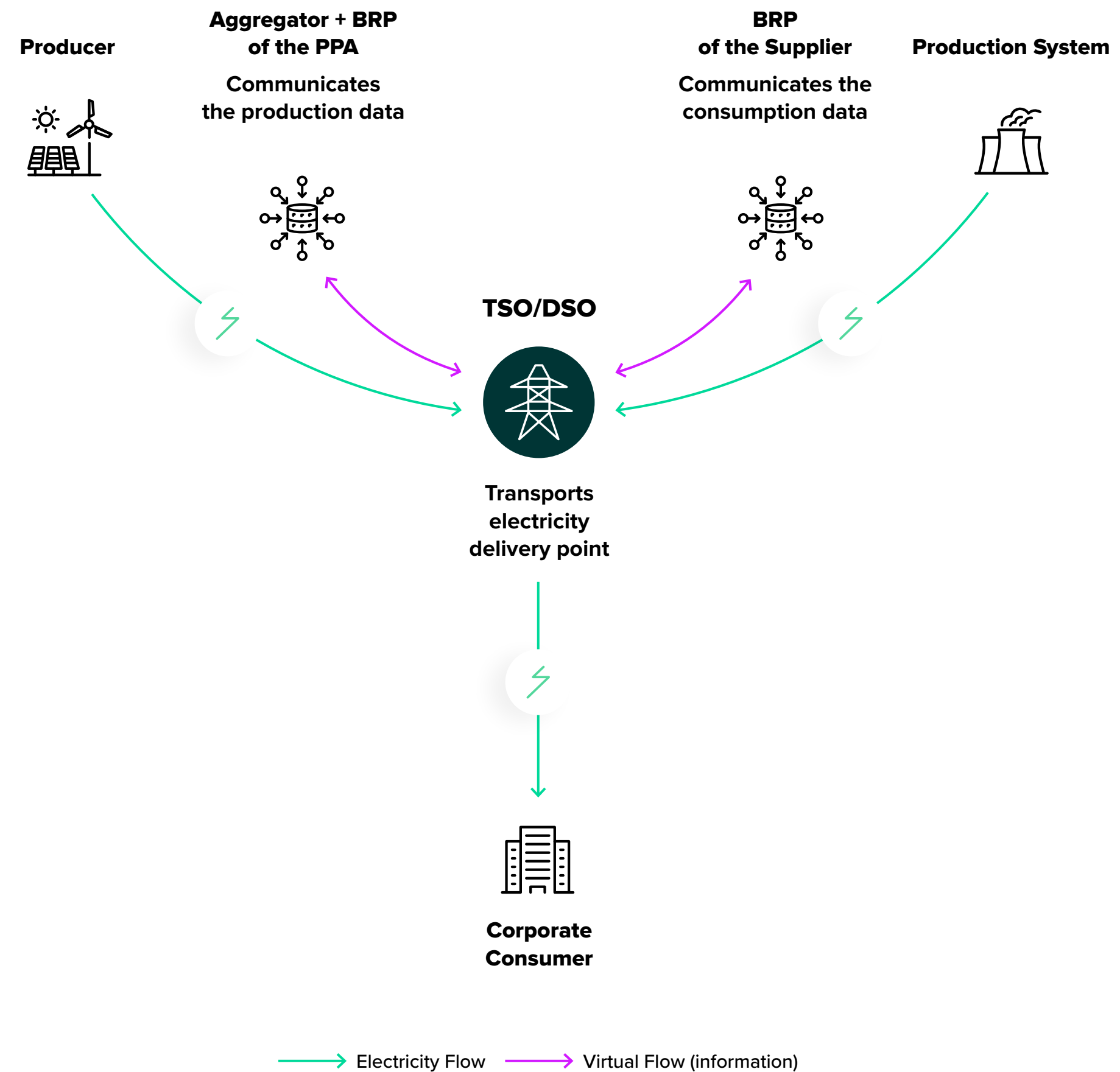
A Distribution System Operator (DSO) is responsible for managing local grid conditions, enabling complex interactions between grid-connected energy resources, and connecting Consumers to Producers.

In a PPA, the DSO connects production infrastructures to the electricity network.

“DSOs play a crucial role in the development of renewable energy. The current networks were never designed to handle the output and diversity of energy production sources we see today.”



THE ROLE OF DSO IN A PHYSICAL OFFSITE PPA



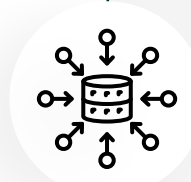
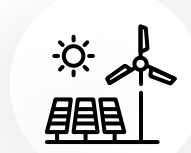
The Supplier

The role of an Electricity Supplier is to **guarantee a reliable supply of electricity to its Customers. The Supplier** manages billing, pricing and customer service to ensure the smooth operation of the network.

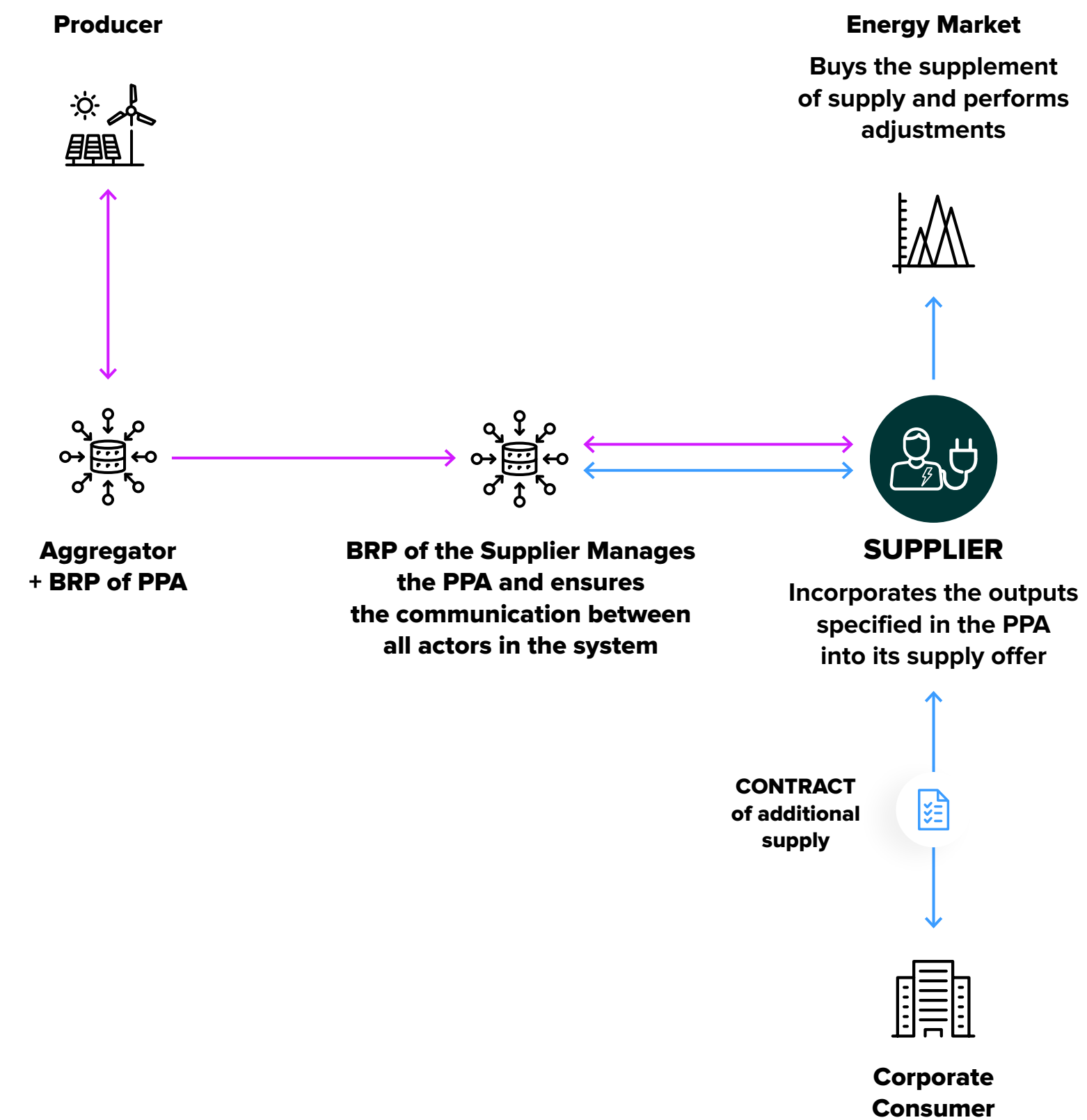
In a PPA, the Supplier **ensures the provision of additional supply**, which may be needed if there are gaps in production. Intermittent power sources, such as solar or wind, don't generate a constant supply, so the Supplier needs to compensate for this variability. In addition to the energy obtained from the PPA, the Supplier complements or supplements the supply with its own offer: the Supplier must provide additional energy beyond what is covered by the PPA to meet the Consumer's needs.

Some Suppliers go a step further for their Customers and can offer guidance to help Customers choose the most appropriate PPA contract for their needs. This is common for those who also operate as Aggregators and BRPs. Suppliers also help ensure the energy's traceability.

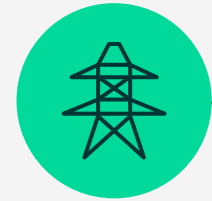
“The Supplier must be actively involved in the process of setting up the PPA contract to make sure the production asset fits well into the Consumer's needs.”



THE ROLE OF SUPPLIER FOR A PHYSICAL OFFSITE PPA



Other key players



Electricity transmission network

The TSO ensures the operation, maintenance, balancing and development of the high voltage electricity network. TSOs are in direct contact with the BRP to ensure that the intermittent energy production of renewable projects does not disrupt the balance of the network.



Financial

In the development phase of new projects, it is common for one or several financial institutions to step in and issue debt to fund the renewable asset. The PPA acts as a guarantee for this financing. In this process, the bank evaluates the contract terms and analyzes the risk of Consumer default.



Lawyer

Law firms are of valuable support during the contracting process. In addition to ensuring the validity of the PPA term sheet regarding contract law, a specialized Lawyer can also assist both parties in allocating risks.



Consulting firms

Consulting firms guide stakeholders across the entire value chain, offering a comprehensive understanding of market challenges and the key elements for successfully implementing a PPA strategy.

They assist Consumers from project inception, helping them identify needs, formulate strategies, and familiarize their teams with PPA considerations. In the implementation phase, they are able to refine tender documents and are able to manage the selection, negotiation, and contracting of PPAs.

Moreover, they support Producers and Suppliers, particularly in shaping and executing sourcing and pricing strategies, as well as in developing innovative new offerings.

KEY INSIGHT

It is critical to reach out to all stakeholders when setting up a PPA and to involve them as much as possible in the contracting process.

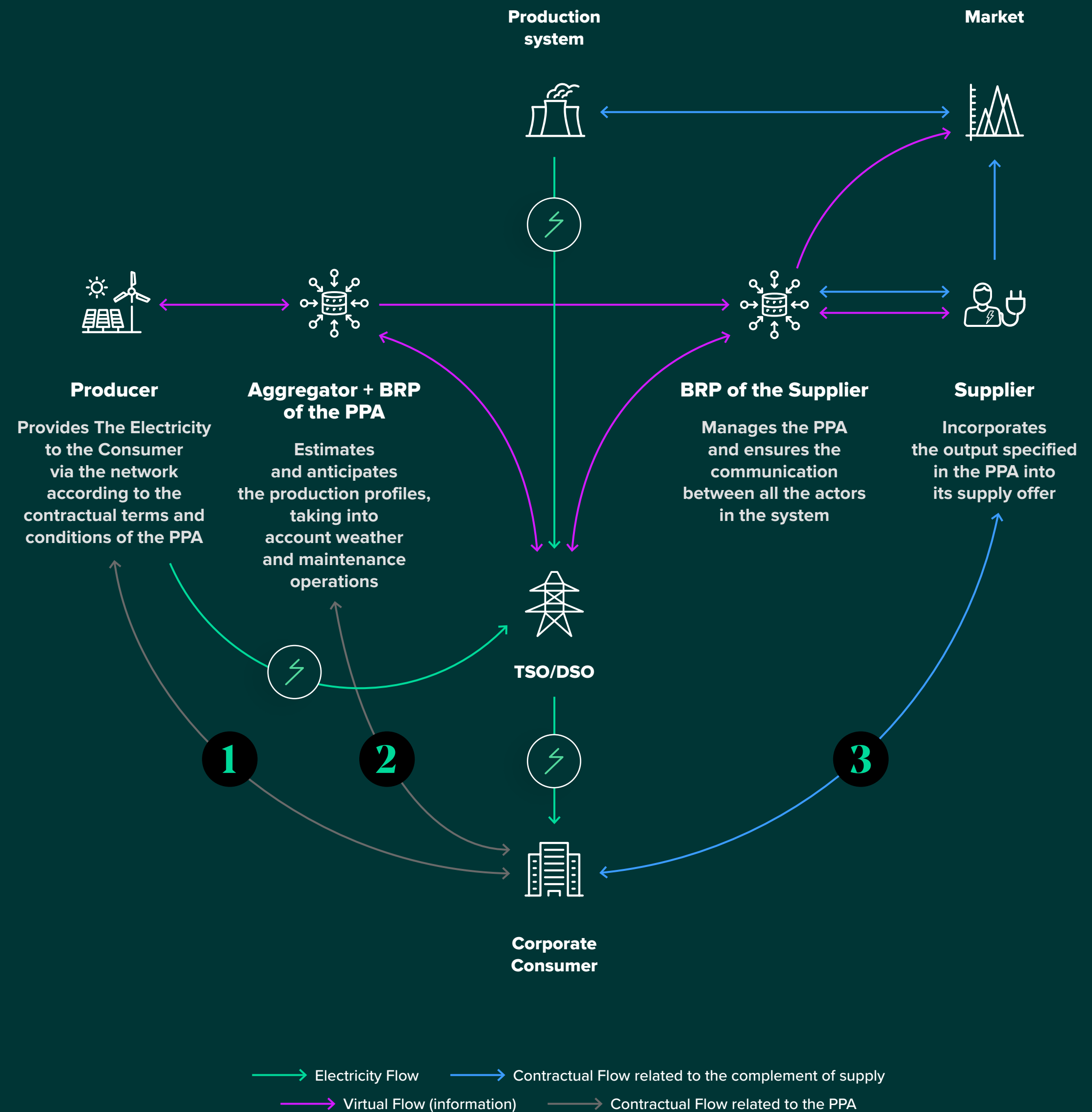
These stakeholders can affect and regulate the finalization of PPAs. But most importantly, they can be valuable supporters in dealing with their complexity.

The case of a Physical Off-Site Corporate PPA

- 1 PPA**
 Corporate off-site physical PPA, directly concluded between a Producer and a Consumer.
- 2 PPA contract management**
 The Consumer has entered a contract with an Aggregator for the management of the PPA.
- 3 Supplementary supply contract**
 The Consumer has contacted the Supplier who has agreed to integrate the PPA into the supply contract.

TO REMEMBER

Putting a PPA into action involves various actors and many steps. In this complex ecosystem, one player may take on several roles. For instance, the Aggregator can also be the BRP for the PPA. It is essential for the Consumer to proactively engage in early discussions with all pertinent stakeholders to strategically assign roles in the PPA.



Part 2

Harness the potential of PPAs for your business



Chapter A
Understanding the market

**What is the state of play
in Europe?**

→ Belgium
The Netherlands
United-Kingdom

**What is the state of play
in North America?**

→ Canada
United-States

PPAs are becoming more popular in Europe

PPAs have experienced considerable growth in Europe since their introduction in the Netherlands. **Scandinavian countries** have had the most success with PPAs, mostly thanks to robust **regulatory frameworks** and **support mechanisms** for renewable energies.

There is **disparity in development** between European countries. Spain, the Nordic countries, and Germany, driven by favorable public opinion, have demonstrated a strong commitment to renewable energies and PPAs by establishing ambitious objectives **and** implementing establishment of **conductive regulatory frameworks**. This disparity in adoption can also be explained by **the unequal distribution of natural resources** conducive to RE impacting the viability of PPA projects.

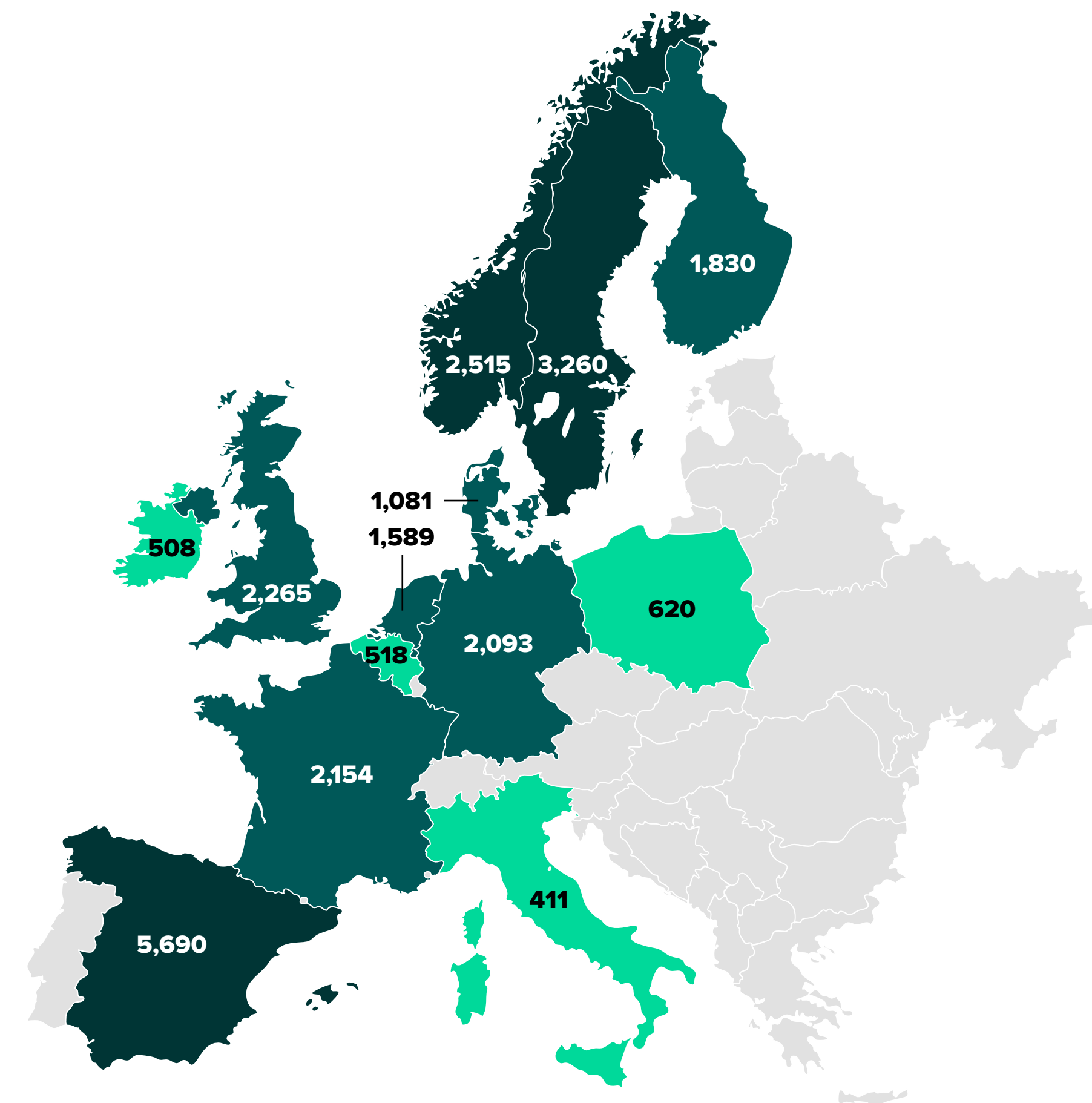
Spain is the **leading country** for PPAs in Europe. It has experienced remarkable momentum since 2018, and today, possesses **more than a quarter** of the cumulative contracted production capacity in Europe, with more than 5.6 GW in 2022.

Several factors contribute to this growth:

- The **competitiveness** of electricity from photovoltaic production assets in Spain;
- **Regulatory constraints** for players who consume a lot of electricity, known as “electro-intensive”, who must now supply at least 10% of their electricity via PPAs;
- **The ambition** of an energy transition towards 100% renewable energy by 2050.

(1) Analysis Sia Partners & Alterna energy

CUMULATIVE GENERATING CAPACITIES CONTRACTED WITH PPAS
(in MW from 2013 to October 2022)⁽¹⁾



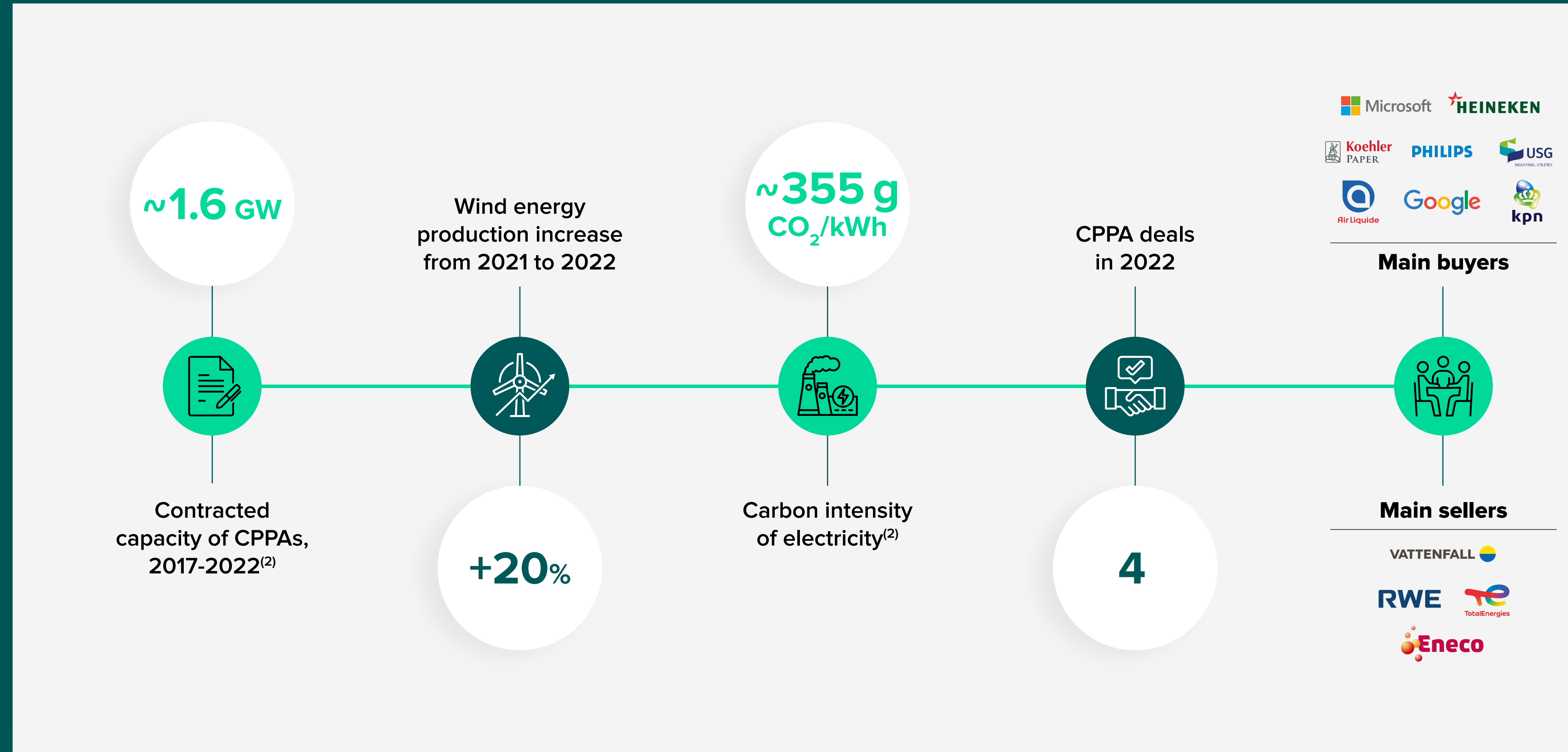
● < 250 MW
 ● Between 250 and 1,000 MW
 ● Between 1,000 and 2,500 MW
 ● > 2,500 MW contractualized



Overview – The Dutch Corporate PPA market in 2022

CPPAs have been present in the Netherlands since the early 2010s, with the market primarily consisting of newly developed wind energy projects. Today, a few key players in the renewable energy sector, notably Vattenfall and Eneco, dominate the market. On the offtaker side, CPPA buyers typically include companies from the technology sector, notably Google and Microsoft, but other major corporations such as KPN and Heineken have also signed substantial contracts.

The Netherlands ranks as the seventh-largest PPA market in Europe with a contracted CPPA capacity of 1.6 GW.⁽¹⁾



(1) European Investment Bank (2) Statista



Energy market review in the Netherlands in 2022

Electricity Market characteristics

Electricity Mix

In 2022, 40% of electricity in the Netherlands came from renewable sources, an increase of 20% compared to 2021. Renewable energies are rapidly growing in the Netherlands, but electricity generation still strongly relies on fossil fuels, natural gas being the most used source for electricity production in 2022 (40%).⁽¹⁾

Electricity Import/ Export

In 2019, the Netherlands became a net exporter of electricity for the first time. Thanks to low gas prices, domestic power production from gas-fired power stations reached a record high. Belgium and Germany have traditionally been the Netherlands' primary trade partners.⁽²⁾

Energy Prices

The average annual price (2022) per MWh on the day-ahead market was exceptionally high (242.3 €/MWh)⁽³⁾, due to high gas prices, supply difficulties and the global context.

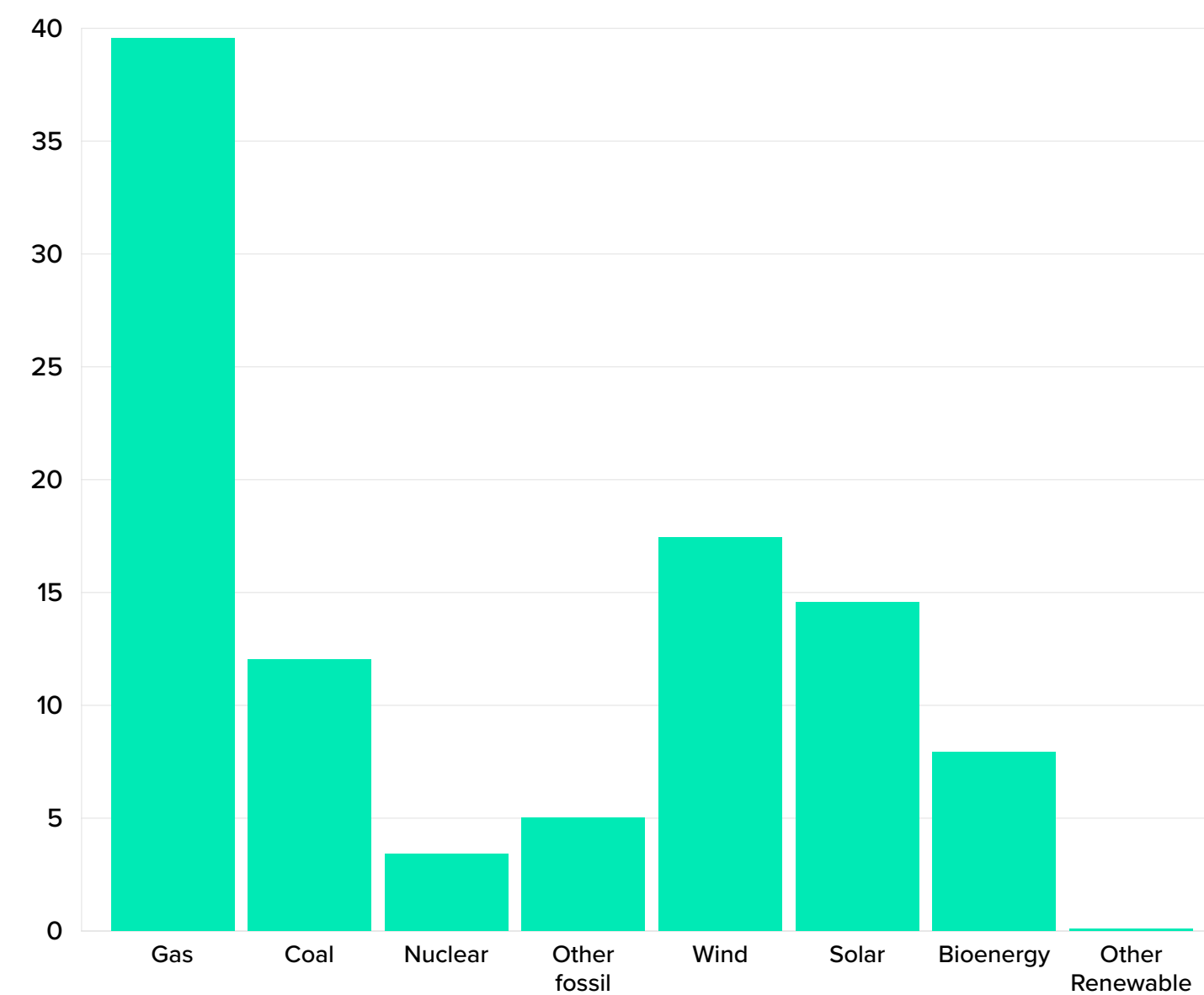
Support mechanisms in place or discussed

The Dutch energy agency manages many support schemes for renewable energy.

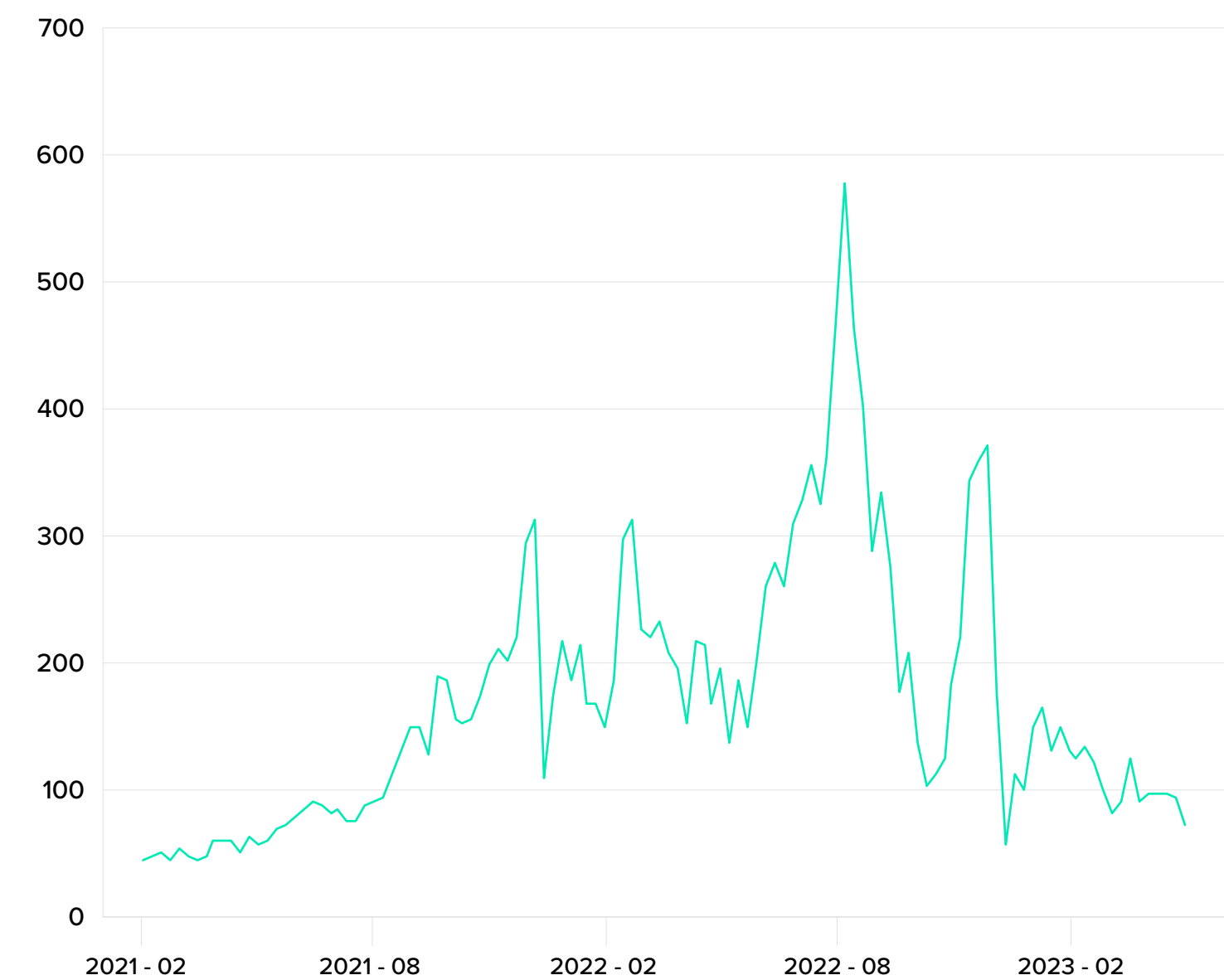
The main subsidy for renewable energy is the SDE++: Sustainable Energy Production and Climate Transition Incentive Scheme. This program offers subsidies to both companies and non-profit organizations engaged in large-scale generation of renewable energy or significant reduction of CO₂ emissions.⁽⁴⁾

In 2019, legislation was enacted to ban the use of coal to generate electricity by no later than 2030.

NL ELECTRICITY SUPPLY BY SOURCE (in %) IN 2022 (Q2)⁽¹⁾



WEEKLY AVERAGE SPOT PRICE (in €/MWh)⁽⁵⁾



(1) Electric Insights Quaterly Reports (2) Energie-Nederland (3) Wholesale energy prices – AquaSwitch (4) Netherlands Enterprise Agency (5) Sia Partners Analysis

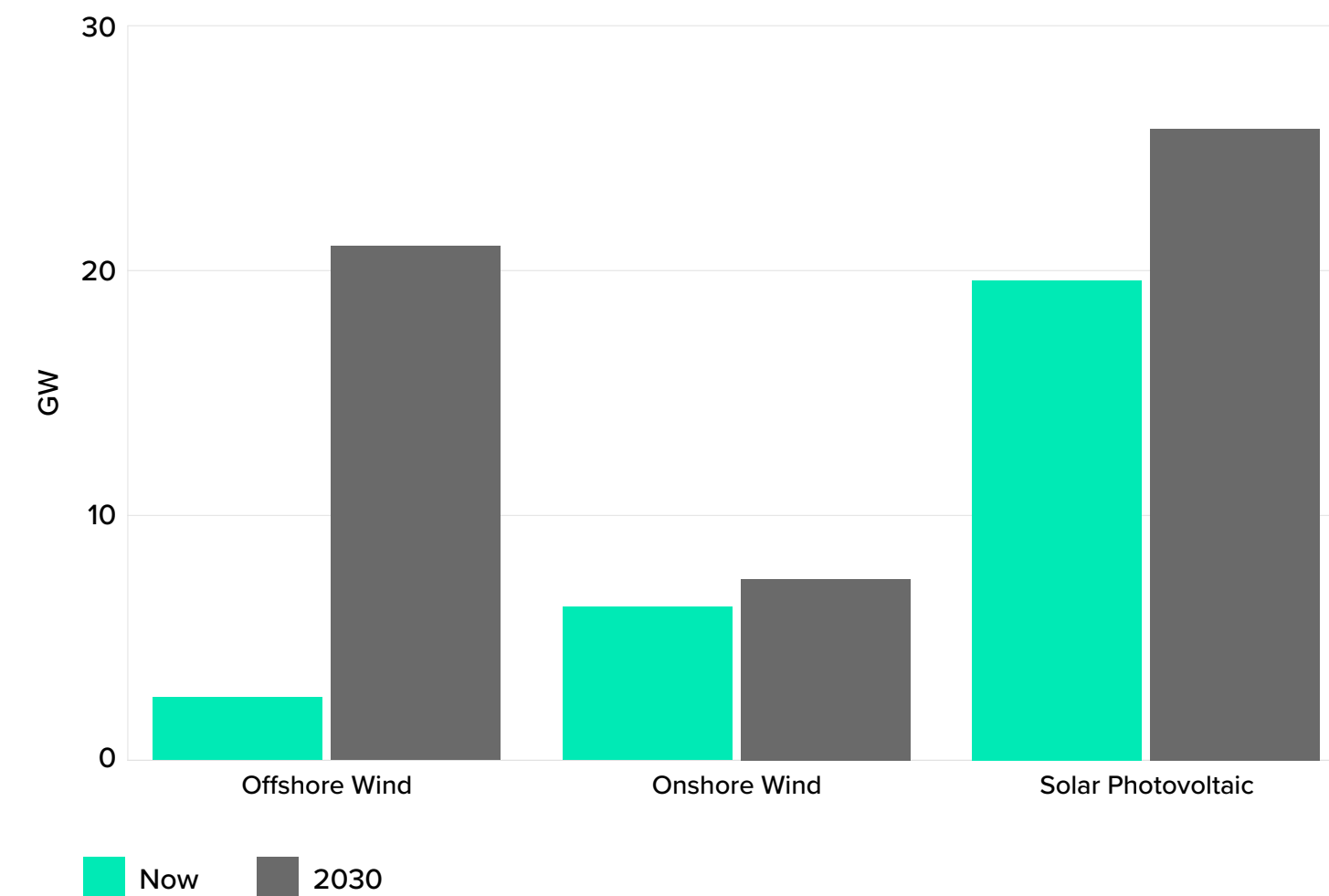


Decarbonization Targets & CPPA integration

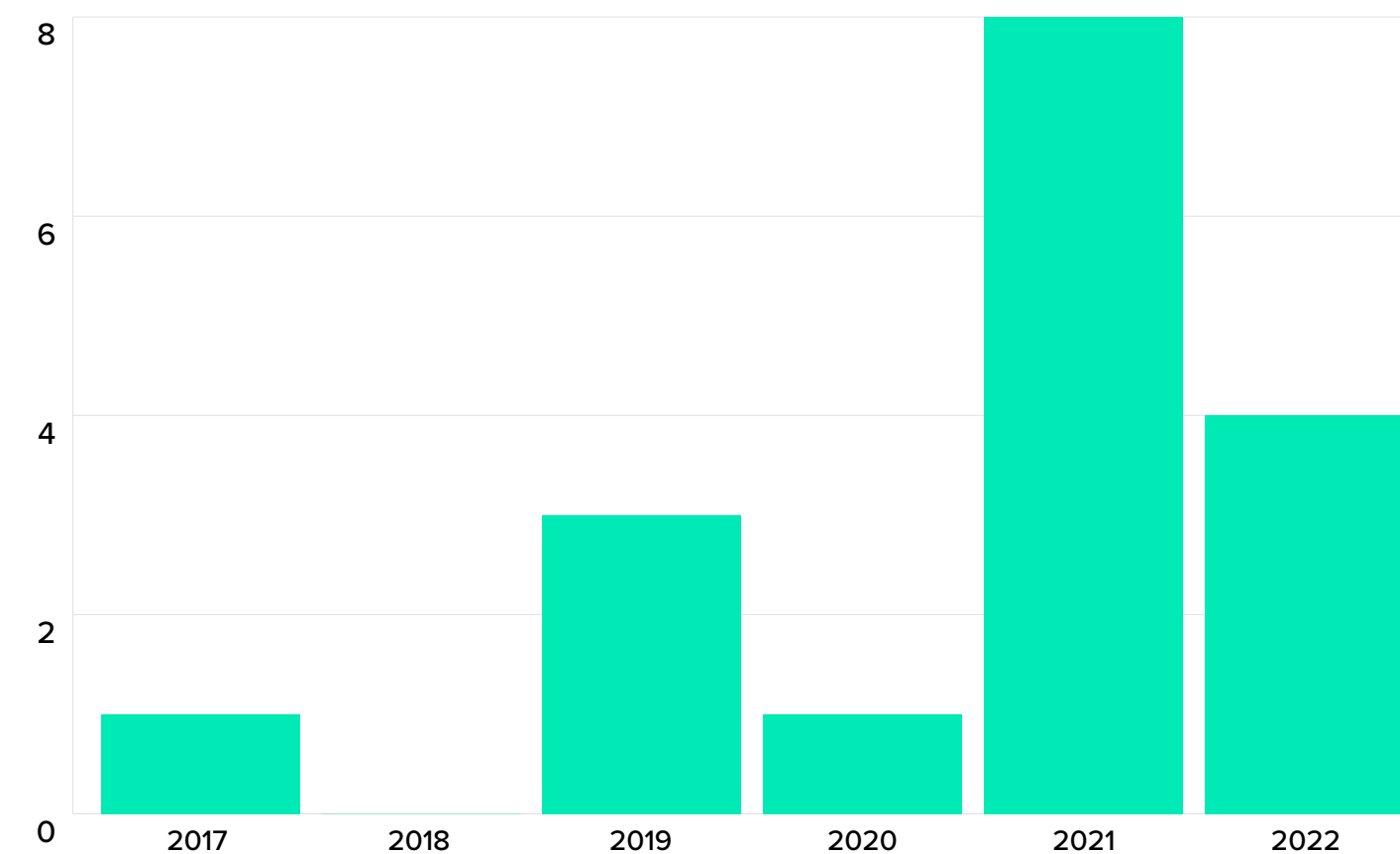
The Dutch government has set ambitious targets for greenhouse gas reduction, aiming for a 55% decrease by 2030 from 1990 levels, with subsequent goals of 70% by 2035 and 80% by 2040, with the ultimate goal of net-zero emissions by 2050.⁽¹⁾

In line with this, the Dutch government made an Energy Agreement for Sustainable Growth with companies and environmental organisations. This agreement involves offering various subsidies to bolster the development of new renewable energy plants and the shift towards low-carbon energy sources.

TARGET RENEWABLE ENERGY CAPACITY IN THE NL ⁽²⁾⁽³⁾⁽⁴⁾

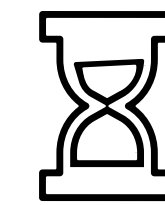


NUMBER OF ANNOUNCED CPPA DEALS SINCE 2017 IN THE NL



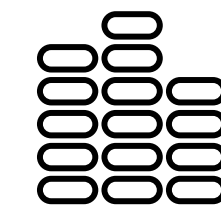
11.7 Years

Average duration of PPA deals announced.



115 MW

Capacity of the Largest CPPA 2022 - between Vattenfall & Air Liquide.



(1) Government of the Netherlands (2) Centraal Bureau voor de Statistiek (3) Solar Magazine (4) RVO Nederland

Corporate PPA Market Analysis



1.

Price Cap to slow down PPA Negotiations

A slow down in PPA might be a result of the 130€/MWh ceiling (versus the EU-wide 180€/MWh proposal) implemented until the end of 2023.

The income cap will apply to electricity generated from wind, solar, hydro, biogas, waste and nuclear power, among others.

2.

PPAs to replace subsidies

Once the SDE++ subsidy scheme ends in 2025, the Dutch power market will be open to solar projects financed solely by PPA contracts.

Subsidy free projects are already in the works. In 2021, Vattenfall revealed plans for a solar park in the Netherlands funded solely through PPAs. Construction is set to commence in 2024.

3.

Ups and downs for PPA growth

Companies in the RE100 group, dedicated to reducing CO₂ and using 100% renewable energy, are expected to play a major role in achieving Dutch decarbonization goals and encouraging the adoption of CPPAs.

However; issues surrounding grid connection may hinder the progress of new renewable energy projects.

Wholesale electricity market prices increased in 2022 and stabilized at the start of 2023. From the end of 2022 a 130€/MWh cap will be in place until the end of 2023.⁽¹⁾

The expected increase in renewable projects, in line with renewable energy targets, is set to drive growth in the PPA market.

The PPA market shows promise, but uncertainties surrounding grid risks persist. There is a pressing demand to increase annual investments in the Dutch grid.⁽²⁾

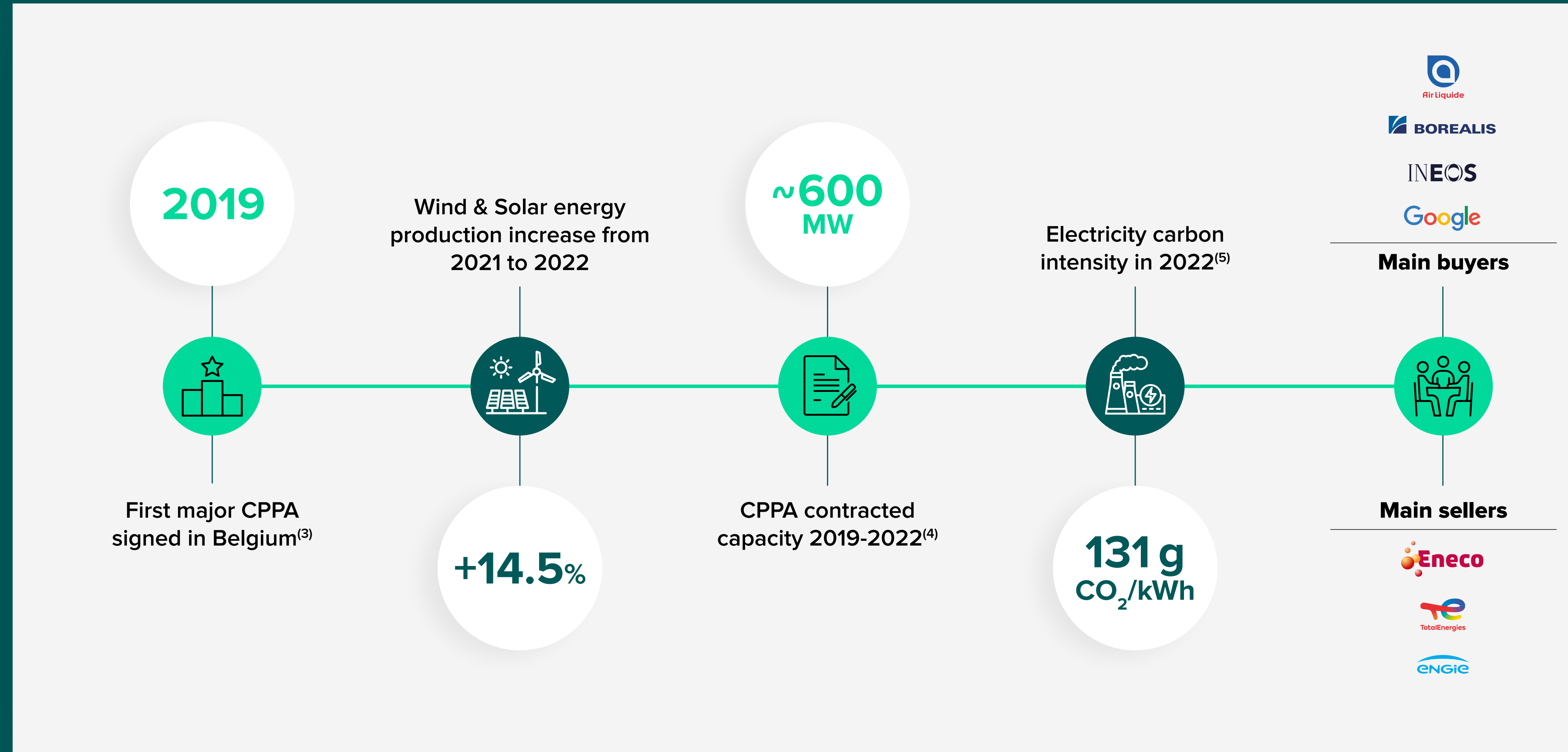
(1) Government of the Netherlands (2) European Commission



Overview – The Belgian Corporate PPA market in 2022

In 2022, Belgium's PPA market, primarily driven by **offshore wind projects**, showed resilience amid global challenges. Driven by sectors like chemical manufacturing and data centers, CPPAs played a big role in helping the country progress towards its sustainability goals and helped to keep energy costs stable. Despite their high development costs and regulatory uncertainties, PPAs were in high demand in Belgium, reflecting a strong commitment to renewable energy and a strategic approach to managing electricity needs.⁽¹⁾

The **2022 PPA** contracted between Ineos and Eneco amounting to **65.5 MW** is a substantial increase from the largest CPPA signed in **2021**, which stood at approximately **15 MW**. This growth highlights the changing dynamics and increasing commitments within the **renewable energy sector**.⁽²⁾



(1) Press Release - Elia, 2023 (2) Press Release - INEOS, 2022 (3) Press Release - Engie, 2019 (4) CPPA Contracted Capacity - Statista, 2023 (5) Emission Data - Nowtricity, 2023

Energy market review in Belgium in 2022



Electricity Market characteristics

Nuclear Energy

Belgium has traditionally relied heavily on nuclear power for a significant portion of its electricity generation. Plans to phase out nuclear power plants by 2025 have been implemented to facilitate a smooth transition to renewable energy.

Market Regulation

The market is overseen by the Federal Energy Regulatory Authority (CREG), with Elia functioning as the Transmission System Operator. Local distribution networks are managed by various Distribution System Operators, while regional regulators such as VREG and BRUGEL handle specific regulatory aspects.

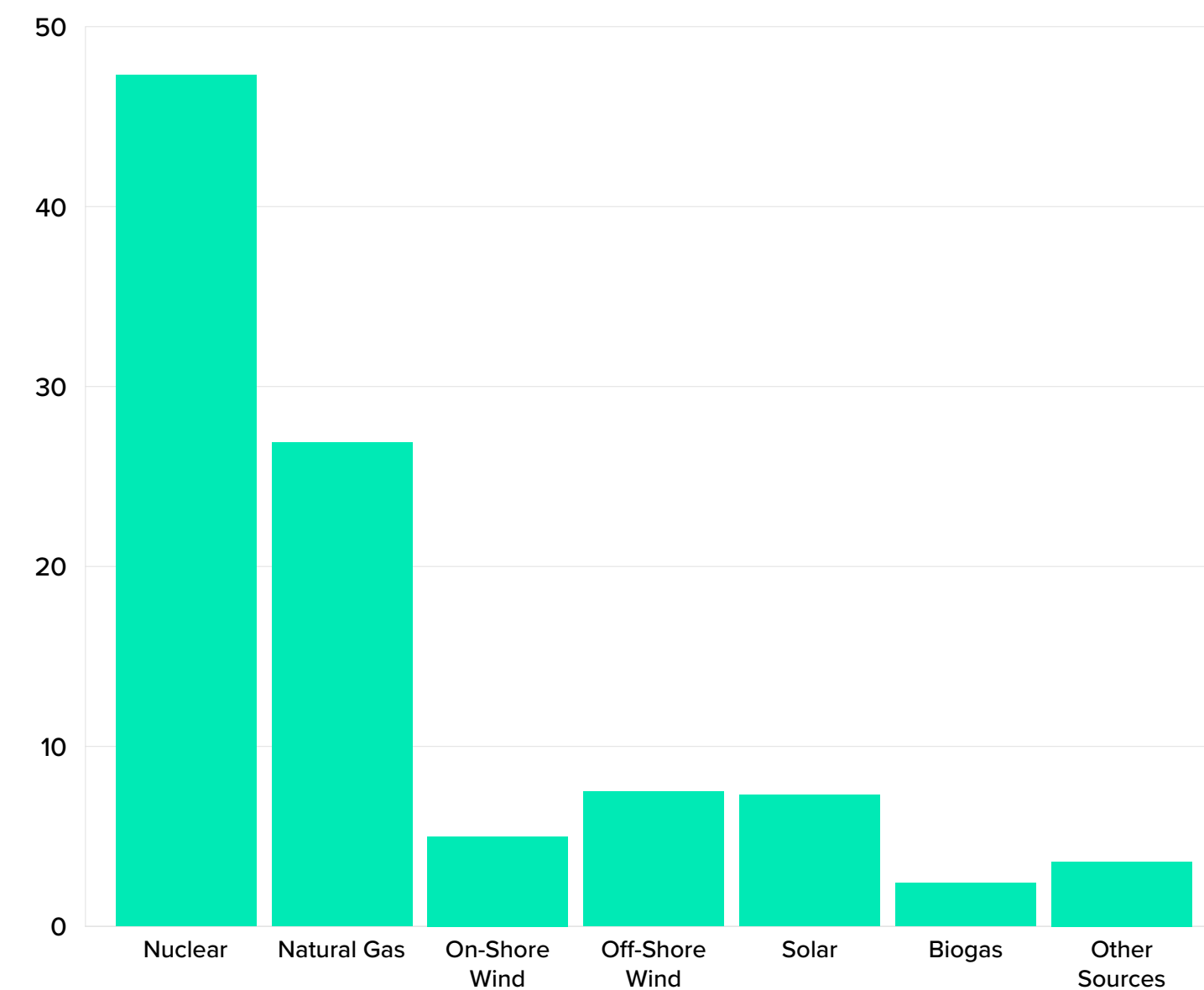
Energy Prices

In 2022, the day-ahead market saw an exceptionally high average annual price per MWh at 245 €/MWh, driven by elevated gas prices, supply challenges, and international factors.

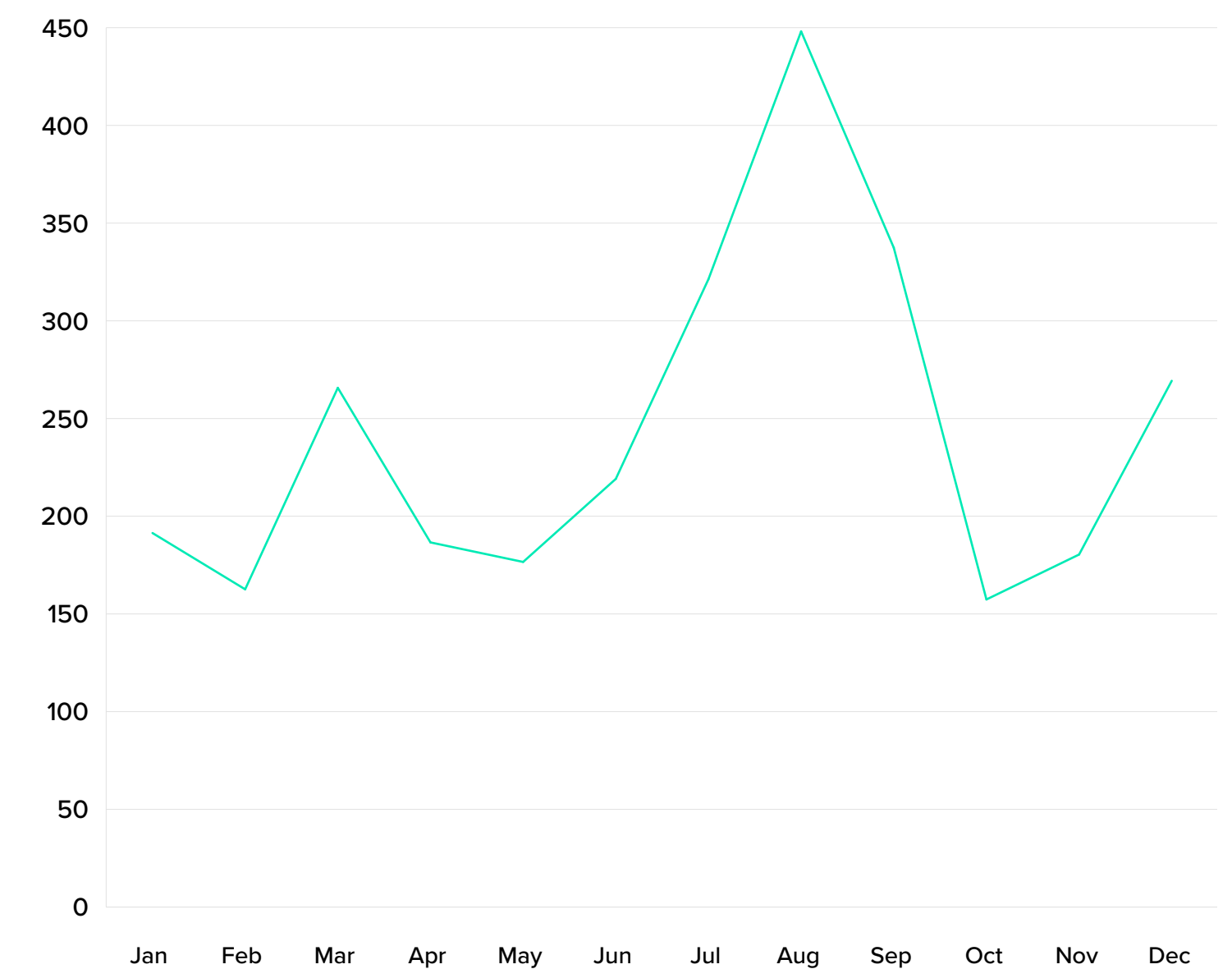
Support mechanisms in place or discussed

Renewable Obligation Certificates (ROCs) and Renewable Energy Guarantees of Origin (REGOs) are used to certify the renewable nature of energy. These certificates can be traded on the energy market, ensuring revenue for RES developers and promoting transparency in Belgian energy transactions.⁽¹⁾

2022 BE ELECTRICITY GENERATION BY SOURCE (in %)⁽²⁾



2022 BE MONTHLY CLEARING PRICE DAY-AHEAD (in €/MWh)⁽³⁾



(1) Renewable Certificates - EDF, 2023 (2) Electricity Security Policy - IEA (International Energy Agency), 2022 (3) Press Release - Elia, 2023

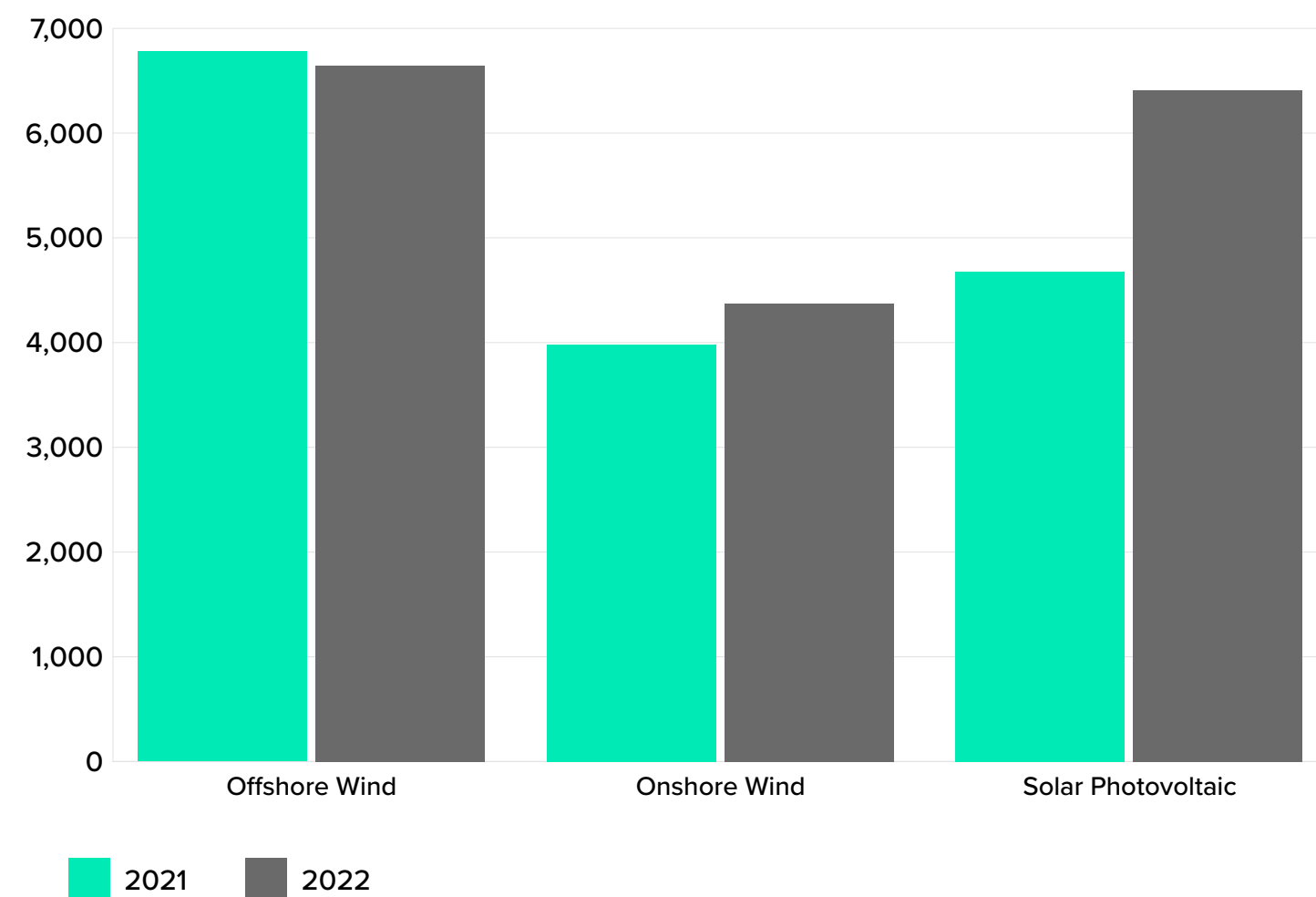


Decarbonization Targets & CPPA integration

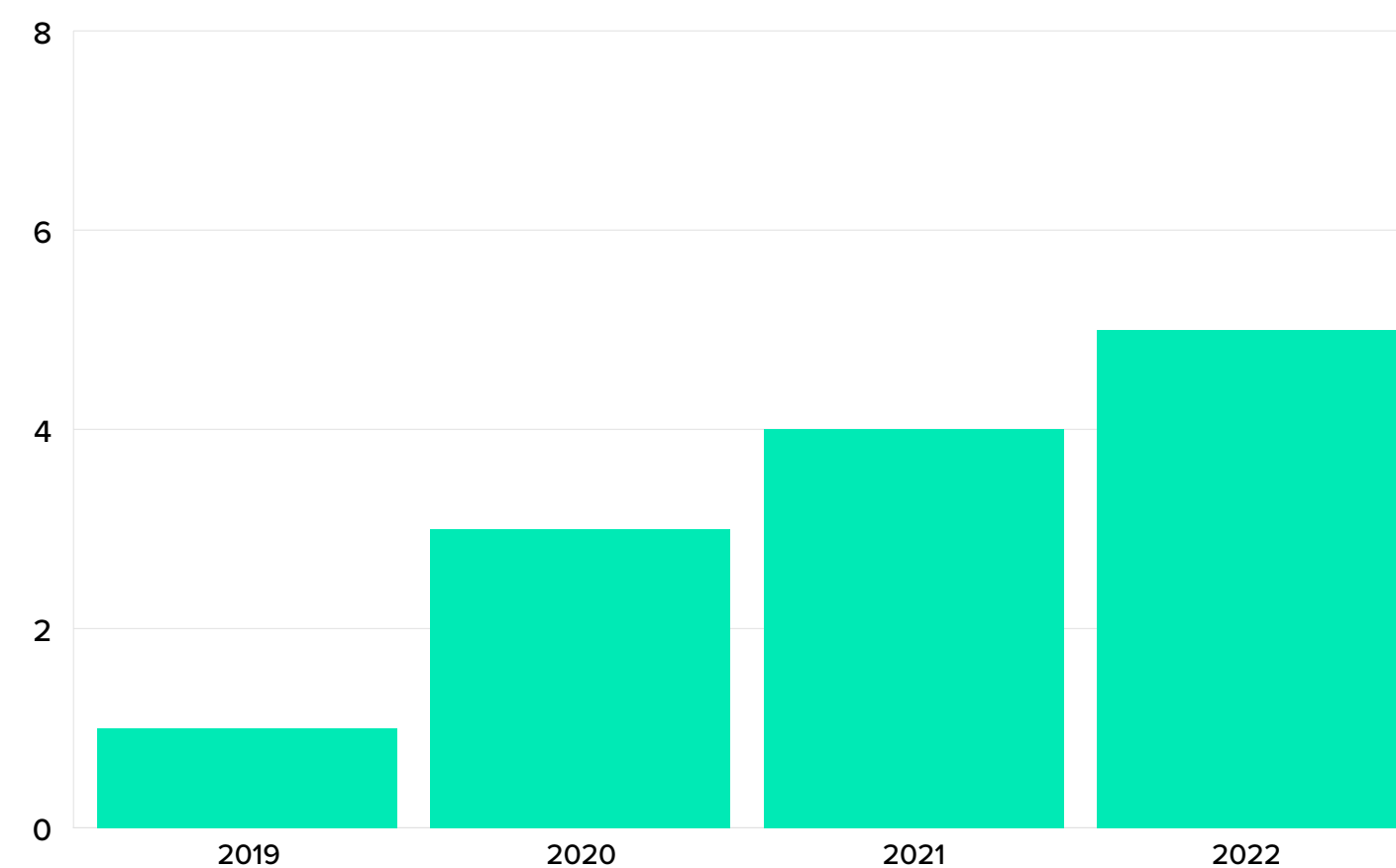
The Belgian government aims to cut greenhouse gas (GHG) emissions by 35% by 2030 compared to 2005 levels, following the Effort Sharing Regulation (ESR). For 2050, a more ambitious goal of reducing GHG emissions by 80-95% has been set. However, Belgium is currently behind in making this transition.⁽¹⁾

In 2022, 25% of electricity production came from renewables, showing an increase of 5% from 2021. Shifting to full renewable energy production will demand substantial investments, estimated at around €415 billion in cumulative investments.

BE RENEWABLE ENERGY PRODUCTION 2021 & 2022 (GWh)⁽²⁾

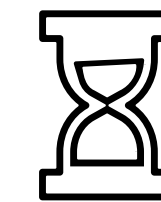


NUMBER OF ANNOUNCED CPPA DEALS SINCE 2019 IN BELGIUM



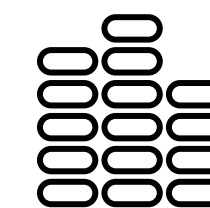
11.1 Years

Average duration of CPPA deals.



65.5 MW

Capacity of the Largest CPPA in 2022 - between Eneco & INEOS⁽³⁾.



(1) Research Paper - Belgian Government, 2020 (2) Press Release - Elia, 2023 (3) Press Release - INEOS, 2022

Corporate PPA Market Analysis



1.

Wholesale electricity prices remain very volatile

Belgian wholesale electricity prices saw intense fluctuations in the previous years due to global conflicts and supply issues, reaching a low point of 14 €/MWh in 2020 and a peak of almost 450 €/MWh in 2022.⁽¹⁾

Companies in Belgium have suffered from these wholesale electricity market volatilities, leading to an increased demand for CPPAs as companies seek long-term price stability.

Wholesale electricity market prices increased in 2022 and have moderately stabilized in 2023. This fluctuation underscores the inherent volatility of the Belgian electricity market.

2.

Companies face pressure to become carbon neutral

The EU, including the Belgium government, has committed to achieve carbon neutrality by 2050. This has boosted the demand for renewables and brought attention to PPAs as a tool to achieve this goal.⁽²⁾

Industry stakeholders can use PPAs to demonstrate their commitment to environmental goals as well as to manage risks associated with fluctuating electricity prices and supply uncertainties.

The government's push for net-zero carbon has led to a growing interest in renewables. In response businesses are using PPAs to switch to 100% renewable energy.

3.

Phasing out current capacity drives a rising demand for new capacity

The Belgian government has planned the phase out nuclear power. By 2025, all nuclear reactors must be closed. Less dispatchable generation may lead to high electricity prices and compromise grid stability.

Belgium cannot rely solely on its current energy mix. It is expected that there will be increased investments in new energy sources, opening opportunities for renewable energy.

The planned nuclear phase-out in Belgium by 2025 will boost the need for alternative energy sources, creating opportunities for renewable energy. With an increase in renewable energy, there should be a rise in PPAs.

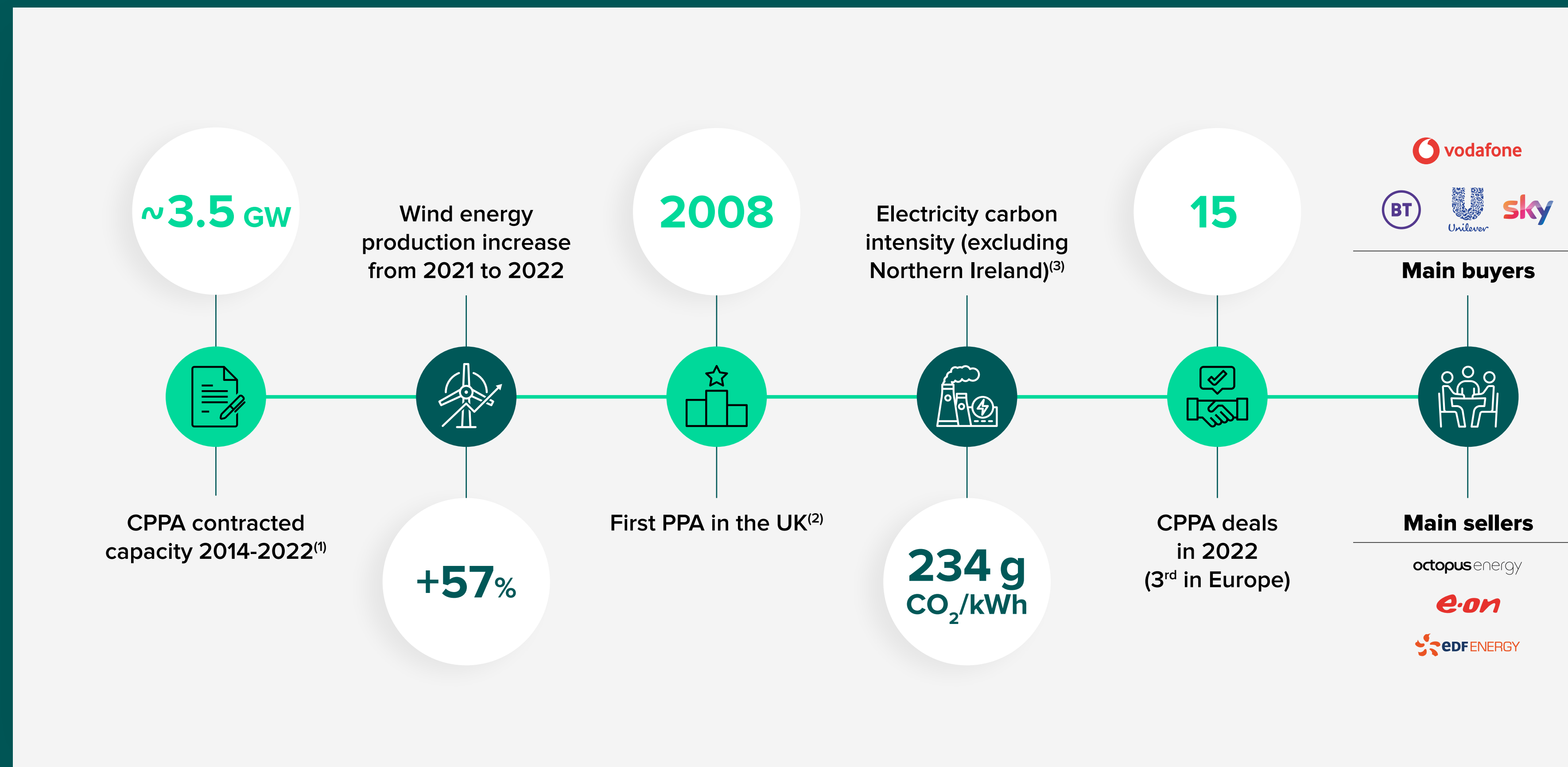
(1) Wholesale Electricity Prices Data - Statista Research Department, 2023 (2) Outline of Climate Goals - Klimaat, 2023 (3) Research Paper - IEA, 2022



Overview – The British Corporate PPA market in 2022

In Europe, GB is one of three most mature PPA markets. New PPA route-to-markets have emerged as a compelling financing model for renewables due to the lower availability of subsidies, lowered flexibility of the dominant subsidy scheme, and Contracts-for-Difference.

A growing number of companies are joining RE100, a global corporate renewable energy initiative bringing together hundreds of businesses committed to 100% of their power supply being sourced from renewable electricity. In 2022, contracted corporate power purchase agreements (CPPAs) experienced a 75% year-on-year increase (952 MW vs 541 MW). The growth of the UK's CPPA market was accelerated following the government's initial decision to withdraw subsidies for utility scale onshore wind and solar PV projects.



(1) Statista (2) UK GBC (3) Electricity maps



Energy market review in the U.K. in 2022

Electricity Market characteristics

Electricity Market

The System Operator (SO) is responsible for ensuring secure supply. National Grid ESO is the system operator and Ofgem is the independent energy regulator.

Electricity Import/Export

In 2022, the UK became a net electricity exporter on an annual basis for the first time. Its interconnector capacity (with France, Norway etc.) stands at 8.4GW and is set to double by 2025.

Energy Prices

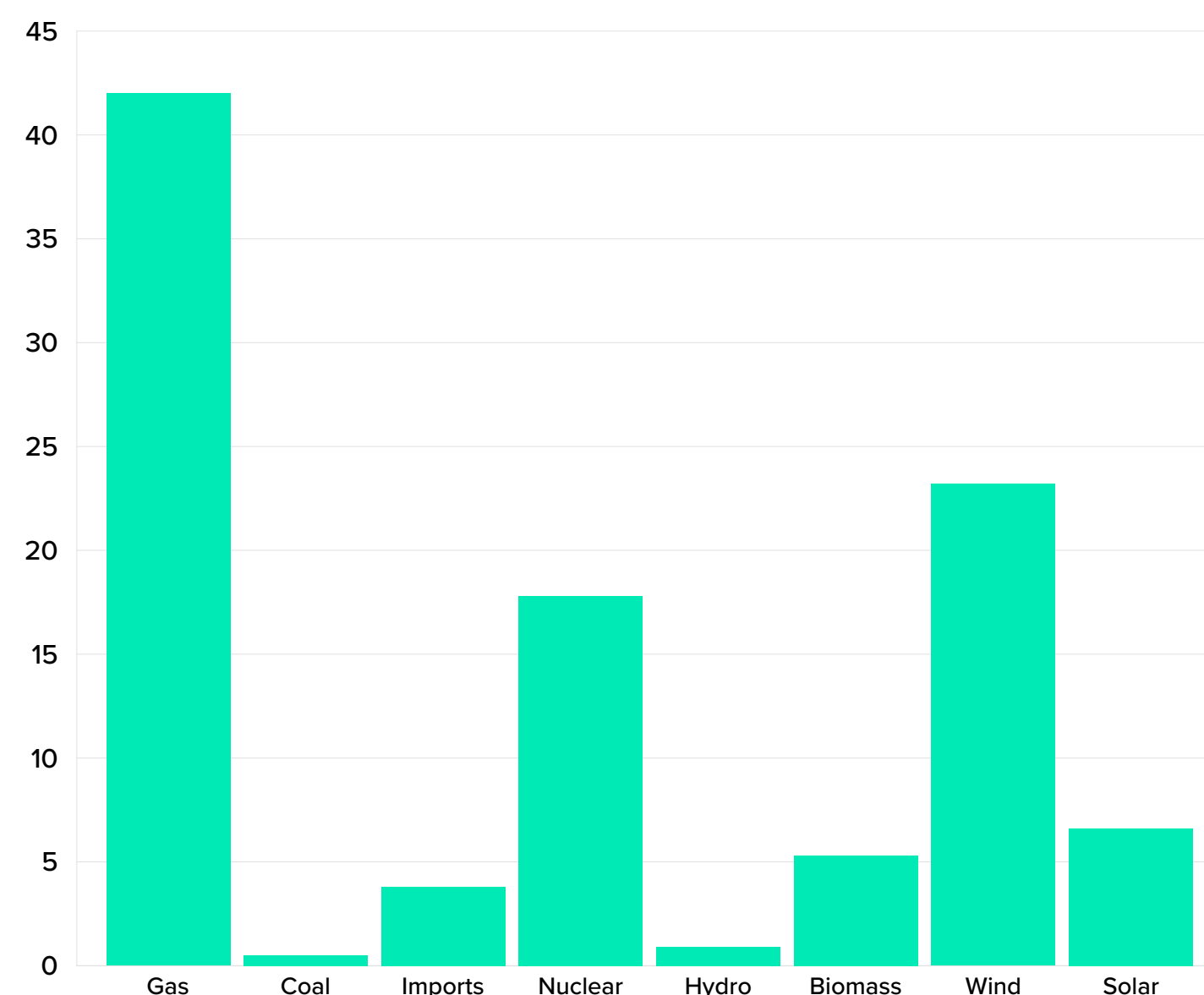
UK wholesale electricity prices decreased by ~ GBP100/MWh (~49%) in 2023 from all time highs of 2022.

Support mechanisms in place or discussed

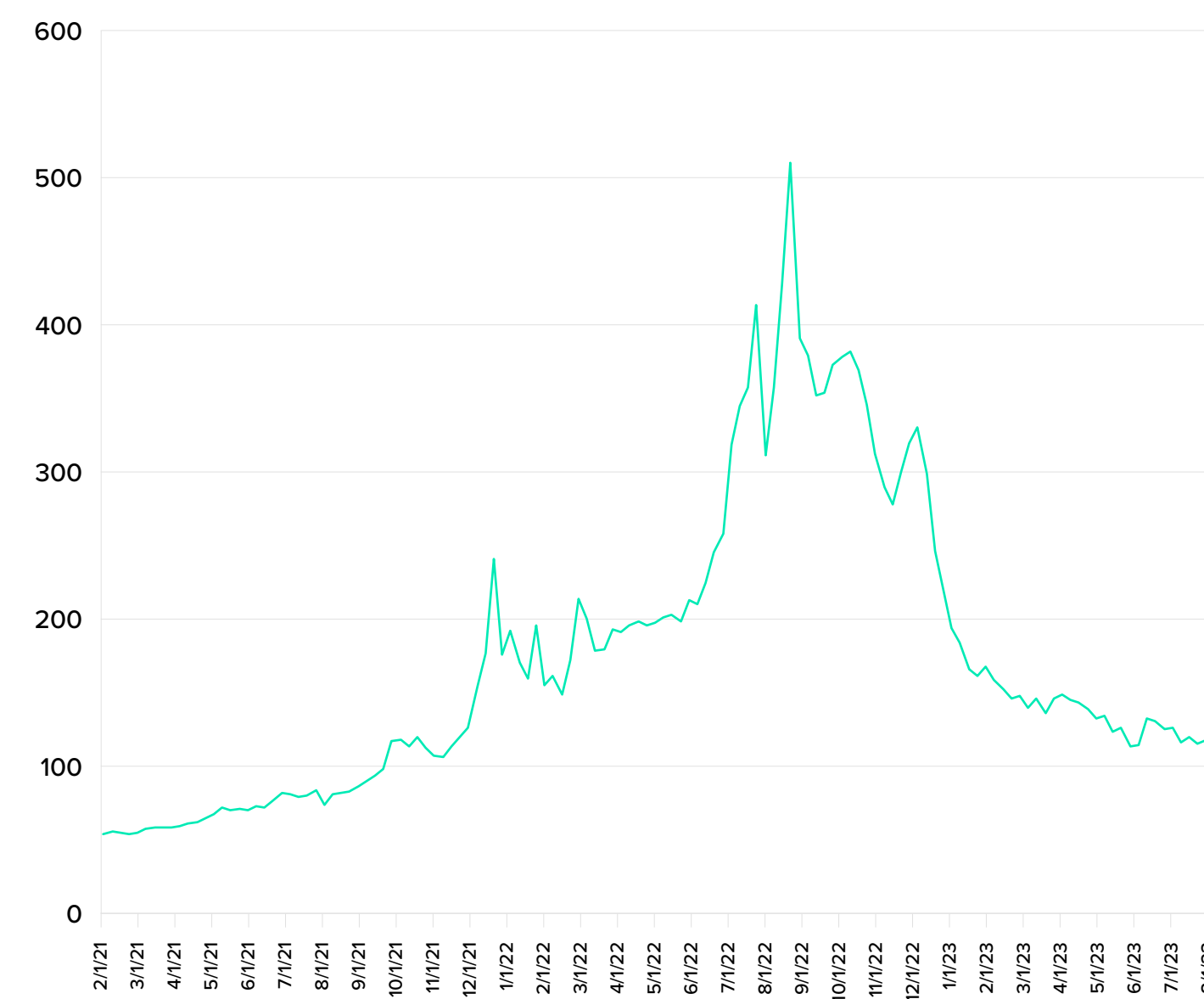
The Review of Electricity Market Arrangements (REMA) consultation published in 2022, aims to deliver a net-zero electricity wholesale market, mass low carbon power generation, flexibility, capacity adequacy and operability.

The Renewables Obligation (RO) is one of the main support mechanisms for large-scale renewable energy generation, requiring licensed electricity suppliers to source a proportion of the electricity they supply to UK customers from renewable sources in the form of Renewables Obligation Certificates (ROCs).

2022 (Q2) UK ELECTRICITY SUPPLY BY SOURCE (in %)⁽¹⁾



WEEKLY AVERAGE FORWARD DELIVERY CONTRACTS (GB) (in £/MWh)⁽²⁾



(1) Electric Insights (2) Ofgem



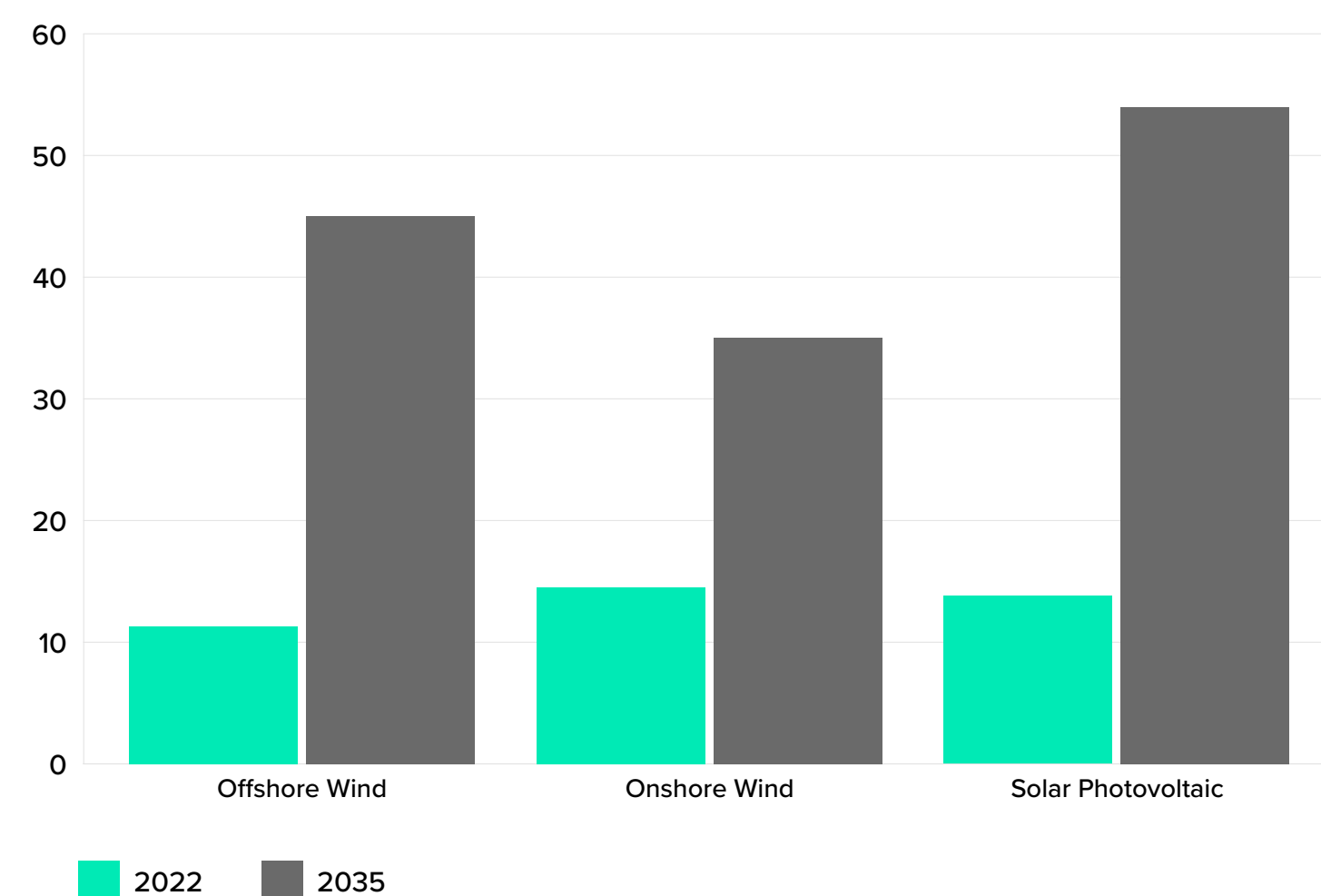


Decarbonization Targets & CPPA integration Targets

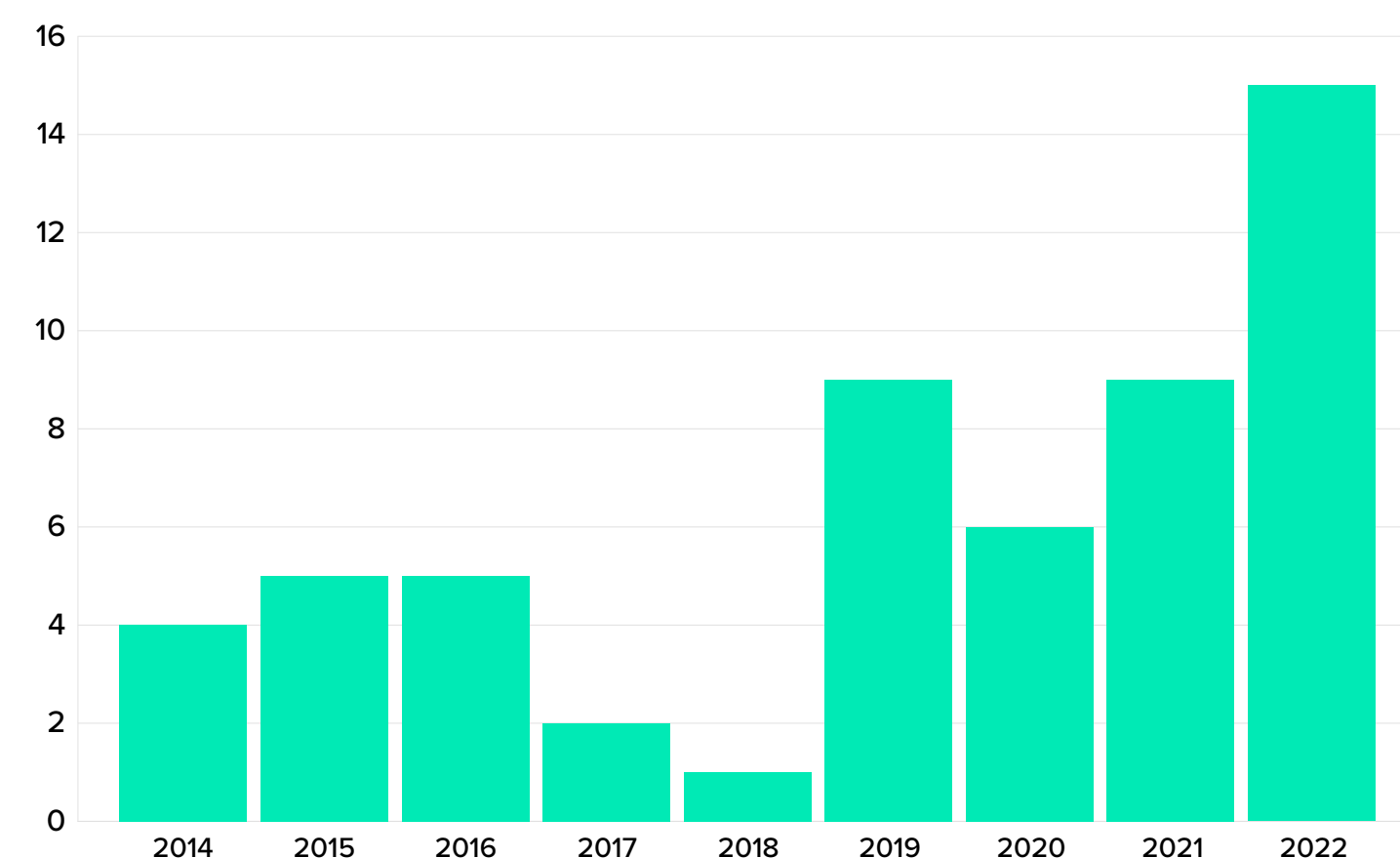
The UK government has set the world's most ambitious climate change target to reduce emissions by 78% by 2035 compared to 1990 levels. A pivotal component of this target includes harnessing renewable energy sources.

In 2022, 40% of electricity came from renewables. This represented an increase of 5% from 2021, mostly due to additional wind generation (ambition for up to 50GW of offshore wind by 2030). This contributed to strong progress towards targets to deliver a decarbonised power sector by 2035 and Net Zero by 2050. As part of its "Advancing Net Zero Programme", the UK Green Building Council (UKGBC) has produced new guidance on Corporate Renewable Energy Procurement to support its members accelerate net-zero transition.

UK RENEWABLE ENERGY INSTALLED AND TARGET CAPACITIES (in GW)⁽¹⁾



UK CPPA DEALS SIGNED 2014 - 2022⁽²⁾



(1) UK Parliament (2) Statista (3) Statista

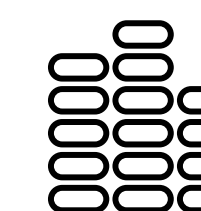
10 Years

Average duration of CPPA deals.



100 MW

Capacity of the CPPA signed in 2022 between ENGIE & Google.



Corporate PPA Market Analysis



1.

Strong interest in long-term fixed price PPAs

Differing views on forward wholesale power prices, particularly captured prices for intermittent renewables due to price cannibalisation, is one reason behind this trend.

Wider strategic moves, including sourcing green power to back renewable supply tariffs, only add to this competitive space.

Ability to hedge against market price fluctuations is a key driver for CPPAs. Moreover, subject to negotiation, corporates may secure prices below-market levels.

2.

Emerging PPA models solidifying demand

The “club” or “consortium” model is when small or medium sized companies take advantage of CPPAs by grouping together to share the risks and enhance bargaining power. This is attractive for larger deals such as offshore wind projects.

The “mini-utility” model is when a corporate sets up an affiliated mini-supply company and becomes the balancing party itself. The generator sells output to the mini supply company who then sells it to the affiliated corporate under an electricity supply agreement.

New models are emerging within the market, building confidence on the demand side, leading the market to remain strong and to continue its growth.

3.

PPA benefits thanks to Govt support

The government will also increase the budget for established technologies such as solar and offshore wind, bringing the new amount to £190m.

The Offtaker of Last Resort (OLR) primarily aims to encourage competition in the Power Purchase Agreement (PPA) market. It does this by providing eligible CfD - holding generators with a guaranteed ‘backstop’ route-to-market at a specified discount to the market price.

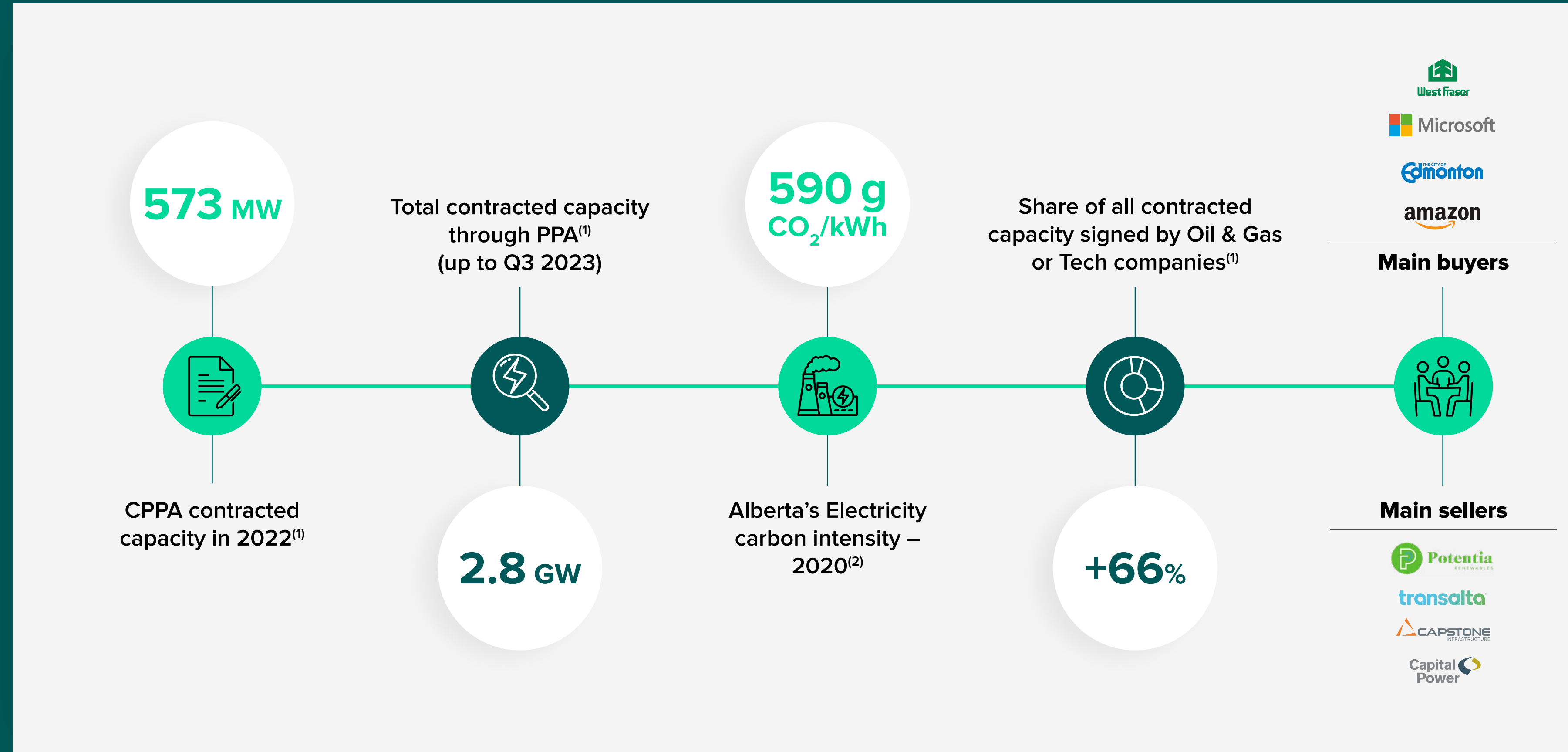
The government’s support mechanisms in response to the energy crisis, and increased focus on transitioning to renewables, contribute to a strong PPA market.



Overview – The Alberta Corporate PPA Market in 2022

Canada is divided into 10 provinces and 3 territories. Each province has its own electricity system and regulatory framework: **most of them have structural barriers to CPPA deals especially when the electricity market is fully operated by a vertically integrated utility.** Except for Alberta and Ontario, most provinces have integrated utilities governing their grids. This setup prevents direct purchase of renewable energy by corporations from independent power producers.

Thanks to its deregulated electricity system and competitive spot market, **the Province of Alberta has attracted all CPPA deals in Canada since 2014.**



(1) Business Renewables Centre Canada (2) Canada Energy Regulator



Energy market review in Alberta in 2022

Electricity Market characteristics

Alberta's Electricity mix

Over 80% of Alberta's electricity comes from fossil fuels (natural gas and coal). However, the government plans to phase out coal-powered electricity by the end of 2030⁽¹⁾.

Alberta's Electricity Prices

Spot prices rose significantly in 2021 and continued in 2022 due to high demand and increasing commodity prices, reaching an average of \$162/MWh.

Alberta's Electricity Demand

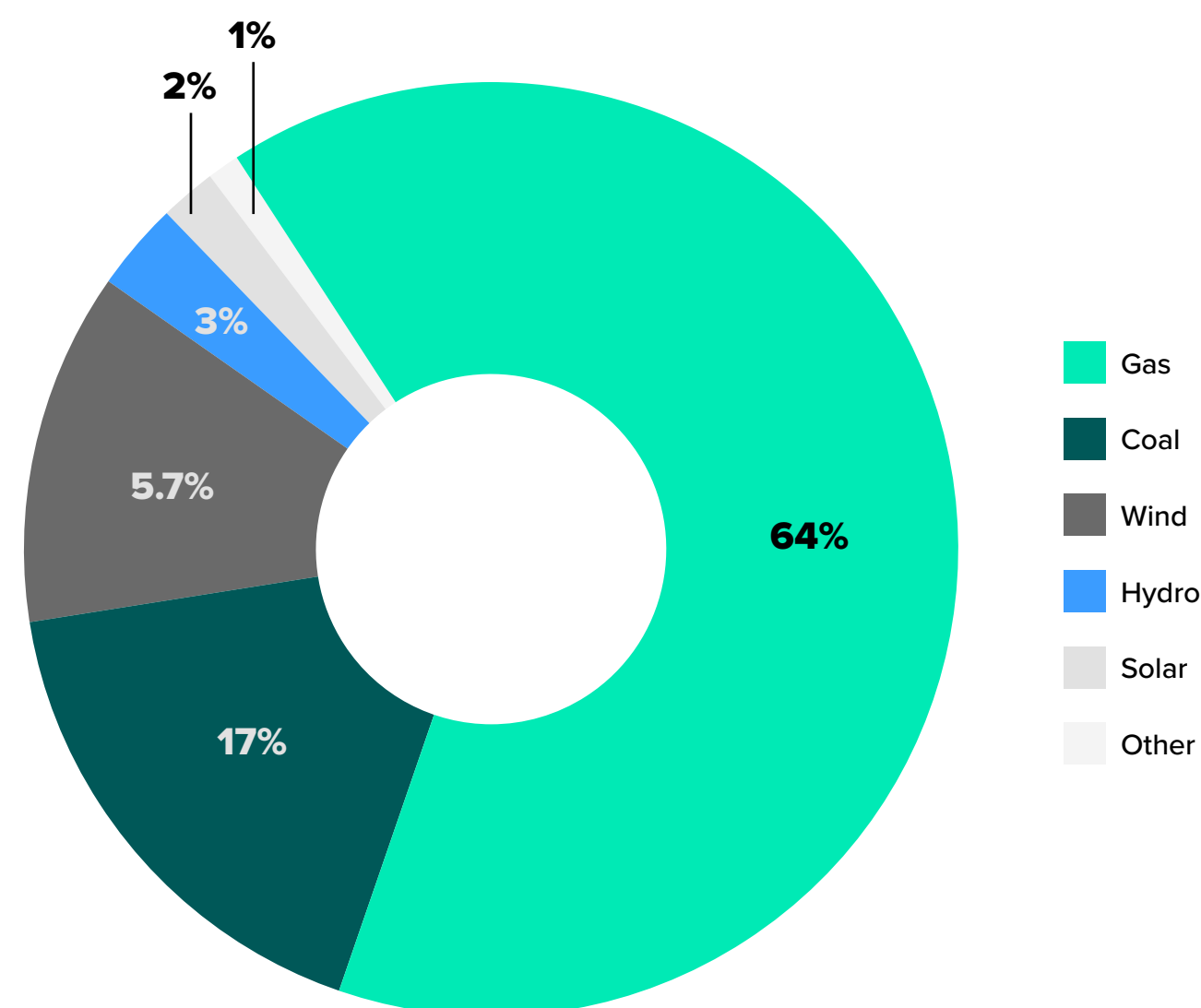
Electricity consumption also increased by 14% in 2022, from 73.9 TWh in 2021 to 83.9 TWh.

Support mechanisms in place or discussed

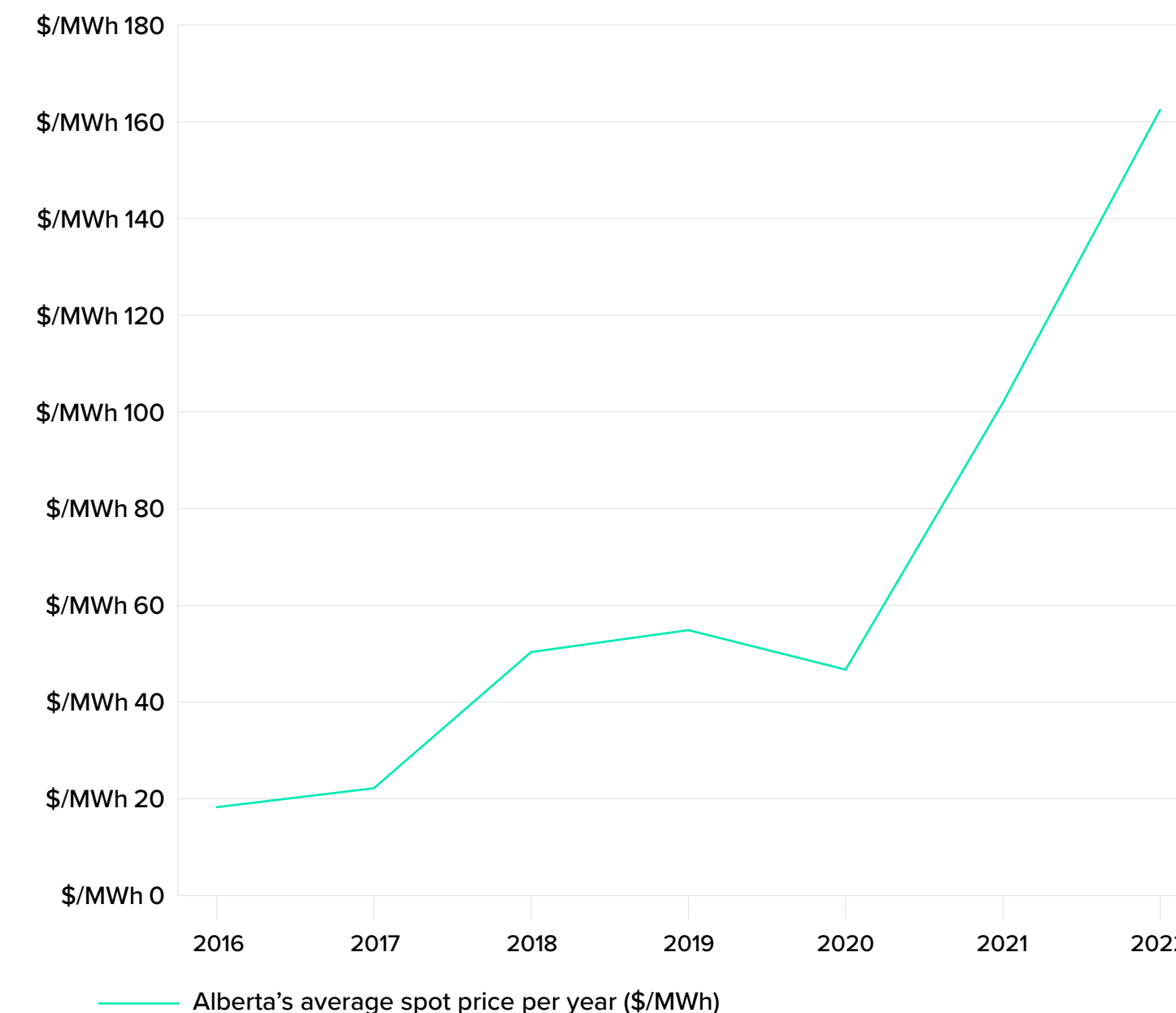
From 2017 to 2019, the government of Alberta has supported the development of new renewable projects through calls for tenders called "Renewable Energy Plan" (REP)⁽²⁾.

Introduced in 2016, the Technology Innovation and Emissions Reduction (Tier) regulation is Alberta's carbon pricing and emissions trading system. The government of Alberta announced that price of carbon will increase by \$15/year to reach \$170/ton in 2030⁽³⁾.

ALBERTA'S ELECTRICITY SUPPLY IN 2022 BY FUEL TYPE⁽⁴⁾



ALBERTA'S AVERAGE SPOT PRICE ROSE BY 59% IN 2022⁽⁵⁾



(1) Alberta's government (2) Energy Regulation Quarterly (3) Alberta's government (4) Canada Energy Regulator (5) AESO



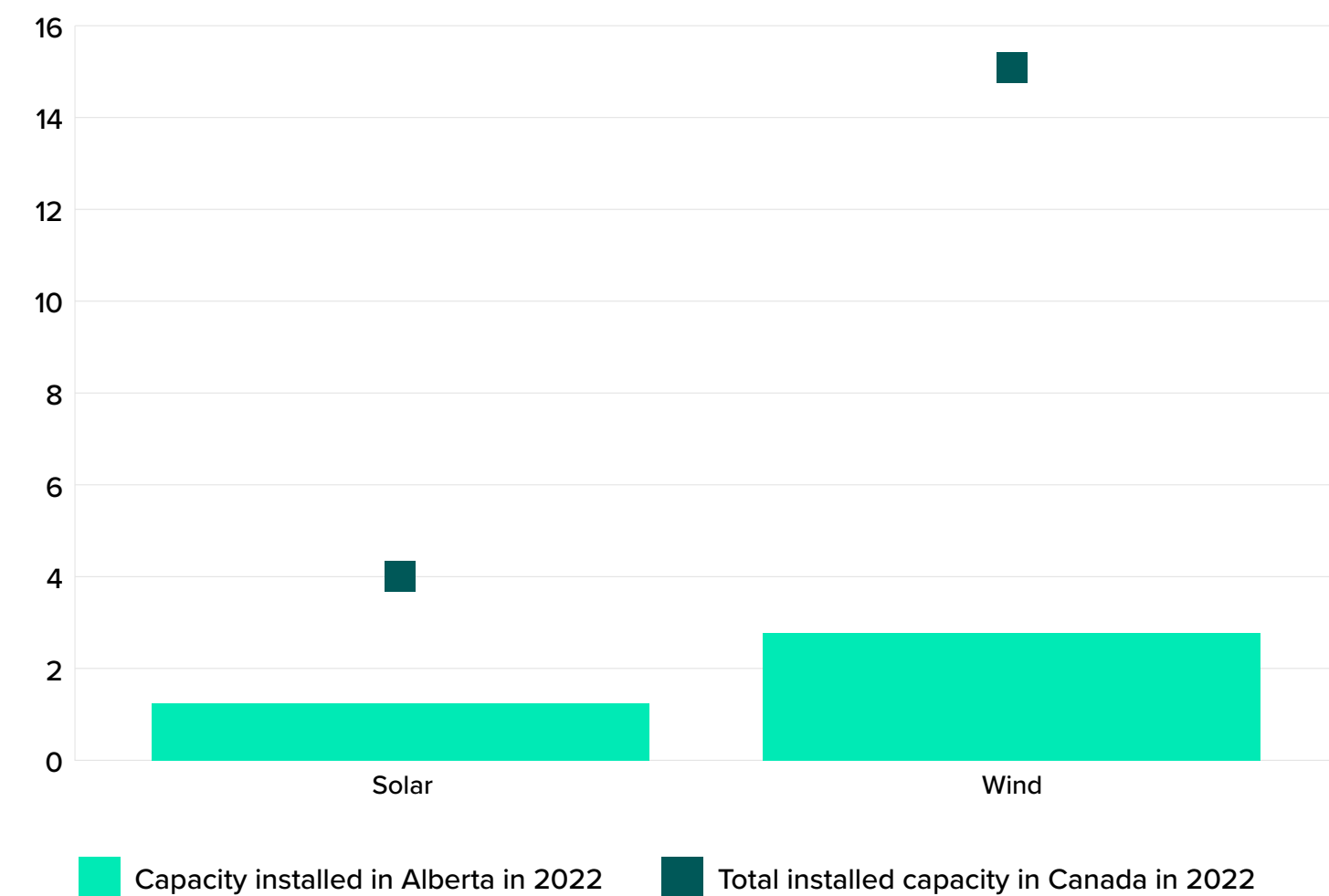


Decarbonization Targets and CPPA integration

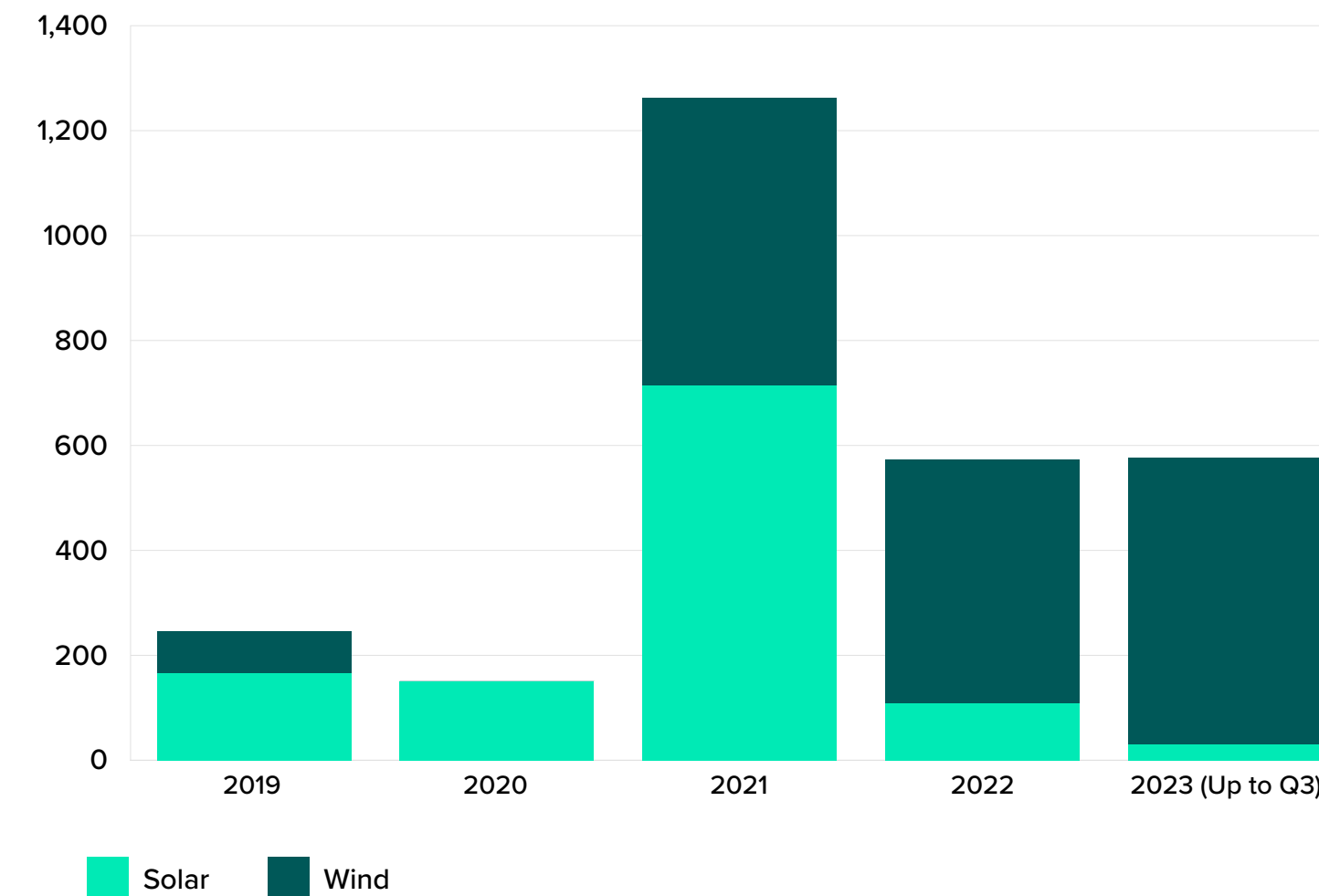
Alberta's electricity generation has a higher carbon footprint compared to the Canadian average. Alberta has set an ambitious target of **30% of its electricity generated from renewable sources in 2030** (vs 10% in 2020). As a result, the development of new projects is a priority.

Under the Tier regulation, **CPPAs can help companies to reduce their indirect emissions or produce emission offset credits**. This mechanism will become more important as the price of carbon increases.

ALBERTA AND CANADA RENEWABLE CAPACITIES INSTALLED (in GW) IN 2022⁽¹⁾



CONTRACTED CAPACITY IN CPPA PER YEAR (in MW) IN CANADA⁽²⁾

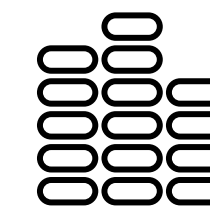


(1) CanREA 2022 (2) Business Renewables Centre Canada (3) Canada Energy Regulator (4) Renewables Now

83.9 TWh
of electricity produced
in 2022.



415 MW
Capacity of the PPA
signed between CIP
& Amazon, construction
started in 2023⁽⁴⁾.



Corporate PPA Market Analysis



1.

Alberta's additional renewable projects are driven by Corporate PPAs

Over the past decade, wind power has been the main driver of renewable capacity growth in Alberta.

Recent power purchase agreements are changing this trend as more than 500 MW of new utility-scale solar capacity is expected to come online by 2023⁽¹⁾ supported by decommissioning of coal-fired plants policy, increased carbon price and incentives to improve efficiency.

2021 has been an outstanding year for the CPPA market, driven by several major deals. This can be attributed in part to a rebound effect following the COVID-19 crisis.

2.

Opportunities and Uncertainties over the CPPA market

The Canadian government will invest more than \$175 million to support the development of 12 new projects in Alberta through the Smart Renewable and Electrification Pathways program.

Last August, The government of Alberta announced a seven-month moratorium on renewable projects. One of the main reasons is to assess farmland protection and grid reliability and supply uncertainties.

CPPA market in Alberta is expected to grow as the number of renewable projects will increase in Alberta but some uncertainties exist over grid connection or regulation.

3.

New CPPA opportunities might open in Ontario in 2024

Even though utilities in regulated provinces annually sign PPAs to enhance their renewable energy supply, the current regulatory structure continues to block CPPAs with independent producers.

However, in November 2023, Ontario's government proposed an amendment that enables large consumers who participate in the Industrial Conservation Initiative to engage in PPAs with specific renewable electricity generators to offset their usage during peak hours.

Alberta remains the only province allowing CPPAs, however new regulation might open opportunities in Ontario starting in 2024.

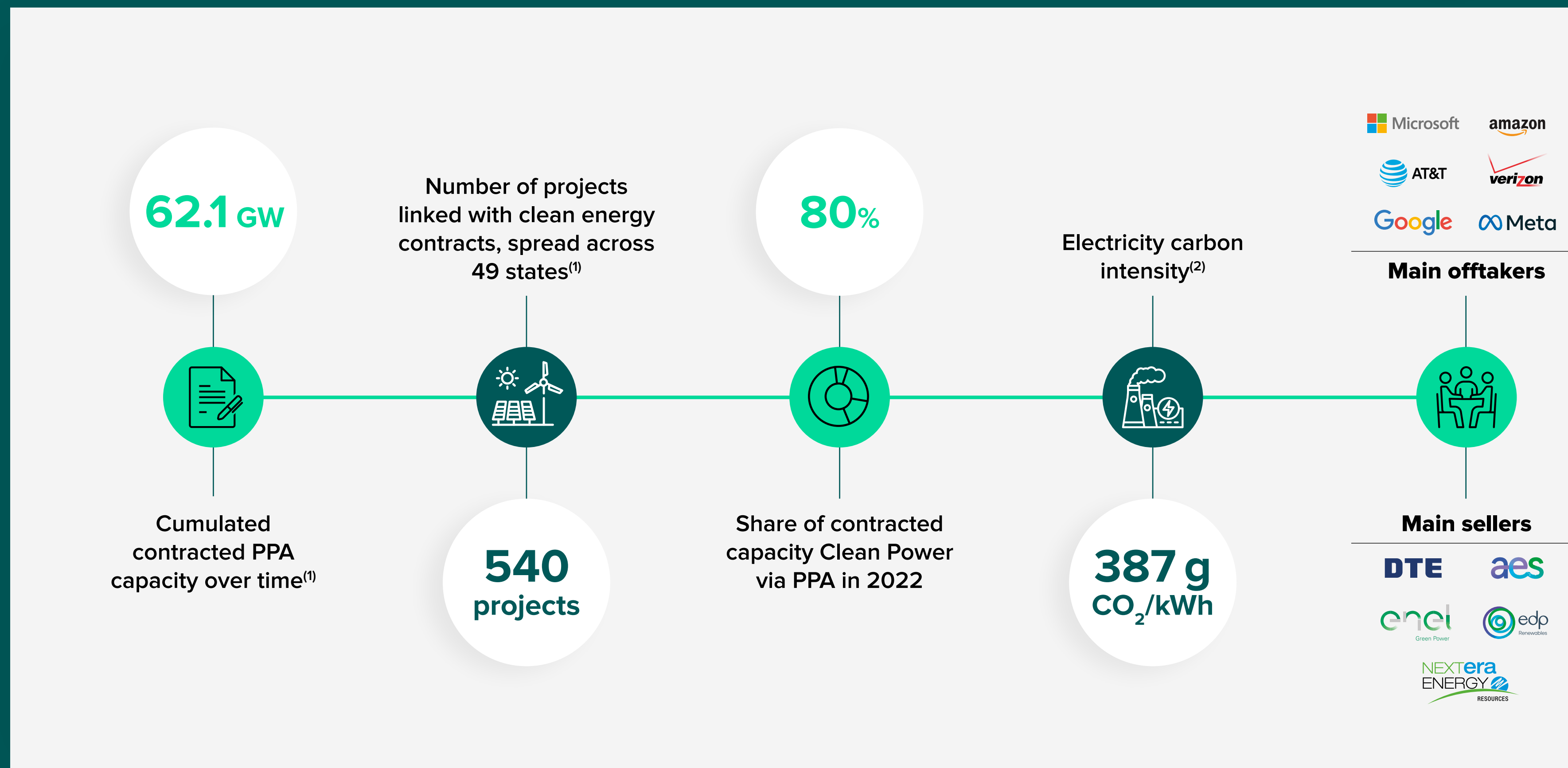
(1) Canada Energy Regulator



Overview – The U.S. Corporate PPA market in 2022

The first to democratize PPA and the biggest market in the world with 62.1 GW, the U.S. is years ahead of the other countries.

The difference of share between CP-PPAs signed for new projects, projects that have passed financial closing, and projects in operation, shows that in 2022: a high number of the CPPAs signed are for brownfield projects already operating (42%), but they only represent a small part of the signed capacity (22%). Committed projects (that have passed financial closing or are under construction) represent the highest share of signed CPPAs (46%) for the highest capacity share (55%). Lastly, new projects (prior financial closing) account for only 11% of total CPPAs signed. This share has fallen compared with 2021, which may be explained by delays in grid connection and the reluctance of Corporates to sign this new type of projects.



(1) American Clean Power (2) EIA



Energy market review in the U.S. in 2022

Electricity Market characteristics

Electricity network

At the highest level, the network covering the lower 48 states is comprised of **three major interconnections** to create larger electricity networks, functioning predominantly independently of one another with limited exchanges of power between them.

Retail & Wholesale markets

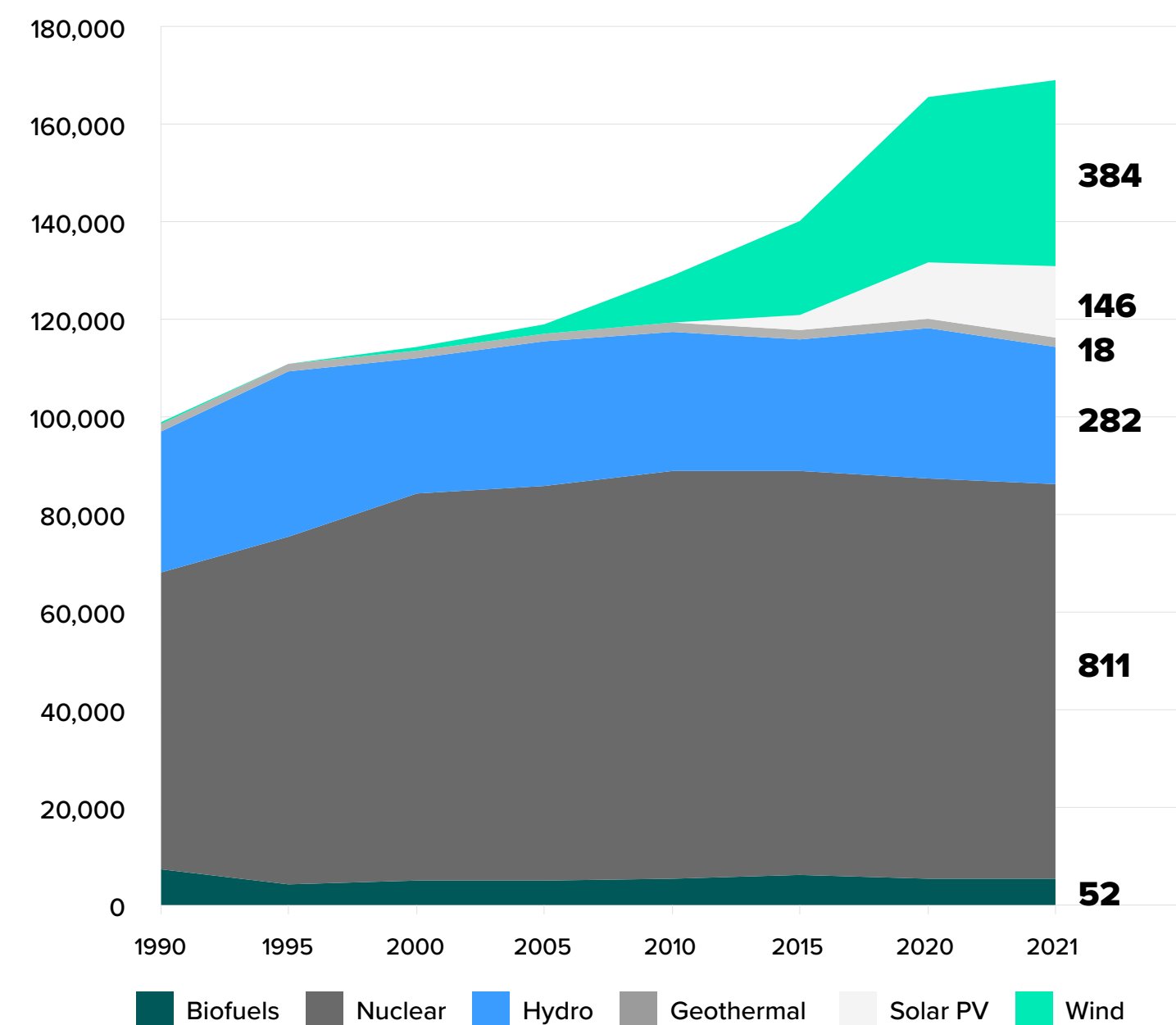
U.S. energy markets are split between **retail** (i.e., direct sales to the end-user) and **wholesale** (i.e., sales for resale) markets. Retail markets are strictly governed by state law and are subject to state regulatory commissions. There are fifty states in the U.S. and thus, in a sense, fifty separate retail markets.

Support mechanisms in place or discussed

Since 2020, the U.S. government allocated **USD 1.34 trillion for clean energy investment support** with more than **210 billion aimed at low-carbon electricity**.

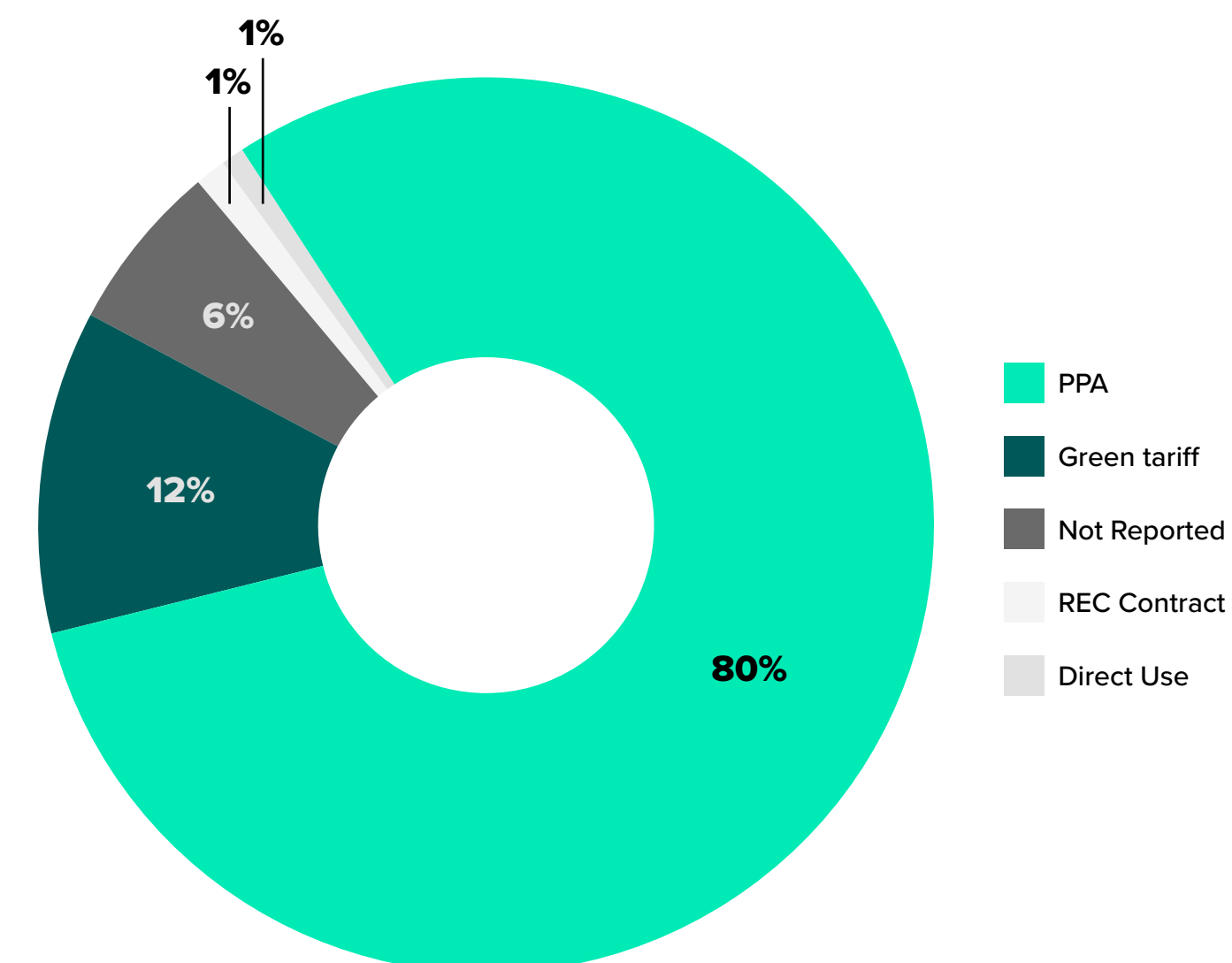
A **Climate Innovation Working Group** as part of the National Climate Task Force was created in 2021 to **coordinate and strengthen federal government-wide efforts** to achieve net-zero emissions.

LOW-CARBON ELECTRICITY GENERATION BY SOURCE
(in TWh) UNITED STATES 1990-2021⁽¹⁾



(1) American Clean Power (2) EIA

CORPORATE CLEAN POWER OFFTAKE BY OFFTAKE TYPE OVER TIME (in GWh) UNITED STATES 2022⁽²⁾

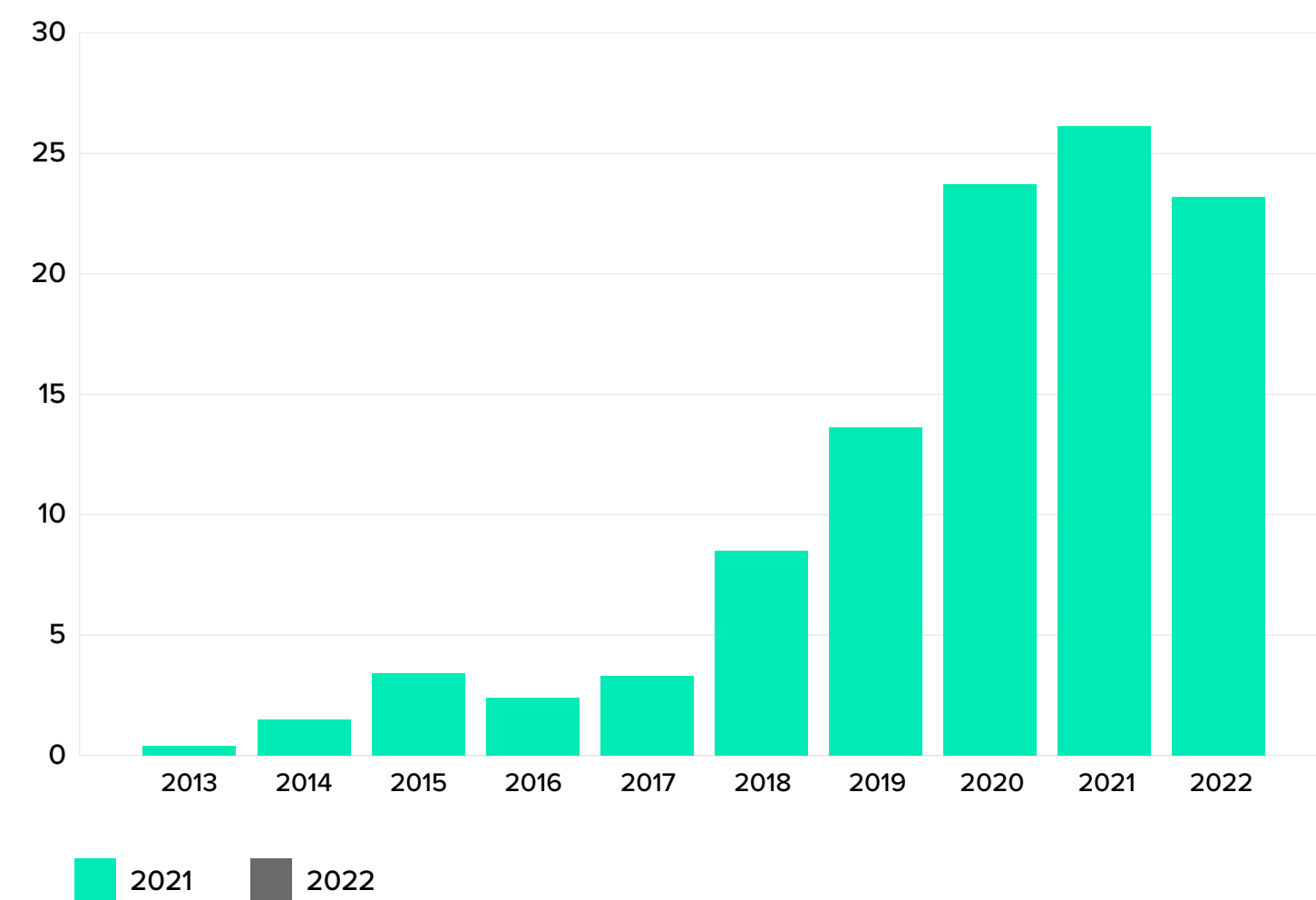




Decarbonization Targets & CPPA integration

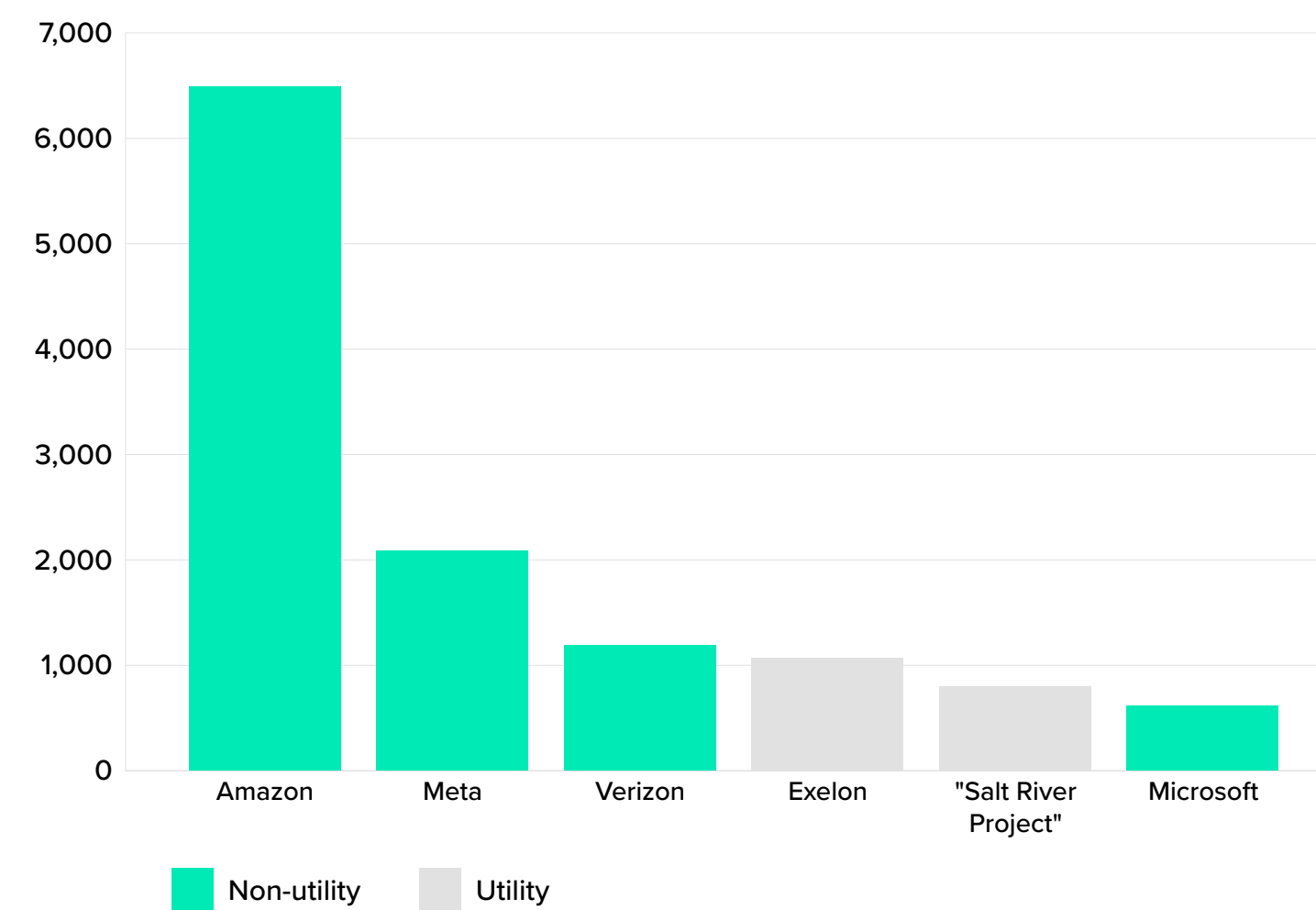
The electric power sector is currently the **second-largest producer of emissions** in the United States. To achieve its goal for **net-zero emissions no later than 2050**, the United States have set a goal to reach a **100% carbon pollution-free electricity system by 2035**.

CORPORATE PPA CAPACITY IN THE U.S. (in GWh)⁽¹⁾⁽²⁾



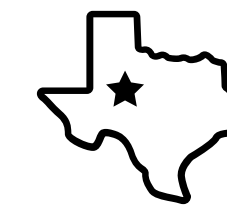
(1) American Clean Power (2) Statista

LARGEST CPPAS CONSUMERS (in GW) IN 2022⁽¹⁾



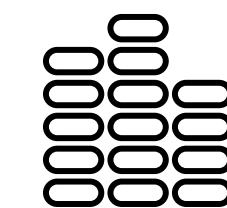
~21%

Of all clean power capacity online or in development located in Texas⁽¹⁾.



650 MW

Capacity of Largest CPPA 2022 – between Ford Motor & DTE.





Corporate PPA Market Analysis

The expansion of Virtual PPAs is driven by rising electricity prices

1.

U.S. market structure impacts an electricity purchaser's capability to engage in a PPA⁽¹⁾

Depending on the state or grid in which it is located, the buyer may enter:

- A physical PPA involving an electricity consumer located in a competitive retail market, and a project located in a competitive wholesale market that is interconnected with the consumer's ISO.
- A financial PPA involving an electricity consumer anywhere in the United States and a project located in a competitive wholesale market (Northeast, Midwest, Texas, and California).

Consumers ability to enter a PPA is highly dependent on the geographical location of the buyer and the project.

2.

Electricity prices driven by electricity demand growth⁽²⁾⁽³⁾

Electricity demand is set to rise sharply over the coming year, from around 4,000 TWh in 2022 to over 5,000 TWh in 2050.

CPPA prices rose by 11% due to rising costs and supply chain disruptions. Yet, demand for virtual PPAs remains strong, offering cost savings by consolidating demand across multiple locations.

Electricity prices will be determined by demand, and the challenge will be to cover this demand with renewable energies, opening great opportunities for the PPA market.

3.

Opportunities and Uncertainties over the CPPA market

Developers foresee ongoing appeal in PPAs due to extended ITC by the IRA and upcoming 10% premiums for energy community projects in 2023. RECs in specific markets further fortify the business case.

Increased CPPA costs pose a risk due to climbing interest rates, elevated equipment prices, interconnection delays, and supply chain disruptions despite growing demand.

More than half of the US solar and wind growth will stem from direct deals with corporations or utilities, driven by financial viability and corporate sustainability goals.

(1) Epa (2) Statista (3) LevelTen

Chapter B

Why sign up for a PPA?

What are the main reasons for signing a PPA?

- Manage your risks
- Contribute to the energy transition

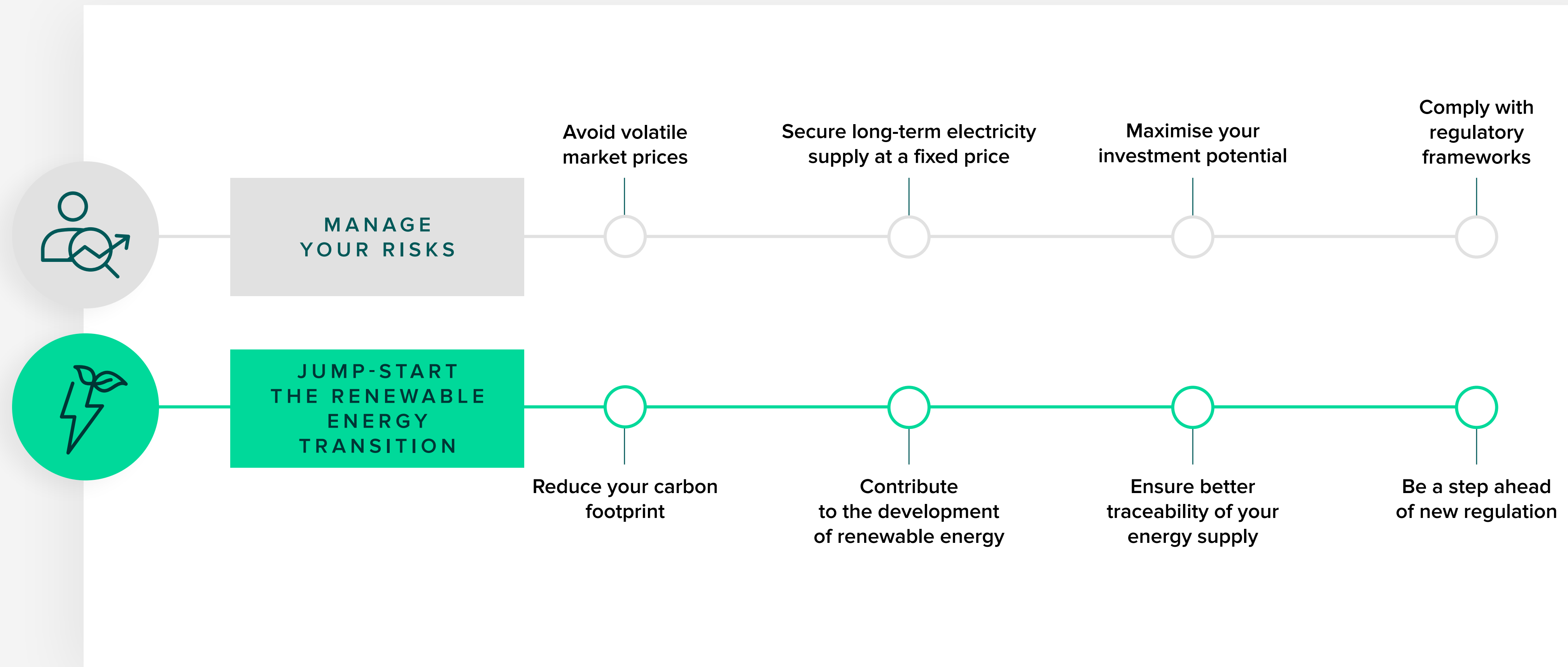
How does this differ from other types of supply?

- Comparison between a PPA and other types of procurement

How is a PPA put into practice?

- Interview with a consumer who has contracted a PPA

A look back at the main reasons for contracting a PPA



Manage your risks



Avoid volatile market prices

Electricity markets' high volatility can pose cash flow risks for businesses, especially during sudden price spikes caused by the global energy crisis. For instance, in France, electricity prices exceeded 1,000 €/MWh in August 2022, almost 20 times higher than in August 2020.

One of the main attractions of PPAs is to “hedge” or secure part of its supply.

Secure a long-term electricity supply and price

The push for carbon neutrality is increasing the use of electrification, leading to a higher demand for electricity. According to the IEA, global electricity demand is expected to increase by 25 to 30% by 2030 in specified policy scenarios (STEPS and APS). This increase is due to the expected adoption in electric motors, electric vehicles (EVs), heat pumps, and hydrogen technology. There are uncertainties about how production will evolve, specifically how to balance the integration of new assets and the exit of existing ones. This could potentially disrupt the balance between supply and demand.

PPAs provide long-term protection against potential challenges arising from structural changes in the electricity market in the coming years. They also offer visibility on cash flow. As a reminder, the average duration of a CPPA is 18 years in 2022.

Maximise your investment potential

Investment opportunities in renewable energy are limited, complex to implement and very expensive.

Unlike individual self-consumption, a PPA does not require infrastructure investments from the buyer.

Comply with regulatory frameworks

In 2025, the new Corporate Sustainability Reporting Directive (CSRD) will make over 8,000 European companies report on the environmental, social, and societal aspects of their activities. The companies concerned are listed companies and those meeting at least two of the following criteria: more than 250 employees, more than 20 million euros in balance sheets and/or 40 million euros in turnover. This marks a significant shift in European CSR requirements.

(1) Forecast report, 2023 edition – RTE

Contribute to the energy transition



Reduce your carbon footprint

Contracting a PPA directly reduces scope 2 emissions, which are indirect emissions related to a company's energy purchase or production. To do this, the PPA must satisfy three inseparable criteria:

- **Uniqueness:** the energy of a PPA can only be used for a single consumer;
- **Spatiality:** the renewable asset must be on the same transport network as the consumer;
- **Temporality:** the time step for reconciling data between production and consumption must be minimized.

Virtual PPA do not meet the criteria set out above, since the electricity from the production park is purchased and then resold directly by the consumer. **It is therefore advisable to contract a physical PPA to reduce your carbon footprint.**

Contribute to the development of renewable energy

In the context of greenfield projects, contracting a PPA allows the producer to secure financing for new assets without relying on government support. Thus, the consumer actively contributes to the deployment of renewable energies in its national energy mix.

Ensure better traceability of your energy supply

Energy traceability involves monitoring the renewable origin of purchased electricity. It is essential for companies aiming to ensure their supply aligns with environmental goals or carbon emission reduction. **In a physical PPA, the producer communicates the actual energy production to the consumer at agreed time intervals (hourly, daily, monthly) and ensures the delivery of the produced energy.** The consumer can also request the allocation of corresponding guarantee of origin certificates from the producer.

Be a step ahead of new regulation

According to IRENA, the development of renewable energies must be **at least 6 times faster** worldwide to help contain the rise in global temperatures below 2°C as set by the Paris agreement. In the European Union, for example, the objective is to reach **45% of the energy mix from renewable sources by 2030**. The pursuit of this objective may lead to more stringent regulations that compel consumers to obtain energy from renewable sources.

Subscribing to a PPA makes it possible to support the development of renewable energies and to anticipate changes in restrictive regulatory frameworks.

Comparison between a PPA and other types of supply

	Supply contract without Green certificate	Supply contract with Green certificate	PPA short term (Duration < 10 years)	PPA long term (Duration > 10 years)
Long-term price security	○	○	○	● ● ●
Traceability of renewable energy	○	●	● ● ●	● ● ●
Contribution to carbon accounting	○	● ● ●	● ● ●	● ● ●
Active contribution to the development of renewable energy	○	●	● ●	● ● ●
Local economic impact	○	○	● ●	● ● ●
Contractual simplicity	● ● ●	● ●	○	○
Easily implemented *	● ● ●	● ● ●	●	○

* In terms of resource mobilization and stakeholders implication

Degree of impact: ○ Weak → ● ● ● Strong

PPA Insights

A consumer's perspective

Pierre FAHY

Sustainable Development
Decathlon Retail France



FRAMEWORK

Customer: Decathlon
Producer & Supplier: Alterna energie
Location: Indre, France (36)
Technology: Solar
Capacity: 15 MWc
Operational: 2025
Duration of PPA: 15 years

Corporate

Physical Off-site

Solar

Greenfield

Pay-as-produced

Indexed

DECATHLON



Why did you contract a PPA (risk management, prices, decarbonization, energy transition, etc.)?

We had several reasons. It's a smart solution that lets us play our part in reaching our goal of having 100% renewable energy in our supply, all while keeping costs competitive and under control.

How do you see PPAs fitting into your company's strategy? How do they help with your overall goals, including CSR?

In the grand scheme of our transition, one major goal is to cut our CO₂ emissions by 20% across our entire value chain. While our direct consumption has a small impact on this, over 80% is tied to how we manufacture our products, often through energy-intensive processes. Not only do we want to source renewable energy but also set an example for our industrial partners.

Who were the internal stakeholders essential to the contracting?

It was a team effort, especially with our legal and financial teams.

How did you get support in figuring out your needs and navigating the PPA contracts?

We teamed up with a Project Management Consultant who guided us through all our procurement processes. Having their expertise was key to structuring these contracts.

How did you decide on the percentage of PPA coverage?

While we didn't have strict limits on this contract because our overall goal is much higher, we're not looking to go beyond 50% of On/Off-site PPAs. The final limit depends on the energy mix we can get (solar/wind) and any challenges in integrating it within our balancing perimeter.

What were the main challenges you faced from considering a PPA to signing the contract?

Luckily, we already had experience from a previous PPA, so we reached our target fairly quickly. Both parties collaborated really well throughout the process.

Any advice for a company thinking about getting into a PPA?

Define your needs as best as possible and seek guidance from experts. And don't be afraid to take the plunge!

Chapter C
**Asking the right questions
for a successful PPA**

What are the steps involved in contracting a PPA?

→ The essential steps to successfully complete your project

What are the key elements to consider when signing?

→ The contract and its terms
Focus: the P50 and P90 production indices
Focus: negative prices

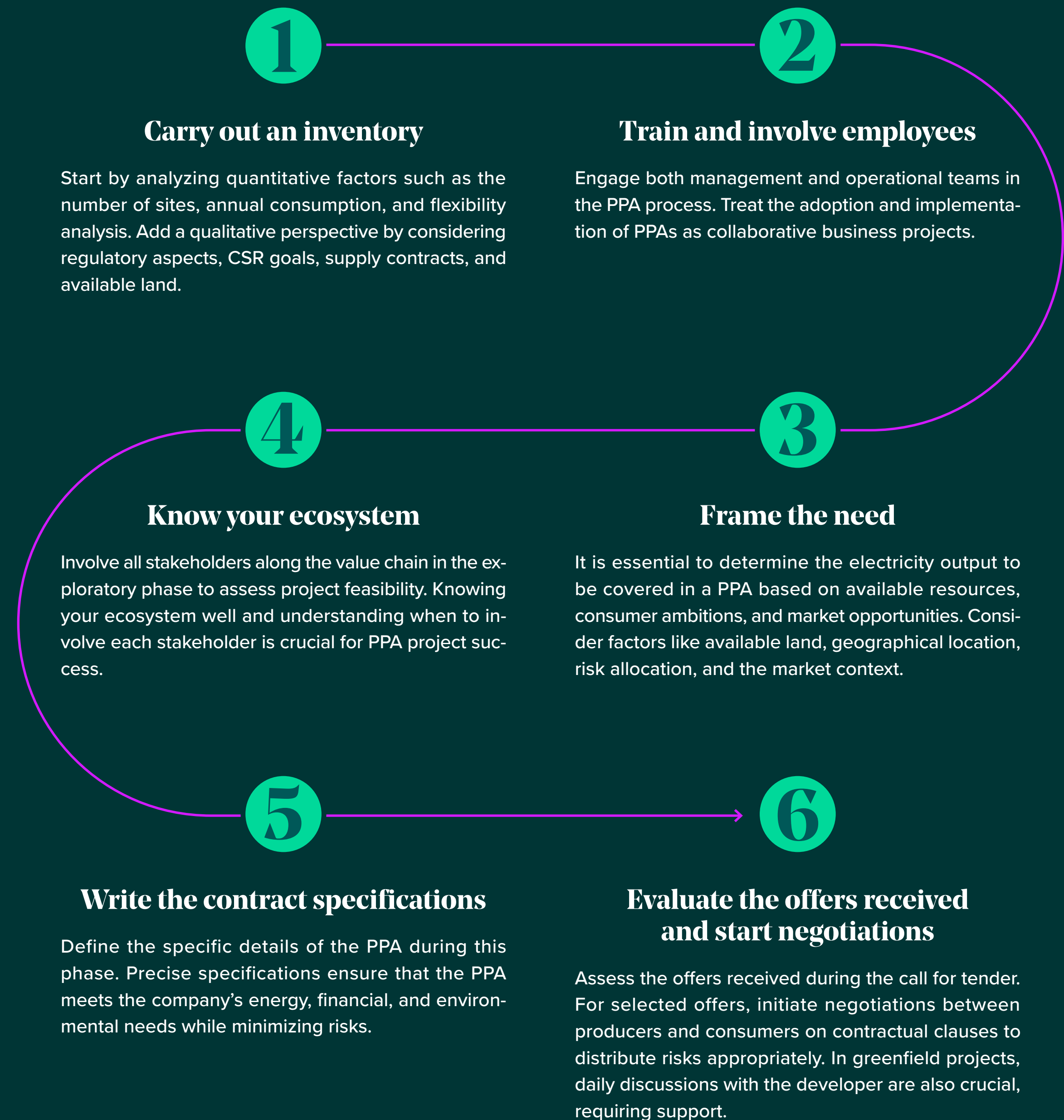
What are the mistakes to avoid?

→ Checklist

The essential steps to successfully complete your project

PPAs are a niche topic of deep complexity. Training and involving all employees, carefully determining your needs, and choosing the best offers pose potential challenges.

Getting help from experts speeds up the process and increases the chances of successfully implementing PPAs.



The contract and its terms

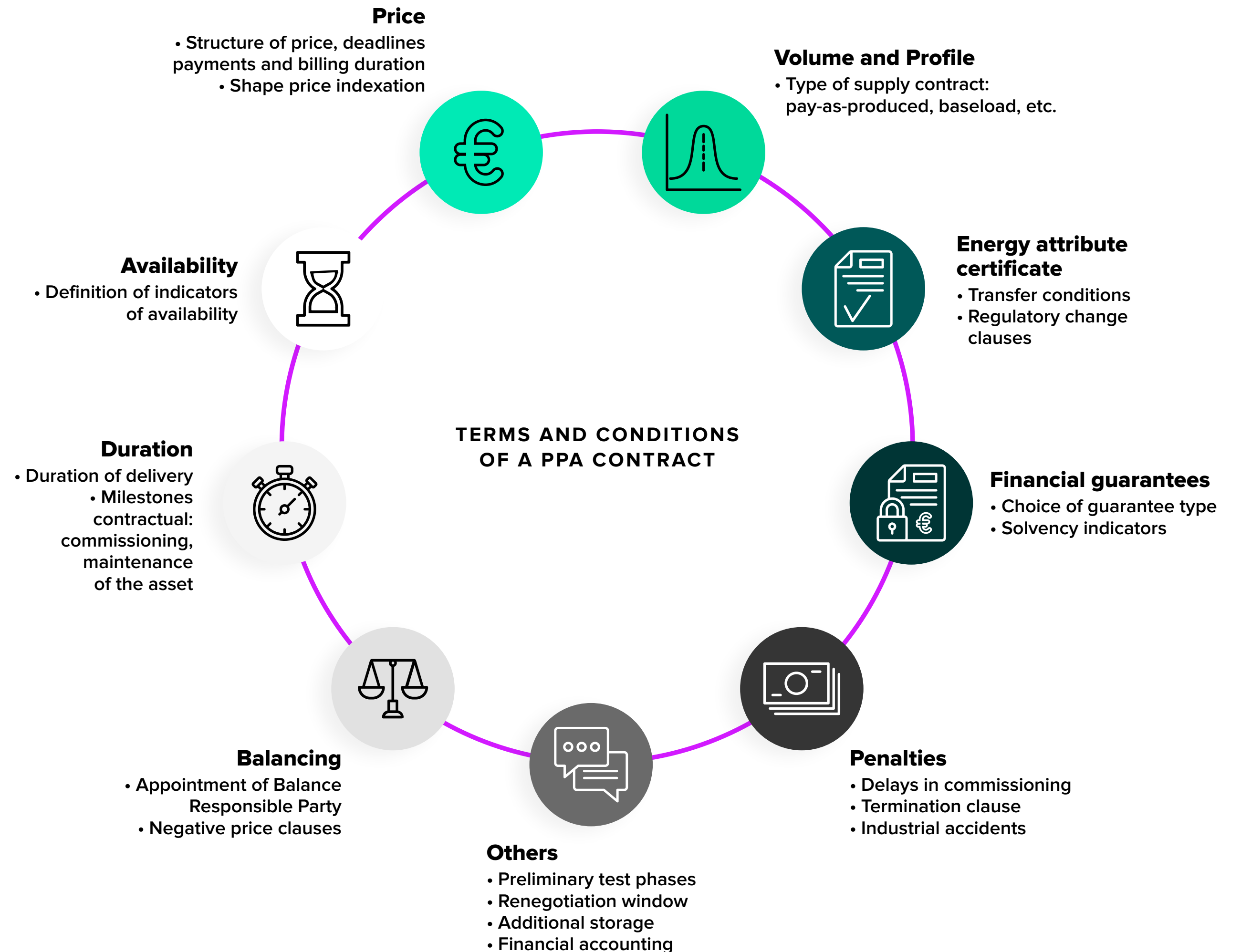
Contractual clauses

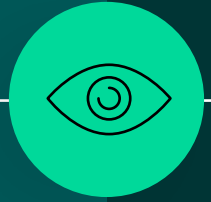
Negotiating detailed contractual clauses in PPAs provides clarity on the risks for all parties involved. This step is crucial for the contract's financial health and strength. Specialized law firms are needed to draft the contract, and it's recommended to involve experts to understand the company's needs and exposure for better PPA support throughout its lifespan.

Accounting

The accounting for PPAs varies based on the type of PPA and the contract clauses. Accounting is crucial as it influences the economic appeal of the PPA.

In Europe, IFRS 16 applies to lease contracts and is relevant in physical PPAs covering the entire economic production of a renewable asset. For virtual PPAs, the agreement is considered a financial instrument falling under the IFRS 9 financial reporting standard.





FOCUS

P50/P90 production indexes

The producer carries out studies to estimate how much electricity is likely to be produced in order to carry out financial modeling. They then communicate this information to consumers using probabilistic values called P50 or P90. P50 represents production with a 50% chance of happening over a year. This means there is an equal chance that actual production will be higher or lower than this value. P90 represents production with a 90% chance of happening over a year. This means actual production has a 90% chance of being higher than this value and only a 10% chance of being lower.

P50 is therefore always higher than P90.

The P50/P90 indicators consider seasonal changes and the impact of weather conditions. It's important to note that P50 and P90 values are used for guidance only, and actual asset performance may differ once in operation.

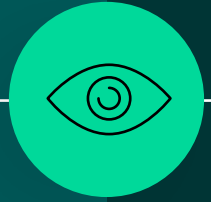
MONTHLY WIND PRODUCTION VS. P50 / P90 VALUES
(in MWh)⁽¹⁾



(1) Analysis via Partners & Alterna energy

KEY INFORMATION

- Producers use the P50/P90 forecast when bidding in response to tenders.
- These indicators are predictions and may not reflect actual production.
- PPAs can include storage to stabilize production.
- When evaluating various producer offers, it's crucial to use a uniform P50 or P90 index for accurate comparison.



FOCUS

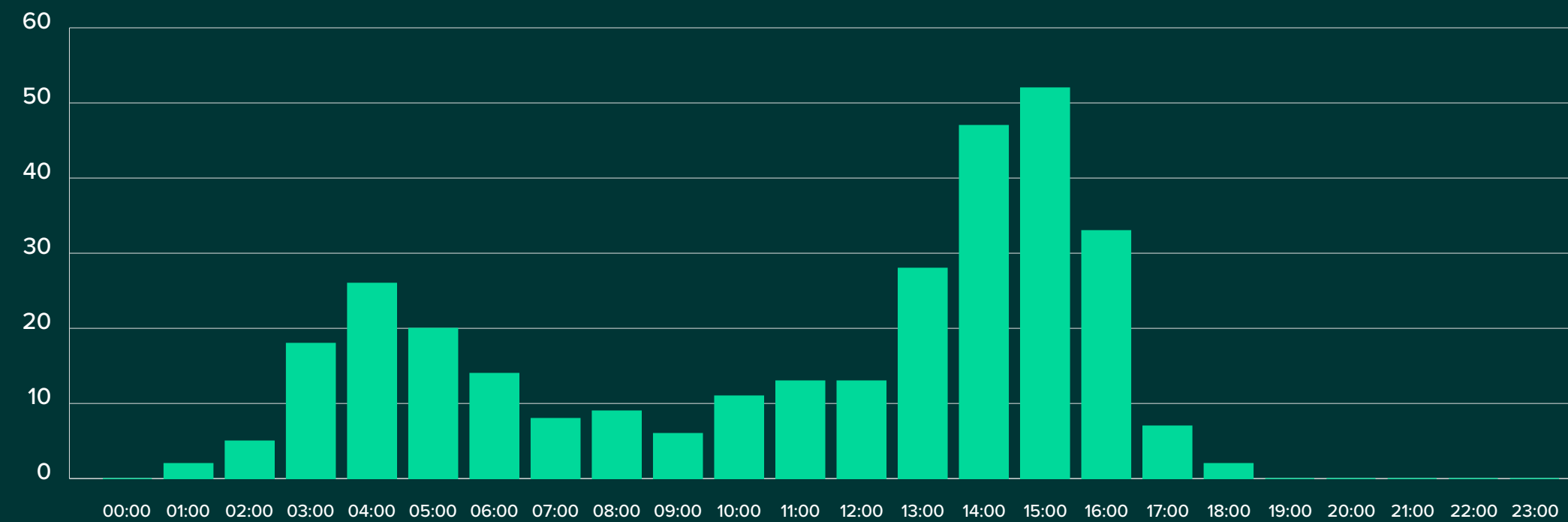
Negative prices

Wind and solar power are intermittent sources of energy: depending on **local weather data**, their production profiles vary significantly. Spot market prices, influenced by the balance of supply and demand, can drop significantly when there is excess electricity from wind and solar sources in a situation called **cannibalization**. As renewable energy production increases, these events happen more frequently.

During these events spot prices may even go below zero, resulting in negative prices. While PPAs are not directly affected by negative prices, consumers might miss an opportunity to get paid for using electricity when market prices are negative. Albeit contractually challenging, a PPA can include an agreement to share potential gains. In such cases the producer stops production and the consumer refunds part of the payment received from the market.

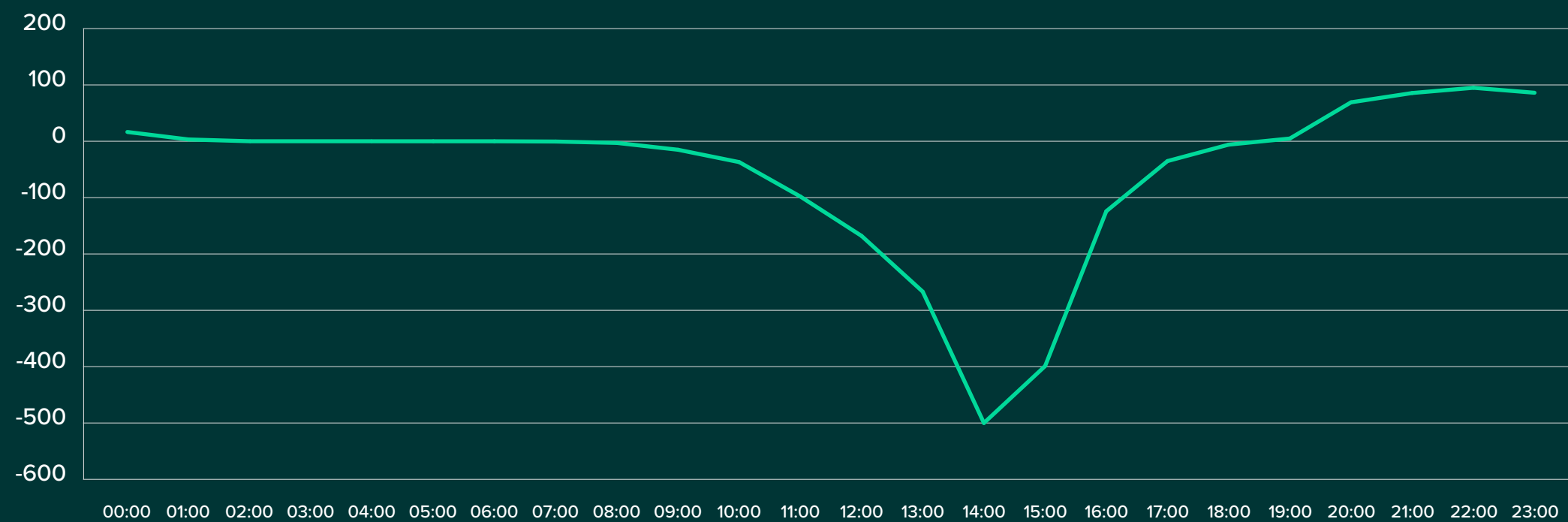
Negative prices typically occur during two main periods: at night, around 4 a.m., when demand is low, and wind power is high, and during summer days, between 2 p.m. and 5 p.m., when solar energy production is at its highest.

NUMBER OF OCCURRENCES OF NEGATIVE PRICE HOURS IN FRANCE
Per hour from 2016 to 07/08/2023⁽¹⁾



In Germany, where the development of renewable energies is well advanced, the occurrence of negative price periods is becoming more intense, culminating at -500 €/MWh in July 2023.

HOURLY SPOT PRICES IN GERMANY ON 07/01/2023 (in €/MWh)⁽¹⁾



⁽¹⁾ Analysis via Partners And Alterna energy on there base of the data from EPEX SPOT

KEY INFORMATION

- On many markets, the increasing frequency of negative prices, driven by the expansion of intermittent generation, is notable.
- The Duck Curve illustrates the market price pattern throughout a day, featuring a pronounced dip in the middle.

Our beliefs

What's next? Take the first step!

To encourage you to embark on your journey with PPAs, we're eager to share a few convictions we've developed while working on the topic.

1. Making PPAs accessible

Many customers have approached us in recent years with questions about PPAs: What are they? How do you proceed? What mistakes should you avoid? How do you gather the right support? We noticed the absence of a comprehensive guide that simplifies and explains PPAs. Therefore, we decided to combine our expertise and create this practical guide to assist you throughout your PPA project.

2. It is the moment

PPAs are on the rise, propelled by increasingly competitive costs of renewable production, a supportive regulatory environment, and improved market liquidity. The energy market crisis in 2022 has made consumers more mindful of risk management, market price fluctuations, and long-term energy supply security.

3. 100% PPA, a false good idea

PPAs offer a way to meet your organization's CSR goals and manage risks. However, covering 100% of your supply with PPA contracts alone can be counterproductive, leading to excessive market exposure and oversizing PPA production.

4. A business project above all

The complexity of PPAs necessitates the involvement of various stakeholders within your organization, including general management, finance, legal, CSR, and the support of experts throughout the project.

5. Signing your PPA is good, managing it is better

Contracting a PPA is the initial step in diversifying your sourcing, but it requires reconciling all your consumption and production data to gain a comprehensive view. As you diversify supplies and increase delivery points, having a single energy management platform becomes invaluable for controlling consumption and enhancing operational efficiency.

6. Gaining a competitive edge

PPAs go beyond a simple commercial transaction; they present an opportunity to reduce carbon emissions and contribute to the extensive development of renewable energies. By entering into PPAs, you are making a committed choice in favor of the energy transition. Traceability, additionality, and local economic impact are among the advantages you can highlight to your customers.

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SORÉGIÉS is a group of local energy companies that accelerates the energy transition at the heart of territories. To achieve this, SORÉGIÉS integrates the entire energy value chain: renewable energy production, management of distribution networks, supply of gas and electricity through short circuits, energy services, and decarbonized mobility. With over 1.5 TWh of electricity from wind, solar, and hydraulic sources, SORÉGIÉS offers its customers local and citizen-driven energy solutions that are efficient and close to home. Over the next three years, SORÉGIÉS will invest over 500 million euros to deploy its innovative model of local energy loops. With expertise in market access, aggregation, and operating dedicated flexibility for territories, SORÉGIÉS has formed a community of several hundred renewable energy producers throughout France. Within the SORÉGIÉS group, the subsidiary Alterna Energy transforms the energy supply model by making the energy-climate transition accessible to everyone, everywhere in France.

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