

The background of the entire page is a low-angle, upward-looking photograph of a wind turbine. The turbine's tower and nacelle are visible, with the three blades extending outwards. The sky is filled with soft, white clouds, and the lighting suggests a bright, sunny day. The overall color palette is dominated by blues, whites, and warm golden tones from the sunlight.

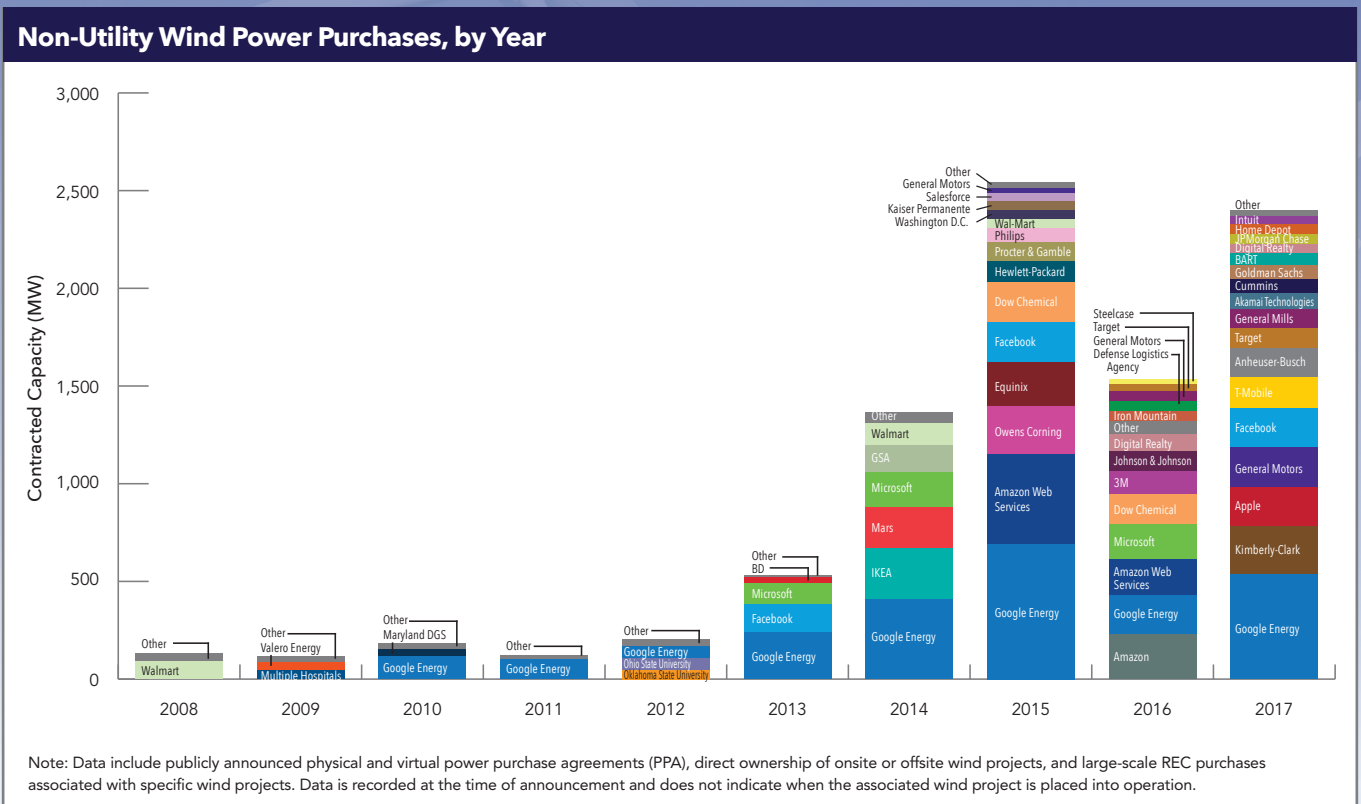
# CORPORATE BUYER'S GUIDE TO WIND ENERGY

[www.awea.org](http://www.awea.org)

Corporations are setting ambitious targets for renewable energy procurement, and are choosing wind energy more than any other source. Wind energy provides a cost-competitive solution for companies seeking to power their businesses with clean, renewable energy at a long-term stable price.

More than **9,100 megawatts (MW)** of **U.S. wind power** were procured through the end of 2017 by corporate and other non-utility customers.

**Corporate buyers represent 94%** of this total, demonstrating significant leadership among non-utility customers. *But they aren't done yet.* Since 2009, the cost of wind has fallen by 67%, and it is now the cheapest source of new generation in certain regions of the country. The time is now for corporate buyers to lock in historically low wind prices.



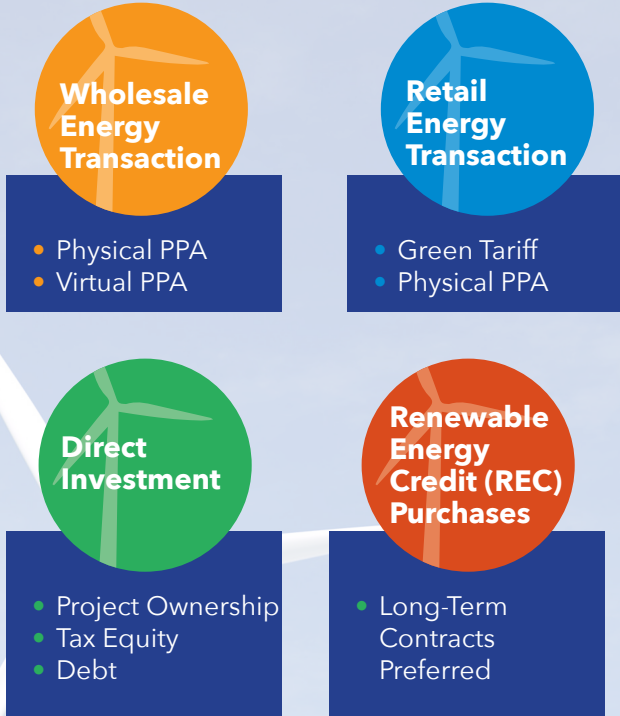
This primer introduces new corporate buyers to the world of wind energy procurement, explaining the multiple ways that a buyer can purchase wind energy.

For those interested in learning more about power purchase agreements (PPA), this primer provides more detail about the common terms found in a PPA contract, the typical negotiation points that can be expected, and the ways in which buyers and sellers can allocate risks inherent to the negotiation points. The final section provides additional resources for new corporate buyers on PPA structure and risk allocation.

AWEA will continue to release primers in the future that provide detail on other procurement methods.

# How to Purchase Wind Energy

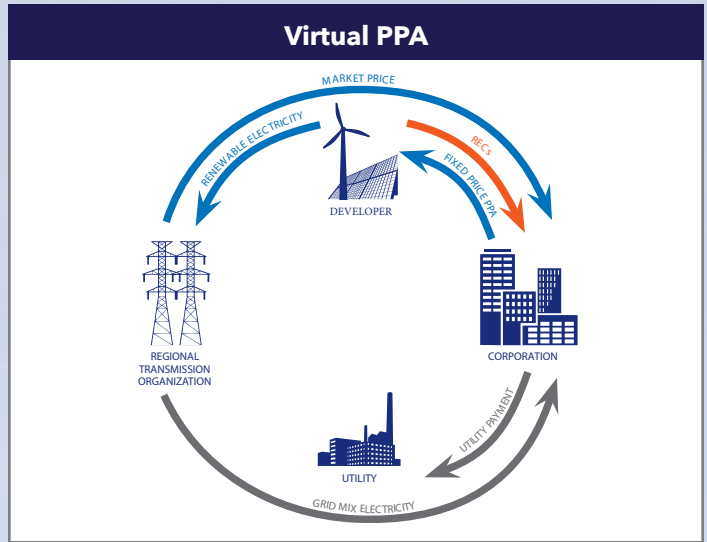
Corporate buyers can purchase wind energy from specific wind projects in a number of ways. Methods include purchasing wind energy through wholesale or retail transactions, making a direct investment in a wind project, or purchasing renewable energy credits (RECs).



The various procurement methods are described in more detail as follows:

## Wholesale Energy Transactions

● **Physical PPA:** A long-term contract to purchase energy – and potentially capacity or other environmental attributes – from a specific wind project, with physical energy delivery included. Contract terms are known and set for a defined period. Physical PPAs can be executed in deregulated retail electricity markets, or in wholesale electricity markets where the customer is registered as a wholesale power marketer. If customers are not equipped to be power marketers themselves, they may also utilize the services of third-party power marketers. When signing a physical PPA, the wind project must be located on the same electricity grid as the buyer’s electricity demand.



Source: EDF Renewables

● **Virtual PPA:** A long-term financial contract to purchase energy – and potentially capacity or other environmental attributes – from a specific wind project. Contract terms are known and set for a defined period. Virtual PPAs differ from physical PPAs because the wind project doesn’t deliver physical energy to the buyer, but sells it onto the wholesale electricity market, receiving a variable market price in return. The difference is calculated each month between the variable market price and a fixed price that the buyer guarantees the wind project; if the variable price is higher than the fixed price, the buyer gets paid the difference, and vice versa. The variable price is determined at a specific point on the grid, either the project’s point of delivery, or the closest market hub on the grid. Virtual PPAs are often called synthetic PPAs or contracts for differences. Virtual PPAs can only be signed with wind projects in wholesale electricity markets; the buyer’s electricity demand can be located anywhere in the United States.

All contracts contain some element of risk, but new solutions emerge every day to help mitigate risks inherent to PPAs. For example, proxy revenue swaps can be utilized for a fee to transfer price and volume risk inherent to a virtual PPA to a third party. These third parties have an appetite to take on “weather risk” such as variable wind speeds. They are called

# How to Purchase Wind Energy (con't)

hedge providers because they provide a “hedge” product, or a strategy to protect against potential loss. With a proxy revenue swap, the hedge provider agrees to pay the seller a net, fixed annual price based on expected wind generation and revenues. In return, the seller agrees to pay the hedge provider a “proxy revenue,” or an annual payment based on a percentage of expected wind generation and revenues.

## Retail Energy Transactions

- **Green Tariff:** Utility-created programs that allow eligible buyers to buy energy – and potentially capacity or other environmental attributes – from one or more wind projects. Green tariffs create opportunity for customers to buy wind energy directly through their local utility, which is important in regulated electricity markets where it can be difficult to directly procure wind energy. Green tariffs can be designed in multiple ways:

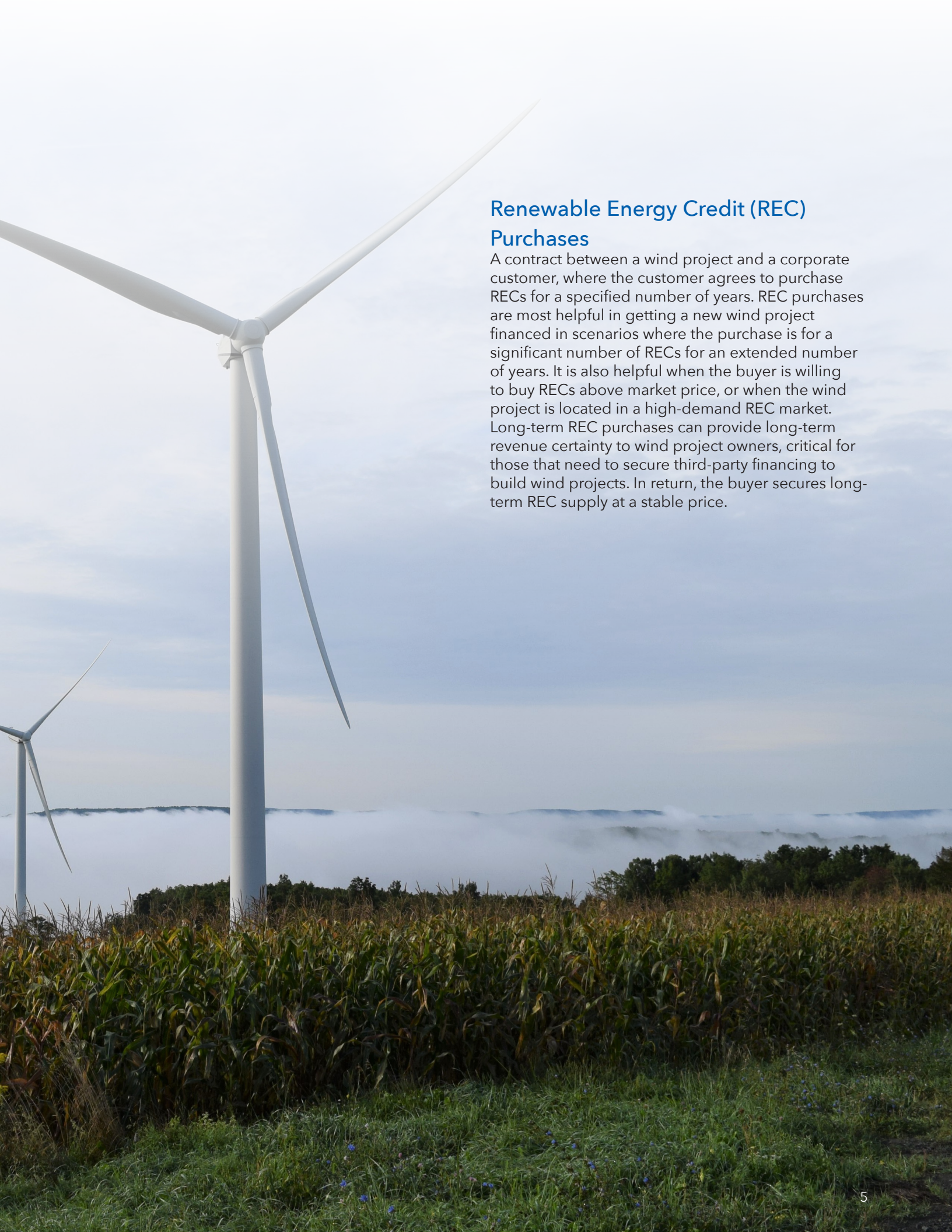
**Sleeved PPA:** The buyer or the utility executes a PPA with a wind project, or a utility develops and owns a rate-based wind project; the pricing and terms are sleeved, or passed, through the utility onto the buyer’s retail bill.

**Subscriber Program:** The utility creates an energy product offering supplied by one or more wind projects in the utility’s resource portfolio mix; one or more buyers enroll to receive a percentage of the total product offering, and the pricing and terms are reflected on the buyer’s retail bill.

- **Competitive Retail Suppliers:** Corporate customers in deregulated retail electricity markets can procure wind energy – and potentially capacity or other environmental attributes – through competitive retail suppliers. The pricing and terms are reflected on the customer’s retail bill.

## Direct Investment

- **Project Ownership:** Corporate customers can choose to directly own a wind project located either onsite or offsite their facilities, acting as the project’s equity sponsor. The project can be as small as an individual wind turbine, or as large as the customer desires. Buyers may choose to retain or sell the energy and other attributes associated with the project, depending on the buyer’s preferences and the electricity market where the project is located.
- **Tax Equity and Debt Investment:** The U.S. wind industry relies heavily on project finance markets to fund new projects, and primarily recruits two types of investment: tax equity and project debt. Corporate customers with sufficient tax appetite have an opportunity to become tax equity investors. These investors make an equity investment into a wind project, with a primary interest in receiving the tax credits that the project produces. Others can opt to provide debt capital to the project in the form of a loan.



## Renewable Energy Credit (REC) Purchases

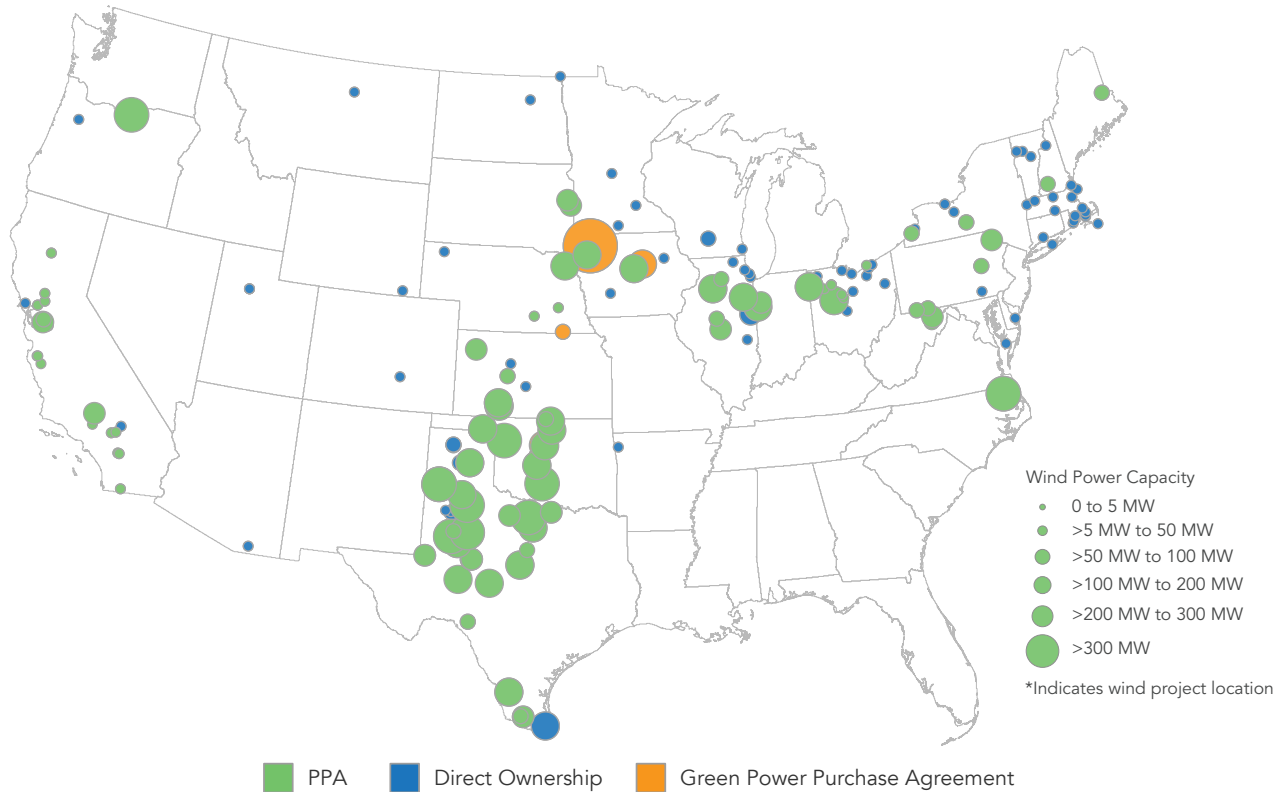
A contract between a wind project and a corporate customer, where the customer agrees to purchase RECs for a specified number of years. REC purchases are most helpful in getting a new wind project financed in scenarios where the purchase is for a significant number of RECs for an extended number of years. It is also helpful when the buyer is willing to buy RECs above market price, or when the wind project is located in a high-demand REC market. Long-term REC purchases can provide long-term revenue certainty to wind project owners, critical for those that need to secure third-party financing to build wind projects. In return, the buyer secures long-term REC supply at a stable price.

# Focus on Wind PPAs

For companies seeking to achieve renewable energy targets, **wind PPAs remain one of the most popular tools available.**

**More than 8,000 MW in PPAs** have been signed since the beginning of 2008, with 80% of that total signed in just the past four years.

Map of Projects with Non-Utility Purchasers of Wind



Note: Data include publicly announced physical and virtual power purchase agreements (PPA), direct ownership of onsite or offsite wind projects, and large-scale REC purchases associated with specific wind projects. Data is recorded at the time of announcement and does not indicate when the associated wind project is placed into operation.

PPAs provide long-term revenue certainty to wind developers, crucial for those that need to secure third-party financing to build wind projects. They also allow buyers to protect themselves against future fuel price uncertainty, particularly future natural gas price increases. Note that certain types of PPAs can only be signed in certain electricity markets. Physical PPAs can only be signed in deregulated retail markets, or in wholesale markets where the customer is registered as a wholesale market participant. When signing a physical PPA, the wind project must be located on the same grid as the buyer's electricity demand. Virtual PPAs can only be signed with wind projects in wholesale markets; the buyer's electricity demand can be located anywhere in the United States.

# What Does a Wind PPA Look Like?

Wind PPAs can vary widely depending on contract structure and terms. Although this is not an exhaustive list, what follows are some of the most common terms found in a PPA.

TERM	DEFINITION
Product Description	Describes the product being purchased by the buyer. The product may include energy, capacity, renewable energy credits (REC), or other environmental attributes.
Structure	Describes the structure of the contract, typically a physical or virtual PPA.
Price	The price being paid by the buyer to receive the product, as measured in \$/MWh. An escalation or de-escalation factor might be included.
Quantity	The amount of the wind project's total output being allocated to the buyer, as measured in megawatt-hours (MWh).
Renewable Energy Credits (REC)	A certificate that proves electricity was generated from a renewable energy resource. RECs are tradable, distinct commodities that can be bought and sold separately from electricity.
Other Environmental Attributes	A non-REC method of valuing renewable energy generation, including but not limited to carbon credits or offsets.
Point of Delivery	The point on the electricity grid where energy is delivered to the transmission system, either the busbar, node, or hub. Depending on contract structure, the point of delivery may also be considered the point of settlement.
Credit Support	The means of providing collateral to mitigate potential losses or risks inherent to the contract; for example, letters of credit, cash, or payment guarantees.
Curtailment Provision	Details on if and when curtailment can be requested by the buyer, and the financial implications when curtailment is ordered by the grid operator.
Term	The period of time when the contract is in effect.
Commercial Operation Date (COD)	The date when the wind project is expected to become operational.
Minimum Energy Production or Availability Guarantee	The minimum level of energy production or generator availability guaranteed by the contract. Level of production or availability will vary.
Termination Rights	Option to terminate the contract if terms are not upheld, such as if the project does not come online by its commercial operation date or there is a failure to meet payment obligations.

# Common Negotiation Points in a Wind PPA

The buyer and the seller will need to negotiate terms in order to finalize and execute a PPA. Although not an exhaustive list, what follows are five commonly negotiated points in a wind PPA, including details on how the buyer and the seller can allocate risks inherent to the negotiation points.

	WHAT IT IS	HOW TO ALLOCATE RISK
<b>Price</b>	When a buyer and a seller agree on a fixed price, they inherently accept price risk, or the uncertainty that electricity market prices might rise above or fall below the fixed price agreed to for the contract term. The seller risks losing money if overall electricity market prices rise in comparison to the PPA price, and vice versa.	The buyer will assume price risk by agreeing to pay a fixed price, plus or minus settlement payments, if signing a virtual PPA. Price risk can be shared by transitioning from a fixed price to a price with a floor and ceiling, or by setting the fixed price equal to a wholesale market price. Price risk can also be mitigated through a proxy revenue swap.
<b>Settlement Point</b>	The settlement point is one of the most commonly negotiated points of a virtual PPA. With a virtual PPA, the seller doesn't deliver physical energy to the buyer, but sells it onto the wholesale market, receiving a variable price in return. The difference is determined each month between the variable price and the fixed price being paid by the buyer. If the variable price is higher than the fixed price, the buyer gets paid the difference, and vice versa. <i>Importantly, the settlement point determines the variable price.</i> The settlement point can be the project's point of delivery, or the closest market hub. Settlement points are commonly negotiated because market hub settlement points carry basis risk, or the difference between the market hub price and the price a wind project actually receives for delivering energy onto the grid. Although less common, physical PPAs can potentially carry basis risk if they are executed in a wholesale market with nodal pricing.	The seller will assume basis risk when settling at the market hub. Conversely, the buyer will assume a greater degree of basis risk when settling at the wind project's point of delivery, since the electricity price at the point of delivery is generally less correlated to the electricity prices that the buyer sees on its normal retail bill. Alternative arrangements can be made to share basis risk, such as by agreeing to periodically adjust the fixed price in the contract to account for basis risk.
<b>Expected Wind Generation</b>	A PPA can be designed in one of two ways: the buyer agrees to purchase wind energy as it is generated, or the buyer agrees to purchase a set amount of wind energy by the hour, month, season, or year. That set amount is based on a pre-determined, expected level of wind generation, or an expected profile. The expected profile is a commonly negotiated contract point because where there is an expected profile, there is volume risk and profile risk. Volume risk is the possibility that actual wind generation, over a long period of time, will fall short of the expected profile. Profile risk is the possibility that hourly wind generation will not match the buyer's hourly demand.	The buyer will assume a degree of volume risk by choosing to purchase a set amount of wind energy. However, that risk can be mitigated if the seller agrees to provide a minimum amount of wind generation during a contract-designated period of time, usually a year. If that minimum amount is not met, then the seller is contractually obligated to provide compensation. Volume risk can also be mitigated through a proxy revenue swap. The buyer will also assume profile risk by agreeing to purchase a set amount of wind energy. Although profile risk can be difficult to mitigate, it can be done in certain ways. For example, the contract can provide for the settlement price to be adjusted during certain time periods. In rare circumstances, the seller can agree to provide a set amount of wind generation by the hour or day.



	WHAT IT IS	HOW TO ALLOCATE RISK
<b>Congestion/ Curtailment Provisions</b>	<p>Congestion occurs on the grid when local transmission lines reach their technical limits in terms of the amount of energy they can carry. As a result, energy prices decrease. Curtailment occurs when a wind project is forced to reduce wind generation from what it could otherwise produce. Curtailment can be caused by congestion, but it can also be caused by lack of transmission access, excess generation during low load periods, voltage, or interconnection issues. Congestion and curtailment provisions must be negotiated to determine what level of compensation might be owed in the case of reduced prices or reduced generation.</p>	<p>The buyer will assume congestion and curtailment risk if they agree to buy energy at any market price, or if they agree to pay the seller during curtailment periods as if the project were generating at normal levels. The seller will assume risk if they set a price floor at which the buyer will purchase energy, or if the buyer does not have to pay the seller during curtailment periods. Risk can potentially be shared by dividing the number of hours per year when the buyer and the seller assume one or both risks.</p>
<b>Credit</b>	<p>Both the buyer and the seller must provide collateral to mitigate potential losses inherent to a contract. The timing and amount of credit provided is a commonly negotiated point in a contract as it affects credit risk, or the risk that counterparties might not be able to meet their financial obligations under the contract. For wind projects with more than one buyer, additional credit risk exists that one of the other buyers could fail to meet their financial obligations.</p>	<p>The buyer will usually provide credit support in the form of cash, letters of credit, or an affiliate guarantee. The seller will often supply a parent guarantee, but can also choose to post cash or letters of credit. Corporate customers are usually required to provide a higher level of credit than the seller.</p>



## How to Learn More

More information can be found on PPA structure and risk allocation on the AWEA website and through these publicly available resources:

- Evolution of the Corporate Wind PPA: Market Insights, AWEA
- Innovation in Power Purchase Agreement Structures, World Business Council for Sustainable Development
- Introduction to Virtual Power Purchase Agreements, EPA Green Power Partnership
- Renewable Energy PPA Guidebook for Corporate & Industrial Purchasers, Apex Clean Energy, American Council on Renewable Energy
- Financing Projects with Virtual PPAs, Norton Rose Fulbright
- An Introduction to Renewable Energy PPAs, Business Renewables Center
- Accelerate Your Energy Strategy with Power Purchase Agreements and Proactively Managing Risks to Accomplish your Long-Term Energy Goals Using Renewable PPAs, Schneider Electric



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