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**USAGE OF POWER PURCHASING AGREEMENTS
IN THE DEVELOPMENT OF RENEWABLE ENERGY
SOURCES**

**WYKORZYSTANIE DŁUGOTERMINOWYCH UMÓW
ZAKUPU ENERGII ELEKTRYCZNEJ W ROZWOJU
ODNAWIALNYCH ŹRÓDEŁ ENERGII**

Abstract: The purpose of this article is to indicate power purchase agreements (PPA) as an important supporting element of the development of renewable energy sources (RES). The author states that as result of the reduction of RES investment costs, PPA become the compe-

titive way to support the development of generation capacities in power sector. That is why the RES power procurement done by large industrial plants in many markets is competitive in relation to conventional power producers. In this situation, the PPA contracts become an instrument replacing state subsidies in securing the financing of RES investments. The more so that PPAs are concluded by more and more industrial enterprises, also increasing their geographical coverage. The article defines PPAs, their classification and the most important examples of their application.

Keywords: Power Purchasing Agreements, Renewable Energy Sources, power market, risk, climate change

Streszczenie: Celem niniejszego artykułu jest wskazanie istotności długoterminowych umów zakupu energii elektrycznej (PPA) dla wspierania rozwoju odnawialnych źródeł energii (OZE). Autor stwierdza, że w rezultacie obniżenia kosztów inwestycji OZE PPA stają się atrakcyjnym sposobem rozwoju mocy wytwórczych w elektroenergetyce. Na wielu rynkach zakup energii elektrycznej na potrzeby dużych zakładów przemysłowych z OZE jest konkurencyjny w stosunku do tradycyjnej elektroenergetyki. W takiej sytuacji umowy PPA stają się instrumentem zastępującym subsydia państwowe w zabezpieczeniu finansowania inwestycji w OZE. Tym bardziej że umowy PPA zawierane są przez coraz więcej przedsiębiorstw przemysłowych oraz zwiększają swój zasięg geograficzny. W artykule zostały zdefiniowane umowy PPA, przedstawiono ich klasyfikację oraz najważniejsze przykłady zastosowania.

Słowa kluczowe: długoterminowe umowy zakupu energii elektrycznej (PPA), odnawialne źródła energii (OZE), rynek energii elektrycznej, ryzyko, zmiany klimatu

Introduction

The attractiveness of renewable energy is supported by forecasts regarding the reduction of its prices, when electricity from conventional power plants may become more expensive in the future. Purchase of electricity from renewable energy (RES) allows for hedging against price fluctuations caused not only by changes in fossil fuel prices, but also greenhouse gas emission rights or the impact of climate change policy on energy prices. Since the production of electricity is not the basic activity of industrial plants, it is difficult to obtain the consent of their owners to implement investments in renewable energy. Hence, the use of Power Purchasing Agreements (PPAs) that are not associated with capital investments and building fixed assets is becoming increasingly popular. Until recently, most PPAs were concluded in North America and Europe by companies operating in related sectors with information technologies¹. Currently, other companies are beginning to enter this market. An example is both airports and railways, as well as production facilities. PPAs are also a marketing tool, presenting renewable energy clients as ecologi-

¹ For computing centers, the cost of electricity is up to 15% of operating costs.

cal and environmentally friendly organizations. The above has become a premise for the author to take up the topic of using Power Purchasing Agreements (PPAs) in financing renewable energy sources (RES) investments. Because the article deals with new trends and phenomena currently affecting the global power industry, the author bases on data obtained directly from the energy market.

The increase in risk on the energy market in 2018 increased the value of PPA transactions – a record was noted in the first half of 2018, when 7.2 GW PPA was concluded and 5.4 GW in the entire 2017². Although the PPA market is developing in the EU and the US, particularly high activity in 2018 was recorded in Sweden and Norway, where the contracts concerned cross-border supplies of green electricity. In addition, PPAs are also concluded in locations where there are large investments in renewable energy – this applies, for example, to Great Britain and the Netherlands. Another reason for concluding PPAs is the end of the renewable energy support period in Germany and the search for opportunities to hedge the market risk of functioning renewable energy sources. The above trends are confirmed in data for 2018, when industrial enterprises more than doubled their RES purchases based on PPA. Globally, PPAs relate to around 8% of contracted renewable energy. Activity on the PPA market also creates liquidity on the forward market for long-term products, which is related to hedging activities for market risk associated with PPA contracts. It is estimated that 2018 in Europe has a PPA of about 5.5 TWh³. For the first time such contracts were concluded in Poland, Germany or Spain. Not only IT companies or data centers contain PPA, but also traditional industry.

1. Characteristics of PPAs and their classification

The PPA, which is a long-term energy purchase contract, serves to hedge the market risk of investments in productive assets on the energy market: *the investor has a certain level of revenues ensured, and the buyer receives energy at a price more favorable than market forecasts*⁴. These agreements are often concluded before starting production and become the basis for obtaining cheaper financing, as they determine long-term stable foundations for the functioning of the investment.

PPAs can take the following forms:

- 1) *physical supply* of green electricity via a direct power grid (using the distribution operator's network; a direct grid connecting the producer and the customer);
- 2) *virtual* PPAs, constituting a financial instrument.

² Power market liquidity set to rise amid PPA boom – experts, w „Montel News” 2019, www.montelnews.com [access: 28.01.2019].

³ Corporate PPAs will continue to surge – Vattenfall, „Montel News” 2019, www.montelnews.com [access: 25.02.2019].

⁴ The possibility of sharing the risk among the parties to the contract contributes to the attractiveness of the PPA among investors in RES.

If the parties are not interested in the supply of electricity – an example can be computing centers of high technology companies such as Google, Apple or Microsoft – the solution is to use *virtual purchase contracts* (VPPA). This is the answer to the problem of the inability to physically purchase all “green” energy (100% of demand) from the local supplier’s network. The VPPA buyer, by concluding the contract, undertakes to finance part of the project, securing the minimum price of electricity. The investor or RES operator sells electricity on the wholesale market, while buyers of VPPA can, for example, settle accounts with the project owner on the basis of a swap contract. Setting a fixed price of energy from RES allows for eliminating the impact of market risk, which translates into the availability of financing for the project – investors expect to secure future revenues affected by market risk (both the volume of production and the prices obtained from its sale). They are willing to accept the risk of volume, however, they expect price level hedging so that they do not deviate significantly from the investment profitability assumed in the financial projections. Hence, the conclusion of the VPPA contract facilitates obtaining financing for the construction of a wind or solar power plant, providing benefits to both parties to the contract: *the company acquires renewable energy from RES at a pre-determined price, and the investor secures financing for it*. Another benefit for the buyer is to avoid the need for physical transmission of electricity. In addition, the use of VPPA allows RES owners to increase the group of entities to whom they can sell their production. In addition to traditional recipients, which are power companies, contractors may also be financial institutions, administrative units, and production and service enterprises (internet companies, commercial networks, chemical plants, electronics manufacturers, etc.). In this way, these entities may also indicate that they are involved in the RES development, although they do not directly implement this type of investment.

As mentioned before, VPPA is a form of hedging market risk. There are several types of VPPA to be identified:

- *SWAP* – the contract is settled financially, and the producer sells electricity directly to the spot market⁵, where the buyer purchases a secured volume. Therefore, both parties hedge market risk: *The RES project developer compensates the green energy buyer for the excess price on the spot market above the agreed price in the contract, while the buyer compensates for the difference if the price on the spot market is lower than that specified in the contract* (this mechanism gives the same effect if both parties transfer the full amount : the buyer transfers all the RES energy value based on the contract price, while the seller transfers the amount obtained as a result of sales on the spot market);
- *Option* – indicate two types of possible options: *option accounted for as a re-*

⁵ The next day’s market - delivery takes place the next day after the transaction.

sult of delivery and options accounted financially. In the case of VPPA, the option should be analyzed financially to avoid the obligation to supply electricity. In this case, the parties have the right or obligation – depending on the type of option – to make a payment of a certain amount, calculated in accordance with the option contract;

- *Forward* – the sale of a commodity, which is electricity from RES at a fixed price with future delivery. The parties may also divide the contract into two elements: *the price of electricity and the price of a certificate* confirming the origin of energy from renewable energy sources. In this situation, the price of electricity is closely linked to the forward or spot market (depending on the contract design). In the case of VPPA, only financial settlement takes place.

Negotiating the VPPA contract is characterized by high requirements for competence in the field of energy market and financial instruments, which creates high *legal and operational risk*. Another risk, *credit risk* is associated with the possibility of failure by either party to such a contract of its obligations, as VPPA is concluded on the OTC market. For example, a green energy producer may go bankrupt, a VPPA buyer may not be able to pay the excess price above the VPPA exercise price (for a swap contract), or pay for the green energy supplied (for a forward contract). And one of the most important operational risks is the need to properly include the VPPA contract in the books, which is associated not only with its inclusion in the books of accounts, but also the correct valuation at the end of the month (*model risk*). The parties to the contract are also exposed to *regulatory risk*, which results from the regulator's possibility of changing RES support systems.

2. Examples of support for RES development using PPAs

In the United States, PPAs are an instrument to support RES development. PPAs include technology companies such as Apple, Google, Microsoft and Facebook, seeking to switch to power their computing centers from RES. Not only the largest banks like *JP Morgan Chase, Citigroup, Goldman Sachs* or *Bank of America*, but also the *US Department of Defense, WalMart*, and *Dow Chemicals* have joined technology companies. In Europe, support was mainly provided by countries that guaranteed stable return on investment. Currently, quasi PPAs are concluded under auction systems – the state guarantees the investor who won the auction by offering an attractive sales price, stability of revenues in the long term (e.g. 15 years). However, in the situation of gradual withdrawal of EU Member States from the guarantee of support for RES investment, commercial PPAs provide prospects for the RES development in the EU, which also becomes a response to increasing ecological awareness of European society⁶. An example

⁶ Production based on renewable energy may in the future become a condition taken into account in tenders or a decisive factor in allowing investments in given locations.

of a developed market for these agreements is the Netherlands, where energy using PPA from RES was bought by railways or a passenger airport operator. The development of PPA in the Netherlands results from the industry trend to become more and more ecological („green”), which is in response to the expectations of the Dutch society. In France, the period of stable prices is coming to an end, resulting from the high share of nuclear power plants in the energy mix. A change in the share of individual types of production sources will at least at the beginning of the process lead to changes in electricity prices on the wholesale market. PPA, currently used by wind and solar power plants, is a hedge against the increase in volatility of electricity prices. PPA has already been concluded by such enterprises as Paris Airport and SNCF (state railways), which decided that it is worth securing part of their electricity demand by means of such agreements⁷. More countries in Europe are opening up to PPAs from RES. Scandinavia, Great Britain and the Netherlands are joined by Italy, Germany and Poland. Trading companies are also entering the RES and PPA market, which offer producers the management of their production portfolio sales and market position balancing services.

PPA is perceived as an interesting risk response instrument by power companies. An example is Vattenfall, which won the auction for the world's first wind farm without support with additional subsidies of 700 MW, which will be built off the coast of the Netherlands by 2022. The concern plans to hedge against volatility of electricity prices using PPA. The risk to the venture is the low liquidity of the PPA market in Europe. Only about 5% of investments in renewable energy are secured against risk in this way. An example would be the conclusion of PPA between Microsoft and Vattenfall in the Netherlands in 2017 regarding ten-year electricity supply from the *Wieringermeer* wind farm (295 MW capacity) and several smaller PPAs securing the market risk of Vattenfall solar farms in the Netherlands. Eneco and *Innogy* concluded similar contracts in the Netherlands. Securing the risk of a 700 MW wind farm may prove problematic basically because of the low liquidity of the market and the search for several entities that are PPA parties. Hence, energy sales through PPA will probably be carried out in tranches for many entities that are industrial clients and IT concerns. The challenge will probably be to convince potential PPA customers that such a transaction will reduce their electricity supply costs and help them achieve their environmental goals. In 2018, Vattenfall concluded a PPA agreement with the pharmaceutical companies *Novozymes* and *Novo Nordisk* regarding the sale of electricity from the *Kriegers Flak* wind farm – PPA covers about 20% of the plant's production.

In December 2018, Dutch Eneco concluded PPA with the developer⁸ of offshore wind farms *Seastar* and *Mermaid* off the Belgian coast with a total capacity of 487 MW

⁷ However, CEZ as the largest power group in the Czech Republic is skeptical about the current level of PPA market development in France and Germany and the possibility of replacing subsidies with long-term PPAs as support for renewable energy development.

⁸ A consortium in which Eneco holds 12.5% shares, *Otary* 70% and *Engie Electrabel* 17.5%.

(investment value of EUR 1.3 billion), which are to start production in 2020. *Eneco* will buy all production from both farms⁹. In Finland, *WPD Finland* developer is investing in a third wind farm without subsidies. Its power is 60 MW. It will be built in central Finland at *Kannus*. Investment financing is ensured by the conclusion of a PPA covering 100% of production. Earlier, PPA supported the investments of the developers of *CPC Finland* and *Tuuliwatti*. Google in Finland also concluded a PPA with three wind farms with a total capacity of 190 MW (Neon, CPC, WPD developers). Another example of using PPA is a long-term contract for the sale of electricity from 660 MW solar power plants concluded by *Cox Energy* for investments in Spain (495 MW) and Portugal (165 MW)¹⁰. *Audax Energia* is a party to the contract (buying electricity). The PPA is collateral for loans financing the investment. The price guarantee applies to 20 years. In Spain, at the end of 2017, in addition to government support, investments in solar farms with a total capacity of 19 GW were developed, some of which were financed thanks to the PPA. An example of the growing importance for PPA in financing the development of renewable energy in Spain is to secure the risk of a 300 MW *Caceres* farm, to which the Israeli *Ellomay Capital* fund is a party. Another company that plans to finance solar power plants in Spain with PPA is German BayWa, which ultimately plans to finance in this way 1 GW of installed capacity – currently PPA secures the functioning of the 175 MW *Don Rodrigo* solar power plant (contract with the Norwegian company *Statkraft*).

In the United Kingdom in 2017, the first solar power plant was established that does not use government support: *Clayhill*, which was connected to an energy storage. In 2018, a 15 MW investment began in the *Westcott Venture Park*, which will also not benefit from government support. It should therefore be assumed that in the United Kingdom electricity production costs at solar power plants are comparable to conventional power plants. Electricity using the PPA will be bought by companies operating in the business park. Another example of PPA is the purchase of electricity by the *Orsted*¹¹ energy group from the *Innogy Trinton Knoll* offshore wind farm located off the coast of Great Britain with a capacity of 860 MW. The PPA contract was concluded for 15 years and the sale price specified at the auction in 2017 was 74.75 GBP / MWh. The volume of energy bought by Orsted is about 3.2 TWh (100% of the plant's production capacity). *Statkraft* aims to conclude a 4 GW PPA in Germany. The first step is PPA agreements with municipal wind farms with a capacity of 46 MW in Lower Saxony regarding the supply of electricity to the industrial customers of the concern¹². Since,

⁹ Eneco also participates in the 370 MW *Norther* offshore wind farm project, which will be built off the Belgian coast.

¹⁰ The majority of shares in these investments were taken over by the *Sonnedit* investment fund managed by *JP Morgan*. This fund controls approximately 1.4 GW of investments in photovoltaic projects in Europe.

¹¹ Formerly Dong Energy. It is currently the largest investor in offshore wind energy in the world.

¹² Statkraft indicated that from 2021 the right to support with a guaranteed tariff will lose about 6 thousand wind turbines with a capacity of approx. 4.5 GW, and in the next five years 14 thousand wind tur-

according to German law, these plants will lose support after 2021, the PPA guarantees their profitability after this time. It is estimated that approximately 1,600 wind farms with installed capacity of 2.5 GW will lose support annually in 2022-2026. *Enercon* applied a similar safeguard for the future profitability of 10.6 MW wind farms in 2018, concluding a PPA agreement with the German association VDKL, which represents the logistics and refrigeration industry.

The first European car manufacturer to conclude a PPA with Statkraft for renewable energy supplies from six 46 MW installations that are currently owned by municipalities in Germany, is Mercedes Benz –in this way, Mercedes Benz provides both electricity for its factories in Germany and the profitability of wind farms, which translates into achieving German climate goals¹³. In 2018, Mercedes Benz also concluded PPA for RES supplies in Poland. Another example of PPA in Poland is the establishment of cooperation between *Innogy* and Warszawskie Przedsiębiorstwo Mostowe Mosty regarding the purchase of electricity in 2019 from wind farms belonging to this company: Zonda Power Plant and EOL Wind Power Plant. The agreement concerns the purchase of approx. 100 GWh.

Concluding remarks

Industrial enterprises that are not interested in speculation on the electricity market, but strive to secure the level of their costs at the expected level, use the opportunity created by long-term contracts for the purchase of electricity (PPA) with RES, which in many cases are only a financial instrument. At the same time, they support the development of green energy, which has both marketing value and supports the achievement of climate goals. The impetus for the development of PPA since 2018 is the increase in electricity prices and greenhouse gas emission allowances (EUA). The increasing attractiveness of the PPA is also reflected in trade in the financial market. The management of the EEX exchange indicates that some financial products – such as long-term futures – are directly linked to the PPA, which due to the duration of the PPA, increases the demand for PPA futures with a maturity of up to 10 years. Creating futures for PPA will also eliminate the credit risk associated with this product, which increases the attractiveness of PPA as a risk response instrument.

bines with a capacity of approx. 17 GW, or approx. 33% of the capacity installed in onshore wind farms in Germany. More in: *Enercon*: end of guaranteed tariffs, time for PPA, www.cire.pl [access: 09.10.2018].

¹³ PPA power plants will lose support in 2021-2022.

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