

Identification and Analysis of Main Drivers and Barriers to the Promotion of PPAs for Green Energy

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Abstract. *With the current climate change, decarbonization is essential to the global energy transition. In this regard many instruments have been created or developed, Power Purchase Agreements, as a direct legal contract between a power provider and a power buyer, being one of the most popular instruments to increase the use of renewable energy. But sometimes, Power Purchase Agreements get violated due to the elements that constrain and prevent its development and implementation. This situation only brings a certain insecurity to the PPA, and the result is nothing other than to compromise its true role and to distance it from the achievement of the objectives established in its contents. The main goal of this research is to identify and analyze the main drivers and barriers which constrain or prevent the development and implementation of Power Purchase Agreements as a tool for promoting green energy. For this research the comparative analysis, survey based on questionnaires, Spearman's correlation matrix and IBM SPSS Statistics for Windows are used. The article reduces the gap among the respondents' opinion regarding the Power Purchase Agreements and their involvement in the implementation and development of these contracts, roughly establishing the level where the PPA is located in the transition to green energy. The results suggest that Power Purchase Agreements play a major role in the renewable energy market and they will have a positive impact in what it means the transition to green energy and the achievement of climate neutrality. Therefore, although Romania is a country rich in energy resources that allow the achievement of climate neutrality, it is necessary to take additional measures to attract investors, whose investments will be crucial in the development of energy from renewable energy sources, the three Power Purchase Agreements concluded up to now, regardless they represent a gratifying step, they are not enough to talk about a real Power Purchase Agreement market.*

Keywords: Power Purchase Agreement, Main Drivers, Main Barriers, Renewable Energy, Green Energy, Zero Carbon Economy, Climate Neutrality

Abbreviation

PPA – Power Purchase Agreement

Introduction

There is an increase in the number of cities that want to reduce their carbon footprint, one of the methods being the use of more renewable energy that will lead direct towards the decreasing carbon intensity of electricity. (Leung and Bailey, 2018)

Lately, more and more countries are moving towards climate neutrality, energy efficiency representing more than 40% of the emissions abatement needed by 2040, according to the IEA Sustainable Development Scenario. Extending existing mechanisms and public funding for the installation of low-carbon technologies are measures that can be taken by governments to increase

funding for energy efficiency investments. At the same time, regulations, incentives and information campaigns are helping to decarbonize the industrial sector. (Iancu, 2021)

PPAs have seen a flourishing development in recent years, receiving more and more importance, thus at the end of 2014, the total number of farms that signed PPA reached 363 and the total capacity 32,641MW (Lei & Sandborn, 2018).

In 2020 “PPAs supported about 25 GW of RE capacity installation world-wide and guaranteed fixed revenues to the RE developers.” (IEA, 2021b) From what we can see, PPAs have proved themselves to be an effective instrument in resolving certain problems that renewable projects face, such as high upfront investment costs and lack of guaranteed revenues. Regarding Miller and Carriveau besides that RE plants make revenues from selling electricity on the market, there are storage technologies which work on intraday and ancillary services markets that involve the adoption of other strategies and PPA structures. (Gabielli et. al., 2022)

The analysis begins after the Introduction chapter and starts with a first PPA definition. A PPA is a long-term agreement signed between a renewable developer and a consumer – generally a company requiring large amounts of electricity – or between a developer and a supplier who then resells the energy with the aim to buy clean energy from a specific asset at a predetermined price. The signing of a PPA means the sale of a project and its environmental attributes (Guarantees of Origin): it is a tool that helps a renewable developer to make an investment decision taking into account on one hand the aspects profitability versus risk and on the other hand to help get the necessary funding for the execution of a project (Iberdrola, 2020).

The purpose of this article is to identify and analyze the main drivers/obstacles which influence/prevent PPAs on the way to green energy and to find appropriate measures that can be applied or improved.

A driver represents a factor that has a specific result on the activity of another entity, referring regardless if we speak about finance and economics to some key factor that has a large influence on some outcome of interest. (Hayes, 2023)

At the same time, CFI team, (2023) speaks about business drivers as being like the key inputs and activities that drive the operational and financial results of a business. Due to Complete Controller, 2019 opinion, drivers represent key factors that define the growth and sustainability of a business, bringing at the same time profit.

This article has the following structure. The introduction presents the Power Purchase Agreement Concept. In Section 2, PPAs are defined with an analysis of the main scientific sources. Within Section 3, the research methodology is presented, which consists in a comparative analysis, a workshop with a panel of experts, a survey based on questionnaire, Spearman’s correlation matrix, IBM SPSS Statistics for Windows and simple linear regression. Section 4 presents the main research results and last, but not least the final section shows the main conclusion. Bibliographical references complete this article.

Literature review

Power Purchase Agreement In The Scientific Literature

PPA is a contract signed between a buyer/offtaker such as a city, company, utility and the seller for example a utility or developer of an electricity project. (Leung and Bailey, 2018)

When signing a PPA there are many aspects that must be taken into consideration among these being the energy resource. Although wind and solar are the most used, there are also other energy resources such as geothermal, nuclear, hydropower, biomass, and biogas that are cost-

competitive. (Leung and Bailey, 2018). The solar power purchase agreement is a contract through which the investors own, invest and operate on the customer roof the rooftop PVs.

In this way the PV output power arrives to the customers without passing through the grid (BNEF, 2019; NREL, 2016). It is to be mentioned that under this type of contract, the investors propose to sell an PV output power to the customers, but with taking the responsibility of the rooftop PVs over the specified period. Another thing that it is to be mentioned is that there are 2 ways in which the proposed rate of the Solar PPA can be performed: first one is a flat rate, and the other one is a discount rate on the typical retail rate (NREL, 2016), but the second alternative is more comfortable and practical to the residential and commercial customers.

Regarding the SPPA electricity charges – from the customers’ perspective Prapanukool et. al., (2020) mention that they consist of on-peak energy charges, SPPA off-peak energy charges, and SPPA demand charges, each of these three possibilities being formulated by considering the excess energy supplied by the utility. As far as it goes from the investor’s perspective, the SPPA revenue consists of SPPA on-peak revenue, SPPA off-peak revenue and SPPA demand charge revenue.

Liberalized electricity markets (Ems) are systems where competitive demand and supply players trade energy. (Algarvio, Lopez, 2023) There are many more electricity markets, among these we enumerate pools, derivatives and bilateral contracts (Kirschen, 2018, Algarvio et. al., 2019). Pools are marginal markets, which involve both demand and supply auctions, their purpose being to increase the well-being of the participants. Derivative markets involve both physical and financial assets that can be traded and that players can use to reduce the price volatility of energy pools (Algarvio, 2022).

Last but not least, bilateral contracting represents the negotiation carried out by the parties in order to conclude a contract, the contractual clauses being established independently of the operators on the market, such as prices, quantities, periods and market zones to market operators.

The main purpose of using bilateral contracts is to reduce the assumed risk of uncertain pool prices (Gabrielli et. al., 2022), but there is a risk associated with the price or quantity (Hopkin, 2012). Nevertheless, there are moments when PPAs do not offer the best term for wind/solar producers because they sell energy at lower electricity prices than those practiced on the wholesale market spot prices. Beside this, direct participation in the wholesale market can lead to high imbalance costs for the wind producers. The discount rate of the Power Purchase Agreements, the capital cost of the farm and the strike price of the Contracts for Difference are crucial elements that influence the profitability of both business cases. (Loukatou et. al., 2021) Also, it seems that if subsidies are taken away from both of them, these are no longer economically meanable, except for the situation in which important reductions are obtained in the capital costs of wind farms and battery storage units.

Regarding the nature of wind power, Johnston et.al., (2015) mention that the electrical power that is generated by wind farms is not constant nor controllable. This situation affects network operation and planning and determines higher costs for system operators, associated with the ancillary service provision required to secure wind power production (Feehally et. al., 2016). Besides, profits of wind operators may be influenced by the variability of electricity prices and high imbalance costs, the more so as they do not hold a long-term contract agreement with a supplier/customer and subsidies are not present (Rodrigues et. al., 2016).

Analyzing these agreements Loukatou et. al. 2021 show that they do not always offer best terms for wind producers because of the selling energy at lower electricity prices than those of the day-ahead or intraday market spot prices. At the same time, according to Panizio, 2016 the number

of PPA provider decreased since their risks are strongly linked to increased and volatile wholesale price risks.

Regarding the price it must be highlighted that it plays an important role, because it will determine whether or not the PPA will be profitable for the seller. A PPA for wind energy for example is typically signed for a period between 15 to 25 years, 20 years being the most common term, due to the fact that this is the expected life period of the major turbine components, and it is also suitable for the lenders who want to see a PPA with a term that exceeds the term of the loan. (Miller et. al., 2017)

In terms of PPA escalator structure, the most common type of agreement is a fixed price PPA (Bolinger, 2013), the next one being an elevator structure in which an escalator (typically 2-3%/year) is applied over the term of the PPA. There are also PPAs where the price in the first ten years is established as fixed, while later the price will be a variable one.

In the renewable energy market there are situations when we speak about negative prices, phenomena which take place when there are big volumes of renewable energy like wind, solar which combined with a low electricity demand force the grid system operators to dial back those electricity generators that don't burn fossil fuel. (Alastair, 2023) In this situation we speak about price cannibalization which represents an emerging threat to the transition to zero-carbon energy, due to the fact that solar and wind get into the power mix. In this way variable renewables depress wholesale power prices at times of high output. (Energy Monitor, 2023) At the same time due to Institute's for energy research, 2023 opinion, in June Europe generated 10.4 percent of its electricity from solar that represents a record. Taking into consideration the rapid growth of the energy from renewable energy sources this leads to a decrease of utilities profits as long as the surplus of energy depresses wholesale electricity prices and results in utilities earning decreasing revenues. This situation is known as renewables cannibalization effect.

In this case a battery storage can compensate for the stochastic behavior of wind power by keeping under control short-term fluctuations (Johnson et.al., Moseley and Garche, 2015) and by establishing the wind energy at a higher price by storing the surplus and by increasing the income of the wind farm (Moseley and Garche, 2015). Nonetheless there are factors such as insufficient revenue streams for wind operators, high capital costs and battery damage which affect the battery storage. (Staffell and Rustomji, 2016). The problem of storing the renewable energy resource (wind in this situation) for a longer period especially on days with more wind or on days with constraints or no or low demand, is treated also by Johnson et.al., (2017). Although in the moment it is established to turn off the wind turbines during congested periods, if wind producers will be asked to deliver, they would lose any subsidies they were able to receive and they must be reimbursed compensated by the system operator (National Grid) through constraint payments (Staffell and Rustomji, 2016; Fei and Strbac, 2016).

Methodology

The main objective of this research is to identify and analyze the main energy drivers/barriers that influence PPA on the way to green energy.

The research methodology used in this paper consists of a workshop with a panel of experts, a survey based on questionnaire, Spearman's correlation matrix, IBM SPSS Statistics for Windows and MS Excel. This work has the main purpose of analyzing and better understanding the main drivers and barriers that influence the promotion and development of PPAs.

A method of research is the organization of a workshop made up of several energy experts which had the purpose to formulate the first hypothesis regarding the key elements that have an

influence upon the development or not of Power Purchase Agreements as they appear to be from the questionnaire. The participants were: energy trader, developer of renewable projects, renewable electricity producer, average industrial consumer, secondary legislator, who have been randomly selected from the respondents from the questionnaire, their opinion being important for a better understanding of the main elements which influence the signing of a PPA.

The formulation of questionnaires had the purpose to find out the main drivers/barriers that may affect the PPAs in the way to green energy, while their results are processed with IBM SPSS Statistics for Windows. The data obtained through the formulation of the questionnaire revealed the main drivers/obstacles presented in Figure 1, which influence or prevent the development of PPAs. In addition, it has to be mentioned that the survey involved 232 respondents that belonged to different categories, such as economic operators, industrial and small consumers and it had the idea to determine the main elements which contribute or not to the development of PPAs.

Furthermore, aspects such as promotion, transition towards green energy, types of green energy resources, the type of resource that requires more attention, price, form of guarantee, negative prices, financing methods were taken into consideration when analyzing the answers.

In order to obtain the research results, the data were processed with IBM SPSS Statistics for Windows. The statistical analysis performed as a result of the processing of the questionnaire was based on the following stages: collection, processing, analysis and interpretation of the survey results. Regarding the horizontal analysis, we show that the answers to each question have different units of measure (ordinal, nominal, scale), so that a horizontal analysis is not eloquent. The vertical analysis is aimed at statistical correlations in order to explore their presence and intensity between the variables included in the model. We wanted to find out the correlations between different elements which influence the development of PPAs and whether these factors were strongly correlated to other factors.

Spearman's rho correlation was used. The main variables used for the correlation analysis are the following: promotion, transition towards green energy, types of green energy resources, the type of resource that requires more attention, price, form of guarantee, negative prices, financing methods.

Results and discussions

Figure 1 shows the main drivers and barriers that influence/prevent the development of PPAs on the way to green energy.

An energy driver represents a factor whose presence, regardless of whether it is stable or fluctuating, has an influence on the PPA market, mainly on entering into such contractual relationships.

The barrier represents a factor or an obstacle that keeps the energy participants apart from entering into contractual relations within a PPA or prevents the signing of such a contract.

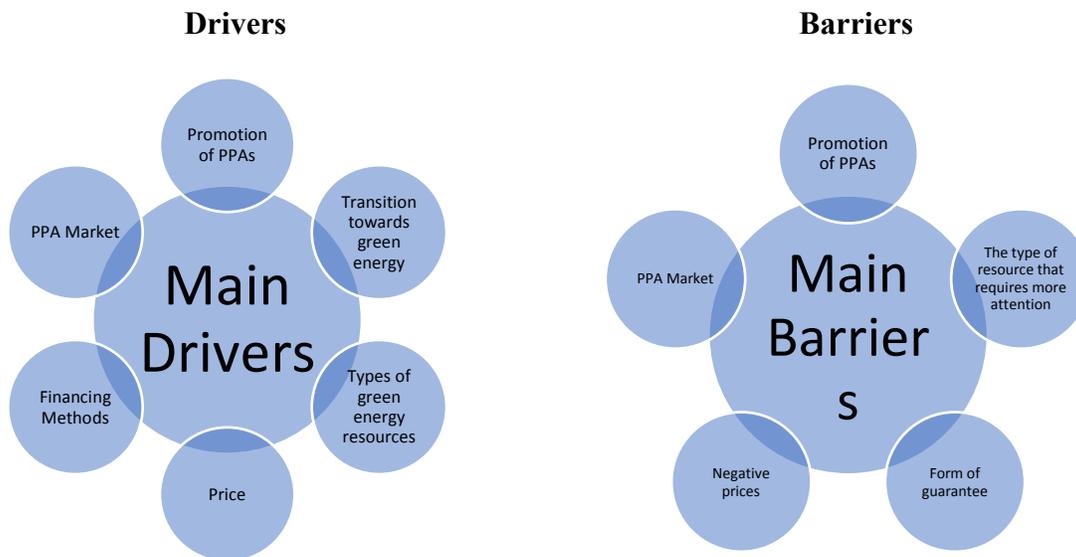


Figure 1. Drivers/barriers that influence/prevent the development of PPA

Source: Authors' own research.

Within the main drivers we mentioned: promotion of PPA, transition towards green energy, types of green energy resources, price, financing methods and PPA market, while the main barriers consist in promotion of PPAs, the type of resource that requires more attention, form of guarantee, negative prices and also PPA market.

As far as it can be seen in both categories, we can find PPA market elements due to the fact that this factor can either influence or prevent the development of PPAs, depending on the measures taken so far at the national level. According to the experts, in situation that the PPA market is a developed one, it certainly represents a driver, as long as it has a positive and encouraging effect in convincing people in entering in such bilateral contract, while in case that the PPA market is not that developed or it is underdeveloped, it automatically leads to a lack of public confidence in such a mechanism, which no matter how useful it is for the promotion of renewable energy, will not provide enough credibility for its benefits to be claimed (as shown in Figure 2).

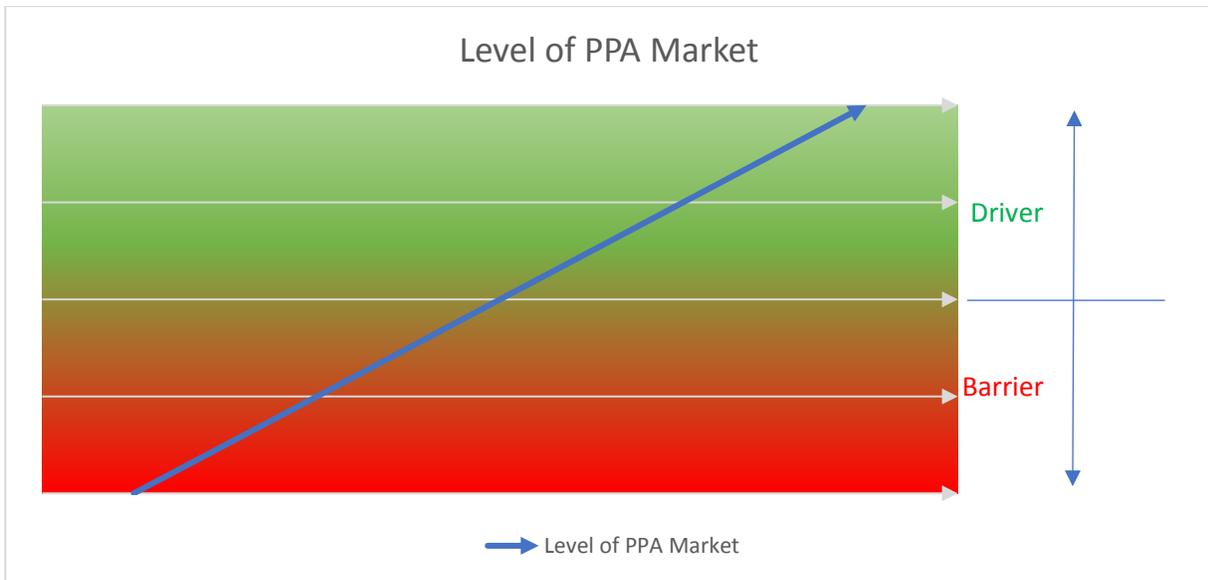


Figure 2. Level of PPA market from barrier to driver

Source: Authors' own research.

The analysis was carried out based on the questionnaire answered by 232 respondents, the results being presented and described in the following figures:

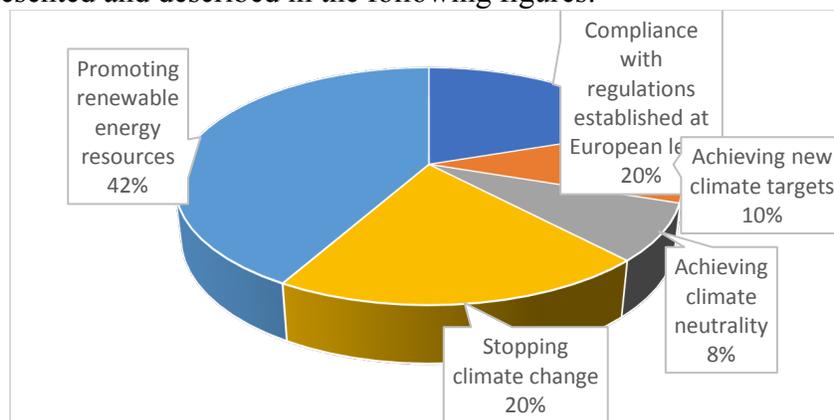


Figure 3. The necessity of promotion

Source: Authors' own research.

It can be observed from the above figure that the variants to this question are:

- a. Compliance with regulations established at European level
- b. Achieving new climate targets
- c. Achieving climate neutrality
- d. Stopping climate change
- e. Promoting renewable energy resources.

Analyzing the results, we can see that the majority of respondents chose option e) Promoting renewable energy resources, which means that they understood the true role of PPAs - which represent a very good legal method to develop green energy. Also, in second place, equal - 20%, are the options regarding compliance with European regulations, respectively stopping climate change, which is a gratifying fact, on the one hand because the European Union has already

taken measures to regulate these contracts at the European level and established the obligation for Member States to regulate them also at national level, and on the other hand, because stopping climate change is a direct consequence of the promotion of renewable resources.

These results have to be analyzed in relation to the answers given to the question on how PPAs will help the transition to green energy (Figure 4), from which we can see that although PPAs are clearly an effective mechanism that helps the development of renewable energy, they can only have a clear result together with other schemes that have been created with the same purpose, 64% of respondents being of this opinion.

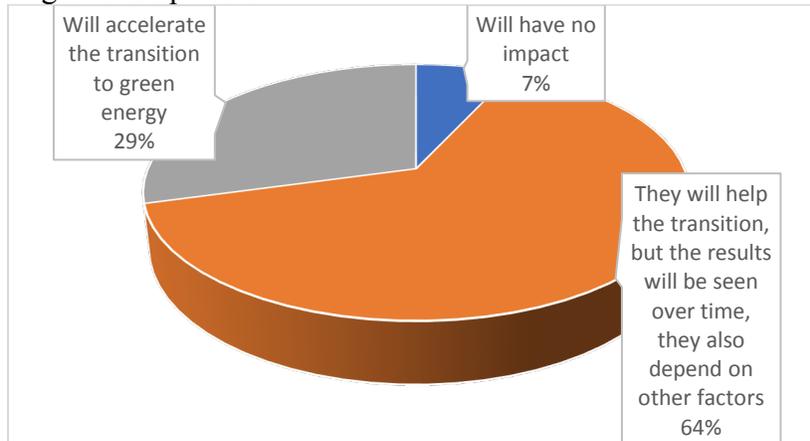


Figure 4. The transition towards green energy

Source: Authors' own research.

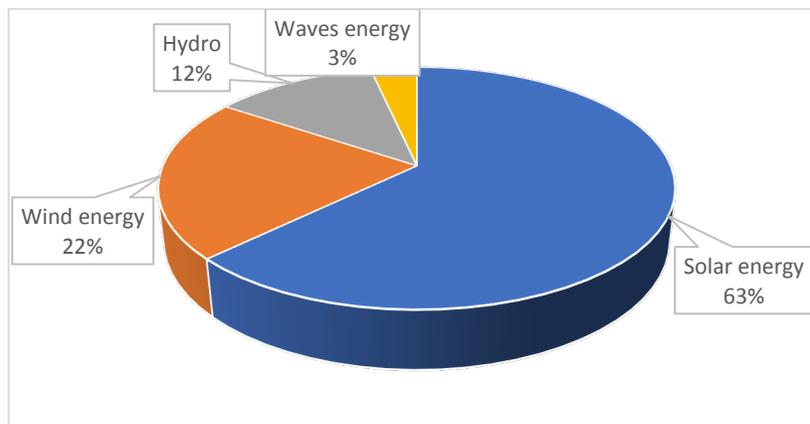


Figure 5. Types of green energy resources considered at the signing of the contract

Source: Authors' own research.

In terms of the types of green energy considered when entering into PPAs, it is clear that solar energy is the most commonly used, with 63% of respondents considering that it would be the most suitable renewable energy resource if they entered into such contractual relationships. The second and third places are occupied by a fairly large distance by wind energy (22%) and hydro (12%), with wave energy having the lowest percentage (3%), which proves that it is the least developed in Romania.

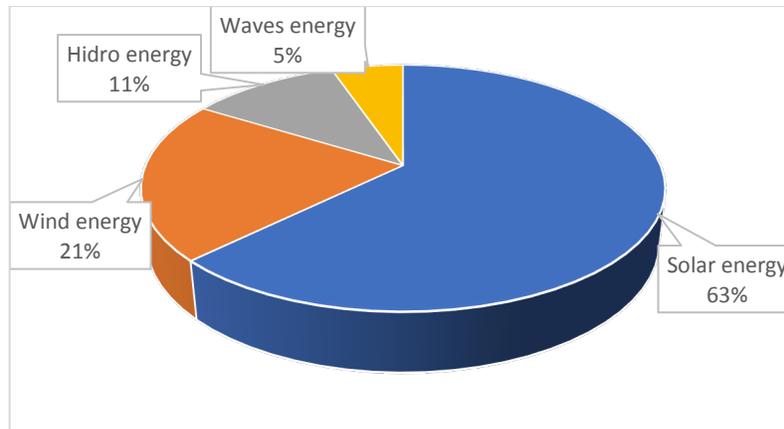


Figure 6. The type of resource that requires more attention

Source: Authors' own research.

Analyzing the results obtained to the question on the renewable energy resource that would need development, we can see that the same percentage of 63% of respondents consider that solar energy would be the one that would need more development, followed at a fairly large distance by wind, hydro and wave energy. This could lead us to misunderstand the question on the one hand, and on the other hand, to a poor knowledge of the energy market, namely the natural resources that are developed or have a clear potential for development.

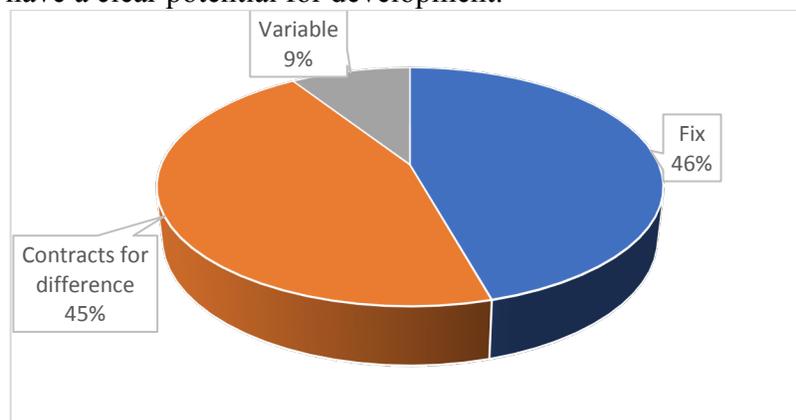


Figure 7. The establishment of the price

Source: Authors' own research.

Clearly, price is a key issue to be taken into account when deciding to enter into a PPA, and there are several options for setting the price: fixed, with 46% of respondents opting for this option, or in the form of contracts for difference, which is an agreement between a "buyer" and a "seller" to pay the difference between the current price of an underlying asset - in this case energy - and its price at contract closing), where 45% of respondents said they intended to set the price in this way. Such a contract-for-difference mechanism is most common in the case of virtual/financial PPA where according to John et. al., 2016 the buyer gets the renewable energy and RECs from the producer for a fixed price, the seller then sells the electricity into the market, the buyer then purchases the electricity from its supplier and at the end the parties establish the difference between the agreed PPA price and the market price. The variable price is not a preferred way for respondents, with only 9% claiming that they intend to enter into a PPA based on such a price.

As De Meulemeester, (2018) affirms, PPA is an important source of financing renewable energy being a tool to comply with renewable energy commitments, leading also to cost savings. He speaks about two ways in which PPAs help by energy at lower price and these are a discount on market prices (for example, Latin America where PPA's are sold with reduction on the regulated market tariff) and a fixed electricity price.

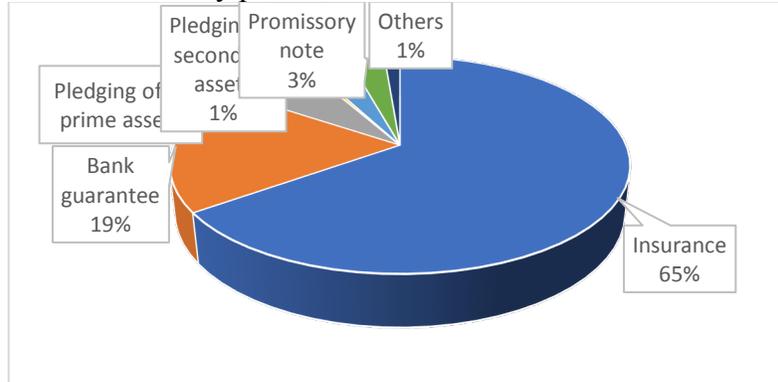


Figure 8. Form of guarantee

Source: Authors' own research.

From the analysis of the figure above, we can see that with regard to the form of guarantee the majority of respondents (65%) agree with the granting of guarantees in the form of insurance, while at a fairly large distance in second place is the guarantee offered by the bank 19% of the respondents resorting to such a form of guarantee. One aspect that is clear is that entering into a PPP must be done by reference to the provision of a guarantee, the security of maintaining contractual relations being determined by such a form of guarantee.

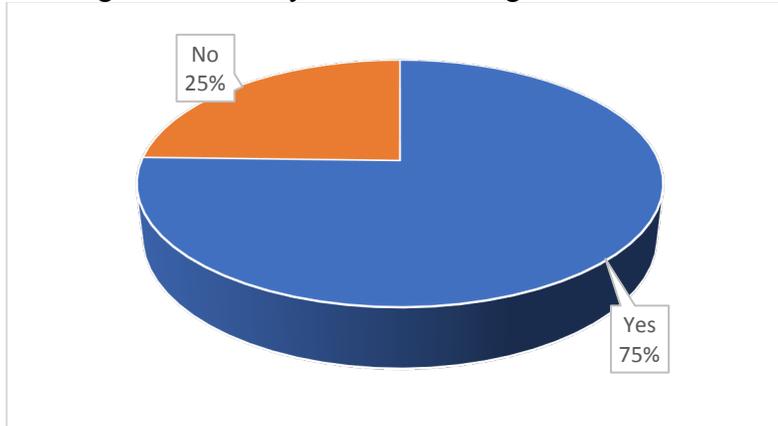


Figure 9. The need to regulate negative prices

Source: Authors' own research.

Negative price regulation is clearly another aspect influencing entry into a PPA, the cannibalization effect being important to be carefully addressed before entering into such a contract. As we have shown above, renewables cannibalization effect takes place when renewables of the same generation profile produce simultaneously, pushing down the wholesale electricity price. So, in areas where big additions of wind or solar power capacity determine the decrease in prices when renewable resources are at peak capacity is called a "cannibalization" effect. (Institute for Energy Research, 2023). These negative prices that occur when demand for energy decreases or supply increases to such an extent are considered to be important by respondents, with 75% of respondents considering it necessary to regulate them in the PPA.

Table 1. Transition Correlation matrix (Spearman's rho correlation)

		PPA market	Promotion of PPAs	Transition towards green energy	Types of energies	The establishment of price	The payment of the price	Form of guarantee	Negative Prices	Financing methods	
Spearman's rho	PPA market	Correlation Coefficient	1.000	-0.007	.181**	0.024	0.118	0.014	0.081	-0.049	0.039
		Sig. (2-tailed)		0.913	0.006	0.711	0.072	0.830	0.221	0.458	0.554
		N	232	232	232	232	232	232	232	232	232
	Promotion of PPAs	Correlation Coefficient	-0.007	1.000	.208**	0.027	-0.068	.202**	0.006	-0.019	-0.100
		Sig. (2-tailed)	0.913		0.001	0.681	0.303	0.002	0.922	0.774	0.129
		N	232	232	232	232	232	232	232	232	232
	Transition towards green energy	Correlation Coefficient	.181**	.208**	1.000	0.056	0.097	.170**	0.034	-0.101	0.066
		Sig. (2-tailed)	0.006	0.001		0.398	0.141	0.009	0.608	0.126	0.314
		N	232	232	232	232	232	232	232	232	232
	Types of energies	Correlation Coefficient	0.024	0.027	0.056	1.000	.159*	0.037	0.077	-0.075	.195**
		Sig. (2-tailed)	0.711	0.681	0.398		0.015	0.575	0.245	0.256	0.003
		N	232	232	232	232	232	232	232	232	232
	The payment of the price	Correlation Coefficient	0.118	-0.068	0.097	.159*	1.000	0.009	0.126	-.141*	0.090
		Sig. (2-tailed)	0.072	0.303	0.141	0.015		0.888	0.056	0.032	0.172
		N	232	232	232	232	232	232	232	232	232
	The payment of the price	Correlation Coefficient	0.014	.202**	.170**	0.037	0.009	1.000	-0.080	-0.100	-0.021
		Sig. (2-tailed)	0.830	0.002	0.009	0.575	0.888		0.223	0.128	0.750
		N	232	232	232	232	232	232	232	232	232
	Form of guarantee	Correlation Coefficient	0.081	0.006	0.034	0.077	0.126	-0.080	1.000	-0.051	.170**
		Sig. (2-tailed)	0.221	0.922	0.608	0.245	0.056	0.223		0.442	0.009
		N	232	232	232	232	232	232	232	232	232
Negative prices	Correlation Coefficient	-0.049	-0.019	-0.101	-0.075	-.141*	-0.100	-0.051	1.000	0.106	
	Sig. (2-tailed)	0.458	0.774	0.126	0.256	0.032	0.128	0.442		0.107	
	N	232	232	232	232	232	232	232	232	232	
Financing methods	Correlation Coefficient	0.039	-0.100	0.066	.195**	0.090	-0.021	.170**	0.106	1.000	
	Sig. (2-tailed)	0.554	0.129	0.314	0.003	0.172	0.750	0.009	0.107		
	N	232	232	232	232	232	232	232	232	232	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Source: Authors' own research.

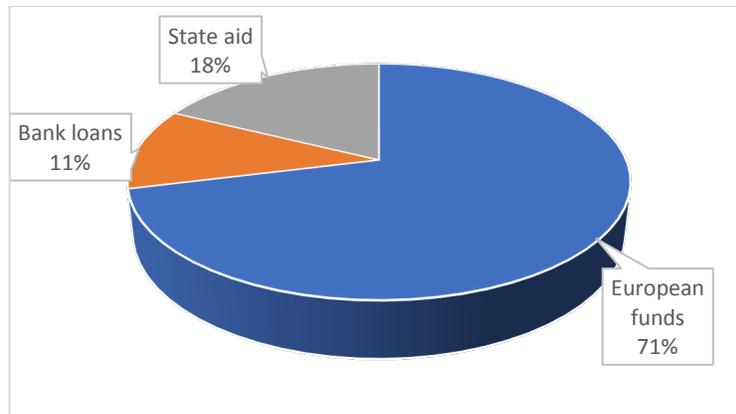


Figure 10. Financing methods

Source: Authors' own research.

Analysing the figure, we can see that European funds are the financial methods preferred by respondents when they decide to enter into a PPP (71%), while state aid (18%) and bank loans (11%) complete the podium, but at a big difference from the first category. It thus seems that the majority of respondents are inclined in favour of European funds, which are apparently either easier to obtain, or have a greater security/credibility than existing national schemes (state aid, bank loans) which are taken into account by less than a quarter of the people interviewed.

From the Spearman correlation analysis, the experts saw that there is an inverse correlation between the market factor and the factor representing negative prices, which is -0.141 , which means that for a confidence interval of 0.05 the market would be more developed if negative prices were not regulated. Negative prices occur at a time when there is a surplus of the energy produced from green energy that cannot be consumed or stored. By not regulating negative prices this energy cannot be sold in any other way, the only solution is to increase consumption, ensured by the transition from energy from polluting energy sources to energy from renewable energy resources.

Another correlation identified through the Spearman analysis is given by the factor of financing modalities which is slightly related to the factors of energy types and form of guarantee, thus: in the case of solar most of the respondents opted for accessing European funds, while for hydro and wave energy most of them intend to obtain state aid.

Other factors such as the market for PPAs, the need for promotion and the payment of the price are factors that are correlated with the factor of the transition to green energy, which also influences it, which proves that the impact will be clearly visible if we talk about a more developed PPA market. Post-delivery payment is another criterion that helps the transition to renewable energy, as it increases the buyer's confidence that he is not blocking money for other uses necessary for the development of his business and can pay for the purchased energy after its delivery.

It is worth mentioning that the experts didn't find direct correlations, all of them being around 0.20 (20%) with a confidence level of 0.01, which means that although there is a correlation between the elements mentioned above, the direct impact of each of them on the transition is not very high, as it is obviously influenced by other elements that exist in an energy market.

Conclusion

This study has investigated the main drivers/barriers that influence/prevent the development of PPAs on the way to green energy.

The preferences of the respondents revealed through the Spearman correlations lead us to the idea that from their point of view there is a clear association between solar energy, which is more developed in Romania, and the access to European funds, which according to the results obtained would be more credible and easier to access. This analysis is made in comparison with the energy obtained from wind and wave resources, that have a slower and even weaker development in the case of waves. As far as we can see these resources' development is rather associated with state aid, which in turn, according to the respondents' opinion, is much more limited and more difficult to obtain than European funds. Practically in this case too, the insufficient regulation and involvement of the Romanian state, through its legislative and executive bodies, led to this opinion of the respondents, who have more confidence in the measures taken by the EU bloc than by their own state.

Also, preferring to access European funds rather than to obtain state aid would prove, on the one hand, an easier access to them, for which procedures are regulated possibly easier than for domestic state aid, and on the other hand, a greater confidence of respondents in the financial aid granted by the European Union, than by the Romanian state. Thus, it can be observed that at the moment there seems to be an understanding of the mechanism since almost half of the respondents (42%) said that the main role of the PPA is to promote renewable energy resources.

The answers given in figure 3 are also eloquent as 64% of respondents believe that PPAs will help the transition to green energy, but in conjunction with other measures to be taken at state level. So, from these answers we can draw the conclusion that the development of the renewable energy market, implicitly the PPA market, depends very much on the improvements brought by the state for the development and implementation of PPAs. Thus, the measures that will be taken must be in the sense of investments mostly in green energy and energy transition. We are aware that substantial measures and investments are needed to achieve energy independence, and Romania has an excellent starting point here, but also to the much more intensive use of renewable sources.

Therefore, it is indicated that in addition to the measures taken so far at the national level, clear measures should be taken to encourage investments in green energy, which means the introduction of economic policies, in general, and sustainability policies, in particular, regarding the implementation and development of PPAs.

Even if the level of signing PPAs in Romania is very low (so far only 3 such contracts have been concluded), it must be shown that Romania is gradually becoming one of the most attractive countries for investments in renewable energy. Supporting the creation of a renewable energy market by creating a legal framework conducive to development also brings with it the development of the PPA market. Until then it is obvious that some steps must be taken, consumers having to be educated to help the producers/investors create new patterns in the market. It seems that corporations are very cautious when they make the decision to buy energy for a long period by signing with developers, one of the main reasons being the massive fluctuations in energy prices that has caused a lot of caution and fear regarding the energy market evolution.

The price also plays an important role in the signing or not of a PPA, as it must be determined as clearly as possible in the contract, which is also the reason why about 90% of respondents opted for fixed price variants, as well as contracts for difference, as they offer the greatest stability and security in this respect. It is very clear that there are many challenges and reasons why investors and off-takers have been reluctant to sign PPAs, such as high volatility of prices on the energy market, the emergency state intervention that capped the wholesale power market revenues, high imbalances costs, market and regulatory risks, so that providing the clearest

possible certainty to these defining elements of the contract, is certainly a benefit in favor of entering into contractual relations under a PPA.

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