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Alternative third-party ownership business models on photovoltaic market in Poland

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ABSTRACT

The production of electricity from renewable energy sources is currently experiencing a boom in the world. This also applies to Poland, which despite the small volumes of RES installations is significantly accelerating the development of this segment. The aim of the article is to discuss the current situation of photovoltaics in the world and in Poland. The analysis of current models of financing photovoltaic in Poland in comparison with global trends already existing in America, Western Europe or China allows to draw conclusions on the development of alternative models of financing photovoltaic investments.

Keywords: photovoltaics, green economy, RES, RES auction, energy policy, energy prices, business models, third-party-ownership model, enterprises

1. INTRODUCTION

Does the current world order need change? Many authors have been asking this question for years. "There are many arguments for the fact that the capitalist system leaves after about 200 years the socio-economic and natural ecological ruins, even in the countries and on the continents, the greatest of their previous achievements." – as Marcin Cieslowski wrote in his paper called the Crisis of capitalism. The world has reached the stage where climate change is

beginning to build awareness of the need for greening, that is, strengthening the use of natural mechanisms in the economic development of the world.

One of the symptoms of the greening of the world's economy is the development of renewable energy sources. Changes can be observed both in the world and more locally also in Poland. It can no longer be denied that the market for renewable energy sources is starting to develop at a very dynamic pace, affecting both the economic and social sphere as well as the situation of the entrepreneurs themselves. Environmental transformation implies changes in the legal system and forces the remodeling of the entire energy market.

Energy production affects almost all sectors of the economy. One more (energy-consuming sectors), others to a lesser extent. The impact of changes that entrepreneurs feel is a key aspect that affects consumers (indirectly) through the increase in the prices of production materials and finally the prices of products offered on the market. The article will focus mainly on the impact of the development of renewable energy sources on Polish economy.

The following questions should therefore be asked: What regulations imply changes in the approach to renewable energy sources and what effects for Polish entrepreneurs will occur in the short and long run? What are the solutions to compensate the impact of the increase in energy prices on the market, so that it does not have negative consequences for the entire economy? Can photovoltaics, as the fastest developing renewable energy source, be a solution for entrepreneurs in the context of rising electricity prices?

In the context of Poland, an important aspect are EU directives that affect the energy policy of the country, then industry, and ultimately consumers. The RES support system, with particular emphasis on photovoltaics, is one of the key elements of the necessary changes that are ongoing in the field of environmental protection in Poland.

As a result of directives and policy changes regarding electric energy obtained from mining sources, the energy policy of Poland is facing a great challenge in upcoming years. There is no doubt that no changes in the so-called "energy mix" will result in constantly growing prices of electricity.

This article aims to discuss both legal aspects, photovoltaic financing systems as well as discussing the situation of entrepreneurs in the context of rising energy prices in Poland.

2. DEVELOPMENT OF PHOTOVOLTAICS IN THE WORLD

Let's start with the basics. What is photovoltaic? The photovoltaic phenomenon consists in the direct conversion of solar radiation energy into DC electrical energy [1]. Photovoltaics market development has its origin in the works of the French physicist Becquerel and his research from 1839 regarding liquid electrolytes tested on a wide range of materials [2]. In the twentieth century, the turning point was the production of the first photovoltaic cell by the Bell Laboratory. In 1954, the first cell was presented with an efficiency of 6% [3]. Since that moment has begun intensive photovoltaic development in the world.

For over 60 years, photovoltaic technology has developed so much that its commercial use for the production of electricity becomes widespread, and above all, profitable¹ [4]. Technological progress has improved the efficiency of photovoltaic modules themselves, and the growing production volume of photovoltaic panels has allowed to achieve economic of

¹ Renewable Power Generation Costs in 2014, IRENA, 2015

scale, which directly translated into panel prices, and ultimately the profitability of generating energy from the sun.

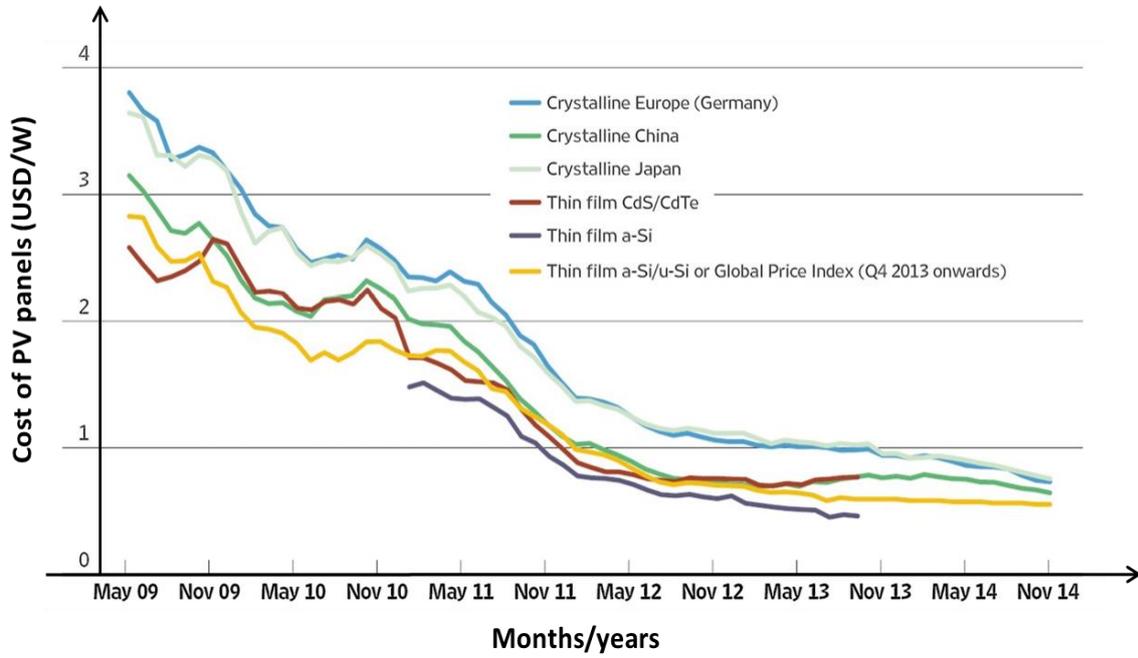


Figure 1. Production cost of photovoltaic panels (USD / W)

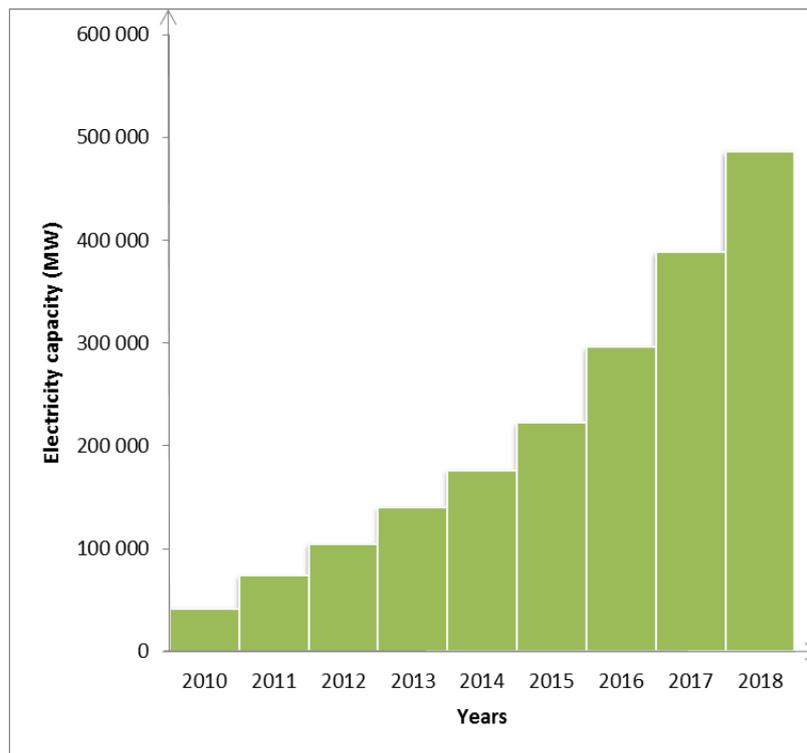


Figure 2. Increase in installed capacity (photovoltaic) in the world expressed in thous. MW

Data on energy production costs using solar panels is provided by the IRENA organization, which is an intergovernmental organization supporting the development of renewable energy sources. According to IRENA data, the fastest decline in prices of photovoltaic panels and, consequently, their economic profitability was observed in years 2009-2014. The Figure 1 presented below shows the cumulative data of various producers in the period under discussion.

As can be seen, the production cost per 1W of installed capacity decreased by more than 75% over the considered period [5]. This had a significant and direct impact on investment growth and installed photovoltaics capacity in the world in recent years. The increase in installed photovoltaic power in 2018 exceeded 480 GW worldwide. Global data is presented on the Figure 2. The data has been presented in MW (megawatt) of installed capacity

As market data shows solar photovoltaic volume is growing at a very fast pace. It is also worth comparing the world data with the situation in Poland.

3. DEVELOPMENT OF PHOTOVOLTAICS IN POLAND

According to the report of the Institute for Renewable Energy (IEO), only about 750 MW of photovoltaic installations are functioning in Poland. The increase in 2019 is forecasted for a further 750 MW and estimated at the level of installed capacity at the end of 2019 at the level of 1.5 GW. [5] This is still a negligible value compared to world volumes. According to the report Renewable Capacity Statistics 2019 published by the International Renewable Energy Agency, the total installed solar panels capacity at the end of 2018 in the world was estimated to 486 GW. [6] This gives Poland the share of the total installed power in the world at 0.15%.

Why Poland has such a low share in world production? The photovoltaic market in Poland has many opportunities, but there are still barriers that slow down the development of the photovoltaic market in Poland.

3. 1. Barriers of the development of the photovoltaic market in Poland

Despite the favorable conditions for the development of photovoltaics in Poland, there are a number of barriers that prevent the development of this market. Mainly the reason of slowing development of this market may have a following sources:

- Administrative
- Legal
- Financial

The most important factors slowing down the development of the photovoltaic market include:

- **Administration** – many Polish entrepreneurs complain about the long time of obtaining the relevant permits (also building permits) and organization of the RES auction of guaranteed prices for the purchase of energy by the State itself. The simplified regulations apply only to micro installations with a capacity of up to 50 KW².

² PV Market in Poland 2018, Institute for Renewable Energy, Warsaw, 2018

- **Lack of trust in RES (renewable energy sources)** – instability of law and changes that occurred in 2016 through the so-called the wind-farm act, led to investors losing confidence in the entire renewable energy market, including photovoltaics. The loss of the value of green certificates as well as the additional tax imposed under the Act, weakens investors' appetite for the implementation of renewable energy projects.
- **Low level of preparation of financial institutions** – as can be read in the report "PV Market in Poland 2019" prepared by the Institute for Renewable Energy, financial institutions are not yet sufficiently prepared to implement larger volumes of loans or other financial instruments aimed at financing photovoltaics³.

3. 2. Factors contributing to the development of photovoltaics in Poland

Despite the existing factors slowing down the development of the photovoltaic market in Poland, there are a number of premises that show that this market will grow in our country at an increasingly faster pace in upcoming years. Figure 3 presents main factors contributing to the development of Photovoltaics in Poland.

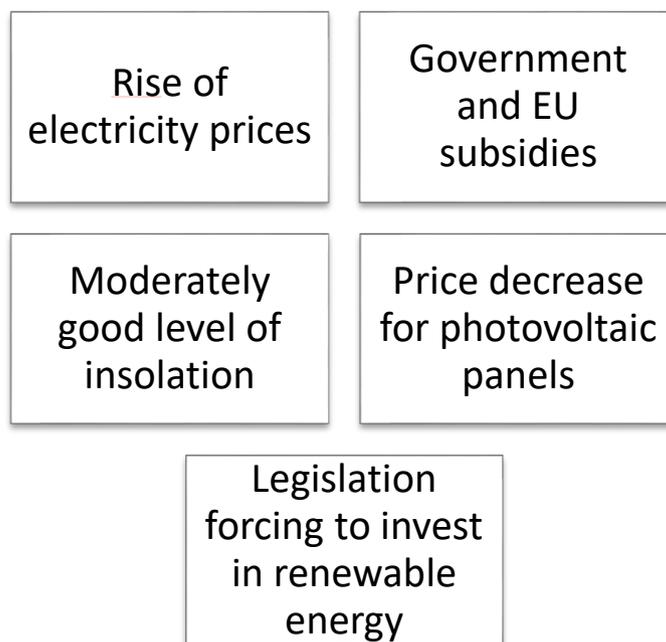


Figure 3. Factors contributing to the development of photovoltaics in Poland

Source: own study based on PV Market in Poland 2018, Institute for Renewable Energy, Warsaw, June 2018

- **Legislation**

In order to harmonize inner community law - Poland, as one of the Member States of the European Union is obliged to implement EU directives. Environmental protection is one of the key values of the European Union. It aims to improve the quality of the

³ The Law of 22 June 2016 on amending the act on renewable energy and other acts, Journal of Law, item 925; 2016

environment, the lives of residents and the creation of a low-carbon business community (Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources). In accordance with the National Action Plan, which is the response to Directive (EU) 2018/2001, the national target for the share of energy from renewable sources in final gross energy consumption in 2020 has been presented at the level of 15%. Ex-post analysis of the implementation of the strategy for the development of renewable energy sources in Poland already shows that Poland will face problems to achieve expected levels and necessary changes in the context of the implementation of Poland's Energy Policy until 2040, which in turn is a response to Directive 2018/2001 of the European Parliament of December 11, 2018 should be made. Although photovoltaic market in Poland has matured to play a much larger role than before in the RES sector, the entire energy sector and energy policy of a state. The current situation in the entire renewable energy sector creates new circumstances and a chance to improve regulations regarding support for photovoltaics. According to the report "Photovoltaic Market in Poland 2018" prepared by the Institute for Renewable Energy, current trends indicate that Poland will run out of 3.6% to fulfill the obligation of at least 15% of renewable energy in the balance of gross final energy consumption in 2020. For every deviation below this level Poland is threatened with costly statistical transfers from other countries and/or financial sanctions. The situation may be improved primarily by renewable energy technologies with the shortest investment cycles, which is photovoltaics.

- **Energy prices**

Electricity prices in Poland are growing and will grow due to the increase in prices of CO₂ certificates. The Polish energy market is still based mainly on energy obtained from coal, therefore energy prices have been rising in recent years and it is forecasted that they may increase by as much as 40% within next year. An increase in electricity prices will result in higher profitability of investments in renewable energy sources, and thus should result in higher investment volumes in this market.

- **Level of insolation**

Poland is characterized by solar radiation at the level of approx. 1000-1100 kWh / m². This is the value that allows obtaining energy from the sun at a sufficient level to carry out investments in solar farms. Solar insolation data in Europe is presented on Figure 4. [9]

- **Price of photovoltaic panels**

Another factor contributing to the development of photovoltaics in Poland is the reduction in the global prices of photovoltaic panels. UNEP Frankfurt School and Bloomberg report entitled "Global Trends in Renewable Energy Investment" presents an analysis of changes in the simple levelized cost of energy (LCOE) for wind, solar and biomass technologies. The model was based on investment decisions in a given year, taking into account expenditures, project development costs, equipment costs, construction costs, financing and operating costs as well as maintenance expenses. In addition, it took into account the power ratio for different technologies - the average efficiency of the wind turbine per MW increased year by year due to technological advances, similar to the increase in the percentage efficiency of photovoltaic modules. The levelized cost of energy (LCOE) for photovoltaics in 2009-2017 dropped by as much as 72%, from 304 USD/MWh to 86 USD/MWh. In the case of onshore wind

energy, there was a 27% drop (from 93 to 67 USD/MWh). For offshore wind energy, an upward trend was observed due to the move to deeper waters (further from the shore), while from the peak in 2012 a decrease of 44% (to 124 USD/MWh) was observed. There were no significant changes regarding LCOE for biomass burning technologies. The rapid development of the photovoltaic market has allowed for increasing volumes of the sales of photovoltaic panel, which means that it also forced more competition and the implementation of new technologies through the economy of scale occurring in this market [8].

- **Government and UE subsidies**

Another important element are government and EU subsidies supporting the development of photovoltaics in Poland. A number of initiatives, subsidies and supplements for energy from renewable sources creates ever better conditions for the development of this market.

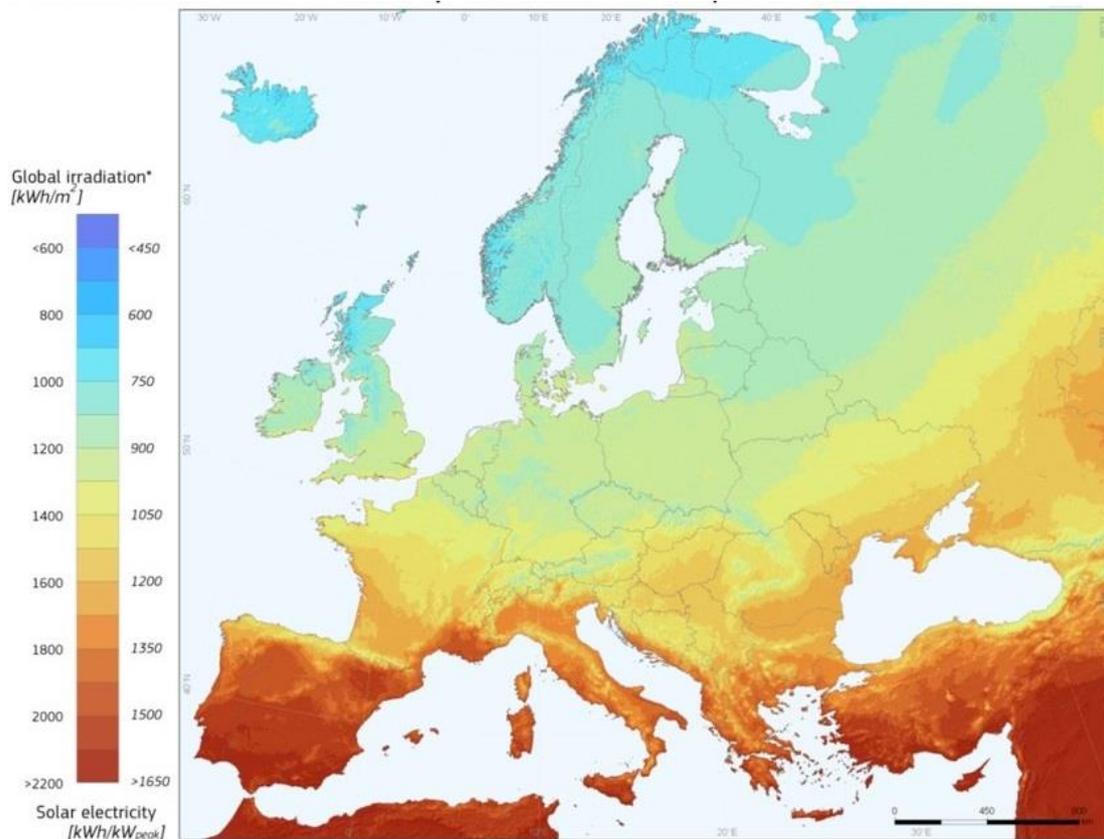


Figure 4. Irradiation level in Europe

Source: *Annual solar irradiation in Europe*, European Commission Joint Research Centre, Brussels, 2014

4. SUPPORT MECHANISMS FOR PHOTOVOLTAICS MARKET IN POLAND

Due to EU requirements and the need to develop the RES market in Poland, there have occurred mechanisms stimulating its development. In the context of companies producing

energy from renewable energy sources, as the consumers themselves, three main types of support can be specified, which are presented on Figure 5 below.

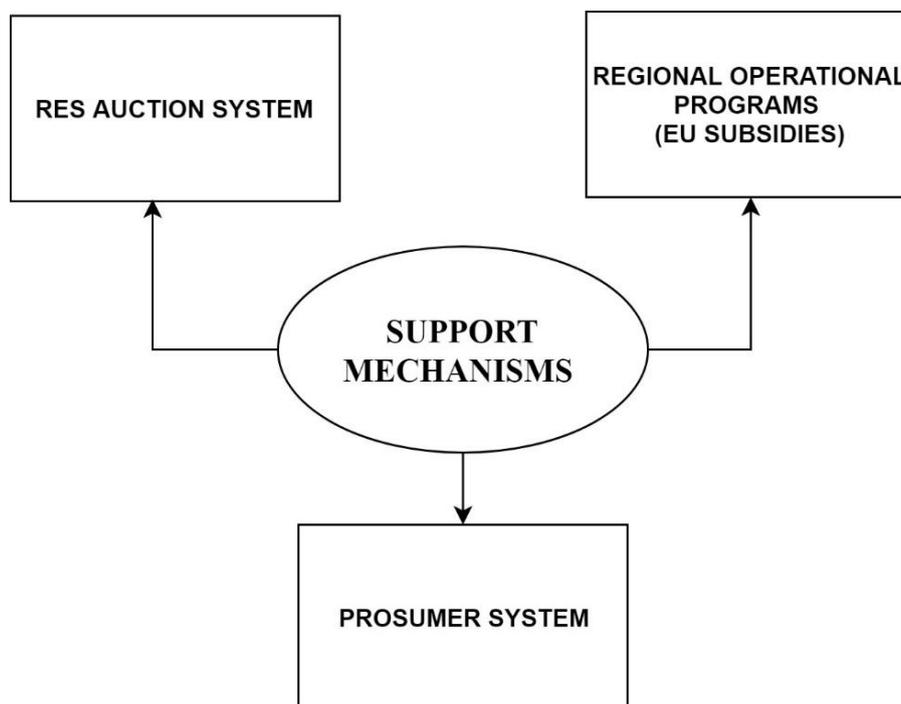


Figure 5. Support mechanisms for the photovoltaic market in Poland

Source: own study based on PV Market in Poland 2019, Institute for Renewable Energy, Warsaw, June 2019

- **RES auction system**

The auction system is an official, state instrument of support for large RES investments, which replaced the previous support system, i.e. so-called "Green certificates". Auctions for the sale of electricity generated in renewable energy installations (RES auctions) is a new model of the green energy support system in Poland. This model was introduced by the Act of 20 February 2015 on renewable energy sources (Journal of Laws of 2017, item 1148)⁴. RES auctions are nothing else than a tender for energy from renewable energy sources. The government orders a given amount of renewable energy and determines the maximum price for which it can buy this energy (so-called reference price). Investors who offer the lowest prices are selected and they will receive fixed price for supplying energy to the network in the period of 15 years. Auctions are carried out by the President of the Energy Regulatory Office. The energy producers submit to the auction offer for sales of energy declared for a period of 15 years at a specified price (not higher than the reference price for a given auction basket). It is worth noting that when the wholesale price of electricity exceeds the offer price and is higher at the moment (indexed with inflation) than auctioned by the producer, it will show a positive

⁴ The Act of 20 February 2015 on renewable energy sources, Journal of Law, 478; 2015,p. 14-45

balance. The electricity producer is obliged to return the amount resulting from the positive balance during the period specified in the auction.

- **Prosumer system**

It assumes that the energy consumer is also its producer. This system was created as part of work on the RES Act of February 2015. The Act introduced new rules for energy settlements for micro-installations with a capacity of up to 40 kW in the form of FIT (feed-in tariff). The rules, however, have not come into effect. After the amendment of the RES Act in June 2016, the FIT guaranteed tariff system was replaced with a system of net settlements (at the current market price of energy) of prosumers with energy providers on an annual basis (with a flat fee of 20-30% by energy trading companies and energy distribution fees). The system, commonly referred to as "discounts system", managed cover a small part of the potential that prosumers were given by FIT tariffs. In practice, the discount system means a decrease in prosumer income, after settlement of investment expenditures and fees for energy selling and distribution companies.

- **Installations subsidized by the ROP (Regional Operational Programs)**

The most important instrument enhancing financing RES in Poland are undoubtedly the EU structural funds managed from the level of individual regions. Photovoltaic prosumer installations are the most popular technology supported in Regional Operational Programs (RPO). As part of the Regional Operational Programs for 2014-2020, in the period of 2016 and 2017, subsidies for solar energy projects (including PV and solar collectors) were contracted for a total amount of PLN 1.26 billion, with total planned investment costs of PLN 1.86 billion. Co-financing from Regional Operational Programs accounted for an average of 70% of the total investment costs [5].

5. ALTERNATIVE FINANCING MODELS FOR PHOTOVOLTAICS

The intensive development of the photovoltaic market forces the search for new business models for running farms and photovoltaic installations. One of them is PPA model (power purchase agreement). Signed PPAs can be divided into two types which is shown on Figure 6. below.

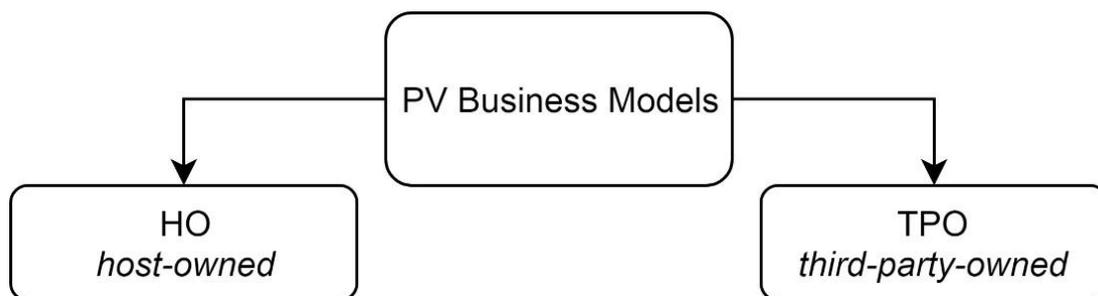


Figure 6. Types of business models on PV market

Source: own study based on G. Brunekreeft, M. Buchmann, R. Meyer, The rise of third parties and the fall of incumbents driven by large-scale integration of renewable energies: the case of Germany, Energy J, 37, 2016, p. 243-262

5. 1. Host-owned business model

The most widespread business model of PV is the proprietary model named host-owned model. The model in literature works under different names. These include among others: end-user owner [9], host-owned feed-in [10] or customer-owned [14, 15]. In the host-owned model, the proprietor of the building as well as the PV installation itself is the main user of the generated energy. The model consists in carrying out investments by the consumer who is at the same time investor and conduct investment on his own buildings or plots.

5. 2. Third-party-owned business model

The TPO (third-party-owned) model has received various names in the subject literature. The main names appearing in the research and publications are: Third-party [13], Third-party ownership [14], Third party PV [11], Third-party-financing [15], Solar services model and EMS Solar Model [16]. All these names refer to models that focus on third party investments (external entities) under PPAs signed with consumers and companies.

The TPO model appeared for the first time in the United States in 2005. One of the first companies offering third-party-owned solutions in photovoltaics in the United States was Sun Edison and MMA Renewable Ventures [16]. Energy sales under the TPO model are already in place in countries such as Germany, Denmark, the Netherlands or China [14].

This model consists in signing PPA type agreements or investment in the form of an external lease (leasing a photovoltaic installation) signed with individual clients or companies, and then building a photovoltaic installation on the premises owned by the customer.

The main advantage of the TPO model is the elimination of financial barriers, in particular high initial costs (purchase of installations) for individual clients and companies. Thanks to the benefits of using the TPO models, such solutions have been rapidly developed in past few years. For example, in 2014, 72% of solar installations in the United States installed in individual customers used solar panels were using the TPO model [19]. However, it is expected that this indicator will begin to fall and by the end of 2020 the panels owned by end users will outstrip the capacity of panels leased or obtained in the TPO model [19]. There are several reasons why there is a slowdown in the investments conducted in TPO model in the United States. These are:

- The increasing availability of financial instruments for end customers
- Fewer suppliers of photovoltaic installations in the TPO model (market saturation)
- SolarCity withdrawal from the model of TPO

The TPO model has a number of advantages for both consumers and companies operating on this market. Among the main advantages of the model, the literature of the subject distinguishes:

- Customers using the TPO model do not incur significant initial investment expenditures (purchase and installation of solar panels)
- Customers get green energy without incurring initial costs [14]
- Lower electricity prices for customers [18]
- Often higher margins for investors (third-party) from the sale of electricity directly to customers compared to the sale of electricity to the grid

- From the customers' perspective, the responsibility for servicing and maintenance is transferred to the investor [19]

In summary, the TPO model allows investors who have good financial standing to install solar panels within buildings and plots owned by third parties, while increasing the cost-effectiveness of installations (higher prices of electricity sales compared to the sale of electricity to the network).

5. 3. Development of the TPO model in Poland

At the moment there are no companies operating on the Polish market that provide comprehensive investments using the TPO model. According to report PV Market in Poland 2019 prepared by the Renewable Energy Institute currently there are several projects with a capacity of 5-50 MW existing on Polish market which count on a PPA formula in the future [5].

The increase in electricity prices in Poland is starting to create favorable conditions for investment developed in the PPA model, including third-party-owned model.

The factors that support the development of TPO models in Poland are:

- **Energy prices** – rising electricity prices in Poland make Polish entrepreneurs and individual consumers willing to sign PPA contracts with external investors at the same time providing them with an area or building on which solar installations could be located.
- **Business security / stability of prices** – entrepreneurs more and more often want to hedge against the sudden rise in energy prices by signing a long-term PPA contract with an external investors
- **Return on investment** – investors who want to build photovoltaic installations in the TPO system can count on higher prices of sold energy, due to the proximity of end-user located at the energy production point (no fees for transmission and indirect charges for consumer)
- **The growing concern of consumers and entrepreneurs about the environment** – An increase in ecological awareness of citizens and business owners in Poland can be observed. Often also clients and company shareholders require more and more efforts to protect the environment and use of renewable energy sources [5].

Counting on the further development of this market in the coming years, we will be able to observe the development of alternative business models on photovoltaics market in Poland, similar to the models used by companies operating for years in the United States, Germany, Denmark or China [14, 20-30].

6. CONCLUSIONS

There is no doubt that photovoltaics is playing a significant role in the development of modern energy system as well as environment protection. The conclusions of the article has been presented below:

- In the world can be observed dynamic development of the renewable energy sector, including photovoltaics itself. The increase in the volume of photovoltaic installations produced in last years has caused a drastic reduction in the prices of the panels themselves, making the solar energy generation more and more profitable.
- In Poland the photovoltaic market is at an early stage of development. Through EU requirements, the market is slowly beginning to adapt to the required changes in the field of environmental protection.
- There are existing systems for supporting investments in solar installations in Poland, but rapid market development and rising electricity prices force the emergence of new business models based on the PPA formula.
- It is likely that further development of the photovoltaic market will be observed in Poland in the coming years, in particular also in the context of the development of TPO models.

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