D2.1, August 2019

Auctions for the Support of Renewable Energy in Poland

Main results and lessons learnt

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D2.1, August 2019, Auctions for the Support of Renewable Energy in Poland

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Contents

1 Characteristics of RES-E auctions in the country

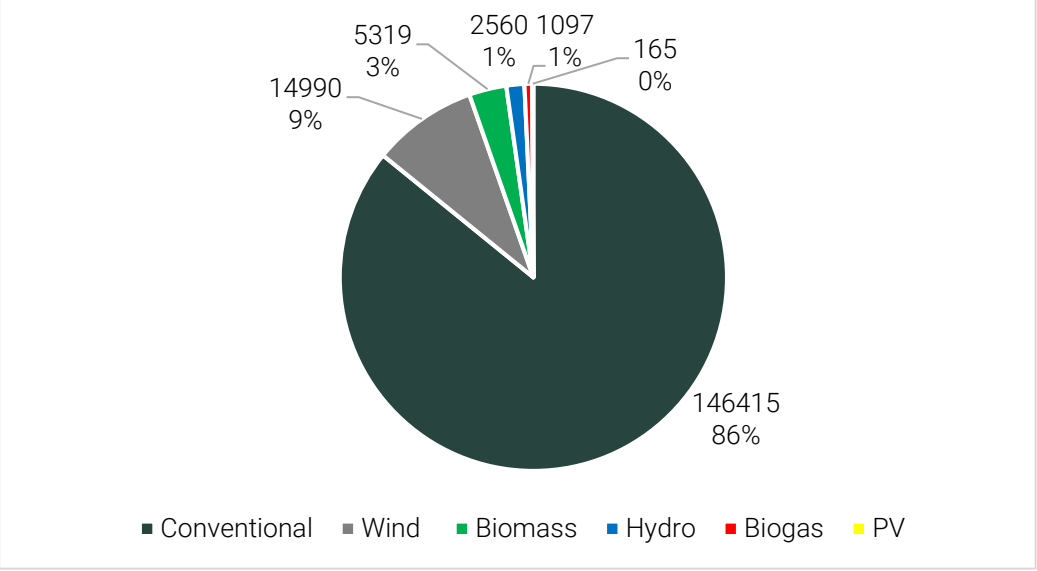
The aim of this paper is to analyze and evaluate the Polish renewable auctions scheme based on the results of auctions implemented so far[1]. It is an interesting case study for several reasons. First, with its share of renewable energy only 11% in 2016, Poland has had to make a strong late push for reaching its 2020 target of 15%. Furthermore, renewable energy support should be shaped with a long term vision since the country's electricity system today relies heavily on coal and lignite inputs. Second, Poland has been operating a hybrid support scheme since 2016. New renewable power plants can receive support in an auction-based feed-in premium (FIP) system, while old power plants are part of a green certificate system. It is possible, however, to migrate from the green certificate system to FIP through auctions. And finally, the auction system in Poland is highly fragmented compared to other European countries. In the Polish auction scheme auction baskets are separated according to three main features: technology, size (separate auctions for power plants with less and with more than 1 MW capacity), and whether the power plant is new or existing intending to shift from the green certificate system to the FIP system.

The paper is structured into three sections. The first summarizes the main characteristics of the auction schemes, followed by an economic evaluation, and a third section draws the main conclusions.

1.1 Goals of the government with organizing auctions

In 2016 the Polish government transformed the green certificate support scheme in order to further increase the share of renewable capacities in its highly fossil-based electricity mix. Figure 1 shows the current share of different technologies and the produced electricity (GWh) in 2017.

Figure 1: Electricity production structure of Poland in 2017, GWh and shares



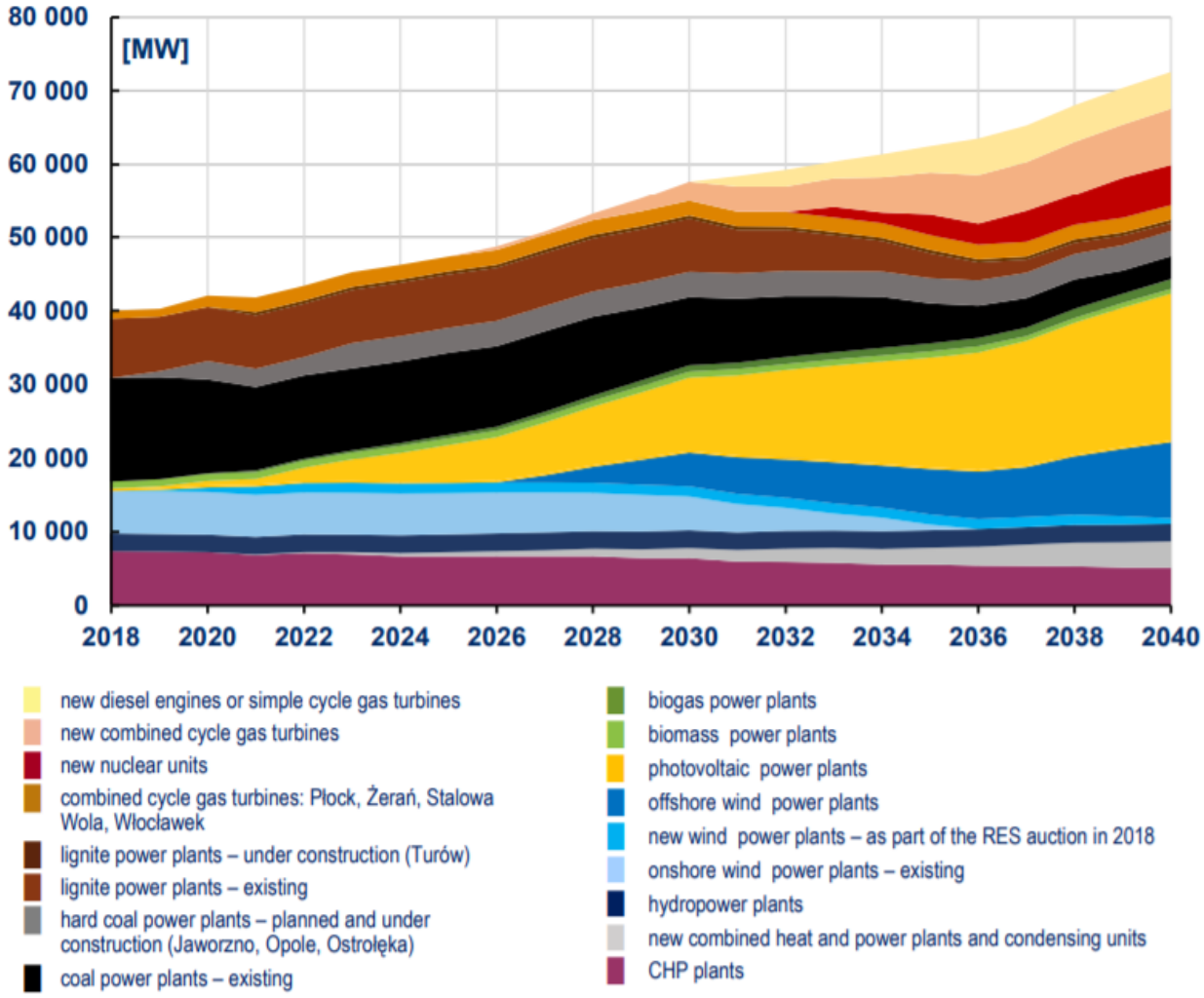
Source: Draft National Energy and Climate Plan (NECP) of Poland 2019, p. 6

In 2017, Poland generated more than 170 TWh (NECP, 2019) of electricity, 86% of which is from fossil fuels (hard coal, lignite, natural gas) compared to only 24 TWh from renewable sources. Onshore wind is the dominant renewable technology accounting for 9% of total generation, compared to 3% biomass and small amounts of hydro, biogas and PV.

[1] Please note that a case study on the planned auction scheme in Poland has already been published in the AURES project: http://auresproject.eu/publications/implementation-of-auctions-renewable-energy-support-in-poland

At an 11% renewable share, Poland currently lags behind its 2020 renewable energy target of 15% (Ministry of Economy, 2009). In fact, the country voluntarily increased its renewable electricity target to 19.3% for 2020 (Ministry of Economy, 2009). According to the draft NECP, Poland's renewable target for 2030 is 21% and 27% for the electricity sector (Ministry of Energy, 2018). Figure 2 summarizes the projected electricity generation capacity until 2040.

Figure 2: Forecast of the electricity generation capacities operating in Poland by fuel types



Source: Draft Energy Policy of Poland until 2040 (2018)

From the graph and the strategic documents three trends are observable. First, Poland plans a massive expansion of PV capacities, moving from slightly below 300 MW in 2017 to almost 20 GW by 2040, and offshore wind, from 5 GW in 2030 to 10 GW by 2040. Both strategic documents highlight that renewable expansion will be mostly based on these two technologies. According to regulatory changes in 2017, construction of onshore wind facilities must comply with very strict requirements and will be completely removed from auctions after 2020 and existing onshore facilities will gradually be phased out in the mid-2030s. The so called "Distance Act" makes it almost impossible to receive building permits for new onshore wind installations (Kamiński, J. – Majnusz, A., 2016) with a minimum distance from installations to households and mixed-use buildings (i.e. cannot be placed closer than ten times the height of the tower to the inhabited areas – 10h rule). The Distance Act applies to existing onshore plants as well, which rules out possible upgrades.

1.2 Main pillars of the Polish RES-E support policy

Before 2016, the main support scheme for renewable electricity production was the green certificate system.[2] In this system, RES-E producers receive tradable certificates of origin for the amount of electricity fed into the grid, while suppliers are obliged to cover their sales using a predetermined share of renewable electricity. When a supplier procures RES-E from a producer, it receives the corresponding green certificates, and must hold a minimum amount at the end of each year. In case of non-compliance, a substitution fee (replacement fee) has to be paid for the missing certificates, the level (minimum share) of which is determined annually. (Cichocki, K.- Młodawski, T.-Lewicki, M., 2018)

The clearing price of tradable certificates is determined by demand and supply of renewables. The annually announced quota obligation level determines the demand, while investments in RES production capacities determine supply. The certificate market has been in a persistent and significant oversupply since 2011 (Skarżyński, G., 2016), mainly due to the increased production of renewable electricity from biomass-cofiring. The resulting fall in price created an unfavorable and unpredictable support scheme for market players. Although the technology neutral certificate system contributed to a relatively cheap expansion of renewable technologies, support for co-firing in large, inefficient coal power plants a way of sustaining highly pollutant technologies, namely coal.

Unable to meet the challenges arising from this green certificate market (e.g. high price volatility and issues with co-firing), it was replaced by a new auction system serving as the sole form of RES-E subsidy in the New RES Act from 2016. As for the transition to the new system, operators of installations starting before 1 July 2016 could choose to remain in the green certificate system for 15 years after the commencement of RES electricity production or participate in the new auctions organized specifically for existing installations and migrate their capacity partially or fully to the new support scheme. (IEA, 2017)

1.3 Design elements of RES-E auctions

The relevant RES Act was approved by the Parliament on 20 February 2015 and entered into force on 1 January 2016. However, it was amended twice before the first auction was announced, first in December 2015 to postpone the enactment of the new measures by 6 months, and again in May 2016 with more significant modifications related to the auctions and the certificate system (details will be provided in later chapters). (Krasnodębski, A. -Kulińska, A.- Motylewski, M., 2016)

Albeit the declared aim of introducing the auction scheme, whose goal was to provide a cost effective and predictable investment environment, the RES Act was amended two more times so far, after the first and second rounds in 2017 and in 2018, respectively. The following tables summarize the characteristics of the Polish auction corresponding to the specific auction round. Subsequent amendments are introduced in the following tables and in the next subchapter.

Table 1.: Main characteristics of auctions and framework conditions

Characteristics	Description of the auction
Characteristics of the national electricity market	The 3 largest, vertically integrated electricity companies accounted for 2/3 of the installed capacity and 70% of domestic electricity production. A substantial state ownership is present in the sector. Although numerous retail companies operate in Poland, the largest share of the retail market belongs to 5 incumbent default suppliers serving households.

[2] Other types of certificates also exist in the country, e.g. blue certificates for the electricity generated from biogas in cogeneration facilities.

	Producers sell their electricity on the commodity exchange or other trading platforms.[3] As shown above, the high majority of electricity is produced in coal power plants. Half of the generating capacity is expected to cease operation by 2035 due to age and incompatibility with the Industrial Emissions Directive Pursuant to the Act on the Capacity Market – approved for 10 years by the EU Commission – a capacity mechanism will be implemented through capacity auctions, in which not only generators, but storage units, foreign capacities and demand-response can also participate.[4]
Name of auction scheme	Aukcyjny system wsparcia (auction support scheme)
Contractual counterparty (auctioneer? provider of support?)	Auctioneer: Energy Regulatory Office Department of Support Systems dsw@ure.gov.pl
Main features (e.g. cross-border auction?/multinational auction?)	Multi-technology auctions, where different technologies compete within special "baskets" with targeted volumes and budget.
Technology focus and differentiation (eligible technologies) - baskets	2016-2017[5]: Basket I - RES plants with full load hours higher than 3504 MWh/ MW/year (regardless of the energy source); Basket II - plants using biodegradable waste to generate electricity; Basket III - RES plants with CO2 emissions of less than 100 kg / MWh with rate of installed capacity utilization higher than 3504 MWh/ MW/year; Basket IV - agricultural biogas plants; Basket V - RES plants which are members of an energy cluster within the territory of a municipality (micro-cluster); Basket VI - RES plants which are members of an energy cluster within the territory of a district (macro-cluster); Basket VII - other. 2017[6]: Waste-to-energy basket for projects over 1 MW were introduced.

[3] 2018 National Report of URE, https://www.ure.gov.pl/en/about-us/reports/67,Reports.html
[4] Agora (2018) Report on the Polish power system Version 2.0 COUNTRY PROFILE, https://www.agora-energiewende.de/fileadmin2/Projekte/2018/CP-Polen/Agora-Energiewende_report_on_the_Polish_power_system_WEB.pdf
[5] IEA (2018)
[6] Krasnodębski, A. -Kulińska, A.- Motylewski, M. (2017)

	2018[7]: Basket I 1) biogas obtained from landfills; 2) biogas obtained from sewage treatment plants; 3) biogas other than those specified in 1 and 2; 4) exclusively dedicated biomass combustion installations or hybrid systems; 5) only installations using biomass, biogas, biogas or agricultural biogas incinerated in a dedicated multi-fuel combustion plant; 6) exclusively dedicated to biomass combustion installations or hybrid systems, in high-efficiency cogeneration. Basket II: 1) hydropower, 2) geothermal energy, 3) offshore wind energy. Basket III: 1) Agricultural biogas installations. Basket IV: 1) onshore wind, 2) solar PV installations. Basket V: 1) Hybrid installations. (see next section for amounts of volumes and budgets)
Lead time before auction	min. 30 days before announcing the auction
Min./max. size of project	Two size categories: "Small" for installations with capacity up to 1 MW and "Large" for installations with capacity of at least 1 MW
What is auctioned? Auctioned bids (in terms of budget, electricity or installed capacity)	Budget and a targeted volume of electricity (MWh) is defined in each basket and size category for the whole lifetime of the support period. Whichever is reached first is binding.
Budgetary expenditures per auction and per year	Defined separately for each auction period and basket.
Frequency of auctions	At least yearly, but auctions are not always held for all baskets.
Volume of the tender	Defined separately for each auction period.
Costs related to grid connection/access	Grid operators are obliged to enter into agreements with RES producers and to provide them transmission priority. The cost of grid connection is borne by the RES producer. Producers up to 5MW capacity face reduced charges. The distribution of grid development costs is not specified in regulation.[8]
Balancing and profile costs	4 €/MWh balancing cost payable by RES producers.

[7] Mroviec, P. (2018)
[8] RES-Legal (2019a)

Table 2.: General auction design (based on Ignaciuk – Jimeno (2019)and additional information)

Design elements	Description
Auction format	multi-unit
Auction procedure	Static
Pre-qualification requirements - Financial	One-stage bid bond (bank guarantee) with confirmed bonds required before auction date (Art. 78.3 RES-Act): In 2016 & 2017[9]: 30 PLN (7.02 EUR) per 1 kW, this guarantee is returned 60 days after the project starts to operate In 2018: 30 PLN (7.02 EUR) per 1 kW for existing and 60 PLN (14.04) EUR per 1 kW for new installations - the bond is refunded if the project does not win or after the commencement of electricity generation.[10]
Pre-qualification requirements - Material	A legally binding building permit is required for new and modernized plants (Art. 75.5.2 of RES-Act). A legally binding environmental permit should be attached if it is required by the Act on Availability of Information on the Environment and Its Protection (Art. 75.5.3of RES-Act). Grid connection agreement (Art. 75.5.1 of RES-Act) Extract from the local land-use plan, in case such a plan exists (Art. 75.5.4 of RES-Act). Schedule of works and expenditures (Art. 75.5.6 of RES-Act). Schematic drawing of the installation indicating the location and of electricity generating units and auxiliary devices, as well as the point of grid connection (Art. 75.5.7 of RES-Act). For offshore wind projects a legally binding permit for the construction and use of man-made islands is required (Art. 75.5.5 of RES-Act).
Auction volume	Volume and budget limits, defined separately for each auction period, basket and size category (see next section on data for volumes and budgets).
Pricing rule	Pay-as-bid
Award procedure	Multi-criteria Support is awarded according to: 1) Price criterion (Art. 80.1.1 RES-Act) 2) Quota criteria (Art. 80.1.2 RES-Act) 3) Criterion of the minimum number of bids (Art. RES-Act)- (not in 2018) Support is awarded to bidders (1) submitting the lowest price of electricity reduced by the amount of tax on goods and services, and (2) whose bids altogether do not exceed 100 percent of the value or volume of electricity specified in the auction announcement and (3) do not exceed 80 percent of the volume of electricity covered by all submitted bids. Furthermore, for the auction to be valid (=support awarded), a minimum of three bids have to be submitted (except in 2018).

[9] Zabłocka, D. – Nowak, P. (2015)
[10] Krasnodębski, A. et. al. (2018)

	In the event that several auction participants offer the same price, the decision is based on the timely order of submitting bids (Art. 80.2 RES-Act).
Price limits	Different by technology and sometimes by size.
Support period	15 years, but not beyond 31 December 2035.
Favorable treatment of specific actors	Power plants with capacities less than 1 MW can compete in a separate auction basket.
Realization time limit	2016 & 2017 Realization period of 48 months for all technologies, except: - 24 months for solar energy - 72 months for offshore wind 2018: Realization period of 36 months for all technologies, except: - 18 months for solar energy - 30 months for onshore wind - 72 months for offshore wind (Art. 74 RES-Act).
Penalties	Cancellation of support for missing the deadline of feeding the produced RES electricity to the distribution/transmission grid. Additional penalties: The installation missing the deadline is barred from participation in auctions for the period of 3 years (Art. 83.3c RES-Act). Failing to reach 3504 full load hours (calculated as an arithmetic mean for consecutive periods of three full calendar years), if so required in the specifications, results in the obligation of returning all public aid obtained in respect to the electricity sold in the year in which the required utilization rate was not reached (Art. 83.3a RES-Act). Loss of the bond deposit of 30 PLN per 1 kW (for existing plants) or 60 PLN per 1 kW (for new plants). Moreover, the Energy Regulatory Office may also impose a fine on the manager of the energy company but the level of fine cannot exceed the 300 percent of his/her salary (Art. 172 RES-Act).
Form of support auctioned	two-sided sliding feed-in premium
In case of premium schemes describe the method of reference wholesale price calculation	Arithmetic mean of average volume-weighted spot price of each hour on delivery day, based on a daily reference period.
Support level adjustments	The sale price of electricity indicated in the winning bids is subject to annual indexation according to the average annual consumer price index from the previous calendar year, specified in the communication of the President of the Central Statistical Office (Art. 92.10 RES-Act).
Transferability of support right	N/A
Other	-

1.4 Additional regulatory factors and changes in legislation

The 2016 RES Act amendment introduced the option for participation of projects located outside of Poland (up to 5% of the total volume auctioned at the previous year's auction) and the participation of hydroelectric plant projects of maximum 20 MW compared to the previous 5 MW (Krasnodębski, A. -Kulińska, A.- Motylewski, M., 2016).

It is also stated that the Council of Ministers determine the schedule of auctions at the request of the Energy Minister (Mrowiec, P.,2018), meaning the authority is not obliged to announce a longer time schedule for the auction rounds and the available budget (published annually).

The amendment also brought changes to the certificate system by introducing a new certificate to the segment of cogeneration facilities (blue for biogas-based cogeneration) (Palusiński, B., 2016), resulting in a lower remuneration for the renewable electricity in the certificate market. The RES obligation system also established different obligatory quotas for each certificate type.

At the same time a new Act entered into force regarding wind turbine investments. The new measures made turbines subject to real estate tax and increased the applicable property tax. The size of the potential areas suitable for turbine construction were reduced substantially (to 1% of the available area)[11] with the introduction of the 10h rule mentioned above, and previously issued building permits became valid for 3 years (later changed to 5 years – until 2021). Maintenance works are allowed on existing turbines, but any capacity upgrade is forbidden. (Krasnodębski, A. -Kulińska, A.- Motylewski, M., 2016)

After the first auction rounds were completed in 2016 the most important modification was related to the certificate system. The calculation method for the replacement fee of certificates was set to 125% of the annual weighted average price of the specific certificate, but no more than 300.03 PLN/MWh (RES-Legal, 2019b). This adjustment acts like a ceiling price for the certificates, affecting stakeholders with green certificate quota obligations. The minimum share of certificates was also modified; the green certificate share was raised beyond 2% and the blue certificate share was reduced to 0.5%. (Palusiński, B., 2017).

[11] European Parliament (2017) Climate and energy policies in Poland, Briefing for the ENVI delegation to Warsaw, Poland, on 18-20 September 2017
http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/607335/IPOL_BRI(2017)607335_EN.pdf

Table 3.: Changes in the certificate system

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Price of replacement fees									
Green (RES-E) PLN/MWh	267.95	274.92	286.74	297.35	300.03	300.03	300.03	300.03	90.00*
Blue (cogen with biogas) PLN/MWh						300.03	300.03	300.03	300.03 *
Minimum shares									
Green (RES-E) %	10.40	10.40	10.40	12.00	13.00	14.00	15.00/ 14.35	15.40	17.50*
Blue (cogen with biogas) %							0.65	0.60	0.50*

Source: Palusiński, B., (2017) *not approved

After the second round of auctions in 2017, the RES Act and the act on wind turbine investments were simultaneously modified (29 June 2018). The auction scheme and procedure were reformed by the introduction of new technological baskets, new application and pre-qualification rules, and new investment conditions for wind turbines (Krasnodębski, A. et. al., 2018).

From 2018 onwards, bidders can submit their offers in paper form or via an electronic platform, replacing the previously used internet platform. After the submission, producers cannot withdraw or modify their bids.

The amendment after the second round of auctions restored the taxation rules valid for wind turbines before the amendment of May 2016 (effective date 1 January 2017) by reducing the applicable real estate and property taxes, but the Distance Act remained unchanged. It also extended the validity of building permits issued before the introduction of the Distance Act from three to five years, which implies that these new wind projects can participate in auctions only until July 2021. If the installation's capacity or environmental impact changes by increased size, height etc., the building permit must be renewed. Transformation and upgrades are not possible in case of existing wind farms breaching the 10h requirement, which are only allowed to perform maintenance work and restoration.

2 Evaluation of the auction results

This section will evaluate the results of the completed auctions in Poland.[12] As highlighted in the previous section, three main auction rounds were conducted in the years 2016, 2017, and 2018. However, as the Polish auction system is differentiated by technology, size and existing versus planned plants, all auctions incorporate several rounds. Altogether, between 2016 and 2018 eighteen separate renewable auctions were organized.

In the following, we evaluate the outcome of the auctions by grouping them into the following 4 categories:

a) Auctions for new PV and wind installations under 1 MW capacity,

b) Auctions for new PV and wind installations with size of at least 1 MW capacity

c) New installations of other technologies

d) Existing installations switching to the new support system.

Newly built PV and onshore wind technologies were competing in multi-technology auctions in all three years. However, with regard to multi-technology baskets, the regulation changed significantly before the 2018 auction round took place. Whereas in 2016 and 2017 onshore wind and PV projects were competing with hydro, geothermal and offshore wind power projects (in the size category of below 1 MW), in 2018 two auctions were organized involving only PV and onshore wind technologies below and above 1 MW.

2.1 PV and onshore wind auctions for installations below 1 MW capacity

The three rounds of the auctions are not fully comparable because of the design changes, but the 2016 and 2017 auctions were predominately won by PV (with a small share of onshore wind) and it is possible to compare their outcomes to the 2018 auction.

Auction rules in Poland specify a limit for the total amount of energy delivered, as well as the corresponding financial budget. The two figures in the next table show a consistent rise in the offered auction budget and the targeted amount of electricity.

Table 4: Auctioned volume and maximum budget available in auctions for PV and Wind projects under 1 MW capacity

2016		2017		2018	
Auctioned amount (TWh)	Maximum budget (million EUR)	Auctioned amount (TWh)	Maximum budget (million EUR)	Auctioned amount (TWh)	Maximum budget (million EUR)
1.57	319	4.72	509	16.07	6243

Source: Ignaciuk – Jimeno (2019)

[12] Data used in the evaluation are based on Ignaciuk – Jimeno (2019) data gathering if not indicated otherwise.

In 2016 only 1.57 TWh of energy was auctioned, rising to 4.72 TWh in 2017 and 16.07 TWh in 2018, more than ten times the 2016 auction volume. The amount of auctioned energy is equivalent to 70 MW PV capacity in 2016, 300 MW in 2017 and 1 GW in 2018 based on the results of the auctions. While the size of the first two auctions were more or less on par with the present European auctions, the third was significantly larger, only outmatched by Spain's July 2017 tender that awarded 5 GW.[13]

The number of offers in the specific Polish tender rounds grew with the budget, from 152 bids in 2016 to 472 in 2017. Data on the 2018 bids are not yet published aside from the number of winning projects (see next table). The relatively high rates of bids awarded in the first and second rounds (55% in 2016 and 75% in 2017) are indicative of a healthy level of competition among bidders. However, in the third round (2018), only about half (8.17 TWh) of the maximum offered 16.07 TWh was awarded and while the budget threshold was not reached either, suggesting that the offered quantity might have been too high, which can hinder cost efficiency significantly.[14] If the bidders were aware that the maximum volume set for the auction is too high, their incentive to submit a competitive price is lower, leaving bids closer to the ceiling price. Figure 3 summarizes the results of the three auctions.

Table 5: Submitted and winning bids in auctions for PV and Wind projects under 1 MW

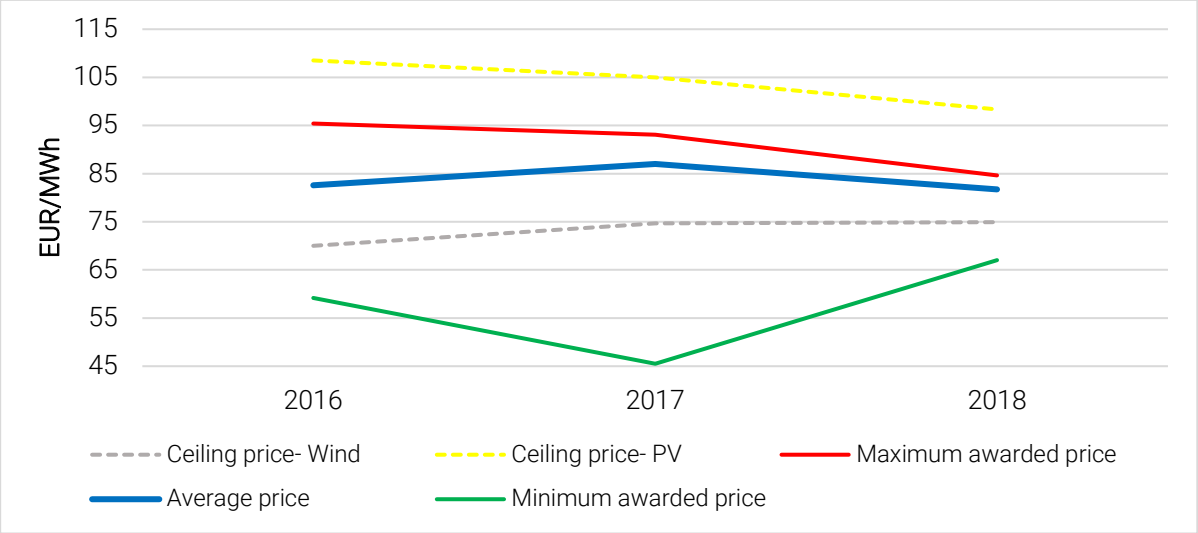
	2016	2017	2018
Number of submitted offers	152	472	N.A.
Number of winning offers (share relative to submitted)	84 (55%)	352 (75%)	552 (N.A.)
Amount of energy receiving support (TWh)	1.56	4.72	8.17
Share of awarded volume relative to max volume set by the auctioneer	99.51%	99.91%	50.86%

Source: Ignaciuk – Jimeno (2019)

[13] In the two rounds of Germany's mixed PV and wind tenders the auctioned capacities were around 200 MW each (2019), in Greece it exceeded 600 MW (2019), while in France 200 MW could receive support (2018). It is important to note that these magnitudes are only partly comparable, as in most of the countries there is no separate auction for projects under and over 1 MW.

[14] On the effect of competition levels in auctions, see the AURES Policy Memo No. 4, The effect of competition levels on auction outcomes, October 2016 http://auresproject.eu/sites/aures.eu/files/media/documents/policy_memo-4_competition_2511016.pdf

Figure 3: Minimum maximum and average winning price compared to ceiling price in auctions organized for PV and wind projects under 1 MW



Source: Ignaciuk – Jimeno (2019)

The graph shows a considerable rift between the ceiling prices set for onshore wind and PV, amounting to 40 EUR/MWh in 2016. Although technological differences might explain the need for different price ceilings in multi-technology auctions, such a large gap is difficult to justify. The ceiling price levels shown above can seriously hinder the competition between the technologies as well as the effectiveness of the auction. It is very likely that a wind park with a bid of 80 EUR/MWh would be more efficient to support than a PV acquiring 100 EUR/MWh. However, due to the low ceiling price the latter power generator would win. In this sense, by lowering the ceiling price of only one selected technology, the multi-technology feature of the tender can be misleading.

The winners in the 2016 and 2017 auctions were almost exclusively PV plants, and in 2018 only PV. While PV might be more competitive at this scale than onshore wind turbines, the data reveals that the ceiling price for wind was significantly lower than the average awarded price of the auction in all three years. This suggests that higher ceiling prices set for onshore wind could have resulted in lower average prices. It suggests that wind generators were priced out from the auction not by the PV bids, but by the relatively strict ceiling price of wind generators.

Ideally, we would expect declining prices due to the rapid development of these technologies and the gained experience of the market participants in case of less mature technologies. The relatively stable average price across the 3 years does not necessarily mean that the auction was inefficient, but can be the result of other design elements. In the Polish case the price evaluation pattern could be heavily influenced by the exponentially increasing auction budget size. With larger auctioned volumes less competitive power plants have more opportunities, generally leading to higher prices. This might explain the rising minimum price awarded between 2017 and 2018, along with bidders' perception of excessive volumes. Nonetheless, the maximum awarded price was declining over the years.

To date, only the 2016 auction round can be properly analyzed for its effectiveness measured by project realization rate, as only projects of the 2016 auction round passed the realization deadline. Out of the 73 winning PV projects in 2016, 55 were completed within the 24-month deadline, corresponding to a 75% realization rate, and 52.5 MW of the awarded 68.4 MW in terms of capacity (77% realization rate). However, only 1 of the 11 small-sized wind projects was completed on time. It suggests that the bids made by the wind developers were too aggressive, and they were not able to finalise the projects within the given timeframe.

The deadline for completing PV projects awarded in the 2017 auction round is June 2019. According to Bellini (2019), by April 2019 the completion rate of these projects was very low: out of the awarded 290 MW capacity only 75 MW were finished, a rate of 26%.

Altogether in the mixed PV and onshore wind auction under 1 MW PV technology dominated the auctions, but it is difficult to tell whether this is due to the technological dominance of PV or the very low ceiling price of onshore wind technologies. The average prices of the Polish auctions were generally higher than other European PV based or mixed auctions, and relatively constant in the three auction rounds. It is important to recall that the offered maximum volume increased drastically between 2016 and 2018 which likely affected the price. The first auction round provided a solid completion rate for PV, but for wind only 1 out of the 11 projects were completed. Until April 2019 the completion rate of the second auction round was very low, but promoters still have until June 2019 to finish their projects.

2.2 PV and onshore wind for plants with at least 1 MW capacity

In 2018 another auction was held for onshore wind and PV installations for installations greater than 1 MW. The available budget was quite large (EUR 3.69 billion), similar to the auction budget for the smaller projects, and limited to 45 TWh. Different ceiling prices were again applied to the two technologies: 93.65 EUR/MWh for PV and 81.95 EUR/MWh for wind projects.

Due to the Distance Act this auction was likely to be one of the last opportunities for onshore wind projects with building permits to apply for support. The draft Energy Strategy for Poland released in late 2018 showed a trend towards the reduced role for onshore wind and the intended shift of support to offshore wind parks. There is no detailed information about the participants of the tender, but according to expert opinion approximately 2 GW capacity participated in the auction.

Table 6: Results of the more than 1 MW capacity mixed PV and Wind auction in 2018

Technology	Number of winners	Awarded (share)	Assigned budget (share)	Minimum price	Average price	Maximum price
PV and Wind, more than 1 MW	31 (all wind)	42 TWh (93.32%)	1.929 billion EUR (52.27%)	36.95 EUR/MWh	45.93 EUR/MWh	50.80 EUR/MWh

Source: Ignaciuk – Jimeno (2019)

The corresponding data shown in Table 6 suggest an intense competition among bidders. Almost all offered energy was sold but the support allocated was only 52% of the total budget, meaning that the auction was highly cost effective. This is supported by the level of winning bid prices: the 46 EUR/MWh average price can be considered quite low even compared to Western European auction results. The two mixed onshore wind and PV auctions in Germany organized in 2018 resulted in the average prices of 53 EUR/MWh and 56 EUR/MWh respectively.

The low price level was presumably the result of two factors. First, wind energy can be considered a mature technology in Poland, as almost 10% of the current electricity generation is wind based. Second, the Distance Act and the poor outlook for wind projects might have prompted wind investors to participate with lower bid prices in the auction, which raises concerns about the future realization rates. [15]

The difference in winning projects below and above 1 MW might be attributable to the economies of scale effect (along with the effect of ceiling prices explained in the previous section). Comparing the outcomes of the auctions in the two size categories, the average winning price for small plants was around 82 EUR/MWh compared to 46 EUR/MWh for large-scale installations. Due to objectives such as diversity of actors and participation of a larger part of society, there is a trade off between cost efficiency and distributional effects/social aspects. Considering that Poland introduced the auction scheme in order to replace the green

[15] Since then, the Polish government announced plans for a 2.5 GW onshore wind auction in 2019, which, if realized, would absorb all currently granted building permits.

certificate system with something more cost-efficient, it is questionable whether the size division delivers this result. Highest prices on the above 1MW auctions are well below the minimum prices of the below 1 MW auctions, underlying the level of efficiency loss.

2.3 New technologies besides PV and wind

Besides PV and onshore wind, biomass, biogas, bioliquids, offshore wind, geothermal and hydro competed in 6 different auction baskets in 2018 (see Table 7).

Table 7: Main characteristics of auctions for new renewable technologies other than PV and wind, 2018

Technology	Offered amount	Auction budget	Auction with valid bids
Biomass or non-agricultural biogas, more than 1 MW	57 TWh	5.836 billion EUR	Yes
Biomass or non-agricultural biogas, less than 1 MW	13.31 TWh	1.289 billion EUR	No
Hydro, Bioliquids, Geothermal, Offshore Wind, less than 1 MW	3.75 TWh	180 million EUR	No
Agricultural biogas, less than 1 MW	11.7 TWh	1.676 billion EUR	Yes
Hydro, Bioliquids, Geothermal, Offshore Wind, more than 1 MW	5.4 TWh	607 million EUR	Yes
Agricultural biogas, more than 1 MW	3.51 TWh	452 million EUR	Yes

Source: Ignaciuk – Jimeno (2019)

Three auction categories can be separated by technology: 1) agricultural biogas, 2) biomass and non-agricultural biogas and 3) hydro, geothermal, offshore wind and bioliquids. All auctions were separated by size above and below 1 MW capacity.

The categorization of technologies raises some questions. For bioenergy-based technologies, it is not clear why agricultural biogas is separated from biomass and non-agricultural biogas. Furthermore, it is not sensible to include bioliquids into the third mixed basket rather than letting it compete with biomass. Finally, the grouping of geothermal, offshore wind, hydro and bioliquids together is not intuitive neither.

Biomass and non-agricultural biogas with at least 1 MW capacity were to be granted the highest share of support with almost EUR 6 billion for 57 TWh. A significant amount was available in the same technology basket for installations under 1 MW and for agricultural biogas plants under 1 MW. In the other categories the actioned amounts were more moderate.

After the 2017 auction, changes to the Polish RES regulation no longer required a minimum of three bids in order to consider an auction successful. However, as Table 7 shows, despite the relaxed rule, two auctions were unsuccessful (biomass and non-agricultural biogas under 1 MW and Hydro-Bioliquids-Geothermal-Offshore wind under 1 MW).

Table 8: Results of effective auctions for new technologies other than PV and Wind, 2018

Technology	Number of successful bids	Contracted volume (share of offered)	Minimum price	Average price	Maximum price
Biomass or non-agricultural biogas, more than 1 MW	1	0.97 TWh (1.70%)	93.65 EUR/MWh	93.65 EUR/MWh	93.65 EUR/MWh
Agricultural biogas, less than 1 MW	29	3.49 TWh (29.83%)	126.17 EUR/MWh	132.33 EUR/MWh	133.39 EUR/MWh
Hydro, Bioliquids, Geothermal, Offshore Wind more than 1 MW	5	0.82 TWh (15.19%)	98.03 EUR/MWh	108.72 EUR/MWh	112.38 EUR/MWh
Agricultural biogas more than 1 MW	3	0.72 TWh (20.51%)	116.13 EUR/MWh	118.28 EUR/MWh	121.05 EUR/MWh

Source: Ignaciuk – Jimeno (2019)

Table 8 summarizes the results of the four auctions with successful bids. The auctioned amount was less than 30% percent of the total offered volume in all cases, and the number of bids was below 5 except for the agricultural biogas installations below 1 MW. Prices are very close to ceiling prices, averaging around 100 EUR/MWh and reaching 132.33 EUR/MWh for small-scale agricultural biogas plants. This data indicates an insufficient level of competition and likely poor cost efficiency. In all cases the auctioned volumes were excessive compared to the potential supply, allocated to a large number of technology baskets, resulting in very small number of bids.

2.4 Projects migrating from green and certificate system to feed in premium system

As described earlier, in Poland the green certificates system and renewable auctions have been operating in parallel since 2016, albeit it is possible to migrate from the former scheme to the latter.

Between 2016 and 2018, 9 auctions were organized for existing power plants to integrate them into the new support scheme but only three were successful. Table 9 includes the details of the auctions.

Table 9: Main characteristics of auctions for existing renewable power plants

Name	Technology	Offered volume	Auction Budget	Number of winning bids	Awarded volume
2016 AZ/1	agricultural biogas, less than 1 MW	2.11 TWh	294 million EUR	6	0.82 TWh
2016 AZ/2	agricultural biogas at least 1 MW	2.31 TWh	319 million EUR	Unsuccessful auction	
2016 AZ/4	hydro[16], less than 1 MW	1.57 TWh	126 million EUR	49	0.42 TWh
2017 AZ/2	hydro[17], less than 1 MW	1.48 TWh	148 million EUR	44	0.31 TWh
2018 AZ/1	biomass and non-agricultural biogas, at least 1 MW	33.86 TWh	3.325 billion EUR	Unsuccessful auction	
2018 AZ/2	agricultural biogas, at least 1 MW	1.47 TWh	189 million EUR	Unsuccessful auction	
2018 AZ/3	geothermal, hydro, bioliquids, offshore wind, less than 1 MW	1.48 TWh	180 million EUR	Unsuccessful auction	
2018 AZ/4	agricultural biogas less than 1 MW	1.15 TWh	153 million EUR	Unsuccessful auction	
2018 AZ/5	biomass and non-agricultural biogas, less than 1 MW	0.92 TWh	120 million EUR	Unsuccessful auction	

Source: Ignaciuk – Jimeno (2019)

As shown in the table above, two auctions targeting hydro power plants in 2016 and 2017, and one for agricultural biogas plants under 1 MW in 2016, resulted in accepted bids. It is important to note however, that in all three cases the auctioned volume was significantly smaller than the offered volume, and all participating offers won. This raises concerns about the level of competition in these auctions.

One interesting case to highlight is the 2018 auction AZ/1 for biomass and non-agricultural biogas plants with capacity of at least 1 MW. As can be seen from Table 9, both the auction volume and available budget were sizable (33.9 TWh and more than EUR 3.3 billion respectively). The aim of the auction was to shift

[16] This was generally a multi-technology auction which required the power plants to have a utilisation rate higher than 3504 full load hours with a CO_2 emissions less than 100 kg / MWh. These restrictions mainly narrowed the available technologies to hydro.

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significant generation capacity from the certificate system to the feed-in-premium support scheme, but the developers have been reluctant to adapt to the new system.

According to ICIS, the auctions failed to draw interest because of the rising wholesale electricity prices together with increased certificate prices.[18] ICIS estimated that the renewable power plant revenues could reach 110 EUR/MWh under the green certificate system, close to the ceiling prices set for the auctions. If producers expected prices to rise, remaining in the green certificate system was a rational choice. In addition, blue certificate prices (for biomass co-firing) are approximately three times as much as green certificate prices, rendering migration to biogas power plants suboptimal. Additionally, market participants are waiting for the new renewable Act of Poland expected later in 2019.

Regarding the success rates, awarded volumes were significantly less than the auction volume limit and each submitted bid won in all cases. Table 10 presents the ceiling, minimum, average, and maximum prices for the 3 auctions.

Table 10: Results of successful auctions for existing renewable technologies

Auction name	Technology	Ceiling price	Minimum price	Average price	Maximum price
2016 AZ/1	agricultural biogas, less than 1 MW	128.69 EUR/MWh	117.55 EUR/MWh	117.71 EUR/MWh	117.76 EUR/MWh
2016 AZ/4	hydro, less than 1 MW	109.69 EUR/MWh	7 EUR/MWh[19]	86.87 EUR/MWh	109.22 EUR/MWh
2017 AZ/2	hydro, less than 1 MW	112.31 EUR/MWh	67.85 EUR/MWh	86.81 EUR/MWh	110.90 EUR/MWh

Source: Ignaciuk – Jimeno (2019)

As for the efficiency of the auctions, Table 10 shows that the agricultural biogas basket bids ranged from 117-118 EUR/MWh, only 10 EUR/MWh below the ceiling price. Furthermore, the 6 winning bids were associated with only 2 companies: PGB Development and PGB Energetyka. The average bid price of the two hydro auctions was around 87 EUR/MWh, which is significantly lower than the ceiling price (109.69 EUR/MWh). Although only a portion of the announced volumes were sold, more than 40 power plants participated in these auctions. However, with winning bids close to the announced ceiling prices, competition between power plants seemed to be low.

[18] https://www.icis.com/explore/resources/news/2018/10/26/10268936/icis-power-perspective-first-2018-polish-res-auctions-fail/?redirect=english&fbclid=IwAR0tObN-860Aq6iokVBm4erWZUZtSW00o79Bxs_JKZ4-tU8X44nNbd9GEhw

[19] It is highly likely that the bidder made a mistake in submitting this bid.

3 Conclusions

The Polish RES auction system is highly complex. In three rounds (2016, 2017 and 2018) Poland organized 18 auctions with varying baskets of technologies. Some included only single technologies and others multiple technology baskets. A second dimension divided the auction by size, below and above 1MW. In addition, auctions were organized to incentivize existing RES producers to move from the old green certificate system into the new auctioned support scheme.

The Polish government is attempting to achieve several objectives simultaneously under the new scheme. On the one hand it wants to move RES production away from the green certificate scheme to reduce the support needed for the expansion of renewable generation. On the other, it wants to help advance RES capacities that would not be able to compete with large-sized wind or PV installations (e.g. small-sized biogas and biomass-based generation) to expand market participation and increase actor diversity. However, support for small-scale producers is inherently more costly and their participation would reduce the cost efficiency. Data shows that a technology basket containing onshore wind and PV, support for smaller installation can be twice as high as larger plants, resulting in about 40 €/MWh price difference. A trade-off between these two objectives should be discussed. It is also evident that the ceiling prices of the mixed PV and onshore wind auction rounds favor PV technologies.

At the same time, with high targeted RES quantities compared to the EU average, the three auction rounds were not meant to be pilot or test auctions. However, the low participation level suggests that serious re-design has to be considered with regard to the technological baskets to achieve the targeted RES level. Poland auction design is now faced with a dilemma to reach the 2020 RES targets; significantly more volumes are needed, but the data shows that sharply increasing volumes can undermine price efficiency. One solution is splitting the yearly auction into smaller volumes with higher frequency, which would allow the Polish authorities a more flexible framework to react to the participation rates and price developments.

As for transferring RES capacities from the certificate to the auctioned support scheme, the results are mixed. The auctions were more successful in the case of hydro technology, where auctions had high participation rates and resulted in relatively moderate prices. Nevertheless, biomass and biogas producers performed poorly, and in many auction baskets there were no participants (6 out of 9 auctions), while in others only very few. In these categories, only investors in hydro based projects could be attracted (above 40 participants), albeit only around 30% of the total budget was allocated. Biogas and biomass producers refrained from participation probably due to the rising certificate prices and the changing regulation defining the RES markets. It is not clear either how the transferred amount of RES production from the certificate market is handled in the system, or how it impacts the supply/demand relation of Poland's remaining certificate market.

The tender for mixed wind-photovoltaic above 1MW resulted in the most competitive prices (45.93 €/MWh average price) below the 2018 German price levels. However, the competitive pressure was not a result of the auction design itself. Onshore wind connection license owners in Poland must realize their projects before July 2021, which pressures them to participate and bid competitive prices. At the same time the Polish energy policy precludes onshore wind from further expansion in the future. This poses a serious question to the auction design: which technology should be promoted, if the low-cost option onshore wind is excluded from the promoted technology mix? In this case probably the PV technology will gain in the short term and offshore wind gets higher chances in the longer term.

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AURES II is a European research project on auction designs for renewable energy support (RES) in the EU Member States.

The general objective of the project is to promote an effective use and efficient implementation of auctions for RES to improve the performance of electricity from renewable energy sources in Europe.

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