Selected Implications of the Investment Freeze in the Onshore Wind Power Sector

Polish Wind Energy Association

May 2016

TPA Horwath Horodko Audit Sp. z o.o.
Member of Crowe Horwath International

Warsaw, 20 May 2016

To:
Wojciech Cetnarski

Polish Wind Energy Association
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Dear Sir,

On behalf of **TPA Horwath Horodko Audit Sp. z o.o.** please find below the report summarizing our analysis of the selected results of the upcoming legislative changes affecting the wind power sector.

We hope that this report will meet your expectations and provide useful information. In case of any questions or comments please do not hesitate to contact us.

Best regards,

Krzysztof Horodko
Managing Partner

Wojciech Sztuba
Managing Partner

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1. Introduction

Polish Wind Energy Association has asked TPA Horwath to analyze the results of the investment freeze (pertaining to investments currently under construction, those not yet covered by building permits and upgrade & replacement projects) in onshore wind energy on capacity installed in this sector, and consequently, on the electricity produced from renewable energy sources.

Our analysis has been based on the draft act presented to the Polish Parliament on 19 February 2016 and eventually adopted on 20 May 2016, introducing regulatory changes (informally called **Distance Act - "ustawa odległościowa"**) related to construction of new wind farms, including in particular restrictions on the distance from the nearest residential (or partly residential) buildings

Below please find the results of our analysis.

2. Summary

Below is a summary of this report, with a description of the key assertions, assumptions and conclusions made in our analysis.

WIND POWER SIGNIFICANCE IN THE CURRENT & FUTURE ENERGY MIX

- After a period of quick growth, capacity installed in the onshore wind energy as at the end of 2015 reached **4 978 MW**, whereas the electricity produced is estimated at **10 702 GWh** annually, representing **47.6%** of total electricity production from renewable sources.
- Total estimated capacity rose by **497 MW** in 2016 year-to-date, a result of construction work started in 2015. We have assumed that there is no significant pipeline left currently under construction. This is because renewables producers entering electricity into the grid after 30 June 2016 will not receive certificates of origin. Therefore, we do not expect new construction to start before the conclusion of the first auction organized on the basis of the Act of 20 February 2015 (that is, until the second half of 2016). Thus, it is reasonable to assume that no new capacity will be added to the system before the second half of 2017.
- To achieve the EU-mandated target share of RES in gross final energy consumption equal to 15%, Poland must, according to the estimates contained in the National Action Plan (KPD), to produce **32.4 TWh** of electricity from RES in 2020. This implies a necessity to increase production by **10.0 TWh** in the years 2016-2020.
- According to our estimates, assuming that auction budgets mimic the plans drawn up in preparation for the 2016 auctions, up to **6.0 TWh** out of the assumed **11.2 TWh** could be provided by industrial-scale wind power plants.

CHANGES PROPOSED IN THE DRAFT

- From the point of view of the wind industry the most important changes introduced by the draft include:
    1) restriction on the distance of newly built wind power plants from the nearest residential and partially residential buildings,
    2) real estate tax base increase (value of the entire wind power plant instead of only foundation and the tower) through an amendment to the Construction Act in the section containing the definition of a structure,
    3) introduction of a requirement for the wind energy producers to obtain a decision of the Office of Technical Inspection (UDT) at least every two years after each upgrade or repair of the power plant, permitting further service, along with payment of a “UDT activities fee” in an amount dictated by the minister of the economy, reaching a maximum 1% of total capital expenditures.
- In this report we purport to estimate the financial consequences of the **wind farm construction freeze** (both in terms of new investments and investments replacing existing farms from approx. 2025 to 2030) due to the potential implementation of the proposal to ban issuing building permits for wind farms located less than ten times the height of the turbine from residential or partially residential buildings.
- The analysis is based on the assumption that such a strict criterion would make any of the potential locations for onshore wind power plants unattractive from the investment perspective, and so that the investments in the industrial-scale wind power (larger than micro-installations) would be de facto suspended as of 2017. Despite the large number of construction permits issued before the Act came in force (according to PWEA estimates, approx. 2 000 MW in terms of capacity), on the basis of which projects could be submitted for auctions, it appears that some of the Act’s provisions would block the construction of new power plants. In almost every case some fairly unpredictable modifications of the original design of a wind farm are required. These can be formally approved through the issuance of a so-called substitute building permit. The draft does not provide this possibility in respect of facilities that do not meet the distance criterion. Therefore, obtaining financing for such projects would be extremely difficult.

REPLACEMENT OF FUTURE WIND FARMS WITH OTHER TECHNOLOGIES

- Wind energy is the cheapest source of RES electricity. However, if investments in the wind power have to give way to other RES sources, the costs of energy production would increase, affecting both consumers and business. Potential wind energy production (above mentioned 6.0 TWh) would have to be substituted by biomass energy production (5.1 TWh, including 1.2 TWh of energy from coal plants adapted to biomass co-firing), biogas (0.6 TWh) and solar power (0.3 TWh). Consequently, LCOE (average long-term cost of electricity) of industrial installations set up between 2017 and 2020 will be approx. PLN 60 per MWh higher that it would be using wind power plants (average price increase **340 PLN/MWh** up to **400 PLN/MWh**).
- In addition, it should be assumed that after 2020 the production of electricity from renewable sources should not fall (moreover, based on CO2 emission goals, it should continue to grow quickly). As a result, wind power plants built by the end of the first half of 2016 would have to be replaced by new installations after they reach limits of their technical sustainability. In the report we estimate the cost of replacing the installations that are going to be scrapped after 2025. Taking into consideration a high level of uncertainty about the LCOE of installations completed in 2030 and afterwards, it is difficult to accurately estimate how much it would cost to replace currently operating wind power plants with new capacities in other RES technologies. Nonetheless our estimates indicate that the expense could reach almost **PLN 2.6 billion** annually in the year 2042.

MUNICIPALITY FINANCE

- The wind power plants investment freeze will hit municipality budgets. This impact will involve loss of revenue from real estate tax and share in income taxes (PIT and CIT) payable to the local governments by potential new installations operators.
- This means real estate tax-related revenue shortage in the years 2018-2020 in the total amount of **PLN 204 million** and since the year 2020 – **PLN 97 million** annually.
- The estimated loss of revenue from CIT and PIT by municipalities is estimated at **PLN 33 million** in the years 2018-2020.
- We have also been able to assess the impact of the lack of replacement investments since 2030 on the budgets of local governments. Expressed in 2015 prices, the overall loss of real estate tax revenue will amount to **PLN 240 million** annually (since 2041), and **PLN 39 million** annually (in 2041) in forgone income taxes.

EMPLOYMENT IN THE SECTOR

- Construction, operations and maintenance of wind farms creates jobs. In the years 2017-2020 the of investment freeze in new wind farm capacity will result in a loss of approx. **12.7 thousand** temporary jobs and **1.1 thousand** permanent jobs. In the years 2021-2029 still **1.1 thousand** will be missing as a result of the past lack of investments.
- Without the replacement investments anticipated to take place since 2030, over **10.0 thousand** jobs connected to the wind farm construction will not be created (in 2037), and **2.7 thousand permanent jobs will be lost** until 2041 (including the largest amount of **650** jobs in 2041).

3. Significance of Wind Power in Current & Future Energy Mix

REQUIREMENTS FOR RES ENERGY PRODUCTION

Due to the EU 2020 climate objectives Poland is obliged to achieve a 15% share of RES in its total gross energy consumption. This objective is apportioned as follows:

- electricity – 19.13%;
- heating and cooling – 17.05%;
- transport – 10.14%.

According to KPD[1], to meet the RES objective Poland should be able to produce 32.4 TWh of green energy per year.

On the other hand, the document *Conclusions from the analysis of forecasting the needs of the Polish Energy Policy until 2050* (PEP 2050, "Wnioski z analiz prognostycznych na potrzeby Polityki Energetycznej Polski do 2050 r."[2]) assumes that the target RES share will be met at the production level of 34.0 TWh.

CURRENT RES ENERGY PRODUCTION

Data on historic production of electricity from renewable energy sources is presented in the table below. The data for the years 2010-2014 is derived from the analysis in "Energia ze źródeł odnawialnych w 2014 r." published by the Central Statistical Office (GUS)[3]. Data on 2015 is derived from Energy Market Agency S.A. studies.

Table 1 Energy produced from renewable sources

RES production	Unit	2010	2011	2012	2013	2014	2015P	2016F
Water	GWh	2 920	2 331	2 037	2 439	2 182	1 828	2 382
Wind	GWh	1 664	3 205	4 747	6 004	7 676	10 702	12 600
Solid biofuels	GWh	5 905	7 148	9 529	7 932	9 160	9 044	6 564
only co-firing	*GWh*	5 593	6 389	7 239	3 929	4 510	4 480	2 000
Biogas	GWh	398	451	565	690	816	842	842
Bioliquids	GWh	1	1	-	1	-	-	-
Solar power	GWh	-	-	1	1	7	57	71
Total	**GWh**	**10 888**	**13 136**	**16 879**	**17 067**	**19 841**	**22 472**	**22 459**

Source: GUS, Energy Regulatory Office (URE), TPA Horwath

**Data by Polskie Sieci Elektroenergetyczne S.A. (PSE)*

Estimates for the years 2015 and 2016 have been prepared under the following assumptions:

- Water – production in 2016 at the 2010-2014 average (2015 was omitted because output was unrepresentative due to unfavorable weather conditions),
- Wind – production in 2016 – TPA Horwath calculations based on data provided by URE and PSE,
- Biomass – production in 2016 assumed at the 2015 level, less output from biomass co-firing (for that purpose we have assumed that the production from co-firing will reach 2 000 MWh as a result of changes in the support system. In January 2016 co-firing production decreased by 55%, to 179 GWh – we have assumed that the annual production will be slightly less than twelve times this value),
- Biogas – production in 2016 assumed at the 2015 level,

[1] Krajowy Plan Działania w zakresie energii ze źródeł odnawialnych (National Action Plan).

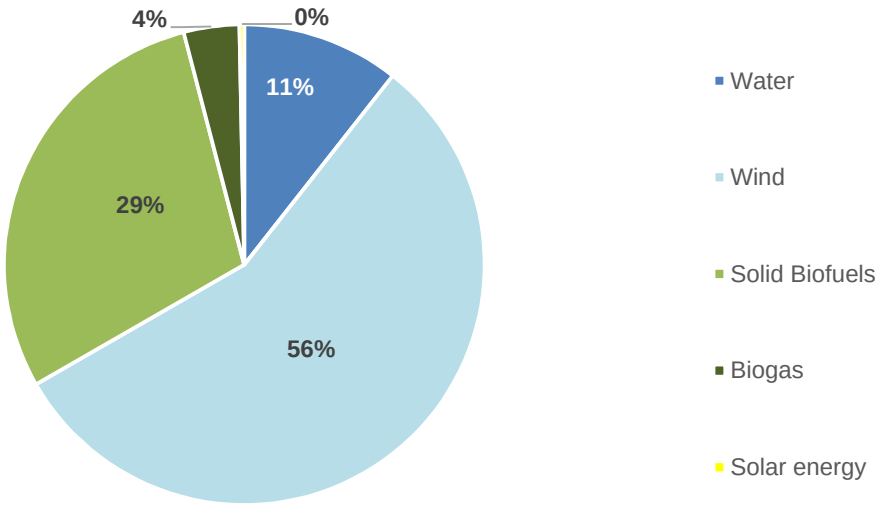
[2] Projekt Polityki Energetycznej Polski do 2050 roku – Załącznik nr 2 - Wnioski z analiz prognostycznych na potrzeby Polityki energetycznej Polski do 2050 roku, www.bip.me.gov.pl

[3] Energia ze źródeł odnawialnych w 2014 r. – Główny Urząd Statystyczny Departament Produkcji, Agencji Rynku Energii S.A., Warszawa 2015

- Solar power – production in 2016 based on capacity installed at the end of 2015 with an assumed average productivity of 1 000 MWh/MW per year.

We expect that that these assumptions will not be materially different from the actual RES energy production in 2016, taking into account the investment freeze associated with the uncertainty about the first RES auction.

Chart 1 Forecasted electricity production from renewable sources in 2016



Source: GUS, URE, PSE, TPA Horwath

REQUIREMENTS FOR RES ENERGY PRODUCTION UNDER THE NEW SUPPORT SYSTEM

As stated before, according to the National Action Plan (KPD) for energy from renewable sources, to meet the RES objective, Poland should be able to produce **32.4 TWh** of green energy per year.

Assuming that the production of electricity in 2016 will amount to 22.4 TWh, fulfilment of the obligation would require to sell at least 10 TWh of additional energy per year under the auction system (11.6 TWh if we were to assume that PEP 2050 is binding).

We also assume (as at the response to Query no. 33620 on the amount of support for each RES technology, representing the intentions of the RES Act designers) that the annual volume of sold energy will be as follows:

Table 2 Increase in energy output necessary to meet EU objectives

	Unit	2016	2017	2018	Total
Water energy:	**GWh**	**20**	**34**	**14**	**68**
<1 MW	GWh	20	34	14	68
Wind energy:	**GWh**	**2 040**	**3 400**	**1 360**	**6 800**
Onshore	GWh	1 800	3 000	1 200	6 000
Offshore	GWh	0	0	0	0
Small wind power plants	GWh	240	400	160	800
Biomass:	**GWh**	**1 303**	**2 171**	**869**	**4 343**
Biogas	GWh	463	771	309	1 543
Solid, including:	GWh	840	1 400	560	2 800
Co-firing	GWh	0	0	0	0
dedicated	GWh	840	1 400	560	2 800
Total	**GWh**	**3 363**	**5 606**	**2 242**	**11 211**

Source: sejm.gov.pl

If the entire volume predicted for auctions is sold and leads to new capacity, this should allow for the RES target described in the KPD to be met. If the required volume is higher (e.g. as at PEP 2050), we have assumed that the difference will be covered by the production in micro-installations.

The presumed volume of electricity sold at auctions is possible to reach only in the event of a significant increase in the volume proposed for auctions in 2017.

Considering the fact that the wind energy production is currently the cheapest RES in terms of LCOE, and taking into account the reduction of purchased energy volume planned in the 2016 budget (for RES projects with productivity of less than 4 000 MWh/MW annually), we have assumed that the wind sources can provide production specified in the response to the query, that is, 6 000 GWh.

We also assume that the average productivity of wind farms operating under the auction system would reach 2 700 MWh/MW annually, and as a result, in the years 2016-2018, new wind power capabilities should amount to 756 MW, 1 259 MW and 504 MW respectively.

The increase in energy output necessary to meet EU objectives is presented in the table below.

Table 3 Increase in energy output necessary to meet EU objectives

	Unit	2018	2019	2020	2021	…	2041
RES electricity output from the 2016 auctions	GWh	3 363	3 363	3 363	3 363	…	3 363
RES electricity output from the 2017 auctions	GWh		5 606	5 606	5 606	…	5 606
RES electricity output from the 2018 auctions	GWh			2 242	2 242	…	2 242
Total output in the auction system	**GWh**	**3 363**	**8 969**	**11 211**	**11 211**	**…**	**11 211**

Source: TPA Horwath

4. Replacement of Future Wind Farms with Other RES Technologies

The cost of replacing wind power with other RES technologies has been estimated under the assumption that the new regulations introduced by the distance act will completely block new investments in industrial-scale wind power.

In this case, production from RES that would have been originally generated by wind farms is going to be replaced by other renewable sources. In our opinion the replacement of this production could be achieved primarily by biomass production (including co-firing in coal boilers), biogas and photovoltaic installations.

We have performed the comparison of the replacement costs by using the LCOE. The following table presents the average LCOE levels for the technologies mentioned before, as well as weights assigned to each of them in the overall process of pushing wind power out. The weights are derived from the current RES production mix, the dynamics of the growth of each technology in recent years as well as the relative importance according to the KPD. The weights are as follows:

- biomass alone – 65%,
- biomass co-fired with coal in dedicated co-firing installations – 20%,
- biogas – 10%,
- solar power – 5%.

A detailed breakdown of the long-term LCOE changes for wind and other renewable energy sources is presented below. Baseline LCOE levels for 2015 were established on the basis of the opinion of the Institute of Renewable Energy on the draft of Ordinance of the Minister of Economy on reference prices for renewable energy. LCOE indexation levels for each RES technology are assumed as follows:

- wind -1.0%,
- biomass 1.0%,
- co-firing 1.0%,
- biogas 0.5%,
- solar energy -2.0%.

We have assumed that the cost of production in installations that do not require fuel (e.g. wind and photovoltaic sources) will decline with continuing technical progress. We anticipate that the decline in the cost of photovoltaic panels will be bigger that this for the wind turbines. On the other hand, in regard to the installations with higher share of variable component in the overall costs (primarily fuel) we have assumed a moderate LCOE growth.

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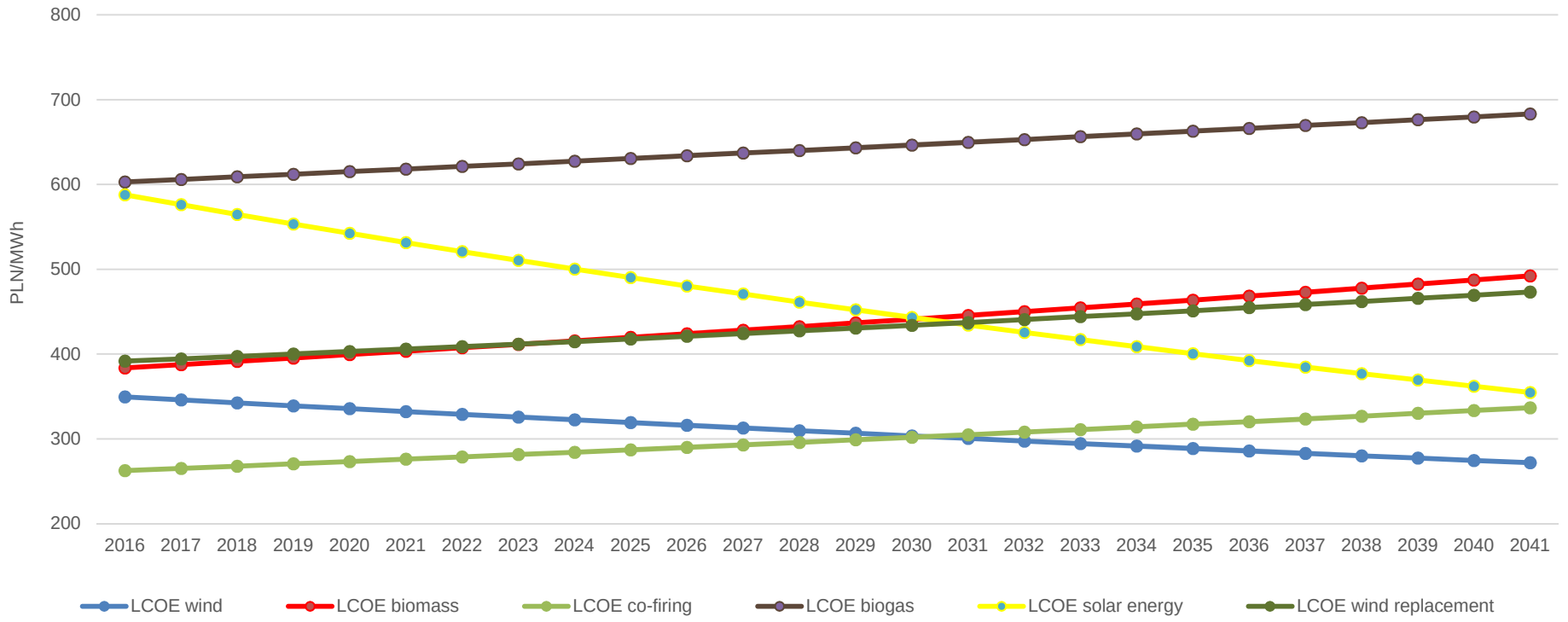
Chart 2 LCOE of technologies replacing wind



Source: TPA Horwath

The average cost of production replacing wind power rises from approx. 389 PLN/MWh in 2015 to approx. 473 PLN/MWh in 2041. The total cost of replacing this capacity by new installations is presented in the table below.

Table 4 Total replacement costs of new installations (constant prices as at 2015)

	Unit	2015	2016	2017	2018	2019	2020	2021	…	2041
Replacement costs	**kPLN**				**98 432**	**281 223**	**361 846**	**361 846**	**…**	**361 846**
Wind energy output from the 2016 auction	GWh				1 800	1 800	1 800	1 800	…	1 575
Wind energy output from the 2017 auction	GWh				0	3 000	3 000	3 000	…	1 575
Wind energy output from the 2018 auction	GWh				0	0	1 200	1 200	…	1 575
LCOE wind	PLN/MWh	353	349	346	343	339	336			
LCOE replacement	PLN/MWh	389	392	394	397	400	403			

Source: TPA Horwath

The annual cost of replacing wind installations that are to be created within the auction system was calculated as the product of the difference between wind LCOE and replacement LCOE times the volume sold on a given auction.

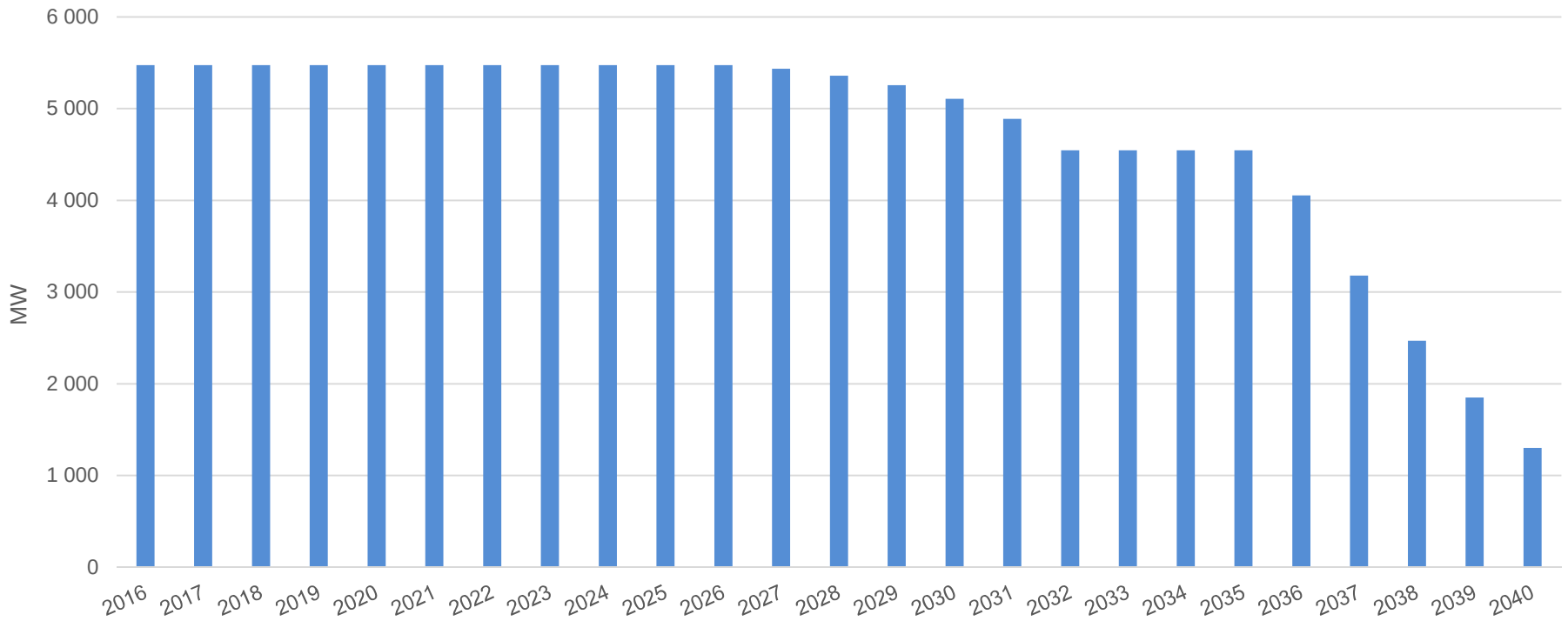
REPLACEMENT COSTS OF THE CURRENTLY OPERATING INSTALLATIONS

The introduction of new regulations will result in an investment freeze, which will mean the inability to replace currently operating wind farms with new capacity under the same technology at the end of their operational lifetimes. When the currently operating wind farms will be shut down, substituting the supply will require replacing the dismantled turbines with new RES energy capabilities (unless there is a significant oversupply of electricity from renewable energy sources, what is not unlikely considering the ambitious objectives related to the reduction of CO2 emissions by 2050).

We assume that currently installed wind power would have been (in the event of abandoning the new regulations) replaced by new installations after 22 years of operational lifetime for installations built in the period 2005-2010 and 25 years for those built since 2011.

Decrease in the installed wind power capacity associated with termination of operational period of the current installations is shown in the chart below.

Chart 3 Installed wind power capacity (assuming no new investments)



Source: TPA Horwath

We also assume that the replacing installations would have had the average productivity of 2 700 MWh/PLN annually. Output of the wind farms replacing currently operating installations is presented in the table below.

Table 5 Output of the wind farms replacing currently operating installations

	Unit	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
2030	GWh	56	112	112	112	112	112	112	112	112	112	112	112	112	112	112
2031	GWh	0	103	206	206	206	206	206	206	206	206	206	206	206	206	206
2032	GWh	0	0	138	276	276	276	276	276	276	276	276	276	276	276	276
2033	GWh	0	0	0	201	403	403	403	403	403	403	403	403	403	403	403
2034	GWh	0	0	0	0	295	590	590	590	590	590	590	590	590	590	590
2035	GWh	0	0	0	0	0	463	925	925	925	925	925	925	925	925	925
2036	GWh	0	0	0	0	0	0	0	0	0	661	1 322	1 322	1 322	1 322	1 322
2037	GWh	0	0	0	0	0	0	0	0	0	0	1 180	2 360	2 360	2 360	2 360
2038	GWh	0	0	0	0	0	0	0	0	0	0	0	961	1 922	1 922	1 922
2039	GWh	0	0	0	0	0	0	0	0	0	0	0	0	835	1 670	1 670
2040	GWh	0	0	0	0	0	0	0	0	0	0	0	0	0	741	1 482
2041	GWh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 757
Total	**GWh**	**56**	**215**	**457**	**796**	**1 293**	**2 050**	**2 513**	**2 513**	**2 513**	**3 174**	**5 015**	**7 156**	**8 952**	**10 528**	**13 026**

Source: TPA Horwath

Below is a calculation of the difference between the cost of replacing the “maturing” wind power with new capacity and replacing it with other RES technologies

Table 6 Costs of replacing wind power with other RES technologies

		2027	2028	2029	2030	2031	2032	2033	2034
Costs	**kPLN**	**6 256**	**24 624**	**53 866**	**97 254**	**163 845**	**270 397**	**336 616**	**336 616**
Production replacing currently operating farms	GWh	56	215	457	796	1 293	2 050	2 513	2 513
LCOE wind	PLN/MWh	313	310	307	304	301	298	295	292
LCOE replacement	PLN/MWh	424	427	431	434	437	441	444	448

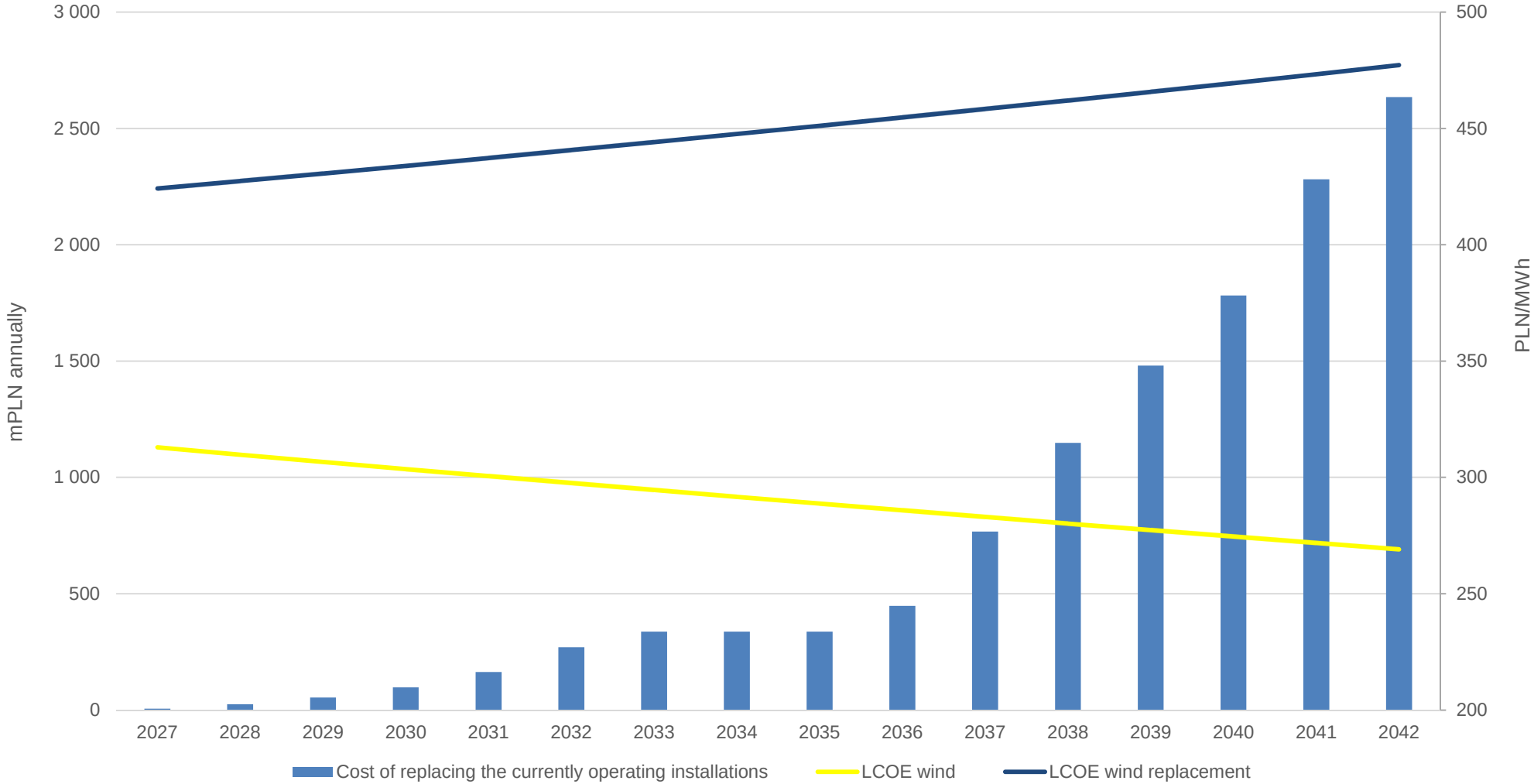
Source: TPA Horwath

		2035	2036	2037	2038	2039	2040	2041	2042
Costs	**kPLN**	**336 616**	**448 256**	**766 894**	**1 148 659**	**1 480 765**	**1 782 562**	**2 281 002**	**2 634 985**
Production replacing currently operating farms	GWh	2 513	3 174	5 015	7 156	8 952	10 528	13 026	14 783
LCOE wind	PLN/MWh	289	286	283	280	277	275	272	269
LCOE replacement	PLN/MWh	451	455	458	462	466	470	473	477

Source: TPA Horwath

Replacement costs of the currently operating installations will reach **PLN 2.6 billion** annually in 2042. In the period 2027-2042 the average annual cost will amount to **PLN 760 million** annually. The underlying data describing replacement costs of the currently operating installations is also shown in the chart below.

Chart 4 Replacement costs of the currently operating installations with other RES technologies



Source: TPA Horwath

5. Municipality Revenues

Wind farms construction has a strong positive impact on revenues of the municipalities in which the facilities are located. In our analysis we have described the effects of the investment freeze on the tax receipts obtained from three sources – real estate tax (**RET**), personal income tax (**PIT**) and corporate income tax (**CIT**). We have also looked into the influence of the proposed changes on the labor market.

RECEIPTS FROM REAL ESTATE TAX

Real estate tax is local in character and as a result, revenues obtained from it are wholly allocated to municipalities budgets. According to our calculations, assuming that average total CapEx per MW is kPLN 7 310 (mEUR 1.7 x 4.3 EUR/PLN) and 30% of that amount is classified as tax base for the real estate tax, average revenues amount to kPLN 43.9 annually per 1 MW of installed capacity.

Taking into account the assumptions affiliated with the opportunity cost of new wind power for the period 2017-2019 calculated in the previous chapter, and estimated amount of revenue per 1 MW derived from the real estate tax, below we present the loss expected to be incurred by municipalities as a result of the investment freeze.

Table 7 Lost Receipts connected with real estate tax [kPLN] on new wind farms build under the auction system

Production launch year	Total annual energy output growth	Capex/MW [kPLN]	RET/MW [kPLN]	2018	2019	2020	…	2041
2016	0	7 310	43.9	0	0	0	…	0
2017	0	7 310	43.9	0	0	0	…	0
2018	667	7 310	43.9	29 240	29 240	29 240	…	29 240
2019	1 111	7 310	43.9	0	48 733	48 733	…	48 733
2020	444	7 310	43.9	0	0	19 493	…	19 493
Lost revenue				**29 240**	**77 973**	**97 467**	…	**97 467**

Source: TPA Horwath

The total amount of real estate tax lost in connection with investment freeze in new wind farms could reach almost PLN **1.7 billion** in the period 2018 - 2041.

Real estate tax receipt loss would be much more noticeable from 2030 onwards, due to the lack of replacement of the currently operating wind farms. Calculations of potential losses are shown in the table below.

Table 8 Potential income from real estate tax derived from the replacement of currently operating wind farms [kPLN] (constant prices as at 2015)

Production launch year	Average power growth	Capex/MW [kPLN]	RET/MW [kPLN]	2027	2028	2029	2030	2031	2032	2033	2034
2030	42	7 310	43,9	1 827	1 827	1 827	1 827	1 827	1 827	1 827	1 827
2031	76	7 310	43,9		3 346	3 346	3 346	3 346	3 346	3 346	3 346
2032	102	7 310	43,9			4 489	4 489	4 489	4 489	4 489	4 489
2033	149	7 310	43,9				6 545	6 545	6 545	6 545	6 545
2034	219	7 310	43,9					9 583	9 583	9 583	9 583
2035	343	7 310	43,9						15 030	15 030	15 030
2036	490	7 310	43,9								
2037	874	7 310	43,9								
2038	712	7 310	43,9								
2039	619	7 310	43,9								
2040	549	7 310	43,9								
2041	1 301	7 310	43,9								
Lost revenue				**1 827**	**5 172**	**9 661**	**16 206**	**25 790**	**40 820**	**40 820**	**40 820**

Production launch year	Average power growth	Capex/MW [kPLN]	RET/MW [kPLN]	2035	2036	2037	2038	2039	2040	2041
2030	42	7 310	43,9	1 827	1 827	1 827	1 827	1 827	1 827	1 827
2031	76	7 310	43,9	3 346	3 346	3 346	3 346	3 346	3 346	3 346
2032	102	7 310	43,9	4 489	4 489	4 489	4 489	4 489	4 489	4 489
2033	149	7 310	43,9	6 545	6 545	6 545	6 545	6 545	6 545	6 545
2034	219	7 310	43,9	9 583	9 583	9 583	9 583	9 583	9 583	9 583
2035	343	7 310	43,9	15 030	15 030	15 030	15 030	15 030	15 030	15 030
2036	490	7 310	43,9		21 474	21 474	21 474	21 474	21 474	21 474
2037	874	7 310	43,9			38 344	38 344	38 344	38 344	38 344
2038	712	7 310	43,9				31 216	31 216	31 216	31 216
2039	619	7 310	43,9					27 131	27 131	27 131
2040	549	7 310	43,9						24 074	24 074
2041	1 301	7 310	43,9							57 073
Lost revenue				**40 820**	**62 294**	**100 638**	**131 855**	**158 986**	**183 061**	**240 134**

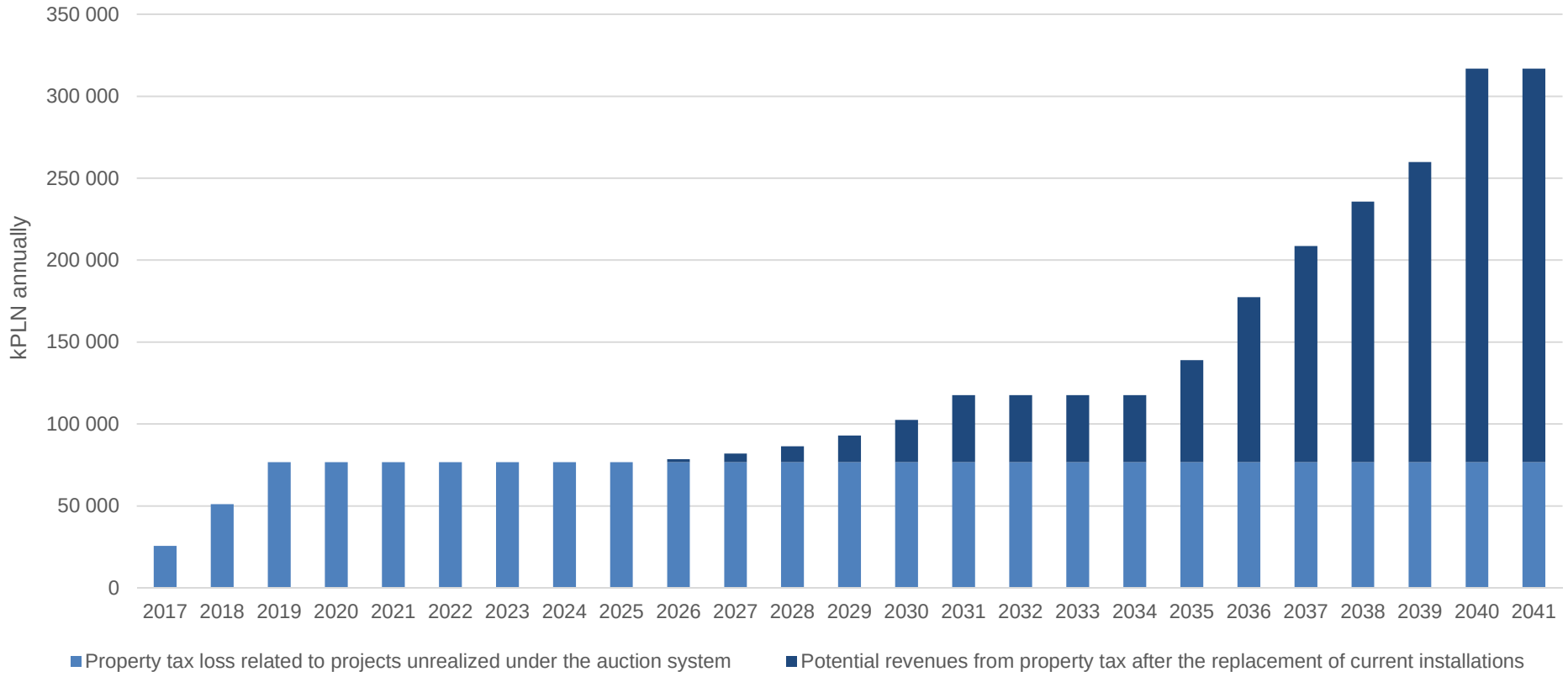
Source: TPA Horwath

The annual amount of the potentially lost tax revenue is estimated to reach **PLN 240 million** in 2040.

The combined effects (the lack of new investments and not replacing the old ones) are shown in the chart below.

Chart 5 Total loss of receipts of municipalities due to the lower real estate tax paid as a result of the investment freeze

Source: TPA Horwath



MUNICIPALITY REVENUES FROM INCOME TAXES

As mentioned before, municipalities benefit from wind farms also via income taxes: PIT and CIT. The PwC report[4] shows that the average amount of PIT connected with each MW installed is approx. **PLN 2.5 thousand** annually, whereas CIT – approx. **PLN 4.5 thousand** annually.

Taking into account the assumptions on new wind power that is expected to be provided in the period 2017-2019 and estimated revenue per MW from real estate tax, below we present the total loss expected to be incurred by the municipalities as a result of the investment freeze.

Table 9 Municipalities income tax revenue lost due to the investment freeze (constant prices as at 2015)

		2018	2019	2020	2021	…	2041
Revenues lost from PIT – potential farms in the auction system	**kPLN**	**1 696.2**	**4 523.2**	**5 654.0**	**5 654.0**	**…**	**5 654.0**
Quantity of working MW	kPLN	667	1 778	2 222	2 222	…	2 222
Revenues per MW	kPLN	2,5	2,5	2,5	2,5	…	2,5
Revenues lost from CIT – potential farms in the auction system	**kPLN**	**3 005.2**	**8 013.8**	**10 017.2**	**10 017.2**	**…**	**10 017.2**
Quantity of working MW	kPLN	667	1 778	2 222	2 222	…	2 222
Revenues per MW	kPLN	4.5	4.5	4.5	4.5	…	4.5

Source: TPA Horwath based on own and PWC assumptions

Combined amount of personal income tax that is going to be lost due to the investment freeze could reach **PLN 12 million only in the period 2018-2020**, while the amount of corporate income tax will amount to **PLN 21 million only in the period 2018-2020.**

Combined amount of lost receipts from personal income tax could be as high as **PLN 392 million combined for the period 2018-2044.**

A calculation of revenues lost due to not replacing the currently operating wind farms with new investments is presented in the table below.

[4] Luka w realizacji celu OZE 2020. Jakie są jej skutki ekonomiczne?, PwC Polska, Marzec 2016

Table 10 Municipality receipts lost due to not replacing the currently operating wind farms

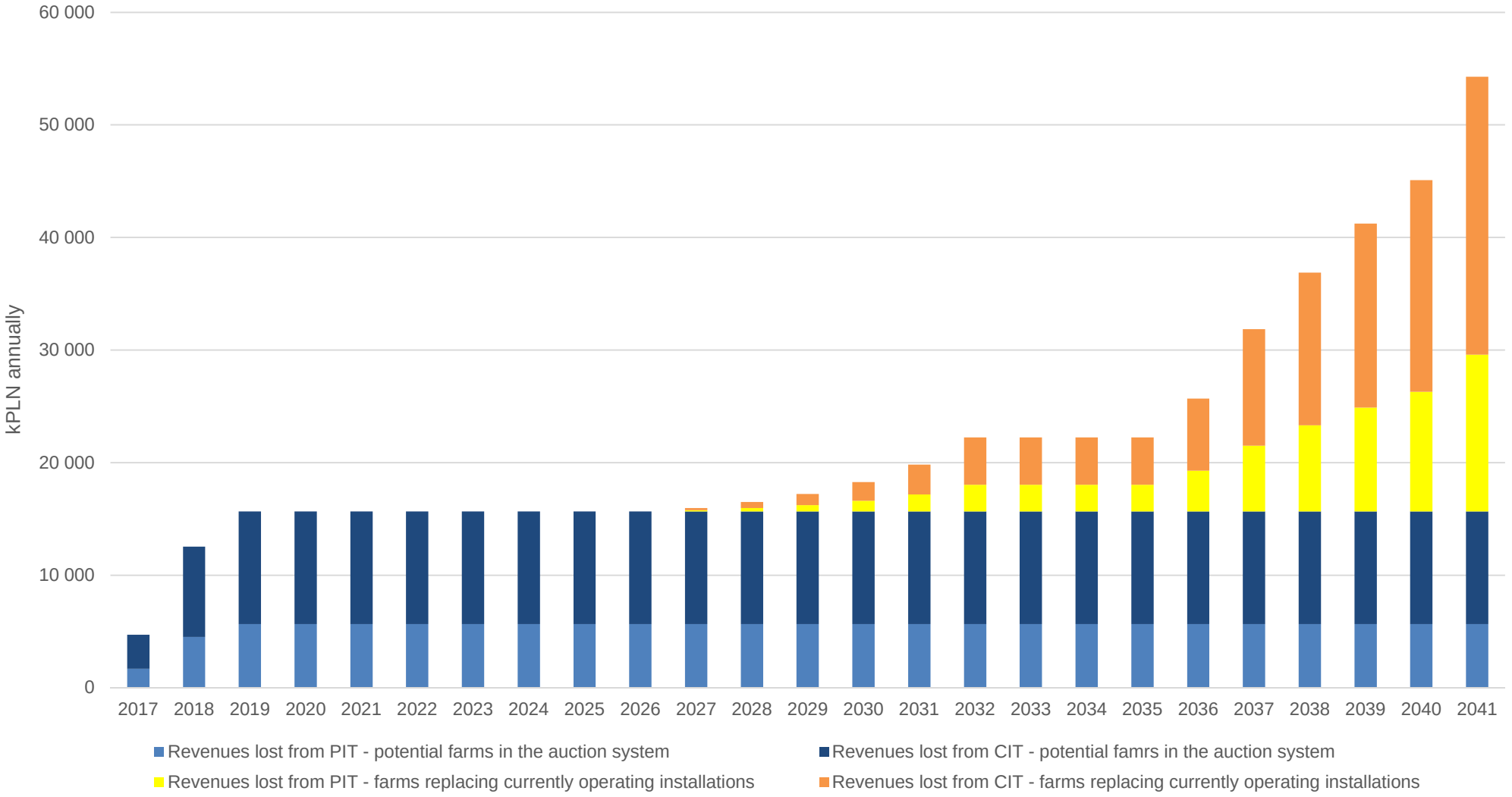
	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Wind farm power launched in 2030 [MW]	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42
Wind farm power launched in 2031 [MW]	0	76	76	76	76	76	76	76	76	76	76	76	76	76	76
Wind farm power launched in 2032 [MW]	0	0	102	102	102	102	102	102	102	102	102	102	102	102	102
Wind farm power launched in 2033 [MW]	0	0	0	149	149	149	149	149	149	149	149	149	149	149	149
Wind farm power launched in 2034 [MW]	0	0	0	0	219	219	219	219	219	219	219	219	219	219	219
Wind farm power launched in 2035 [MW]	0	0	0	0	0	343	343	343	343	343	343	343	343	343	343
Wind farm power launched in 2036 [MW]	0	0	0	0	0	0	0	0	0	490	490	490	490	490	490
Wind farm power launched in 2037 [MW]	0	0	0	0	0	0	0	0	0	0	874	874	874	874	874
Wind farm power launched in 2038 [MW]	0	0	0	0	0	0	0	0	0	0	0	712	712	712	712
Wind farm power launched in 2039 [MW]	0	0	0	0	0	0	0	0	0	0	0	0	619	619	619
Wind farm power launched in 2040 [MW]	0	0	0	0	0	0	0	0	0	0	0	0	0	549	549
Wind farm power launched in 2041 [MW]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 301
Total installed capacity	**42**	**118**	**220**	**370**	**588**	**931**	**931**	**931**	**931**	**1 420**	**2 295**	**3 006**	**3 625**	**4 174**	**5 475**
PIT income on MW [PLN]	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
PIT income loss [kPLN]	**106.0**	**300.0**	**560.5**	**940.1**	**1 496.0**	**2 367.9**	**2 367.9**	**2 367.9**	**2 367.9**	**3 613.6**	**5 838.0**	**7 648.8**	**9 222.7**	**10 619.3**	**13 930.0**
CIT income on MW [PLN]	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
CIT income loss [kPLN]	**187.7**	**531.6**	**993.0**	**1 665.6**	**2 650.6**	**4 195.3**	**4 195.3**	**4 195.3**	**4 195.3**	**6 402.3**	**10 343.2**	**13 551.5**	**16 339.9**	**18 814.2**	**24 679.9**
Total income loss [kPLN]	**293.7**	**831.6**	**1 553.4**	**2 605.7**	**4 146.6**	**6 563.2**	**6 563.2**	**6 563.2**	**6 563.2**	**10 015.9**	**16 181.2**	**21 200.3**	**25 562.6**	**29 433.4**	**38 609.9**

Source: TPA Horwath based on own and PWC assumptions

Municipality tax receipt losses from PIT and CIT in 2015 constant prices could amount to, respectively, approx. **PLN 14 million** and **PLN 25 million** annually since 2041.

The summary of income tax losses is presented in the chart below.

Chart 6 Municipality receipts – total income taxes loss



Source: TPA Horwath based on own and PWC assumptions

6. Employment in the Sector

The below estimates of the impact of the investment freeze in the wind energy sector in Poland are based on the analysis by the Warsaw Institute of Economic Studies – "Wind power sector impact on the Polish labor market"[5]. As is estimated in the report, construction of every new 10 MW of wind power requires creating 39 directly affiliated jobs (114 jobs in total), whereas each 10 MW of operating wind farms requires 2 directly affiliated jobs (5 in total).

Based on this research, below we present our assessment of the impact of the investment freeze on the jobs that could have been created as a result of constructing and operating new wind farms under the auction system.

Table 11 Jobs not created due to the investment freeze in the auction system

	2018	2019	2020	2021	...	2041
Related to construction	7 600	12 667	5 067	0	...	0
Directly	2 600	4 333	1 733	0	...	0
per MW	4	4	4	4	...	4
Quantity of constructed MW	667	1 111	444	0	...	0
Indirectly	5 000	8 333	3 333	0	...	0
per MW	8	8	8	8	...	8
Quantity of constructed MW	667	1 111	444	0	...	0
After the construction period	333	889	1 111	1 111	...	1 111
Directly	133	356	444	444	...	444
per MW	0	0	0	0	...	0
Quantity of operating MW	667	1 778	2 222	2 222	...	2 222
Indirectly	200	533	667	667	...	667
per MW	0	0	0	0	...	0
Quantity of operating MW	667	1 778	2 222	2 222	...	2 222
Total	**7 933**	**13 556**	**6 178**	**1 111**	...	**1 111**

Source: TPA Horwath based on own and WISE assumptions

The above table presents temporary jobs associated with wind farm construction, amounting to over **12.7 thousand** during the construction period, as well as permanent jobs (both technical and administrative) tied with operations of almost **1 100**.

[5] Wpływ energetyki wiatrowej na polski rynek pracy, Warszawski Instytut Studiów Ekonomicznych

The analysis should also consider job loss that would occur as a result of the lack of future replacement of currently operating wind farms. Calculations of the overall amount of temporary jobs that are expected to be affected by this process are presented in the table below.

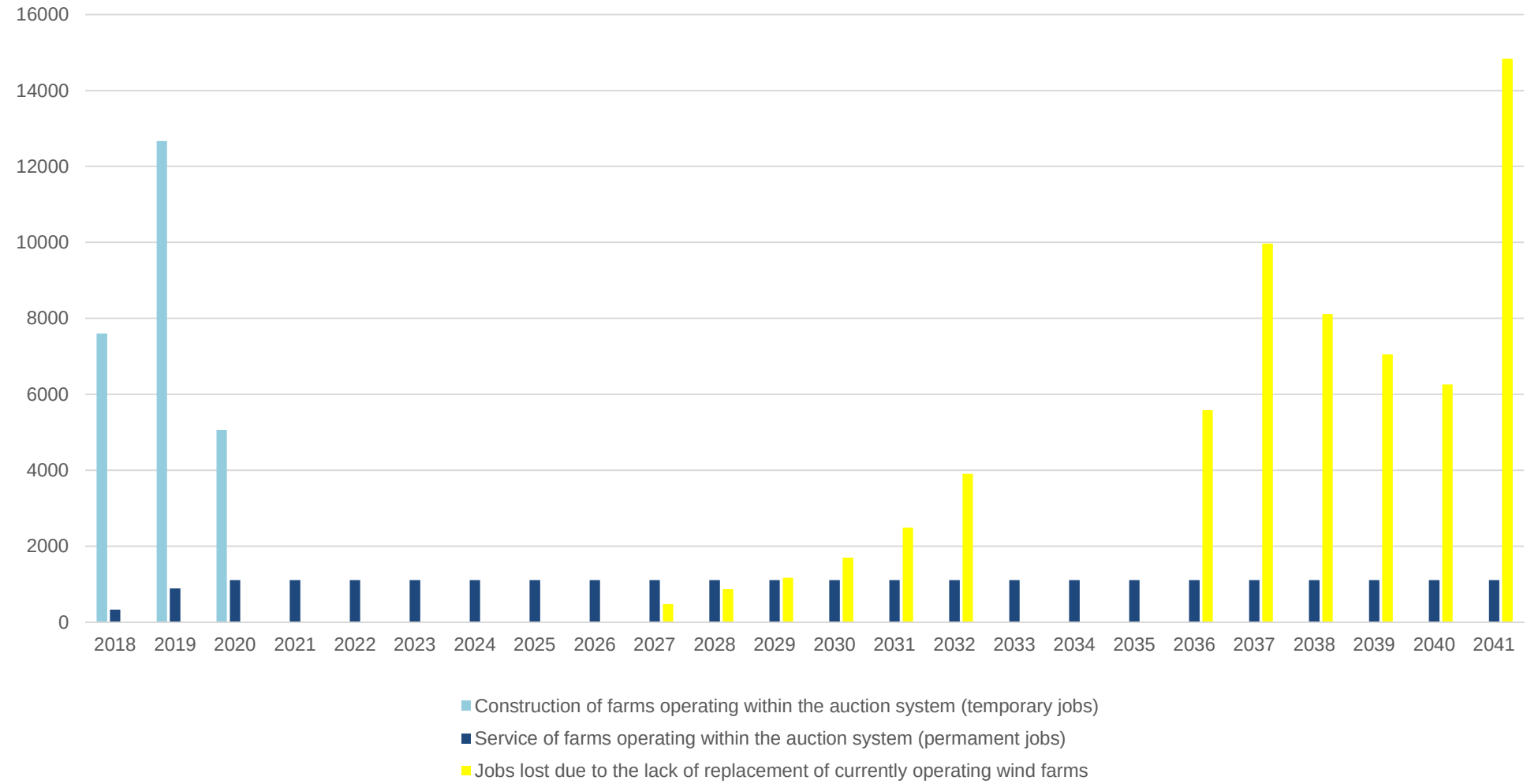
Table 12 Temporary jobs lost due to the lack of replacement of currently operating wind farms

	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Directly	162	297	399	582	852	1 336	0	0	0	1 909	3 410	2 776	2 413	2 141	5 075
per MW	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Quantity of constructed MW	42	76	102	149	219	343	0	0	0	490	874	712	619	549	1 301
Indirectly	312	572	768	1 119	1 639	2 570	0	0	0	3 672	6 557	5 338	4 639	4 117	9 759
per MW	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Quantity of constructed MW	42	76	102	149	219	343	0	0	0	490	874	712	619	549	1 301
Total	**475**	**870**	**1 167**	**1 701**	**2 491**	**3 907**	**0**	**0**	**0**	**5 581**	**9 966**	**8 114**	**7 052**	**6 257**	**14 834**

Source: TPA Horwath based on own and WISE assumptions

The number of temporary jobs lost due to the lack of replacement of currently operating wind farms could amount to almost **15 thousand** in the year 2041. This process has been visualized in the chart below.

Chart 7 Jobs lost and not created due to the investment freeze in the auction system



Source: TPA Horwath based on own and WISE assumptions

The last category associated with employment in the wind energy sector are people working permanently at the currently operating wind farm companies, who would lose their jobs due to the lack of replacement of currently operating installations. A calculation of the estimated scale of the process is presented below.

Table 13 Permanent jobs lost due to the lack of replacement of currently operating wind farms (annually)

	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Directly	-8	-15	-20	-30	-44	-69	0	0	0	-98	-175	-142	-124	-110	-260
per MW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deactivated farms (MW)	-42	-76	-102	-149	-219	-343	0	0	0	-490	-874	-712	-619	-549	-1 301
Indirectly	-12	-23	-31	-45	-66	-103	0	0	0	-147	-262	-214	-186	-165	-390
per MW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deactivated farms (MW)	-42	-76	-102	-149	-219	-343	0	0	0	-490	-874	-712	-619	-549	-1 301
Total	**-21**	**-38**	**-51**	**-75**	**-109**	**-171**	**0**	**0**	**0**	**-245**	**-437**	**-356**	**-309**	**-274**	**-651**

Source: TPA Horwath based on own and WISE assumptions

The cumulative number of jobs expected to be eliminated in the period 2030-2041 is presented in the table below.

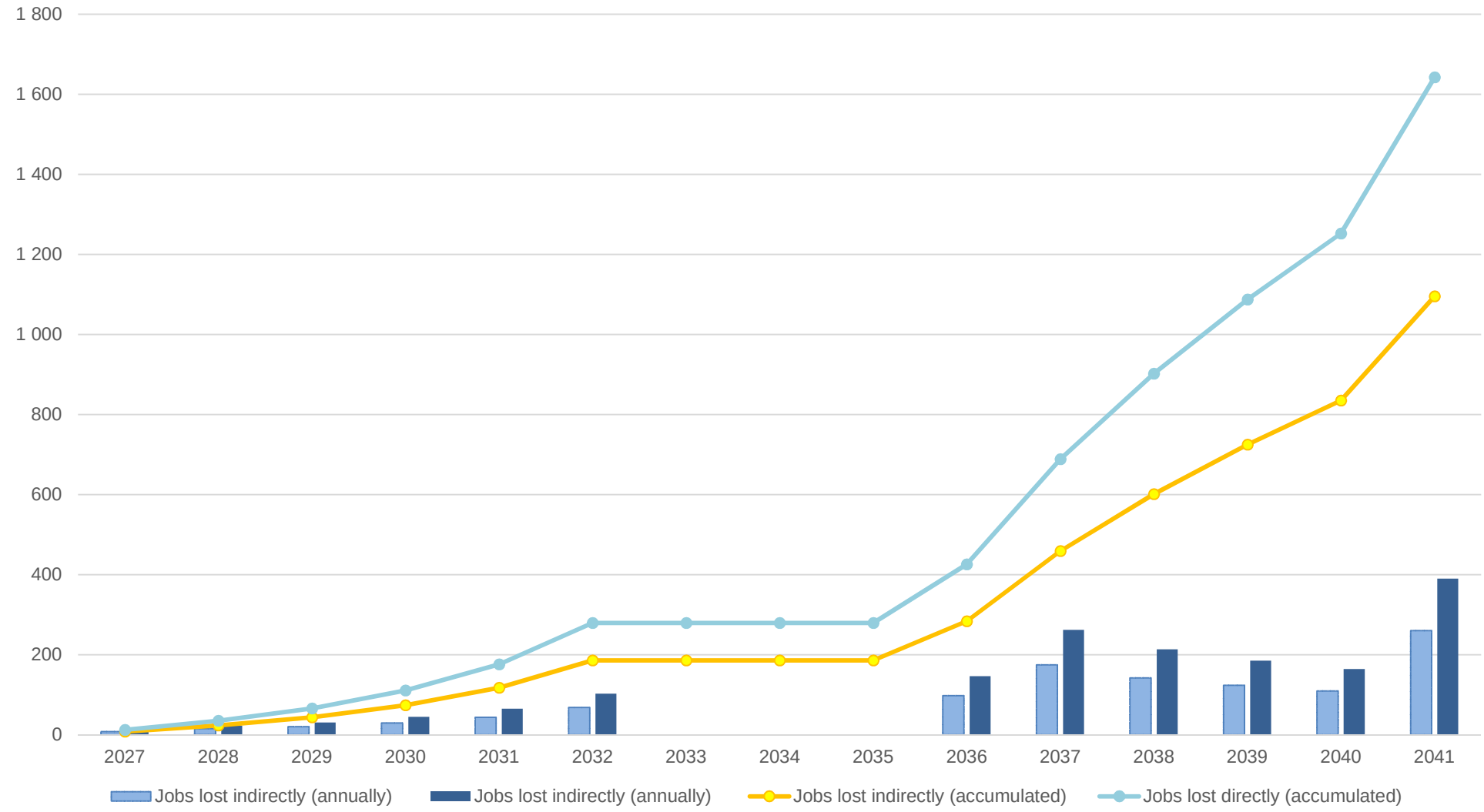
Table 14 Permanent jobs lost due to the lack of replacement of currently operating wind farms farm (accumulated)

	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Directly accumulated	-9	-24	-44	-74	-118	-186	-186	-186	-186	-284	-459	-601	-725	-835	-1 095
Indirectly accumulated	-12	-35	-66	-111	-176	-279	-279	-279	-279	-426	-688	-902	-1 087	-1 252	-1 643
Total jobs accumulated	**-21**	**-59**	**-110**	**-185**	**-294**	**-465**	**-465**	**-465**	**-465**	**-710**	**-1 147**	**-1 503**	**-1 812**	**-2 087**	**-2 738**

Source: TPA Horwath based on own and WISE assumptions

According to our estimates, one can expect **over 2700 permanent jobs** to be eliminated during the analyzed period as a result of the investment freeze. The exact pace of the process is also shown in the chart below.

Chart 8 Permanent jobs lost or not created due to the investment freeze in the wind energy sector



Source: TPA Horwath based on own and WISE assumptions