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# Alternating Current

## Landscape of climate finance in the Polish energy sector

Deep transformation of the Polish energy system is possible without the need to increase the current investment levels in renewable energy, provided that the rate of investments in solar energy is maintained and investments in wind energy become unlocked. Access to finance is not a limiting factor for a significant reduction of GHG emissions in the Polish energy sector by 2035.

**Edited by Maciej Bukowski**



ENERGY, CLIMATE AND ENVIRONMENT

Alternating Current.  
Landscape of climate finance in the Polish energy sector

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## Executive summary

- **Background:** The Recovery Plan for Europe poses a great challenge for Poland, which perceives investments in renewables only as a burden associated with additional costs rather than an opportunity for economic development. Fragmented information about the scale and sources of financial flows associated with low-emission investments, as well as about the instruments used by different types of investors to finance renewables, carry the risk of incomplete or ineffective use of European funds offered within both the Multiannual Financial Framework and the Recovery Plan. To use these resources, public and private sector will have to present a large number of carbon-neutral investment projects. However, the engagement of investors and financial sector in the process is conditional upon the existence of a favourable institutional and legal environment that creates sufficient incentives and reframes renewables as an attractive investment opportunity.
- **Methodology:** The landscape of climate finance in the Polish energy sector is a synthetic diagnosis of the current state of private and public financial flows associated with investments in renewable energy technologies. The methodology also enables the analysis of investment needs implied by the low-carbon transformation of the economy and the assessment of viable financing options. The study is based on the data collected for renewable projects launched in the period of 2013-2019. These include data on the renewable energy capacity broken down into individual low-carbon technologies, as well as data on sources, instruments and volumes of financial flows associated with each type of renewables and different types of investors.
- **Regulatory environment:** There were three distinct investment phases in low-carbon technologies in the period of 2013-2019. At the beginning of the decade, the system of green certificates was the driving force for investment in renewables. Its collapse coupled with an inefficient implementation of the auction system for renewables led to a slowdown of the transformation of the Polish energy system in 2015-2017. The breakthrough came in 2018 when the threat of Poland's failure to meet its 2020 climate targets resulted in the launch of auctions for new wind and photovoltaic projects, while the falling costs of these technologies and dedicated support systems for renewables allowed new type of investors to enter the market: non-energy companies (prosumers) and households.
- **Scale of investments:** In 2013-2019, a total of approx. PLN 48 billion (ca. EUR 10.8 bn) was allocated to low-carbon energy investments, which enabled the funding of installations with a total capacity of approx. 8.6 GW. About 62% of these funds were allocated to onshore wind farms and 28% to PV projects.
- **Investors:** Private energy companies and prosumers played the largest role in increasing the share of renewables in the Polish energy mix. Together, these two groups of investors account for 81% of all renewable capacities installed in 2013-2019. The share of the public sector and state-controlled energy companies in funding renewable energy technologies in 2013-2019 did not exceed 15%.

- **Sources of financing:** Private capital, in particular from commercial banks, had a dominant role in financing low-carbon technologies. It accounts for a total of about 83% of all invested funds. The remaining 17% of the funds came from public sources, in which European funds played the main role – both the Structural Funds and the debt instruments of the European Investment Bank and the European Bank for Reconstruction and Development.
- **Final investments:**
  - **Wind energy – PLN 29.9 bn (ca. EUR 6.7 bn)**
    - Private energy companies account for over 90% of all wind energy investments in 2013-2019. Over 90% of them were financed by commercial banks and investors' equity.
    - Changes in the regulatory environment suppressed the development of wind farms in 2015-2017. The introduction of auctions for wind farms made them, again, an attractive investment, what led to a sharp, tenfold increase in spending in 2018-2019.
  - **Photovoltaics – PLN 13.7 bn (ca. EUR 3.1 bn)**
    - Until 2016, the expenditures on solar energy were limited. The surge occurred in 2017-2019 when the expenditures increased almost three times reaching PLN 4.9 bn (ca. EUR 1.1 bn) in 2019. This was the result of falling technology costs and a favourable regulatory environment (auction system, prosumer discounts, tax reliefs for households).
    - The systematic growth of investments in solar energy was accompanied by a significant change in the structure of investors and financing sources – while at the beginning the development of this market segment was largely dependent on public investments (local governments) and EU funds, after 2017 private entities (households and business prosumers) and commercial banks played the dominant role.
  - **Biogas – PLN 2.4 bn (ca. EUR 0.5 bn)**
    - The volume of expenditures on this technology is much smaller than in the case of wind and solar energy, and the interest of investors has varied over time. Support from the EU and national funds was not able to counter the rapid decline in investors' interest after the collapse of the green certificates system, and its revival was only brought by a properly parameterized auction system after 2017.
    - Despite the availability of financial instruments that are designed to support the development of biogas, such as auctions, feed-in tariffs and premiums, access to funding remains a major challenge that needs to be overcome for the technology to become a more attractive investment.
  - **Biomass – PLN 1.8 bn (ca. EUR 0.4 bn)**
    - The engagement of investors in financing the biomass projects has varied over time. Owing to unfavourable regulatory environment and competition posed by photovoltaics





and wind energy, private investors are reluctant to engage in such investments, responding only to dedicated public support programmes. So far, those are not generating sufficient incentives to stimulate the sustainable development of biomass energy in Poland.

- **Hydropower – PLN 0.5 bn (ca. EUR 0.1 bn)**

- In contrast to investments in other renewable energy technologies, investments in hydropower in 2013-2019 were primarily associated with the modernisation of existing installations and not the construction of new capacities. For this reason, the results show that state-controlled energy companies were a major investor in the development of hydropower in Poland.
- Poland's limited hydropower potential means that small hydropower plants owned by private investors (households and business prosumers) have the greatest opportunities for growth. Expenditures on new installations will, however, require the emergence of new support mechanisms and reduction of existing administrative barriers.

- **Future investment needs**

- A comparison of current investment levels with the National Energy and Climate Plan (NECP) indicates that if the renewables were to be developed at a pace and scale envisaged by NECP, the investments in renewables will have to undergo an almost two-fold decrease over the upcoming decade. Adoption of a more ambitious scenario, one that would include further development of PV and unblock further investments in onshore wind farms, would enable a substantial transformation of the Polish energy system as well as coal exit by 2035, while maintaining the current level of investment in renewable energy.
- Financing will not become a barrier for the Polish economy to substantially reduce GHG emissions (by 80-95% and more). Even in the most ambitious transformation scenario, the required increase in financial flows for zero-carbon energy does not differ from Poland's experience from previous years. Moreover, the estimated share of European and national public funds (up to PLN 2.5 bn, or ca. EUR 0.6 bn per year) represents less than 10% of the total amount of funds that Poland will have at its disposal for the low-carbon transformation in the 2020s (a total of over PLN 30 bn, or ca. EUR 6.7 bn per year from EU funds and the sale of emission allowances).
- Maintaining the current high rate of investment in renewables and managing the risks associated with technologies that will act as a back-up for solar and wind energy remain two key challenges associated with financing the low-carbon transformation. Without a long-term vision for a carbon-neutral energy system in Poland and a strategy of how to adapt the gas infrastructure to the requirements of climate neutrality (e.g. by developing power-to-gas technology or implementing CCS/CCU solutions), there is a high risk that financial flows that support conventional power plants in the next several years will result in the development of stranded assets.

- **Recommendations for policymakers:**
  - **Redesign the strategic approach to low-carbon transformation of the energy sector**, in particular:
    - abandon the false belief that transformation has to be driven by public funds disbursed in the form of direct support and the engagement of state-owned enterprises,
    - redefine the role of the state as a regulator, whose objective is to create favourable conditions for investors to mobilise private funds,
    - facilitate the flow of direct financial support only to areas where it is necessary (e.g. investments carried out by local governments as well as investments in bioenergy and small hydropower plants).
  - **Adopt a double stimulus package for the energy sector**, as a response to the economic crisis:
    - **Regulatory stimulus** that will unlock investments in onshore wind farms and accelerate investments in PV using the auction system and through further prosumer support, whilst ensuring a competitive regulatory and infrastructural environment for offshore wind energy.
    - **Fiscal stimulus** – direct investment support framed in the logic of the Recovery Plan for Europe, focused on technologies such as biogas, biomass CHP, small hydropower and prosumer investments by local governments.
  - **Clarify the long-term vision of the energy transformation until 2050** that would, among others, define the role of nuclear and gas technologies, as well as energy storage (power-to-X, including hydrogen from water electrolysis) in the Polish energy mix. The vision needs to be framed within the EU reduction goals for 2030 which imply a decrease in emissions by at least 50% compared to 1990.
  - **Enable active participation of diverse investor groups** in the transformation of the Polish energy sector, whilst acknowledging the dominant role of the private sector in the process and the need to redefine the role of state-controlled companies.
  - **Strengthen the dialogue between the public sector, private investors and financial institutions** focused on their role in the financing of low-carbon transition in order to ensure that their activities are in line with the objectives of building a climate-neutral economy.

# 1. Introduction

In its press release presenting the strategy for financing the European Green Deal published at the beginning of 2020, the European Commission estimated that the investments needed to achieve the 2030 climate goals amount to EUR 260 billion per year (EC 2020a). In the Recovery Plan for Europe established in response to the economic crisis caused by the COVID-19 pandemic, the European Commission states an even greater amount, estimating that the implementation of actions foreseen under the European Green Deal and simultaneously meant to assure fiscal stimulation of the EU economy after the epidemic will require EUR 470 billion per year until 2030 (EC 2020b). These estimates show that the transformation to a low-carbon economy requires an unprecedented redirection of financial flows towards sustainable investments, while confirming that projects contributing to climate neutrality can aid the European economy's recovery from the recession caused by the coronavirus pandemic. Therefore, the instruments foreseen in the Recovery Plan for Europe assume that support for the development of sustainable investment projects will be provided both directly – e.g. by requiring a minimum share of green investments in the budget, and indirectly – e.g. by implementing a methodology for tracking financial flows devoted to low-carbon investments (cf. Table 1).

**Table 1.** Financing the transformation to a low-carbon economy – selected actions that enable the mobilisation of financing in support of sustainable investment projects

Instrument name		Selected activities related to the mobilisation of financing in support of sustainable investment
European Green Deal	Multiannual Financial Framework (MFF)	<ul style="list-style-type: none"> <li>→ EC's proposal that at least 25% of EU budget expenditure should contribute to climate goals</li> <li>→ Proposal to improve the efficiency of monitoring financial flows for climate purposes from the EU budget</li> </ul>
	European Investment Bank (EIB)	<ul style="list-style-type: none"> <li>→ Adaptation of the Bank's operations to the principles and objectives of the Paris Agreement by the end of 2020</li> <li>→ Proposal to implement a methodology for tracking financial flows targeted at low-carbon investments</li> </ul>
	Invest EU	<ul style="list-style-type: none"> <li>→ EC's proposal that at least 30% of the Invest EU budget should contribute to achieving climate goals</li> <li>→ Proposal to implement a methodology for tracking financial flows targeted at low-carbon investments</li> </ul>
	Strategy for financing sustainable development	<ul style="list-style-type: none"> <li>→ Adopting, by the end of 2020, delegated taxonomy acts defining low-carbon investments that contribute to climate goals</li> <li>→ Proposal for a reformed sustainable development strategy aimed at increasing financial flows supporting the implementation of sustainable development goals</li> </ul>

Recovery Plan for Europe	<ul style="list-style-type: none"><li>→ In addition to digitisation, the transformation to a low-carbon economy is a priority area of the Recovery Plan for Europe</li><li>→ EC proposal regarding the introduction of a primary “do no harm” principle for environmental objectives, i.e. only investments that align with environmental goals (including climate goals) can be carried out</li><li>→ EC’s proposal that, in addition, at least 25% of the proposed Recovery Plan budget should contribute to climate goals</li></ul>
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Source: WiseEuropa based on EC (2020a) and EC (2020c)

The Recovery Plan for Europe poses a particularly serious challenge for Poland, where investments in renewable energy sources tend to be seen as costs rather than development opportunities. Awareness of the current shape of financial flows enabling the implementation of low-carbon investments, as well as their desirable form in the coming years, is low in Poland. Therefore, it should not come as a surprise that many actors perceive the construction of a zero-emission energy sector as a project that exceeds Poland’s financial capacity and see the goal itself as impossible to achieve.

Fragmented information regarding the scale, sources and instruments of financing the renewable energy sector, as well as the involvement of particular groups of investors in this process, is not only a hindrance to Poland’s climate policy, but also brings with it a risk of the European funds offered under the Recovery Plan being used incompletely or ineffectively. This stems from the fact that the use of said financing will require a large number of zero-emission investment projects by the public and private sectors to be presented, which also entails the establishment of an appropriate institutional and legal infrastructure that would garner interest from investors and the financial sector (cf. Table 1). The creation of such a range of instruments necessitates an understanding of the current state and requires one to look into the future. To facilitate this, we have decided to present the “Landscape of climate finance in the Polish energy sector”, which is the first study in Poland that enables one to:

- assess the total scale of climate finance broken down into energy sources;
- identify the financing sources and the degree to which they are used by investors;
- understand the role state-controlled companies and private companies play in the transformation;
- analyse the relationship between private and public financing;
- assess the share of specific instruments in climate finance, including the importance of own equity, debt instruments and public policies in stimulating the market.

The presented report is the third study by WiseEuropa devoted to mapping financial flows supporting the low-carbon transformation. In the first publication “Domestic Landscape of Climate Finance. Why systemic approach to climate finance matters?” (Wetmańska et al. 2019a) we showed how financial flow analysis is used in other European countries, highlighting the added value that such landscapes bring to the climate policy of individual countries. In the second



study “Tracking climate-related investments and finance flows. Implications of the EU Taxonomy” (Wetmańska et al. 2019b) we covered the ongoing discussion on the European arena regarding the Taxonomy for Sustainable Financing, which defines low-carbon investments contributing to the achievement of UN climate goals. Continuing this line of examination, in this study we focus on the energy sector, presenting in the following chapters a synthesis of the current state of financial flows in the renewable energy sector, supplementing it with an analysis of investment needs related to the low-carbon transformation and an assessment of future financing options. In the coming year, we plan to publish subsequent studies covering other sectors of the Polish economy. The first of these, scheduled for publication in autumn, is entitled “Landscape of low-carbon investments in the construction sector”. We kindly encourage you to read them.

## Acknowledgements

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## 2. Methodology

### 2.1 Scope of analysis and key definitions

The purpose of mapping low-carbon investment projects in the energy sector is to analyse sources, vectors and means of financing projects allowing the decarbonisation of Polish economy, which includes understanding the role private and public entities play in this process. To this end, the structure and volume of outlays incurred by various groups of investors, as well as the method and sources of their funding, have to be determined.

#### How do we understand low-carbon energy investments?

For the purposes of this analysis, we have defined low-carbon energy sources as such that can – in the long term – be part of a climate-neutral energy system, i.e. renewable sources, nuclear power plants and conventional plants equipped with CCS/CCU systems. Simultaneously, given the lack of ongoing investment projects pertaining to sources falling into the last two categories, we focused on analysing financial flows related to CHP with renewable sources, distinguishing five main types:

- onshore wind farms,
- solar PV (both farms and micro-installations),
- hydro plants (new and upgraded),
- biomass sources (including CHP plants) – excluding co-firing plants,
- biogas plants.

Like in the case of nuclear energy and CCS/CCU installations, the analysis does not include offshore wind energy, because no such project has entered the implementation phase in Poland so far. The study focuses on installations producing electric power, which is why the landscape does not include investments in electric power grids, heating (excluding RES CHP plants), as well as outlays related to improving energy efficiency of end users.

We only consider investment projects that lead to the construction or modernisation of existing infrastructure, excluding acquisitions of existing assets that do not have – by and in themselves – an impact on the operations of the electric power system.

## Types of investors

This analysis covers companies for which energy production is the main activity (energy companies), diverse prosumer groups, including companies and households, as well as national and local public sector institutions. In the case of energy companies, we have distinguished state-controlled enterprises and private entities. Overall, for the purposes of this study, we have divided investors into six categories outlined in table 2.

**Table 2.** Types of investors in the Landscape of climate finance in the Polish energy sector

Type of investor	Description
Energy companies - state-controlled enterprises	State-controlled energy companies involved in low-carbon investment projects. These mainly include capital groups, such as PGE, Tauron, Enea and Energa, but also other companies with a state involvement investing in the sector, e.g. PGNiG Termika or Zespół Elektrowni Wodnych Niedzica S.A. State-controlled financial institutions (banks, insurance companies) are not included in this category.
Private energy companies	Energy companies that invest in low-carbon projects, excluding state-controlled enterprises.
Business prosumers	Enterprises whose main activity is not related to the energy sector, investing in electricity production systems for their own needs. Other non-public organisations, e.g. religious associations or organisations have also been added to this group due to the low investment volume and a nature of involvement in the energy market similar to business prosumers (non-public institutional prosumers).
Public sector - national level	Public entities investing in low-carbon projects, e.g. national parks, education organisational units or the State Fire Service headquarters.
Public sector - local level	Local government institutions investing in low-carbon projects, mainly represented by municipalities, cities, poviats and independent public health care centres.
Households	Households investing in RES micro-installations. Entities managing residential premises, such as co-operatives and housing associations have been included in this group.

Source: WiseEuropa

## Instruments

The study covers a wide range of financial instruments that allow investors to obtain the funds necessary for implementing low-carbon projects. This category includes, in particular: subsidies, preferential loans, commercial loans, as well as the investor’s own funds. In order to map low-carbon investments in Poland, the financial instruments have been divided into three categories, according to the nature of the commitment. These are subsidies, loans and equity.

**Table 3.** Types of instruments in the Landscape of climate finance in the Polish energy sector

Types of instruments	Description
Subsidies	Non-refundable financial support provided to investors for implementing a specific project, subject to specific financial settlement rules. In the analysis we only consider investment aid that can be made available in the form of subsidies from European or national funds, as well as an investment subsidy in the form of tax relief (e.g. thermal modernisation relief that includes investments in solar panels). The Landscape does not include operational support (e.g. green certificates, income from auctions), as this is not used directly as a project financing source. However, it should be underlined that operational support systems play a key role mobilising private investment projects, which is reflected in the analysis.
Loans	<p>Preferential and commercial loans have been distinguished among loans.</p> <ul style="list-style-type: none"> <li>Commercial loans offered by banks, including credit, loans and bonds issued at market rates. The terms of commitment may vary depending on the instrument and the type of investor.</li> <li>Preferential loans granted by European financial institutions or national environmental protection funds, among others, offer more favourable terms for repayment, both in terms of the interest rate, required security, as well as the repayment schedule when compared to commercial terms. The preferential loan offer is addressed to particular groups of borrowers.</li> </ul>
Equity	<ul style="list-style-type: none"> <li>In the case of companies, financing project outlays with equity is done either through an increase in corporate capital or reinvestment of annual operating surpluses (profit).</li> <li>Household’s own funds represent the income or savings used to directly finance low-carbon projects without taking credit, loans or support from third parties.</li> </ul>

Source: WiseEuropa

## Sources of funding

Information on the sources of funding presented in this analysis indicates the origin of funds used to implement low-carbon investment projects. Three main types of funding have been distinguished: national public funding, European funding and funds of companies and households (including those managed by the financial sector). Each of the indicated groups includes more detailed categories of funding sources, as presented in the table below.



**Table 4.** Sources of investment funding included in the Landscape of climate finance in the Polish energy sector

Funding sources	Category	Description
National public funding	National budget	Funds from the national budget, used, for example, as own funds for investment projects for national institutions or to cover the costs of subsidies (e.g. lost income resulting from tax relief).
	Local budgets	Local government funds used as own funds for investment projects.
	National and regional environmental funds	National Fund for Environmental Protection and Water Management (NFOŚiGW) and Voivodeship Funds for Environmental Protection and Water Management (WFOŚiGW). Funds obtain funding from environmental fees and distribute them as repayable or non-repayable aid for environmentally friendly investment projects. This category includes only aid provided from the Funds' own funds, without any EU funding managed by them.
European funding	European funds	Funding allocated from European funds, both within the framework of national and regional operational programmes.
	European banks	This category includes the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD), which grant loans for low-carbon investment projects.
Companies and households	Commercial banks	Loans offered to public and private investors by commercial banks.
	Company and household budgets	Financial resources of companies and households that are directly engaged in financing low-carbon investment projects performed by particular entities.

Source: WiseEuropa

## 2.2 Data sources and timeframe of the analysis

This analysis considers data on low-carbon investments in the energy sector launched in 2013-2019. The data includes, first of all, the amount of renewable power capacity broken down into individual low-carbon technologies together with investment outlays incurred in the analysed projects and financial flows broken down by years and types of investors. Defining the landscape of low-carbon investment projects required access to data with the highest possible level of detail. Wherever possible, we relied on data for individual investment projects. In other cases, we disaggregated bulk amounts, based on partial information and source literature. We obtained the necessary data from databases and public registers, reports and documents published by other

institutions, as well as directly from public institutions through the institution of requests for public information.

Since some of the data was only available in aggregate form, it was necessary to compare and combine information from various sources. The data acquired made it possible to compile information related to:

- annual increases/decreases in installed capacity – both at the national and individual energy company level,
- the number of completed projects, their total costs, including eligible costs, amount of co-funding from a particular source, project start and end dates, as well as the environmental and material effects,
- loans and credits granted by European banks and environmental funds,
- the types of investors implementing specific types of projects,
- the capital expenditure (CAPEX) depending on the type of investment project.

Despite the wide range of collected data, it was not possible to obtain detailed information for all analysed projects. Some public institutions explicitly stated that they did not dispose of particular data. Meanwhile, in the case of private institutions, the problem turned out to be the impossibility to provide access to such information for fear of the company’s competitive position being weakened. In situations where lack of access to data significantly hindered the analysis, estimates were made based on information regarding similar projects, as well as available subject literature and market information. Table 5 presents a summary of all sources.

**Table 5. Data sources used in the Landscape**

Data source	Description
Ministry of Development Funds and Regional Policy	<ul style="list-style-type: none"> <li>• Information shared by the Ministry of Development Funds and Regional Policy under the access to public information regime, as well as posted on the European Funds Portal.</li> <li>• Data for a total of over 7,000 projects covering energy sector investment projects implemented through the Operational Programme Infrastructure and Environment in the years 2014-2020 and 2007-2013.</li> <li>• Indicators used: eligible costs, amount of co-financing, value of projects (PLN), additional installed capacity (MWe).</li> </ul>
Ministry of Climate	<ul style="list-style-type: none"> <li>• Information made available under the access to public information regime for projects financed by the EEA Financial Mechanism and the Norwegian Financial Mechanism.</li> <li>• In total approx. 150 projects covering energy investment projects in 2015-2017.</li> <li>• Indicators used: eligible costs, amount of co-financing (PLN), additional installed capacity (MWe).</li> </ul>

Ministry of State Assets	<ul style="list-style-type: none"> <li>Information included in the National Energy and Climate Plan (NECP) for 2021-2030, along with appendices.</li> <li>Indicators used: estimated capital expenditure per unit of energy depending on the technology used (CAPEX) – as a supplement to information on investment outlays calculated directly from data for individual projects.</li> </ul>
Energy Regulatory Office	<ul style="list-style-type: none"> <li>Information shared by the ERO under the access to public information regime, as well as posted on the Office's website.</li> <li>In total information about 21 resolved RES auctions in 2016-2019, data regarding RES installed capacity in 2012-2019 and information on installations obtaining support under the FIT/FIP system.</li> <li>Indicators used: amount and value of energy sold through the auction (MWh/PLN), installed RES capacity – total and covered by FIT/FIP systems (MWe).</li> </ul>
National Fund for Environmental Protection and Water Management	<ul style="list-style-type: none"> <li>Information made available by the NFOŚiGW under the access to public information regime.</li> <li>In total approx. 100 projects in the field of electric power generation, as well as approx. 30 NFOŚiGW priority programmes (incl. BOCIAN, Mój Prąd, System Zielonych Inwestycji) implemented in the years 2006-2019.</li> <li>Indicators used: Amounts of loans and subsidies paid out (PLN), additional installed capacity (MWe).</li> </ul>
European Investment Bank (EIB)	<ul style="list-style-type: none"> <li>Information obtained from the database on projects financed by the EIB, which is available on the institution's website.</li> <li>A total of 29 projects that were implemented in 2011-2020 thanks to EIB financing.</li> <li>Indicators used: Project funding amounts (EUR), descriptions for some projects also included the total project value and installed capacities.</li> </ul>
European Bank for Reconstruction and Development (EBRD)	<ul style="list-style-type: none"> <li>Information obtained from the database on projects financed by the EBRD, which is available on the institution's website.</li> <li>Information on 25 projects that were implemented in 2011-2020 thanks to EBRD financing.</li> <li>Indicators used: Project funding amounts (EUR, PLN), descriptions for some projects also included the total project value and installed capacities.</li> </ul>
Energy companies - state-controlled enterprises	<ul style="list-style-type: none"> <li>Information obtained from periodic reports, management board reports on the activities of capital groups and company websites. It covered the period from 2012 to 2019.</li> <li>The evaluated companies were primarily Polska Grupa Energetyczna (PGE), Tauron Polska Energia, Grupa Enea and Grupa Energia. The information sought included both details about implemented projects, as well as aggregated data on RES investments.</li> <li>Indicators used: Power installed in RES broken down by energy source (MWe), investment outlays for the construction and modernisation of generating plants (PLN).</li> </ul>
Statistics Poland (GUS)	<ul style="list-style-type: none"> <li>Statistical data for the renewable energy sector available in reports made available on the GUS website.</li> <li>Indicators used: total capacity installed in the Polish energy system broken down by technology (MWe).</li> </ul>

Source: WiseEuropa

## 2.3 Key assumptions

The methodology used to prepare the Landscape of climate finance in the Polish energy sector in 2013-2019 was prepared on the basis of the methodology developed by the Institute for Climate Economics (I4CE) used for the annual analysis of financial flows supporting low-carbon investments in France (Hainaut and Cochran 2018).

We measured low-carbon investment project flows by way of two complementary approaches:

- aggregation of cash flows from primary sources with a high degree of detail and completeness.
- estimation of financial flows from funding sources, through intermediaries, to end investors, based on mixed information sources.

The first approach analyses, among others, cash flows from national and European public institutions, enabling us to identify specific projects that received support in the form of subsidies or preferential loans, as well as the exact funding in specific years. A highly detailed analysis in this case was made possible thanks to the Ministry of Development Funds and Regional Policy providing detailed information on projects implemented with European Union co-financing.

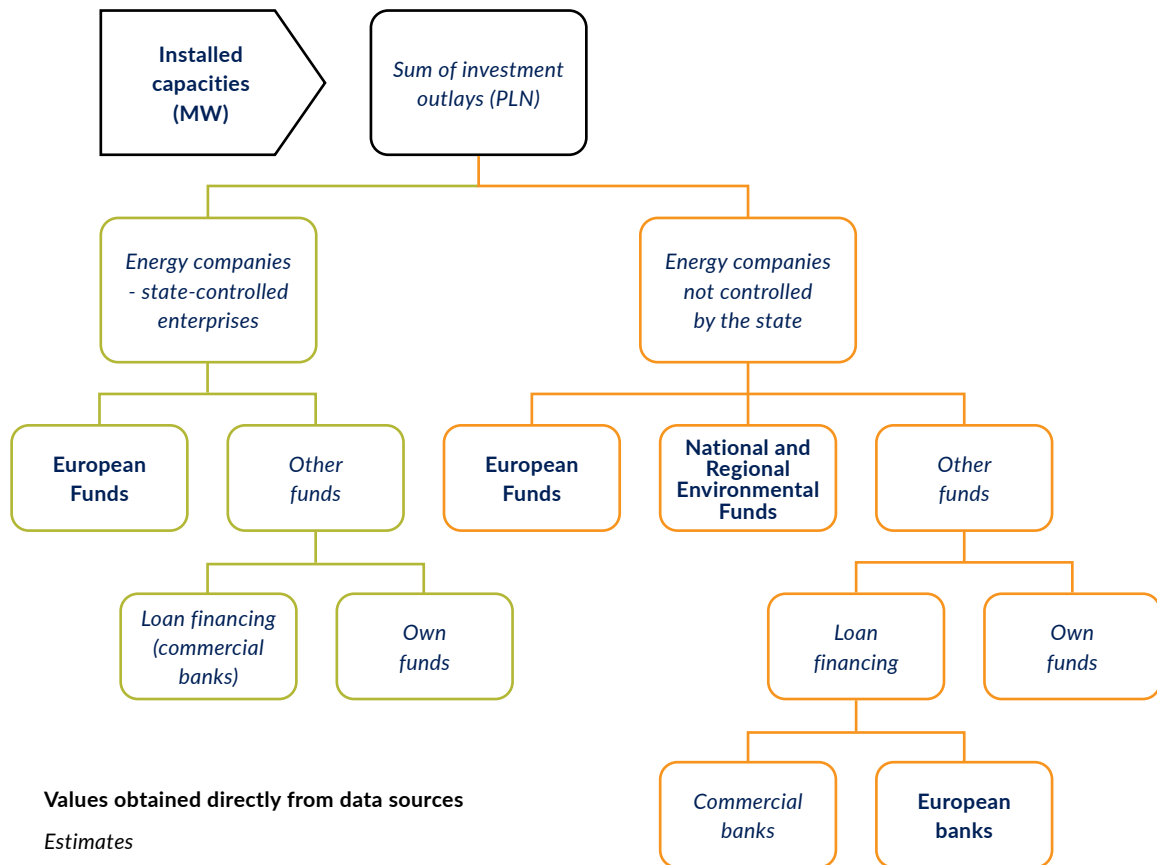
The second approach was used in those Landscape elements that required approximate estimates based on partial data, e.g. due to incomplete information on individual projects or data with a high level of aggregation. This approach also included data difficult to access as a result of applicable law. One example here is information on the operations of financial institutions that is not publicly disclosed. In light of these restrictions, the starting point for the analysis was statistical data on nationwide capacity increase, broken down by technology, which made it possible to estimate the total volume of investments by technology as the product of the total increase in capacity installed in the power grid (in MW) and average investment outlays per 1 MW of capacity for a particular technology. Having this aggregate information and additional partial information, we were able to conduct a more detailed analysis by adopting a few additional assumptions:

- We assigned the total volume of investment outlays and related financial flows to the project launch year. This date was determined based on information for individual projects (in the case of subsidies), a won auction or a submission to the FIT/FIP system. In case project-level information was absent, we adopted the typical length of investment for a given technology.
- Estimates of total investment outlays after deduction of identified public funding (European and national subsidies, preferential loans, own contributions of public institutions) and investments of state-controlled companies allowed the private sector's contribution to funding of RES investments to be determined. For the majority of technologies, we assumed that these investment projects are implemented by energy companies, i.e. entities whose key activity is energy generation. Solar PV is the exception, for which we have established a 25:75 ratio for 2017 and 2018, and 35:65 ratio for 2019 for business prosumers and households. (cf. IEO 2019).
- For the purposes of estimating investment project volumes by funding sources and instruments, we assumed that private sources not included in the collected data constitute the investor's own funds or loans from commercial banks. The ratio between own funds and loans was established on the basis of the debt-to-equity market indicator set for most technologies at a 25:75 level. Wind energy is the exception, for which we raised the estimated debt-to-equity indicator to 30:70 after 2015 due to increased regulatory environment uncertainty.



- When estimating low-carbon investment project volumes, we excluded outlays allocated to the development of the transmission and distribution grids, as well as other investment projects in auxiliary infrastructure, which has no impact on the increase of RES installed capacity.

**Diagram 1.** Data disaggregation – on the example of onshore wind farms



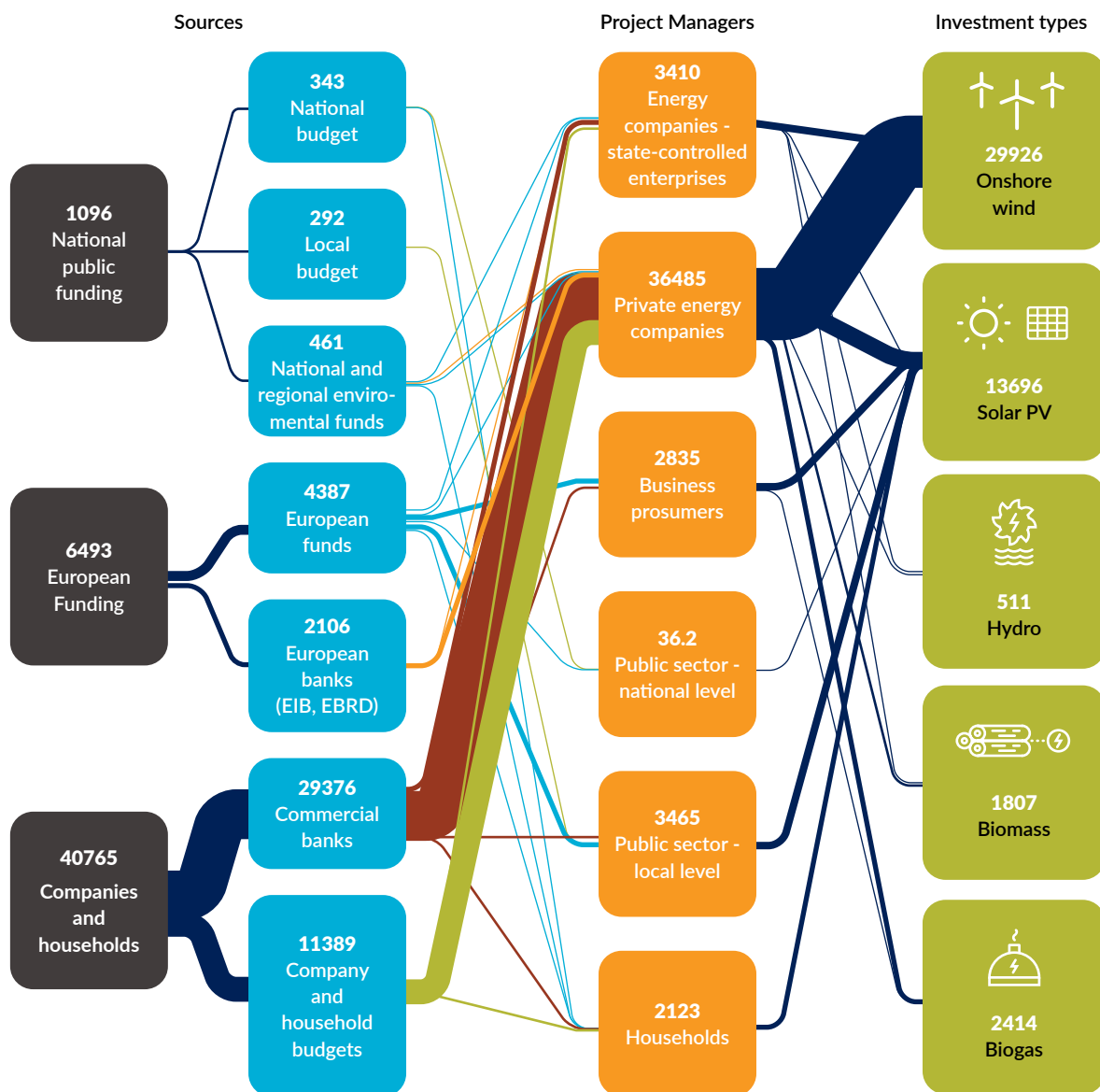
Source: WiseEuropa

# 3. Results

## 3.1 Financial flows in the energy sector in 2013-2019

Diagram 2. Landscape of financial flows in the energy sector in 2013-2019

Landscape of climate finance in Poland, renewable energy sector  
(amounts in million PLN, total flow in the 2013-2019 period)



**Financial instruments:**

- Grants and investment subsidies
- Concessional loans
- Commercial loans
- Equity

Source: WiseEuropa



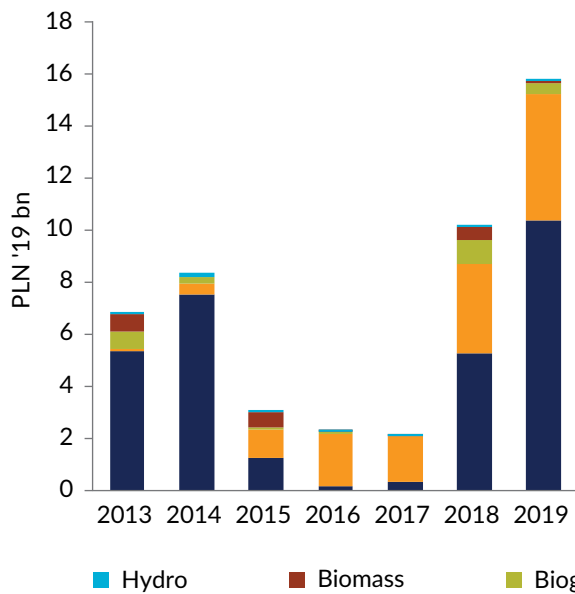
## Regulatory context

Investments in renewable energy sources in Poland in 2013-2019 were carried out in a highly variable institutional setting. At the beginning of the decade, given that the prices of new wind or solar power plants were still relatively high, their development was determined by the creation of a public support system. Such a system was established in the form of a green certificate system. Consequently, 2013-2015 saw a more intense implementation of renewable projects, primarily wind, resulting in the creation of approx. 2.7 GW of new capacity in the system. However, political and market scepticism towards the support system in place gradually increased, while the prices of green certificates were falling, before sinking to the bottom in 2015. In 2016, an alternative support system, one previously prepared, was introduced in its place, but did not initially function (no auctions were announced). Simultaneously, new investment barriers appeared in the form of the law on minimum distance requirements for new projects and taxes significantly limiting the attractiveness of renewable projects for private investors and banks. In 2016-2017, the auction system was gradually being implemented by the Ministry of Energy, but in this period, the emphasis was placed on migration auctions for existing facilities (leaving the green certificate system), but without conducting large auctions for new renewable capacities, especially the most commercially attractive wind turbines. Together with the law on minimum distance requirements and unfavourable tax burdens, this blocked the development of RES on commercial principles, which was only slightly offset by the increased activity of local governments taking advantage of EU funding. The breakthrough came in 2018-2019, when the threat of Poland failing to meet its energy goals for 2020 led to the launch of wind and solar auctions, while the falling costs of these technologies and dedicated support systems allowed new categories of investors, business prosumers and households to enter the market (cf. Appendix A). Further in the chapter, we show the details of this process in terms of investment outlays, financial flows and financing sources.

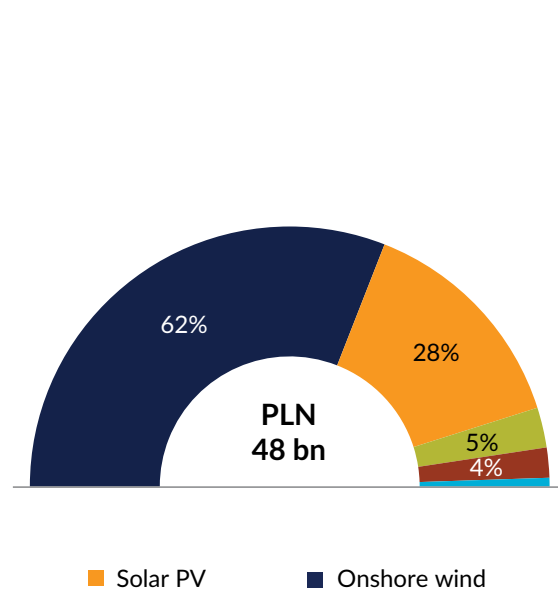
## Scale of investments

- The scale of investments in RES in Poland depends on the expenditure on wind energy and solar PV. In 2013-2019 wind projects constituted approx. 62% and solar approx. 28% of the value of all investments in renewable energy in Poland.

**Figure 1.** Low-carbon investments by RES technology in 2013-2019



**Figure 2.** Total value of investment projects by RES technologies in 2013-2019



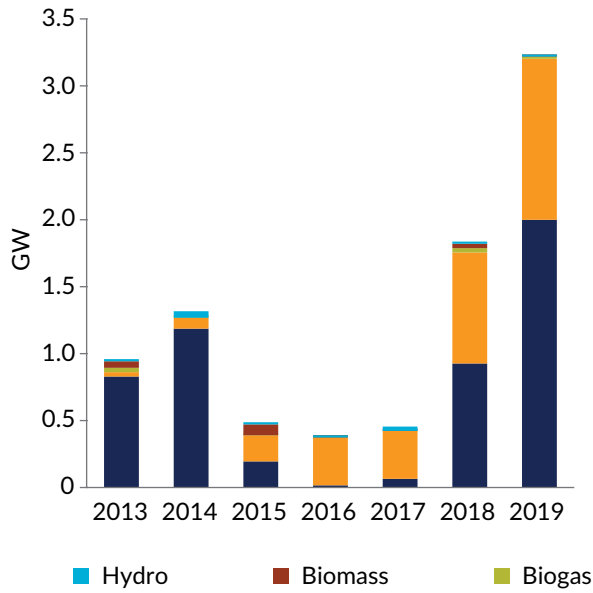
Source: WiseEuropa

The cumulative value of funds invested in RES in 2013-2019 amounted to approx. PLN 48 billion. Approximately 62% of this amount was allocated to the development of the wind energy sector, in which approx. 5.2 GW of new capacity was built. Second to attract investors' attention was solar PV (approx. 3 GW of new capacity), which received around 28% of all funds allocated to RES in the researched period. Further down the list are investments in the development of biogas plants (5% of total outlays) and biomass sources (4%), while hydro plants accounted for a small margin of the market (approx. 1%). Investor interest in particular technologies fluctuated. Investments in solar PV have been steadily increasing from PLN 143 million in 2013 to PLN 4.9 billion in 2019, with significant acceleration in 2018. Meanwhile, wind farm development saw significant variation due to the 2015-2017 crisis. In 2019, the value of investments in wind farms exceeded PLN 10 billion.

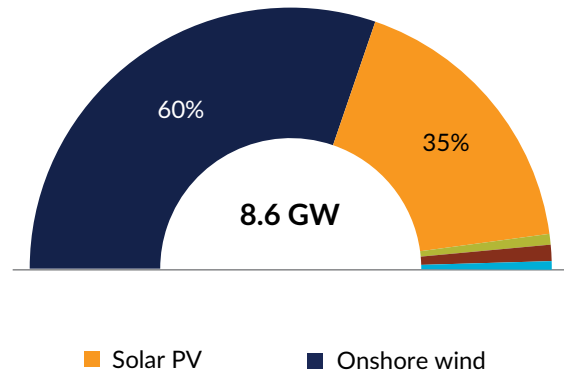




**Figure 3.** New installed capacity by RES technology in 2013-2019



**Figure 4.** Cumulative share of new installed capacity by RES technology in 2013-2019

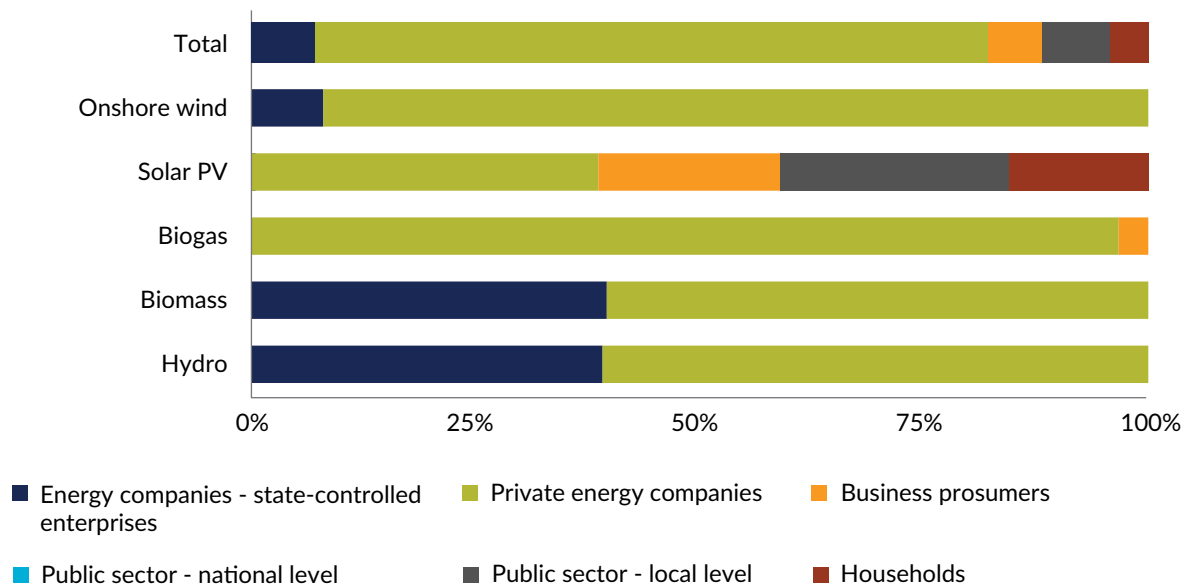


Source: WiseEuropa

## Investors

- The share of the public sector and state-controlled energy companies in financing RES technologies in 2013-2019 did not exceed 15%.
- Private energy companies and business prosumers played the greatest role in increasing the share of RES technologies in the Polish electricity mix, accounting for a total of 81% of all renewable capacity installed in 2013-2019.

Figure 5. Cumulative share of investor groups in financing RES technologies in 2013-2019



Source: WiseEuropa

The main category of investors leading the expansion of renewable energy capacity in Poland are institutional investors, for whom the energy sector is the main field of activity. These entities can be divided into private companies and state-controlled enterprises. In 2013-2019, private energy companies spent over PLN 36 billion on constructing new renewable energy sources, which accounted for as much as three-quarters of all RES investment projects in this period. This amount exceeded outlays on RES of state-controlled energy companies more than tenfold (PLN 3.4 billion). The two categories of energy companies also differed in terms of the structure of incurred expenditure. Private companies dominated the fields of biogas plant and onshore wind farm construction, accounting for over 90% of the value of all investment projects completed in 2013-2019. Their share exceeded 60% in other market segments as well. Solar energy was the only exception, as in this case private energy companies financed only 38% of all investment projects, due to significant activity of business prosumers, households and the public sector (mainly local governments). Unlike private companies, state-controlled enterprises conducted limited investments in wind, solar PV or biogas, focusing rather on financing biomass sources and hydro plants, although in these too they had a minority share, accounting for approx. 40% of total outlays. Business prosumers whose principal economic operations concern other areas of the economy invested only in solar PV (PLN 2 billion) and to a much lesser extent in biogas plants (PLN 74 million). Meanwhile, the public sector (primarily local governments) and households were

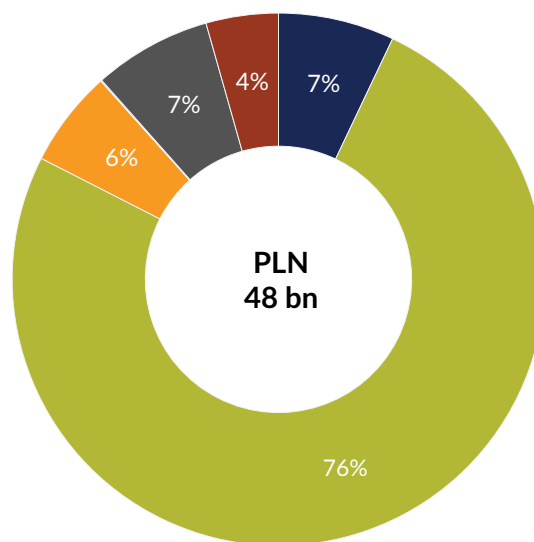
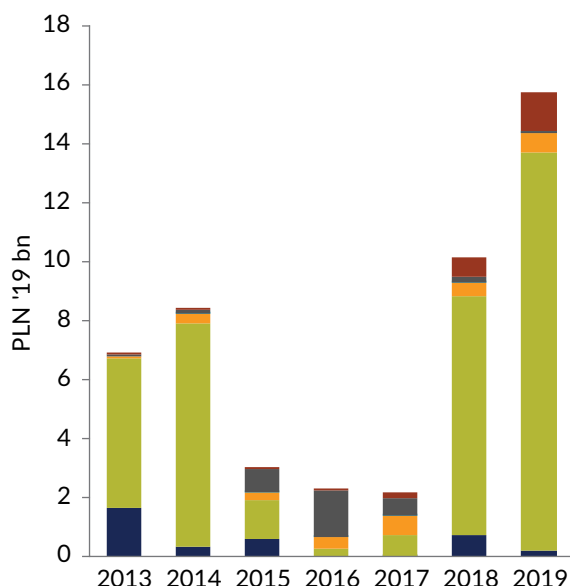


involved exclusively in financing solar PV, to which they allocated PLN 3.5 billion and PLN 2.1 billion, respectively.

- In 2015-2017, a significant decrease in funding of RES technologies occurred due to the limited activity of private energy companies in funding low-carbon investment projects.
- This fall was offset by the investment boom in 2018-2019 and, to a much lesser extent, a systematic increase in the activity of households and business prosumers.

**Figure 6.** Financing of low-carbon investments in the energy sector by investor group in 2013-2019

**Figure 7.** Cumulative share of particular investor groups in financing low-carbon investments in the energy sector in 2013-2019



- Households
- Public sector - local level
- Public sector - national level
- Business prosumers
- Private energy companies
- Energy companies - state-controlled enterprises

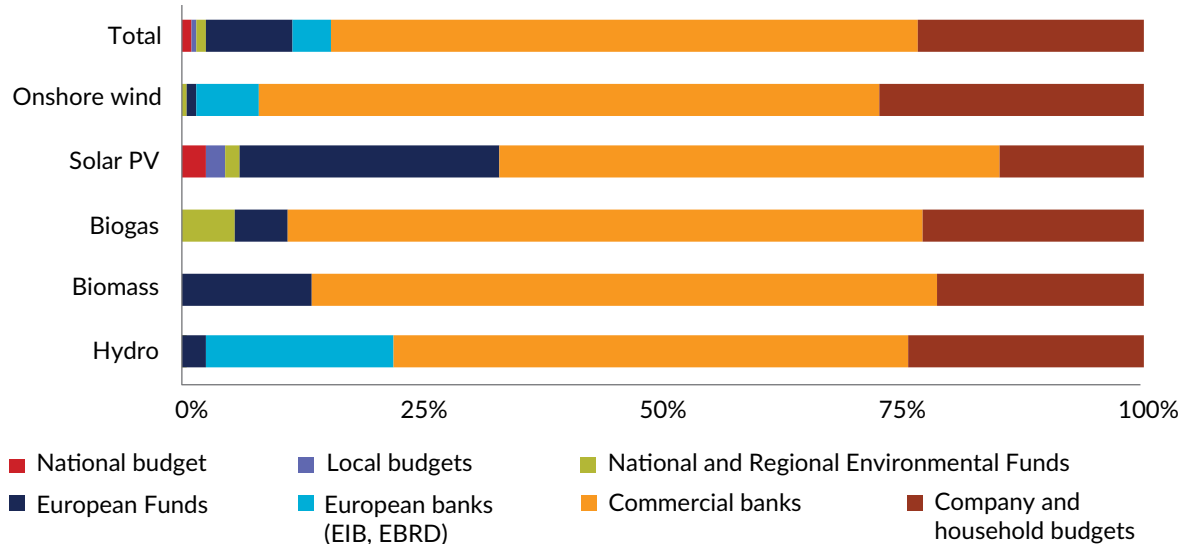
Source: WiseEuropa

Even though energy companies other than state-controlled ones allocated the most capital to RES technologies in 2013-2019, the scale of their involvement changed dynamically over time. In 2015-2017, a significant, almost six-fold, decrease in investments implemented by energy companies was observed, going from PLN 7.6 billion to PLN 1.3 billion. Interest in investments in renewable sources returned in 2018-2019, when private entities invested a total of PLN 21.7 billion. In the crisis period of 2015-2017 the role of the public sector grew, especially that of local governments, which in 2016 accounted for as much as 70% of all renewable investments in Poland. However, this was temporary and resulted from the availability of EU funds for local governments in this period. In the last two years business prosumers and households took over the public sector's role on the RES market. In 2019, they completed 4% and 8% of all renewable energy investments in Poland, respectively. Over the entire period, local governments, business prosumers and households had a 2.5-times greater share when compared to state-controlled energy companies.

## Sources of funding

- Commercial banks are the main source of RES funding, accounting for over 50% of the investment project value in each of the analysed technologies.

Figure 8. Cumulative share of available sources of finance for RES technologies in 2013-2019



Source: WiseEuropa

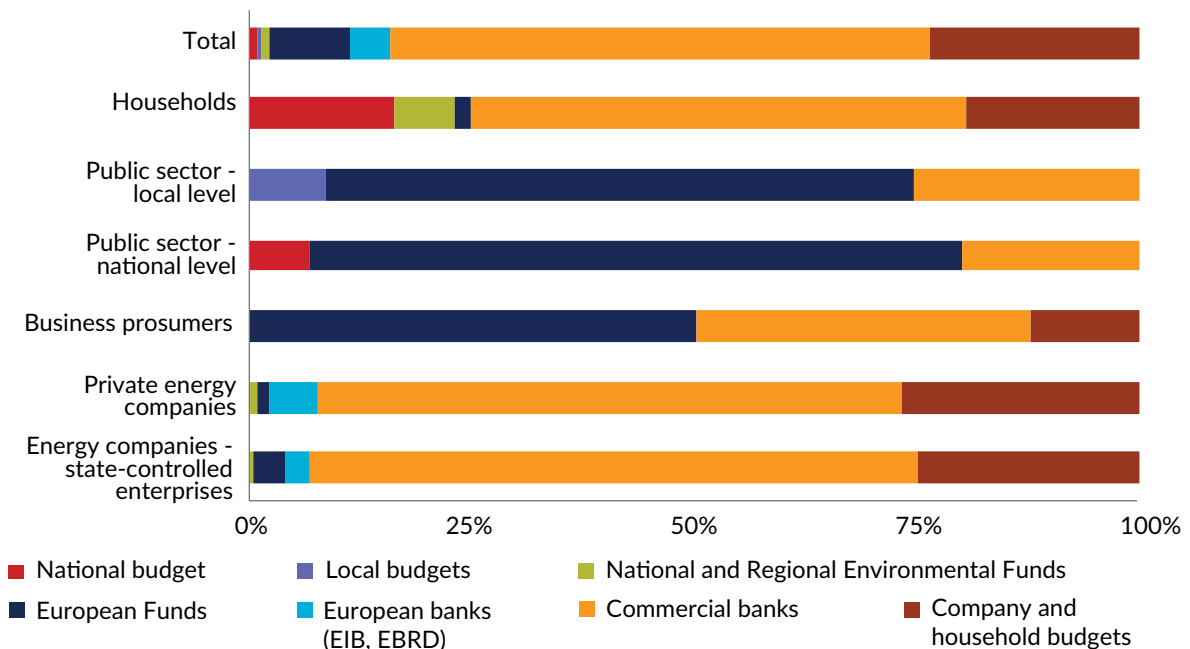


An analysis of financial flows in 2013-2019 enabled us to identify three key sources of financing for RES in Poland, i.e. commercial banks, own equity of companies and households, as well as financing from European investment banks and funds. Capital from commercial banking was the main source of RES funding (PLN 29.4 billion). At least 50% of all types of investments in renewable energy power plants were completed based on a bank loan, with commercial banks playing the greatest role in the development of biomass sources, providing funding for over 65% of their value.

A significant share of own equity of companies and households in financing (PLN 11.4 billion) was characteristic of all types of renewable sources. Depending on the technology, equity covered between 15% and 30% of the investment project value for solar PV and wind farms, respectively (with an average of approx. 23%). In turn, European funds were an important source of funding for solar PV (27.3%), also supporting the development of bioenergy to a slightly lesser extent. Meanwhile, investment banks funded the development of hydro plants (20%) and wind farms. National public funding was of minor importance, providing support to only 2% of all RES investments in the 2013-2019 period and, in the case of solar PV and biogas plants, approx. 4%-6%. Investments in solar PV used the most diverse financing sources, including central and local budgets, European funds, commercial loans or support from national and regional environmental funds.

- The public sector implements low-carbon investments mainly on the basis of European funds, while the private sector and households rely on capital from commercial banks.

Figure 9. Cumulative share of available sources of finance by investor types

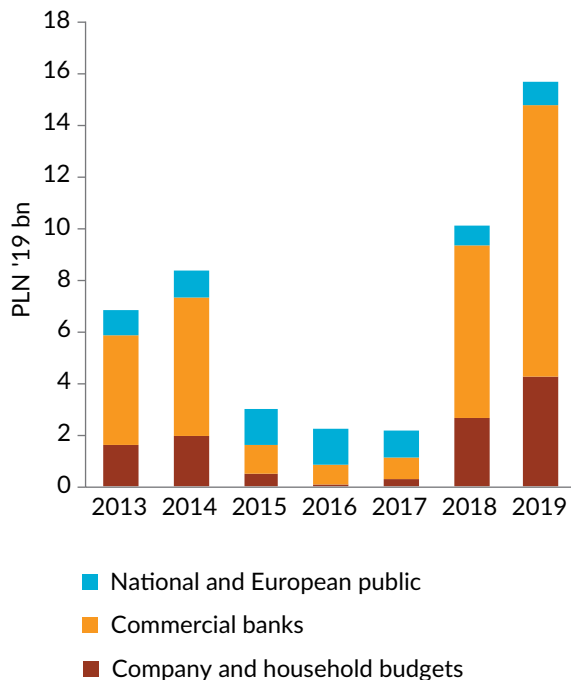


Source: WiseEuropa

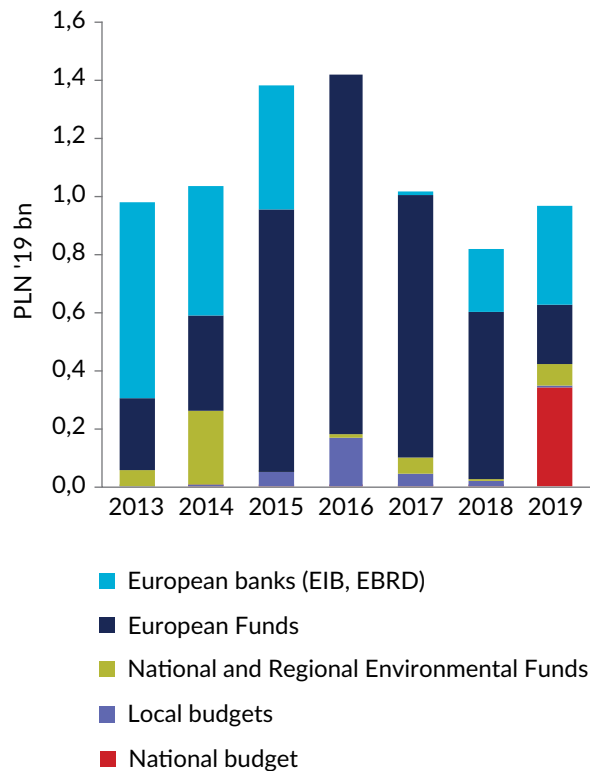
The collected data also makes it possible to determine financing models in particular investor groups. Energy companies, regardless of the form of ownership, obtain most of their funding (almost 70%) from commercial banks. In this group of investors, the own contribution is approx. 25% of the investment project's value. They finance remaining investments (6%) from EU funds, with European funds playing a more significant role for state-controlled enterprises and European investment banks in the case of private companies. Business prosumers and the public sector implement a different renewable energy financing model, with their investments based on European subsidies at a level of 50% -70%. In turn, households completed nearly 25% of investments thanks to national public funds (national budget and, to a lesser extent, national and regional environmental funds), financing the rest through loans (approx. 50%) and equity.

- The scale to which commercial banks are involved determines the rate of RES development. Data for 2018 and 2019 shows that commercial financial institutions can mobilise large capital in a very short time, but the experiences from the turn of 2014 and 2015 serve as a reminder that banks can just as quickly decide to stop financing.
- European funds play the dominant role in supporting RES technologies from public sources, exceeding national public funding nearly tenfold in 2013-2018. Only in 2019 did this change with a significant increase in the national budget's share in RES financing.

**Figure 10. Main sources of financing in 2013-2019**



**Figure 11. Sources of national and European public financing (2013-2019)**

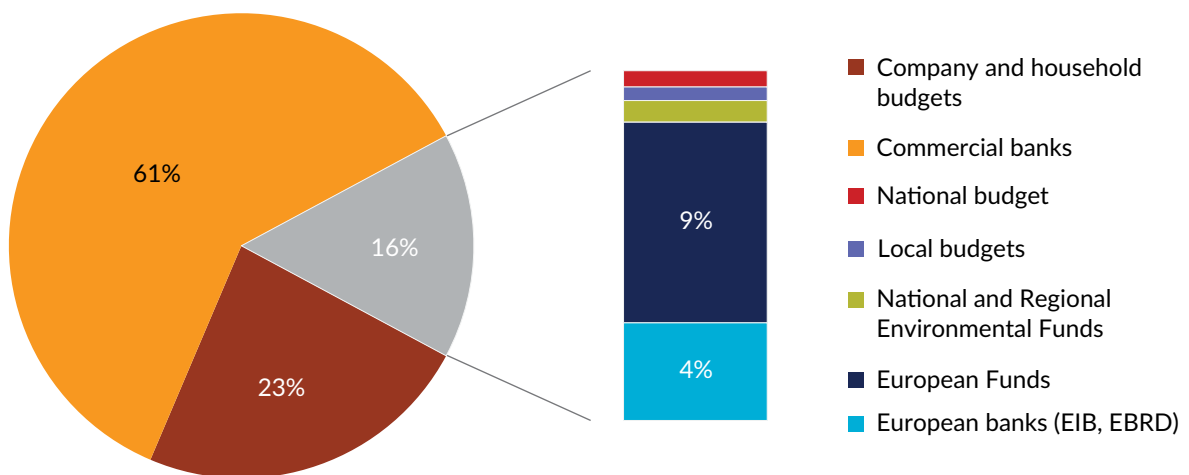


Source: WiseEuropa



Over the entire investigated period, the financing of investments in renewable sources in Poland was dominated by private capital (83%). In effect, the withdrawal of commercial banks from financing this sector in 2015-2017 due to regulatory changes resulted in a sharp decline in renewable energy source investments in Poland. The value of commercial loans for RES in 2016 (PLN 740 million) was about 7.3 times lower than in 2014 (PLN 5.4 billion). For this reason, during this period financing from national and European public funds gained importance, covering approx. 51% of costs of all projects in the renewable energy sector completed in 2015-2017. Despite this, the cumulative share of public funds throughout the period was relatively small, amounting to just 16%, of which the majority came from European funds (9%) and banks (4%). Only 3% (PLN 635 million) of RES finance flows in 2013-2017 came from national public funds (most of them from the national budget). A breakthrough for renewable energy investments in Poland came in 2018, when, following a three-year decline in the involvement of commercial financial institutions, an almost eightfold increase in lending to new projects by banks occurred and was even more significant in the subsequent year.

**Figure 12.** Cumulative share of individual sources of finance for low-carbon investment projects in the energy sector in 2013-2019



Source: WiseEuropa

## 3.2 Results by type of final investment

### Wind power

- Private energy companies accounted for over 90% of all investments in wind energy in 2013-2019 and over 90% of them were implemented based on financing from commercial banks and investors' equity.
- Changes in the regulatory environment blocked wind energy investments from developing in 2015-2017, causing them to fall almost to zero during this period. Only the auction system created in 2016 turned wind farms into an attractive investment again, leading to a sharp increase in expenditure volume in 2018-2019.

Figure 13. Financing of onshore wind farms by investor groups in 2013-2019

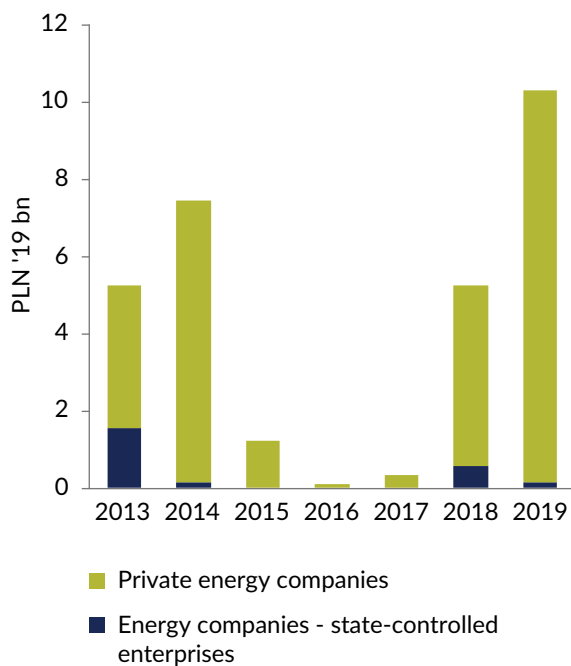
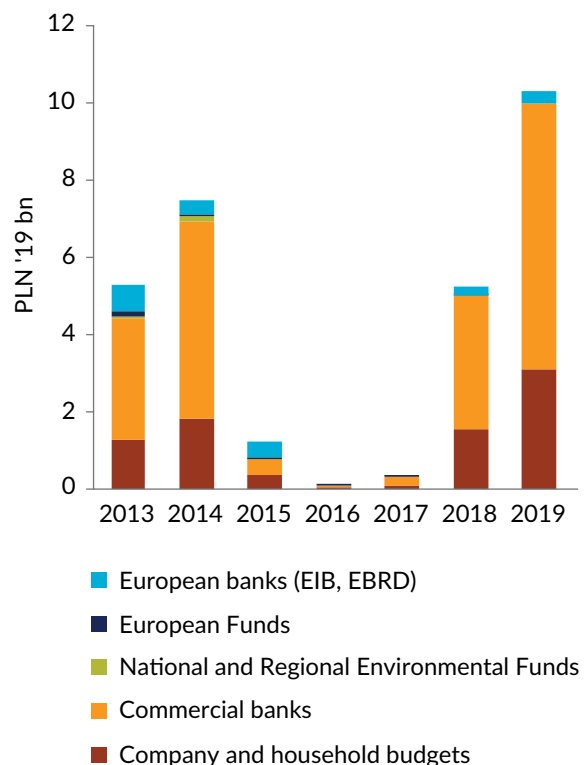


Figure 14. Financing of onshore wind farms by funding sources in 2013-2019



Source: WiseEuropa

In total, nearly PLN 30 billion was invested in wind energy in 2013-2019. Private energy companies were the main investor, responsible for over 90% of all projects in implementation. Their commitment to investments in wind power varied over time. In 2013-2014 approx. PLN 12 billion was spent, but the regulatory changes in 2015 brought about a slump, as a result of which the development of wind energy in Poland almost completely stopped in 2016-2017, while





commercial banks withdrew from projects of this nature. A rapid revival came in 2018-2019, leading to an investment boom even larger than before: in 2019 alone, the value of investments in wind exceeded PLN 10 billion.

It should also be noted that the contribution of state-controlled energy companies in wind energy development was negligible in the analysed period. They did take over 13 wind farms with a total capacity of 476 MW from other entities, spending approx. PLN 2.9 billion, but all the acquired farms were built before 2013 by private entities and so are not included in this Landscape of low-carbon investments. The share of public companies in the construction of new wind capacity in 2013-2019 can be estimated at 8%, yet in the last two years it did not exceed 5%. The sector's regulatory environment, including changes in the functioning of public support systems for renewable energy, was the primary factor influencing the high volatility of wind power investment volumes after 2013. Still at the beginning of the decade, the state's key mechanism in this regard was the green certificate system, financing wind energy as the cheapest renewable source (along with co-incineration). The effectiveness of this instrument is reflected in large-scale investments of 2013 and 2014. Many investors sought to finish implementation of wind projects undertaken under this system in 2013-2015 due to the unstable regulatory environment – the lack of certainty as to what direction reforms positioning RES in state policy in that period would take (reluctant approach towards wind energy from the main opposition party at that time). For this reason, expenditure on wind projects had already collapsed in 2015, even before the fall in price of green certificates and the introduction of the so-called Distance Act, which set the minimum distance of wind farms from buildings at ten times the height of the wind tower and applied to all projects without building permits at the moment of the Act's entry into force.

In addition, a higher property tax was levied on wind farms in 2017 and the auction system introduced in 2016 did not offer support to wind energy in the first years of its operation. All these issues meant that the sector was too risky from the perspective of commercial financial institutions, leading to a quick withdrawal of commercial banks from wind power investment projects. The downward trend turned out to be short-lived, even though the main regulatory limitations (Distance Act) are still in effect. The dynamic increase in wind energy investments observed in the last two years was dictated by two factors – the abolition of tax on non-construction elements of wind farms and the announcement of auctions intended for the first time for new wind power projects. In meeting market expectations, the government allowed for the implementation of delayed projects – ones that received building permits before the 10H rule entered into force. Auctions conducted in 2018-2019 showed that wind farms were the most competitive in terms of costs, with the prices of energy contracted through the auctions turning out to be below the wholesale electricity price, which means that financial operational support for new power plants is unlikely. The growth in investments seen in 2019 was significant not only when compared to previous years, but also against the backdrop of other EU Member States. Last year, Poland was third in the EU in terms of funding new onshore wind farms. Only Spain and the Netherlands were implementing larger scale investments (WindEurope 2020). However, maintaining the pace of investments in the coming years will, above all, require a stable regulatory environment and liberalisation of the 10H rule. Otherwise, the possibilities for new projects to be launched will be very limited.

## Solar PV

- Until 2016, expenditure on solar energy was limited. Rapid growth occurred in 2017-2019, when expenditure on new investments in solar PV increased almost threefold – the dynamic increase in outlays was a result of both the falling costs of this technology and the favourable regulatory environment.
- The systematic increase in solar energy investments was accompanied by a significant change in the structure of investors and funding sources – while at the beginning this market segment’s development was largely dependent on public investments and EU funds, after 2017 private entities and commercial banks played the dominant role in this RES technology’s development.

Figure 15. Financing of solar PV by investor groups in 2013-2019

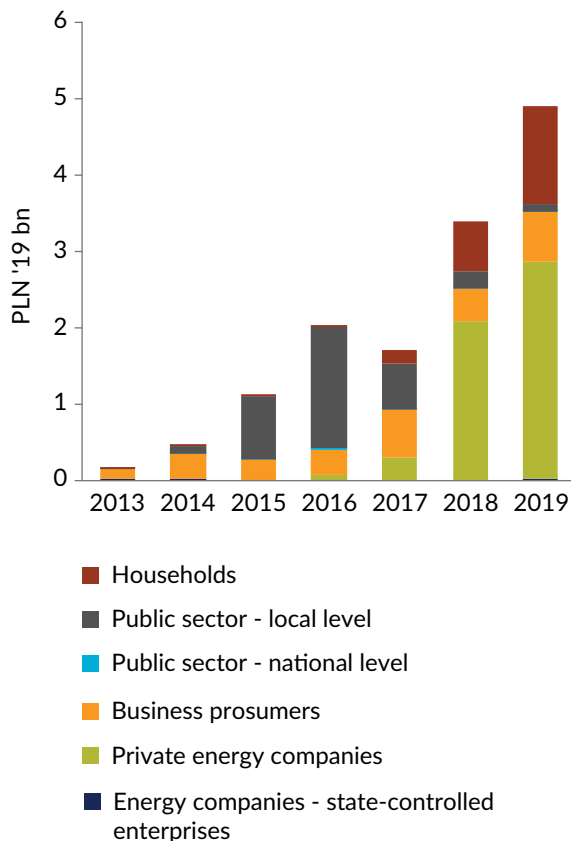
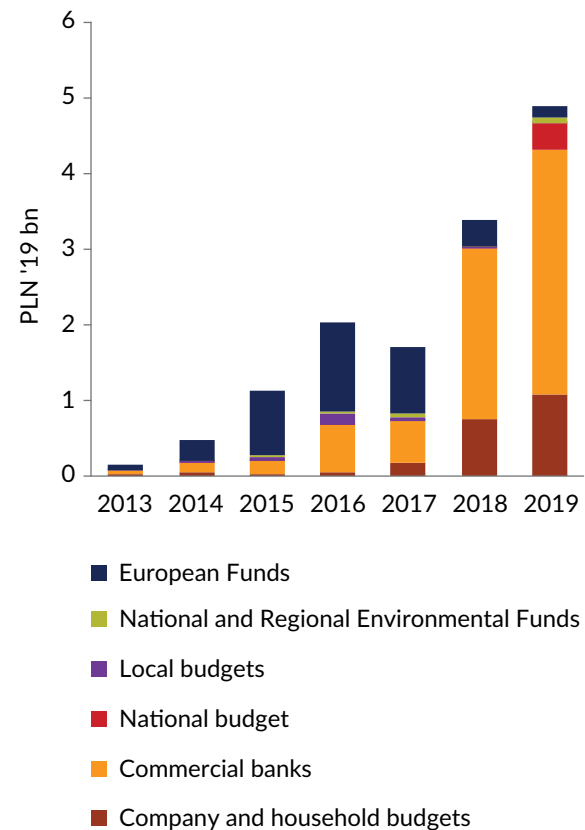


Figure 16. Financing of solar PV by funding sources in 2013-2019



Source: WiseEuropa

An analysis of financial flows supporting investments in solar PV shows that this is the sector with the most systematic increase in outlays out of all renewable energy technologies in Poland. The total volume of solar energy investments in 2013-2019 reached PLN 13.7 billion, with two waves of investment being distinguishable – the first in 2013-2016 and the second in 2017-2019 – when looking at the scale of involvement of particular investor groups and financing sources.



In the initial period, the greatest role in solar PV development was played by local governments and business prosumers (in 2015-2016 local governments were responsible for over 75% solar energy investments in Poland), while European funds were the main source of financing (accounting for even 77% in 2015). The role of state-controlled companies in the development of solar energy has so far been rather marginal, contrary to private entities, which in 2017-2019 increased their investment outlays on solar PV almost tenfold, reaching PLN 2.8 billion in 2019. The investment activities of private companies in this period saw significant supplementation in the form of a similar scale of increases of household involvement – while they allocated PLN 175 million to solar energy in 2017, it was PLN 1.3 billion two years later. Simultaneously, with every year the sector's funding was increasingly based on commercial financial institutions, with the national budget also adding to the pool of available funds to a small extent in 2019.

Both in terms of investor groups and sources of financing, investments in solar PV were the most diverse of all low-carbon technologies. The rapid decline in the price of solar panels and the possibility of the technology being used in both micro-installations and large-scale projects have all contributed to the development of diverse financial instruments, all the while allowing various groups of investors to engage. At the start of the analysed period, the scale of investments was small, while the projects were implemented mostly by the public sector, based on high subsidies from European funds – Regional Operational Programmes. In the absence of other support and the still high commercial panel prices, EU funds played an important role until 2017. The limited share commercial banks had in this period can be mainly explained by the sector's bad experiences with investments in wind farms, i.e. excessive regulatory risk associated with investments in RES according to the banks. Only the launch of the auction system for solar PV in 2018, an improvement in the national regulatory environment, EU regulations, including the increase of the prosumers' role and the rapid fall in PV panel prices allowed the mobilisation of almost PLN 3 billion in private funds, PLN 2.3 billion of which came from commercial banks, as well as the involvement of energy companies in the implementation of solar PV projects. It follows that a scale-up of the market was possible with relatively limited support from public funds. Rising energy prices, further development of RES auctions and a decrease in unit costs of solar energy, together with the introduction of a new support instrument in 2019 in the form of personal income tax relief (the thermal modernisation credit for owners of single-family houses also includes investments in solar PV panel systems) contributed to the installation of 1 GW of solar power in just 12 months. At the same time, the National Fund for Environmental Protection and Water Management introduced Program Mój Prąd (My Power Program) for micro-installations, which are currently the most popular type of solar installations. Its effects will most likely be visible in data showing investment dynamics in RES in 2020, but even today one can expect an even faster growth of solar energy outlays in the coming years – the wait for the second GW of new capacity will probably be much shorter.

## Biogas

- Outlays on biogas plants were much smaller than in the case of wind and solar energy and investor interest varied greatly over time.
- Support from EU and national funds was not able to counteract the rapid decline in investments in this technology after the collapse of the green certificate system, while the revival of interest among private entities came only with an auction system based on proper parameters.
- In spite of support instruments, such as auctions, FIT and FIP being available, financing sources still remain a challenge, limiting the possibility of biogas plant development.

Figure 17. Financing of biogas plants by investor groups in 2013-2019

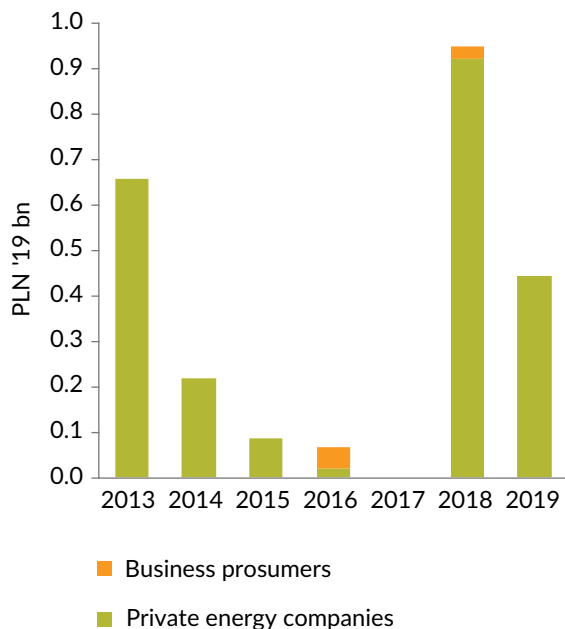
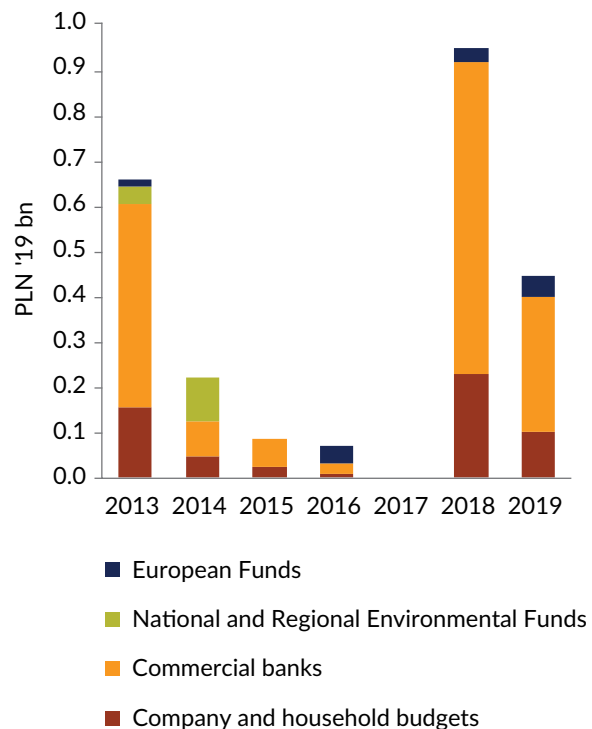


Figure 18. Financing biogas plants by funding sources in 2013-2019



Source: WiseEuropa

The total amount of investment expenditure on biogas plants in 2013-2019 was PLN 2.4 billion, with the majority of investment projects implemented by private energy companies (state-controlled companies are completely absent in this market segment). Only in 2016 and 2018 did business prosumers join in biomass investments, but their input did not exceed 3% of the value of all investments from that period. A regular and significant decline in investments could also be observed in 2013-2016, from PLN 655 million in 2013 to only PLN 68 million in 2016, along with a decrease in involvement of commercial banks, while 2017 even saw the development of biogas plants in Poland completely stopped. After a year of inactivity, investment



levels rose sharply, to nearly a billion PLN, with the majority of funding obtained from commercial banks based on the new RES support system. Last year, however, only half of the capital from 2018 was mobilised.

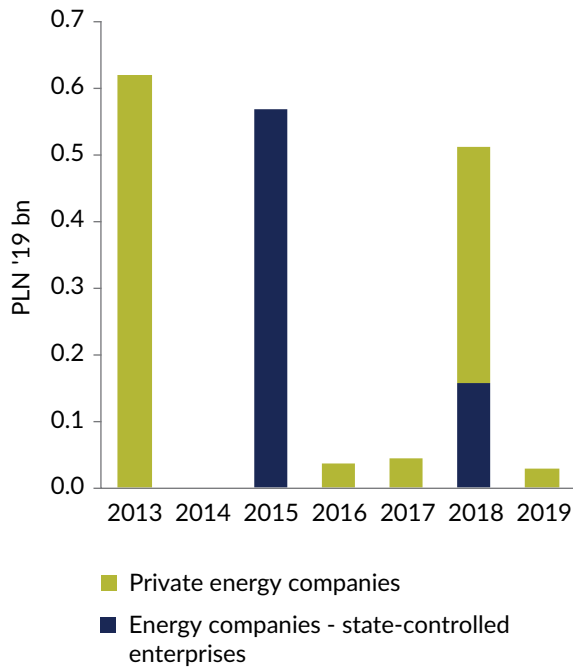
The collapse of investments in biogas plants after 2013 was, first and foremost, a consequence of problems with the green certificate system and the relatively high variable costs of biogas energy generation. Even though existing projects received support under the blue certificate scheme, this did not cover new investments. Only the auction system implemented in 2016 proved to be an impulse for the sector's development. However, the scale of support dedicated to biogas plants was incomparable with that given to the remaining technologies, such as solar PV or wind farms – in 2018-2019 the value of auctions for wind energy amounted to PLN 24.4 billion, solar PLN 6.5 billion, while for biogas it was PLN 3.4 billion. Another biogas plant support instrument, one more flexible and adapted to the reality in Poland, is the FIT and FIP system implemented in 2018 and targeted at small and existing, but also planned biogas plants, which previously had been unable to compete effectively in the auction system.

Despite a relatively extensive range of public instruments, the market's interest in biogas plants remains small due to the challenges associated with the availability of financing sources and the related need to assure a relatively high own contribution. European funds, which were used by companies focused on biogas energy production, as well as agricultural producers (including agricultural micro-enterprises), provided only targeted support, which did not lead to an improvement in the economic situation of the entire sector. Very low interest is further compounded by the competition faced from solar PV. With its much simpler operation, as well as lower technical and legal requirements, solar PV remains the preferred technology among many investors who would potentially have the conditions to build a biogas plant.

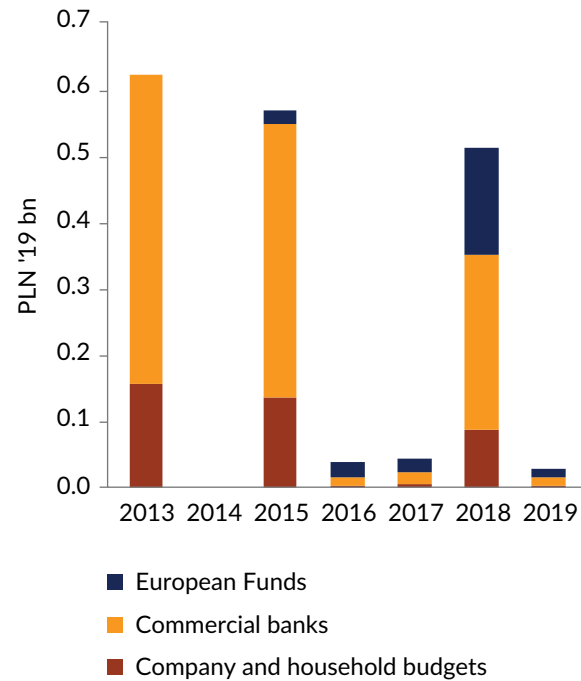
## Biomass

- Interest in biomass investments exhibited great variability over time. Due to the adverse regulatory environment and significant competition from solar PV and wind energy, private investors were reluctant to engage in this type of investments, responding only to dedicated public support programs, which, however, have not so far generated sufficient incentives to stimulate the sustainable development of this technology in Poland.

**Figure 19. Financing of biomass installations by investor groups in 2013-2019**



**Figure 20. Financing biomass plants by funding sources in 2013-2019**



Source: WiseEuropa

The total amount invested in biomass sources in 2013-2019 was approx. PLN 1.8 billion, which is over 3.5 times less than in solar PV and almost 14 times less than in wind power. The distribution of investment streams was uneven during this period, concentrated mainly in 2013, 2015 and 2018. In the studied period, one could rather observe stagnation in biomass investments and the lack of new, large projects in facilities dedicated to electric power generation. In effect, after 2013, investments of energy companies in the area of cogeneration dominated (co-incineration was not included in the analysis as it is not treated as a low-carbon source). However, large investment projects in new, “green” biomass units had been started even before 2013, when larger funding streams flowed from EU funds, as well as national and regional environmental funds. After 2013 support from these sources, even though still relatively small, was more point-specific and applied to individual investment projects only.

Interest among investors has remained low over the years, which stemmed both from an adverse regulatory environment (e.g. uncertainty related to the functioning of the green certificate system), as well as the relatively greater attractiveness of investments in other technologies such as biomass co-fired with coal (especially at the beginning of the analysed period, in 2013-2015). The availability of competitively priced raw materials, resulting from the low potential for using domestic resources and the need to import, was another barrier. Limited interest of investors in RES auctions for biomass in 2018 and 2019, as well as the lack of micro and small biomass installations in the FIT/FIP system in 2019 suggest it will be very difficult to change this unfavourable investment dynamic in the coming years.



## Hydro power

- In contrast to investments in other RES technologies, investments in hydropower in 2013-2019 consisted mainly of outlays on upgrades of existing facilities, not building new ones.
- Poland's limited hydro power potential means that small hydro power plants exhibit the greatest growth potential in the hands of private investors (households and business prosumers). Expenditure on new facilities of this type will, however, require the introduction of new support mechanisms and a reduction of existing administrative barriers.

Figure 21. Financing of hydro power plants by investor groups in 2013-2019

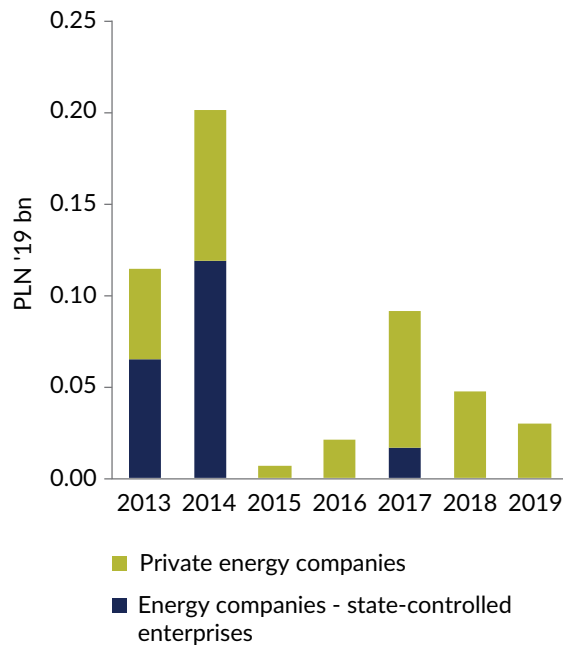
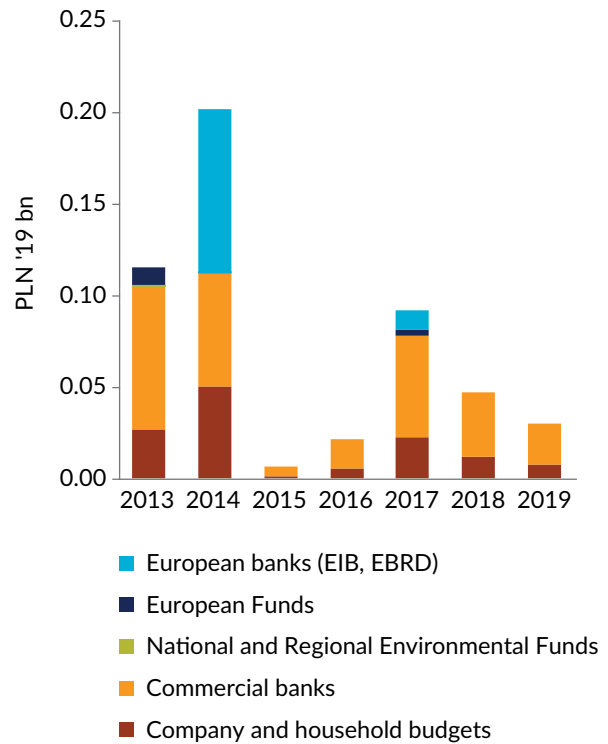


Figure 22. Financing hydro power plants by funding sources in 2013-2019



Source: WiseEuropa

We estimate the total volume of investments in this sector in 2013-2019 to be approx. PLN 500 million. These outlays were incurred both by private entities and state-controlled enterprises (the latter were mostly upgrading existing facilities, which sometimes led to an increase in installed capacity). In total, in 2013-2019, state entities invested approx. PLN 300 million in hydroelectric power plants and private approx. PLN 200 million. In terms of financing sources, funds from commercial banks were mostly involved in the entire period considered, except for 2014, when about half of the investments were conducted with the support of European banks (EIB, EBRD). One of their beneficiaries was Tauron Polska Energia, which used funds obtained from the EIB to upgrade hydroelectric power plants along with grid upgrades.

Due to the nature of hydro power, limited access to detailed data on investment outlays constituted a major challenge in conducting the analysis, in particular in the case of small, geographically distributed projects conducted by private companies before 2018. In this case we based our estimates on aggregated information and information regarding support from EU funds, as well as national and regional environmental funds. In addition, for 2018-2019 we also included planned new capacities reported under the FIT/FIP system, as well as the results of RES auctions.

Poland's hydropower potential is seen as not only limited (Kowalczyk and Cieśliński 2018), but also insufficiently exploited – it mainly includes the Vistula, Oder and near-sea river basins. Such an assessment is primarily the result of an evaluation of Poland's hydrological conditions, with limited water resources and low retention, and is compounded by climate (low rainfall) and topographical (lowland nature of Poland) factors. Such conditions entail limited potential for hydroelectric power plant development, resulting in the dominance of facilities that have existed for decades in the total number of units connected to the power grid. Investment outlays in recent years included mainly upgrades, such as replacements of turbine sets, transformers or electrical systems, as well as upgrades of auxiliary infrastructure.

Currently, the potential to construct new facilities exists mainly in the small hydropower plants sub-sector, as is indicated by a relatively large interest in support under FIT/FIP systems in comparison to other RES technologies. However, at present this system primarily serves to assure maintenance and upgrades of existing facilities, rather than the creation of new ones, which can also be observed in the relatively small contracted amounts through the RES auctions in 2018-2019. Therefore, growth in investment expenditure in this sector may only occur with the introduction of new support instruments, which would go hand in hand with the reduction of administrative barriers preventing the establishment of new power plants, which are criticised by the industry. Another opportunity for micro-investments in hydro power appeared with the possibility of obtaining financing from Norwegian funds under programmes operated by the Ministry of Climate with the support of the National Fund for Environmental Protection and Water Management.



## 4. Investments in 2013–2019 and the energy transformation up to 2050

Recent years saw the beginning of the Polish power sector's transformation towards net zero emissions. The latest analyses for Europe (cf. JRC 2020) indicate that achieving climate neutrality by mid-century will require rapid increases in wind energy and solar PV, supplemented at the end of the power grid by other zero-emission technologies of energy production and storage. These changes will also apply to Poland, but – as in other EU countries – the pace of transformation and the final technology mix remain an open question.

All currently developed scenarios of the power sector's transformation share a common trait, namely a shift in focus to capital-intensive, but mostly operationally cheap, energy generation and storage technologies: wind power plants, solar panels, nuclear power plants, CCS/CCU systems, lithium-ion batteries or electrolysis and hydrogen storage systems. Therefore, mobilising capital in the investment phase is one of the key challenges for the transformation of Poland's and Europe's energy sector. However, until now little attention has been paid in the national public debate to comparing future capital needs with the current level of outlays in the sector and the associated financial flows. In this chapter, we compile a landscape of investments in low-carbon energy sources from 2013-2019 and the investment needs resulting from the National Energy and Climate Plan, as well as more ambitious energy sector transformation scenarios that are a realistic extension of scenarios presented in the NECP. Such an approach makes it possible to determine medium and long-term capital needs, as well as the scale of public and private fund mobilisation sufficient to meet Poland's international commitments to reduce emissions.

## 4.1 Medium term perspective: investment needs up to 2035

In order to estimate the gap between the current level of investments in zero carbon energy technologies and the investment needs in the 2035 perspective, we are taking the following transformation scenarios into consideration:

- **NECP scenario** – taken directly from the National Energy and Climate Plan adopted at the end of 2019.
- **NECP scenario with retirement of coal-fired power plants by 2035** – assuming accelerated renewable energy development (additional 13 GW of onshore wind farms and 11 GW of solar PV by 2035) supplemented by higher capacities in gas-fired power plants and CHP plants (total of 16 GW by 2035). In this respect, we consider two variants of the scenario with different emission reduction ranges: with and without the commissioning of a nuclear power plant (in the second variant the gap in the system is supplemented by gas-based generation capacity). Investments on this scale will allow coal to be withdrawn from the Polish energy mix while limiting the increase in energy production from gas to 25% of electricity production at most (cf. enervis (2019)).

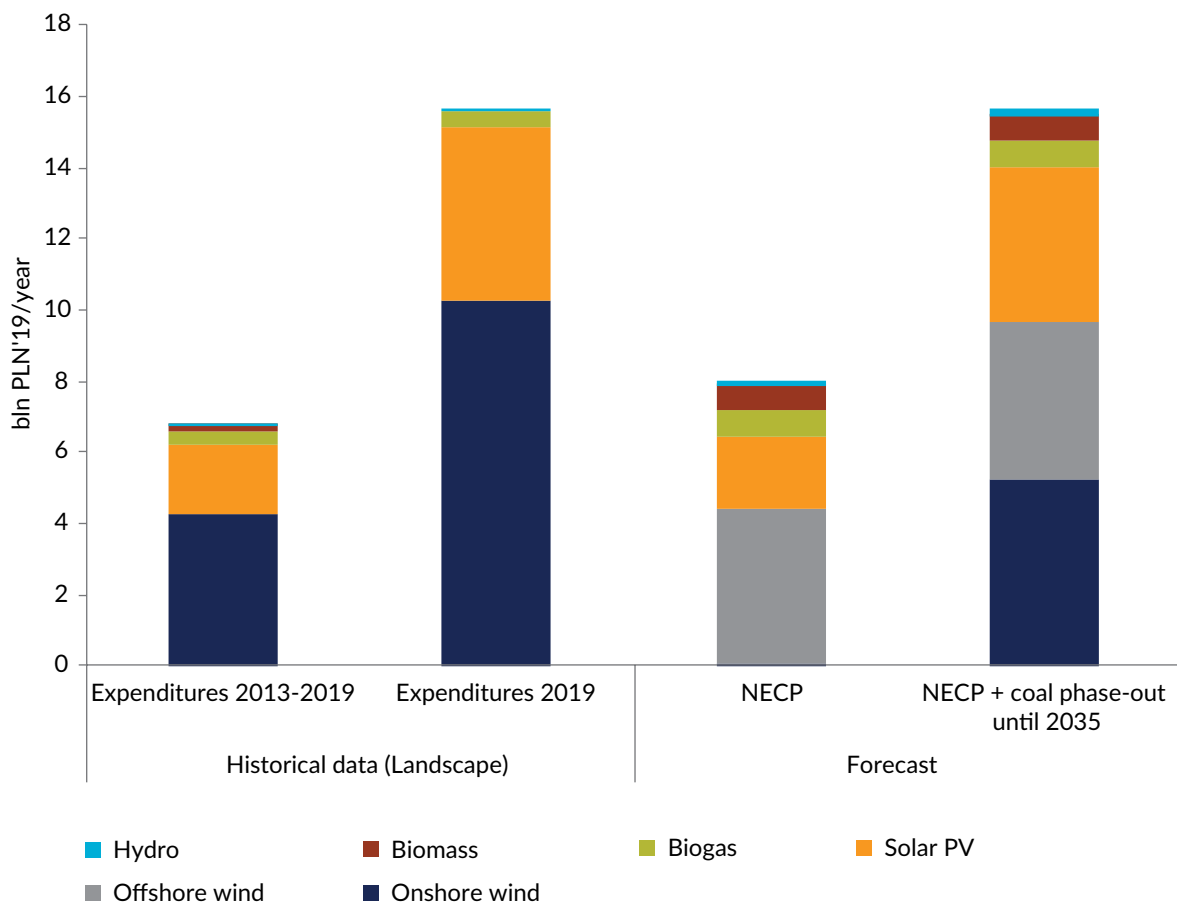
In terms of renewable energy development, the NECP scenario assumes that focus will be on the development of offshore wind energy and a gradual increase in solar PV power, while accelerating investments in biogas plants, biomass-based sources and, to a lesser extent, hydro power plants. The implementation of the Plan's assumptions would lead to the average annual renewable energy investment expenditure falling by almost half when compared to the level recorded in 2019. Therefore, investments in RES in 2021-2035 would, according to NECP, only be about 17% higher than the average for the 2013-2019 period, which included a three-year dip in the sector. The offshore wind energy development programme would not compensate for the fall in onshore wind farm investments, while the outlays for solar PV would fall to levels from 2016-2017 and would be more than twice lower than in 2019. Meanwhile, the implementation of NECP assumptions would require an approximately threefold increase in investments in biogas plants and a more than twofold increase in outlays on biomass sources and hydro power plants when compared to the 2013-2019 period.

Therefore, the renewable energy capacity expansion scenario presented in the NECP differs greatly from the possibilities and market expectations by focusing on renewable energy technologies (biomass and biogas) that have not so far attracted much interest from investors and the financial market, while at the same time completely (onshore wind) or partly (solar PV) overlooking those that had garnered such interest. At the same time, the NECP scenario underestimates RES financing opportunities in Poland based on domestic (own and banking) and European (subsidy and credit) funds by at least a factor of two. The second scenario, assuming accelerated retirement of coal energy, is free of such characteristics. It requires additional expansion of onshore wind farms and solar PV, but to a degree fully comparable to the scale of investment in these technologies



observed in 2019. In this scenario the forecast structure of investment outlays in 2021-2035 is almost identical to projects started in 2019. The only significant difference is the diversification of investments in wind energy into onshore and offshore plants. This scenario assumes that in 2021-2035 approx. PLN 10 billion a year will need to be mobilised for the development of wind energy, but with half of the necessary funds allocated to offshore projects. Through a comparison of historical and projected investment expenditures it is possible to conclude that, at the moment, one should speak not so much of an investment gap in renewable energy, but rather of the possibility in achieving a real technological transformation of the energy sector involving withdrawal from the generation of electricity and heat in coal power plants and a reduction of emissions by at least 3/4 in 2021-2035. Having said that, these goals can be achieved while maintaining the level of capital mobilisation and investor involvement already achieved in 2019.

**Figure 23.** Average annual expenditure on investments in renewable energy sources by technology – historical data and forecasts until 2035



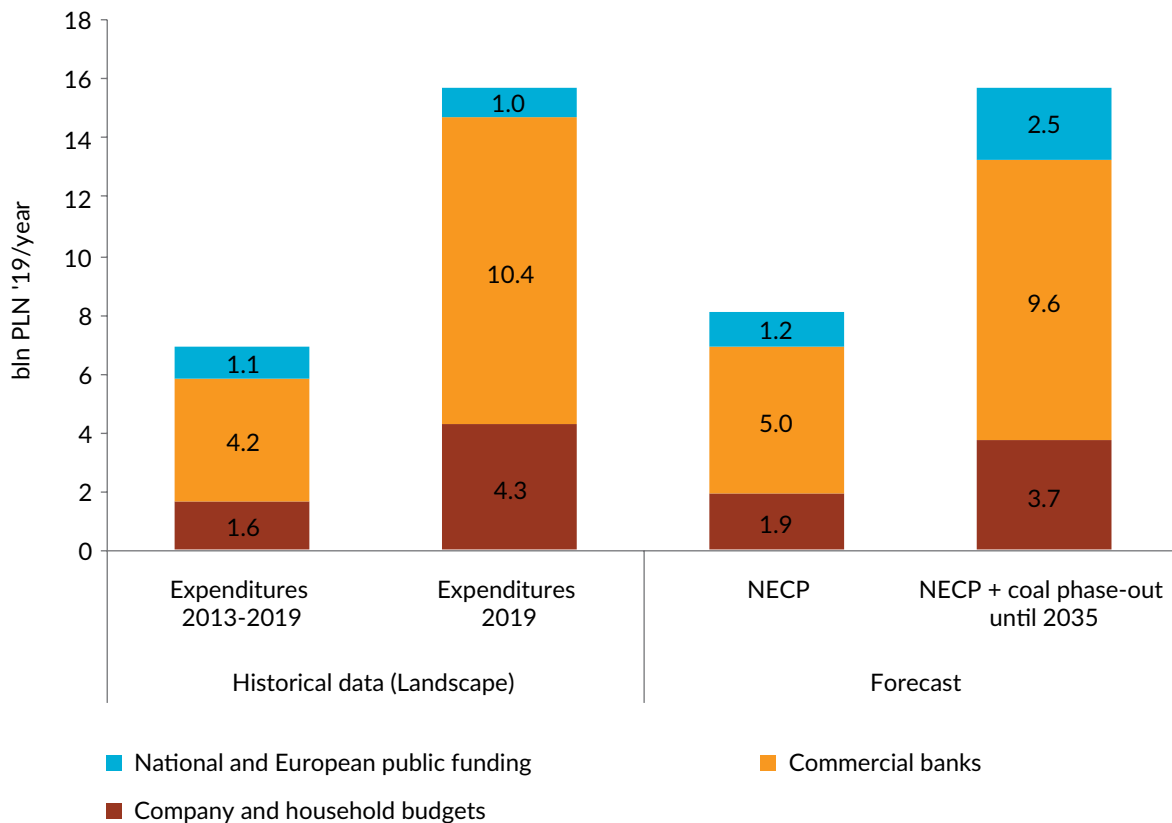
Source: WiseEuropa based on data collected in creating the Landscape, data presented in NECP (MAP 2019), the enervis (2019) analysis and own estimates

The collected data also enabled us to analyse possible financing sources for the future development of RES, in particular in the more capital-demanding scenario of withdrawal from coal by 2035. Assuming the average financing structure for individual technologies from 2013-2019 is maintained, it can be estimated that in this variant the financing that needs to be mobilised in the form of own funds of investors interested in RES (including households and business prosumers)

should be approx. PLN 600 million less on an annual basis than that achieved in 2019 (exceed PLN 4.3 billion). Similarly, we estimate the demand of private investors for commercial credit in the accelerated transformation scenario to be PLN 9.6 billion a year, i.e. approx. 800 million less than today. Therefore, our calculations show that doubling the pace of the energy transformation versus NECP assumptions should not be a major financial challenge from the perspective of households, business prosumers and energy companies (even excluding state-controlled enterprises). The condition is to maintain a favourable regulatory environment for solar PV and lift administrative restrictions for onshore wind farm investments. What is important, seeing the current declarations regarding diversification of the generation structure and involvement in the offshore wind energy sector by state-controlled energy companies, an increase of their, so far marginal, role in financing the energy transformation can be expected in 2021-2035.

Meanwhile, when compared to 2019, we expect to see an increase of approx. PLN 1.5 billion in the average annual demand for public support. This stems from two factors: the increase in bio-energy investments assumed in NECP, which are more dependent on public support, as well as the assumption that interest in prosumer investments is maintained in the public sector, especially at the local government level. If the transformation was to take place on a commercial basis to a similar extent as today, it would have to rely on more intense expansion of wind and solar power, requiring at the same time less public support. The need to increase public funding should not be a real barrier stopping Poland's withdrawal from electricity and heat production in coal power units by 2035. This is due, among other factors, to the fact that Poland's revenues from the sale of emission allowances through the EU ETS system in 2019 amounted to approx. PLN 11 billion and are estimated to reach a similar average annual level (approx. PLN 10 billion) in 2020-2030. Simultaneously, in this period Polish investors will be able to use the Modernisation Fund for 2021-2030, amounting to approx. PLN 1.5 billion per year, as well as funds allocated under the Recovery Plan for Europe for the development of Poland's low-carbon economy, which can be estimated at approx. PLN 75 billion (assuming that 25% from the total pool of EUR 68.5 billion in returnable and non-returnable funds allocated to Poland, will be, as required by the EC, directed at activities related to climate protection). Together with the allocation previously planned for Poland under the EU Multiannual Financial Framework, the EU funds designated for the low-emission transformation of the national economy will total over PLN 20 billion annually in the 2021-2027 period. Therefore, the overall pool of public funds (both national and EU) for possible financing of low-carbon investments in the 2020s will exceed PLN 30 billion a year, a figure over ten times greater than the estimated direct support needs for power sector investments. This means it will also be possible to direct public funds to other sectors – in particular heating buildings and transport – without delaying the necessary changes in electricity, and even supporting them by accelerating the electrification of the economy and increasing demand for carbon-neutral electricity.

**Figure 24.** Average annual expenditure on investments in renewable energy sources by financing source – historical data and forecasts until 2035



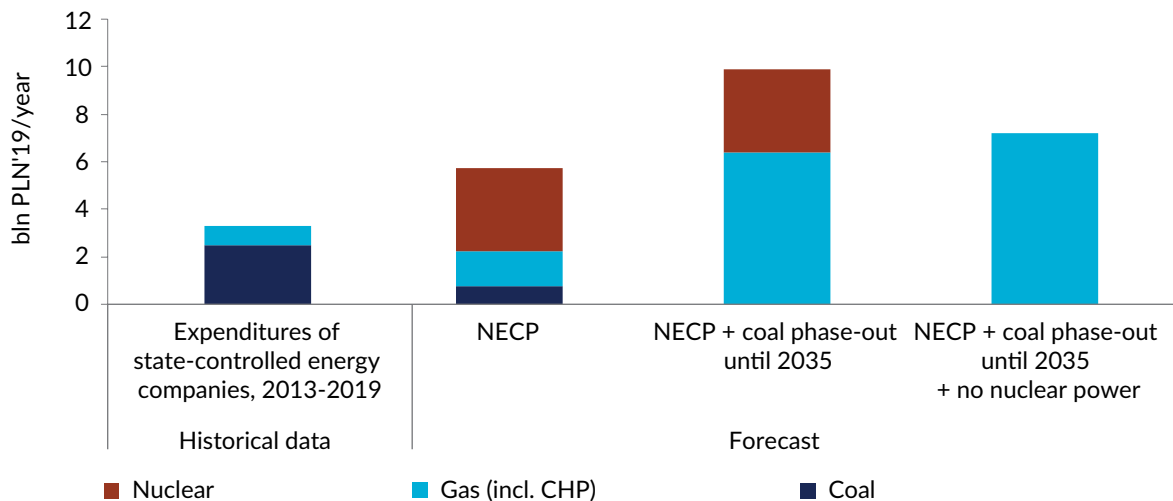
Source: WiseEuropa based on data collected in creating the Landscape, data presented in NECP (MAP 2019), the enervis (2019) analysis and own estimates

The PLN 2.5 billion per year shown in Figure 24 is the maximum estimate of the necessary public involvement in the power sector's low-carbon transformation by 2035. This stems from the fact that new support instruments (e.g. the FIT-FIP system) may accelerate the appearance of RES facilities (in particular biomass, biogas plants, small hydro power plants) benefitting from direct investment support from national or European funds. Similarly, the increased prevalence of the ESCO formula (financing of the necessary investment outlays by the energy company at the energy consumer's location in exchange for distribution of the energy service charges over time), not only related to improving energy efficiency, but also RES installations, may reduce the need for capital involvement on the part of prosumers, including those from the public sector.

From the financial sector's perspective, the accelerated transformation scenario of the Polish energy sector by 2035 will generate constant financing demand of approx. PLN 10 billion per year, while the more conservative perspective on changes presented in the NECP will lead to demand for loans of approx. PLN 5 billion per year. However, the reconstruction of the Polish energy sector will not only include renewable energy sources. Regardless of the transformation scenario, capital expenditure on conventional power plants will increase significantly. The structure and level of necessary outlays will be determined by two key elements of the national energy policy: the adopted pace of withdrawal of coal power plants from the power system and the decision regarding the development of nuclear energy in the 2030s. A summary of necessary investment

expenditure in various transformation scenarios shows that assuring financing for sources that supplement RES generation may prove to be a major challenge for state-controlled energy companies, which have until now been a key investor in this market segment. Investments foreseen in the NECP will require approximately 3/4 higher annual expenditure on conventional power plants than that on investments started by state-controlled energy companies in the 2013-2019 period (this amount does not include the Ostrołęka C coal block, for which funding was ultimately not secured). Expedited withdrawal of coal power from the system combined with the cancellation of the nuclear power plant investment will translate into approx. PLN 1.4 billion of additional investments in conventional power plants versus the NECP. The most capital-intensive option would be to combine the implementation of the nuclear programme with the withdrawal from coal energy: this will require three times higher average investment expenditure than what was actually implemented by large energy companies in 2013-2019.

**Figure 25. Average annual expenditure on investments in conventional energy sources – historical data and forecasts until 2035**

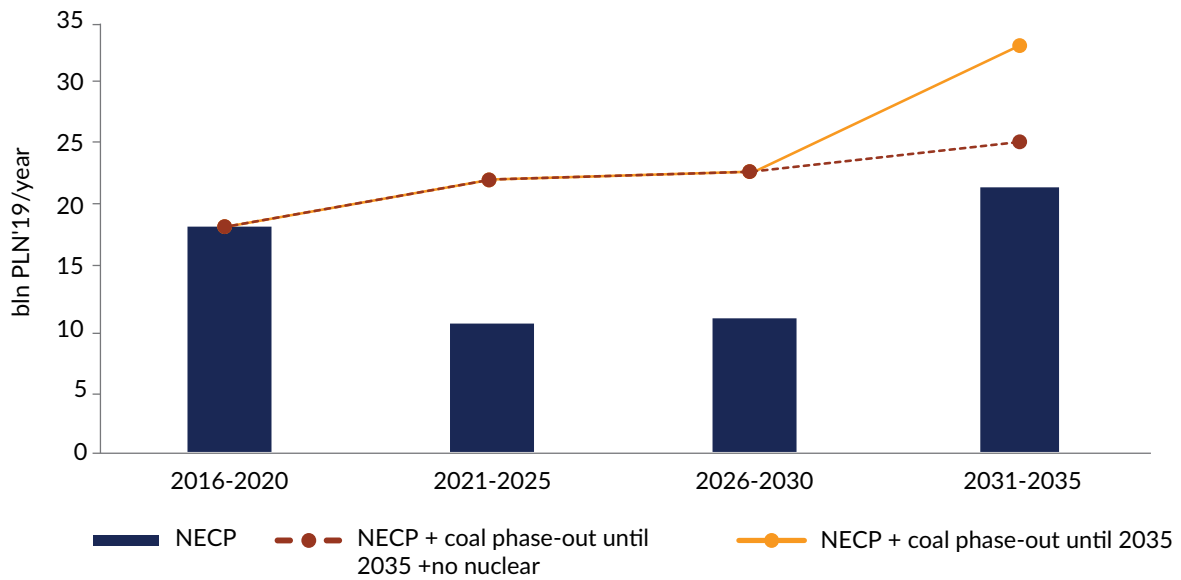


Source: WiseEuropa based on data collected in creating the Landscape, data presented in NECP (MAP 2019), the enervis (2019) analysis and own estimates

Similar to renewable energy, the energy transformation will require a wider group of investors than before to be included in the conventional segment as well, e.g. ones ready to invest in distributed gas co-generation or to co-finance the Polish nuclear energy development programme. Given the uncertainty inherent in both the long-term prospects of gas assets (the need to convert to climate neutral solutions by 2050) and the project-specific risk of nuclear power, ensuring funding for capacity complementing renewable energy sources in the system may prove to be a greater challenge than financing a rapid increase of RES' share, which can probably be fully assured by investors. Reduction of sunk cost risk, especially for gas infrastructure, will play an important role. This entails an urgent need to combine medium-term investment plans with long-term scenarios for the creation of a fully climate-neutral Polish energy system. This will make it possible to determine the likely role of zero-emission gas (power-to-gas technologies, biomethane, hydrogen) and nuclear power. Involvement of private investors, together with state-controlled companies, in this segment of the energy market will be the key to risk diversification. From the financial sector's perspective, determining the uncertainty associated with investments in conventional energy will be crucial. The

EU's sustainable financing taxonomy and TCFD's recommendations on climate risk management (cf. Bukowski et al. 2018) will serve as an important reference point in this regard. Decisions falling within this scope must be made carefully and in line with the long-term decarbonization strategy in order to protect investors and the financial sector from unnecessary sunk costs.

**Figure 26.** Average annual expenditure on investments in generation capacity in the energy sector – historical data and forecasts until 2035



Source: WiseEuropa based on data collected when preparing the Landscape, data presented in NECP (MAP 2019), the enervis (2019) analysis and own estimates

The last subject worth raising in this context is the issue of whether implementing the primary NECP scenario, which does not assume withdrawal from coal in the energy sector by 2035, is valid. From the perspective of total capital expenditure on electricity generation, the NECP scenario entails a significant decline in investments in the sector in the early 2020s. The crisis caused by the COVID-19 pandemic, combined with the EU and national stimulus packages launched in response, require the validity of this scenario to be revisited. Estimates presented in this analysis show that the scenario of the Polish energy sector's accelerated reconstruction, in particular, maintaining the high pace of RES project launches achieved in 2018-2019, will mean that the already emerging investment gap in this decade can be avoided. Mobilising appropriate financial flows will be fully in line with the long-term needs and potential of the Polish economy, limiting its exposure to further increases in GHG emission costs and making it possible to implement generation technologies whose costs are quickly falling. Importantly, maintaining high capital expenditure in the energy sector in the 2020s will make it possible to avoid the leap in financial needs at later times, when cheap public funds, such as those foreseen in the post-COVID19 Recovery Plan for Poland, are not available.

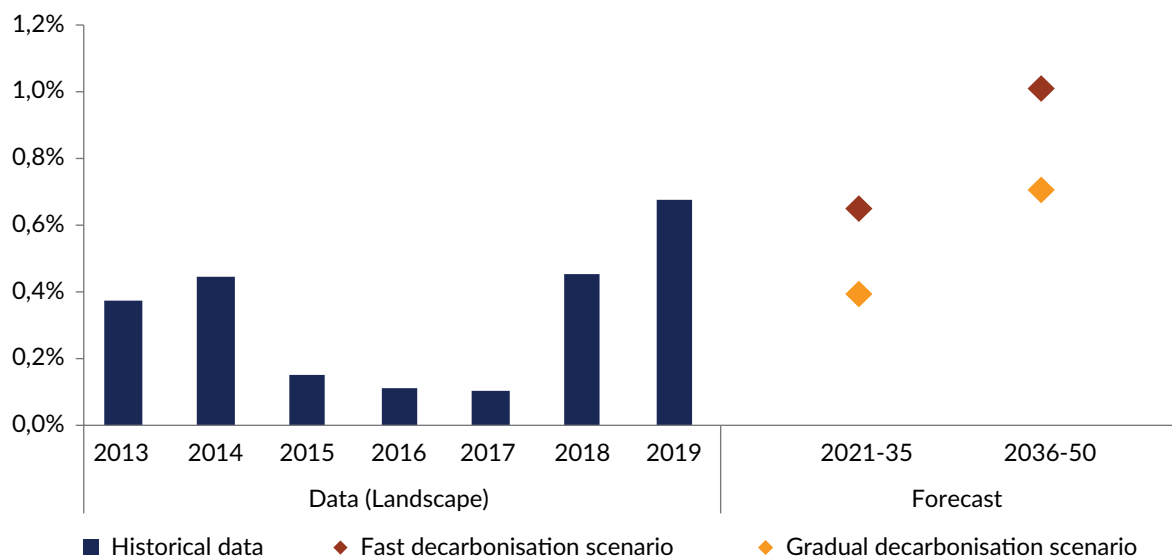
## 4.2 Long-term perspective: investment needs up to 2050

We have considered the estimated scale of long-term investment needs in the power sector based on two transformation scenarios up to 2050, differing in the emission reduction levels and capital intensity:

- Gradual decarbonization scenario** – implements the assumptions of the NECP until 2035. In 2035-2050, it assumes a focus on improving energy efficiency and further development of renewable sources, with moderate electrification of the economy and no large-scale use of power-to-X technology. This scenario allows emissions of the entire Polish economy to be reduced by 80-85% when compared to 1990, with a target electrical power demand of 350 TWh.
- Rapid decarbonization scenario** –provides for additional investments in RES and gas sources allowing for the withdrawal of coal energy, while simultaneously developing nuclear energy (cf. chapter 4.1), until 2035. In the 2035-2050 period this scenario assumes rapid electrification of the economy and development of power-to-X technologies that will allow natural gas and crude oil to be removed from the primary energy mix not only in the energy sector, but in the economy as a whole. This scenario includes large-scale investments in all zero-emission energy sector technologies (RES, nuclear power, CCS/CCU) allowing over 500 TWh of electrical power to be produced and net emissions of the entire economy to be reduced by more than 95%.

It needs to be emphasised that the scenarios considered are not the recommended paths for the Polish energy sector’s transformation, but they serve to determine a wide range of potential investment needs of the sector by 2050.

**Figure 27.** Average annual expenditure on investments in zero-emission power capacity in the energy sector as a % of GDP – historical data and forecasts until 2050



Source: WiseEuropa based on data collected in creating the Landscape, data presented in NECP (MAP 2019), the enervis (2019) analysis and own estimates





A comparison of long-term investment needs with data from the Landscape indicates that the financing of both decarbonization scenarios is completely within Poland's current financial capabilities. Since it can be assumed that the GDP of Poland will, within the same time, double in the 2020-2050 period, the real cost of financing the transformation will be even lower. In the gradual decarbonization variant one could even expect a temporary decline in the investment-to-GDP ratio and a capital mobilisation comparable to the current one after 2035. Meanwhile, the rapid decarbonization scenario means that it is enough to maintain the current level of RES financing until 2035 and increase financial flows by approx. 0.3% GDP in 2035-2050. Using far-reaching electrification and achieving complete climate neutrality by mid-century is therefore not a difficult task to finance. For comparison, zero-emission energy investment projects grew by 0.6% of GDP in 2017-2019, proving that a quick mobilisation of funds for the transformation is possible in a situation when a favourable regulatory framework appears and new groups of investors become active on the market (households, prosumers, private energy companies). Given that the quick decarbonization scenario assumes a sizeable increase in electric power demand in Poland and a gradual displacement of natural gas and petroleum-based fuels from the market, achieving a 1% GDP figure of total investments in zero-emission generation capacity, taking into account diversion of financial flows from the fuel industry, should not be a problem for banks. Such a fundamental system change will, however, be a challenge for enterprises that base their business models on oil and natural gas. This applies to state-controlled companies in particular. They should already be preparing to reconstruct their business model in response to the upcoming changes in generation structure and the use of energy carriers in the economy, including investments in RES generation.

Banks and public institutions involved in financing investment projects based on fossil fuels other than coal should also assess the risk brought by the transformation into a climate neutral economy on an ongoing basis. An important guideline for the financial sector and investors would be a zero-emission strategy prepared by the state containing a critical reflection on how the zero-emission energy system in Poland will be finalised in the long term and what role individual technologies complementing renewable energy will play. It is necessary to reduce the risk of sunk capital and focus on intelligent development of energy infrastructure (including grid infrastructure), so that it is adapted to function within the confines of a zero-emission economy. This will require the potential to improve energy efficiency, synergies between various zero-emission technologies, cross-border cooperation, as well as cooperation between the public sector, private investors and the financial market to be used to the fullest extent.

## 5. Summary and recommendations

In this publication, we have compiled available data on financing low-carbon investments in order to better understand the processes occurring in the Polish energy sector in recent years and to properly define future challenges and opportunities for decision-makers, the private sector and financial institutions. The 2013-2019 period was one of instability in the renewable energy sector, which remains the only zero-emission segment of the Polish energy system. Previous years' experience shows that the key factor affecting the sector's condition is the market organisation defined by the state (including support systems financed from the accounts of energy consumers) and not direct financing of energy projects from public funds. It was the lack of a RES system operational framework and administrative restrictions that led to the collapse of investments in renewable sources in 2015-2017, while the launch of auctions for large facilities combined with the relaxation of criteria for participating institutions (wind projects prepared before 2017) and the introduction of additional preferential terms (including tax) for prosumers that allowed for a surge in investment projects in 2018-2019. Importantly, thanks to the falling costs of renewable technologies, support systems are increasingly less a transfer of funds from consumers to energy producers, but more and more often a mechanism for purchasing cheap electricity.

The coming years may bring about a rapid development of renewable energy in Poland, supplemented by the expansion of conventional gas capacity, and, in a long-term perspective, zero-emission technologies stabilising the energy grid, such as power-to-X, nuclear power or CCS/CCU. However, this requires a review of the national energy policy's assumptions towards accelerating the transformation and withdrawal of coal from the system by about 2035. The alternative is another collapse of investment projects in the sector, coinciding with the negative economic effects of the pandemic and the rapidly growing cost of maintaining a high share of coal power in an environment where emission allowance prices rise and reduction targets become more stringent. In conditions where bank financing is cheap, funds earmarked for Poland in the Recovery Plan for Europe are easily available and the cost competitiveness of wind and solar energy continues to grow, choosing to slow down the pace of transformation of the energy sector, as implied in the NECP, is a suboptimal solution.

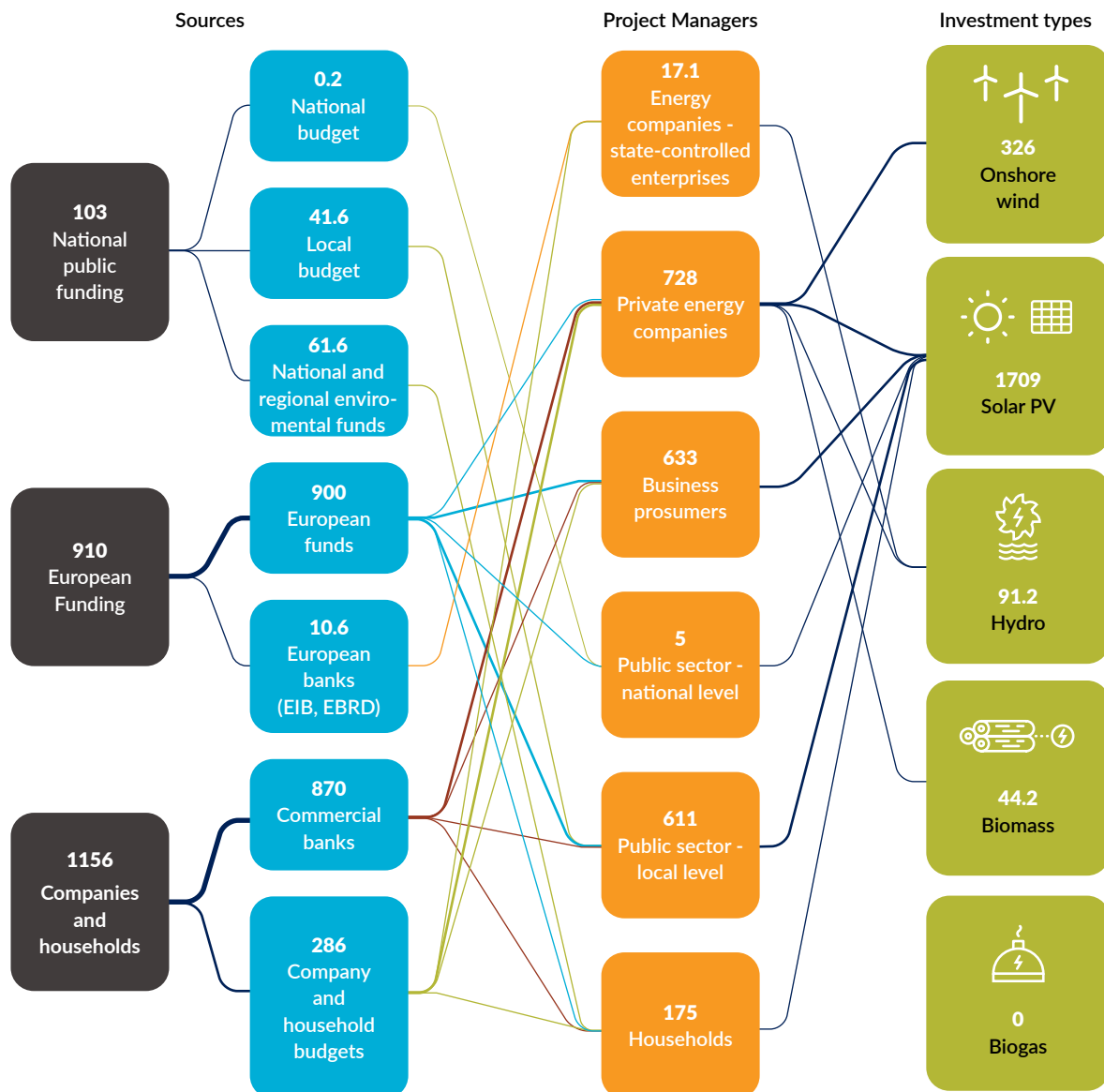
**Recommendations for decision-makers:**

- **Change in the strategic approach to the low-carbon transformation of the energy sector**, including:
  - abandoning the false belief that direct financing of investments from public funds, primarily based on state-controlled companies, is necessary;
  - defining the role of the state as a regulator that creates favourable conditions for investors and for the mobilisation of private funds;
  - committing direct support only to areas where it is actually necessary (e.g. local government investment projects, bioenergy, small hydro power).
- **Adoption of a double stimulus package for the energy sector** in response to the crisis:
  - **Regulatory stimulation** – unblocking investments in onshore wind farms and accelerating investment projects in PV through the auction system and further support for prosumers, ensuring a competitive regulatory and infrastructural environment for offshore wind energy.
  - **Fiscal stimulation** – direct support for investment projects in line with the framework of the Recovery Plan for Europe, which focuses on complementary technologies (biogas plants, biomass CHP plant, small hydro power plants) and prosumer investments by local governments.
- **Urgent clarification of the long-term vision for the energy transformation by 2050**, with a definition of the role of nuclear and gas energy, as well as energy storage (power-to-X, including hydrogen electrolysis) in the Polish energy mix, in a manner aligned with the EU's reduction targets for 2030, which assume a decrease in emissions of at least 50% versus 1990.
- **Involvement of all investor groups** in the Polish energy sector transformation, with particular emphasis on the state's acceptance of the dominant role of private investors in this process and the need to define the right role for state-controlled companies, one considering the need to diversify their activities outside the gas and fuel sector.
- **Strengthening and organising the dialogue between the public sector, private investors and financial institutions** within the scope of financing low-carbon investment projects and limiting the risk of capital being wasted on projects that deviate from the requirements of a climate neutral economy.

# Appendix A: RES boom in 2017-2019

Diagram 3. Landscape of climate finance in the Polish energy sector, 2017

Landscape of climate finance in Poland, renewable energy sector  
(amounts in million PLN, 2019)



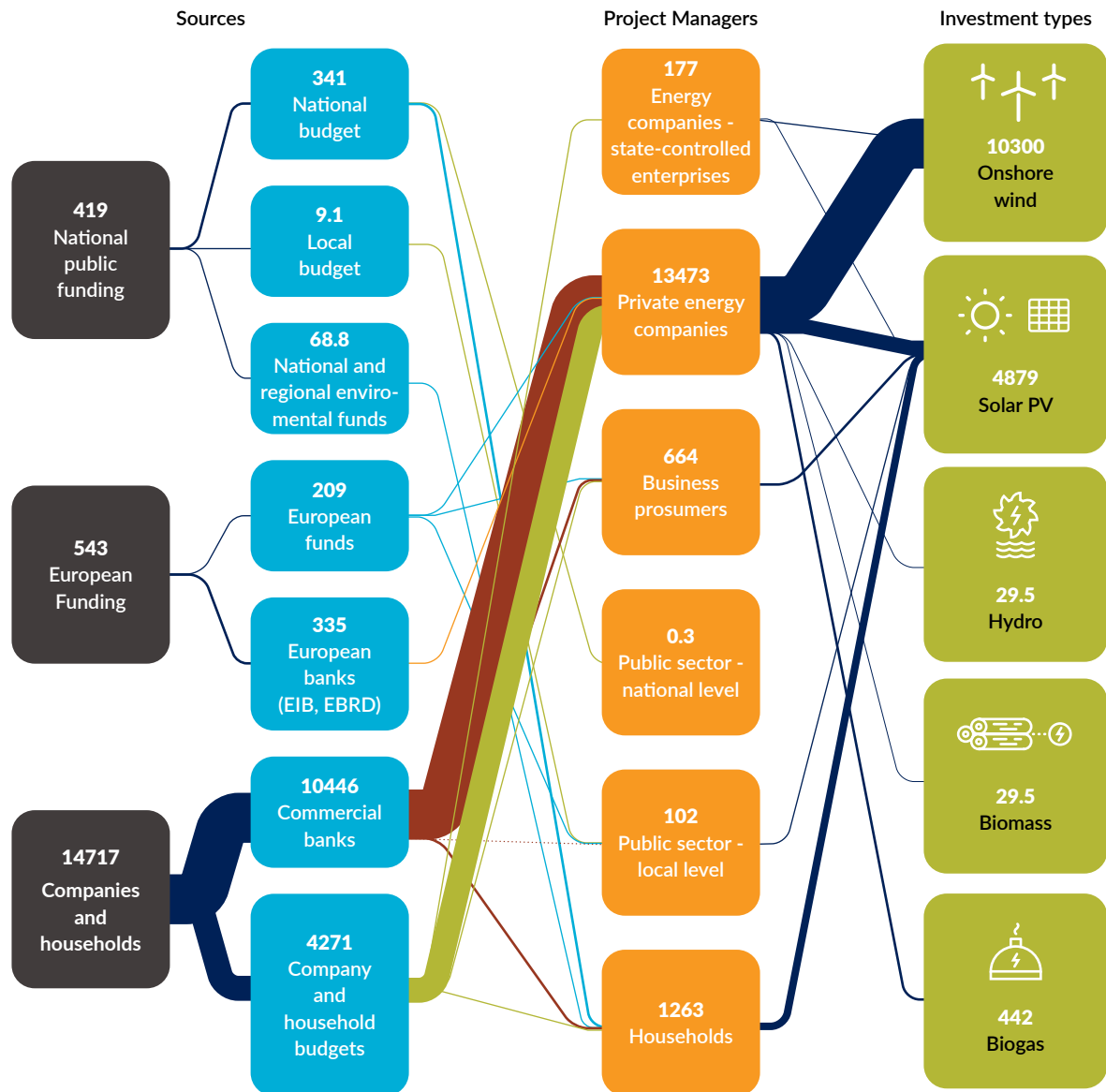
**Financial instruments:**

- Grants and investment subsidies
- Concessional loans
- Commercial loans
- Equity

Source: WiseEuropa

Diagram 4. Landscape of climate finance in the Polish energy sector, 2019

Landscape of climate finance in Poland, renewable energy sector  
(amounts in million PLN, 2019)



Financial instruments:

- Grants and investment subsidies
- Concessional loans
- Commercial loans
- Equity

Source: WiseEuropa

# Appendix B: Landscape of domestic climate finance

**I4CE: sharing a methodology to produce an improved knowledge base and policy assessments tools for shifting investments**

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I4CE – Institute for Climate Economics is a Paris-based think tank with expertise in economics and finance with the mission to support action against climate change. Through its applied research, the Institute contributes to the debate on climate-related policies. It also publishes research to support financial institutions, businesses and territories in the fight against climate change and that assists with the incorporation of climate issues into their activities and operations. I4CE is a registered non-profit organisation, founded by the French National Promotional Bank Caisse des Dépôts and the French Development Agency.

## **Improving knowledge on climate finance & investment for better policy**

Achieving the objectives laid out in the Paris Agreement to keep the increase in global mean temperature “well below 2°C” will require significant changes in how our societies and economies function. The transition to a low-carbon, resilient economic model implies significant investments in buildings, transport systems, vehicles, power plants and many other parts of the infrastructure that supports the economy – and our daily lives. In turn, the transition will also require changes in investments with climate-adverse effects (fossil fuels or energy intensive technologies) that must be reduced, and funds redirected to finance what we truly need for our future.

Shifting and scaling-up financial flows to meet national climate and energy objectives requires an improved knowledge base, as well as policy and project assessment tools for shifting domestic investment patterns and to engage financial and economic actors.

“Landscapes of domestic climate finance and investment” are comprehensive studies mapping financial flows dedicated to climate change action and the energy transition. Covering both end-investment and supporting financial flows from public and private stakeholders, Landscapes capture how the financial value chain links sources, intermediaries, project managers and end-investment. The resulting systematic tracking of domestic climate investment and related financing flows is a powerful process for supporting national climate and energy policy.

- First, highlighting the gap between current policies and climate objectives can help generate awareness and engagement with national stakeholders.
- Second, aggregating indicators from different sectors into a single, coherent view serves as a reference point to track where the transition stands year after year.



- Finally, sectoral analysis of the economic conditions in which low-carbon projects can thrive improves the understanding of investment policy successes and setbacks.

Today, there is an opportunity to improve domestic tracking of climate finance in Europe and the world. Landscapes have been recognized as an important part of understanding the impacts of the broader 'greening' of the financial system on the real economy at the European and International level. While a number of countries to date have produced domestic landscapes, knowledge on domestic climate-related end investment, financial flows supporting this investment by public and private actors remains limited across the European Union and beyond.

Since 2018, I4CE has been working with WiseEuropa to explore how our methodological approach can be adapted to support policy discussions in Poland. Moving forward, we hope to work with other partners in countries around the world to help them better understand what we have done – and to support to produce this kind. We invite all interested parties to get in contact us and look forward to working with you to achieve our shared climate objectives.

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## Energy, Climate and Environment Programme

Poland, Europe and the world are currently facing unprecedented challenges associated with the environment and resources. Avoiding dangerous climate change, improving public health and increasing resource security requires a profound economic transition. Taking advantage of opportunities and avoiding the associated developmental traps requires in-depth evaluation of the short- and long-term impacts of environmental protection and natural resource management policies. Under the Energy, Climate and Environment Programme, we prepare comprehensive sectoral and macroeconomic analyses, focusing on the broadly defined low-emission economic transition in Poland and globally. We are active in areas such as: Polish and EU energy and climate policy, domestic resource policy, improving resource efficiency in the economy, protection of the environment and public health by limiting harmful emissions, sustainable transport policy. This paper is a part of the Energy and Climate Project.



ENERGY, CLIMATE AND ENVIRONMENT

Other publications:

"Domestic Landscape of Climate Finance . Why systemic approach to climate finance matters?",  
Bukowski M., Wetmańska Z., Śniegocki A., Röser F., Fekete H., Emmrich J., Cochran I., Hainaut H.

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