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Actions and challenges for climate protection in Poland – brief overview

1988 – 2018 – 2050

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1988 – 2018 – 2050

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Introduction

The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992, is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, within a sufficient time frame. The Climate Convention assumes international cooperation in combating climate change, in particular reduction of greenhouse gas emissions responsible for the global warming. This cooperation is supposed to rely on the principle of common but differentiated responsibility.

The adoption of the Convention created a formal platform for international cooperation on combating climate change and contributed to the development of further agreements in this area. The agreement requires the parties to cooperate on reduction of greenhouse gas emissions, adaptation to climate changes, scientific research and regular climate monitoring, dissemination of technologies, practices and processes reducing anthropogenic greenhouse gas emissions, reporting on emissions of these gases and providing financial assistance to developing countries in this area. The Convention has been ratified by 196 countries. The first agreement that extended and specified the provisions of the Convention is the Kyoto Protocol adopted in December 1997. By signing the Kyoto Protocol on 15 July 1998, Poland committed to reduce greenhouse gas emissions by 6% in 2008-2012 compared to the level of emissions in 1988. This goal was achieved with a surplus, since domestic reductions in GHG emissions were estimated in 2008-2012 at approx. 30% compared to the base year.

In May 2004, Poland became a member of the European Union. Since then, together with other Member States and the European Commission, Poland has been contributing to the EU's climate and energy policies and has been engaged in negotiations carried out by all Member States in the Climate Convention. In 2011 Poland took the Presidency of the EU Council and was responsible for developing a common EU position. This also referred to climate negotiations and COP18 in Doha, held at that time, where e.g. Amendment to the Kyoto Protocol, the so-called Doha Amendment was adopted, ratified by Poland in 2018. In December 2015, during COP in Paris, the Paris Agreement was adopted, being the next stage in the climate policy following the Kyoto Protocol, engaging all parties to the Convention to protect the climate, ratified by Poland a year later. On 28 September 2018, Poland submitted the Instrument for Ratification of amendment to the Doha Amendment to the United Nations General Secretariat in New York.

COP24 in Katowice will be the third Conference of the Parties held in Poland. So far, Poland has hosted the Conference of the Parties to the UNFCCC twice: COP14 took place in Poznań in 2008, while COP19 took place in Warsaw in 2013. It should be noted that in 1999, during COP5 in Bonn, prof. Jan Szyszko acting at that time as the Government Plenipotentiary for Climate Convention was elected as the President. This means that Michał Kurtyka, the current Secretary of State at the Ministry of the Environment and the Plenipotentiary for the Presidency of COP24, takes the function of the President of the COP in December this year as the fourth Pole in history. Earlier this function on behalf of Poland was heldby prof. Jan Szyszko – President of COP5 (in 1999-2000), prof. Maciej Nowicki – President of COP14 / CMP4 (in 2008-2009) and Mr. Marcin Korolec – President of COP19 / CMP9 (in 2013-2014).

The results of the 14th Conference of the Parties to the Climate Convention (COP14), which was held in Poznań in 2008, included:

- establishing the Adaptation Fund, created to provide financing for adaptation projects and programs in developing countries vulnerable to negative impacts of climate change;
- adoption of the Poznań Strategic Program on Technology, aimed at helping in fast and efficient transfer of climate-friendly technologies; and
- launching the GreenEvo program: Green Technology Accelerator, prepared for the promotion of Polish environmental technologies and support for the development of enterprises in the field of environmental protection.

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Among the achievements of the Conference of the Parties to the Climate Convention (COP19), which took place in Warsaw in 2013, the following should be listed:

- establishing the Warsaw International Mechanism on Loss and Damage whose task is to finance adaptation activities as well as those related to the effects of violent climatic events in developing countries. The Warsaw Mechanism is a special achievement of the Warsaw Summit, since the most vulnerable countries had tried to create it since the very signing of the Convention, i.e. for over 20 years;
- the Warsaw Framework of REDD + – a system designed to protect tropical forests – was defined. The REDD + mechanism refers to the problem of deforestation and forest degradation;
- solid grounds were laid for a new climate agreement that was supposed to be reached in 2015 in Paris;
- thanks to the efforts of the Polish presidency, it was possible to mobilize the states-parties to declare a total payment of over USD 100m to the Adaptation Fund;
- a decision regarding the financing of the Green Climate Fund was made – it was determined e.g. that in order to combat climate change in developing countries, the developed countries will spend at least USD 10bn on a yearly basis to further mobilize resources from private sources.

In May 2004, Poland became a member of the European Union. Since then, together with other Member States and the European Commission, Poland has been contributing to the EU's climate and energy policies and has been engaged in negotiations carried out by all Member States in the Climate Convention.

Economic transformation of Poland

in the framework of greenhouse gas emissions

In 1989, Poland abandoned a centrally planned economic system and launched its transformation towards a market economy. The year is considered to be the beginning of political and economic transformation in the country. However, before the system and structure of the economy changed, one of the first results of this breakthrough was an initial decline in production. The 1990 – a year adopted as the base year in the Kyoto Protocol – was the first year after major changes in Poland, which was clearly reflected in an economic sustainability gap. It was in 1990 that the Polish economy saw a temporary breakdown. Therefore, the volume of greenhouse gas emissions in 1990 did not correspond to the normal emission level, adequate to the development needs of our country or the economic potential of Poland at that time. This year as a base year would not be reliable for the Polish economy. This aspect was considered during the negotiations of the Kyoto Protocol and, consequently, 1988 became Poland's reference year for the estimated emission reduction under this agreement.

In 1988, Poland had a centrally planned economy, and at the same time experienced a social and political conflict. One of negative effects of this situation was high inflation (62.2%) and additionally the so-called hidden inflation, caused, e.g. by rationing of food products. On the other hand, unemployment was at a minimum level (less than 1%). At that time, Poland definitely deviated from the welfare level of other European countries, which is seen e.g. in an almost three-fold difference in GDP in the per capita purchasing power parity. A prevailing part of family expenses was spent on food and fixed housing payments, which contributed from over 45% to almost 64% of total household expenditures.

The GDP energy intensity in 1988 amounted to 23.6 kJ/USD'94 ppp. The basic factors responsible for this value included e.g.: low efficiency of the economy in the past, low share of crude oil and natural gas in the primary energy structure; low share of highly-productive carriers, i.e. electricity, liquid and gas fuels in the final energy structure, and low per capita electricity consumption. The share of energy consumption in 1988 accounted for 42% in industry, 1.5% in construction, 2% in agriculture, 5% in transport and 1% in household and welfare economy, with the remaining part allocated to other sectors. The per capita energy consumption in 1988 stood at 14.04 GJ. The balance of energy demand and supply in Poland was largely based on fossil fuels – coal representing 76.5%, crude oil 14.3%, and gas 7.8%. The share of renewable energy sources in the domestic structure of primary energy consumption was below 1%.

The industry had the largest share in the GDP structure, reaching the level of 49% in 1988. At that time the industry was marked primarily by the prevalence of processing of energy- and resource-intensive primary raw materials. In the same year, buildings sector accounted for 12% of the GDP, and so was agriculture (total agricultural production had been stable since 1983). The debts of Poland in 1988 amounted to USD 30bn.

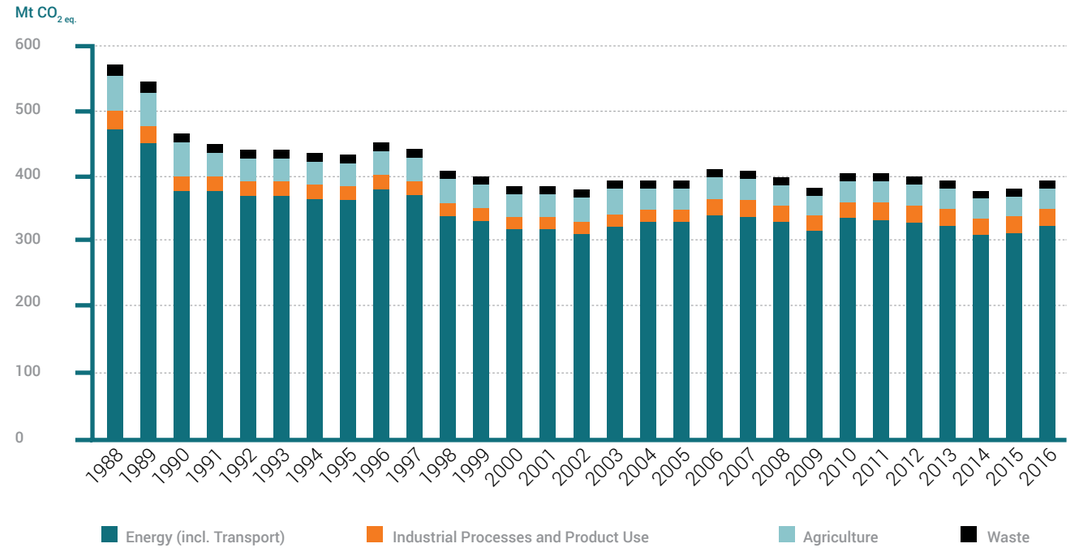
Regardless of the effects of central economic control, Poland with its economic indicators was included in Annex I to the United Nations Framework Convention on Climate Change. Therefore, the Convention ratification imposed on Poland the same obligations as for other countries listed in the annex. The most important of these was the restore prior levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol (Article 4(2)(a) of the Convention) by the end of the current decade. For this group of countries, this meant a return to the emission level reported in 1990. For Poland, however, this meant stabilization of emissions in 2000 at the level seen in 1988.

In the post-1989 period, Poland made significant progress in terms of energy efficiency and environmental quality, one of the largest in Europe. This was primarily owing to the energy and industry sectors, where both industry indicators improved and favourable structural changes took place. Most of the changes and improvements resulted from the economy restructuring and upgrading of plants, which led to improved energy efficiency. For many years, a reduced use of hard coal and lignite as energy sources and a growth of consumption of oil-derived fuels has been observed, while the share of energy from renewable energy sources in final gross energy consumption has been systematically growing and in 2016 exceeded 11%. All these activities resulted in meeting by Poland its reduction target set out in the Kyoto Protocol with a large surplus. The decrease in greenhouse gas emissions between 1988 and 2016 is shown in Fig. 1.

Poland's accession to the European Union was another important milestone from the country perspective, not only from a political, but also economic and environmental point of view. Opening up to the Union allowed Poland to take advantage of the opportunities offered by the EU common market and free movement of goods, people, capital and services. From the environmental perspective, it was extremely important to adapt the Polish law and imposed obligations to the requirements of EU environmental policies. On the one hand, some activities at the EU level were very strict from the Polish economy point of view and by way of negotiations it was possible to introduce temporary derogations, also regarding emissions, e.g. derogations for low emissions, derogations on the energy and climate package. On the other hand, the fact that European integration also opened new sources of financing for investments aimed at improving Poland's environmental condition was very positive.

The assessment of Poland's current achievements in the climate policy must take into account the context of political and economic transformation, as well as the associated challenges, social costs and burden of the centrally planned economy before 1989. In the light of such important and demanding challenges, it would be perfectly reasonable to shift additional effort in the area of environmental and climate policies to a later date (which would resemble the path followed by developed countries). This did not happen. From the very beginning of the transformation, Poland appreciated the importance of environmental quality and significance of global warming threats. A national environmental policy relying on sustainable development principles was developed and adopted as early as in 1991, being one of the most advanced and preceding the adoption of the Community's Fifth Environmental Action Program promoting the same principles in 1992. Information on the environmental quality and undertaking urgent actions to eliminate threats, despite many other economic and social challenges, has always been one of the priorities of the national policies. The same was true for Poland's involvement at the international level, including participation in the elaboration and rapid ratification of the United Nations Framework Convention on Climate Change, and later the Kyoto Protocol.

Fig. 1. Greenhouse gas emissions in Poland in 1988-2016



Source: KOBiZE

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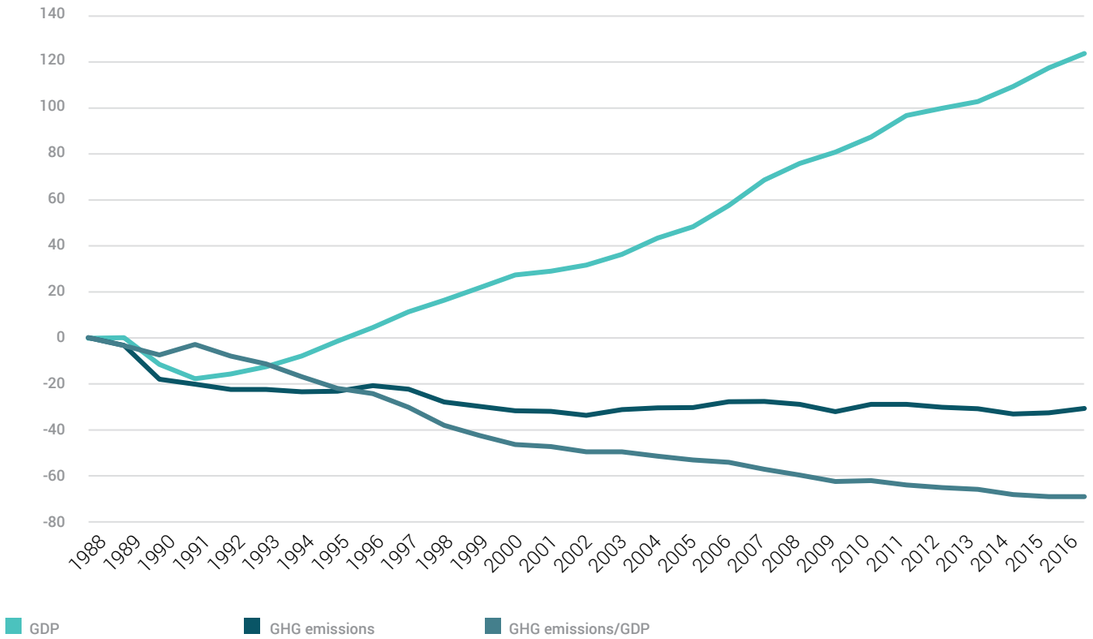
As a result, in the period of political and economic transformation, Poland managed to achieve high indicators of improved environmental quality, reducing greenhouse gas emissions, reducing energy intensity of the economy, significantly affected by the energy and industry sectors. Importantly, these achievements were made along with effective reconstruction of the economy, improvement of social indicators and impressive efforts to adapt the country to EU requirements before the accession in 2004. Among many indicators, it is worth reminding that between 1988 and 2016, the GDP more than doubled in Poland, while greenhouse gas emissions decreased by over 30% – in other words, the emission intensity of GDP went down by more than 60%. The phenomenon of separation of the two processes, which could have a similar course from a historical point of view, was called decoupling (Fig. 2).

Fig. 2. Decoupling economic growth from emissions – GDP, greenhouse gas emissions change relative to 1988



Source: KOBiZE based on the World Bank

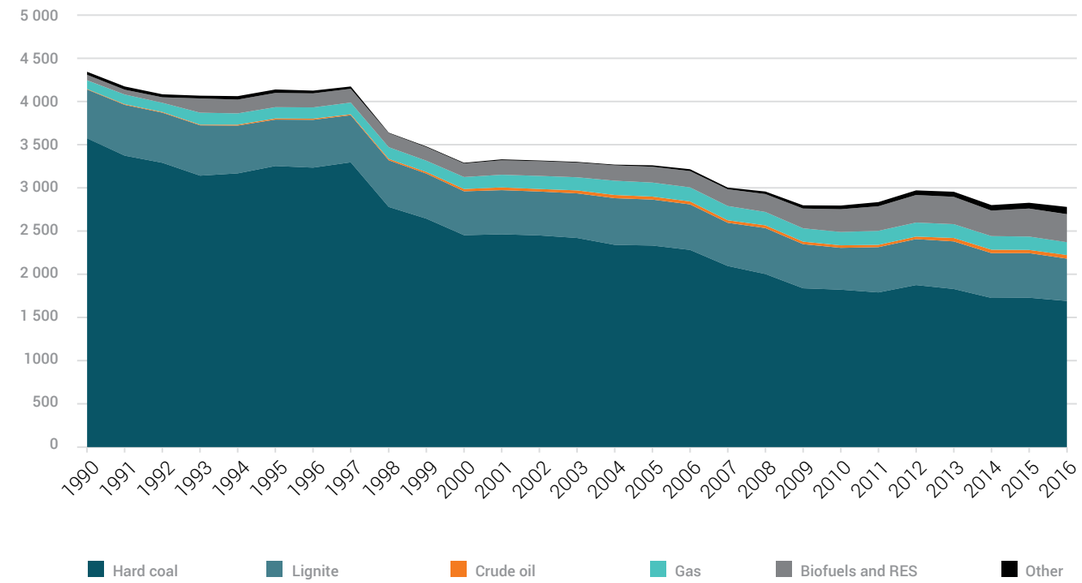
When assessing the above achievements from a time perspective, it may be concluded that by taking up the challenge of including environmental and climate policies into priorities of the country's reconstruction, Poland did not only see associated economic and social costs, but also an opportunity – perhaps unique – for significant improvement in this area. Today's indicators of the environmental quality and the impact on global warming prove that the opportunity has been used.

Changes to the energy and industry sector

After 1989, Poland's energy policies focused to a large extent on transformation process of the power sector, consisting in adapting it to the requirements of the reform of the entire Polish economy. Dominated by state ownership, a strongly centralized power sector managed by the command and control system had to be adapted to the new free market economy aimed at creating competitive conditions in the sector and to environmental protection requirements adopted by Poland. The restructuring of the Polish energy sector was primarily based on the allocation of activities to the following three subsectors: distribution, trade and production, based on demonopolization, and privatization as the second stage.

New energy policy objectives were to be implemented by building a competitive energy market, creating strong entities capable of competing with foreign businesses and establishing transparent legal regulations. A vertical consolidation process was launched as a more effective solution, giving the opportunity for better use the economies of scale and synergy at a defined degree of concentration. Consequently, four capital energy groups were established and the Transmission System Operator and Distribution System Operators were separated as independent legal entities. A program for restructuring of long-term contracts was also prepared. The changes observed in the Polish energy sector over the last dozen or so years meet the basic principles of the energy market liberalization. These include: commercialization, privatization, business separation, third party access, competition and supervision of an independent regulator. In the free market conditions, as a result of the operating costs optimization, with the costs associated with new, increasingly stringent environmental regulations being also a significant component, the technology of energy generation has been gradually changing. For the last thirty years, the structure of obtaining primary energy for the whole economy

Fig. 3. Structure of primary energy production in Poland in 1990-2016 [PJ]



Source: KOBiZE based on EUROSTAT

has changed. Primary energy grew from 4,344 PJ in 1990 to 2,781 PJ in 2016. The share of coal in the structure of primary energy production dropped from over 95% in 1990 to 78% in 2016, while lignite production has remained at a similar level. At the same time, the importance of biofuels and renewable energy sources increased: from around 1.5% in 1990 to 12% in 2016 (Fig. 3). A decline in hard coal mining had a decisive impact on reduction of primary energy production. This is connected, among others, with a decrease in demand and a significant drop in exports of this fuel.

Power energy production increased from 136 TWh in 1990 to 166 TWh in 2016. Coal is a prevailing raw material in the structure of power energy production. Since 1990 the power energy production from coal has been maintained at a similar level between 130 and 140 TWh, but the share of coal in the production structure fell from 96% in 1990 down to 78% in 2016. The share of renewable energy sources and biofuels in power energy production increased from 2.5% in 1990 to 14% in 2016.

Low efficiency was a characteristic feature of enterprises before 1989 – the industry was energy- and material-intensive. The breakthrough and transformation led to a shift in production technology towards more innovative installations. Above all, solutions reducing the energy intensity of production gained importance. The purpose of the changes was also to reduce production costs in the industry sector by applying modern technologies and limiting the importance of heavy industry. Savings were introduced in the raw material economy, while processes of product manufacturing and processing were improved. Enterprises started to switch to gas technologies. Generally, the reduction of emissions in the industry sector was affected by many different factors. The final result was very favourable from the point of view of reducing emissions – a relative reduction of carbon dioxide emissions in the industrial sector amounted to more than 40% of the figure from 1988. A significant improvement was seen in the area of fuel combustion, where emissions were reduced by 48%. The progress was not so large because of limited possibilities of emission reduction within process transformations; however, the relative achieved result of 28% can be considered good.

Emission changes in agriculture, transport and buildings sector

Total greenhouse gas emissions in agriculture amounted to 30.1 Mt CO_2e in 2016 and were lower by 37% against 1988. The reduction of emissions in this period was caused mainly by a significant decrease in the number of livestock, when the cattle population dropped by nearly a half – from over 10m in 1988 to 5.7m in 2002. Since 2002, just before Poland's accession to the European Union (in 2004), the number of dairy cows became stable along with establishment of milk quotas, which normalized the milk market. At the same time, the stock of sheep decreased by approx. 94% (from 4m in 1988 to 0.27m in 2012). Additional reasons for the declining agricultural production in the 1990s included reduction of Polish exports to Eastern markets, worse ratio of price for agricultural products to the price of production resources, as well as increased competitiveness of imported foods from Western Europe.

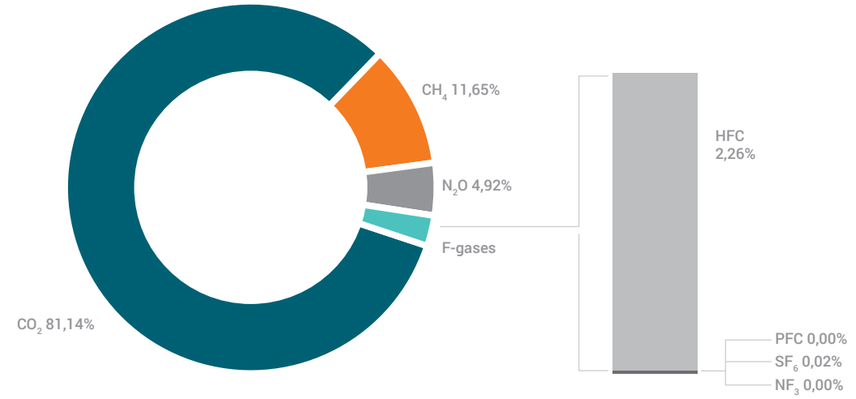
In the transportat sector, greenhouse gas emissions in 1988-2016 increased by 120% along with rapidly increasing number of vehicles and fuel consumption. At the same time, the share of this sector in total greenhouse gas emissions increased from 4% in 1988 to over 13% in 2016. Road transport emissions definitely prevail among means of transport with the share that increased from 86% in 1988 to nearly 98% in 2016.

The prevalent share in greenhouse gas emissions in the buildings sector is represented by households (60 to 68% depending on the year). It is possible to see a decline in the share of service buildings and institutions. Taking into account the trend, the total GHG emissions between 1988 and 2016 decreased by more than 46%, mainly due to the overall reduction in fuel consumption compared to 1988 (approx. 29%) and change to the fuel structure – a decrease in carbon consumption from 67% in 1988 to 40% in 2016 and an increase in natural gas use from 10% in 1988 to 27% in 2016.

Current greenhouse gas emissions in Poland

Emissions of carbon dioxide in Poland (excluding LULUCF) in 2016 were estimated at approx. 321.18 Mt CO_2eq. This is down by 31.8% relative to the base year of the Kyoto Protocol (1988). Carbon dioxide emissions accounted for 81.14% of total greenhouse gas emissions in Poland in 2016 (Fig. 4). The main source of CO_2 emissions is fuel combustion, representing 92.6% of total emissions. Energy industries account for 50.5%, manufacture and construction industries – 8.8%, transport – 16.4%, and other sectors – 16.8%.

Fig. 4. Share of individual greenhouse gases in the total national emissions in 2016 (excluding LULUCF)



Source: KOBiZE

Methane emissions (excluding LULUCF) in 2016 amounted to 1,844.37 kt, i.e. 46.11 Mt CO_2eq. The emissions in 2016 was lower by 33.9% compared to the base year. The share of methane in the total national GHG emissions in 2016 accounted for 11.6%. Three main sources of methane emissions include volatile emissions from fuels, agriculture and waste. Their shares in the national methane emissions in 2016 amount to 42.4%, 30.1% and 19.1%, respectively. The emission from the first of the above categories consists of emissions from underground mines (approx. 36.9% of the total CH_4 emissions) and emissions from extraction, processing and distribution of crude oil and gas (in total, approx. 5.5% of emissions).

The emission of nitrous oxide (excluding LULUCF) in 2016 amounted to 65.38 kt, i.e. approx. 19.48 Mt CO_2e. The N_2O emissions were down by 33.6% relative to the base year (1988). The share of N_2O emissions represented 4.9% of total GHG emissions in 2016. Agriculture is the main source of nitrous oxide emissions in Poland, with the following shares in total N_2O emissions in 2016: agricultural soils – 67.4%, animal faeces – 10.3%, chemical industry – 4.3% and fuel combustion – 12.3%.

Emissions of fluorinated industrial gases (HFCs, PFCs and SF_6) in 2016 amounted to a total of 9.05 MtCO_2e, representing around 2.3% of the total GHG emissions in 2016. The emission of industrial gases was higher by 2,594.7% compared to the base year (1995). Such a significant increase in emissions in this group of gases is caused by the increase in emissions related to the use of cooling and air conditioning equipment.

International and EU climate policy measures in Poland

Functioning and experience in the EU ETS implementation

The European Union emission trading system EU ETS being the economic mechanism has been operating in the European Union since 1 January 2005. The purpose of this system is to reduce greenhouse gas emissions in a cost-effective and economically efficient way. The basis for its operation relies on the cap and trade principle, which consists on determining the total number of allowances cap and allowing them to be traded in on the market. Directive 2003/87/EC introducing the EU ETS has been implemented into the Polish law by Act of 22 December 2004 on greenhouse gas and other substances emission allowance trading, which was the first legal act defining the principles of functioning of the emission allowance trading system in Poland. The Directive has been amended several times, among others, to include additional greenhouse gases and additional activities, as well as to introduce changes to the principles of allocation of emission allowances, which necessitated a change to national legislation in this respect. Currently, the most important principles of the EU ETS functioning include:

- auctioning is the basic method of allocated emission allowances ,
- in the current period the allocation of allowances is free of charge, while the share is gradually shrinking,
- since 2013, no allowances have been allocated free of charge for the power energy production (some countries, including Poland, have a provisional right to derogate from this principle),
- free allocation is also allowed for installations in sectors exposed to the risk of carbon leakage.

The EU ETS system covers mainly emissions of carbon dioxide, but also perfluorocarbons and nitrous oxide from the activities specified in the Directive (other greenhouse gases may be included in the system by the Member States on an optional basis). Apart from emissions, the other important element of the EU ETS system includes entities covered by it (installations) as well as activities and processes carried out by them, determining their inclusion into the system. Currently, the system covers the following types of operators: energy installations, refineries and chemical industry, coke ovens, production and processing of ferrous metals, mineral industry, including cement production, glass production, ceramic products and paper industry. The most numerous group of installations participating in the EU ETS is represented by combustion installations with a total thermal power exceeding 20 MW. The number of installations by type of activities is shown in Fig. 5.

Green Investment Scheme

The Green Investment Scheme (GIS) operating under the Kyoto Protocol is a form of conversion of funds from the sale of AAUs[1] to support investments in climate protection activities. The GIS scheme has been operating in Poland since 2009, enabling effective management of funds derived from the sale of AAUs. The National Fund for Environmental Protection and Water Management (NFOŚiGW) was entrusted with the function of the national operator of the green investment scheme. Relevant regulations define the rules of calling for proposals for project co-funding and assessment, followed by monitoring and evaluation of environmental effects obtained.

Having a significant surplus of AAUs in 2008-2012, by September 2015 Poland concluded 11 contracts for their sale. Polish units were bought by the following entities: European Bank for

[1] AAU means Assigned Amount Unit (AAU) representing a permit to emit 1 t of CO_2.

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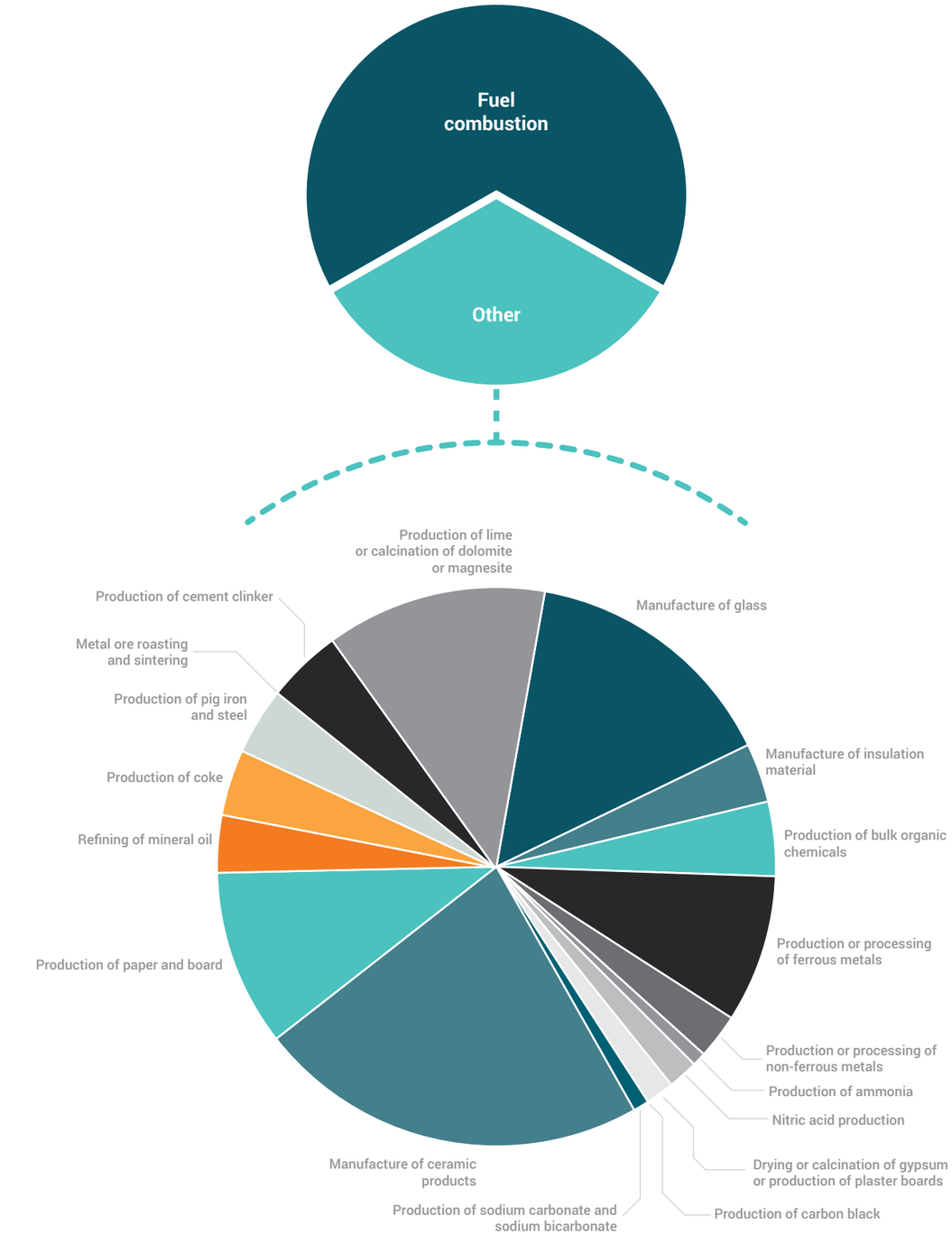
Fig. 5. Share of installations participating in the EU ETS in Poland, by type of activities



Source: KOBiZE

Reconstruction and Development acting for the government of the Kingdom of Spain and the Irish government, the Japanese government Organization for the Development of New Energy and Industrial Technologies and private

Japanese entities, the International Bank for Reconstruction and Development acting as a trustee of the Spanish Coal Fund and Coal Fund for Europe, the Government of the Kingdom of Spain and the Government of the Italian Republic.

The funds from the above buyers of AAUs, amounting in 2009-2018 to PLN 796.5m, are allocated to co- financing of tasks related to supporting projects implemented under programs and projects covered by the national green investment scheme, including projects within the scope of:

- energy efficiency in construction (thermal upgrading),
- renewable energy sources (agricultural biogas plants, biomass heat and power plants, connection
- to wind energy production sources)
- energy-efficient street lighting,
- low-carbon and zero-emission urban transport.

The total cost of undertakings implemented in 2011-2017 amounted to PLN 2.5bn, and the share of co- financing from the funds collected on the climate account and other funds from the NFOŚiGW represented 55% of the total cost. The most often co-funded activities were those in the field of energy efficiency, including mainly thermal upgrading of approx. 1,823 public buildings, receiving 60% of the total funds. The remaining GIS priority programs include: improvement of transmission networks for the purpose of connecting wind energy, which 12% of funds were allocated to, zero-emission public transport – 11%, energy-efficient street lighting – 11%, agricultural biogas plants – 5% and biomass burning-based electricity generation – 1%.

JI mechanism in Poland

The mechanism known as Joint Implementation (JI) is an instrument established by the Kyoto Protocol, pursuant to Article 6 thereof. The idea of the JI mechanism consists in meeting reduction obligations by the countries listed in Annex I to the Climate Convention by providing an opportunity to earn reduction units obtained from projects in another country listed in this Annex. An investor decreases its costs of emission reduction (compared to the costs that it would have to incur when implementing domestic projects) and increases its emission limit. However, a host party (host of the project) gains environmentally friendly, modern technologies. In practice, the functioning of the JI mechanism means the implementation of joint projects (JI projects) reducing greenhouse gas emissions. As a result of the JI project, emission reductions are obtained which, after verification, are converted into Emission Reduction Units (ERUs) so that they are transferred from the host country to the investor. The ERUs obtained this way can help to settle international emission obligations in a cost-effective manner.

The JI mechanism in Poland was active in 2008-2012. During that time, a total emission reduction of over 21 Mt CO_2e was achieved in Poland as a result of implementation of 37 JI projects, while the number of emission reduction units transferred to foreign partners, i.e. investors, amounted to 20m ERUs. It is worth noting that among the 16 Member States of the European Union where JI projects were implemented, it was in Poland that generated the largest number of ERUs was generated, accounting for 23.4% of all ERUs from the EU.

The JI projects implemented in Poland varied depending on the volume of expected emission reductions, the method of achieving reduction, the type of reduced gas, as well as the economic sector that they were implemented in. These included projects related to industrial processes, demethanization of mines, replacement of energy generation from mine methane combustion or use of renewable energy sources. The JI mechanism in Poland was of significant importance for the Polish chemical sector related to the production of nitrogen fertilizers. With the help of foreign partners four major nitrogen plants based in Puławy, Włocławek, Kędzierzyn and Tarnów carried out four JI projects aimed at reducing N_2O emissions. Thanks to JI projects, the Polish chemical industry companies have reduced their current emissions and upgraded their plants, being able to operate properly within the EU ETS system, with no additional costs.

Poland's potential, targets and commitments for the next decades

Poland, as a signatory to the UN Framework Convention on Climate Change and the Kyoto Protocol and a member of the European Union, participates in efforts aimed at reducing climate changes undertaken by the international community. In the first commitment period resulting from Poland's ratification of the Kyoto Protocol, Poland undertook to reduce greenhouse gas emissions in 2008-2012 by 6% compared to the base year. In the second commitment period specified in the Doha Amendment, i.e. in 2013-2020, Poland has not pursued any individual reduction target, as the European Union, its Member States and Iceland have concluded an agreement on the joint fulfilment of the target. The joint reduction target was expressed as a commitment to reach average annual emissions of 80% of the total emissions of all countries in base years.

The European Union pursues its goals through EU policies and national policies of the Member States, with EU emissions divided into two main sectors: emissions covered by the EU Emission Trading System (the so-called EU ETS sector) and other emissions (the so-called non-ETS sector). The EU law imposes emission limits on the Member States only in the non-ETS sector (chiefly emissions from agriculture, transport, waste, volatile emissions and emissions from small industrial and energy installations). However, in the EU ETS sector, which includes large industrial and energy installations, EU Member States do not have any obligations to reduce emissions – emissions are limited at the European Union level. The list of Poland's commitments is shown in Table 1.

Table 1. Poland's international and EU commitments until 2020

Specification	International commitments (UNFCCC)			EU law	
	Kyoto Protocol		Convention	Climate and Energy Package	
				EU ETS	ESD
Commitment period and target year	First commitment period (2008–2012) – CP1	Second commitment period (2013–2020) – CP2	2020	2013–2020	2013–2020
Emission reduction target	-6%	-20%	-20%	Total emission reduction in the EU of 21% relative to 2005 r.	Emission growth of 14% relative to 2005, according to annual emission limit
Base year	1988 for CO_2, CH_4, N_2O 1995 for HFCs, PFCs, SF_6	1988 for CO_2, CH_4, N_2O 1995 for HFCs, PFCs, SF_6, 2000 for NF_3	1990	1990 for total emissions; 2005 for RES and energy efficiency as well as for EU ETS and ESD emissions	
Gases covered	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	

Source: KOBiZE

3X20 climate and energy package

In 2008, the European Parliament and the Council adopted the so-called energy and climate package setting the following goals until 2020:

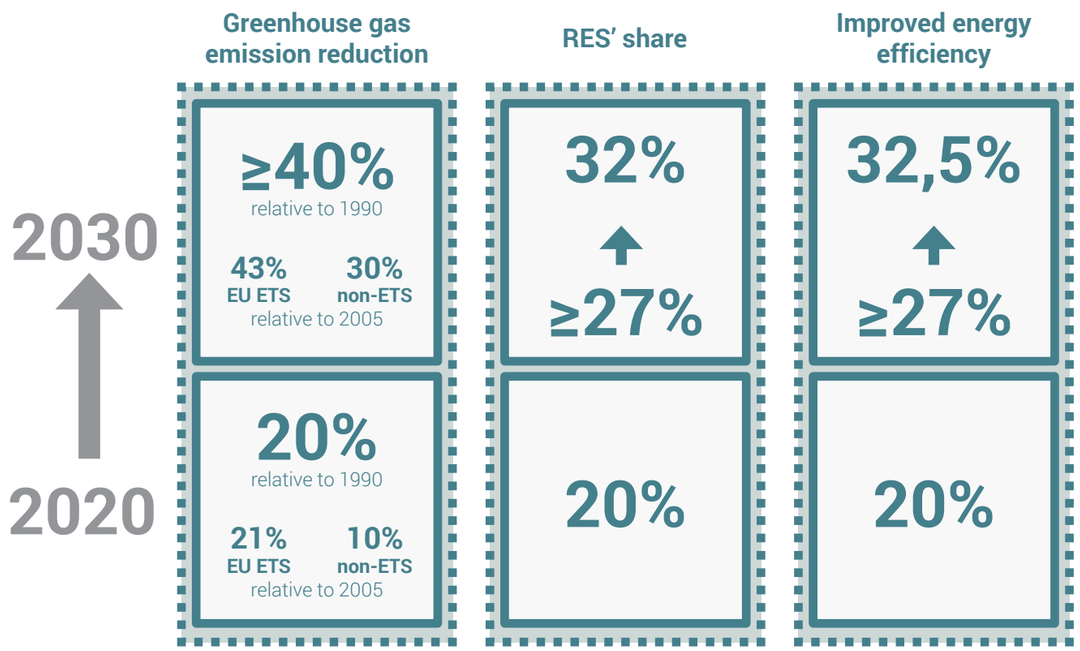
- 20% reduction in greenhouse gas emissions (with a 30% reduction option, if appropriate international agreements are concluded) compared to the emission level in 1990;
- increase of up to 20% in the share of renewable energy in the final energy consumption;
- 20% increase in energy efficiency (in comparison with forecasts for 2020),
- increase of up to 10% at least in the share of biofuels in the total consumption of transport fuels.

The emission reduction is carried out in two areas – the energy sector and branches of the industry covered by the EU Emission Trading System (EU ETS) and the so-called non-ETS sectors. The EU ETS covers over 10,000 installations that account for more than half of CO_2 and 40% of all greenhouse gas emissions, is the main tool for reducing emissions in the European Union. Between 2013 and 2020, greenhouse gas emissions within the system should be reduced by 21% compared to the 2005 emission levels. The volume of emissions in the non-ETS area in Poland is more or less similar to the volume of emissions within the EU ETS (accounting for around 50% of national emissions). In contrast to the EU ETS, the non-ETS emissions are determined at the level of the EU Member States. The volume of emissions granted to Poland in 2013-2020 represents +14% compared to 2005 (and thus assumes a growth possibility). In the EU as a whole, the target in the area of non-ETS is -10% until 2020. As revealed by the available data, Poland is on the path to fulfil its reduction commitments for 2013-2020 with a surplus, estimated at approx. 65 Mt CO_2.

EU climate and energy policies until 2030

As early as in 2014 the European Union agreed on its reduction targets for 2030, as well as RES and energy efficiency targets, which were yet increased in 2018. The justification emphasizes that achieving the defined targets will make the European Union's economy, including its energy system, more competitive; while simultaneously the level of energy security and the efficiency of fighting climate change will increase. The above climate policy objectives apply to the entire European Union, but at this stage, the level of detail and participation of Member States and economic sectors in their achievement are defined in various ways. A comparison of the EU commitments until 2030 with targets for 2020 is shown in Fig. 6.

Fig. 6. EU commitments until 2030 relative to the 2020 target



Source: KOBiZE

The EU Member States – as was in 2012-2020 – do not have individual reduction targets for emissions covered by the emissions trading system for 2030, as the EU ETS target is settled only at the EU level. It is assumed that the reduction of greenhouse gas emissions covered by the EU ETS will reach 43% in 2030 relative to the level of emissions reported in 2005. It was also decided that in order to protect the international competitive position of European enterprises, the EU ETS would continue to grant free allowances in sectors exposed to the risk of carbon leakage (CL). The reduction target for 2030 for the non-ETS sector was "divided" into EU Member States. For Poland, it amounts to -7% compared to 2005 emissions from the sector. This is a very ambitious goal considering the fact that in 2013-2020 Poland has the right to increase emissions in the non-ETS by 14% against 2005.

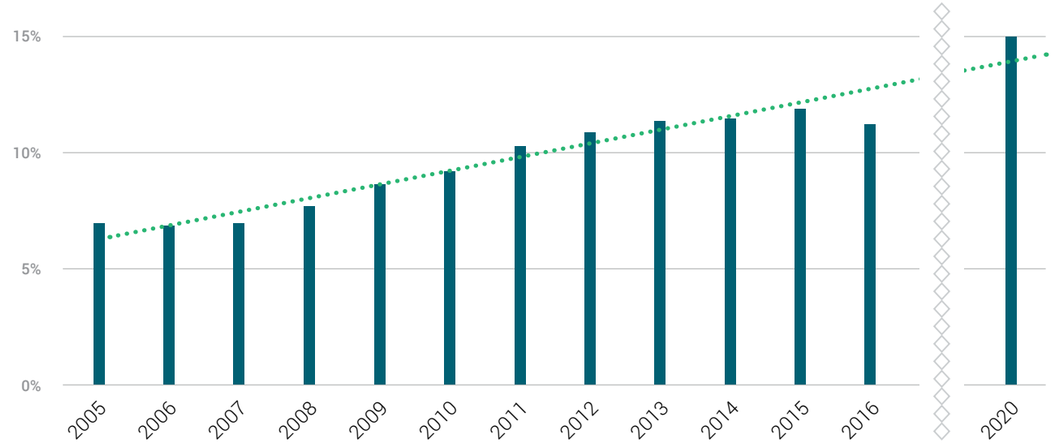
2050 perspective

Poland has good prospects for implementation of the European Union's climate policies both until 2030 and in the long run until 2050. It seems that achievement of ambitious reduction targets in the field of non-ETS (mainly transport, household and municipalsector, and agriculture) will be a serious challenge. Moreover, one should not forget about further transformation of the Polish energy and industry, underpinned by very important aspects, such as energy security of the country, stable and new jobs, significant added value, and recently development of innovative technologies, including those impacting on emission reduction.

In the 2050 outlook, the national economy will see an increase in demand for primary energy and power energy in Poland. The demand will grow, despite expected significant progress in energy efficiency. Poland is ahead of many challenges in the energy sector, where the potential to reduce emissions is the highest and which is closely related to the energy policy of the state. For various reasons, coal will remain the basis of Poland's energy security, but its share will be significantly reduced. Currently, 79% of electricity in Poland is generated by hard coal and lignite. High prices of CO_2 emission allowances will determine the profitability of replacing coal units with new high efficiency ones, the share of natural gas and RES. In order to reduce greenhouse gas emissions, it will be necessary to diversify activities towards low-emission sources of energy production, support of energy efficiency, development of cogeneration, electromobility or prosumer energy.

- **Energy efficiency. Cogeneration. Heating systems.** Energy efficiency has the highest potential of greenhouse gas emission reduction. In addition, the whole household and welfare sector shows a significant reduction potential, with the most important activities including: construction of new energy-efficient buildings, thermal upgrading of residential and commercial buildings, replacement of obsolete furnaces, development of heating infrastructure and connections to heating networks. These activities will also contribute to significant improvement of air quality. Poland declares that by 2030 the share of insulated residential buildings in the total housing stock will represent 70%. Another important aspect will be to improve efficiency in industrial sectors consuming power energy, which will contribute to reducing the demand for its generation. Actions in this area include e.g. development of energy and heat production from gas cogeneration in industry and heating, development of energy-efficient heating and cooling systems, and improvement of energy efficiency in the industry sector.
- **Development of renewable energy sources.** The development of RES will depend on its economic competitiveness in comparison with other energy production technologies. In order to achieve the RES targets, it will be necessary to launch a full-function support system in modern, dispersed and cost-effective investments that will improve the security and flexibility of the Polish power system. It is assumed that until 2050 the share of energy from RES in the final gross energy consumption in Poland will be growing systematically, e.g. owing to the implementation of the EU climate policy. The greatest potential in the RES development is seen in offshore wind energy. The share of RES in the final energy consumption in transport and heating sector will also gradually increase.

Fig. 7. Share of renewable energy sources in the total gross energy consumption in Poland in 2005-2016 [%]

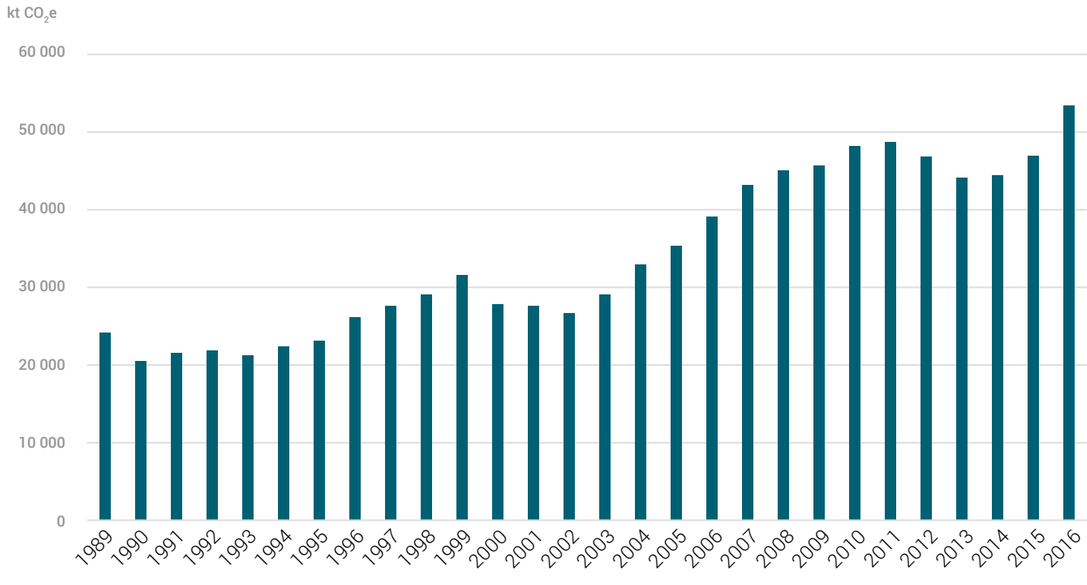


Source: Renewable energy sources in 2016, GUS, Warsaw 2017

- **Electromobility.** Besides energy efficiency improvement, electric transport may turn out to be one of the most breakthrough technologies in the Polish energy sector. Having noticed the huge potential of electric vehicles, alternative fuels and global trends of dynamic development of the automotive industry, the Polish government developed the Electromobility Development Plan "Energy for the Future". The most important assumption of the plan is to achieve 1melectric cars in Poland by 2025. The implementation of this objective would allow for achieving specific environmental benefits related to the reduction of transport pollution in agglomerations. Additional effects would entail limited Poland's energy dependence, by reducing the demand for liquid fuels, and thus reducing the volume of oil imports. An important function of the program will be stimulation of conditions for construction of electric cars in Poland, which would have a positive impact on many economic branches related to the car industry. An important element of the electromobility development plan is proper timing of activities in the field of support for industry as well as scientific and research institutions, stimulation of demand (e.g. by introducing tax reliefs, larger depreciation write-downs for companies) and development of infrastructure and legal regulations (e.g. development of energy charging points and refuelling of alternative fuels, possibility of using bus lanes and free parking).

- **Development of nuclear energy.** Nuclear energy along with its development depends on both energy security aspects and becomes an economically justified source of energy production, in particular as regards a price increase of CO_2 emission allowances. According to the forecasts, the first block of a nuclear power plant in Poland may be launched in 2035. In recent years, some European countries have shown a desire to reduce the share of nuclear energy or completely withdraw from it, which was undoubtedly affected by the Fukushima nuclear power plant disaster in 2011. One of such countries is Germany, which has announced that by 2022 it is going to close down all, even the most modern nuclear power plants (although they cover as much as 25% of the power energy demand). The gap in energy production is to be filled with RES energy and energy from natural gas-fired gas turbines[2]. France is another country in Europe that foresees reduction in nuclear energy production from 75% to 50% by 2025, which requires closing 17 reactors (however, this will be difficult to implement, given France's decreasing capacity to produce coal energy and technological problems in RES development). Other countries in Europe, such as Belgium and Switzerland, are planning to shut down all nuclear reactors by respectively 2025[3] and 2034[4]. The same path seemed to be followed by the country that suffered most in recent years due to having nuclear power plants – Japan, which has changed its original direction (when it was closing down power plants) and again intends to use nuclear energy. The trend of building new nuclear facilities is also followed by China where currently there are 45 such power plants, and another 15 are under construction (by 2030, nuclear energy will account for 8-10% of the total electricity production in China). At present, around 50 nuclear power plants are under construction in 15 countries across the world (the largest number in China, Russia, India, and South Korea)[5].

Fig. 8. Transport emission trend in 1988-2016



Source: KOBiZE

- **Prosumer energy.** The energy policy of the country should also consider to a large extent a development of dispersed source generation, i.e. many small energy sources that meet local energy needs of municipalities or even individual buildings. It will be very important to create appropriate legal regulations and investments in infrastructure (networks, reserve capacity), allowing the existing electricity consumers (prosumers) to sell the surplus of locally produced energy to the system.

It should be noted that the energy transformation of Poland will involve additional social costs. Mining is the sector that will be particularly affected. At present, the number of staff employed in mining in Poland represents almost a half of the total number of employees in the mining sector in Europe. It is estimated that by 2025, 77,000, and by 2030 as many as 160,000 mining-related jobs, i.e. in the mining and energy sector, could be at stake. In this context, it should be noted that the costs incurred by Poland will be much higher in this case than in other countries owing to the highest level of employment in mining and mining- related sectors. Potentially, some employment opportunities for some employees from the mining sector are likely to be found in the sector of renewable energy sources, industry or the developing electromobility sector.

[2] https://book.energytransition.org/pl/node/36

[3] http://www.world-nuclear-news.org/NP-Belgian-government-approves-life-extensions-1912145.html

[4] https://derstandard.at/1304552826299/Ab-2019-Schweiz-plant-Atomausstieg

[5] http://www.world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide.aspx

The risk of carbon leakage is another challenge for Poland and the entire EU, bringing a number of negative economic and business consequences. The reduction or discontinuation of production in the EU connected with this risk may result in transfer of jobs to other regions of the world and outflow of capital, which may cause a rise in unemployment rate and intensification of negative social moods. Another economic risk that may occur in this context is the relocation of production within the EU itself in order to reduce manufacturing costs of enterprises. Since the manufacturing costs are determined by the cost of allowances included in the energy price, and thus the energy emission capacity in a given Member State, the share of high-emission fuels (e.g. coal) in the national fuel and energy balance is very important, since it will determine industrial competitiveness, which in the case of Poland must be taken into particular account.

In the last thirty years Poland came a long way from an economy based on central planning, with inefficient industry and agriculture, and a poorly developed service sector, to a market economy. During that time, our country underwent a series of institutional, economic and environmental changes – becoming a member of the European Union, implementing and taking active part in reduction commitments at a global level, fighting the effects of the economic crisis, and as one of few European countries managed to avoid a decline in GDP or has recently been promoted to the group of developed countries. The wide package of structural, legislative and economic changes as well as the inflow of funds allocated to environmental protection resulted in simultaneous economic growth and emission reduction. However, a number of barriers, duties and goals still have an impact of the shape of Poland's climate and energy policy, including specific raw material situation, further need for infrastructure development, high energy demand related to economic development, or external environmental policy requirements. Poland aims at synergy between activities having a positive impact on sustainable development and emission reduction, while maintaining the competitiveness of the economy and enterprises, ensuring energy security and economic growth. In the long run, the diversification of activities and development directions is a key response to the current challenges, because only then can stabilization be ensured and the risk of middle income trap be limited. On the one hand, Poland faces the inevitable in the form of the need to reduce the use of fossil fuels; on the other hand, it is important to focus on innovative solutions, such as electromobility. Moreover, considering the conclusions of the special IPCC report[6] dated October 2018 indicating the need to reduce global warming by up to 1.5°C, activities in this area should be undertaken as soon as possible and should apply to all sectors. This results from the conclusion that the increase in the average temperature of 1.5°C will bring much fewer adverse changes than the one of 2°C. It should be noted that the actions that still need to be taken do not preclude the development of stable economy. According to the latest study by the International Energy Agency "World Energy Outlook 2018", global investments in the energy sector will amount to USD 2,200bn on a yearly basis by 2025 and USD 2,800bn on a yearly basis in 2026-2040, and will mainly focus on renewable energy, while investments in coal capacity will halve by 2040[7].

Meeting the environmental requirements and transformation of the energy and industry sectors are huge challenges posed by the European Union and international community. As revealed by to-date Poland's experience, the transformation gives an opportunity to increase the industry efficiency, energy efficiency, and structural changes. However, it should be borne in mind that the Polish economy still has to compete with producers from around the world; hence, it is so important to equalize emission reduction commitments at the global level. Other important aspects include provision of adequate and stable financing for environmentally friendly investments, as well as establishment of legal framework and standards affecting the preservation of competitiveness.

[6] IPCC, 2018: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre- industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)].
[7] World Energy Outlook 2018,International Energy Agency, 2018

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Green city
Joanna Kwiecień

ART COMPETITION
ECO-CITY OF THE FUTURE

You and I look after the environment, as health is above all else
Jagna Koncewicz

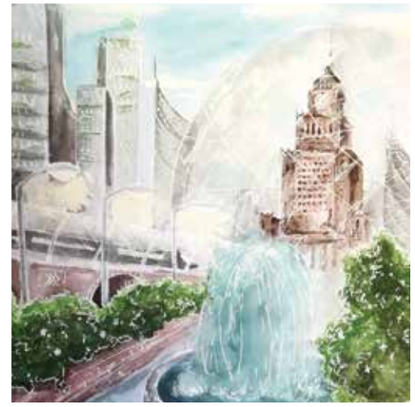
Water city of the future
Adam Jeździkowski

The world of the future
Katarzyna Kilikiewicz

Eco-cool
Jakub Guzy

By building eco-cities,
we invest in the future of the world
Hanna Drygalska

Live in symbiosis with nature
Wiktoria Grodowska



Warsaw symbiosis
Katarzyna Wolnik

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