Fondazione Giuseppe Di Vittorio

WORK ING PAPER FDV

ENERGY FOR A JUST AND GREEN RECOVERY DEAL: THE ROLE OF THE INDUSTRIAL RELATIONS IN THE ENERGY SECTOR FOR A RESILIENT EUROPE

JUNE 2023

REJENERAXION:
Poland National Baseline Report

Matgorzata Koziarek
Institute of Public Affairs

n.6/2024

ISSN: 2724 1882

Direttore scientifico della collana

Paolo Terranova	**p.terranova@fdv.cgil.it**

Responsabile dell'area Ricerca

Daniele Di Nunzio	**d.dinunzio@fdv.cgil.it**

Coordinamento redazionale

Fabiana Lippa	**f.lippa@fdv.cgil.it**

Progetto grafico e editing

Antonello Claps	**a.claps@fdv.cgil.it**

La collana di pubblicazioni on line Working Paper della Fondazione Di Vittorio (WP-FDV) comprende lavori originali e inediti, espressione delle attività di studio e ricerca svolte dall'Istituto. I contributi sono da considerarsi come pre-print di lavori di ricerca, la cui diffusione risponde all'obiettivo di documentare e divulgare tempestivamente i risultati di studi e ricerche e favorire il dibattito scientifico sui temi di interesse della Fondazione. Le proposte di lavori scientifici per la pubblicazione nella collana Working Paper possono essere presentate da ricercatori e studiosi della Fondazione Di Vittorio e dai collaboratori ai progetti dell'istituto. Ogni proposta è sottoposta a un processo di referaggio, da parte di revisori selezionati dal comitato di redazione. Il WP deve essere proposto prima di una sua eventuale pubblicazione su una rivista scientifica. Non si accettano testi già pubblicati o in corso di pubblicazione. Il regolamento completo, con le istruzioni per la presentazione delle proposte, è disponibile sul sito web della Fondazione. La collana è identificata da un International Standard Serial Number (Issn) che ne consente l'identificazione e il riconoscimento come pubblicazione elettronica in serie. Ogni singolo volume della collana è numerato, in ordine progressivo. Tutti i Working Paper sono pubblicati sul sito della Fondazione Di Vittorio e accessibili gratuitamente e senza restrizioni. Il diritto d'autore rimane in capo agli autori. Le opere sono pubblicate con Licenza Creative Commons (CC-BA-NC-SA) e possono pertanto essere distribuite, modificate, create opere derivate dall'originale, ma non a scopi commerciali, a condizione che venga: riconosciuta una menzione di paternità adeguata, fornito un link alla licenza e indicato se sono state effettuate delle modifiche; e che alla nuova opera venga attribuita la stessa licenza dell'originale. Il testo contenuto all'interno dell'opera, e l'opera stessa, possono essere citati, a condizione che venga indicato l'autore, l'opera, la collana e il sito internet della Fondazione Di Vittorio, in cui la collana è pubblicata https://www.fondazionedivittorio.it

N. 6/2024
ISSN 2724-1882
© 2024 FDV
ROMA, giugno 2024

La Fondazione Giuseppe Di Vittorio è l'istituto per la ricerca storica, sociale ed economica e per l'educazione e la formazione sindacale fondato dalla Cgil.

Per commenti e/o richieste di informazioni rivolgersi a:

Fondazione Giuseppe Di Vittorio
Via G. Donizetti, 7/b – 00198 Roma
Tel. +39 06 857971
wp@fdv.cgil.it
www.fondazionedivittorio.it

Table of Contents

List of abbreviations

ARE	Agencja Rynku Energii S.A.
BCC	Business Centre Club
CB	Collective Bargaining
CBAM	Cross border adjustment mechanism
EEA	European Economic Area
EBI	European Investment Bank
EBRD	European Bank for Reconstruction and Development
ETS	EU Emissions Trading System
EU	European Union
FE	Forum Energii
GIPH	Górnicza Izba Przemysłowo-Handlowa
	(Polish Mining Chamber of Industry and Commerce)
FZZ	Forum Związków Zawodowych (Trade Union Forum)
FZZGWB	Federacja Związków Zawodowych Górnictwa Węgla Brunatnego
GDP	Gross domestic product
GHG	Greenhouse gas
GUS	Główny Urząd Statystyczny (Statistics Poland)
IEA	International Energy Agency
ILO	International Labour Organisation
ISP	Instytut Spraw Publicznych (Institute of Public Affairs)
IPSS	Instytut Pracy i Spraw Socjalnych
IBS	Instytut Badań Strukturalnych (Institute for Structural Research)
JSW	Jastrzębska Spółka Węglowa SA
JTF	Just Transition Fund
KL	Konfederacja Lewiatan (the Polish Confederation Lewiatan)
KOBiZE	Krajowy Ośrodek Bilansowania i Zarządzania Emisjami (The National Centre for Emissions Management)
LNG	Liquid natural gas

LWB	Lubelski Węgiel Bogdanka S.A.
LULUCF	Land use , land use change, forestry
MAP	Ministerstwo Aktywów Państwowych (the Ministry of State Assets)
NACE	Nomenclature statistique des Activités économiques dans la Communauté Européenne
NABE	Narodowa Agencja Bezpieczeństwa Energetycznego
NCBR	Narodowe Centrum Badań i Rozwoju (National Centre for Research and Development)
NECP	National Energy and Climate Plan
NFO iGW	Narodowy Fundusz Ochrony Środowiska (National Fund of Environmental Protection and Water Management)
NRRP	National Resilience and Recovery Plan (Krajowy Plan Odbudowy)
OECD	The Organisation for Economic Co-operation and Development
OPZZ	Ogólnopolskie Porozumienie Związków Zawodowych (All-Polish Trade Union Alliance)
OZZGNiG	Ogólnopolski Związek Zawodowy Górnictwa Naftowego i Gazownictwa
OZZZPRC	Ogólnokrajowe Zrzeszenie Związków Zawodowych Pracowników Ruchu Ciągłego
PEA	Polish Electricity Association
PEP 2040	Poland's Energy Policy until 2040
PGE	Polska Grupa Energetyczna
PGG	Polska Grupa Górnicza
PGNiG	Polskie Górnictwo Naftowe i Gazownictwo
PSE	Polskie Sieci Energetyczne
PUP	Powiatowy Urząd Pracy (Powiat Employment Office)
PV	Photovoltaics
RDS	Rada Dialogu Społecznego (Social Dialogue Council)
SRK	Spółka Restrukturyzacji Kopalń (The Mine Restructuring Company)
TJTP	Territorial Just Transition Plan
TU	Trade union

RE	Reneweable energy
RES	Reneweable energy sources
RRF	Recovery and Resilience Facility
WB	World Bank
WUG	Wyższy Urząd Górniczy (State Mining Authority)
WUP	Wojewódzki Urząd Pracy (Regional Employment Office)
ZPEP	Związek Pracodawców Energetyki Polskiej (Union of Polish Energy Employers)
ZPP	Związek Przedsiębiorców i Pracodawców (Union of Entrepreneurs and Employers)
ZPPPWB	Związek Pracodawców Porozumienie Producentów Węgla Brunatnego
ZRP	Związek Rzemiosła Polskiego
ZZG	Związek Zawodowy Górników

REJEnerAXION Project National Report Poland

Abstract

Energy transition in Poland, and the resulting national policies, strategies and regulations have been driven by the EU climate policy and by Poland's commitments following from its Member State status. While different measures have been introduced to promote the energy transition, including dedicated support schemes targeting different stakeholders, no commitment has been made concerning the date of achieving climate neutrality by the country.

The traditional dependence on coal to secure energy needs (77% in electricity generation mix in 2022), poses a particularly difficult challenge, both in economic and social terms, because of the proportionately higher costs of decarbonisation: investment needed to convert the energy system (over EUR 195 billion, i.e. over 3% of GDP needed until 2030) and to alleviate the negative effects on coal dependent regions and workers , and to support them to reorient their economies and careers for the low-carbon future.

To secure energy sovereignty, while phasing out the predominantly domestic coal, the country has taken systematic efforts to diversify suppliers of natural gas which is to serve as transition fuel, while the country invests in the construction of its first nuclear power plant and increases RES capacity.

Over the last decade the share of fossil fuels has slowly declined. Energy consumption has been decoupled from GDP, and the primary and final energy intensity dropped by over 20%, accompanied by an increase in plant efficiency. That was matched by a falling trend in GHG emissions. With the production of hard coal dropping by one third and that of lignite by 15%, the share of coal and lignite mining jobs in the energy sector shrunk to 33% from 48%.

The jobs affected by the energy transition are concentrated in a few regions, which are noted for a high share of coal-based employment and/or the strong reliance of their revenues on coal-based operations. The regional authorities together with local stakeholders developed Territorial Just Transition Plans which are to help reorient regional economies towards low carbon future. Parallelly to those efforts, miners' trade unions were able to negotiate a social contract covering State owned hard coal mines, followed by a social contract covering State owned lignite mines and coal and lignite fired power plants. Otherwise, the government has been avoiding a substantive discussion with the social partners on the challenges involved in energy transition and ways to address them, and the country has been suffering from the lack of political leadership in its transition to climate neutral economy.

JEL Classification:

N74, Q56; Q30; Q54; J50

Keywords:

Poland, just transition, energy transition, climate policy, social dialogue.

THE ENERGY SECTOR IN POLAND[1]

1. AN INTRODUCTION

Over the last decade the climate and environmental issues have made their way into the mainstream public debate, and energy transition has, although with some difficulties, become a key concern of the decision makers and social partners, even if they have questioned it or opposed the implementation measures. Energy transition in Poland, and the resulting national policies, strategies and regulations have been driven by the EU climate policy and by Poland's commitments following from its Member State status.

The traditional dependence on coal to secure energy needs, poses a particularly difficult challenge, both in economic and social terms, because of the proportionately higher costs of decarbonisation: investment needed to convert the energy system and to alleviate the negative effects on coal dependent regions and workers, and to support them to reorient their economies and careers for the low-carbon future. Energy transition also poses a question about Poland' s energy sovereignty, as the country does not have domestic energy sources which could secure it either soon or easily, even though the RES sector has been developing dynamically.

While different measures have been introduced to promote the energy transition, including dedicated support schemes targeting different stakeholders, no commitment has been made concerning the date of achieving climate neutrality by the country. The government has been avoiding a substantive discussion with the social partners on the awaiting challenges and ways to address them, as a result no roadmap for just transition has been drawn within the social dialogue framework, except a social contract covering State owned hard coal mines, followed by a social contract covering State owned lignite mines and coal and lignite fired power plants.

[1] This paper is part of the project "REJEnerAXion - Energy for a just and green recovery deal: the role of the industrial relations in the energy sector for a resilient Europe", a European Union co-funded research project (101052341/SOCPL-2021-IND-REL) aimed at analyzing and strengthening the role of innovative industrial relations structures, including social dialogue, to respond in a socially fair and balanced way to the main challenges and opportunities offered by a clean-energy transition at national and European level.

The project partners are: Fondazione Di Vittorio (Italy, project coordinator); Federazione Italiana Lavoratori Chimica Tessile Energia Manifatturo – FILCTEM CGIL (Italy); Fundacion 1° de Mayo (Spain); Association travail emploi Europe société-ASTREES (France); wmp consult – Wilke Maack (Germany); Laboratoire d'Etudes sur les Nouvelles formes de Travail, l'Innovation et le Changement, LENTIC, Université de Liège (Belgium); Instytut Spraw Publicznych (Poland); Central European Labour Studies Institute CELSI (Slovakia (and Hungary). Supporters are: European Federation of Public Service Unions- EPSU (EU); European Trade Union Institute – ETUI (EU). Website: https://www.rejeneraxion.com/.

The aim of the paper is to provide the main results of research reports at a national level based on desk analysis and qualitative research (in-depth interviews with stakeholders) considering the transformations taking place in the energy sector oriented towards clean energy and their impacts on the world of work and the role of industrial relations and social dialogue for a just transition.

2. NATIONAL POLITICAL FRAMEWORK FOR ENERGY TRANSITION

2.1. Overview of relevant policy and legal framework

Energy transition related policies are shaped at national level, in particular by **the Ministry of Climate and Environment**, responsible for national strategies on energy, climate, environment and sustainable development, and are co-ordinated with **the Ministry of Economic Development and Technology,** responsible for industry, construction and housing sectors; **the Ministry of Infrastructure** in charge of transport and mobility; the Government Plenipotentiary for the Transformation of Energy Companies and Coal Mining, located in **the Ministry of State Assets**, which deals with issues related to the management of mineral deposits and of the state property, including the oversight of state controlled-companies – as well as with other ministries and government agencies. The national policies are implemented at regional and local levels by **regional and municipal governments**, which are responsible for energy planning and energy efficiency measures, and have the authority to limit and prohibit the use of certain fuels and certain residential sector energy installations. They are also responsible for policies relevant for just transition of regional and local communities.

Poland's strategy and policies for energy transition are defined mainly by **the National Energy and Climate Plan (NECP)** adopted in 2019 and **the Poland's Energy Policy until 2040 (PEP 2040**) adopted in early February 2021. The NECP provides a policy framework for and sets Poland's energy sector targets to implement EU climate goals, policies and laws, but has not been adjusted to the more ambitious EU level targets of the "Fit for 55" or REPowerEU, as yet. NECP focuses on *decarbonisation, energy efficiency, energy security, internal energy market,* and *research, innovation and competitiveness*. The PEP 2040, which is coherent with NECP, defines policy objectives and measures for energy transition, however it does not indicate the year when Poland is to become climate neutral. Its pillars are: *just transition, zero-emission energy system*, and *good air quality*, to be complemented with the fourth pillar of *energy sovereignty* as part of the document update[2] in order to address the new challenges resulting from the sanctions on Russian fuel imports.

No date for achieving climate neutrality by Poland has been set. Poland's target of **reduction of greenhouse gas emissions** in non-ETS sectors (i.e. sectors which are not incentivised to decarbonize by the market mechanism of EU ETS) was set for 7% in 2030 compared to the level in 2005. The target is going to be reached, on the one hand, by an **increased RES share** in gross final energy consumption (growing by 1,1% annually to reach 23%[3]), in electricity generation (to 32%) , heating (to 28%) and in transport (to 14%), and, on the other hand, by **reduced** primary **energy consumption** (by 23%[4]) and final energy consumption (by 21.5%[5])

[2] The government prepared PEP 2040 update at the end of 2022, but the full legislative path is expected to be completed at the turn of 2023 and 2024. https://www.are.waw.pl/o-are/aktualnosci/do-konca-roku-aktualizacja-polityki-energetycznej-panstwa

[3] If additional funds are allocated by the EU for just transition, otherwise 21%

[4] Compared to the PRIMES 2007 forecast, i.e. to approx. 91.3 Mtoe [PEA 2022]

[5] Compared to the PRIMES 2007 forecast, i.e. to approx. 67 Mtoe [PEA 2022]

thanks to **energy efficiency** supporting measures in energy sector, buildings and transport. RES share is to grow as a result of the continued deployment of solar PV and onshore wind, bioenergy (including domestic biomass) and geothermal energy, and thanks to the development of offshore wind capacity and advanced biofuels. Coal is going to serve as a stabilizer of the electricity supply, with its share to fall below 56%[6] in 2030 compared to 79.7% in 2021. The coal demand, which is to be covered mainly from economically improved domestic production, is expected to decline as a result of the growing CO_2 prices under ETS. Coal regions will be supported to ensure their just transition. Household heating is to be coal-free by 2030 in cities and by 2040 in rural areas, with heating demand to be covered by district heating and zero- or low-emission individual sources (heat pumps electricity, natural gas smokeless fuels). The use and efficiency of co-generation is to be increased. Energy security, given the expected growing demand for electricity, is to be ensured, among others, by introducing nuclear power (the first nuclear power unit to be commissioned by 2033 and followed by subsequent five units) and relying to greater extent on gas as a transition fuel. By 2040 the coal share in electricity generation has been estimated to fall to 28% or 11%, depending on the CO_2 price growth dynamics, and domestic coal production is expected to phase out by 2049 [PEP 2040]. Poland is to continue to diversify directions of fossil fuel imports and to increase the availability and capacity of current cross-border interconnections, to strengthen the integration of the national transmission system of natural gas with the systems of Central and Eastern Europe and the countries of the Baltic Sea region, and to expand LNG import capacity. To boost the development of new technologies and solutions supporting the twin (green and digital) transition Poland is to increase expenditure on R&D to 2.5% GDP in 2030, with a view of such key applications as energy storage , smart metering and energy management systems, electromobility and alternative fuels, and hydrogen technologies.

The implementation of NECP and PEP 2040 goals and targets is to be supported by Poland's **Recovery and Resilience Plan**, since the greatest proportion of its budget: 42.7% has been allocated for green energy and energy efficiency, as well as accessible green transport. However the funding under RRF has been withheld until Poland fulfils its commitments concerning the reforms of the judicial system.[7]

The NECP and PEP 2040 are complemented by a number of other policy documents, including the Raw Materials Policy, the National Framework for the Alternative Fuels Infrastructure Development, the Polish Hydrogen Strategy, and others.

2.2. Institutional initiatives to support a just energy transition

Initiatives and sources supporting energy transition include (a non-exhaustive list): (1) domestic market-based instruments, such as tradable green certificates and blue certificates for

[6] =< 56% to 37.5%

[7] *https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)733665; https://www.gov.pl/web/planodbudowy*

RES generated electricity, or white certificates for energy efficiency in enterprises, auctions providing guaranteed fixed income to winner investors, feed-in premiums and feed-in-tariffs, etc.; (2) grants and loans for reducing air emissions, improving energy efficiency, replacement of energy/heating sources for RES installations, low and zero emission transport (e-vehicles and charging infrastructure) - provided under different domestically funded dedicated support schemes run by the National Fund of Environmental Protection and Water Management (NFOŚiGW) whose beneficiaries are individuals, municipalities, enterprises and other entities; (3) grants for R&D projects or pre-commercial procurements under the National Centre for Research and Development (NCBR) programmes financed from domestic and EU funds, as well as part of international projects (e.g. under Horizon Europe) (4) Operational programmes co-financed by EU; Environment, Energy and Climate Change Programme financed by the Norwegian Financial Mechanism and EEA; the National Recovery and Resilience Plan to be funded by RRF ; (5) Just Transition Fund supporting (so far three of the seven) coal regions (6) Modernization Fund financing modernization of the energy sector; (7) InvestEU guarantees and (8) other sources: World Bank, EBI, EBRD, etc. [PEP 2040; NFOŚiGW website, NCBR website].

According to the government estimates Poland will need EUR 195 billion (over 3% of GDP) to modernise the energy sector and achieve the NECP 2030 targets from 2021-2030, and EUR 350 billion until 2040. EUR 60 billion is expected to be secured from EU and national funds to support the energy transition by 2030, including: the EU RRF, Cohesion Fund, Just Transition Fund and ReactEU, as well as the EU Modernization Fund, the National Special Purpose Fund and the Energy Transformation Fund [IEA 2022].

2.3 The geopolitical implications on energy transition

Poland's energy demand has been met predominantly by domestic coal, which made the country relatively independent on imports in securing its energy needs. While the production and consumption of coal is gradually reduced, Poland will need to rely more on natural gas as a transition fuel, until it can be replaced by nuclear power (the first reactor to be completed by 2035), to stabilize the electricity supply, which will increasingly be generated by RES. This will inevitably increase Poland's fuel import dependency, as the country has been able to cover domestically only about 20% of its demand of natural gas. (The energy import dependency rates are given in Table 1).

Table 1 Energy import dependency of Poland (%)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL	**34.02**	**31.628**	**26.25**	**29.42**	**29.85**	**30.76**	**38.27**	**43.51**	**45.24**	**42.76**	**40.44**
Solid fossil fuels	-1.00	-6.44	-10.17	-8.57	-11.44	-11.70	-2.96	8.23	6.02	0.33	-3.61
Anthracite	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*106.43*	*144.85*	*100.00*	*95.94*	*105.37*	*91.22*
Coking coal	*5.08*	*0.14*	*0.03*	*2.12*	*2.90*	*-1.71*	*6.65*	*4.72*	*7.00*	*-7.93*	*-1.90*
Other bituminous coal	*9.41*	*3.71*	*-2.26*	*0.74*	*-3.96*	*-2.74*	*6.65*	*23.88*	*20.61*	*17.64*	*10.67*
Natural gas	75.10	73.40	74.20	71.97	72.21	78.38	77.77	77.60	82.37	78.25	83.57
Oil and petroleum products (excluding biofuel portion)	96.83	96.63	93.54	95.45	99.50	94.96	98.60	98.77	97.33	96.86	96.39
Crude oil	97.23	97.38	94.77	96.51	100.48	94.46	97.19	98.31	96.71	96.57	94.65

Note: Minus means a net exporter.

Source: Eurostat NRG_IND_ID

In 2016 LNG regasification terminal was opened and as a result the country was able to diversify suppliers. The imports of gas in 2021 (2020) were: from Russia 10.5 bcm (9.6 bcm) , Germany (3.7 bcm (3.3 bcm), Qatar 2.4 bcm (2.3 bcm) and United States 1.6 bcm (1.0 bcm) [Eurostat NRG_TI_GAS]. Compared to 2016 the Russian share in Polish gas imports dropped from 84.33% in 2016 to 69.56% in 2020 [Eurostat NRG_IND_IDOGAS][8]. Since 2022 the import from a single source may not exceed 33%. There is a plan to construct a floating LNG terminal to increase LNG import capacity [IEA 2022]. The country, which has a large farming sector, is also going to increase efficient use of domestic bioenergy. It has already been a biofuel exporter and self-sufficient producer. The import of wood pellet from Poland to EU increased steadily from 31,9 kt in 2012 to 472,3 kt in 2021 [Eurostat NRG_TI_BIO]. As a predominantly lowland country Poland does not have favourable natural conditions to develop hydropower, but has a potential for windpower, both in land and off-shore. With moderate sun exposure, the country has the best conditions for PV in its southern part.

3. MAJOR TRENDS IN THE ENERGY SECTOR

3.1. Main characteristics of the country's energy system

Primary energy consumption was 4611.8 PJ in 2021, rising from 4387.3 PJ in 2012 with a steep peak in 2018 followed by a compensating sink in 2019, which was aggravated in 2020 by the COVID-19 pandemic, and followed by a recovery slightly exceeding the pre-COVID level. [Based on ARE data]

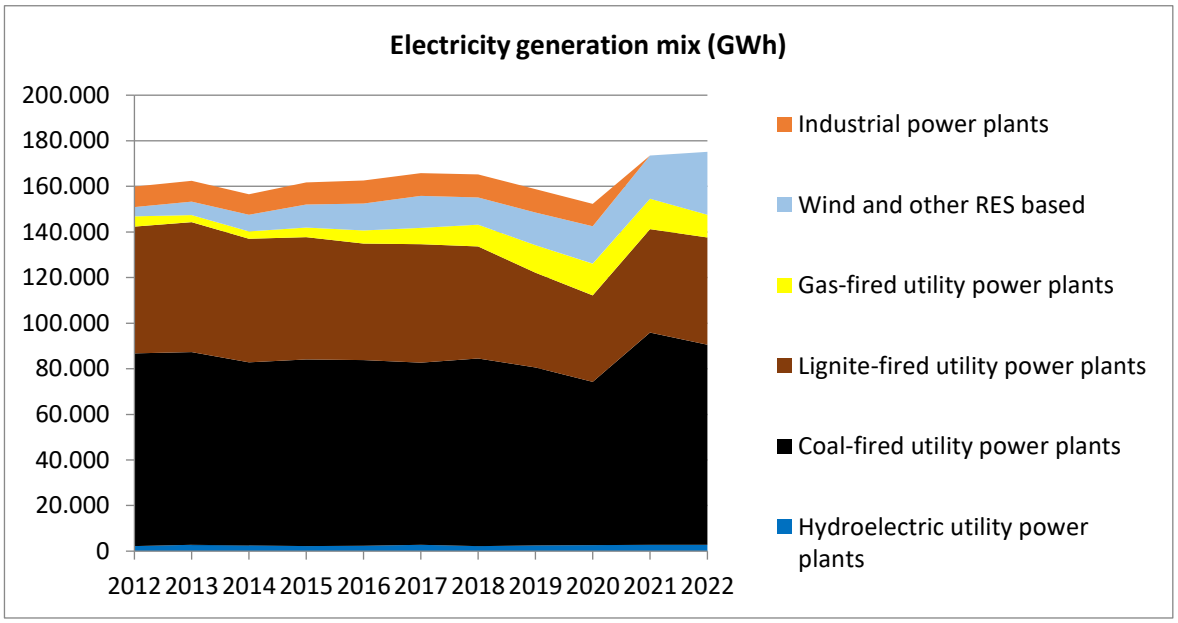
The *primary energy consumption mix* is dominated by fossil fuels, even though over the last decade their share decreased from over 90% to 84,9%, matched by an increased share of wood, other renewables and other fuels. Hard coal and lignite, which provided for almost 53% of

[8] However, in 2021 the amount of Russian gas import jumped up to 10.5 bcm (the value comparable to 10.9 bcm in 2016). [Eurostat NRG_TI_GAS].

primary energy consumption in 2012, in 2022 represented 45,5%, and the share of crude oil dropped from 24% to 22,8%. At the same time, though, the proportion of natural gas in the mix rose from 13,1% to 16,5%. [Based on ARE data as of 29.04.2023]

Similar trends were observed in Poland's *electricity mix*. Domestic power plants generated 175,157 GWh in 2022 ((compared to 156,342 GWh in 2010): of which by hard coal fired utility plants 50.1% (57.1% in 2010), lignite fired utility plants 26.8% (31.6% in 2010), natural gas fired power plants 5.7% (2.7% in 2010), hydroelectric utility power plants 1.6% (2,1% in 2010), wind and other RE based sources 15.8% (0.8% in 2010). [Based on PSE data[9]]

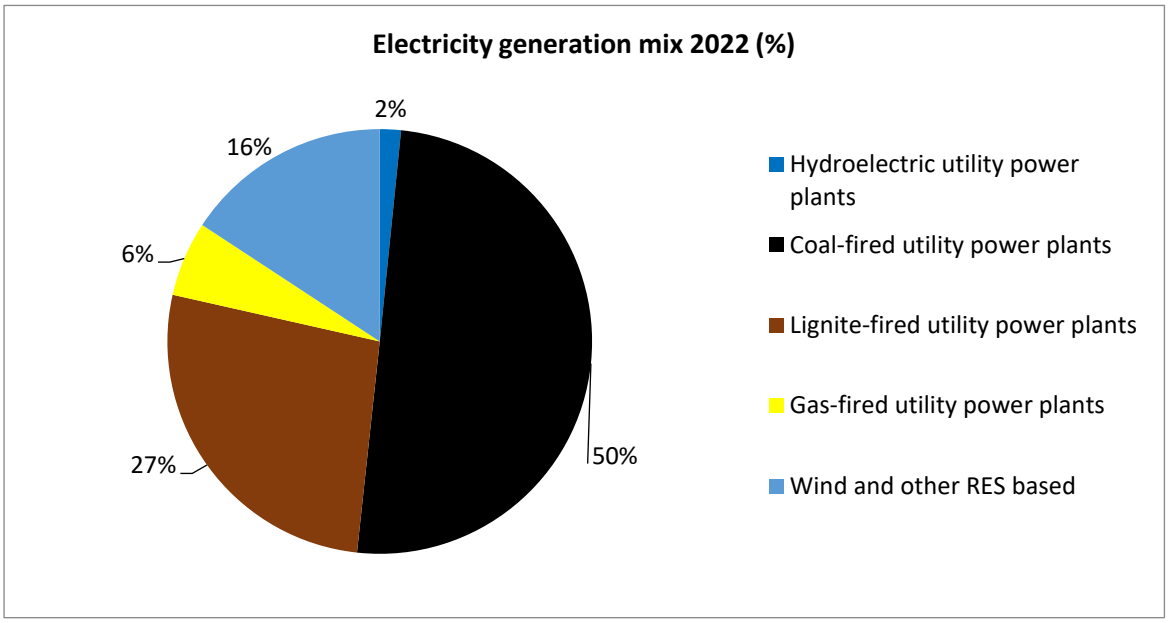
Fig. 1



Source: based on PSE data

[9] In 2010-2020 the mix included industrial power plants, which in 2010 accounted for 5.7% of electricity generation.

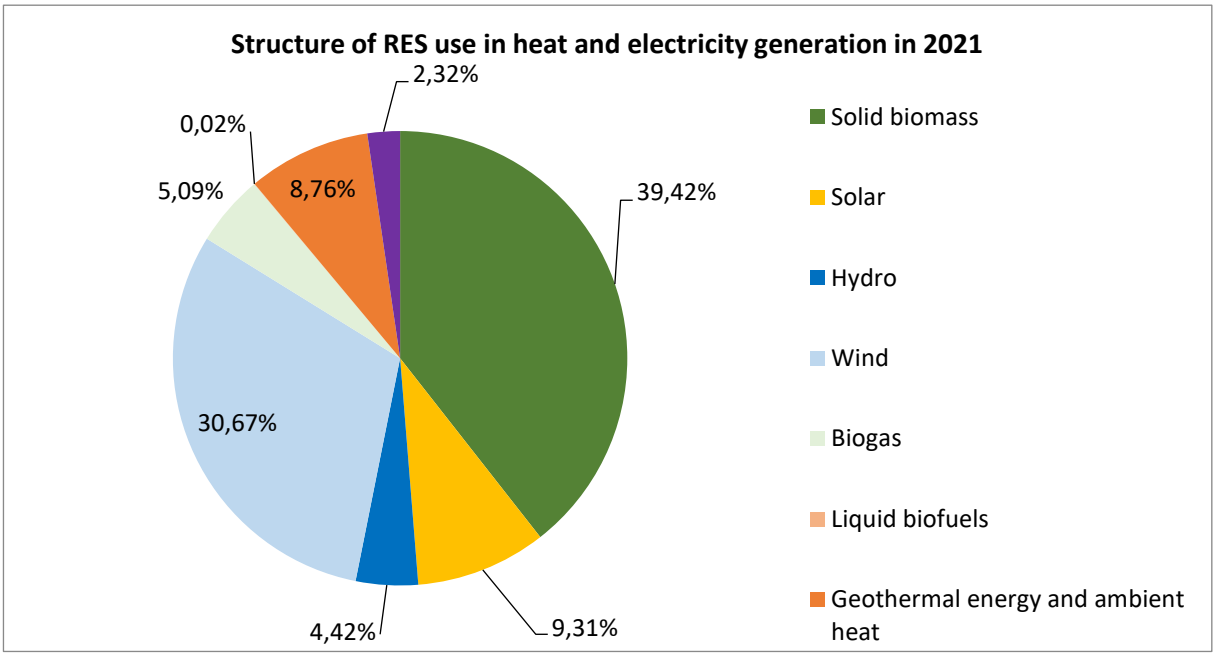
Fig. 2



Source: based on PSE data

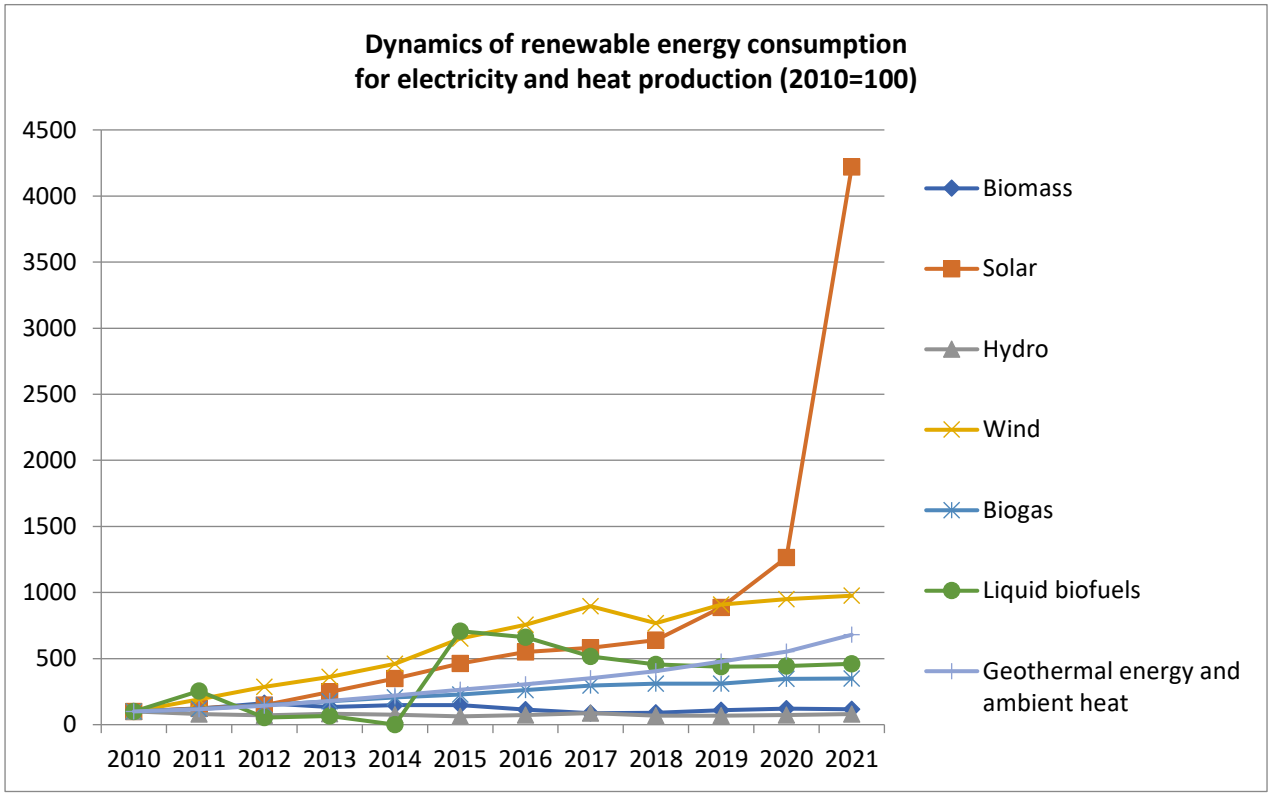
In 2021 the consumption of renewable energy sources in electricity generation and heat supply was 190 537.6 TJ (218% increase compared to 2010), of which biomass 39%, wind 31%, solar 9%, geothermal energy and ambient heat 9%, biogas 5%, hydro 4%, renewable municipal waste 2%, liquid biofuel 0% [0.02%]. Between 2010 and 2021 a few RES demonstrated very dynamic increases, with 2020/2021 ratios: 4221% for solar, 976% for wind, 680% for geothermal energy and ambient heat and 461% for liquid biofuels. Renewable municipal waste has been registered in the mix only since 2018. [Based on ARE data]

Fig. 3



Source: based on ARE data (as of 29.04.2023)

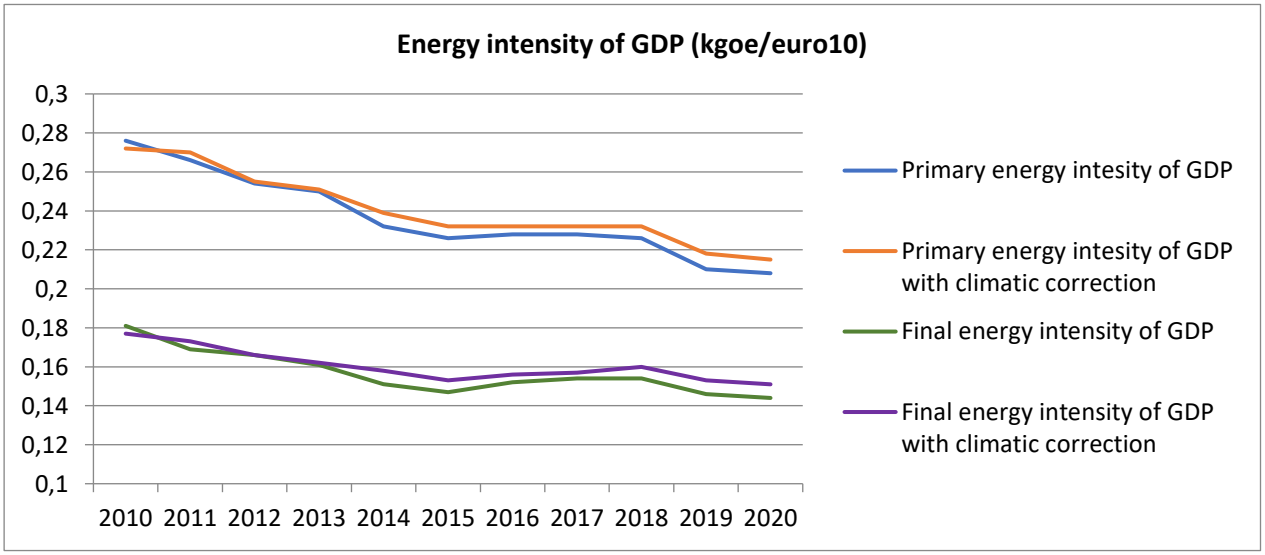
Fig. 4



Source: based on ARE data (as of 29.04.2023)

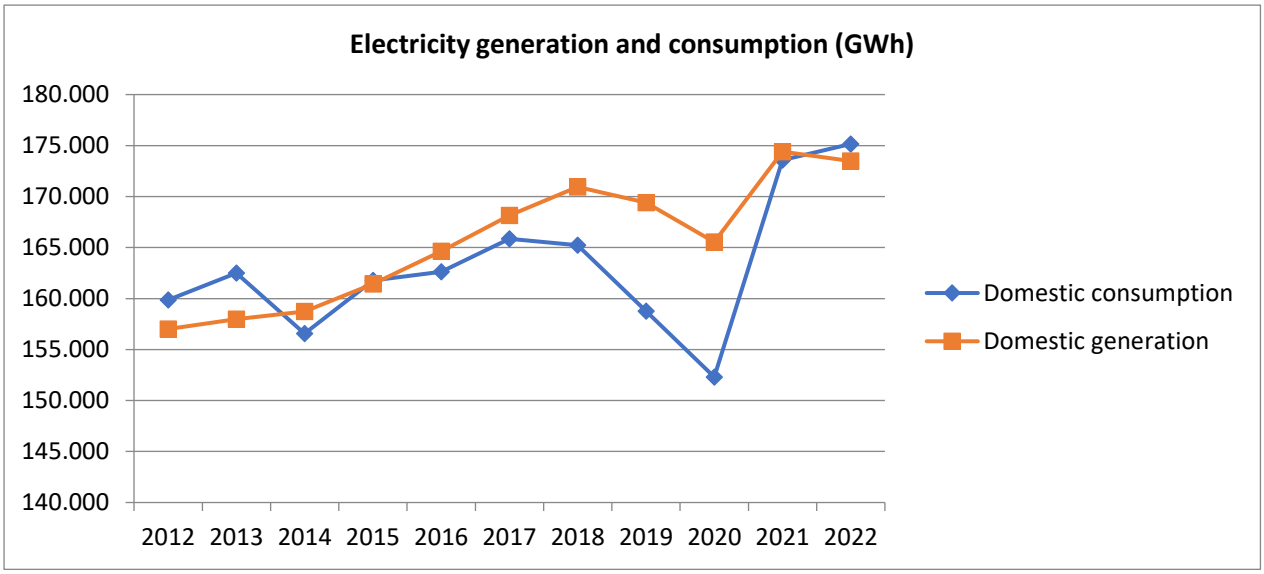
Energy consumption has been decoupled from GDP. In the years 2010-2020 the primary energy intensity of GDP noted a 24,6% decrease (with the average annual pace of 2,8%), while the final energy intensity of GDP dropped by 20,4% (with the average annual pace of 2.2%). Corrected by the climate factor the primary and final energy intensity fell by 21% and 14,7%. Over that period heating plant efficiency increased from 80,9% in 2010 (81% in 2011 and 2012) to 83,1% in 2020. [Based on Statistics Poland (GUS) data]

Fig. 5



Source: Statistics Poland (GUS)

Fig. 6



Source: PSE

Fossil-fuel based plants are predominantly situated in the close vicinity of coal and lignite deposits. As of the end of 2021 there were 20 active hard coal mines (of those 19 active mines are located in **the Upper Silesian Basin** and 1 in Bogdanka, Lubelskie region), and 8 hard coal mines under liquidation in SRK; 5 lignite mining plants (operating 7 active opencast-mines and 4 under liquidation). Coal and lignite power plants are concentrated in the same regions.

Gas and crude oil extraction plants included: 2 operating on the Polish waters of the Baltic sea, 2, which are PGNiG divisions in Sanok (south-east Poland) and Zielona Góra (south-west Poland), operating 52 gas or crude oil mines and 7 undground gas storage facilities, and 4 other plants. [WUG 2021] The two major refineries are located in Plock in central Poland and in Gdańsk on the Batlic Sea coast, where also the only Naftoport terminal in Gdańsk is located.

The highest concentration of wind power turbines are in the Baltic coastal area, which has the most favourable natural conditions.

3.2. Environmental trends in the energy sector

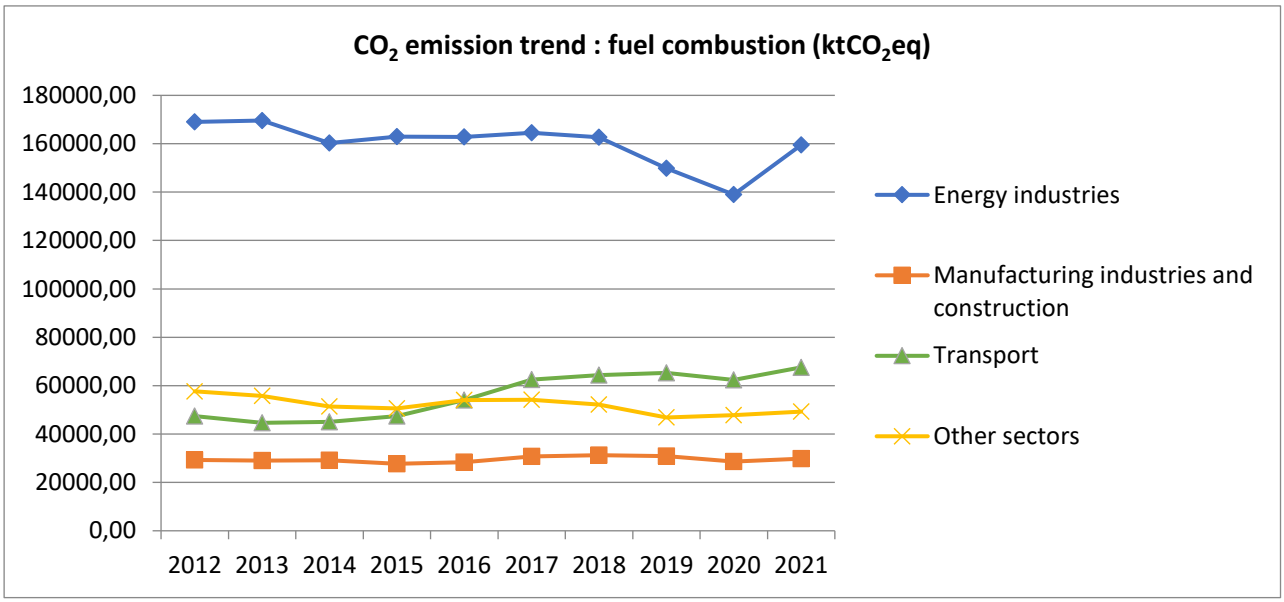
Total GHG emissions (without LULUCF) from energy[10] amounted to 336170,52 CO_2 eq (kt) in 2021 (a notable increase from 305335.93 CO_2 eq (kt) in 2020), i.e. (0.4% less than in 2012 and 70.1% less than in base year).

CO_2 was responsible for 92% of energy related GHG emissions. As much as 99% of CO_2 emissions originated from fuel combustion and 1% from fugitive emissions from fuels. In 2021 the total **CO_2 emissions from fuel combustion** amounted to 306255.28 kt CO_2eq 30% decrease from base year, but 1% increase from 2012, and as much as 10% increase from 2020). As of 2021 energy industries reduced their CO_2 emissions by 6 % compared to 2012 (from

[10] *Energy covers: A. Fuel combustion (all sectors), B. Fugitive emissions from fuels, C. CO2 transport and storage.*

168997.12 kt CO_2eq to 159 531.67 kt CO_2eq; and by 38% from base year), while manufacturing industries and construction – noted a 2% increase. Over the same period, emissions from transport increased by 42% (180% from base year). The other sectors noted a 14% reduction. [Based on KOBiZE data: Inventory 2021: Submission 2023 v1].

Fig. 7



Source: based on KOBiZE data

Compared to the reference value of 100 for the year 2000, overall GHG emission intensity of energy consumption fell from 92.3% in 2011 to 82.2% in 2020 to reach 84.4% in 2021 [Eurostat SDG_13_20]. The highest **CO_2 emission intensity**, measured as CO_2 emission per 1TJ of energy consumption, was observed in energy industries: 0.9 kt CO_2 in 2021. In three sectors: manufacturing and construction, transport, and agriculture/forestry/fishing it amounted to 0.07 kt CO_2 while commercial/institutional and residential sectors emitted 0.06 kt and 0.05kt CO_2 per 1TJ respectively. [Based on KOBiZE data: Inventory 2021: Submission 2023 v1].

A big problem for Poland is polluted air. The energy industries sector[11] is the biggest contributor to SO_2 emissions (182.8 kt or 42% in 2020) and a medium contributor to NOx emissions (124.5 kt or 21% in 2020). Other major SO_2 emission contributors are households and fuel combustion in industry (29% and 18% respectively). Households are also the biggest source of particulate matter pollution (43%). Between 2010 and 2020, energy industries reduced their emission levels: SO_2 by 42%, NOx by 21%, particulate matter by 66%. Also emissions from households noted remarkable reductions: SO_2 by 31%, NOx by 24%, particulate matter by 35%. [Based on Statistics Poland (GUS) data]

[11] Public electricity and heat production, refineries and manufacture of solid fuels and other energy industries

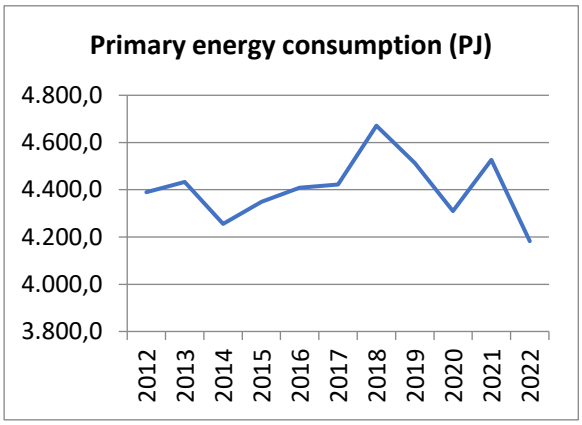
Environmental impacts from coal and lignite mining include land devastation and degradation, wastewater from mine drainage (including saline waters), disturbed water relations and ground sinks. Land devastated and degraded by mining and quarrying to extract energy materials, which require reclamation amounted to 12,398 hectares (as of 2021), most of which was found in lignite open-cast mining regions: 56% in Wielkopolska, 11% in Łódzkie, and 10% in Lower Silesia; and also in hard-coal mining Silesia - 18%. In comparison, reclamation needing land affected by energy, gas and water supply activity totalled 777 ha. Lands under hard-coal and lignite mining activity as of 2021 covered 5,371 ha and 17,430 ha, respectively. Over 2021, 610 ha was reclaimed, 149 ha managed, 539 ha managed and transferred to other users. [Based on Statistics Poland (GUS) data]

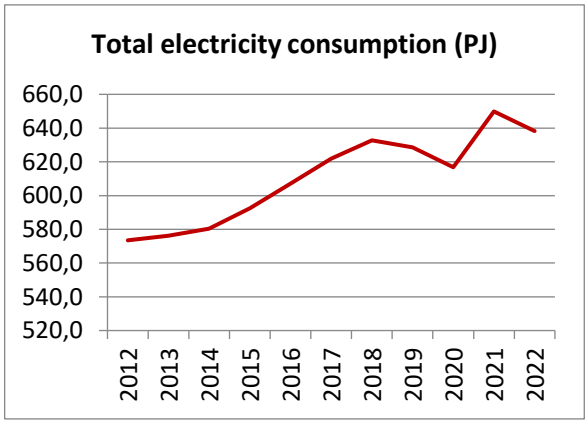
3.3. Economic trends in the energy sector

The contribution to the total Poland gross value added by the *electricity, gas, steam and air conditioning supply* sector equalled 3.0% in 2021 (compared to 3.1% in 2020 and 2016), *manufacture of coke and refined petroleum products* contributed 0.4% in 2020 (compared to 0.6% in 2016; no data available for 2021). Disaggregated data for fossil energy material mining and extraction are not available[12]. [Based on OECD data 6A. Value added and its components by activity, ISIC rev4]

In 2022 **primary energy consumption** was 4182.4 PJ, 5% lower than in 2012, and in between it was going up and down with a peak in 2018 and a smaller one in 2021. Meanwhile **primary energy consumption** showed a relatively consistent growing trend (11% increase from 2012 to 2022 when it reached 638.3 PJ), interrupted by a temporary sink in 2020. [Based on ARE data as of 29.04.2033]

Fig. 8



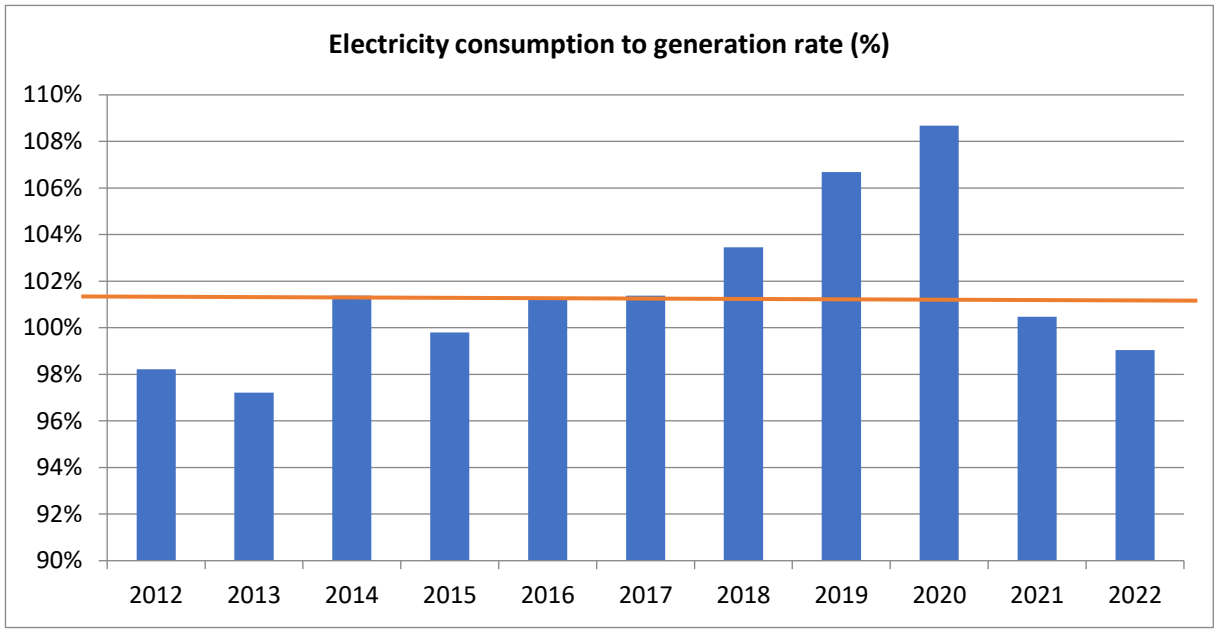


Source: ARE data as of 29.04.2023

Electricity consumption to production ratio was close to 100% until 2018, when it exceeded 103%, to rise to 107% and 109% in 2019 and 2020 respectively, and fall back to 100% in 2021, and 99% in 2022. [Based on PSE data]

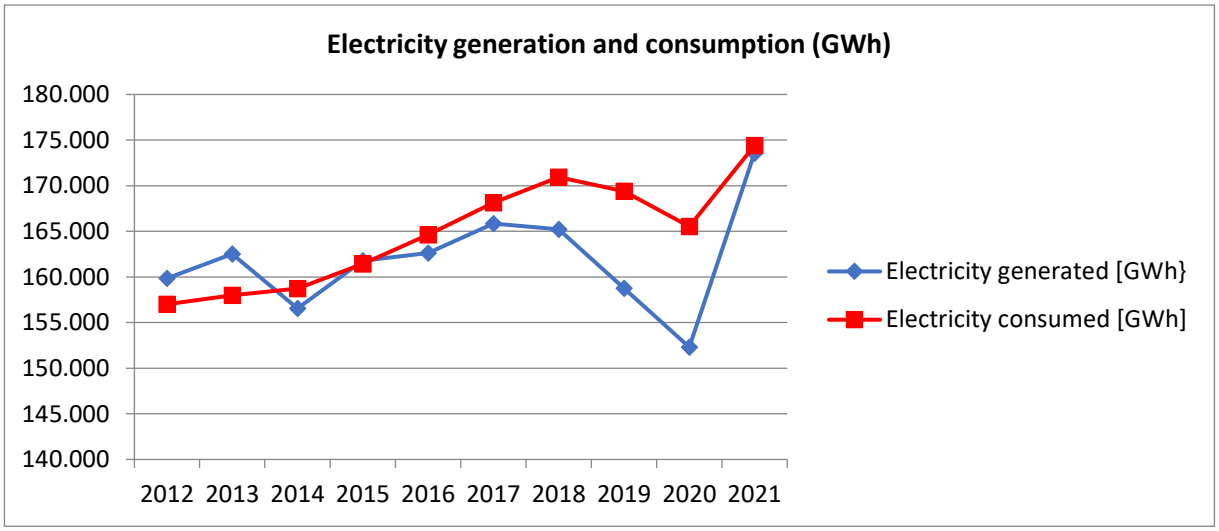
[12] The available aggregated data for mining and quarrying, includes, among others, also copper mining, and therefore is of limited usability.

Fig. 9



Source: based on PSE data

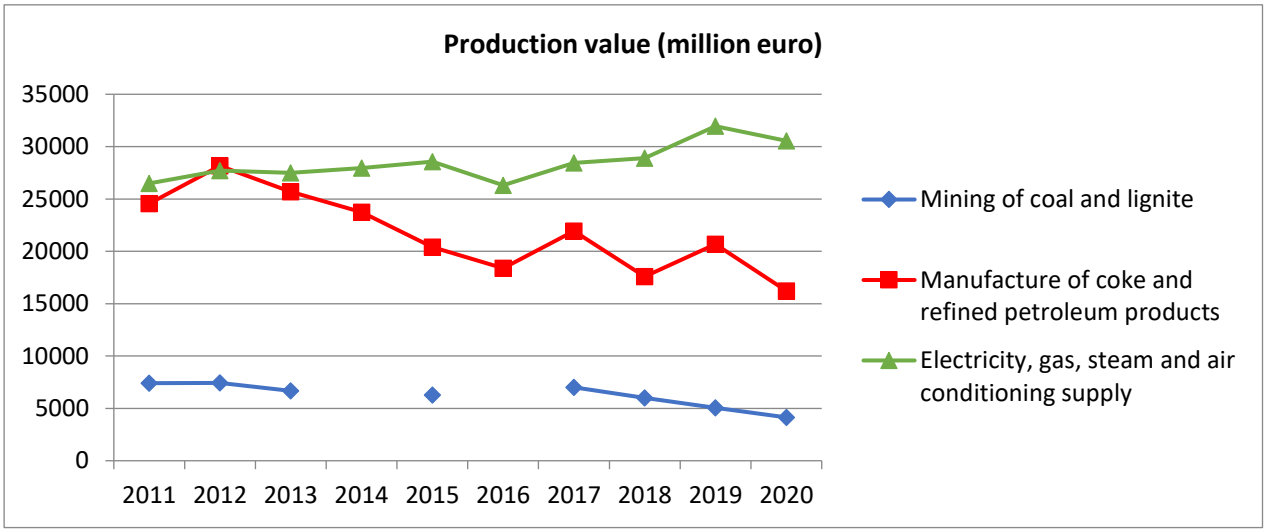
Fig. 10



Source: based on PSE data

From 2011 to 2020 the **production value** of *mining of coal and lignite*, and *manufacture of coke and petroleum products* dropped by 44% and 34% respectively. Contrariwise *electricity, gas, steam and air conditioning supply* noted a 15% production value increase.[Based on Eurostat data SBS_NA_IND_R2]

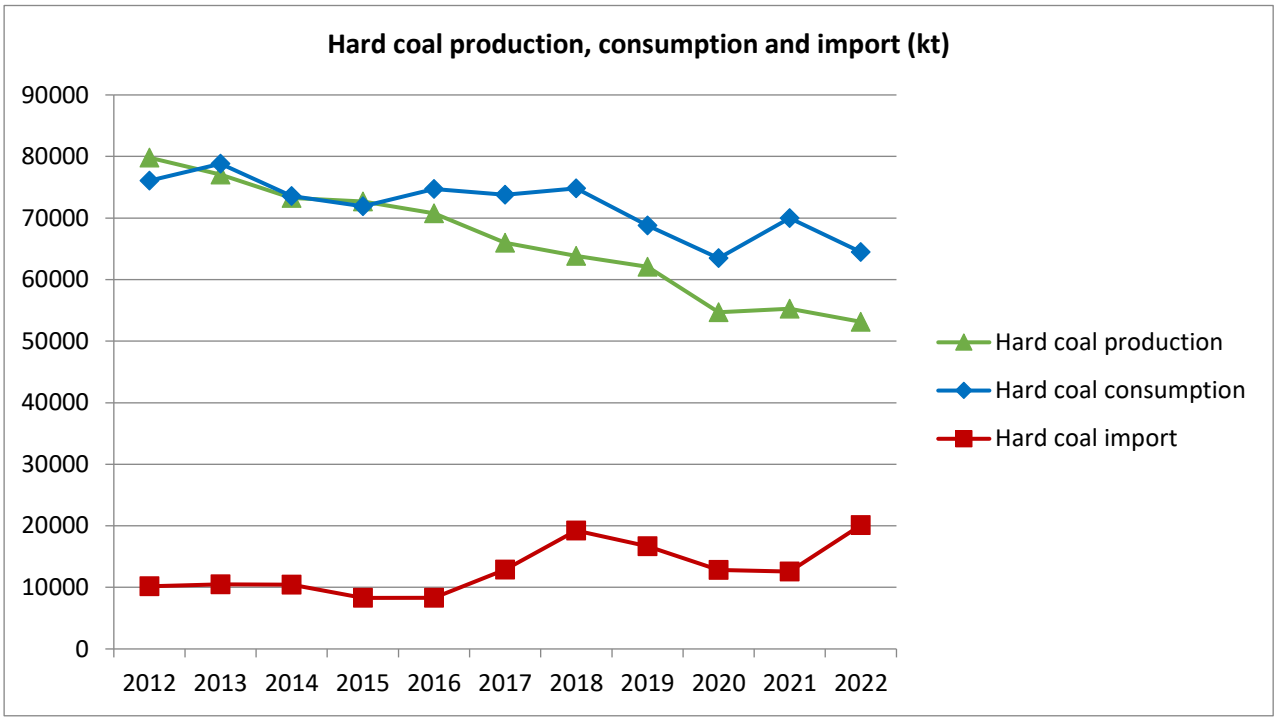
Fig. 11



Source: Eurostat SBS_NA_IND_R2

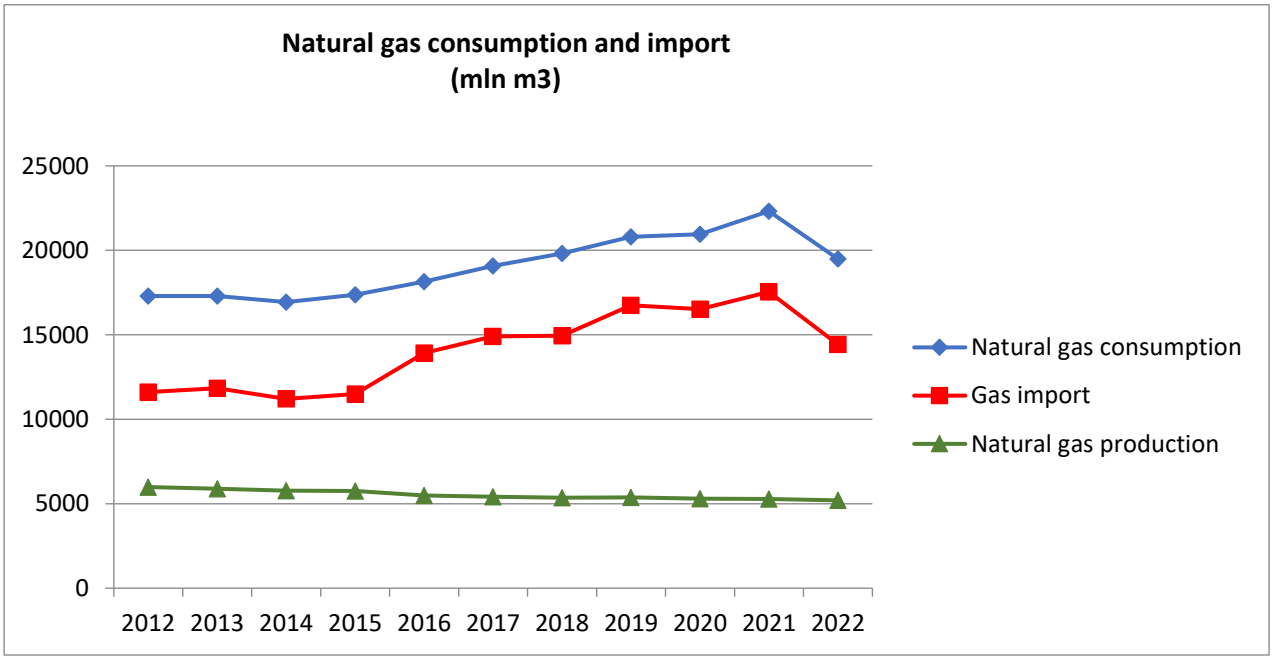
From 2012 to 2022 the **production** of hard coal dropped by 33% from 79812.8 kt (1887.7 PJ) to 53145.2 kt (1265.6 PJ), and that of lignite fell by 15.% from 64,279.8 kt (533.1 PJ) to 54,621.4 kt (444.0 PJ), a higher amount than in 2021. Extraction of gas declined by 14% to 5198.1 mln m^3 (136.8 PJ). The amount of crude oil extracted was 854.1 kt (36.3 PJ), higher by 26% than in 2012, but declining since the peak of 1010,3 kt (42.9 PJ) in 2018. Over the same period the total energy generated from hydro, wind, solar, geothermal and ambient heat sources increased by 330% from 28.6 PJ to 122.7 PJ (103 TWh to 441.8 TWh), energy from wood was stable at the level of 200 PJ from 2012 to 2017 to rise above 300 PJ in 2018 and remain at the latter level since then, while annually generated energy from waste fuels and other materials was fluctuating around 184 PJ. [Based on ARE data as of 29.04.2023]

Fig. 12



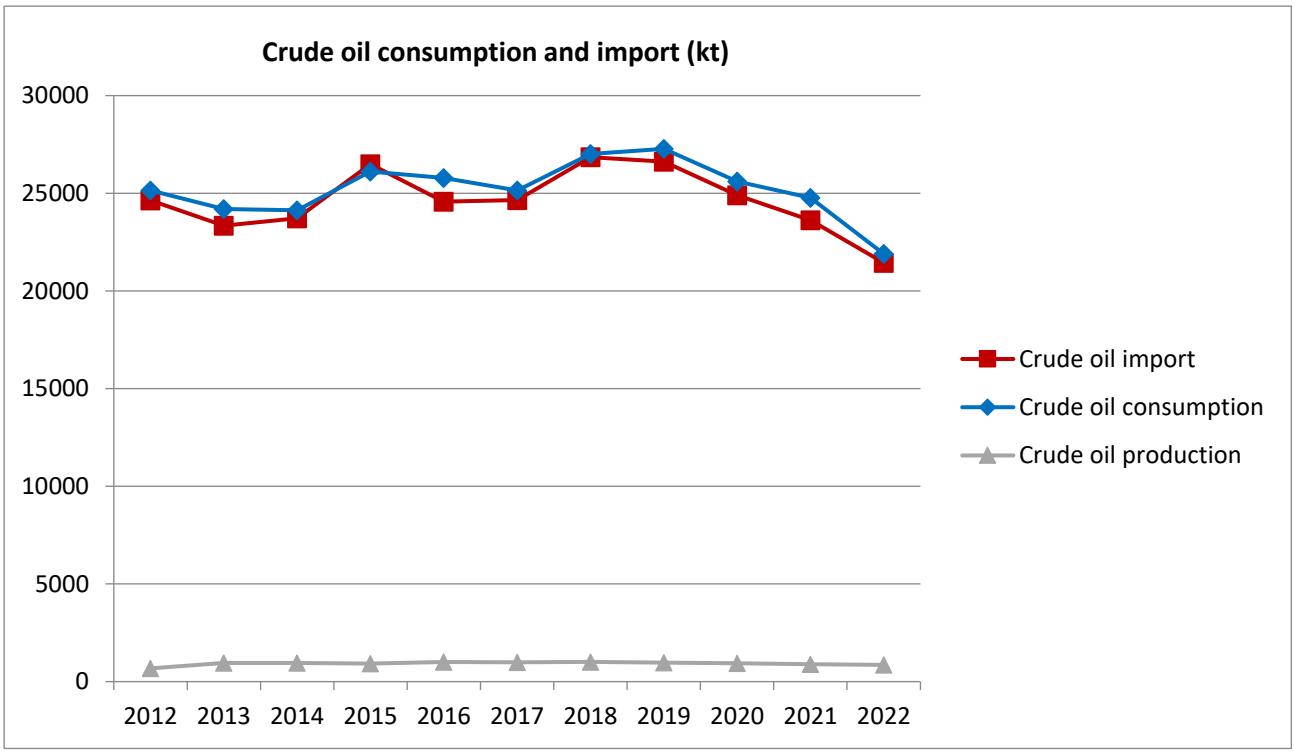
Source: based on ARE data as of 29.04.2023

Fig. 13



Source: based on ARE data as of 29.04.2023

Fig. 14



Source: based on ARE data as of 29.04.2023

Over the last decade (from 2012 to 2021) the share of **import**ed hard coal in the domestic primary energy consumption increased from 13% to 26% in 2018 and subsequently declined to 18% in 2021, rising to 31% in 2022. The share of imported natural gas increased from 67% in 2012 to 79% in 2021 and 74% in 2022. At the same time, the domestic hard coal production was declining and the natural gas share in the energy mix was increasing[13]. The imports of oil represented 95% of the demand in 2021 (noting a slight decline from 99% in 2018) and 98% in 2022. Poland was also an exporter of small amounts of hard coal (6505.2 kt in 2021, 5476.9 kt in 2022). [Based on ARE data as of 29.04.2023]

Box 1 Energy sector in the pandemic

Energy production and consumption trends were disturbed by the pandemic, noting a sink from 2019 to 2020, followed by a recovery from 2020 to 2021. The total energy production fell by 4% (from 4522.9 PJ in 2019 to 4328.5 PJ in 2020) to bounce back to 4,561.9 PJ in 2021. Likewise electricity consumption noted 2% decline from 2019 to 2020, followed by 5% increase from 2020 to 2021 when it reached 649.9 PJ, an unprecedented value in the decade. [Based on ARE data as of 29.04.2023] The pandemic caused a fall in coal production and coal-fired power generation, however RES-generated electricity remained relatively stable, due to favourable market conditions. [PEA 2022]. Electricity supply deficit was bridged by an import of 13.3 TWh equivalent to 7.8% of domestic consumption. [FE 2021]

[13]*However between 2021 and 2022 the natural gas share dropped by 1% according to ARE data as of 29.04.2023.*

Box 2 Energy sector during the war in Ukraine

The war contributed to a spike in natural gas price as well as destabilised the domestic hard coal market, and made it necessary to replace cheap imports from Russia with coal from other directions, while Russia's invasion contributed to almost threefold increase in coal prices [PEA 2022]. From 2020 to 2021 the domestic production of hard coal increased by 1% and that of lignite by 14% (in the latter case exceeding the volume of 2019) [based on ARE data]. In 2021 coal-generated electricity was 93037 GWh, the highest score in the decade, and lignite-generated electricity exceeded the prepandemic value of 2019. Together, hard coal and lignite increased their share in electricity mix by 3% compared to 2020. [Based on PSE data]

The energy sector is dominated by State controlled companies including PGE, Tauron, Enea and PKN Orlen, which are electricity generation owners and wholesale and retail electricity sellers. The Polish electricity transmission network is 100% State owned and operated by a few State owned or controlled companies. The key hard coal mine operators are state owned, of which the largest are PGG (8 mines and 36600 workers) and JSW (5 mines and 22000 workers) (data as of the end of 2020). The biggest lignite mine operators are PGE, ZEPAK and the Sieniawa Lignite Mine Company, of which the first is state-owned, and the other two are private. The lignite and coal-fired generation assets are to be separated from State-controlled companies and transferred to form a new State-controlled holding: NABE. The gas sector is dominated by State-owned PGNiG (merged into Orlen Capital Group in Dec. 2022), which is also the dominant producer of crude oil in Poland. PGNiG and PKN Orlen (merged with LOTOS in mid-2022) own the domestic oil production and refining capacity and dominate wholesale oil products supply. PERN (100% State-owned) owns most of oil pipeline infrastructures, and approx. half of crude oil storage and oil product storage. [IEA 2022]

3.4. Employment trends in the energy sector

The energy sector represents 2% of the total number of employed in the national economy . The largest groups of employed within the sector work in *electricity, gas, steam and air conditioning supply* representing over 59% jobs, and in *the mining of coal and lignite*: 33% jobs (43% and 48% respectively in 2012). The remaining 10% jobs were in the extraction of crude oil and gas and the manufacture of coke and refined petroleum products. [Calculations based on 2022 data of Eurostat LFSA_EGAN22D].

The sector is highly masculinised: 82% of the employed are men (92% in *mining of coal and lignite*,77% in *electricity, gas, steam and air conditioning*). [Calculations based on 2022 data of Eurostat LFSA_EGAN22D]).

The coal mining workforce is characterised by relatively low average worker age: 39 in 2019 in Silesian mines [Sokołowski et al 2021 p.13], at the same time, more than 40% of the miners will have retired by 2030 [Sokołowski et al 2021. p. 16]. This results from an early retirement age of mine workers, who are entitled to miner retirement pension after 25 years of mining work

underground irrespective of age, or they may retire at 50 or 55 years of age if they have worked 25 years (women 20 years) in mining of which 15 or 10 years underground, respectively.

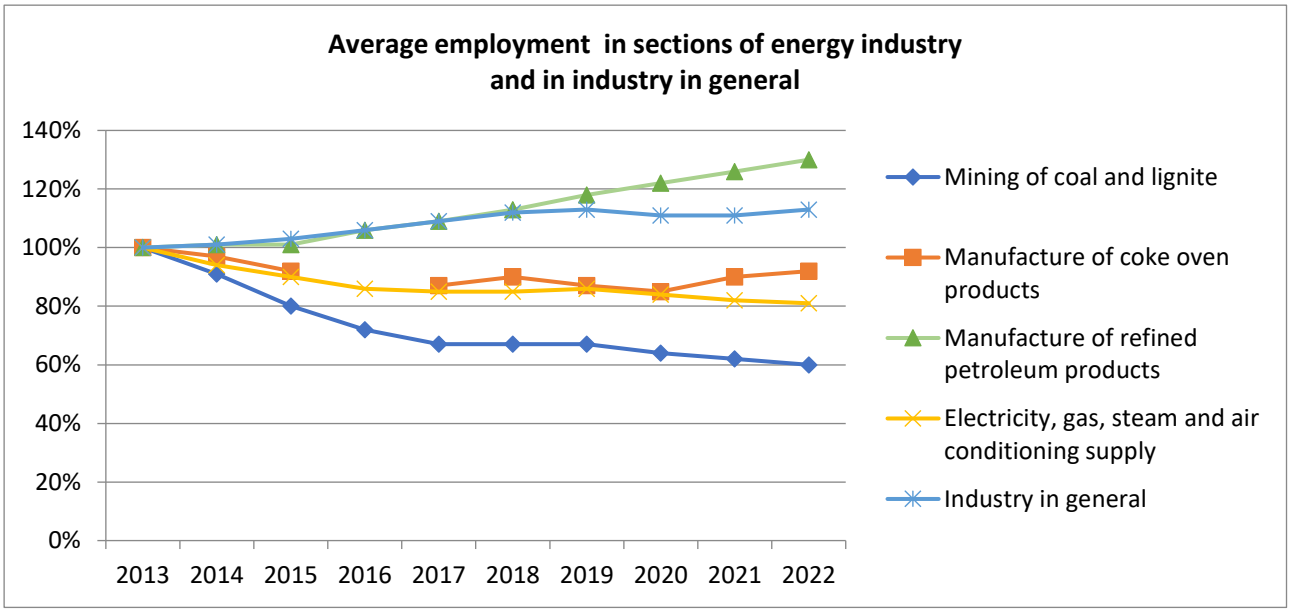
In Silesia (which has 94% share in the subsector workforce) blue collar workers represent 77%, engineering and technical supervision staff – 17%, administrative employees – 6%. Women predominantly hold blue-collar or administrative jobs on the surface. [Sokołowski et al 2021 p. 13] In *electricity, gas, steam and air conditioning supply* the dominating occupations are: professionals (26%), technicians and associated professionals (24%), as well as craft and related trades workers (26%). Plant and machine operators and assemblers represent 6%, and clerical staff and managers - 7% each group. [Calculations based on 2022 data of Eurostat LFSA_EISN2[14]].

3.4.1 The impacts of the energy transition on employment (direct and indirect)

In 2022 the average employment in the Polish energy sector (in enterprises employing at least 50 persons) was 196,100: including 111,700 jobs in *electricity, gas, steam and air conditioning supply*, 70,400 in *mining of coal and lignite*; 3,600 in *manufacture of oven coke*[15]; and 10,700 in *manufacture of refined petroleum products*. The change from 2013 to 2022 was: a fall by 14% in *electricity, gas, steam and air conditioning supply*, a fall by 40% in *mining of coal and lignite*, a fall by 8% in *manufacture of oven coke*; and a rise by 30% in *manufacture of refined petroleum products*. [Based on Statistics Poland (GUS) data[16]]

[14] No data available on elementary occupations.
[15] The latter two figures are averages for the first quarter of 2022
[16] https://stat.gov.pl/obszary-tematyczne/przemysl-budownictwo-srodki-trwale/przemysl/naklady-i-wyniki-przemyslu-1-3-kwartal-2022-roku,4,48.html The source data does not include enterprises of less than 50 employees. No data is provided on the average employment in gas and oil extraction.

Fig. 15

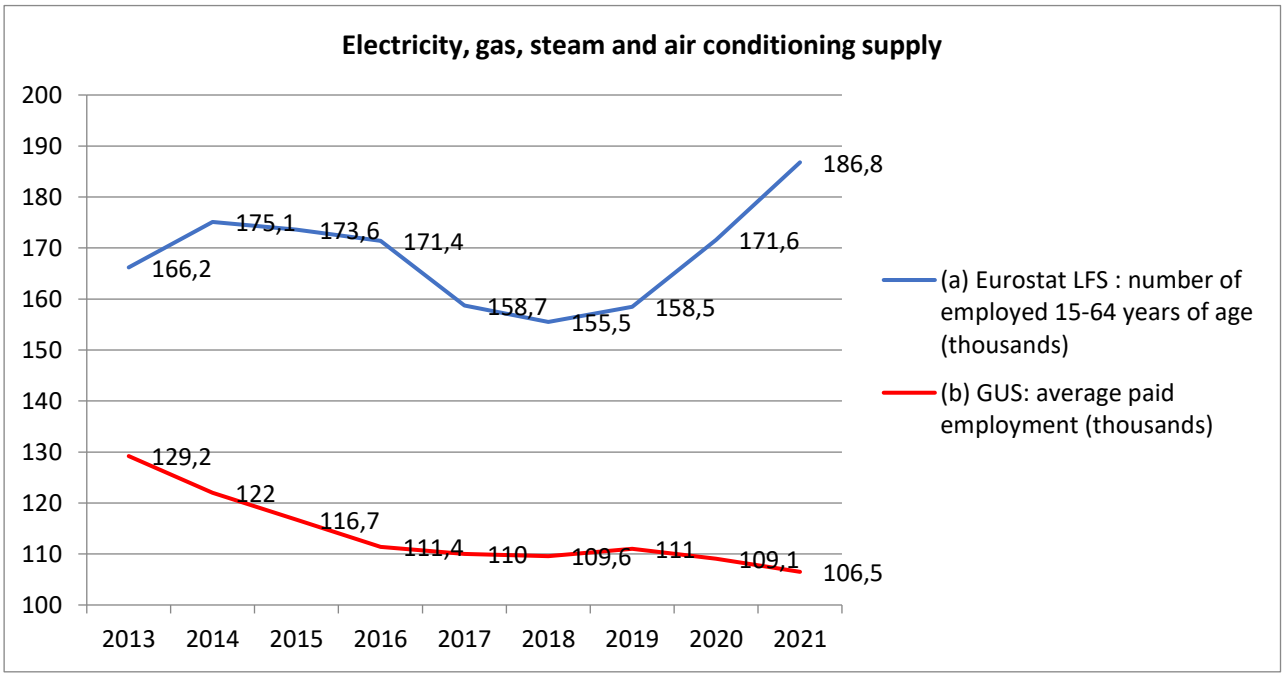


Note: data covers enterprises employing 50 and more persons. Industry in general includes B+C+D+E NACE sectors.

Source: Statistics Poland (GUS)

Regarding employment trend in *electricity, gas, steam and air conditioning supply* there is an interesting discrepancy between the Statistics Poland (GUS) data from enterprises 50+ and the EU Labour Force Survey. On the one hand, digitalisation and automation may have been contributing to employment decline in bigger companies (which dominate the sector), on the other hand RE is likely to create job opportunities in smaller companies or for self-employed.

Fig. 16



Note:

(a) based on the EU Labour Force Survey. There was a break in data series between 2020 and 2021 (change in methodology)

(b) indicates full-time job equivalents in companies employing at least 50 persons (based on data supplied by companies)

Source: based on Statistics Poland (GUS) and Eurostat LFSA_EGAN22D

The number of employed in **fossil-fuel mining and extraction in Poland** as of 31st Dec. 2021 was 112,546 of whom 76,413 by mining/extraction companies (38% fall from 2012) and 36,133 by mining related service providing entities. The data for specific fuels are indicated in Table2.

Table 2 Number of employed in fossil-fuel mining and extraction in Poland.

	Mining/extraction companies			Mining-related service providing entities	
Year	2012	2019	2021	2020	2021
hard coal	*106103*	*76852*	*69413*	*29831*	*27295*
lignite	*12549*	*6190*	*4446*	*3494*	*2853*
gas and oil	*3377*	*2523*	*2554*	*5657*	*5985*
Total	122029	85565	76413	38982	36133

Source: based on WUG https://www.wug.gov.pl/bhp/stan_bhp_w_gornictwie

As of 2019 **indirect jobs related to coal mining** amounted to 112000 (of which 90% were located in the Silesia region) included:

- 56,700 jobs in **mining related goods and services**: of which 13,900 in manufacturing (e.g. in the production of mining machinery), 10,000 in transport , and 7,600 in trade and repair.
- 41,700 (approx.) jobs in coal-based part of **power sector**: approx. 21,000 in coal-based electricity generation and 20,700 in coal-based heating
- 13,600 jobs in **coking industry** [TJTP Silesia: Urząd Marszałkowski Województwa Śląskiego 2020, Potencjał p. 33]

Direct and indirect jobs in renewable energy (full time equivalent) amounted to 92,600 in 2021 (33600 in 2012), of which:

- 32,700 in solid biofuels (falling since the peak of 39,100 reached in 2019),

- 20,200 in PV (continued steep increase from 350 in 2014, boosted by solar energy support programmes)

- 17,900 in biofuels (compared to peak values of 31,400-41,200 in 2016-2018)

- 10,900 in wind power (a recovery after the fall from 11,500 in 2015 to 3000 in 2018 caused by legal limitations imposed on siting new in-land turbines). [Data based on EurObservER

2014-2021]

The reduction of workforce in coal mining in recent years can largely be attributed to scheduled retirement combined with a hiring freeze. In the process of downsizing coal extraction some workers are relocated from closing mines to the ones which continue their operation. Few workers decide to leave jobs, taking a severance pay, negotiated under the social contract [Sobiesiak-Penszko et al 2022]. Due to low unemployment rates and relatively slow pace of the transition so far, the labour market has been able to easily absorb workers leaving the mining sector, while the war in Ukraine resulted in labour market freeze, as the pressure grew on increasing the domestic production of coal.

The actual factors which determine the feasible job opportunities are skills and competencies (actual and required), green transition related job trends, and the features of local labour markets in the affected regions (given the limited worker mobility).

Apparently, the most realistic employment opportunities for ex coal-workers are provided by construction sector due to relative similarity in required skills and competencies and promising job creation prospects, according to estimates by IBS [Fundacja WWF 2021] it may create 11,000-22,000 new jobs by 2030, but also transport and logistics [TJTP Silesia: Urząd Marszałkowski Województwa Śląskiego 2020 p.35]. Construction and transport seem to match miner preferences [see Kiewra et al 2019; Christiaensen et al 2022 (3)]. At the same it is in those sectors that deficit occupations (i.e. those in which deficit of workers is projected) are found [WUP w Krakowie 2023]

Employment in construction is expected to be boosted especially by energy efficiency related demand for thermal insulation and retrofitting of buildings. Otherwise there are green job prospects linked to land reclamation and renewable energy (especially in wind power, photovoltaics, e.g. on post-mining areas, and bioenergy). Renewable energy was consequently indicated as the most attractive sector to work in three coal regions studied by World Bank [Christiaensen et al 2022 (1), (2), (3)], however mostly by higher educated and younger workers, yet negatively assessed by Wielkopolska miners who would rather find a job in construction. Development of electromobility has already challenged the current jobs in the automotive industry value chain, which makes this sector a less realistic employment destination for ex-coal workers, even if listed among their preferences in 2018 [Cf. results of miners' survey in Kiewra et al 2019]. In a more recent WB study Silesian miners indicated manufacturing industry among the least attractive alternatives [Christiaensen et al 2022 (1)]. Meanwhile job opportunities driven by circular economy include re-manufacturing (relevant for highly industrialised Silesia) besides repair and recycling, as well industrial waste use and municipal waste treatment technologies [TJTP Silesia: Urząd Marszałkowski Województwa Śląskiego 2020]. Other prospective areas of green job development are renewable materials, smart facility management, design and management of blue and green infrastructure. Actual local job opportunities will largely depend on local conditions and development potentials (and may involve, for instance, tourism in Wielkopolska).

The actual transition pathways for coal-workers may be limited by their strong aversion to relocation and commuting and a preference of continued use current competencies (particularly strong among women and older workers). For instance, in the WB study carried out in coal regions [Christiaensen et al 2022 (1), (3)] an additional hour to commute was worth 1/5th of a monthly salary in Wielkopolska, as well as in Upper Silesia. In Silesia, financial compensation justifying moving abroad for work was evaluated at PLN 2,448 per month and moving to another region within Poland at PLN 1,651, while in Wielkopolska: PLN 5055 per month and PLN 2705 per month (equivalent of monthly and half a monthly average per month).

The Occupation Barometer, which is a tool projecting the demand for occupations at national, regional and powiat levels does not allow to trace those occupations which are related to green economy or RES are as they are spread across occupational groups, however qualifications in this area are increasingly being included in the recruitment expectations of employers adapting their companies to the circular economy or providing services in this area, as reported in Wielkopolska region [WUP w Poznaniu 2023].

3.4.2 Skill needs and training

The need of traning and reskilling and upskilling depends on the overlap of needed skillsets between declining jobs and available new jobs (which depend also on technological change and the need to diversify economies whose labour markets will be most affected by the energy transition) and workers' job preferences. It also depends on workers transversal skills levels.

Self-assessment based studies [Christiaensen 2022(1),(2), (3)] show that the transversal skills of coal-related workers, compared with the rest of the labour force in Poland[17], controlled for education level, are on average on similar level as displayed by the other Poles, for most skills. They are substantially higher for maintenance, assembly and repair skills and slightly lower for advanced digital skills. Miners show the lowest level of transversal skills, with the highest gap in organisation at work, digital skills, and ability to perform simple calculations. The skill gaps of Silesian coal workers are higher when compared within the age cohort of less than 45 years. [Christiaensen 2022(1),(2), (3]

Even though renewable energy sector might be seen as the most attractive employment alternative for coal-based energy workforce, it scores relatively low in skill similarity[18]: 0.54 from *a mechanic of opencast mining machinery* to *an equipment fitter of RE devices*, 0.36 from *a mining engineer in lignite mining* to *an engineer of RE equipment and systems*, and as low as 0.26 from *a technician of opencast mining and equipment* to *a technician of RE systems.* [Christiaensen 2022 (3)]

Given the comparison of skillsets as well as salary levels, viable pathways can be found for technical operators (for instance from driver of mining hosting machines to driver of specialised railway cranes in Silesia, or from truck mechanic to tractor mechanic in Wielkopolska), though more difficult in the case of higher skilled specialised employees compared to non-sector specific workers, as indicated by the WB studies. No viable options could be identified by WB

[17] With the data from the Polish Human Capital Balance (Bilans Kapitału Ludzkiego) survey as reference.
[18] Where 0 would indicate no skill overlap, and 1 – full skill overlap.

experts for lignite mining technician or underground miners in Silesia due to high salary disproportions (50% lower and 30-40% lower in the target jobs respectively).

The need of measures to support green jobs creation is recognized in the National Action Plan for Employment [Ministerstwo Rozwoju, Pracy i Technologii 2021], alongside with jobs in silver economy and upskilling for digitalisation. Sectoral Skill Councils are considered as the proper fora for co-operation with employers in identifying the detailed educational needs. Otherwise there are two mechanisms which shape the supply of formal vocational education: decisions of competent authorities to launch or discontinue courses educating for particular occupations, and the demand on part of the students. For instance in Silesia authorities have become reluctant to continue mining classes, as there were no students willing to take up such education, with a parallelly observed excessive demand for places in PV fitter. The necessary minimum training in mining professions is to be maintained until the cessation of the mining production, with simultaneous reskilling of the workers to jobs outside mining, to facilitate the transition. [TJTP Silesia: Urząd Marszałkowski Województwa Śląskiego 2020]. The Program for Hard Coal Mining in Poland [MAP 2022] provides for the workforce upskilling related to technological changes as well as automation and digitalisation of mining irrespective of one-time re-training course for employees of mining enterprises secured under the provision of a Social Contract negotiated between the government and miners (see Chapter 4). IBS projects a shortage of engineering and technical supervision staff in 2040, who will be needed in the process of coal mines decommissioning, suggesting that it could be alleviated by upskilling of some blue-collar underground workers. [Antosiewicz et al 2021 p. 17]

Under TJTPs skill building of workers is to be supported through development programmes targeting enterprises and promoting vocational education. Worker mobility programmes include: outplacement via (a) occupational transition path (statutory labour market instruments and services, specialist training and education courses, certifying examinations, job placement; counselling and vocational guidance, subsidised employment and retrofitting of workplace (b) support to start a business combined with training and advisory services, (c) redeployment including reskilling and upskilling of employees in order to preserve their jobs in enterprises undergoing restructuring to refocus their activities, in particular toward low-emission economy. [TJTP Silesia: Urząd Marszałkowski Województwa Śląskiego 2020].

3.4.3 The impact of the energy transition on work organization and working conditions

In the energy sector, coal mining stands out for OSH risks and high remuneration and consequently, transition to another sector is likely to involve lower salary, but safer working environment.

The most frequent risks found in the energy sector include:

- in mining of coal and lignite: dusts (including fibrous dusts and carcinogenic dusts), noise, strenuous work, excessive physical exertion, particularly dangerous machinery,

insufficient lighting, carcinogens, and hot microclimate
- in extraction of crude petroleum and natural gas: noise, particularly dangerous machinery, strenuous work
- in manufacture of coke and refined petroleum products: strenuous work, excessive physical exertion, hot microclimate, noise, radiation
- in electricity, gas, steam and air conditioning supply: particularly dangerous machinery, strenuous work, noise and other strenuous work related factors [Statistics Poland Zatrudnieni w warunkach zagrożenia związanego z uciążliwością pracy według sekcji i działów w 2020]

Among different sectors of economy, mining and quarrying represents the highest occupational accident risk per 1000 employed (14.17 total, 0.07 fatal, 0.06 severe), yet comparable to the ones found in water supply, waste management, land reclamation. Construction has a similar incidence of fatal and severe accidents, but only 4.56 total accident rate. In comparison, the accident rates in electricity, gas, steam and air conditioning supply were: 5.96 total, and 0.04 fatal and 0.07 severe. [Statistics Poland (GUS): preliminary data for 2021 published on 08.04.2023].

Staff reduction in coal and lignite mining combined with ceased investments in assets maintenance or modernisation is perceived by some miners as potentially increasing occupational risks to which they are exposed. [Sobiesiak-Penszko et al 2022] The total number of accidents per one million ton was rising continuously from 25.9 in 2017 to 32.7 in 2021. Over that time the total number of accidents per 1,000 employed was relatively stable, but increased from 16.1 in 2020 to 18.3 in 2021 (the fatal accidents ratio increased from 0.15 to 0.17). In 2021 fatal and severe accidents were caused by inappropriate use of mining machines and devices in 50% of the cases in hard coal mines, and in all the cases in open cast lignite mining. [Based on WUG data].

The exposure to OSH risks has been compensated by remunerations which are remarkably higher than the national average. In 2021 average monthly earnings in *mining and quarrying* sector were 52% higher than in the national economy, and in *electricity; gas, steam and air conditioning supply* 43% higher. [Calculations based on Statistics Poland (GUS) data for enterprises employing 50 persons or more]

3.4.4 The territorial and regional impacts of the energy transition (also in an intersectoral perspective)

Energy transition will particularly affect a few regions, among them - the most coal dependent Silesia, with 80% of Poland's mining sector employees, where coal mining represents 5% of employment and 6.9% gross value added in the region. In its Rybnik subregion coal related jobs represent as much as 20-50% of total employment. The number of workers to be affected by the transition in Silesia was estimated to be 72,000 in the mining conglomerates and

17,000 employed by subcontractors is (as of 2020) (without coal-based industries such as power stations and the coking industry) [Christiaensen et al 2022 (1)]. Outside the region there are two hard coal mines and a coal-fired power plant Siersza (4020 employees), operated by state owned company Tauron SA which are located in the easternmost part of the Upper Silesian Basin, in the west of the Małopolska region [TJTP Małopolska: Urząd Marszałkowski Województwa Małopolskiego 2022], and one hard coal mine (Bogdanka) situated in the Lubelskie region.

Most of lignite mining is located in Łódzkie region which is the site of a conglomerate consisting of open-cast mines and a lignite fired power plant (7530 employees), operated by the state owned Capital Group PGE and situated in the Piotrkowski and Sieradzki subregions. On average, the municipalities of Bełchatów district depend on PGE for 39% of their revenues, the highest reliance of municipal revenues on PGE was noted in Szczerców 80,3%, Rząśnia 79,4%, Sulmierzyce 78,6% and Kleszczów 53,6%. [TJTP Łódzkie: Urząd Marszałkowski Województwa Łódzkiego 2021] . Another lignite conglomerate consisting of open-cast mines and a lignite fired power plant (3800 employees) operated by privately owned ZEPAK Capital Group, is situated in Eastern Wielkopolska, the Konin subregion. ZEPAK employees represent between 19-39% of employment in four neighbouring municipalities. Almost half of the Konin subregion working population is inactive. [Christiaensen et al 2022 (3]. Finally, Lower Silesia region is the site of a lignite open-cast mine and a lignite-fired plant, both operated by state-owned PGE, situated in the Zgorzelecki district, where 11% of employees work in lignite mining, 6% in the power plant and additional 5-8% in associated companies; 62% of the working-age population is inactive. [Christiaensen et al 2022 (2)] The neighbouring Wałbrzych sub-region in Lower Silesia relied heavily on the mining industry in the past, but due to the unfinished transformation it still suffers from low economic development, degraded infrastructure, a high coal share in heating and unreclaimed post-mining areas. [TJTP Wałbrzych: Urząd Marszallkowski Województwa Dolnośląskiego 2022] All the lignite regions suffer from large-scale degradation of the land surface, soils, water resources (depression funnel) and landscape, and a decline in biodiversity.

Five coal regions: Wielkopolska, Silesia and Western Małpolska, Łódzkie and Lower Silesia are beneficiaries of the Just Transition Fund in the amount of EUR 3.85 billion. The money has been very much awaited, even if its small compared to the investment needed to carry out the transition and mitigate its social and economic effects. The major challenge and concern is to use those limited funds so they are spent wisely and effectively, especially that the timespan for that remains very short.

3.5. Drivers, Barriers and dilemmas to the energy transition

The key drivers of the energy transition are: EU policy and related EU level legislation, as well as driven by it national policies, strategies, programs and regulations; dedicated support schemes and market incentives targeting different stakeholders (citizens, prosumers, enterprises, municipalities, and other entities); continued reduction technology costs in the case of RES [PEA 2022], consumer (especially corporate consumer) and large enterprise pressure as a result

of implementing Environment, Social Responsibility, and Governance (ESG) [PEA 2022]. Other factors are shrinking fossil fuel deposits or growing costs of their extraction, availability of funds for green investment, and growing environmental awareness of citizens.

One of the key barriers of the energy transition is the perception of the EC climate policy as something imposed externally and the lacking ownership of the energy transition process, and, as a result, the lack of political leadership at national level committed to carrying out the process and a coherent national strategy covering all areas of economy accompanied with a consistent implementation plan and action. As a result, stakeholders are left without the necessary support and with the dilemma whether to wait and see or take any action, and if so, what direction to take.

Given the investment volume needed for the energy transition (as well as the social costs) the lack of sufficient funding may turn out the second key barrier. The investment gap in Poland until 2030 has been estimated at 77 bn EUR [PEA 2022]. Barriers to investments as, indicated by enterprises are the lack of long-term government strategies and relevant laws (67.1%); lack of favourable offer of public funding 37.1%, technology price 34.3%, lack of skilled workers (15.7%) indications by 70 member enterprises of Konfederacja Lewiatan [Konfederacja Lewiatan, Forum Energiii 2021]. The investment potential of energy companies (as well as energy intensive industries) in low-emission sources is reduced by the increasing prices of CO_2.

There are also problems with the integration of RES generated electricity with the distribution networks which are not adapted to handle significant energy supply fluctuations involved in RES operation, and as a result the number of refusals to connect new RES units has been increasing since 2019 [PEA 2022]. Another challenge is posed by the concentration of the generation sources and transmission grids in the south of Poland which need to be expanded in the north to be able to integrate future off-shore windpower sources. There are also inherent limitations to the use of weather-sensitive RES (the need to match them with stable energy sources in addition to investing in energy storage). At the same time the untapped potential of bioenergy is likely to be limited by the sustainability related restrictions on the use of biomass, as well as by the availability of raw material for biogas.

Other inhibiting factors include the economic crisis, high inflation, and market instability related to the war in Ukraine.

4. SOCIAL DIALOGUE, INDUSTRIAL RELATIONS AND INNOVATIVE PRACTICES IN SUPPORT OF THE ENERGY TRANSITION

4.1. Industrial relations systems in the energy sector

The industrial relations system in Poland is characterised by two forms of worker representation: work councils and trade unions with the domination of the latter, fully decentralised collective bargaining, in practice, confined to company level (single-employer bargaining), with no co-ordination or influence by the government, CB coverage of 13,4% (2019) [OECD][19], TU density of 12,7% (2018), employers' organisation density of 20% (2018)[20].

Compared to the national averages, the energy sector stands out for much higher TU density and CB coverage rates.

In *hard coal and lignite mining* is quite fragmented with 8 trade unions[21]. There is only one sectoral employer organisation ZPPPWB (Employers' Union Lignite Producer Alliance), however another organisation, i.e. GIPH (the Chamber of Mining Industry and Commerce), which represents mainly hard coal mining and related companies, de facto has also been playing a role of an employer organisation and so it officially declares. . The estimated CB rate in the extractive industries sector[22] was 23% in 2016. [Euround 2016: Table 39 Annex IV].Only one multi-employer collective agreement remains in force, covering all lignite companies . The *gas sector*[23], is characterised by medium fragmentation (3 trade union organisations[24]) with no collective agreements in force, and no sectoral employer organisation, and trade union density of 37%[25] (2020) and the coverage of (exclusively single-employer) collective bargaining of approximately 90% (the sector being dominated by large state-owned enterprises). [Eurofound 2022-2]. In *the electricity sector*[26], CB coverage in the largest companies operating in particular NACE sections was: 9% in 35.11 (production of electricity), 12% in 35.12 (transmission of electricity), and 12% in 35.13 (distribution of electricity). Trade union density based on 4 out of 5 trade unions covered by data was 52%. All of the 5 trade unions[27] were involved in single-employer and multi-employer bargaining and regular consultations on working conditions.

---

[19] Percentage of employees with the right to bargain OECD.Stat [Data extracted on 07.01.2023]

[20] Latest available year. Source: J. Visser, ICTWSS Database version 6.0. Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS) June 2019, University, as quoted in: OECD 2019 Negotiating Our Way Up: Collective Bargaining in a Changing World of Work https://www.oecd.org/employment/negotiating-our-way-up-1fd2da34-en.htm
of Amsterdam. June 2019

[21] FZZGWB, NSZZ Solidarność 80, OZZZPRC, PZZ Kadra, SGiE NSZZ Solidarność, WZZ Sierpień 80, ZZ Kontra, ZZ Przeróbka), of which all cover also other sectors, except the last one.

[22] Including, besides 05 Mining of coal and lignite, also 07 Mining of metal ores; 08 Other mining and quarrying; and 09 Mining support service activities.

[23] Covering NACE 35.21 manufacture of gas, 35.22 distribution of gaseous fuels through mains, 35.23 trade of gas through mains

[24] SPCH NSZZ Solidarność, OZZGNiG, PPZ Kadra.

[25] As reported by the Network of Eurofound correspondents (compared to 58% according to Eurostat).

[26] Covering NACE 35.11 (production of electricity, 35.12 transmission of electricity, 35.13 distribution of electricity, 35.14 trade of electricity

[27] SKE NSZZ Solidarność, SKEE, ZZZE, ZZiT, OZZZPRC.

The 4% of companies organised in the only employer organisation in the electricity sector (Union of Polish Energy Employers, ZPEP, established in 2019) represent approximately 90% of the workforce. [Eurofound 2022 (1)].

A few big State-owned companies of the energy sector[28] are members of Pracodawcy RP, a national level representative employer organisation.

There are four sectoral tripartite social dialogue bodies: Tripartite Team for the Social Security of Miners; Lignite Mining Tripartite Team; Energy Tripartite Team, and the Fuel and Petrochemical Sector Subgroup of the Chemical Industry TripartiteTeam.

4.2. Position of social partners with regard to the energy transition

The position of the social partners towards the green transition has been heterogeneous, differences have been visible both, among employers' organizations and within the trade union movement, as revealed by the positions and appeals published by the representative organizations[29].

Konfederacja Lewiatan (KL), which brings together large companies, including those with majority foreign ownership, assessed the Fit for 55 package as both an opportunity and a challenge [KL 2021] related mainly to ensuring the competitiveness of EU and Polish industry, which requires appropriate strategic decisions and adequate implementation instruments (investment support, incentives and facilitation, access to information, methodology and tools for assessing and measuring progress, reporting standards), and focusing efforts on key areas (green energy, alternative fuels, modernization of electricity grids), as well as securing significant resources for Poland from the Just Transition Mechanism, including the Just Transformation Fund). The KL also advocated for using up to 100% of the revenues from the sales of EU ETS allowances for energy transition.

Another representative employer organisation: Związek Przedsiębiorców i Pracodawców (ZPP) [ZPP 2021 (1)], on the other hand, assessed the Fit for 55 package as an ideological project, underestimated in terms of risks, leading to a decrease in the competitiveness of the EU economy, threatened by the fiscal or quasi-fiscal nature of climate policy instruments and by the EU ETS' vulnerability to speculation. Also, protectionist measures such as CBAM could result in retaliatory tariffs. The ZPP further pointed out to the lack of balance between the pursuit of a zero-mission economy and ensuring energy security for the EU as a whole. While supporting the equitable transition of coal-based sectors, the EU should not restrict the ability to invest in projects using transition fuels. ZPP also called for a greater emphasis on instruments of a positive nature (deregulatory and entrepreneurship-supporting initiatives). Both ZPP and KL, as well as the Business Centre Club, have repeatedly made appeals to the authorities to

[28] Tauron Polska Energia SA, PKP Energetyka, PKN Orlen SA, PGNiG Obrót Detaliczny, Polska Spółka Gazownictwa.

[29] No reference is made to the statements of Pracodawcy RP, a representative employer organisation, as no relevant documents were published on their website.

remove regulatory and procedural barriers and create a favourable environment for RES development (including, among other things, relaxing the 10H rule). [cf. ZPP 2020; 2021 (2), 2022 (1),; KL 2020 (2), 2022; BCC: Steinhoff 2022]. The KL went furthest in its stance, assessing that the target of a 50% RES share in electricity by 2040 is unambitious, given the national potential and the goals of the Fit for 55 package) and that it should be adopted for 2030, or 2035 at the latest, while for 2040 it should be set at 75% , if Poland were to become carbon neutral. This stands in stark contrast to the position of another employer organisation - Związek Rzemiosła Polskiego which, in its commentary to the NRRP, stated that since coal remains the primary source of energy for the Polish economy, Poland should focus its investments on coal processing (gasification), obtaining substitutes, etc., rather than exposing the country to "expenditures on expensive and inefficient renewable energy sources," and that the implementation of climate policy in its current form poses a real threat to the competitiveness of the Polish economy [ZRP 2021]

The employer organizations have also made demands for member states to retain discretion in certain areas of national policy implementing jointly set goals, such as energy taxation [ZPP 2021 (1)], or identifying sustainable projects and creating pathways to support entrepreneurs [KL 2020 (1)].

Just as employers analysed the green transition primarily from the point of view of its impact on the competitiveness of the economy, trade union organizations evaluated it mainly through the prism of its impact on jobs. In 2015, the OPZZ called for a change in the EU anti-coal policy and renegotiation of the climate package, renegotiation of EU Council Decision 787 of 2010, with a view to extending it, and for the government to obtain funds in the EU to subsidize Poland's coal power industry, especially mining. The Climate Protocol, which was to be adopted at COP 21 in Paris, was considered by the union as harmful to Poland [OPZZ 2015]. Four years later, in a commentary to the NECP, another representative trade union - the FZZ indicated that the authorities should provide information on identifying and securing strategic deposits for the country's energy security (especially hard coal and lignite), and that Poland should achieve the greatest possible energy independence by 2050 [FZZ 2019]. The following year, in a position paper on the RRF [OPZZ 2020], OPZZ pointed out that relying on EU revenues from increased emission fees is unfavourable for Poland and may generate unemployment, and in a commentary on the draft NRRP [OPZZ 2021 (3)] they advocated easing the transition process through the use of clean coal technologies that will improve energy efficiency and preserve jobs, as well as supporting municipalities in investing in low-carbon coal fuel as a transition fuel. They proposed developing district heating networks to support jobs in the heating industry, and advocated for supporting projects that would create jobs in the sectors and regions most closely linked to energy extraction and production. A few months later, NSZZ Solidarność called for blocking the Fit for 55 package: to "achieve climate neutrality by 2050 and not sooner," and for a reform of the EU ETS. They pointed out that energy-intensive sectors would relocate outside the EU, and that this process would be accelerated by the implementation of CBAM (not including indirect costs). The extension of the ETS to cover

transport would dramatically increase costs and prices, and the ban on the sale of cars with internal combustion engines would lead to massive layoffs. Extending the ETS to residential buildings would in turn lead to a cumulative spike in electricity and heat prices, increasing the scale of energy poverty. According to NSZZ Solidarność, the speed at which ETS prices had been rising was forcing a pace of transformation that the industry is unable to stand up to. [NSZZ Solidarność 2021].

4.3 Role of the social dialogue in support of a socially just energy Transition

The role of social dialogue in Poland has been systematically weakening in recent years, and the authorities have pushed back for as long as possible a substantive discussion with the social partners on the challenges that await Poland in relation to the green transition and measures to prepare for it.

Social partners have kept facing difficulties in their rights being recognised by the government, even though they are guaranteed by law. Symptomatic evidence include a complaint of the FZZ [2019] that it was given one day to consult the NECP, or repeated appeals to the government by representative organisations from both sides on that their role in the implementation and monitoring of the NECP is recognised [OPZZ 2020; ZRP 2021], not to mention an infamous attempt by the government to guarantee the Prime Minister the right to freely dismiss members of the national level tripartite body – the Social Dialogue Council (RDS) using the period of epidemic or epidemic threat [cf. 2020 Joint letter].

At the same time the government has consistently promoted the message that Poland would stick with coal, which apparently was to suffice for 200 years, in an effort to reassure miners that their jobs were safe and that EU climate policy was merely an ideological invention that the government would oppose. At the beginning of July 2019, at a meeting of the RDS Tripartite Team on the Social Security of Miners, trade unionists demanded "for each job eliminated in mining a comparable (equally paid) job in other industries, for every reduced kilowatt of coal-generated energy, a kilowatt of energy generated from domestic RES sources", but the government did not take up the issue [Niemiec 2021]. In January 2020, in the face of questions about which companies were selling imported coal to state-owned companies, and in the face of a proposal by the ZZ "Przeróbka" that purchases should be covered by social clauses (concerning labour and human rights), the government side promised to limit coal imports (ibid.). In the end, it was only when the PGG (the Polish Mining Group) was threatened with bankruptcy as the result of the failure of previous mining restructuring programmes, the rising price of CO_2 allowances and the pandemic standstill, that that the miners' protests led to the launch of negotiations for a social contract. It was a rather hasty process: the outline of the contract was presented on 25 September 2020 and the agreed final content was signed on 21.05.2021, with no guarantee of EC notification. The signatories were the Polish government, representatives of trade unions, representatives of coal companies covered by its provisions as well as the Association of Mining Communities in Poland.

The contract sets a schedule of hard coal mine closures (first in 2021 and last in 2049) and provides for a package of safeguards for its employees, which involve the right to keep the job till retirement, or, if not possible, to be reposted to another operating mining unit; or to benefit from a special preretirement mining leave during which one receives 80% of one's salary, or one-time severance payment of PLN 120,000 and a one-time retraining opportunity. However, apparently no training schemes were available to miners as of middle 2022 [Sobiesiak-Penszko et al 2022]. Besides those arrangements, the contract stipulates a State aid mechanism to support the mines remaining in operation, which however, requires EC notification of compliance with EU member state-aid rules to become effective.

On top of that, the contract provides for an investment of more than $4.1 billion in clean coal technologies, such as coal gasification, carbon capture and sequestration, or smokeless fuel production installations. [Śniegocki et al 2022].

While the contract has provided miners with safeguards and an apparently predictable framework of coal mine phase-out, it did it only with respect to those employed by PGG, Tauron and Węglokoks, leaving other hard coal mines, and lignite mining out of its scope, not to mention mining dependent companies and sectors. In JSW and LWB mines, which are not covered, trade unions were able to negotiate guaranteed employment (for 10 and 5 years respectively), which, however, not only seem to lack legal statutory back-up, but also cannot be considered a just transition scheme. [Forsal.pl 12.07.2021; Cire.pl 12.07.2021). Actually, lignite miners from Wielkopolska and Belchatów, felt largely left to themselves by the government [Sobiesiak-Penszko et al 2022].

In December 2022 the situation changed as, following 18 months of negotiations, another social contract was signed to protect the interests of the employees of companies with lignite mining and coal and lignite fired generation assets, as they were to be transferred from the State-owned companies and to a new State-controlled holding: NABE. The contract provides guaranteed employment until 2033, preretirement leaves entitling to 80% of one's salary for all production workers (75% of workforce), or severance payments equalling 12 monthly salaries. It also retains the provisions of the collective agreements in force. On being transferred to NABE, the workers are going to receive a consolidation bonus in the amount of PLN 8,000. What is important, also the workers of private companies, like ZEPAK in Wielkopolska (the company which is not going to transfer lignite assets to NABE), will be eligible for preretirement leaves and severance payments during systemic downsizing or phasing-out lignite extraction. On top of that, the contract obliges the employer signatories to develop strategies by the end of 2023 defining the ways of increasing the financial potential of NABE by creating jobs based, among others, on low and zero-emission technologies, including RES. It also recognizes the need to replace heating sources in the relevant mines and power plants with low and zero-emission technologies and use their sites and infrastructure for large scale electricity generation based on low and zero emission technologies.

The contract was signed by the government, the sectoral trade unions, the relevant State companies, and the lignite mining employer organisation as a participant. Apart from the contract, a separate agreement was signed to protect the workers in the transition period. As the protective measures are to be financed from the State budget they need a law to come into force as well as require EC notification.

In January 2023 negotiations started on a social contract for the State controlled power companies which will remain outside NABE.

In addition, the social partners, in joint resolutions on the forum of the Social Dialogue Council (RDS), sought to provide tools to support vocational retraining and training of employees of the automotive sector [RDS 2020], the broadly understood conventional energy sector [RDS 2021], as well as formulated similar proposals in the positions of their organisations to individual programmes, e.g. support for jobs in the heating sector through the development of district heating networks in NRRP [OPZZ 2021 (3)].

Irrespective of the above, the activities undertaken for just energy transition in Poland were largely confined to the processes of preparation of Territorial Just Transition Plans in the coal regions, which took place outside the structures of social dialogue understood as negotiations among, representatives of governments, employers and workers. The processes were led by regional authorities involved a wide range of local stakeholders, including, among others, representatives of local trade unions and employers. Even though the outcomes of the sectoral social dialogue are relevant for the mitigation of social and economic effects of the energy transition in the regions, both types of processes were disconnected.

ANNEX –QUALITATIVE SURVEY RESULTS

Explanatory note

In order to validate and complement the findings obtained through a desk research a qualitative survey was held with 9 interviewees including: 2 representatives of trade unions, 2 representatives of a regional level public institution, 2 representatives of employer organisations, 2 experts, 1 local leader. A picture of the energy transition in Poland, as emerging from the information and opinions of the interviewees is presented below, starting with a general overview of the transition landscape, with its drivers and barriers to set the context for specific areas of interest covered by the survey, which are discussed subsequently.

Drivers for and barriers to the clean energy transition.

The respondents share the view that the energy transition is first and foremost driven by the EU climate policy and related EU level legislation which has been implemented into the Polish legal system. Other factors that encourage transition is shrinking fossil fuel deposits or growing costs of their extraction, availability of funds for green investments, and the growing environmental awareness and feeling of agency on part of citizens.

The perception of the EC climate policy as something externally imposed and the lacking ownership of the energy transition process is manifested by the lack of internalisation of the relevant EU policies and inexistence of a national strategy to reach such a goal as climate neutrality and to change every activity related to GHG emissions accordingly. Neither is there an idea how to do it, while this applies to all areas of economy. Poland lacks political leaders with a long term vision beyond an electoral term to drive the change, convincing others to it, and a solid plan to carry it out. Such a plan should be based on broad dialogue, stakeholder involvement, and building alliances, coalitions for the change, which is a big challenge.

As a trade union leader phrased it: "When entering into negotiations or accepting EU law, those in power did not realise what consequences this would have, the fires are being put out post factum and not at the planning stage. The barriers are serious and follow from an insufficient diagnosis of problems involved in the green transition, problems which, from my point of view, above all affect the public, the mining regions and the citizens."

The lack of consistency on the government side, contradictory messages from its representatives, combined with unstable law leaves employers and workers uncertain what to expect. As a result companies face the dilemma whether to start doing anything or wait and see how the situation develops, and many, especially smaller, companies take the latter attitude. According to an employer organisation representative "There is no structured, orderly support for entrepreneurs and insufficient information about it". Insufficient knowledge about transition, such as identified among mining-related entrepreneur, is another barrier.

The responsibilities related to the transition of the energy sector are unclearly split among three ministries: the Ministry of Climate and Energy, the Ministry of State Assets and the Ministry of

Economic Development and Technology, while the involvement of the ministry responsible for labour issues has been surprisingly marginal.

Actually, the terms and conditions of the transition process appears to be dominated by the mining and energy industries, which capital-wise are dominated by the State. As one of the interviewees pointed out law seems to be drafted to suit the needs of State employers, as illustrated by the provision in the social contract which stipulates that their activity of PGG could be subsidized in case of a negative financial result, which can demotivate the company to introduce innovations, invest, and reduce environmental impact.

Since the knowledge how to carry out transition in the mining region is available only locally it is not going to be successful without the involvement of local leaders, who however should be supported by the State with its competencies, which is not the case. With no national level transition strategy and no vision related to achieving climate neutrality, regions have no reference which could help them in their dilemmas which direction to take: e.g. whether to focus on developing of autonomic vehicles or air industry. Smaller dilemmas are: where to site, with what money, who is to restructure it all, whether it should be regions, as it is now, whether to involve private capital or not.

In those municipalities which are dependent for a significant share of their (over-average) revenues on mining and energy conglomerates, local communities are likely to be striving to postpone change as much as possible, especially that they seem overlooked in transition debates (contrary to miners who are apparently best protected group thanks to the provisions of a sectoral social contract).

Besides the barriers linked to the role of the government in leading and managing the transition process, inhibiting factors are economic crisis, high inflation, and market instability related to the war in Ukraine. One of the interviewees also mentioned that for Poland phasing out coal is more challenging as it does not have nuclear power to replace it.

Employment

There are no **labour market forecasts** or monitoring tools which would focus particularly on the impact of energy transition in the country. The available tools include the system of Polish labour market forecasting by 2050[30] developed by IBS, Łódź University and IPSS, and the Occupation Barometer[31] for annual forecasts at national, regional and powiat levels, which is based on expert panel predictions referring to the data on registered unemployed and long-term unemployed as well as on registered job offers. There is, however, also a World Bank developed methodology to indicate transition paths based on skill overlap which can be used in designing

[30] https://ibs.org.pl/research/system-prognozowania-polskiego-rynku-pracy [Access on 26.06.2023]
[31] https://barometrzawodow.pl [Access on 26.06.2023]

support measures.

Energy transition and the declining demand of work in mining professions coincides with other labour market trends, such as digitalisation, which is going to have the most profound impact because it will bring a structural change. It is accompanied by a generational change bringing in different worker expectations.
Given the currently observed technological change, the most needed professions in 10 years are quite likely unknown today. Therefore the education system should develop skills for life-long learning (such as reading with comprehension, mathematical reasoning, and knowledge about the world on which ability of critical thinking can be built). The vocational education system in Poland is considered not flexible enough nor adapted to the actual demand. The supply is shaped by two mechanisms – the decisions by relevant authorities to permit opening or maintaining specific courses (classes) at different vocational education levels, and by the interest of potential students, which should make their career choices shaped by the information on what the labour market is going to like, which, ideally, should be supplied by schools. In practice, vocational schools observe almost no interest in mining classes, which, as a result, have been discontinued even though hard coal mines need new workers, and an excessive demand for PV fitter classes.
So far the overall impact of energy transition on labour market has been moderate, as the transition induced changes have only been starting and are not spectacular. The pace of hard coal mines phase-out has been slow enough for the labour market to absorb those who have been leaving the sector, especially that unemployment rates are low and there is deficit of workers, which may encourage companies to retain and retrain workers, if needed. The war in the Ukraine with the following sanctions on Russian coal imports has generated pressure on the domestic extraction of this fuel to compensate the supply gap, resulting in labour market freeze. It needs to be stressed though, that significant differences can be found even between neighbouring regions hence the local dimension must be taken into account.

It is low skilled jobs which are most vulnerable to energy transition both in mining and coal-based energy supply sectors, especially that blue collar workers (for instance of those working in carburisation (coking) and de-slaging sections of coal-fired power plants), would be harder to reskill. Qualified miners apparently have sufficient skills to find jobs in other sectors. The usually mentioned destinations are RES and green economy, construction and automotive branch, but RES may not necessarily be the best fit, and in the car industry even minor market disturbances might generate redundancies. Electricians and electric fitters can change employers without changing their profession, and the necessary modernisation and expansion of the power grid is going to generate jobs in power network operation and construction. Besides the level of skills (low versus medium or high), it is also worker's age that is likely to determine possible career paths. The younger ones might take advantage of the opportunities created by the digital revolution, which is sure to develop new markets, branches and jobs.

Many hard coal miners expect they will be able to retain employment in mining until retirement,

at least this is what they are told. There are however important differences need between hard coal and lignite miners, as the former can retire much earlier. Retirement could be a possible scenario for an evolutionary reduction of fossil fuel dependent jobs in natural gas supply, as the industry switches to biogas and hydrogen, yet the transition prospect and its impact on jobs in this sector remain unclear as of today.

Labour market policy

On national level Poland's labour market policy is shaped by the Ministry of Family and Social Policy, which also coordinates public employment services. The Ministry adopts annual National Action Plans for Employment which are consulted with social partners. Likewise there are annual plans at regional and powiat levels adopted by WUPs and PUPs who are the key actors implementing employment policy.

They however do not have instruments to proactively shape labour market, and lack flexibility to respond to changes in labour market in time. According to a local leader from Silesia there is either no offer for workers leaving the mining sector, or it is not well matched, and what is more important no such offer has been developed in advance, which creates much mistrust and uncertainty.

The several employment promoting measures which are provided for by the Law on Promoting Employment and on the Labour Market Institutions[32] andwhich are applied by WUPs and PUPs target the already unemployed, which is considered the key drawback. The measures include, among others, employment and re-training vouchers, and could be used to facilitate just transition of workers, if the eligibility criteria were adjusted accordingly, as currently the beneficiaries are the unemployed below 30 or over 50 years of age.

In the mining regions there are also dedicated support programmes for workers whose jobs are threatened by the transition. However to be effective they need to be well coordinated with the demand (i.e. employment reduction plans of employers), which has turned out difficult to achieve as they take long to prepare and launch (also due to public procurement procedures) and are not flexible enough to respond to the changing situation. The interviewees quoted two cases of such timing mismatches: programme by the Regional Development Agency in Wielkopolska Wschodnia and a retraining programme by the WUP in Silesia for, which have occurred as the transition has slowed down or not started. It is also difficult to carry out large scale programmes with low unemployment rates, such as in Silesia. An interviewed expert also pointed to the risk of different support programs competing for beneficiaries (pressure to deliver declared target values as committed, for instance if there are parallel public and employer-run programmes.

The challenges are increased by the lack of co-ordination of centrally taken decisions with the local level which is going to be most affected by them, as exemplified by the lack of consultation of the coal-mine closing time table for Silesia.

[32] Ustawa o promocji zatrudnienia i instytucjach rynku pracy

Work organization and working conditions

Looking from regional perspective the restructuring efforts of employers do not always bring in added value to the regions. The attitudes of employers vary: from the lack of interest in in the future of the region and focus on closing to an active involvement, as represented on the one hand by the State-owned PGE GiEK in Bełchatów (in Łódzkie region) or Tauron in Silesia, and on the other hand, by private ZEPAK in Wielkopolska Wschodnia. As an interviewed expert put it, in the first case: "the information of what is going to happen, how fast, who and how many are going to lose their jobs is hold back until the very last moment, and if there is a problem, the protection measures focus only to a selected group of workers"; in the second case "the entrepreneur is in the centre of the process, discusses, takes initiatives, thinks about new forms of activity, transforms himself together with the region". The actual attitude may depend on whether the management has freedom to transform.

Enterprise strategies of mining, mining-related and energy sector companies towards transition described by the interviewees can be categorized as follows: (1) business reorientation to green energy sources (e.g. biofuels, green hydrogen in case of Orlen), to production of RES related equipment (e.g. instead of mining machines), or to new services (e.g. energy efficiency services besides energy supply), (2) sales re-orientation to markets outside Europe (e.g. for mining equipment), (3) applying new technologies, (4) taking a "wait and see" attitude (especially smaller companies), and (5) halting investment in assets, with a view of business closure (mines with closing schedule).

The impact of enterprise strategies on workers seem to depend on the situation and approach taken by the enterprise, which results to some extent from the organisational culture as well as on the attitude and strength of its trade unions. The falling demand and production is likely to lead to lay-offs (which was the case of a producer of mining equipment). However, there are, even if infrequent, cases of enterprises which have avoided redundancies by relocating workers to other jobs (e.g. to services which were previously outsourced, following a pressure from a trade union), or have planned re-training of staff as part of company strategy to reorient their business profile, e.g. ZEPAK in Wielkopolska Wschodnia.

Moving from mining to other sectors, which involve fewer occupational risks, is likely to improve the working conditions of former underground workers; the work safety of those who continue working in mines seems to deteriorate, due to halted investment and reduced staffing combined with an increased pressure on coal production outputs after the outbreak of the war in Ukraine. To meet the higher demand for coal, mines have to hire new staff, while many candidates are not properly prepared for the job, as mining education has been in decline.

Sectoral level

The few big employers of the sector who are members of Pracodawcy RP, are preparing themselves for transition and try to be innovative and competitive. The organisation watches

the challenges involved in ESG, and promotes the idea and knowledge of it among its members. GIPH (Chamber of Mining Industry and Commerce), which appears also in the role of employer organisation, and brings together mining companies (which are predominantly State-owned) and mining-related businesses, has refocused its strategy to concentrate on supporting the latter group through the energy transition process. To be able to negotiate support measures for those entities, it is planning to develop and propose a definition of a mining-related business, so it could be used as a set of legally implementable criteria for support eligibility. The organisation is also involved in building the capacity of those companies to reorient their business to new activities.

Overall **trade unions** strategies range from supporting to denying the need for any kind of transformation, it depends on the region and whether transition is seen as inevitable. They are concerned with protecting certain social groups, not everyone, just employees of mines or power plants and, usually they do not go beyond that. It needs to be noted though, that on trade union initiative, a provision was included in the social contract for the coal mining sector, to set up a similar system of protective measures to cover specialized mining companies co-operating with hard coal mining sector. Some trade unions are involved in designing measures for changes in the labour market to move from coal and coal power with the regional authorities, others take a firm stance on protecting mining and coal-based power generation and treat the JTM, and EU energy and climate policies as a threat. The "solution seeking approach" can be illustrated by proposals of ZZG which included "employment voucher" (subsidized employment) for miners to find employment outside mining, or subsidized remuneration for retained workers in mining-related companies who have changed their business profiles, invested in new machines, re-trained workers and avoided lay-offs. ZZG has also cooperated with technological research centres in finding technological solutions to retain coal-based jobs, while achieving environmental effects.

In the natural gas sector, which has a less clear transition horizon, a sectoral trade union is monitoring the situation and pressing the employer responsible for gas distribution to speed up investment needed in distribution network modernisation to ensure the transition from natural gas to biogas, and in, a longer perspective, to hydrogen, a this is seen both by the employer and the trade union as the future of their company.

No initiatives to co-ordinate activities between different energy transition affected sectors have been identified either among employer organisations or trade unions.

The forum for the sectoral level social dialogue is the Social Dialogue Council (RDS), which is a national level tri-partite body, and in particular its sector focused respective tri-partite teams which were involved in the drafting of sectoral social contracts (see details below). Besides that, apparently no substantial issues have been agreed. On part of the government the Ministry of State Assets played the central role in mining and energy related dialogue (as those sectors are

State dominated. The RDS has also been used as a forum for developing common positions of social partners. When agreed, a position is adopted as resolution and forwarded to the government for a response.
Otherwise social partners have been involved in consulting draft relevant policy documents and draft laws, regulations or policies, often with very little time left for commenting (e.g. 36 hrs to comment on PEP2040), which makes it very difficult or impossible to agree the common position between the members of an organisation.

Miner trade unions were able to negotiate a social contract with the government, which provides for protection measures of hard coal miners working underground in the State owned mines, however not in private ones. It did not cover lignite mining workers, either. Only with the signing of a social contract on the transformation of lignite mining and power generation industries, including the separation of coal extraction and production assets from the State-owned companies – lignite miners together with electricity workers gained a comparable protection. It needs to be noted, though, that negotiating that contract with trade unions was necessary for the State to be able to move state-owned coal mines and power stations to a separate entity: NABE, as the workers of those companies were protected by collective agreements. What is important, the beneficiaries of the contract also include employees of private companies, such as ZEPAK, meeting relevant criteria,. However the contract entered into force only at the end of December 2022, already after employment in ZEPAK mines had already been largely reduced without such protective measures in place, as the lignite mining trade unions were not strong enough to secure them for miners being laid-off.

Even though the social contract was signed, according to an interviewed expert, NABE has not been explained to workers regarding its business model and timeline as well as the sources of funding to maintain its operation.

Still large groups of workers remain not covered by such protective measures. Besides mine employees working on the surface, those are workers of mining-related companies (the latter estimated to be 40,000 to 400,000 in Silesia, depending on the methodology applied).

Territorial/Regional level

As fossil-fuel based industries in Poland are concentrated in few regions, the outcomes of the government-led social contract drafting processes and their outcomes have been very relevant for the regions. Still they ran parallel and disconnected to the region-led processes related to the development of Just Transition Territorial Plans to mitigate the social impacts of energy transition of the mining regions and select new activities to drive their economies.

In this context there have been concerns that the government has followed its own agenda, including the timetable of mines closure, which has not been consulted at regional level, while alternative employment opportunities for miners to be laid-off should be developed first.

At regional level social partners have participated in the TJTP planning process, as well as have been involved in other regional level initiatives targeting their membership base (workers or enterprises), for instance surveying the needs or organising workshops, as well as different in stakeholder fora (working teams, monitoring committees). They also consult regional policies, documents and initiatives. In Silesia a key trade union concern in the TJTP consultations was insufficient focus of the plan on job creation. Also to an interviewed trade union leader the plan appearstoo general, lacking clear-cut vision, direction, destination and co-ordination.
As a trade union leader put it their organisation sees its role "as some sort of conscience of this [stakeholder] forum and a reminder that this is supposed to do something good for citizens and residents, especially those most likely to be affected by the transformation - rather than the creators of this programme, or someone who had a significant influence on the shape of this document". They also alert authorities about social risks involved in the closure of mines which financed local social infrastructure (sports and culture) to plan preventive measures.

The interviewees from Silesia pointed out that the financial contribution from JTF is very small compared to the cost of energy transition, which is estimated to be 200-250 billion euro in that region, with JTF contributing 2 million, and the government 800 million over 10 years. Also there should be a plan how to coordinate spending from different sources to address particular needs. Locally, the situation within the regions is very differentiated.

Socio-environmental level

The connections between the energy transition and socio-environmental aspects are most likely to be recognised by employer organisations through the framework of ESGs (Environment, Social responsibility and Corporate governance), which is particularly relevant for bigger enterprises in energy supply, and not necessarily for the sector of mining related companies, which include small businesses. Trade unions remain focused traditionally on worker-related issues.
Among social issues, energy poverty has probably been recognized as the one of the most interest. In a debate on privileged entities [i.e. beneficiaries of energy price cap] the social partners were for making the list of such entities as inclusive as possible, and it was them who brought this topic onto the forum of the RDS.
Social partners have co-operated with other stakeholders on specific issues (interviewees mentioned research institutes). The rather few contacts that either employer organisations or trade unions have had with green NGOs (if at all) have not brought any outcome, with each side committed to its position. Apparently NGOs are more open to such contacts, but may lack the necessary expertise. There also seems to be a cultural difference: trade unions are experienced negotiators, while NGOs are more comfortable with other formats of dialogue. The interviewees recognized the need of multi-stakeholder dialogue, but the question of stakeholder selection (mandate) may be an issue.
According to a local leader from Silesia the Regional Social Dialogue Council or public consultations organised by the Marshall (head of the regional self-government) have not passed

the test of a suitable forum for extended multi-stakeholder dialogue, which would need to be based on a more bottom-up less-formalised-formula or a round-table.

REFERENCES

(2020) Joint letter of the European Social Partners to the European Commission on the situation in Poland https://www.etuc.org/sites/default/files/document/file/2020-04/2020-04-01-polish-social-dialogue%20European%20Social%20Partners.pdf Attachment: Protest organizacji pracodawców i związków zawodowych w sprawie zamachu na niezależność Rady Dialogu Społecznego i autonomię organizacji partnerów społecznych 28.03.2020 https://pracodawcyrp.pl/upload/files/2020/05/2020-03-28-protest-rds.pdf [Access on 26.06.2023]

(2021) Umowa Społeczna dotycząca transformacji sektora górnictwa węgla kamiennego oraz wybranych procesów transformacji województwa śląskiego https://www.gov.pl/attachment/040f02f5-9117-443e-ac80-a9732636feee [Access on 26.06.2023]

(2022) Umowa społeczna dotycząca transformacji sektora elektroenergetycznego i branży górnictwa węgla brunatnego, w tym wydzielenia wytwórczych i wydobywczych aktywów węglowych ze spółek z udziałem skarbu państwa, 22.12.2022 https://www.gov.pl/attachment/040f02f5-9117-443e-ac80-a9732636feee [Access on 26.06.2023]

Antosiewicz, M.,Mazurkiewicz, J.,Sokołowski, J.,Frankowski, J.,Lewandowski, P. (2021). Dekarbonizacja i zatrudnienie w górnictwie węgla kamiennego w Polsce: evidence from Poland, IBS Research Report 01/2021, https://ibs.org.pl/publications/dekarbonizacja-i-zatrudnienie-w-gornictwie-wegla-kamiennego-w-polsce/ [Access on 26.06.2023]

Christiaensen, Luc; Ferré, Céline; Gajderowicz, Tomasz; Ruppert Bulmer, Elizabeth, and Wrona, Sylwia (2022 (1)) "Towards a Just Coal Transition: Labor Market Challenges and People's Perspectives from Silesia" World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO. https://openknowledge.worldbank.org/handle/10986/38119 [Access on 26.06.2023]

Christiaensen, Luc; Ferré, Céline; Gajderowicz, Tomasz; and Wrona, Sylwia (2022(2))"Towards a Just Coal Transition: Labor Market Challenges and People's Perspectives from Lower Silesia" World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO https://openknowledge.worldbank.org/handle/10986/38090 [Access on 26.06.2023]

Christiaensen, Luc; Ferré, Céline; Honorati, Maddalena; Gajderowicz, Tomasz; and Wrona, Sylwia (2022 (3)). "Towards a Just Coal Transition: Labor Market Challenges and People's Perspectives from Wielkopolska." World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO. https://openknowledge.worldbank.org/handle/10986/38175 [Access on 26.06.2023]

Cire.pl (website) 12.07.2021 „Bogdanka podpisała z górnikami porozumienie dotyczące gwarancji zatrudnienia", Centrum Informacji o Rynku Energii https://www.cire.pl/artykuly/serwis-informacyjny-cire-24/186972-bogdanka-podpisala-z-gornikami-porozumienie-dotyczace-gwarancji-zatrudnienia [Access on 26.06.2023]

EurObservER (2021) The State of Renewable Energies in Europe. Edition 2021 20th EurObservER Report https://www.eurobserv-er.org/pdf/20th-annual-overview-barometer/ [Access on 26.06.2023]

EurObservER (2019) The State of Renewable Energies in Europe. Edition 2019 19th EurObservER Report https://www.eurobserv-er.org/pdf/19th-annual-overview-barometer/ [Access on 26.06.2023]

EurObservER (2018) The State of Renewable Energies in Europe. Edition 2018 18th EurObservER Report https://www.eurobserv-er.org/pdf/18th-annual-overview-barometer/ [Access on 26.06.2023]

EurObservER (2017) The State of Renewable Energies in Europe. Edition 2017 17th EurObservER Report https://www.eurobserv-er.org/pdf/annual-overview-2017-en/ [Access on 26.06.2023]

EurObservER (2016) The State of Renewable Energies in Europe. Edition 2016 16th EurObservER Report https://www.eurobserv-er.org/pdf/annual-overview-2016-en/ [Access on 26.06.2023]

EurObservER (2015) The State of Renewable Energies in Europe. Edition 2015 15th EurObservER Report https://www.eurobserv-er.org/pdf/annual-overview-2015-en/ [Access on 26.06.2023]

EurObservER (2014) The State of Renewable Energies in Europe. Edition 2014 14th EurObservER Report https://www.eurobserv-er.org/pdf/annual-overview-2014-en/ [Access on 26.06.2023]

Eurofound (2022 (1)), Representativeness of the European social partner organisations: Electricity sector, Sectoral social dialogue series, Dublin https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef21043en.pdf [Access on 26.06.2023]

Eurofound (2022 (2)), Representativeness of the European social partner organisations: Gas sector, Sectoral social dialogue series, Dublin https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef21044en.pdf [Access on 26.06.2023]

Eurofound (2016), Representativeness of the European social partner organisations: Extractive industries sector, Sectoral social dialogue series, Dublin https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1636en.pdf [Access on 26.06.2023]

Forsal.pl (website) 30.03.2021 „JSW przedłuża gwarancje zatrudnienia dla wszystkich pracowników o 10 lat" https://forsal.pl/biznes/przemysl/artykuly/8131905,jsw-przedluza-gwarancje-zatrudnienia-dla-wszystkich-pracownikow-o-10-lat.html [Access on 26.06.2023]

Forum Energii (2021) Raport Transformacja energetyczna w Polsce. Edycja 2021. Analizy i Dialog, Forum Energii https://forum-energii.eu/public/upload/articles/files/Raport_Transformacja%20energetyczna%20Polski_2021.pdf [Access on 26.06.2023]

FZZ (2019) Opinia FFZ do projektu Stanowiska Rządu Rzeczypospolitej Polskiej do Zalecenia Komisji w sprawie projektu zintegrowanego krajowego planu w dziedzinie energii i klimatu w Polsce obejmującego lata 2021–2030 FZZ IX 604/02/10/2019, 02.10.2019 http://fzz.org.pl/wp-content/uploads/2019/10/Odpowied%C5%BA-na-pismo-od-Ministra-Energii.pdf [Access on 26.06.2023]

Fundacja WWF Polska (2021). Kierunki Terytorialnego Planu Sprawiedliwej Transformacji i Rozwoju dla Województwa Śląskiego, Warszawa https://ibs.org.pl/en/news/just-transition-in-upper-silesia-wwf-report-available/ [Access on 26.06.2023]

IEA (2022) Poland 2022 Energy Policy Review, https://iea.blob.core.windows.net/assets/b9ea5a7d-3e41-4318-a69e-f7d456ebb118/Poland2022.pdf [Access on 26.06.2023]

Kiewra, Daniel; Szpor, Aleksander; Witajewski-Baltvilks, Jan (2019). Sprawiedliwa transformacja węglowa w regionie śląskim. Implikacje dla rynku pracy: evidence from Poland, 02/2019, Instytut Badań Strukturalnych https://ibs.org.pl/publications/sprawiedliwa-transformacja-weglowa-w-regionie-slaskim-implikacje-dla-rynku-pracy/ [Access on 26.06.2023]

Konfederacja Lewiatan (2022) Aktualizacja Polityki Energetycznej Polski (PEP2040) – uwagi Lewiatana, [letter to the Minister of Environment] KL/192/87/DZS/2022, 11.05.2022 https://lewiatan.org/wp-content/uploads/2022/05/KL-192-87-DZS-2022.pdf [Access on 26.06.2023]

Konfederacja Lewiatan (2021) GOTOWI na 55 „FIT for 55" – stanowisko horyzontalne Konfederacji Lewiatan KL/393/277/DZS/2021, 22.10.2021 https://lewiatan.org/wp-content/uploads/2021/10/KL-393-277-DZS-2021.pdf [Access on 26.06.2023]

Konfederacja Lewiatan (2020 (1)) Stanowisko dot. Planu inwestycyjnego na rzecz zrównoważonej Europy. Plan inwestycyjny na rzecz Europejskiego Zielonego Ładu COM KL/144/90/DZS/2020, 10.04.2020 https://lewiatan.org/wp-content/uploads/2021/10/KL-144-90-DZS-2020.pdf [Access on 26.06.2023]

Konfederacja Lewiatan (2020 (2)) Stanowisko Rady OZE w Konfederacji Lewiatan, dotyczące modyfikacji „zasady 10h", wprowadzonej ustawą o inwestycjach w zakresie elektrowni wiatrowych] [letter to the Minister of Development] KL/124/73/DG/2020, 24.03.2020 https://lewiatan.org/wp-content/uploads/2021/10/PROJEKT_10h_Stanowisko_Rady_OZE.pdf [Access on 26.06.2023]

Konfederacja Lewiatan, Forum Energii (2021) Europejski Zielony Ład – ocena wiedzy i postaw przedstawicieli polskiego biznesu, styczeń https://lewiatan.org/wp-content/uploads/2021/08/zielony_lad.pdf [Access on 26.06.2023]

Ministerstwo Aktywów Państwowych (2022) Program dla sektora górnictwa węgla kamiennego w Polsce przyjety przez RM z korektami z 2022 r., Ministerstwo Aktywów Państwowych

https://www.gov.pl/attachment/21157355-d3e6-4ea2-8cfc-3e7a4d87696f [Access on 26.06.2023]

Ministerstwo Aktywów Państwowych (2019) Krajowy Plan na rzecz Energii i Klimatu na lata 2021-2030 https://www.gov.pl/web/klimat/krajowy-plan-na-rzecz-energii-i-klimatu including: Executive Summary of Poland's National Energy and Climate Plan for the Years 2021-2030 [NECP PL) https://www.gov.pl/attachment/e64830c9-440f-4f17-b3e7-8abd7667d406 [Access on 26.06.2023]

Ministerstwo Klimatu i Środowiska (2021) Polityka energetyczna Polski do roku 2040 https://www.gov.pl/web/klimat/polityka-energetyczna-polski [Access on 26.06.2023]

Ministerstwo Klimatu i Środowiska (2023) Scenariusz 3 do do prekonsultacji aktualizacji KPEIK/PEP2040. Analiza dla sektora elektroenergetycznego z uwzględnieniem zmiany sytuacji

polityczno-gospodarczej po inwazji Rosji na Ukrainę, czerwiec 2023 https://www.gov.pl/attachment/37f0218e-da89-4e15-9cd0-0992549f6627 [Access on 26.06.2023]

Ministerstwo Rozwoju, Pracy i Technologii (2021) Krajowy Plan Działań na rzecz Zatrudnienia na rok 2021, Warszawa https://www.gov.pl/web/rodzina/krajowy-plan-dzialan-na-rzecz-zatrudnienia2 [Access on 26.06.2023]

NCBR website https://www.gov.pl/web/ncbr

NFOŚiGW website https://www.gov.pl/web/nfosigw

Niemiec, Jarosław (2021) „Nowy Zielony Ład czy ekoszwindel, czyli górnicy już wiedzą, co jest grane" pp. 13-26 in: Wielka gra. Czy jesteśmy gotowi na zieloną rewolucję?, OPZZ ,Warszawa 2021, http://www.wielkagra.cba.pl/ [Access on 26.06.2023]

NSZZ "Solidarność" (2021) Stanowisko KK nr 2/21 ws. „Fit for 55", 06.10.2021 https://www.solidarnosc.org.pl/dok/wp-content/uploads/2021/10/Stanowisko_KK_nr_2_21.pdf [Access on 26.06.2023]

OECD (2019) Negotiating Our Way Up: Collective Bargaining in a Changing World of Work https://www.oecd.org/employment/negotiating-our-way-up-1fd2da34-en.htm [Access on 26.06.2023]

OPZZ (2021 (1)) Wielka gra. Czy jesteśmy gotowi na zieloną rewolucję?, Warszawa 2021, http://www.wielkagra.cba.pl/ [Access on 26.06.2023]

OPZZ (2021 (2)) Stanowisko Prezydium OPZZ z dnia 18 maja 2021 roku w sprawie Krajowego Planu Odbudowy i Zwiększania Odporności w wersji przekazanej do Komisji Europejskiej w dn. 30 kwietnia 2021 r., 18.05.2021 https://www.archiwum.opzz.org.pl/assets/opzz/media/files/9eb02b3e-c6c9-4b63-bc77-8dbf71dd85e5/2021-05-18-stanowisko-prezydium-opzz-w-sprawie-krajowego-planu-odbudowy-i-zwiekszania-odpornosci-w-wersji-przek-do-ke-dn-30-04-21r.pdf [Access on 26.06.2023]

OPZZ (2021 (3)) Stanowisko Prezydium OPZZ z dnia 16 marca 2021 roku w sprawie Krajowego Planu Odbudowy i Zwiększania Odporności , 16.03.2021 https://www.archiwum.opzz.org.pl/assets/opzz/media/files/eeef2f99-8d66-4761-a700-d7d676a85a7f/2021-03-16-stanowisko-prezydium-opzz-w-sprawie-kpo.pdf [Access on 26.06.2023]

OPZZ (2020) Stanowisko Prezydium OPZZ z dnia 8 września 2020 roku w sprawie budżetu Unii Europejskiej na lata 2021-2027 i planu odbudowy, 08.09.2020 https://www.archiwum.opzz.org.pl/assets/opzz/media/files/0fb11df8-1939-415f-ae60-e45b07bf45fb/2020-09-08-stanowisko-prezydium-w-sprawie-budzetu-unii-europejskiej-na-2021-2027-i-planu-odbudowy.pdf [Access on 26.06.2023]

OPZZ (2015) Stanowisko Prezydium Ogólnopolskiego Porozumienie Związków Zawodowych z dnia 4 listopada 2015 r. w sprawie sytuacji w sektorze surowcowo-energetycznym kraju, 04.11.2015 https://www.archiwum.opzz.org.pl/assets/opzz/media/files/73e4770c-4485-4eeb-9476-91705d9d64e9/2015-11-04-stanowisko-prezydium-w-sprawie-sytuacji-w-sektorze-surowcowo-energetycznym-kraju.pdf [Access on 26.06.2023]

PEA (2022) Polish Energy Transition Path, Warsaw October 2022, https://pkee.pl/wp-content/uploads/2022/11/EN_Report_PKEE.pdf [Access on 26.06.2023]

RDS (2021) Uchwała nr 103 strony pracowników i strony pracodawców Rady Dialogu Społecznego z dnia 9 grudnia 2021 roku w sprawie projektu ustawy o zmianie ustawy o systemie handlu uprawnieniami do emisji gazów cieplarnianych oraz ustawy – Prawo ochrony środowiska (nr UA7 w wykazie prac legislacyjnych i programowych Rady Ministrów). http://rds.gov.pl/rds_assets/uploads/2021/12/2021-103-Uchwa%C5%82a-strony-pracownik%C3%B3w-i-strony-pracodawc%C3%B3w.pdf [Access on 26.06.2023]

RDS (2020) Uchwała nr 90 strony pracowników i strony pracodawców Rady Dialogu Społecznego z dnia 30 września 2020 r. w sprawie problemów sektora motoryzacyjnego. http://rds.gov.pl/rds_assets/uploads/2020/10/Uchwa%C5%82a-nr-90.pdf [Access on 26.06.2023]

Sobiesiak-Penszko Paulina, Koziarek Małgorzata, Pazderski Filip (2022) *Co po węglu? Górnicy o klimacie, transformacji i przyszłości*, Warszawa: Instytut Spraw Publicznych https://www.isp.org.pl/pl/publikacje/co-po-weglu-gornicy-o-klimacie-transformacji-i-przyszlosci [Access on 26.06.2023]

Sokołowski, Jakub; Frankowski, Jan; Mazurkiewicz, Joanna; Lewandowski, Piotr (2021) The Coal Phase-Out and the Labour Market Transition Pathways: the Case of Poland, IBS Working Paper 01/2021, June 2021 https://ibs.org.pl/app/uploads/2021/06/The-coal-phase-out-and-the-labour-market-transition-pathways-the-case-of-Poland.pdf [Access on 26.06.2023]

Śniegocki, Aleksander; Wasilewski, Marek; Zygmunt, Izabela, and Look, Wesley (2022) Just Transition in Poland: A Review of Public Policies to Assist Polish Coal Communities in Transition. Report 22-06, May 2022, Environmental Defence Fund https://www.edf.org/sites/default/files/documents/Report_22-06_June_1_2022.pdf [Access on 26.06.2023]

Steinhoff, Janusz (2022) Raport Gospodarka, 28.10.2022, Think Tank Gospodarczy Gabinet Cieni BCC https://www.bcc.org.pl/wp-content/uploads/20221028-raport-ggc-gospodarka.pdf

Urząd Marszałkowski Województwa Dolnośląskiego (2022) Terytorialny Plan Sprawiedliwej Transformacji dla Województwa Dolnośląskiego 2021-2030. Subregion Wałbrzyski. Wersja 10.0 po uwagach KE. https://umwd.dolnyslask.pl/fileadmin/user_upload/Gospodarka/FST/TPST_Walbrzych.pdf [Access on 26.06.2023]

Urząd Marszałkowski Województwa Łódzkiego (2021) Terytorialny Plan Sprawiedliwej Transformacji Województwa Łódzkiego https://strategia.lodzkie.pl/wp-content/uploads/2021/06/projekt-Terytorialnego-Planu-Sprawiedliwej-Transformacji-WL_2021.06.29.pdf [Access on 26.06.2023]

Urząd Marszałkowski Województwa Małopolskiego (2022) Terytorialny Plan Sprawiedliwej Transformacji dla Małopolski Zachodniej. Projekt https://bip.malopolska.pl/api/files/2863756 [Access on 26.06.2023]

Urząd Marszałkowski Województwa Śląskiego (2020) Terytorialny plan sprawiedliwej transformacji województwa śląskiego 2030, grudzień 2020, https://transformacja.slaskie.pl/images/Dokumenty/1671795808_terytorialny_plan_spr.2022.pdf

WUG website https://www.wug.gov.pl/bhp/stan_bhp_w_gornictwie

WUP w Krakowie (2023) Barometr zawodów raport podsumowujący badanie w Polsce https://barometrzawodow.pl//forecast-card-zip/2023/report_pl/raport_ogolnopolski_2023.pdf [Access on 26.06.2023]

WUP w Poznaniu (2023) Barometr zawodów raport podsumowujący badanie w województwie wielkopolskim

https://barometrzawodow.pl/modul/publikacje?publication=province&province=15&county=&year=2023 [Access on 26.06.2023]

ZPP(2022 (1)) Zacieśnianie polityki energetycznej UE, a polskie wyzwania, 26.09.2022 https://zpp.net.pl/wp-content/uploads/2022/09/26.09.2022-Zaciesnianie-polityki-energetycznej-UE-a-polskie-wyzwania.pdf [Access on 26.06.2023]

ZPP (2022 (2)) Stanowisko ZPP ws. ochrony polskiego przemysłu przed wzrostami kosztów energii elektrycznej i gazu, 08.09.2022 https://zpp.net.pl/wp-content/uploads/2022/09/08.09.2022-Stanowisko-ZPP-ws.-ochrony-polskiego-przemyslu-przed-wzrostami-kosztow-energii-elektrycznej-i-gazu-1.pdf [Access on 26.06.2023]

ZPP (2022 (3)) Stanowisko ZPP ws. rewizji dyrektywy UE dotyczącej opodatkowania produktów energetycznych i energii elektrycznej, 07.02.2022 https://zpp.net.pl/wp-content/uploads/2022/02/07.02.2022-Stanowisko-ZPP-ws.-rewizji-dyrektywy-UE-dotyczacej-opodatkowania-produktow-energetycznych-i-energii-elektrycznej.pdf [Access on 26.06.2023]

ZPP (2021 (1)) Stanowisko ZPP ws. pakietu Fit for 55, 26.10.2021 https://zpp.net.pl/wp-content/uploads/2021/10/26.10.2021-Stanowisko-ZPP-ws.-pakietu-Fit-for-55.pdf [Access on 26.06.2023]

ZPP (2021 (2)) Stanowisko ZPP ws. nowelizacji prawa energetycznego oraz ustawy o odnawialnych źródłach energii, 07.07.2021 https://zpp.net.pl/wp-content/uploads/2021/07/07.07.2021-Stanowisko-ZPP-ws.-nowelizacji-prawa-energetycznego-oraz-ustawy-o-odnawialnych-zrodlach-energii.pdf [Access on 26.06.2023]

ZPP (2020) Stanowisko ZPP ws. przywrócenia możliwości inwestowania w lądową energetykę wiatrową, 30.03.2020 https://zpp.net.pl/wp-content/uploads/2020/03/30.03.2020-Stanowisko-ZPP-ws.-przywro%CC%81cenia-moz%CC%87liwos%CC%81ci-inwestowania-w-la%CC%A8dowa%CC%A8-energetyke%CC%A8-wiatrowa%CC%A8.pdf [Access on 26.06.2023]

ZPP (2018)Stanowisko ZPP ws. propozycji wprowadzenia opłaty emisyjnej, 25.05.2018 https://zpp.net.pl/wp-content/uploads/2018/05/Stanowisko-ZPP-ws.-propozycji-wprowadzenia-op%C5%82aty-emisyjnej.pdf [Access on 26.06.2023]

Związek Rzemiosła Polskiego (2021) Stanowisko Związku Rzemiosła Polskiego do projektu Krajowego Planu Odbudowy i Zwiększania Odporności, 21.04.2021 https://zrp.pl/wp-content/uploads/2021/04/Stanowisko-ZRP-do-Krajowego-Planu-Odbudowy.pdf [Access on 26.06.2023]