WiseEuropa

POLAND'S HEAVY INDUSTRY DECARBONISATION

Policy and Financing Roadmap

Kamil Laskowski, Maciej Giers

DISCLAIMER

The views expressed in this work represent those of the authors only and do not necessarily reflect any other institution's or funder's perspective nor any of the experts' consulted.

Supported by:

Federal Ministry for Economic Affairs and Climate Action

European Climate Initiative EUKI

on the basis of a decision by the German Bundestag

EUROPEUM INSTITUT PRO EVROPSKOU POLITIKU INSTITUTE FOR EUROPEAN POLICY

WiseEuropa

ISBN:978-83-67829-16-8

Contents

1. Preface

List of Abbreviations

BF	Blast Furnace
BOF	Basic Oxygen Furnace
CBAM	Carbon Border Adjustment Mechanism
CC(U)S	Carbon Capture (Utilisation) and Storage
EAF	Electric Arc Furnace
ECRA	European Cement Research Academy
EE	Energy Efficiency
EU	European Union
GCCA	Global Cement and Concrete Association
IEA	International Energy Agency

1. Preface / introduction

The decarbonisation of high-emission, heavy industries like cement, steel and chemicals presents a multitude of unique challenges, including the significant initial investment required for the implementation of low-carbon technologies, the longevity of existing production facilities with infrequent opportunities for renewal, often not until 2050, the nascent stage of many of these technologies, and the international trade of low-margin products. These factors can deter the early adoption of novel technologies and introduce the risk of competition from imported products with high carbon footprints. This document provides a comprehensive analysis of the decarbonisation trajectory for Poland's most carbon-intensive industries – cement, steel, and chemicals – with a primary focus on the 2030 timeline, while also considering the ultimate goal of achieving net-zero emissions by 2050.

The report has two objectives: firstly, it aims to establish a connection between policy, investment, and financing aspects pertinent to the decarbonisation of Poland's high-emission industries; secondly, it proposes potential solutions to the challenges that industry stakeholders may encounter on the path to decarbonisation. The correlation between investments and financing needs is evident, and it is imperative that policies, regulatory frameworks, and government incentives or levies are in alignment with decarbonisation targets to ensure consistency.

Poland's situation is unique within the European context, as it is one of the most industry-oriented economies in the European Union. With escalating decarbonisation mandates, the country is confronted with significant and politically sensitive challenges. Its geographical location in Central Europe restricts its potential for renewable electricity generation or large-scale carbon storage in comparison to other European regions. Therefore, Poland must strategically plan its transition to low-carbon growth, capitalizing on its primary assets: its infrastructure and skilled workforce.

The economic, investment, and financing aspects of the decarbonisation of Poland's high-emission industries have been addressed in a limited number of sources. This report seeks to stimulate policy, investment, or financing actions by relevant stakeholders that will expedite the decarbonisation of these hard-to-abate industries. It is not intended to be exhaustive, but rather to serve as a synopsis for potential considerations, steps, and actions. However, further studies may be required to evaluate decarbonisation investments, estimate the financing capacities of hard-to-abate industries, comprehend the economic viability and competitiveness of new technologies and product opportunities, or delineate policy scenarios addressing investment and financing risks.

2. Executive Summary

2. Executive Summary

Polish heavy industry (the term by which we mean cement, steel and chemical production) faces the unprecedented challenge of decarbonisation, which is particularly difficult as the efforts aimed at reducing CO_2 emissions require substantial amounts of finance. However, which is stated in this report and exemplified by our findings, this effort is not out of reach for Polish industrial companies. Of course, innovative decarbonisation technologies (such as Carbon Capture, Storage and Utilisation (CCUS) and hydrogen-based technologies) are expensive, but their massive deployment is predicted to happened in the 2030s and 2040s, whereas the time perspective fixed for this study is 2030. Therefore, until 2030 decarbonisation efforts in Polish heavy industry should be oriented towards energy efficiency and fuel switch to lower-emission alternatives (where possible). Cost estimates for Best Available (energy efficiency) Technologies that have not yet been implemented in Poland are not advanced enough to be implemented in the coming decades, when CCUS and hydrogen-based solutions will become more mature, technically and financially feasible, and when regulatory barriers to their deployment will be removed. Just waiting for these technologies without carrying out decarbonisation investments in the meantime might not be the solution, as CO_2 emissions reductions made in the 2020s would translate into lower costs of implementing innovative measures in the 2030s and 2040s since there will be less CO_2 to abate. Moreover, the issue of urgent industrial decarbonisation is of significant importance given the development of climate policies in the EU. The phase-out of free allocation under the EU ETS reform (related to the introduction of CBAM) will exert a financial pressure on industrial companies still in the 2020s, as the free allocation will be gradually phased out starting in 2026.

An important impediment to industrial decarbonisation in Poland is, however, the approach of public authorities and industrial companies themselves. The issue is neither upheld nor sufficiently addressed by the state, and private stakeholders do not always show particular interest in reducing their CO_2 emissions (which could be demonstrated by the diverse quality of ESG reports and decarbonisation strategies submitted or not submitted by them). Hence, although the starting point of the Polish heavy industry (i.e. development of CO_2 emission levels as of 2021 and low interest in the issue) would not dare to predict a huge reduction in CO_2 emissions in the near future, investments in energy and fuel efficiency (which would translate into lower CO_2 emissions due to the high dependence of the Polish industry on fossil fuels) are fully consistent with the current annual investment expenditure, i.e. they will not require excessive financial outlays from industrial enterprises. Moreover, EU funds (Modernisation Fund in particular or revenues from EU ETS auctions) provide enough money to finance energy efficiency improvement predicted by us, but they are not fully used and accurately distributed by the state. Even despite this missed opportunity, the last resort to support decarbonisation investments could be private sustainable finance, whose development is delayed due to little experience in obtaining financing from the capital market in the Polish industry. For this reason the potential of green bonds or sustainability-linked loans needs to be communicated and explored.

3. Polish Industry's Current Status

3. Polish Industry's Current Status

Over the past three decades, Poland's industrial sector has experienced a comprehensive metamorphosis. The initial industrialization model, which was primarily focused on the production of fundamental material goods such as coal, steel, fertilizers, and cement for domestic consumption, has been supplanted by a production model oriented towards the exportation of a diverse array of consumer and investment goods. During this period, the magnitude of industrial production escalated nearly sixfold, primarily attributable to the dynamic expansion of a broad spectrum of processing industries, including machinery, food, consumer electronics, automotive components, furniture, and chemical products. Consequently, the significance of heavy industry within the Polish economy has experienced an inevitable decline. Certain facilities were decommissioned, while others underwent extensive technical and economic restructuring. This restructuring led to a substantial enhancement in production efficiency. Given a constant or slightly increasing production volume, this efficiency improvement necessitated significant reductions in employment.

1. OVERALL SITUATION OF POLISH HEAVY INDUSTRY FOLLOWING MAJOR SHOCKS IN 2020-2022

In recent years, the Polish manufacturing sector, particularly the heavy industry, has been suffered two significant disruptions, which have emerged as the primary drivers and influential factors in the trajectory of industrial production. The first shock occurred in 2020 when the COVID-19 pandemic instigated a transient yet profound economic recession, succeeded by a swift resurgence and surge in the consumption and export of industrial goods. In 2021, the Polish processing industry witnessed double-digit growth dynamics, surpassing the trend observed over the preceding two decades, during which the added value in the Polish industry grew by approximately 5-6% per year. This growth trajectory has positioned Poland as one of the leading producers of industrial goods in Europe. The second shock occurred in 2022 with the Russian invasion of Ukraine, which exacerbated the already apparent shortage of selected components, raw materials, and fuels essential for industrial production. This shortage has resulted in an explosion of costs in the industry, high consumer price inflation, and a general stagnation of consumer demand, not only in Poland but also in Europe, which is the main export market for Polish industry. As a result, the country's industrial production has stagnated since mid-2022, gradually returning to the long-term trend.

The key question is how did/do Polish cement, steel and chemical industries perform in these circumstances? Primarily, it is crucial to underscore that each of these industries has been subjected to distinct developmental stimuli over the past several years and decades. Relative to the late 1980s, steel production in Poland has nearly doubled, predominantly due to alterations initially in the volume and subsequently in the structure of domestic demand. Additionally, efficiency and environmental mandates within the steel sector, necessitated by the market economy, have also played a significant role. Certain steelworks were decommissioned, and the remaining facilities, following requisite modernization investments, concentrated on the production of products that allowed them to maintain a relative comparative advantage over imports.

The circumstances were different in the cement sector, which was inherently less susceptible to import competition. Owing to privatization and substantial modernization investments, this sector was able to swiftly meet escalating environmental requirements. A favourable factor was the gradual increase in demand for cement from the developing economy, which, from the late 1990s, began to correlate with a relative recovery in the construction sector, encompassing infrastructure, office, industrial, and residential construction. The demand for cement progressively increased, followed by the growth in the volumes of its domestic production, albeit at a slower pace than the dynamics of the industry as a whole.

Situated between the steel and cement industries was the internally diverse chemical industry. On one hand, the value of products manufactured therein was increasing, primarily due to the emergence of more technologically complex products, predominantly in the realm of petrochemistry or synthetic chemistry. On the other hand, the largest branch of the chemical industry in terms of volume – the production of artificial fertilizers – was constrained by the needs of Polish agriculture, which, after an initial rapid decline (crisis of the 1990s), began to gradually recover, growing at a moderate rate of 1-2% per year. Analogous to the steel and cement industry, the escalating environmental requirements, initially narrowed down to pollutants directly harmful to human health, and later also those resulting from the European climate policy, played a significant role in the chemical industry.

The recent economic perturbations in the European and Polish economies have exerted a significant influence on the heavy industry in Poland. Specifically, in the steel sector, challenges with the supply and price escalation of natural gas and electricity culminated in a decrease in steel production. The primary cause was a temporary shutdown of one of the blast furnaces in the largest Polish steel plant in Dąbrowa Górnicza, operated by ArcelorMittal, which attributed the high energy prices as the primary factor behind the closure. Concurrently, the import of iron ore declined due to the conflict in Ukraine – a country that has been the main supplier of iron ore to Poland over the past two decades. Elevated natural gas prices have also raised serious concerns about the uninterrupted production of nitrogen-based fertilisers. The decline in production volume was brief, primarily due to the government policy aimed at preventing disruptions in the supply of fertilizers to the agricultural market. Regarding other branches of chemical production, where natural gas is utilized as an energy source and not as a feedstock, the volatility of natural gas prices was not a significant factor in 2022, as they

do not rely heavily on natural gas for energy consumption. The Polish cement sector did not suffer considerably (if at all) from the COVID-19 and energy crises. Its performance was primarily driven by a high investment rate in the construction sector, propelled by the already initiated projects in infrastructure and residential buildings. However, this resilience pattern may be affected in 2024 by the delayed effects of the recent hike in interest rates, which are gradually translating into a declining number of new residential project starts.

Figure 1. Production of steel in Poland 2019-2022

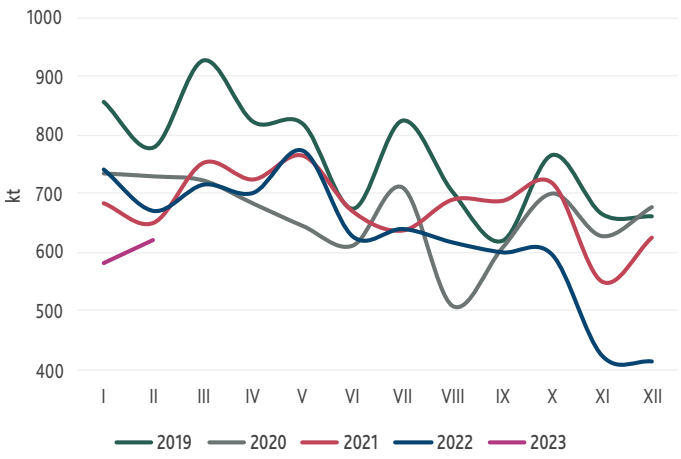


Figure 2. Iron ore imports to Poland in 2018-2022

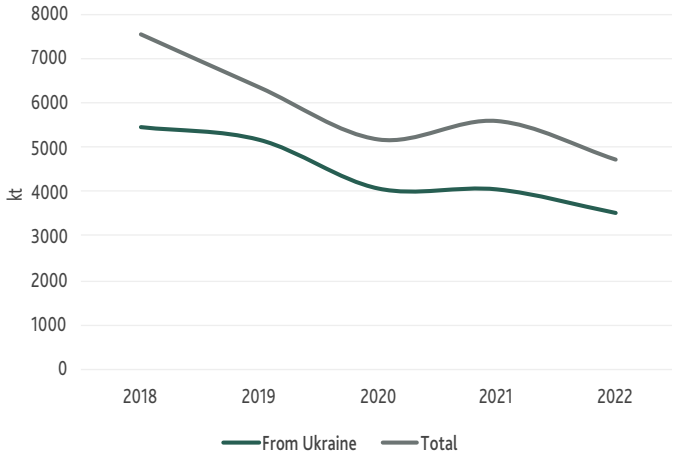
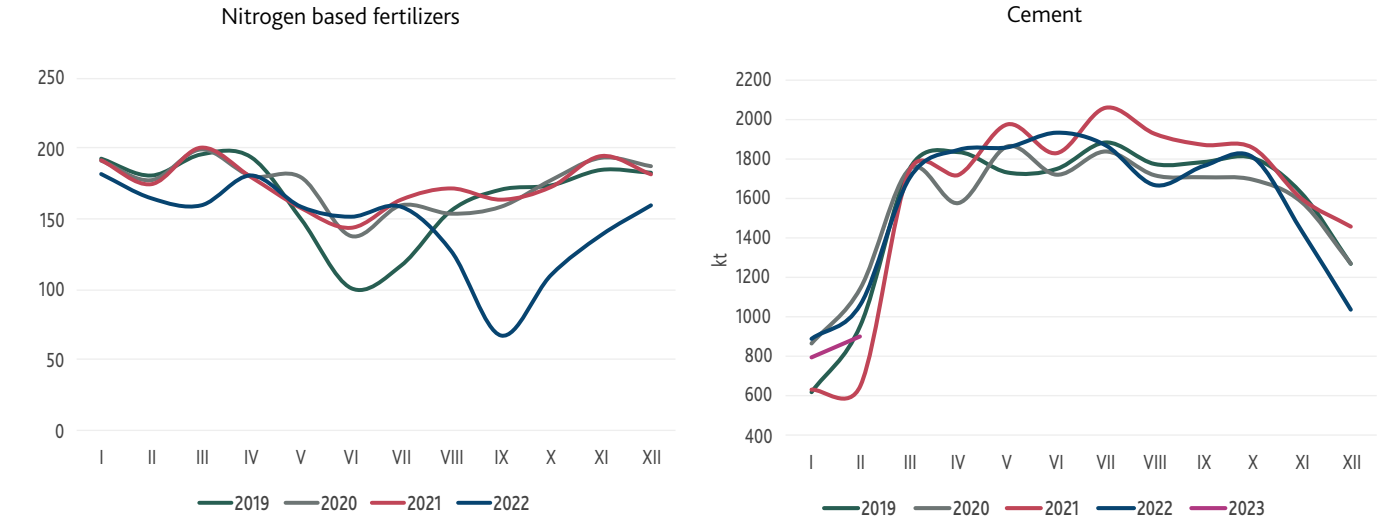
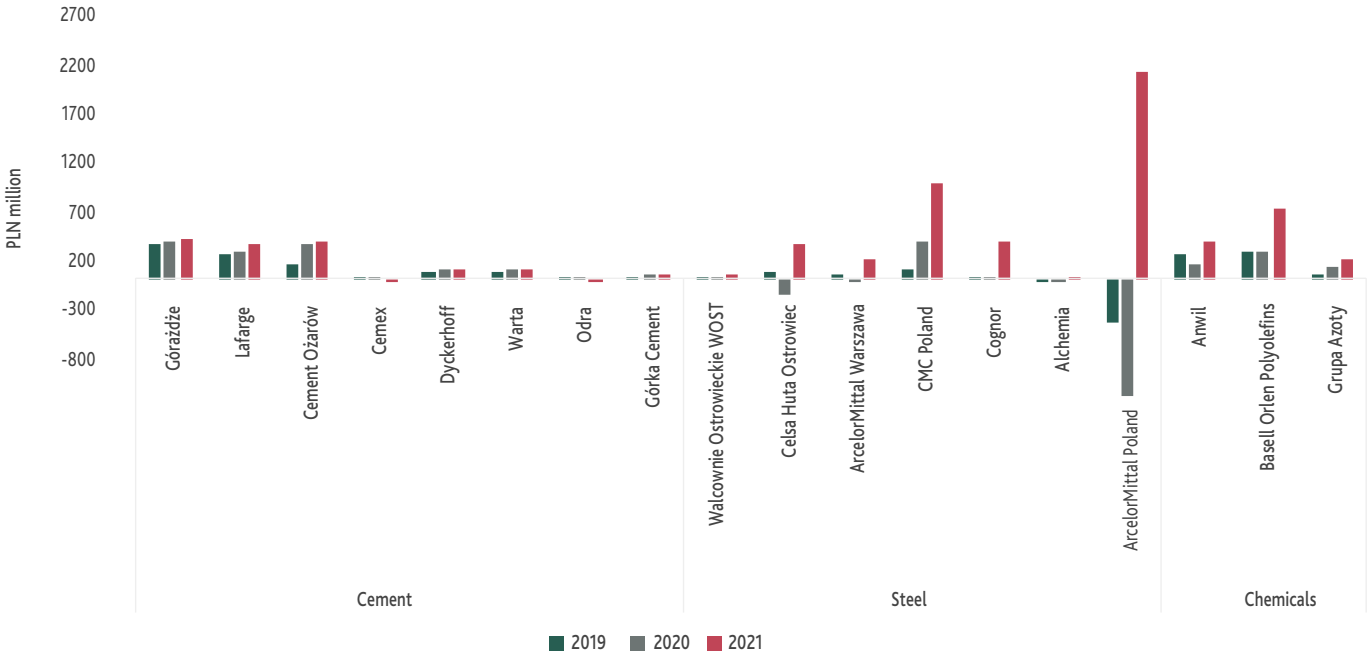


Figure 3. Production of fertilizers and cement 2019-2022



An examination of the financial data from Polish companies operating in the steel, cement, and chemical sectors reveals that, in general, they navigated the COVID-19 crisis without detrimental impacts on their profitability. They even reaped benefits from the economic resurgence in 2021 as the economy rapidly recovered from the production crisis. This observation is particularly pertinent to the steel sector: following a few years of losses or marginal profit, 2021 emerged as a financially positive year. Regrettably, reports for 2022 are currently unavailable (as of March 2023). These would be significant as they would explain the impact of the war in Ukraine on the financial results of Polish heavy industry.

Figure 4. Net profit of Polish industrial companies operating in steel, cement and chemical sectors in 2019-2021



2. DECARBONISATION EFFORTS AND INCENTIVES

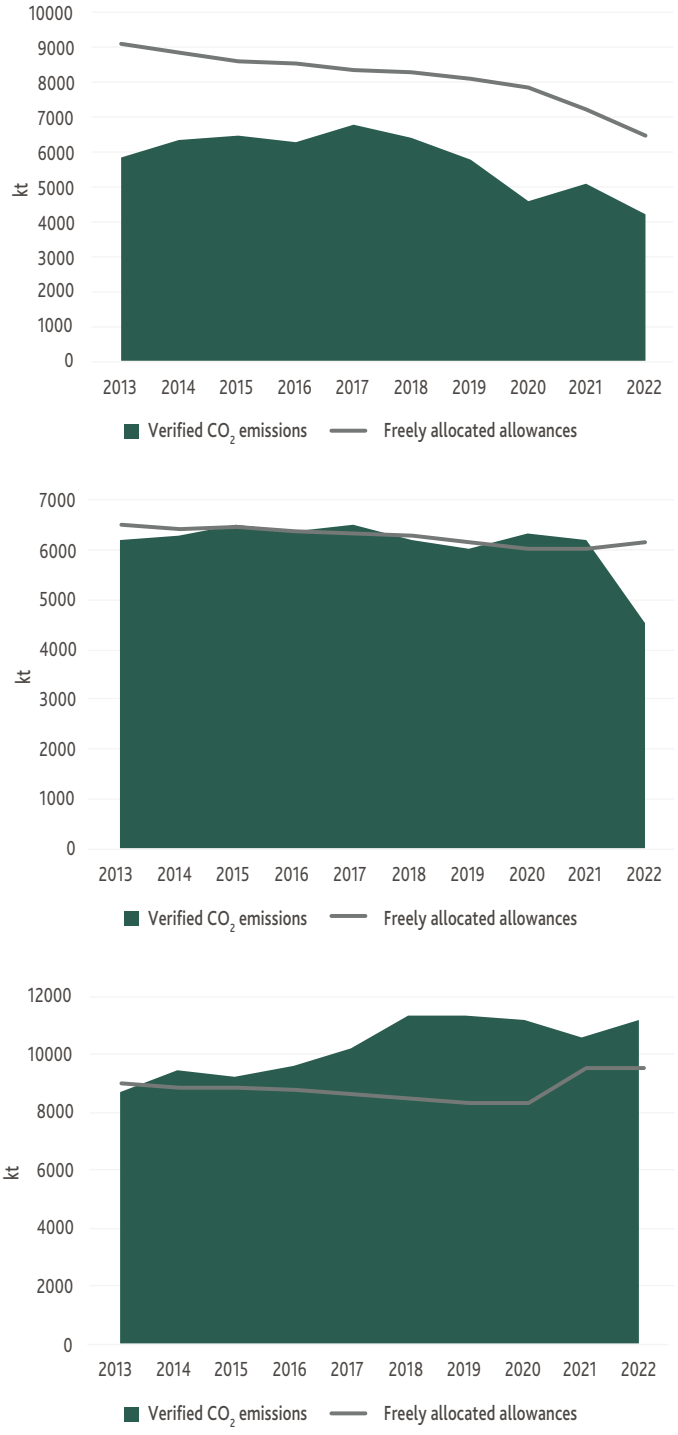
Polish industrial companies as a whole do not seem to care much about decarbonisation. The cement sector is taking a lead, as three Polish cement companies officially pledged to reduce their CO_2 emissions by 2030. Lafarge is even leading in cutting edge, CCS technologies for cement sector, not only in Poland, but also on a global scale (not to mention a major retrofit of the Małogoszcz cement plant).

Simultaneously, the impetuses for decarbonisation vary across sectors. There has been no explicit economic pressure on the decarbonisation of the steel industry in Poland, as a significant surplus of freely allocated emissions has been granted to the sector in recent years (see: Figure 5).

Despite this, steel companies have announced several decarbonisation projects that may alter the level of emissions in the near future. Specifically, in March 2022, the "Green Steel" project was initiated when Nowa Huta Przyszłości S.A. (KNHP) and Centrum Badawczo-Wdrożeniowe Zielona Stal S.A. (CBW Zielona Stal) signed a letter of intent to establish an R&D centre for steel decarbonisation.[1] A year later, the largest steel producer in Poland – ArcelorMittal – announced the intent to renovate its blast furnace process in Dąbrowa Górnicza. The renovation is expected to enhance energy efficiency and reduce carbon dioxide emissions and water consumption.[2] Moreover, in June 2023, the company announced an ambitious plan to construct a plant producing steel via the process of electrolysis by 2027. The plant is projected to produce 80,000 tonnes of sponge iron and up to one million tonnes in 2029.[3] There are also plans, announced by the Polish company Węglokoks, to deploy a new electric-arc furnace (EAF) with a capacity of up to 1 million tonne of steel per annum in Ruda Śląska by 2027.[4] This initiative aligns with the trend of increasing the share of EAF steel in Polish steel production, which translates into a lower carbon footprint of Polish steel.

1 See: https://www.gramwzielone.pl/woddor/107485/agh-szykuje-patent-na-bezemisyjna-produkcje-stali
2 See: https://polskiprzemysl.com.pl/wiadomosci/modernizacja-pieca-hutniczego-arcelormittal/
3 See: https://www.wnp.pl/hutnictwo/arcelormittal-buduje-zaklad-produkcji-stali-z-elektrolizy,721083.html
4 See: https://www.wnp.pl/hutnictwo/weglokoks-zbuduje-stalownie-za-5-mld-zl-to-pierwszy-krok-do-odbudowy-przemyslu-stalowego,610513.html

Figure 5. GHG emissions and free EU ETS allocations 2013-2022



Significant decarbonisation steps have also been undertaken in the cement industry, which – in contrast to the steel sector – incurs substantial costs of purchasing surplus CO_2 emission allowances as the volume of its emissions exceeds the threshold of free allocation. One of the most significant developments is the GO4ECOPLANET project of Lafarge Polska, which aims to construct a full CCS installation in its cement plant in the Kujawy region. The project was granted funding from the EU Innovation Fund, and an agreement with the European Union was signed in January 2023. A significant portion of CAPEX (EUR 228 million out of a total of EUR 265 million) will be funded by the EU Innovation Fund Programme. The CCS plant is scheduled to commence operations in 2027.[5] Moreover, in June 2023, the mayor of Barcin published his positive decision (environmental permit) for the plant, which is a crucial step in the permitting process.[6] In April 2023, Lafarge Polska announced that it had signed a PPA with KGAL Investment Management and will purchase energy from two wind farms, which are expected to supply half of the energy consumed by it in Poland.[7] By the end of 2023 Lafarge Polska is also to deliver the retrofitting investment in Małogoszcz cement plant which is expected to result in a 20% drop in the volume of annual CO_2 emissions.[8] Cemex Polska, another leading Polish cement producer, although not carrying out massive decarbonisation investments as of 2023, has announced decarbonisation targets for its Polish cement plants: 29% CO_2 emissions reduction for the Chełm cement plant and reduction by 23% for the Rudniki cement plant compared to 2021. The targets are to be achieved mainly by scaling up the use of clinker substitutes.[9]

In relation to fertilizer production, in late 2022, the Azoty Group announced that it is analysing the prospects of producing green ammonia in the Police plant.[10] The Group also intends to purchase 100% of shares in the 270MW PV project[11] and signed a memorandum of understanding with the Ultra Safe Nuclear Corporation on the deployment of Micro Modular Reactors. These actions supplement Azoty's main project "Green Azoty", which aims to install 380MW of renewable production capacity by 2030.[12] Similar initiatives are being considered in other branches of the chemical industry. In April 2023, the European Commission approved a plan for state subsidies for the production of green hydrogen by the Orlen Group in the Gdańsk Refinery. Hydrogen will be used in refining processes and will be directly subsidised with 158 million EUR. The project includes the construction of a 100MW electrolyser and a 50MW PV-farm. By 2027, the installation is expected to produce 13,500 tonnes of green hydrogen annually.[13] Moreover, in June 2023, there was a meeting of the Vice-Minister of National Assets with a representative of ExxonMobil dedicated to industry decarbonisation. According to media reports, the Polish government expressed

5 See: https://www.gramwzielone.pl/walka-ze-smogiem/109864/to-bedzie-pierwsza-w-polsce-calkowicie-zeroemisyjna-cementownia
6 See: https://www.wnp.pl/energetyka/wazna-decyzja-na-drodze-do-budowy-instalacji-ccs-w-polskiej-cementowni,724515.html
7 See: https://www.gramwzielone.pl/energia-wiatrowa/20143182/lafarge-kupi-energie-z-farm-wiatrowych-w-polsce
8 See: https://www.lafarge.pl/lafargeholcim-zainwestuje-ponad-100-mln-euro-w-modernizacje-cementowni-malogoszcz
9 2021 Sustainability Report by Cemex Polska (available at: https://www.cemex.pl/raport-zrownowazonego-rozwoju-2021)
10 See: https://www.portalmorski.pl/wiadomosci/zegluga/52330-grupa-azoty-analizuje-czy-produkowac-u-siebie-zielony-amoniak
11 See: https://www.wnp.pl/chemia/grupa-azoty-kupuje-farme-fotowoltaiczna-ktorej-jeszcze-nie-ma,659134.html
12 See: https://www.gov.pl/web/aktywa-panstwowe/grupa-azoty-police-amerykanska-spolka-ultra-safe-nuclear-corporation-i-zachodniopomorski-uniwersytet-technologiczny-podpisaly-porozumienie-w-zakresie-budowy-w-policach-badawczego-reaktora-modulowego-mmr-czwartej-generacji
13 See: https://poland.representation.ec.europa.eu/news/pomoc-panstwa-wodor-z-lotosu-2023-04-12_pl

its interest in the company's solutions for heavy industry, especially in CCS technologies.[14]

It is also important to mention that in February 2023, Orlen announced its new investment strategy. By 2030, the company, which owns multiple businesses in the petrochemical and chemical industry including oil refining, pledged to spend up to PLN 120 billion for "green investments", constituting 40% of total planned investments during this time.[15] Orlen also announced an ambitious plan for the deployment of Small Modular Reactors (SMR). In collaboration with Synthos, one of the largest chemical companies in CEE, Orlen aims to construct up to 76 SMRs by 2038, with the first one to be implemented in 2028. Some of the SMRs will support the decarbonisation of facilities owned by the two companies, such as the oil refinery in Płock.[16]

The decarbonisation efforts of Polish industrial companies are summarised in the table below.

Table X. Decarbonisation efforts by Polish companies from hard-to-abate industrial sectors

Sector and company	ESG reporting	2030 decarbonisation target at the national level (reference year)	Planned or ongoing decarbonisation efforts and investments
ArcelorMittal Poland			No reported efforts
Cemex Polska		Chełm cement plant: -29% CO_2 (2021) Rudniki cement plant: -23% CO_2 (2021)	Mainly clinker substitution
Dyckerhoff Polska			No reported efforts
Górażdże Cement		-30% CO_2 from clinker production (1990)	No reported efforts
Lafarge Cement		-55% kg CO_2 / tonne of cement (1990)	Retrofit of Małogoszcz cement plant (-20% CO_2, -1/3 energy consumption) Carbon capture installation at the Kujawy cement plant
Cementownia Odra			No reported efforts
Cement Ożarów			No reported efforts
Cementownia Warta			No reported efforts

14 See: https://forsal.pl/biznes/ekologia/artykuly/8733536,dekarbonizacja-polski-bedzie-wspolpraca-z-exxonmobil.html

15 See: https://wgospodarce.pl/informacje/124214-pkn-orlen-strategia-120-mld-zl-tzw-inwestycji-zielonych-do-2030-r

16 See: https://biznes.interia.pl/gospodarka/news-pierwsze-male-reaktory-jadrowe-smr-orlenu-i-synthosu-znamy-w,nld,6722462

4. Detailed Outlook on the Current Situation and Trends in Individual Sectors

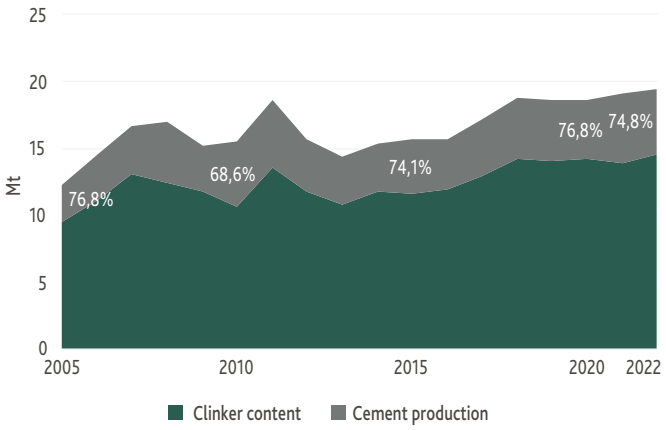
4. Detailed Outlook on the Current Situation and Trends in Individual Sectors

1. CEMENT

GVA share (2019)	Employment share (2019)	CO_2 emissions share (2019)
1,1%	0,9%	5,4%

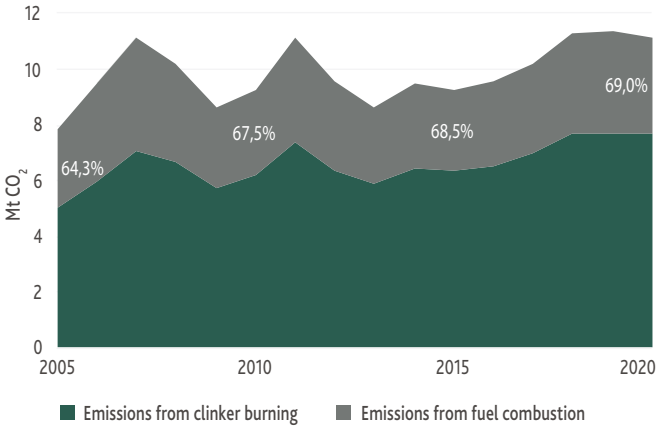
Cement production (see: Figure 6) in Poland have fluctuated since 2005, mainly due to macroeconomic developments. For example, a sudden drop in cement production following the crisis in 2008 and a rapid bounce back can be observed. Similarly in the case of the impact of the COVID-19 pandemic: cement production development slowed down in 2020, but increased again in 2021 and 2022. This is reflected in CO_2 emissions from cement production over this period (see: Figure 7), as they have not been decoupled from cement production. However, the share of emissions from clinker burning has increased by approximately 5% between 2005 and 2021, whereas clinker content actually decreased compared to 2005. This proves that Polish cement companies succeeded in reducing CO_2 emissions from fuel combustion, i.e. increasing energy efficiency of cement production or switching to lower-carbon fuels (in fact, the share of CO_2 emissions dropped by 5% compared to 2002). The observed trend of improving energy efficiency of cement production appears as a low-hanging fruit for the decarbonisation of Polish cement.

Figure 6. Cement production in Poland between 2005 and 2022



Source: WiseEuropa based on Polish Cement Association and Statistics Poland

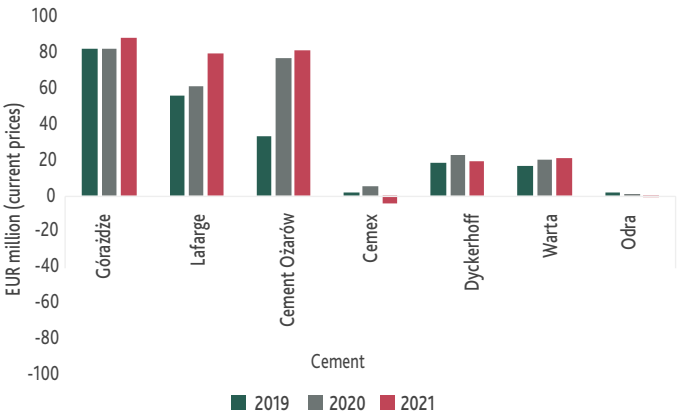
Figure 7. CO_2 emissions from cement production in Poland between 2005 and 2020



Source: WiseEuropa based on EU ETS data and UNFCCC

In general, Polish cement companies got through the COVID-19 crisis without visible damage to their profitability (see: Figure 8). If they were to start decarbonisation investments, they would maintain a good financial situation.

Figure 8. Net profit of Polish cement companies in the 2019-2021 period



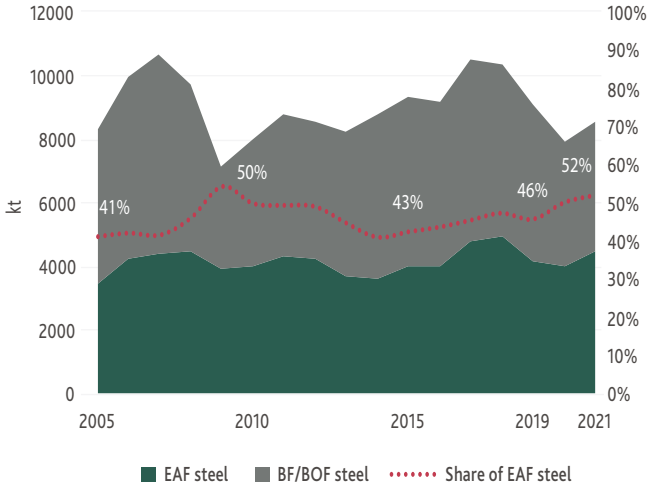
Source: WiseEuropa based on financial reports submitted to National Court Register

2. STEEL

GVA share (2019)	Employment share (2019)	CO_2 emissions share (2019)
0.5%	0.4%	2.5%

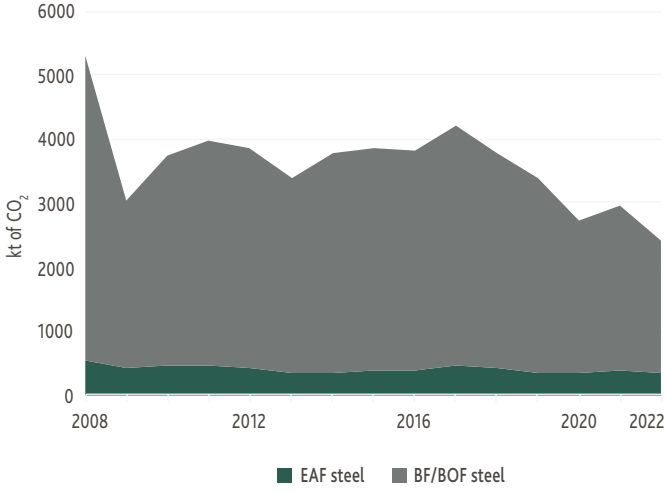
Steel in Poland is produced in one of two ways: either through ironmaking in blast furnace from coke, iron ore and other additives and then in basic oxygen furnace (BF/BOF steel), or in the electric arc furnace from scrap steel (EAF steel). As of 2023, there is one integrated (BF/BOF) steelmaking plant and 7 electric arc furnaces. Although of smaller capacity, EAFs have been increasing their share in Polish steel production and as of 2021 more than a half of Polish steel comes from EAFs (see: Figure 9). The remaining share of steel is being made via the BF/BOF route which is much more carbon intensive (see: Figure 10). Due to its overwhelming importance for CO_2 emissions from the Polish steel sector, and given limited decarbonisation options for EAFs, this study is focused on the decarbonisation of Polish BF/BOF steel production.

Figure 9. Steel production in Poland between 2005 and 2022



Source: WiseEuropa based on Statistics Poland

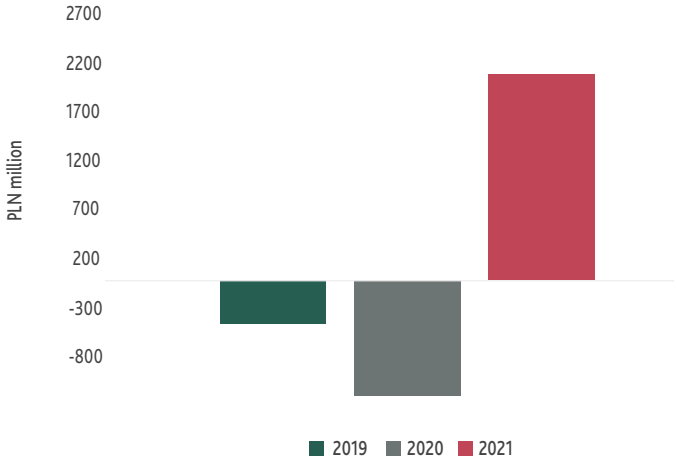
Figure 10. CO_2 emissions from steel production in Poland between 2008 and 2022



Source: WiseEuropa based on EU ETS data

ArcelorMittal Poland owns the Polish BF/BOF steel plant. The company seems to have benefitted from the economic bounce-back in 2021, when the economy was suddenly recovering from the production crisis caused by the COVID-19 pandemic, as in 2021 a substantial profit has been reported after a few years of losses or marginal profit.

Figure 11. Net profit of ArcelorMittal Poland in the 2019-2021 period



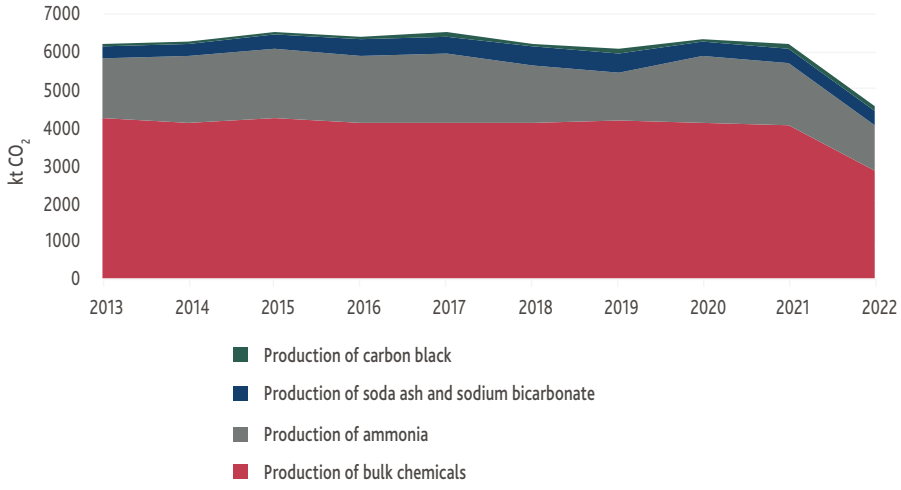
Source: WiseEuropa based on financial reports submitted to National Court Register

3. CHEMICALS

GVA share (2019)	Employment share (2019)	CO_2 emissions share (2019)
0.9%	0.5%	3.8%

There is a wide range of chemical products, but as the data on CO_2 emissions show (see: Figure 12), the most substantial CO_2 emission reductions might be achieved through decarbonisation efforts in ammonia and bulk chemicals production. Bulk chemicals are chemical products, mainly derivatives of oil and petroleum, the most emissive of which is ethylene, which is why ethylene is not taken not into consideration in this study when designing the decarbonisation scenario, investment needs and financial capacities.

Figure 12. CO_2 emissions from chemical production in Poland between 2013 and 2022 (by product)



Source: WiseEuropa based on EU ETS data

5. Policy Environment of Poland's Heavy Industry

5. Policy Environment of Poland's Heavy Industry

1. POLISH POLICY FRAMEWORK

The Polish industrial policy pertaining to the green transformation, with a particular emphasis on decarbonisation, is characterized by a conspicuous absence of a comprehensive approach and strategic planning. As a result, this creates several additional obstacles to the decarbonisation of industries, as industry representatives lack clarity on the specific modifications required and policies often show contradictions.

First of all, there is a lack of strategic understanding and vision at the level of the central government. A significant underlying issue is the absence of a strategy for decarbonising the entire economy, thereby leaving the role that the industry should play in these plans undefined. The National Climate and Energy Plan delineates certain policies and measures dedicated to industry, such as diversification of raw materials for the domestic chemical industry, reduction of unit energy consumption in industry by 20% compared with 2018, and actions enhancing sustainable use of renewable resources in industry. However, industry decarbonisation is not a government priority. The strategies and policies regarding the issue are transient: plans are formulated but their implementation is often incomplete. The Strategy for Sustainable Development (the so-called "Morawiecki plan") exemplifies this problem. The reform package included a reindustrialization plan targeting heavy industries. However, like the rest of the Strategy for Sustainable Development, it was never consistently or holistically executed.

The implementation of strategic documents is thus inefficient, attributable to the lack of governance procedures and implementation management, as well as monitoring indicators for these strategies and roadmaps. In 2022, "The Pathway to Circular Economy" should have been implemented, but the document still lacks a precise timeline with milestones and crucial reforms for businesses and organisations, and there is no communication campaign targeted at the stakeholders. Consequently, awareness of the impending changes and policies is low. Moreover, in the absence of a framework that consolidates all the policies constituting a decarbonisation strategy, it is challenging for the industry to locate crucial information. This is particularly important given the absence of a timeline for implementing the policies described in different strategies.

The shortcomings in strategic planning result from the politicisation of the topic of decarbonisation. A document that planned to address the issue thoroughly and consistently is currently still in draft form. "Polish Industrial Policy" is a strategic document that emphasised three main fields of transforming the industry: green transition, digitalisation, and competition. However, due to a lack of political consensus and frequent personnel changes in the Ministries causing disruptions in the operation of national administration, the "Polish Industrial Policy" was not being processed. It was finally released but with a new title, i.e. "Strategy for productivity", but the issue of decarbonising industrial production is not tackled in this document either.

Furthermore, there are no cross-sectional policies and direct reforms dedicated to decarbonising the industry. Moreover, the activities that are being undertaken are fragmented, and they lack inter-ministerial cooperation and communication with local governments. The lack of inter-ministerial cooperation results in a critical barrier, namely an inconsistency in strategic documents and policies. Proposals from different documents can not only differ but also contradict each other. This creates a significant barrier for the industry, which requires long-term stability due to the long investment cycle.

The public consultation procedure is not regularly employed, and thus it does not ensure a diversity of views and the real participation of citizens and other stakeholders in the creation of strategies and regulations. Therefore, existing documents lack key insights that would warrant in-depth analysis. Poland's strategies' level of ambition regarding decarbonisation is also much lower than the goals that are being presented by the European Union. This is certainly true for the issue of decarbonising the industry. The policies lack the level of ambition that is needed to ensure the success of decarbonisation and the green transition.

2. EUROPEAN POLICY FRAMEWORK

Industry decarbonisation in Europe is to a large extent driven by EU policies. In the coming years Polish industrial companies will face the consequences of certain pieces of legislation passed by the EU, and Polish authorities should take these laws and measures into consideration when designing the general CO_2 emission reduction strategy for Polish economy (including industrial production) and industrial policies in particular.

The policies listed and described below have been included in the scenario of CO_2 emission reduction in Polish heavy industry by 2030 developed in: Chapter 5. Roadmap's scenario description.

- **EUROPEAN CLIMATE** LAW AND EMISSION REDUCTION TARGETS:

Union-wide greenhouse gas emissions and removals regulated in Union law shall be balanced within the Union at the latest by 2050, thus reducing emissions to net zero by that date, and the Union shall aim to achieve negative emissions thereafter.

In order to reach the climate-neutrality objective set out in Article 2(1), the binding Union 2030 climate target shall be a domestic reduction of net greenhouse gas emissions (emissions after deduction of removals) by at least 55 % compared to 1990 levels by 2030.

- **EU ETS REVISION** AND EMISSION REDUCTION TARGETS FOR SECTORS COVERED BY THE EU ETS:

Achieving the Union's emissions reduction target for 2030 will require a reduction in the emissions of the sectors covered by the EU ETS of 62 % compared to 2005.

- **RED III RECAST**[17] (STILL IN PROGRESS) AND RES SHARE IN THE INDUSTRY:

Mainstreaming renewable energy in industry

Member States shall endeavour to increase the share of renewable sources in the amount of energy sources used for final energy and non-energy purposes in the industry sector by an indicative average minimum annual increase of 1.9 percentage points by 2030. That increase shall be calculated as an average for the three-year periods, i.e. 2024 to 2027 and 2027 to 2030.

Member States shall ensure that the contribution of renewable fuels of non-biological origin used for final energy and non-energy purposes is 50% of the hydrogen used for final energy and non-energy purposes in industry by 2030. Member States shall ensure that by 2035, the contribution of renewable fuels of non-biological origin used for final energy and non-energy purposes is at least 70% of the hydrogen used for final energy and non-energy purposes in industry. (EP mandate)

OR

Member States shall endeavour to increase the share of renewable sources in the amount of energy sources used for final energy and non-energy purposes in the industry sector by an indicative increase of at least 1.1 percentage points as an annual average calculated for the periods 2021 to 2025 and 2026 to 2030.

Member States shall ensure that the contribution of renewable fuels of non-biological origin used for final energy and non-energy purposes shall be 35% of the hydrogen used for final energy and non-energy purposes in industry by 2030 and 50% by 2035.

(Council mandate)

- **CBAM** AND GRADUAL PHASE-OUT OF FREE EMISSION ALLOWANCES18 FOR STEEL, CEMENT AND, PARTIALLY, CHEMISTRY (AS FAR AS FERTILIZERS ARE CONCERNED) BY 2034, STARTING IN 2026

- **REPOWEREU** AND EU-WIDE PROMOTION OF HYDROGEN AND BIOMETHANE IN INDUSTRY:

Electrification, energy efficiency and uptake of renewables could allow industry to save 35 bcm of natural gas by 2030.

Largest reductions in gas, almost 22 bcm, could be made from non-metallic minerals, cement, glass and ceramics, chemicals production and refineries.

Around 30% of EU primary steel production is expected to be decarbonised on the basis of renewable hydrogen by 2030.

Biomethane production needs to reach 35 billion cubic metres (bcm) per year by 2030.

- **NET ZERO INDUSTRY ACT** AND EU-WIDE CO_2 INJECTION CAPACITY TARGET

An annual injection capacity of at least 50 million tonnes of CO_2 shall be achieved by 2030, in storage sites located in the territory of the European Union, its exclusive economic zones or on its continental shelf within the meaning of the United Nations Convention on the Law of the Sea (UNCLOS) and which are not combined with Enhanced Hydrocarbon Recovery (EHR).

- **EU TAXONOMY** AND TECHNICAL SCREENING CRITERIA FOR SECTORS IN SCOPE (AS PREREQUISITES FOR OBTAINING FINANCE FROM THE MARKET AND – AS FAR AS A HORIZONTAL APPLICATION OF A DNSH PRINCIPLE IS CONCERNED – FROM ALL EU FUNDS)

17 European Commission (2022), Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 of the European Parliament and of the Council (available at: https://data.consilium.europa.eu/doc/document/ST-13372-2022-INIT/EN/pdf)

18 European Commission (2023), Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union (available at: https://data.consilium.europa.eu/doc/document/ST-6210-2023-INIT/EN/pdf)

Box 1. Polish cement production and the EU Taxonomy – case study

Technical Screening Criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation → CO_2 emission threshold is set at **0.469 t CO_{2eq}/tonne of cement**, achieved emission reduction should be below this threshold if a given investment investment/activity is to be qualified as aligned with the EU Taxonomy.

However, a given investment in a cement plant can still be taxonomy-aligned when complying with another environmental objective, i.e. climate change adaptation (in March 2023 it is the only other environmental objective for which we have TSC), for which there is less severe CO_2 emission threshold: **0.530 t CO_2eq/tonne of cement.**

Meanwhile, GHG emissions in Polish cement in 2022 were **0.59 t CO_2eq/tonne of cement**, which is not very far from the EU taxonomy thresholds. Therefore, Polish cement can perform a minor decarbonisation effort in order to be an attractive partner for banks and investors seeking green assets and investment opportunities. For this reason, mobilising finance for the decarbonisation of Polish cement plant in the market shouldn't be a difficult challenge, especially compared to other sectors.

6. Roadmap's Scenario Description

6. Roadmap's Scenario Description

Our estimation of investment needs for industrial decarbonisation, which is a prerequisite for further assessing what role could be played by public finance sources and private sustainable finance in financing industrial decarbonisation in Poland and, hence, for determining what steps should be made until 2030 in order to mobilise sufficient finance, is based on the predefined scenario of CO_2 emissions reduction in three industrial sectors in scope of this study. For this purpose, different models and projections available in public domain have been reviewed from the perspective of their usability for the aims of this report, i.e. whether they are compliant with EU decarbonisation policies, whether they allow to calculate the costs of decarbonisation, and to what extent they are consistent with Polish characteristics (for example current CO_2 emissions).

Therefore, two different approaches have been adopted depending on the sector:

- When it comes to cement, CO_2 emissions reduction pathway was outlined on our own based on, firstly, decarbonisation plans and investments announced by Polish cement companies. This pathway was compared against carbon intensity targets for 2030 pledged or calculated by Cembureau, the International Energy Agency and Global Cement and Concrete Association (GCCA) in order to verify whether Polish cement is "on track". As we observed a gap between CO_2 emissions reduction that are to be achieved in the current investments pathway and international CO_2 emission reduction targets, additional available investments were taken into account in order to allow Polish cement to align with recommended trends. To that end, we referred to the review of decarbonisation technologies in the cement sector, ECRA Technology Papers[19], developed by the European Cement Research Academy in cooperation with the Global Cement and Concrete Association. The report defines energy savings for every decarbonisation technology in scope, so, having known the fuel consumption breakdown in Polish cement sector[20] and the CO_2 emission factor applicable for each fuel, we calculated potential CO_2 emissions reduction thanks to implementing a given technological solution. The report describes a wide range of decarbonisation technologies and we strived to make a selection of technologies tailored to the current state of Polish cement sector (the selection we made is enclosed in Annex 1). We chose CAPEX-intensive technologies aimed at increasing energy efficiency of cement production, we rejected clinker substitution technologies (as we do not know the availability of clinker substituents in the Polish market) and fuel switch (as the availability of low-emission alternative fuels, including natural gas, is hard to predict). Decarbonisation costs have been then calculated based on cost estimates determined in ECRA Technology Papers on a single cement plant level. Therefore, the final costs have been multiplied by the number of cement plants operating in Poland;

- In the case of steel and chemical production, IndustryPLAN[21], a tool developed by the University of Aalborg, which outlines CO_2 emissions and energy consumption reduction pathway in particular industrial sectors by 2030 and by 2050, has been applied. Regarding decarbonisation measures, this scenario relies on Best Available Technologies in energy efficiency and some innovative and electrification measures, but the majority of them, including the application of hydrogen, massive electrification and deployment of CC(U)S installation, is postponed for the decades between 2030 and 2050 due to their insufficient market maturity. Fuel switch itself is included in the model (e.g. from fossil fuels to fuels of biological origin and electricity), but its cost have not been incorporated in the scenario calculation – fuel share for every five year period is an exogenous variable. The main limitation of this tool, however, is that it refers to 2015 as a starting point for designing the decarbonisation pathway and that cost calculations are based on 2015 prices which might have significantly increased since then, especially given inflation in the early 2020s.

The underlying assumption behind all of the scenarios is that they do not include the implementation of breakthrough industrial decarbonisation technologies, namely Carbon Capture, Storage and Utilisation, and hydrogen use on a massive scale, because we predict that they will not play a major role in Polish industry before 2030 which constitutes the time perspective of this roadmap. This prediction is based on information from many industry-related reports and is widely shared by industrial stakeholders in the EU.

19 European Cement Research Academy (2022), The ECRA Technology Papers 2022 – State of the Art Cement Manufacturing – Current Technologies and their Future Development (available at: https://ecra-online.org/fileadmin/redaktion/files/pdf/ECRA_Technology_Papers_2022.pdf)

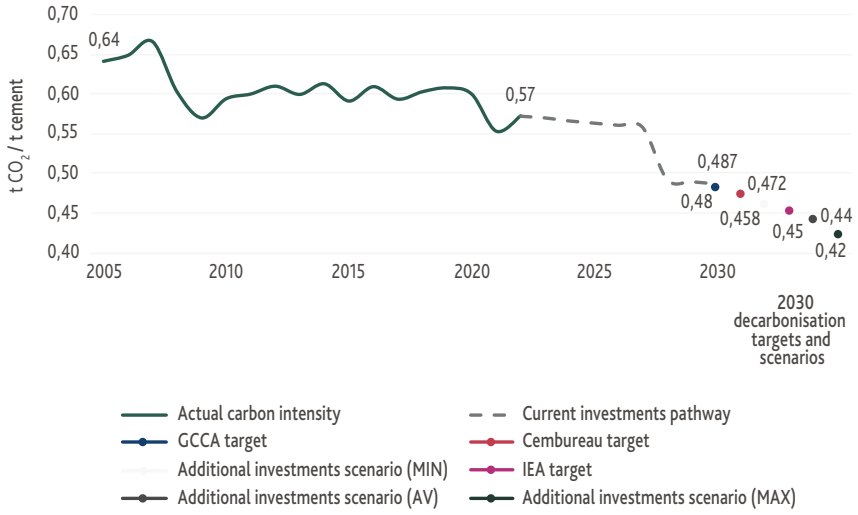
20 Eurostat, Disaggregated final energy consumption in industry – quantities by NACE Rev. 2 activity (available at: https://ec.europa.eu/eurostat/databrowser/view/NRG_D_INDQ_N__custom_7110228/default/table?lang=en)

21 Johannsen, R. M., Mathiesen, B. V. (2023), IndustryPLAN. VBN. IndustryPLAN_V1(.xlsm) (available at: https://vbn.aau.dk/en/datasets/industryplan)

1. DECARBONISATION SCENARIO FOR CEMENT PRODUCTION BY 2030

Based on ongoing or announced decarbonisation efforts a CO_2 emissions reduction pathway was drawn against carbon intensity targets by Cembureau, IEA and GCCA for cement on the course to achieving climate neutrality in 2050.

Figure 13. CO_2 emissions reduction in Polish cement sector by 2030 – is Polish cement on track?



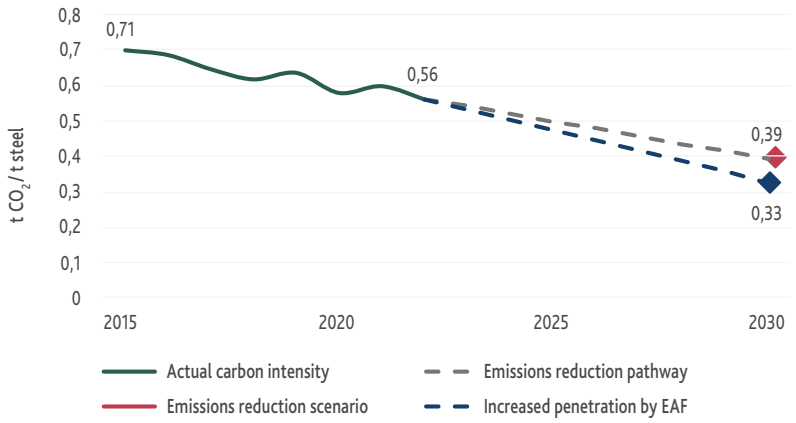
Source: WiseEuropa based on decarbonisation announcements by Polish cement companies, Cembureau, GCCA, IEA and ECRA

Thanks to the massive decarbonisation effort by just a few of Polish cement companies, and to a very large extent thanks to a CCS deployment at the Kujawy cement plant, Polish national cement production as a whole is very close to achieving CO_2 emissions reduction targets set by international organisations. However, especially given the financial pressure exerted by EU regulations, other Polish cement companies should not and cannot act like a free rider. In the perspective of 2050 and climate neutrality target investments aimed at achieving 2030 targets at the cement plant level should be made anyway.

2. DECARBONISATION SCENARIO FOR STEEL PRODUCTION BY 2030

As can be seen in Figure 14, CO_2 emissions reduction from steel production reported in Poland in the 2015-2022 period is much greater than required by the linear pathway suggested by the IndustryPLAN tool – as a result, as of 2022 the Polish steel sector would need limited effort to reach the assumed 2030 CO_2 emissions target. However, the observed reduction due to improved carbon efficiency of steel production in Poland. As Figure 14 shows, in 2021 CO_2 emissions per tonne of steel (from BF/BOF and EAF route together) is much further from the target envisioned by IndustryPLAN (but it is congruent with the outlined emissions reduction pathway). Therefore, the penetration of Polish steel production with efficiency technologies is still limited and the decline in CO_2 emissions which occurred in 2015-2021 was also due to the growing share of lower carbon EAF steel (faster than assumed by IndustryPLAN), but primarily because due to the decline of steel production in Poland (see Figure 14 in the chapter on the current state of the steel market in Poland) compared to the emissions reduction scenario, which assumes that in 2030 steel production in Poland would amount to 9900 kt, whereas in 2021 it was 8500 kt.

Figure 14. Reduction of the carbon intensity of steel by 2030



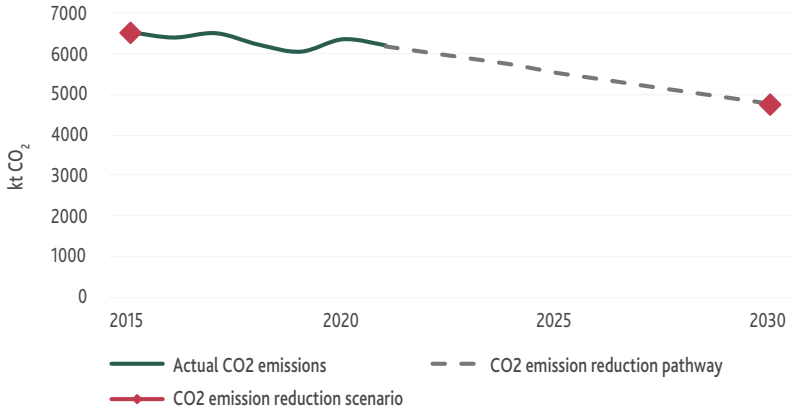
Source: WiseEuropa based on IndustryPLAN and EU ETS data

Since the main emission reduction measures on which the scenario is based are BAT increasing energy efficiency, achieving the 2030 emission target should be driven by reducing the consumption of fossil fuels, especially since steel production is not expected to increase significantly by 2030 compared to 2015 (according to the IndustryPLAN). In fact, the scenario assumes significant reduction of energy consumption, which translates into reducing reliance on fossil fuels. However, a major discrepancy has been identified between input data on energy consumption in 2015 inserted into the IndustryPLAN and actual numbers submitted to Eurostat. This indicates that the scenario and estimated decarbonisation costs are not essentially appropriate for the case of Poland. However, the model might be useful in predicting what could be the cost of reducing energy intensity of steel production as it does not necessarily depend on energy consumption levels. IndustryPLAN assumes energy intensity of steel production in Poland to be reduced by 2.7 GJ / tonne of steel by 2030.Decarbonisation scenario for chemical production BY 2030

3. DECARBONISATION SCENARIO FOR CHEMICAL PRODUCTION BY 2030

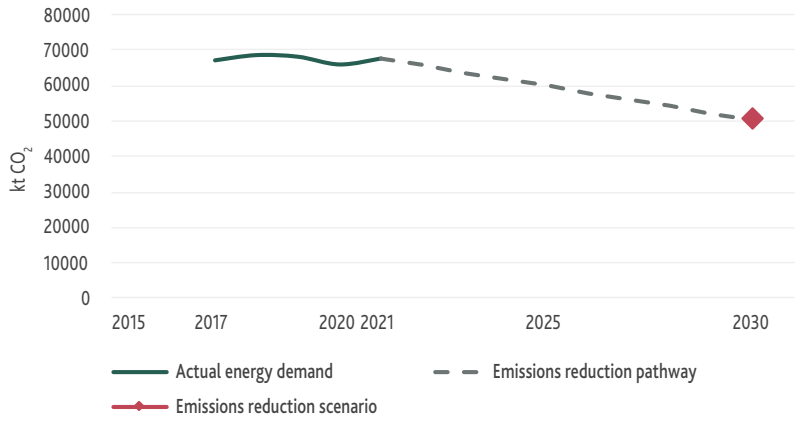
Figure 15 shows calculated CO_2 emissions reduction resulting from the implementation of energy efficiency technologies (which is proved by Figure 16 demonstrating a decrease in energy demand).

Figure 15. Reduction of energy demand from chemical production by 2030



Source: WiseEuropa based on IndustryPLAN and Eurostat data

Figure 16. Reduction of CO_2 emissions from chemical production by 2030



Source: WiseEuropa based on IndustryPLAN and EU ETS data

Since the main emission reduction measures on which the scenario is based are BAT increasing energy efficiency, achieving the 2030 emission target should be driven by reducing the consumption of fossil fuels, especially since steel production is not expected to increase significantly by 2030 compared to 2015 (according to the IndustryPLAN). In fact, the scenario assumes significant reduction of energy consumption, which translates into reducing reliance on fossil fuels. However, a major discrepancy has been identified between input data on energy consumption in 2015 inserted into the IndustryPLAN and actual numbers submitted to Eurostat. This indicates that the scenario and estimated decarbonisation costs are not essentially appropriate for the case of Poland. However, the model might be useful in predicting the cost of reducing the energy intensity of steel production as it does not necessarily depend on energy consumption levels.

7. Investment needs

7. Investment needs

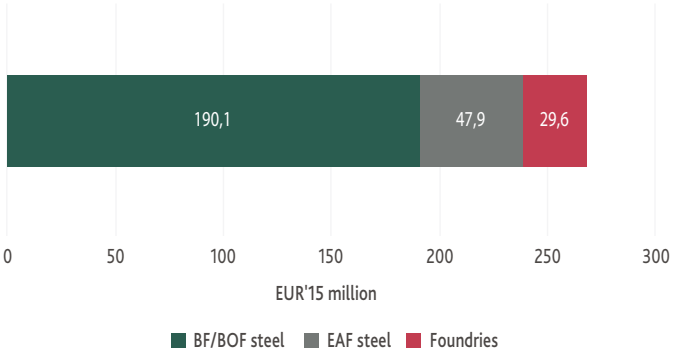
1. CEMENT

Based on the review of decarbonization technologies of the cement industry provided by ECRA, a technological mix was selected for the Polish cement plant, taking into account the current state of technological advancement of Polish cement plants. Mature energy efficiency technologies (with a minimum TRL of 7) were selected from the list and, thanks to estimates of thermal energy savings and CO_2 emissions and a cost assessment, the cost of decarbonisation for a single plant was calculated. **Thus, the capital expenditure required to achieve (approximately) a carbon dioxide emission intensity of 0.44 t CO_2/tonne of cement may amount to EUR 182 million per cement plant in Poland, which translates into a total capital expenditure of EUR 1,642 million in the entire Polish cement sector.**

2. STEEL

IndustryPLAN provides an assessment of decarbonisation costs by 2030 for particular branches in the steel sector and the sector as a whole. Total cost amounts to **EUR 268 million**; a detailed breakdown for steel production routes and stages is presented in Figure 17.

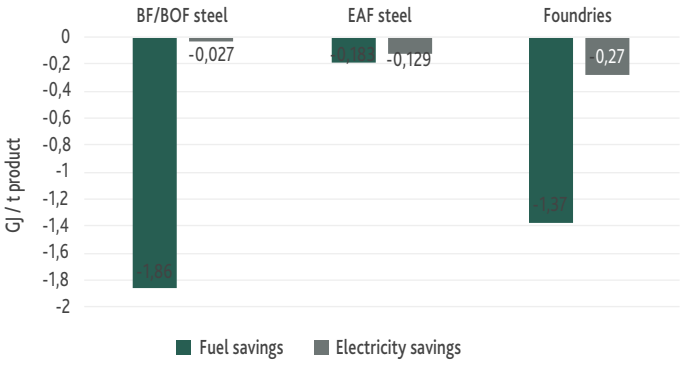
Figure 17. Cost of steel sector decarbonisation in Poland by 2030



Source: WiseEuropa based on IndustryPLAN

However, given the discrepancies between actual energy consumption in 2015 and energy consumption in 2015 assumed by the model, it appears that the most credible approach is to treat decarbonisation cost calculated by the IndustryPLAN tool as the cost of decreasing energy intensity of particular steel products. Therefore, investments worth EUR 268 million would lead to a calculated drop in energy intensity of particular products (less significant in terms of electricity intensity). A detailed breakdown for steel products and energy and electricity intensity development is demonstrated in Figure 18.

Figure 18. Reduction of energy and electricity intensity of steel products thanks to decarbonisation investments by 2030

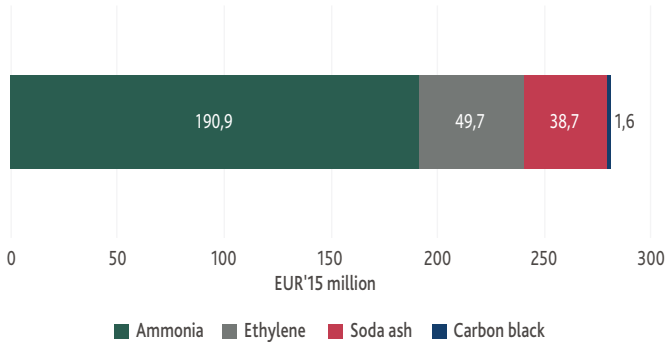


Source: WiseEuropa based on IndustryPLAN

3. CHEMICALS

IndustryPLAN provides an assessment of decarbonisation costs by 2030 for particular groups of chemical products and the sector as a whole. Total cost amounts to EUR 281 million; a detailed breakdown for chemical products is presented in Figure 19.

Figure 19. Cost of chemical sector decarbonisation in Poland by 2030



Source: WiseEuropa based on IndustryPLAN

However, given the discrepancies between actual energy consumption in 2015 and energy consumption in 2015 assumed by the model, it appears that the most credible approach is to treat decarbonisation cost calculated by the IndustryPLAN tool as the **cost of decreasing energy intensity of particular chemical products**.

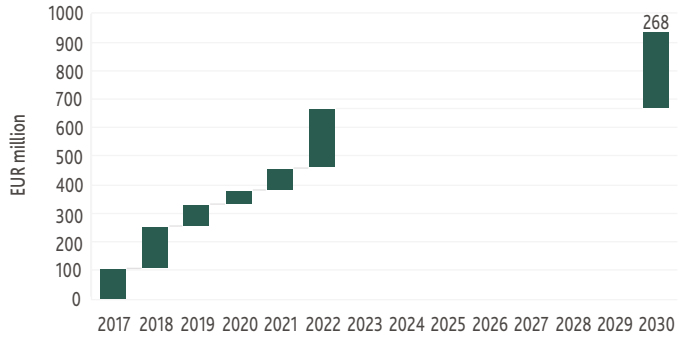
8. Financing available

8. Financing available

1. PRIVATE FINANCE

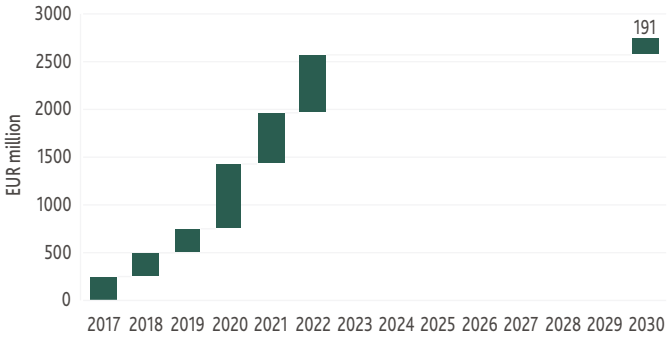
When compared to the amount of investments made by companies in the last few years, we can see that the cost of gradual decarbonisation until 2050 does not have to be excessive in the case of steel and chemical production (see Figures 20 and 21, respectively).

Figure 20. Decarbonisation investment needs compared to the value of to date investments in the steel sector



Source: WiseEuropa based on financial reports submitted by steel companies and own calculations

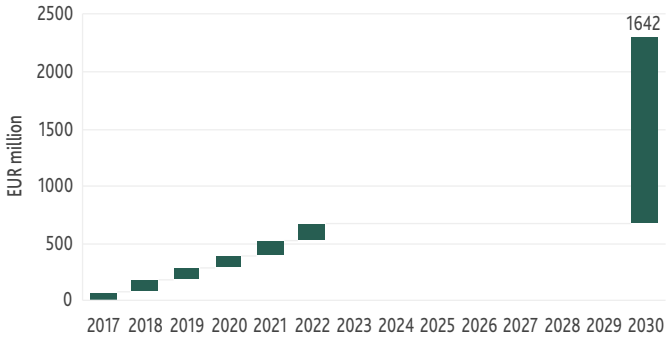
Figure 21. Decarbonisation investment needs compared to the value of to date investments in the chemical sector



Source: WiseEuropa based on financial reports submitted by steel companies and own calculations

However, additional decarbonisation investments might be a significant, unprecedented burden for cement companies (see: Figure 22).

Figure 22. Decarbonisation investment needs compared to the value of to date investments in the cement sector

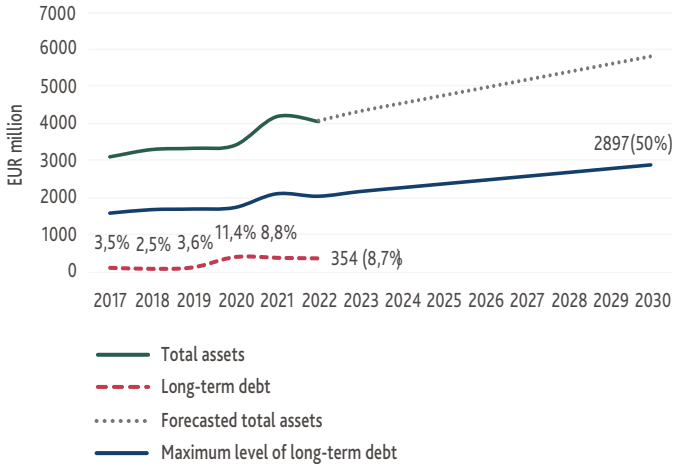


Source: WiseEuropa based on financial reports submitted by cement companies and own calculations

As a result, private, company-based financial resources generated in the upcoming years by steel and chemical sector might be expected to be sufficient to finance the decarbonisation of these sectors in Poland by 2030.

In the case of cement companies, external financial leverage might be required in order to foster decarbonisation efforts. Fortunately, the level of long-term debt in Polish cement sector (i.e. bank credits, loans, bonds with the date of repayment exceeding one year) is low for the time being, so there is a room for additional debt finance – the assumption, stemming from the market-based perspective, is that the safe and "healthy: level of long-term debt is 50% of total assets" (see: Figure 23.)

Figure 23. Long-term debt in Polish cement sector



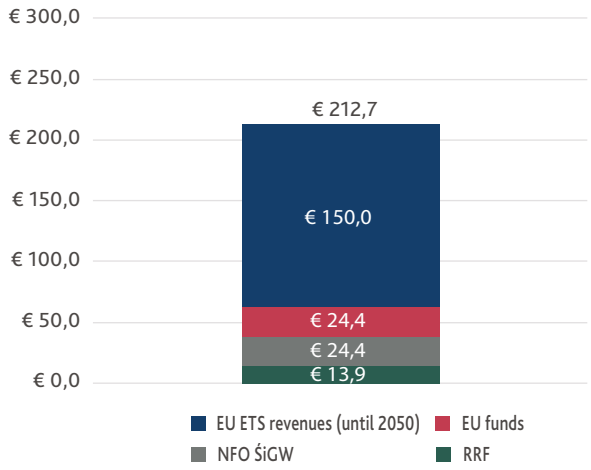
Source: Financial reports submitted by Polish cement companies

Therefore, Polish cement sector possess the capacity of borrowing additional ca. EUR 1.7 billion by 2030 which would be sufficient to finance decarbonisation efforts. However, it might not be safe to use the available debt capacity to the limits and this is why blended finance, i.e. finance with the share of public funding, would be a good solution for the cement sector. Available public funding opportunities are therefore discussed below.

2. PUBLIC FINANCE

This is extremely important, given that available public financial resources do not effectively support decarbonisation because, for example, ETS revenue auctions are not used in accordance with legal obligations arising from the EU ETS Directive. Expenditures in the industrial sector provided for in the Recovery and Resilience Plan (approved by the European Commission on 1 June, 2022) that can be allocated to the decarbonisation of industrial processes are included in A.2.2.1. activities, i.e. investments in the implementation of environmental technologies and innovations, including those related to the circular economy. EUR 162 million is allocated within this fund, which corresponds to 3.4% of the total allocation on category A – "Resilience and competitiveness of the economy" and to 1.07% of the total allocation on "climate contribution". The lack of one strategic document related to the decarbonisation of industry at the national level with planned allocation of financing is only adding to the problem of low level of ambition in other documents.

Figure 24. Expenditures in the energy and industrial sector (EUR billion) – public sources of finance



Source: WiseEuropa based on NECP, PEP2040 and "Carbon-neutral Poland 2050" by McKinsey

We have estimated how much of available public funds could be mobilised to finance the decarbonisation of both the energy and industrial sector.

Since the revenues from the EU ETS might be the most important source of finance for the decarbonisation of industry, the misallocation of funds from the EU ETS by the Polish government, proved by the Warsaw-based branch of the Client Earth foundation[22], is a burning issue, as it results in the waste of substantial funds which could be more efficiently spent on the decarbonisation of industry.

22 ClientEarth (2022), Kreatywna księgowość. Jak Polska marnuje środki z EU ETS (Creative accounting. How Poland wastes revenues from the EU ETS) (available at: https://www.clientearth.pl/media/wz5h00b5/20220518-kreatywna-ksi%C4%99gowo%C5%9B%C4%87-jak-polska-marnuje-%C5%9Brodki-z-eu-ets-raport-fundacji-clientearth.pdf)

The Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union (with amendments, hereinafter referred to as: EU ETS Directive) states that "at least 50 % of the revenues generated from the auctioning of [emission] allowances (…), or the equivalent in financial value of these revenues[23]" should be used for a dozen of allowed activities, among which there are initiatives relevant to the decarbonisation of industry, such as:

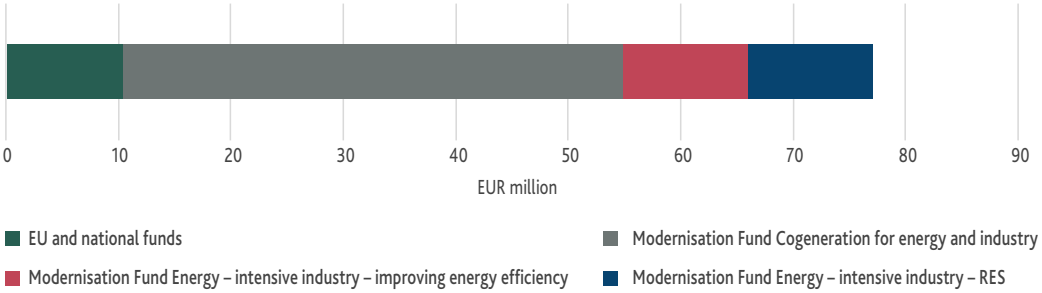
- the development of RES, as well as the development of "other technologies that contribute to the transition to a safe and sustainable low-carbon economy"[24];
- "the environmentally safe capture and geological storage of CO_2, in particular from solid fossil fuel power stations and a range of industrial sectors and subsectors" [25];
- "research and development in energy efficiency and clean technologies in the sectors covered by [the] Directive"[26], i.e. including cement, steel and chemicals.

However, as the Client Earth foundation highlights, in 2013-2020 three-fourths (i.e. approx. EUR 3 billion in total within the 2013-2020 period, which amounts to less than 1% (0.7%) of state budget revenues in 2020) of these 50% of the revenues from the auctioning of emission allowances have been spent on the activities not allowed by the EU ETS directive that may be even considered as contradictory with the purpose of this Directive, e.g. on the exemptions from excise tax on electricity generated from RES. Although somehow associated with RES, the funds allocated to the "exemptions from excise tax on electricity generated from RES" are just transferred to the state budget in order to compensate the loss in state revenues and they may be further distributed in any way – and it is impossible to determine whether they financed activities aimed at reducing CO_2 emissions.

As a result, funds that could support the industrial companies in their decarbonisation efforts, have been wasted. Thus, in the future they should be better distributed through funding programmes launched by the government and dedicated to the industrial sector.

Another important source of public finance could be EU funds distributed under MFF and Modernisation Fund.

Figure 25. National and EU funds available for industrial decarbonisation to date (as of May 2023)



Modernisation Fund seems to be a missed opportunity, as Poland can still absorb nearly EUR 20 billion (EUR 19 844 million) from this source, however, the Polish government did not apply for these funds.

23 Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC, article 10 (3)

24 Ibidem, article 10 (3) (b)

25 Ibidem, article 10 (3) (e)

26 Ibidem, article 10 (3) (g)

9. Conclusions - policy & financing recommen-dations

9. Conclusions – policy & financing recommendations

1. POLICY

- **STRATEGY**

What?	Who?	How?	When? (timeline)
Outline a long-term strategy for supporting industry decarbonisation from the state level	*Respective ministry*	The strategy should be accompanied by legally binding measures and performance indicators	As soon as possible
Develop decarbonisation strategies for particular industrial branches	*Industrial associations comprising the representatives of particular branches*	In collaboration with the company representatives and in line with the decarbonisation plans of the parent companies of Polish plants	As soon as possible
Push for changes in the state policy	*Industrial associations comprising the representatives of particular branches and jointly the companies*	By using the bargaining power of associations, strengthened by common position elaborated in the sectoral strategies and adopted by the companies	Once the sectoral strategies are delivered

- **STATE AID**

What?	Who?	How?	When? (timeline)
Conclude "sector deals" with steel, cement and chemical industry	*Public entities and representatives of a particular industrial branch*	By agreeing on a set of measures to provide a stable regulatory and policy environment, and hence to boost investments	As soon as possible
Implement amendments to public procurement law	*Legislative bodies*	By setting obligatory green requirements, which must be satisfied by the proposals	As soon as possible

- **REGULATORY FRAMEWORK**

What?	Who?	How?	When? (timeline)
Remove barriers to deploying CCS	*Legislative bodies*	By allowing pilot projects, onshore CO_2 storage and removing preference for pipeline transport	As soon as possible
Remove barriers to the on-site green electricity generation	*Legislative bodies, Energy Regulatory Office*	By loosening requirements on obtaining a license for a "direct electricity line" and hence facilitating cPPAs	As soon as possible

2. FINANCE

What?	Who?	How?	When?
Include green industrial technologies in green bonds framework	*Ministry of finance, private issuers (e.g. PKN Orlen)*	By allowing to spend proceeds on decarbonisation of industrial processes	As soon as possible
Design a plan to spend revenues from EU ETS on green transition	*Government and legislative bodies*		As soon as possible
Apply for greater amounts of money from Modernisation Fund			
Facilitate green bonds issuance by tax reliefs			
Improve non-financial, ESG reporting			
Fast-track the competition for EU funding		By establishing a contact point for interested stakeholders	As soon as possible

WiseEuropa

WiseEuropa is an independent think-tank specialising in macroeconomics, as well as economic, European and foreign politics.

WiseEuropa's mission is to improve the quality of national and European politics and the economic environment by basing them on sound economic and institutional analysis, independent research and assessment of the political impact on the economy. The Institute engages citizens, entrepreneurs, experts and public policy makers from Poland and abroad in a joint reflection on the modernisation of Poland and Europe and their role in the world. WiseEuropa's goal is to work for an active and committed role for Poland in the open, sustainable, democratic development of Europe. WiseEuropa's core activities focus on stimulating and inspiring public debate on the future of Poland and Europe..

www.wise-europa.eu

On 16 March 2023, at the Polish Climate Congress, the WiseEuropa Foundation was awarded the title of Energy Transition Leader 2023. The competition jury included representatives of the Polish Climate Congress, the Polish National Energy Conservation Agency and the Industrial Development Agency.

ISBN: 978-83-67829-16-8