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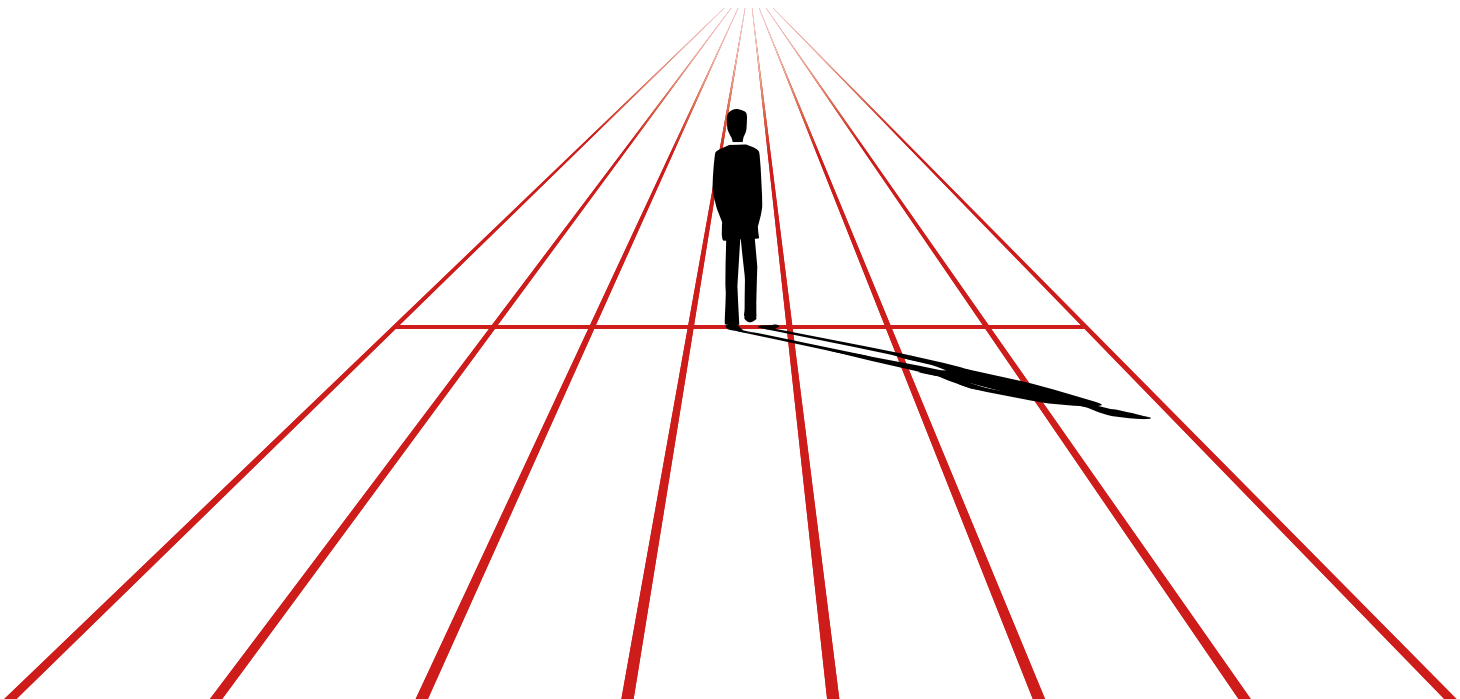

Dear Readers,

It is with a great pleasure that we submit to you the first issue of the **„GO$_2$50"** Publication - the most recent publication of the National Centre for Emissions Management at the Institute of Environmental Protection – National Research Institute. This Publication has been created in response to the growing interest in the issues related to energy and climate policy, in particular, in light of the challenges which the EU faces in the building of a zero-carbon economy by 2050 and the implementation of the European Green Deal strategy. These plans of the EU will involve the need to take intensified reduction efforts – both in the EU ETS and non-ETS. Therefore, in early March of this year the European Commission proposed a legal framework to enable the achievement of climate neutrality targets in 2050 (so-called Climate Law) and in this September it presented a comprehensive plan for raising the EU reduction target for 2030 to 55% relative to 1990, based on the publication of an assessment of the costs and benefits related to the proposal, i.e. the so-called impact assessment. It should be noted that the plans mentioned above will require reform of the EU ETS and non-ETS, translating, among others, into changes in the reduction targets, the introduction of new mechanisms to speed up reductions (e.g. the inclusion of new sectors in the EU ETS, changes to the MSR, a border tax), the behaviour of EUA prices on the carbon market or the development of new low-carbon technologies. We believe that the EU long-term plans for climate policy are so complicated and multidimensional that it is important to describe them and share the related knowledge with you.

All the more so as IOŚ-PIB/KOBiZE (and formerly KASHUE) has for many years dealt with broadly conceived energy and climate policy and the areas related to the fulfilment of international commitments in the field of air and climate protection. Since the very foundation of our institution we have developed in this field, preparing different concepts, analyses and solutions which we publish on our websites. At present, however, given the transition-related challenges ahead of us, we would like to intensify our activities and transfer to you our knowledge based on a dozen or so years of experience, in the form of a new, cyclically released publication. We deeply hope that the present Publication will enjoy at least the same appreciation on your part as our publications to date have.

Paweł Mzyk

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What is the outlook for the EU ETS carbon market in 2020?

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What is the outlook for the EU ETS carbon market in 2020?

Author:
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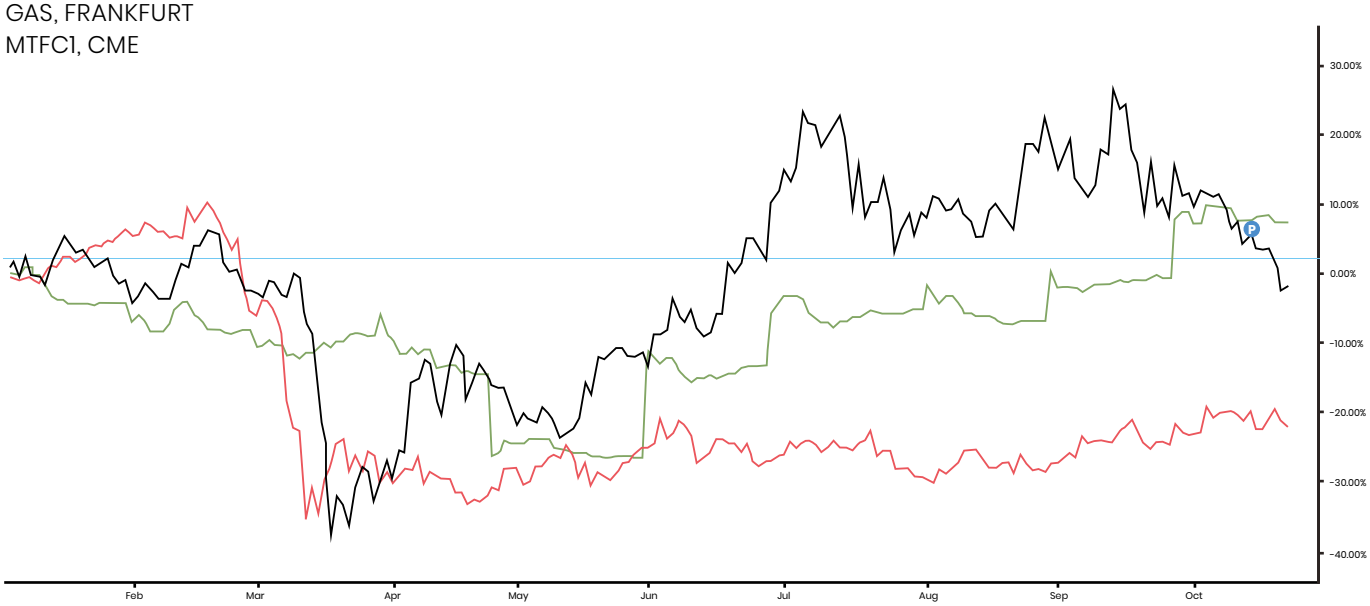
The fundamental analysis of the EU ETS market[1]

The end of the 1st quarter 2020 was characterised by high volatility of the prices of European Union Allowances (EUAs). Still in February, the prices reached almost 26 EUR/EUA, but as a result of the panic caused by the COVID-19 pandemic in mid-March of this year their value fell to about EUR 15[2].

The sentiment of the market participants at that time reflected their fears of a decline in industrial production in Europe (stoppages in production and broken supply chains), the closing of the particular economies as part of the so-called lockdown or the fear of a global recession. This translated into emission reductions in the EU ETS system (EU ETS) and a reduced demand for EUAs. In parallel, there were deep declines in the prices

CHART 1. COMPARISON OF THE CORRELATION OF THE EUA PRICES ON THE FUTURES MARKET (BLACK COLOUR) WITH THE PRICES OF RAW MATERIALS: GAS (RED COLOUR) AND COAL (GREEN COLOUR).

Published on Investing.com, 22/Oct/2020 - 9:45:55 GMT, Powered by TradingView.
Carbon Emissions Futures, (CFD):CFI2, D
GAS, FRANKFURT
MTFC1, CME



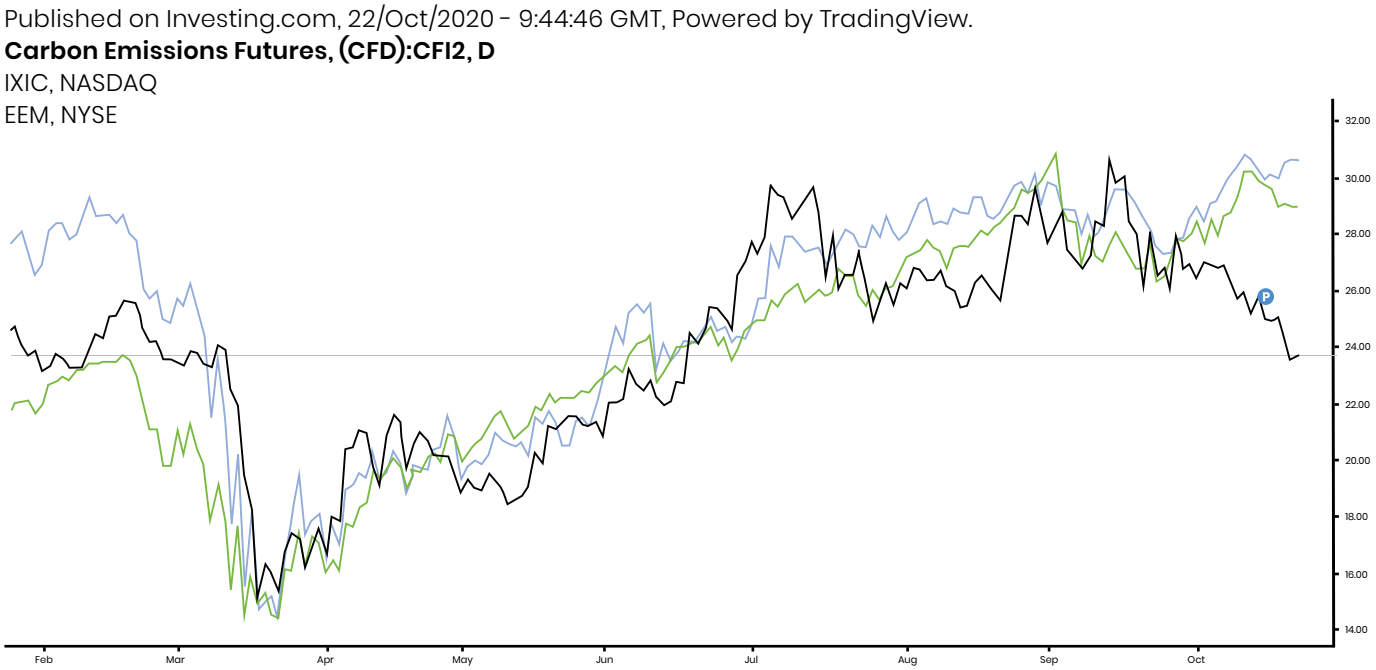
Source: Own elaboration by KOBiZE via the investing.com platform

Legend to the chart
Black line - quotation of future contracts EUA prices on the ICE Future Europe exchange (prices in EUA).
Green line - coal price quotations - API2 (% scale).
Red line - gas prices in Frankfurt - Naturgy Energy Group SA (% scale).

[1] The fundamental analysis deals with the economic drivers of demand and supply (which cause prices to rise, fall or stabilise).
[2] On 18 March, on the secondary spot market, the closing quotes of EUAs fell to the level of EUR 15.23, while on 23 March on the futures contract futures during trading their prices even reached the level of EUR 14.34.

at all world stock and commodities markets (with oil prices even reaching negative values). Later, just after 2.5 months, there was a rebound which no-one had expected, causing EUA prices first to reach their February levels (EUR 26, i.e. as much as before the pandemic was announced) and soon, in early July, to reach levels of about EUR 30 which had not been seen on the secondary market for almost a year[3]. It is interesting to note that on the futures market at some moment the EUA prices even exceeded this level (EUR 30.8 EUR on 13 July this year). This means that the value of EUAs rose by more than 100% from mid-March to early July. Although at the turn of July and August there was a downward correction to around EU 26, still the EUA prices persisted above their February levels, i.e. those in the period before the pandemic. Later, at the turn of August and September, the EUA prices twice came close to or even exceeded the level of EUR 30. However, from late September the EUA prices fell again and on 22 October their quotes varied around the level of about EUR 23. The first (July) increase in the EUA prices to about EUR 30 was widely commented on by almost all the market experts. Most of them were unable to understand the reason for such a spectacular price increase despite the relatively weak funda-

CHART 2. COMPARISON OF THE CORRELATION OF THE EUA PRICES ON THE FUTURES MARKET (BLACK COLOUR) WITH THE STOCK INDEXES: IN THE USA - NASDAQ COMPOSITE (GREEN COLOUR) AND THE EMERGING MARKETS INDEX (BLUE COLOUR) IN 2020.



Source: Own elaboration by KOBiZE via the investing.com platform

Legend to the chart

Black line - quotation of future contracts EUA prices on the ICE Future Europe exchange (prices in EUA)
Green line - quotation of US technology stock index (Nasdaq Composite) - no scale.
Red line - quotation of the emerging market equity index (iShares MSCI Emerging Markets ETF) - no scale.

[3] On 6 July, the EUA price on the secondary markets of the ICE and EEX exchanges was EUR 29.63 EUR. For the last time such a high price level could be seen on 23 July 2019 (EUR 29.77).

mental factors for 2020. When looking at the supply of allowances, after all this year, as a result of the resumption of British auctions and the monetization of 50 million allowances as part of the Innovation Fund (IF) (auctions), there will be about 73 million allowances more than last year. It should also be borne in mind that the participants in the EU ETS still "hold" a relatively large surplus of allowances. As indicated by the data published by the European Commission in May, the number of allowances in circulation (i.e. exactly the surplus of allowances) in 2019 was about 1.385 billion EUAs[4]. On the other hand, the mechanism for reducing the surplus (the Market Stability Reserve - MSR) has been in operation since as early as 2019 and, in addition, certain Member States declare that they will cancel allowances in relation to the closures of coal-fired power plants[5]. On the other hand, on the supply side, emissions should be expected to fall in 2020 as a result of the switching from coal to gas or RES (this was recently encouraged, particular, by low gas prices and political decisions of many Member States to phase out coal). Certainly, the COVID-19 pandemic now underway also contributes to a decrease in emissions. There is little doubt that in the latter case the fall of emissions caused by a collapse in industrial production and the drop in energy demand will be significant. E.g. Refinitiv expects that the emissions in the EU ETS will fall in 2020 by as much as about 16% relative to 2019. Recently, most participants in the market seem to ignore all the fundamental factors mentioned above (contributing, at present, to an increase in the supply of allowances and a decrease in the demand for them). Besides, they are not the only ones to do so, as the same tendency can also be seen on other markets, in particular, stock and commodities markets. Despite the threat of a global recession, most of these markets have already made up for almost all the losses suffered before the pandemic and even reached new historical records. The recent strong correlation between EUA prices and stock prices demonstrates how important this is from the point of view of the EUA market (although this correlation was much weaker from early October). It can be seen perfectly well in Chart 1, where the EUA prices change in one direction following the US stock indexes (the NASDAQ Technology Sector Index) and the Emerging Markets Indexes. On this basis, the hypothesis can be put forth that in uncertain times – such as those when exactly the pandemic lasts, most markets react in a similar way by falling into the same states of euphoria or panic. The cause of the fear on the market is known, but how can one explain this sudden surge of euphoria since 2020 at the time of the worst global recession over several dozen years, with the year-on-year GDP falling by about 15% in the European Union and by about 10% in the United States? The answers to this question should be sought in the monetary policies of the USA and Europe. Specifically, the American central bank (the so-called FED) first cut the interest rates practically to zero and then, on an unprecedented scale to date, printed more dollars which reached the market in a wide stream (via the so--called stimulus packages). The European Central Bank also decided to apply the same scheme, by chasing the FED in the additional printing of money (as the interest rates have already long been close to zero).

[4] https://ec.europa.eu/clima/news/ets-market-stability-reserve reduce-auction-volume-over-330-milion-allowances-between
[5] https://carbon-pulse.com/91064/

A large amount of cheap money on the market at the time of low interest rates (low interests on deposits and low bond yields) had to be invested somewhere. So it is not surprising to see that the emission allowance market become "fashionable" among institutional investors, as evidenced by the trading volumes growing from year to year. And in the future perhaps consideration will also have to be given to the demand which individual investors can generate. E.g. recently the information was published that one of the US institutions placed on the New York Stock Exchange a special index fund[6] (the so-called Exchange Traded Fund - ETF), which will reflect the allowance prices in the EU ETS, RGGI (Regional Greenhouse Gas Initiative) and the California Cap And Trade Programme. It seems to be the first ETF of this type and it cannot be ruled out that more of them will be established. This can contribute to enhancing the EUA market. The demand for allowances is also generated by the participants in the EU ETS themselves, e.g. the industry sector, which, exceptionally, will not be able to borrow EUAs from next year (since this will be a new trading period) to surrender sufficient number of allowances to cover emissions in Registry in 2020. Added to this is the fear of future as industrial installations still do not know how many free allowances they will receive and how many additional allowances they will have to purchase in the next trading period. Therefore, at this moment the best option for them is to keep allowances at their accounts and even successively buy more of them.

Another, perhaps the most important factor which can have a strong effect on the EUA market this year is a change in the EU climate policy. The implementation of climate neutrality and the European Green Deal will require raising the EU emission reduction target for 2030 to at least 55% (from the present 40%). As indicated by the CAKE estimates, this may lead to a change in the target in the EU ETS from 43% to about 57% and a change in the linear reduction factor (LRF) from 2021 from the expected 2.2% to about 3.7% (it is 1.74% for the present period). In order to achieve this ambitious target, the EU ETS needs to be reformed; in particular, there is a need to change the mechanism of the Market Stability Reserve (MSR) expected to undergo a review at the end of 2021. At present, each year almost one fourth (24%) of the allowance surplus on the market goes from the auction pool to the reserve (it is the so-called MSR intake rate). From 2024 to 2030 this can already be "only" 12% and, given the higher reduction target, may be unfavourable for its achievement. Therefore, it can be assumed that certain parameters of the MSR will change. It seems that the simplest change to make will be to maintain the 24% MSR intake rate until the end of 2030.

[6] https://kfafunds.com/krbn/

Refinitiv estimates that this change alone may cause a doubling of the EUA price at the end of 2030. There is also a number of other ideas of how the MSR mechanism should be changed. Recently, some of them were presented by the Öko-Institut, e.g. a hybrid form of the current rate which would depend on the upper or lower MSR threshold[7], establishing a flexible upper threshold which would decrease over time as the cap or emissions themselves would diminish, or accelerating the operation of the mechanism by more quickly adjusting the auction pool (at present, the MSR operates with a delay of about 1 to 2 years). It should also be borne in mind that there is still the issue of the so-called Brexit to consider.

United Kingdom intends to leave the EU ETS by the end of this year and to create its individual system – the co-called UK ETS. There are plans for the linking of the two systems in the future, but it is not known when this will happen. In contrast, it is known that Brexit will affect on diminish the supply of allowances in the period from 2021 to 2030. Refinitiv estimates that this can be even as much as about 750 Mt. On the other hand (in the long term), it should be expected that, as a result of the policy of a gradual coal phase - out in the EU and the increasing importance of renewable energy sources, the emissions in the EU ETS should fall. This should result in a higher surplus of allowances on the market, which the MSR should effectively cope with (after all, it has been created for this purpose). In conclusion, it seems that at present the market discounts in the EUA prices the future fundamental factors which can bring in the longer term a significant limitation of the supply of EUAs on the market (given the impossibility of borrowing the EUAs from next year and the raising of the EU reduction target) and the situation on the stock markets supported by a variety of packages to stimulate the economies (in the USA and Europe). Therefore, the EUA prices should be expected to significantly increase in the longer term; e.g. CAKE forecasts that the raising of the target in the EU ETS to 57% by 2030 (i.e. 55% for the EU as a whole) will cause the allowance prices to grow to EUR 41 in 2025 and to EUR 76 in 2030.

It seems that at present the market discounts in the EUA prices the future fundamental factors which can bring in the longer term a significant limitation of the supply of EUAs on the market (given the impossibility of borrowing the EUAs from next year and the raising of the EU reduction target) and the situation on the stock markets supported by a variety of packages to stimulate the economies (in the USA and Europe)

The technical analysis of the EU ETS market

A technical analysis of charts can bring interesting indications of the future behaviour of the EUA prices on the market. It should be recalled that in contrast to the fundamental analysis the technical analysis focuses exclusively on the investigation of the behaviour of the market. On this basis, it can be said that the fundamental analysis investigates the causes of the behaviour of the participants in the market, whereas the technical analysis shows the effects themselves. In the technical analysis, the market price functions as the indicator of fundamental factors, have

[7] Intake Rate = 12% x TNAC/the lower threshold or the rule that all the allowances above the upper threshold go to the reserve (i.e. the difference between the TNAC and the upper threshold).

already been discounted by the price and thus are already "on the market"; in turn, prices begin to react to the yet unknown aspects of the fundamental situation. Therefore, the technical forecasts are based on the assumption that relevant market information is discounted in the market prices long before they become generally known. In the case of emission allowances, it can be exactly the fears of operators functioning within the EU ETS regarding the future limitation of the supply of allowances in relation to the implementation of the European Green Deal and the climate neutrality policy (e.g. through raising the EU reduction target and the reform of the EU ETS and the MSR mechanism) or also investors' fears about the economic impacts of the second of COVID-19 wave.

CHART 3. THE WEEKLY TECHNICAL CHART OF FUTURES CONTRACTS ON EUAS IN 2020 (FROM MARCH 2019 TO OCTOBER 2020) WITH VISIBLE IMPORTANT ZONES (LINES) OF SUPPORT AND RESISTANCE AND THE UPTREND CHANNEL, AS WELL AS WITH MARKED 20- AND 50-DAY MOVING AVERAGES (GREEN AND RED COLOURS).

Source: Own elaboration by KOBiZE via the investing.com platform

Legend to the chart

Black candles (bars, black corps) - quotations of EUA contracts prices on the ICE Future Europe exchange (in EUR) indicating that the closing price was set below the opening price at the end of the weekly trading. These candles reflect declines in prices.

Black candles wicks - (vertical lines extending from the body candles) - maximum and minimum EUA future prices on the ICE Future Europe (in EUR) on a weekly basis.

White candles (bars, white corps) - quotations of EUA contracts prices on the ICE Future Europe exchange (in EUR), indicating that the closing price was set above the opening price at the end of the weekly trading. These candles reflect price increases.

White candles wicks - (vertical lines extending from the body candles) - maximum and minimum EUA future prices on the ICE Future Europe (in EUR) on a weekly basis.

Blue horizontal lines (bold) - marked support (or resistance) lines for EUA prices.

Green arrow - support zone for EUA future prices.

Red arrow - resistance zone for EUA future prices.

Red lines - used to designate the trend area (channel) currently prevailing on the market (upward or downward).

Red curve - the moving average of EUA contracts prices for the last 50 trading days.

Green curve - moving average of EUA contract prices for the last 20 trading days.

“

Looking more broadly at the technical situation on the EUA market, i.e. since 2018, it can be seen that the level of about EUR 30 is the key price zone. It is exactly at this level the rally of the EUA prices stopped in July 2019, in 2020 and in September 2020, creating a demand barrier, i.e. the so-called resistance line.

In the technical analysis, it is most important to determine the price trend[8] – whether it is a downtrend, an uptrend or perhaps a horizontal (sideways) trend. If the prices show an uptrend it is very likely that they will continue to rise; if the prices show a downtrend they will likely fall; still, when a sideways trend develops on the market the prices should move in a specific price interval. Looking more broadly at the technical situation on the EUA market, i.e. since 2018, it can be seen that the level of about EUR 30 is the key price zone. It is exactly at this level the rally of the EUA prices stopped in July 2019, in 2020 and in September 2020, creating a demand barrier, i.e. the so-called resistance line. In turn, as regards the lower limit to the price movement, it was the price level of EUR 15 that created the supply barrier, i.e. the so-called support line. It was exactly this price that stopped the downtrend when the COVID-19 was announced.

From mid-March this year (just as on almost all the other financial markets) the allowance prices entered a clear uptrend. It was confirmed by increasingly high lows in May, in August (twice) and in September (so 4 times as a total). The uptrend line (channel) mentioned above is marked with red lines in Chart 3. However, the technical situation changed on 18 September when the EUAs

[8] The direction taken by high and lows determines the market trend. The character of the trend depends on whether these points arrange themselves at increasingly higher levels, increasingly lower levels or horizontally. Therefore, an uptrend should be defined as a series of highs and lows situated at increasingly higher levels; a downtrend conversely as a series of falling highs and lows; and highs and lows arranging themselves horizontally means a sideways trend.

CHART 4. THE DAILY TECHNICAL CHART OF FUTURES CONTRACTS ON EUAS IN 2020 (FROM FEBRUARY TO OCTOBER 2020) WITH THE VISIBLE PRESENT RISING CHANNEL AND IMPORTANT ZONES (LINES) OF SUPPORT AND RESISTANCE.

Published on Investing.com, 22/Oct/2020 - 9:44:46 GMT, Powered by TradingView.
Carbon Emissions Futures, (CFD):CF12, D

Source: Own elaboration by KOBiZE via the investing.com platform

Legend to the chart

Black candles (bars, black corps) - quotations of EUA contracts prices on the ICE Future Europe exchange (in EUR) indicating that the closing price was set below the opening price at the end of the weekly trading. These candles reflect declines in prices.

Black candles wicks (vertical lines extending from the body candles) - maximum and minimum EUA future prices on the ICE Future Europe (in EUR) on a weekly basis.

White candles (bars, white corps) - quotations of EUA contracts prices on the ICE Future Europe exchange (in EUR), indicating that the closing price was set above the opening price at the end of the weekly trading. These candles reflect price increases.

White candles wicks (vertical lines extending from the body candles) - maximum and minimum EUA future prices on the ICE Future Europe (in EUR) on a weekly basis.

Blue horizontal lines (bold) - marked support (or resistance) lines for EUA prices.

Blue horizontal lines (thin) - marked with the so-called Fibonacci retracements lines of support (or resistance) for EUA prices.

Green arrow - support zone for EUA future prices determined by the boundaries of the uptrend channel.

Red arrow - resistance zone for EUA future prices determined by the boundaries of the uptrend channel.

Red lines - used to designate the trend area (channel) currently prevailing on the market (in this case upward).

Black solid broken line - the scenario reflecting the increase in EUA prices in the coming weeks and months.

Black dotted broken line - a scenario reflecting the fall in EUA prices in the coming weeks and months.

broke this very important for investors uptrend line falling below EUR 27.5. On successive days in September, there were several attempts to return to this channel; however, all of them failed. This means that the lower line of the rising channel, which had long been the support line, became for a moment the resistance line for prices. In October, the depreciation on the EUA market deepened further. First, the 20-day moving average situated at the level of about EUR 26.26 (illustrated by the green colour in Chart 3) was broken from above. Later the support at the psychological level of EUR 25 failed. And, finally, the level set by the 50-day moving average (illustrated by the red colour in Chart 3) broke down, too. As a result of greater supply, on 22 October the prices fell to about EUR 23. The very quick breakthrough through the particular support levels and the overall technical situation can be a signal for the market that the present uptrend may have reversed. This presumption is strengthened by the readouts of the RSI index which has shown a downtrend since July (this is the so-called divergence which signals a change of the trend). In addition, Chart 4 shows the formation of a double high (the prices have not been able twice to significantly exceed EUR 30), which in the technical analysis is often a formation which signals a reversal of the present trend.

In the pessimistic scenario, the EUA prices (illustrated by a dashed line in Chart 4) should continue to fall to the level set out by the Fibonacci retracement between 50% and 38.2%, i.e. about EUR 22.5-20.5. This should be followed by a market rebounded reaction, where the key market factor will be the testing of the very important support line set at the level of EUR 25 (which has several times prevented the prices from falling to lower levels). A breakthrough from this zone should bring further falls to around the level of 23.6% set by the Fibonacci retracements (the level of about EUR 18.5). Ultimately, the EUA prices can fall to the levels of March of this year, i.e. to about EUR 15. The falls in the allowance prices in the nearest weeks are suggested by negative investors' sentiment on the global financial markets. In the times of the COVID-19 crisis, both the bad and good investors sentiment in the world can determine the dominating trend on the particular markets. This correlation, in particular, with the stock markets in the USA and Europe, could be seen on the EUA market over last months. Since March on these markets, just as on the EUA market, there have also been very strong price increases (despite the pandemic underway). At present, it seems that, given the fear of the second COVID-19 wave and the possible successive lockdowns of the economies, the uptrend on these markets can reverse at any time and a situation resembling the falls in March can emerge on the markets, which will also affect the EUA market.

A less likely optimistic scenario should also be assumed. However, if prices manage to return to the rising channel plotted in Chart 4, then in the timeframe of the nearest months rises are possible, even to around the upper limit of this channel, i.e. the I EUR 38-40 levels (the implementation of this uptrend growth scenario is illustrated with a solid line in Chart 4).

However, in this case, the breakthrough from the very significant level of EUR 30 and then the psychological EUR 35 level, will be of key importance. Given the absence of a technical structure for the levels of more than EUR 30, it can be quite easy to achieve the EUR 35 EUR price level.

TABLE 1. COMPARISON OF THE MOST IMPORTANT FUNDAMENTAL AND TECHNICAL FACTORS WHICH CAN AFFECT THE EUA PRICES IN THE NEAREST FUTURE.

CATEGORY	GROWTH FACTORS	DECLINE FACTORS
FUNDAMENTAL FACTORS	• The impossibility of borrowing EUAs from 2021 to surrender emissions in 2020 (an increased demand for EUAs); • An uncertain situation of industry in the 4th period (a decreased value of benchmarks, probably fewer free EUAs); • Brexit from 2021 – a separate UK ETS system (reducing the EUA supply by about 750 million in the period from 2021 to 2030); • The European Green Deal, a revision of the EU emission reduction target (including the one of the EU ETS), a revision of the MSR mechanism at the end of 2021; • More new participants in the market who perhaps buy allowances for speculation purposes; • Lower supply of allowances due to a large probability that allowances may be cancelled in the context of the closures of hard coal-fired power plants.	• A decrease in emissions in 2020 as a result of COViD-19; • The switching from coal to gas and RES as part of so-called fuel switching; • Greater supply of EUA in 2020 vs. 2019 (the resumption of British auctions + the sales of 50 million EUAs from the IF); • A gradual coal phaseout by EU Member States; • Sales of EUAs for speculation purposes (in the short term).
TECHNICAL FACTORS	• A return to the uptrend channel creates an opportunity for the continuation of the uptrend and the achievement of the levels set by the upper line of the rising channel and a 161.8% Fibbonacci retracement, i.e. the level of about EUR 40.	Strong signals indicating a reversal of the trend and the beginning a downtrend: • A downward breakthrough of EUA prices from the uptrend channel. • A very quick breakthrough through the support levels set by moving averages – the 20- and 50-day MAs in the weekly chart. • Readouts of the RSI index and the divergence appearing in the chart. • The "double high" formation.

Source: Own elaboration by KOBiZE

Is the European Union the global leader in climate action? Reflections on the role of EU actions from a global perspective.

Author: PhD Marzena Chodor, Climate Policy Instruments Unit, KOBiZE

Is the European Union the global leader in climate action? Reflections on the role of EU actions from a global perspective

Author:
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Introduction

The representatives of the European Commission and other European institutions as well politicians of many EU Member States like to frame EU climate policy as an unquestionable signpost for the world in its efforts to combat climate change and, thus, to achieve the goals of the United Nations Framework Convention on Climate Change (UNFCCC, 1992) and the Paris Agreement (Paris Agreement, 2015). The European Green Deal, which was designed on a grand scale, promised in September 2019 by the new President of the European Commission right after her election and unveiled in December 2019 (at the time when the 25th session of the Parties to the UNFCCC, COP 25, was held in Madrid), provides for higher ambitions in EU climate action by adopting legislative measures and resources to implement them, including huge financial outlays. As a result, Europe is to become the first climate neutral continent by 2050. Climate neutrality is not the sole goal of the European Green Deal. Its political goal is to ensure the EU remains the global leader in the efforts to tackle climate change and strengthens this position[9]. Practically since the beginning of the international negotiations with a view to taking joint global action to address the threats posed by anthropogenic climate change, Member States and the institutions representing them have vigorously emphasised on the international scene (as part of the so-called Berlin Mandate, so-called as it was adopted in Berlin in 1995 at COP[10]) the need for a common, i.e. international, response to the threats posed by global climate change. The EU is strongly engaged in so-called climate diplomacy with regard to third countries, while its leadership in international climate action and its aspirations to be the leader in this field are one of the pillars of the common foreign policy of the EU.

In accordance with this paradigm, the EU was the main proponent of the ambition which led to the adoption by the Parties to the UNFCC of the first international agreement where part of developed countries committed to implementing quantified emission limitation and reduction objectives (QERLO) in the first commitment period (2008-2012),

[9] Such theses were put forward by the Commission President Ursula von der Leyen, inter alia, in her speech in Madrid at COP 25 on 2 December 2019, https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_19_6651

[10] The Berlin Mandate adopted during the first Conference of the Parties to the UNFCCC (COP 1) initiated the negotiations which resulted in the adoption of the Kyoto Protocol in 1997.

i.e. the Kyoto Protocol (KP[11]) and then, due to the efforts of its diplomacy, caused the Protocol to enter into force in February 2005.[12] So what is the real impact of the actions taken by the EU in the field of climate policy on the actions taken by other states and other entities? One of highlighted EU achievements is its emissions trading system (EU ETS) which has been in place since 2005, covering emissions from more than 11,000 installations in Member States, as well as Norway, Iceland and Lichtenstein.

The EU ETS is the largest carbon market in the world, covering about 45% of EU CO_2 emissions from the production of energy, steel, aluminium, cement, glass, paper, ceramics, the chemical sector and refineries, as well as since 2012 the emissions from the air transport among EU Member States. The EU exports its know–how on the operation of an emission trading system to developing countries, including China, as well as to the co-called immediate neighbourhood countries, especially, associated countries, which have undertaken in their association agreements to implement elements of the EU ETS. A declared aim of the EU is to convince other countries, through climate diplomacy, bilateral agreements, including association agreements, and through capacity building support, to cover CO_2 emissions from the production of energy and industry with emission allowances resembling those under the EU ETS, which would then be linked to reduce emission reduction costs and to enhance the liquidity of the allowance market and competitiveness of the actors in the particular fields, ultimately leading to the creation of a global emission trading system.[13] The EU enjoyed its first success in linking emissions trading systems on 1 January 2020 when the agreement on the linking of the Swiss emissions trading system and the EU ETS entered into force[14]. However, as a result of the so-called Brexit, 1,000 British installations and 140 UK-administered aircraft operators will remain in the EU ETS only until 1 January 2021; this somewhat diminishes the relatively modest success of linking two ETS for the first time.

The impact of EU policy on the international carbon market

In turn, the EU ETS contributed to the development of the international market of trade in certified emission reductions (CERs) and to the relatively more modest trade in emission reduction units (ERUs) from project-based mechanisms which were established under the KP as an instrument supporting the reduction commitments made by part of developed countries. Indeed, in the 2nd ETS trading period (2008-2012), concurrent with the first KP commitment period, and in the 3rd ETS trading period (2013-2020), the operators of installations covered by the system were able to partly surrender allowances to cover their emissions

[11] The Kyoto Protocol (1997) was the first international agreement under which part of developed counties which were Parties to the UNFCCC committed to reducing their emissions in 2008-2012 (the 1st commitment period) and in 2013-2020 (the 2nd commitment period). The countries which made those commitments are listed in Annex B to the Protocol. In order to facilitate the fulfilment of the commitments by the Parties which made them and to support the implementation of emission reduction projects in developing countries, it was agreed that the Clean Development Mechanism (CDM) would be established, while the corresponding scheme for developed countries and primarily for so-called economies in transition was to be the Joint Implementation (JI) mechanism. For more information see: https://unfccc.int/process/the-kyoto--protocol/mechanisms

[12] J. Vogler, EU Policy on Global Climate Change: The Negotiation of Burden-Sharing, [in:] Making EU Foreign Policy: National Preferences, European Norms and Common Policies, D. C. Thomas [Ed.], Palgrave Macmillan 2011, pp. 150-173.

[13] Linking Emissions Trading Schemes. ICAP, 2015.

[14] The talks on the linking of the EU ETS with the emissions trading system in place in Switzerland started in 2009.

using CERs and ERUs[15]. Certain EU Member States also contributed, albeit to a lesser extent, to the development of the market of trade in assigned amount units (AAUs)which applied in practice the third KP mechanism[16]. The resources gained by AAU-selling Parties to the KP which transformed their political system after 1989 (losing, in this context, a significant part of their industrial capacity following the bankruptcy of a number of industrial plants) under bilateral agreements concluded with the purchasers of the units were allocated to emission reduction investments; hence, the name of Green Investment Schemes[17] came into use.

Controversies about CDM projects

The opening of the EU ETS, creating the largest market of CO_2 emission allowances in the world, to units from project-based mechanisms triggered the expansive development of projects of this type. The underlying purpose of allowing the use of units from KP mechanisms was to ensure for the operators of installations covered by EU ETS supply of units cheaper than the emission allowances generated in the EU ETS system. The supporting argument was the possibility of implementing emissions reducing projects in developing countries where costs were lower. The units thus acquired were expected to reduce the operating costs of European companies and to give them more time for emissions reducing investments. In practice, it turned out that investors had implemented only projects producing units accepted by the EU emissions trading system. In light of this, e.g. nuclear CDM projects did not develop since they were excluded from the outset by the EU. For the same reason forestry projects suffered a similar fate. In turn, the period from 2008 to 2012 saw the expansive development of projects which caused a higher production of gases harmful to the ozone layer in the atmosphere, such as projects reducing HFC-23 gas as well as another industrial gas, N20; in addition, they brought huge profits because of their high global warming potential (GWP) attributed to the impacts of these gas and their low implementation costs. Although Europe quickly realised that the EU ETS system was flooded by units which were simply harmful to the environment, it was impossible to react quickly given that, as a rule, the process of amending a directive is a long-lasting one.

In the course of the work to amend the EU ETS Directive in 2008 and 2009, the European Union proposed that in the period from 2013 to 2020 operators might only use units from projects registered before the end of the 1st trading period (2008-2012)[18] under the Kyoto Protocol and excluded units from

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[15] In the 3rd ETS trading period (2013-2020), units from international projects are first converted to European Union Allowances (EAUs) and only then surrendered when operators account for their emissions.

[16] These are those Member States that in the 1st commitment period under the Kyoto Protocol accounted for their emissions from non-ETS sectors using surplus AAUs purchased from countries which held them in the 1st commitment period. It should be said that Member States also used project mechanisms (CDM and JI) to account for their emissions from non-ETS sectors.

[17] Cf. https://sustainabledevelopment.un.org/index.php?page=view&type=99&nr=148&menu=1449

[18] Units from CDM projects registered after 2012 in the least developed countries (LDCs) are allowed as an exception.

projects to destroy HFC-23 and N2O, maintaining a ban on the use of units from forestry and nuclear projects[19]. It also imposed on all hydro-power projects with installed capacity of more than 20 MW the obligation to verify their compliance with the guidelines of the World Commission on Dams.[20] Thus, the loophole in the EU ETS was closed after the end of the 2nd trading period (2008-2012). New Zealand also adopted a ban on the use of credits from HCF-23 reduction projects in its emissions trading system. The issue of the side effects caused at least by some CDM projects was just one of the problems arising as a result of demand for CERs.

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A large number of CDM projects was implemented in China where procedures enabling their registration and implementation were efficiently introduced and where – given the large degree of industrialisation – the potential was a large one. Poorer countries, needing investments in renewable energy generation, were unable to compete with China or India, where mainly huge industrial gas destruction projects were implemented. Therefore, relatively few projects found their way into Africa, particularly, into the African states belonging to the least developed countries. Until 2010 barely 2% of all the CDM projects registered was implemented in Africa[21]. At present, there are 254 CDM projects in Africa, representing about 3% of all the projects of this type[22]. On this occasion, it is worth mentioning the controversies aroused by the so-called additionality of CDM projects. In very simple terms, the additionality of a project means that the project would not have arisen if a given investor had not invested in it to achieve emission reductions which could then be approved as a CDM project by the CDM Executive Board and released on the carbon market (so, in fact, on the EU market, since in fact CERs were also purchased only by Japan). The CDM Executive Board devoted a good deal of time and attention to the issue of additionality, but in practice it was the easiest to demonstrate in such projects as those intended to destroy industrial gases, which were implemented solely to gain units and sell them to brokers and banks (which would then resell them to the operators of installations covered by the EU ETS). In light of this paradox and due to the realisation by the public opinion in the EU that so-called carbon offsetting only meant the shift of emissions from EU Member States to third countries and had a slight effect on global emission reductions, when the EU ETS Directive was last amended (in 2018) it was decided that after 2020 the EU would not allow emissions in the EU ETS to be

[19] R. Jeszke, S. Lizak, M. Pyrka, E. Smol, A. Błachowicz, Analiza wpływu ograniczenia wykorzystania jednostek CER/ERU z projektów redukujących emisję gazów przemysłowych na rynek węglowy i cenę uprawnień do emisji [An analysis of the impact of the limited use of CERS/ERUs from projects reducing industrial gas emissions on the carbon market and emission allowance prices – in Polish], KASHUE-KOBiZE, Warsaw, 2010 https://www.kobize.pl/uploads/materialy/materialy_do_pobrania/opracowania/KASHUE_Ograniczenie_CER_w_EU%20ETS_opracowanie_25_11_2010_wer3.0_web_final.pdf

[20] In the period from 2008 to 2012, Member States issued letters of approval for hydro-power projects with installed capacity of more than 20 MW based on a voluntary alignment with requirements and the monitoring of their fulfillment.

[21] https://blogs.worldbank.org/climatechange/why-so-few-carbon-projects-africa

[22] As of 2 July 2020; https://www.cdmpipeline.org/cdm-projects-region.htm

surrendered with units from project-based mechanisms. The EU emission reduction target for 2030 as adopted in the Climate and Energy Package, which is in effect until the completion of the amending process initiated this year, is to be achieved by own national actions and offsetting mechanisms are hardly likely to be allowed in the context of greater reduction efforts. In the period from 2008 to 2012, installation operators used as many as 1,058 billion Kyoto units to surrender their emissions[23]. The extent to which operators have used their credit entitlement in the 3rd trading period (2013-2020) will be known after it ends. Given that the carbon market had internalised the doubts about CDM projects and their huge supply, with the demand mostly limited to the EU ETS, the prices of these units were always lower than those of emission allowances and, therefore, the extent of their use was very high since it enabled operators to reduce the costs of their participation in the system. In the period when units from KP mechanisms were accepted in the EU ETS, either directly or after their exchange into EUAs, operators decided to use them in amounts enabling them to fully avail themselves of their entitlements. Intermediaries played a large role here, as they even persuaded companies to sell allowances allocated to them and use Kyoto units to surrender their emissions. Given the fact that the EU ETS is the largest carbon market in the world, the departure from the use of units from project-based mechanism means in fact that the demise of these mechanisms.

What about offset projects in the future?

Since 2015 the Parties to the Paris Agreement have negotiated the terms of the implementation of Article 6 of the Agreement which introduces new market-based mechanisms[24], intended to make it easier for the Parties to more quickly achieve ambitious reduction targets. However, it is not certain of the EU will allow them to start by opening the EU ETS and the sectors remaining outside the EU ETS as was the case with the Kyoto mechanisms. Indeed, both the supporters of Article 6 and investors in CDM projects have so far vested their hopes in CORSIA[25] (the offsetting scheme adopted by the International Civil Aviation Organization (ICAO) the pilot phase of which is expected to begin in 2021) and in a similar system expected in the future for international maritime transport. The grounding of aircraft caused by the announcement of the COVID-19 pandemic in the first quarter of 2020 and the related losses of airlines call into question the swift implementation of the CORSIA mechanism. If air traffic returns to its condition from before the pandemic (which is not so self-evident) and the pilot scheme is launched as planned on 1 January 2021 the choice of 2019 and 2020 as the baseline years for determining the basis for the use of offsets (which become mandatory if CO_2 emissions exceed their average from those two years) is likely to arouse protests of airlines. If the ICAO postpones the implementation of the CORSIA the implementation of the offsetting scheme for maritime transport will also

[23] Data from the European Commission: https://ec.europa.eu/clima/policies/ets/credits_en

[24] The Paris Agreement introduced the accounting mechanism for transactions among the Parties to the Agreement (countries), so-called internationally transferred mitigation outcomes (ITMOs) in its Article 6.2, a mechanism for crediting emission reduction projects in its Article 6.4 and so-called non-market approaches in its Article 6.8

[25] https://www.icao.int/environmental-protection/Pages/A39_CORSIA_FAQ2.aspx

be delayed or the IMO will perhaps decide to apply a different scheme, this will mean losses for investors in CDM projects for whom the EU ETS will be completely closed from January 2021, while the negotiators working on the implementation of Article 6 of the Paris Agreement can feel that the pressure for them to quickly agree the details of Article 6.4 has lessened. It is not known either if the UE reopens to units from market-based mechanisms arising under Article 6 of the Agreement. It is only the Commission's proposals of changes in the ETS system in relation to the higher reduction target by 2030, to be presented this year, that will dispel the doubts as to whether the EU will strengthen its reduction target using the new market-based mechanisms or will uphold its intention to fulfil the commitments it has made by means of its internal efforts. The current position of the European Commission assumes that in the future the carbon markets under the Paris Agreement will develop by linking emissions trading systems.[26]

Unintended effects of the EU ETS: windfall profits and carbon leakage

One of the unintended effects of the introduction of an emissions trading system by the EU was the unjust enrichment of many companies operating in Member States in the EU ETS covered sectors in the 1st trading period (2005-2007) and in the 2nd trading period (2008-2012). Free EUAs were then allocated to installation operators by Member States[27], which, wishing to secure the interests of companies operating in their territories, awarded too many allowances to "their" entities. Although since its very beginning a declared purpose of the EU ETS was a shortage of allowances, intended to encourage operators to invest in CO_2 reduction technologies, the market expectations turned out to be different (inconsistent with the actual supply). In the 1st trading period, initially, the allowance prices were high, in excess of EUR 30 and the suddenly fell to barely several EUR, to finally drop to zero at the end of 2007.[28]

> The current position of the European Commission assumes that in the future the carbon markets under the Paris Agreement will develop by linking emissions trading systems.

However, many operators were quick enough to profit from free allowances by selling them at high prices. These windfall profits emerged even in the 3rd ETS trading period (2013-2020), although most EUAs are now distributed through auctions and only the sectors exposed to a risk of carbon leakage, i.e. the relocation of production from Member States to countries without emissions-limiting market-based instruments or other regulations, receive part of allowances free of charge. E.g. according to CE Delft,[29] in the period from 2012 to 2014, installation operators from the sectors

[26] https://ec.europa.eu/clima/policies/ets/credits_en
[27] In the 2nd trading period, about 10% of allowances was distributed through auctions.
[28] The allowance prices fell to zero at the end of 2007 because the allowances issued in the period from 2005 to 2007 could not be banked for use in the next period trading period.
[29] CE Delft is an independent research and consultancy organisation specialised in developing innovative solutions to environmental problems and working, inter alia, for the European Commission and the Governments of Member States.

exposed to a risk of carbon leakage in 19 EU Member States received in this procedure unlawful state aid in an amount of EUR 24 billion.[30] This did not prevent production cuts and plant closures in the sectors which received support in the form of free allowances and often made profit from them. The continued openness of EU markets to imports from countries which did not reduce emissions from industry and energy generation lessened the effectiveness of EU climate policy, whilst simultaneously causing increased emissions in third countries. At the same time, it turned out that just the example of the EU was not an effective incentive to encourage other countries to introduce the same or similar solutions. In addition, different cases involving the relocation of EU emissions to third countries have been revealed, providing arguments for the implementation of the carbon border adjustment mechanism (CBAM) foreseen as part of the European Green Deal. One of such cases is the electricity imports to the EU from the neighbouring countries. This electricity is not only produced in coal-fired power plants in North Africa, the Balkan countries, Turkey and Ukraine, but also its generation can be seen to grow with a view to its exports to Europe.[31]

Attempts to question the EU leadership in climate action

In the process of the international climate negotiations, the EU is one of the major actors, cooperating with the progressive countries[32] committed to enhancing the ambition of actions taken by the the Parties to the Convention.

In 2018, the EU, i.e. all its Member States were responsible together for about 8% of global anthropogenic greenhouse gas emissions[33] and their share has diminished from year to year.[34] The EU is on track to achieve by 2030 at least a 40% emission reduction from 1990 levels and for a dozen years or so it has been the only region able to report steady progress in greenhouse gas emissions reductions. The EU leadership in climate action seems unquestionable to certain observers only. The EU actions are criticised for their too low ambition by many organisations, think tanks and climate activists, with the famous Greta Thunberg at the forefront.[35]

[30] https://carbonmarketwatch.org/publications/policy-brief-carbon-leakage/

[31] https://ember-climate.org/project/interconnectors-and-coal/

[32] The group of progressive countries, i.e. those that voice the need for increasing the ambition and pace of actions to tackle climate change, includes primarily the countries in the AOSIS (Alliance of Small Island States) group, African countries, certain countries in Latin America and several countries which are not EU Member States, mainly Switzerland and Norway.

[33] https://www.pbl.nl/sites/default/files/downloads/pbl-2019-trends-in-global-co2-and-total-greenhouse-gas-emissions-summary-ot-the--2019-report_4004.pdf

[34] The most recent data are given in the emissions inventory reports of EU Member States: https://www.eea.europa.eu/publications/european--union-greenhouse-gas-inventory-2020

[35] https://www.europarl.europa.eu/news/pl/headlines/society/20200227STO73520/greta-thunberg-wzywa-parlament-do-wykazania-sie-przy-wodztwem-klimatycznym

Interestingly, in datasets showing the regional distribution of emissions, the data on Europe often, without clearly highlighting it, include not only the emissions of Turkey (which, after all, is a part of Asia in geographical terms) but also those of Ukraine, Belarus and even Russia.[36] This provides the basis for statements that European countries or Europe as a region belong to the highest emitters in the world, giving a convenient excuse for different vested interests to escalate their requests for financial support for adaptation and mitigation actions in third countries, technology transfer and capacity building, and, at the same time, to stimulate the pressure on the part of the public opinion in Europe for an enhancement of its own reduction efforts. Opinions are also often voiced that the EU does too little for climate protection, that EU actions should be intensified and that EU ambitions are inconsistent with the responsibility of the EU and its citizens for climate change in the world. It is worth noting that for several years China has been the largest world emitter, with its share in anthropogenic emissions in 2018 exceeding 27%. The USA, which used to top the list, now takes a second place, already emitting half as many greenhouse gas emissions as China. India comes third, with the fastest growth rate of emissions. Among EU Member States, in 2019 only Germany was included in the top 15 largest emitters, taking a sixth place in this ranking, with its share of 2.2%.[37]

> The EU leadership in climate action seems unquestionable to certain observers only.

The comparison published by the World Economic Forum shows that in 2019 the 15 largest emitters were responsible for 72.2% of global emissions, meaning that the other countries signatories to the Paris Agreement adopted in 2015 (a total of 197 countries which are, at the same time, Parties to the UNFCCC have acceded to the Agreement) are responsible for about 27% of GHG emissions.[38] These countries include the other EU Member States, with some of them taking distant places in the ranking.

So what is at stake here is mainly the emission reductions in a dozen countries or so, although the actions of others are of importance, too, since the situation is dynamic and deteriorates from year to year. For several years now the United Nations Environment Programme (UNEP) has published its annual report summing up the results of global actions, "Emissions Gap Report". The gap in question is the difference between the emissions which should be achieved in accordance with the recommendations of the international expert body, called the Intergovernmental Panel on Climate Change (IPCC)[39], advising the Parties to the UNFCCC and the Paris Agreement, and the total combined reductions declared by these Parties.

[36] https://www.carbonbrief.org/5-facts-about-europes-carbon-emissions

[37] For more information see: https://www.weforum.org/agenda/2019/06/chart-of-the-day-these-countries-create-most-of-the-world-s-co-2-emissions/

[38] It seems that these calculations do not include GHG emissions from international aviation and maritime transport as separate emissions. It should be noted that the jurisdiction of the UNFCCC does not cover emissions from international maritime transport and international aviation which are the subject matter of negotiations within the IMO (International Maritime Organization) and the ICAO (International Civil Aviation Organization).

[39] IPCC – International Panel on Climate Change. For more information see: https://www.ipcc.ch/

The most recent UNEP report, published at the end of 2019 before COP 25 in Madrid, indicates that the Parties to the Paris agreement will not be able to achieve the global goal of limiting the growth the growth of the average global temperature below 2°C if the cumulative greenhouse gas emissions are not reduced by 15 Gt by 2030. This challenge is doubled for the target of 1.5°C (it is not in effect, although it is recommended on the basis of a special report of the IPCC[40]), the achievement of which requires the global emissions to be reduced by 32 Gt by 2030.[41] Therefore, the ambition of the nationally determined contributions (NDCs) submitted under the Agreement would have to be adequately enhanced.

Does the EU lead in climate action?

The UNEP indicates that the EU Member States are the minority among the G20 countries to fulfill in 2020 their voluntary commitments made 10 years ago in the course of COP 16 in Cancun.[42] For this reason, too, although the G20 countries will achieve as a group the reduction targets declared in Cancun, with an annual surplus of about 1 Gt CO_2e, the credit for this should primarily go to the EU. Not only such countries as Turkey, Argentina and Saudi Arabia made no pledges to reduce emissions in Cancun, but also the commitments of several other countries, including Australia, were hardly ambitious. The UNEP predicts that a number of the G20 countries which declared in Cancun that they would reduce their emissions by 2020, including Canada, Mexico, South Korea, Indonesia, the USA and the Republic of South Africa, will not meet the targets they proposed. The UNEP believes, therefore, that, the EU is in the forefront of climate action, even though its actions are insufficient.

The Paris Agreement does not obligate countries to take equal efforts in order to achieve the goals of the Agreement. Their nationally determined contributions are expected to reflect their capabilities and the principle of equity, in light of their national circumstances. The countries will themselves decide on the ambition of the actions which they will take. The current cumulative ambition of the Parties to the Paris Agreement is insufficient.

The countries' commitments communicated in the form of NDCs will be implemented by the Parties to the Agreement from 1 January 2021. However, the Paris Agreement allows its signatories to adjust their reduction plans by using the opportunity offered by the mechanism of a periodic evaluation of the effects of the actions taken by the Parties in the form of a global review of ambitions (a global stocktake) followed by a successive round of communicating NDCs. The principle of "no backsliding" was adopted, meaning that each successive nationally determined contribution should be at least as ambitious as the previous one. Although, in accordance with the arrangements made in Paris in the course of the negotiations on the details of the Agreement it was decided that the first contributions to the Agreement communicated as intended nationally determined contributions (INDCs) would be updated before COP 26 in 2020, because of the postponement of COP 26 to 2021, the Parties are still able to communicate their updated NDCs in the

[40] IPCC SR1.5: https://www.ipcc.ch/sr15/
[41] https://wedocs.unep.org/bitstream/handle/20.500.11822/30798/EGR19ESEN.pdf?sequence=13
[42] COP.16

course of this year. In addition, in accordance with the provision of Article 4.11 of the Paris Agreement, each country may at any time adjust its existing nationally determined contribution if the purpose of the adjustment is to enhance its level of ambition, in accordance with the guidelines adopted at the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA[43]).

> Their nationally determined contributions (NDCs) are expected to reflect their capabilities and the principle of equity, in light of their national circumstances.

If the ambition of climate actions does not improve during the current round of NDC adjustments we will remain on the pathway to the growth of the average global temperature by 3.2°C by the end of this century. In this situation, China's public announcement made at the end of this September that it planned to reach zero emissions in 2060 met with huge enthusiasm on the part of both expert and diplomatic communities. The Chinese greenhouse gas emissions were expected to peak in 2030, to be followed by their fall to zero over the next 30 years. On this occasion, it is interesting to recall that it has also taken China about 30 years to become the largest global emitter. If China fulfilled this commitment this would make it possible to limit the rise of the global average temperature by the end of this century by another 0.2 to 0.3°C. But over the nearest 10 years China emissions would continue to grow, strongly contributing to deepening the climate crisis. Even under the assumption that the Chinese emissions will really fall from 2031, in order to achieve together the temperature target of the Paris Agreement, the Parties to the Agreement will have to fill in the reduction gap equivalent to halting the global temperature rise by the missing 1.5°C. The fall in CO_2 emissions caused by the reduction of anthropogenic greenhouse emissions during the COVID-19 pandemic is a transitional one in nature. Although many countries foresee actions to limit greenhouse gas emissions in the post-pandemic period, given the continued growth of the energy demand and the commitment of the particular countries to increase their GDP on the basis of the existing structure of industry and the economy, their efforts seem foredoomed to fail. Radical changes need time and, if one were to believe the IPCC forecasts, there is no time left. In order to halt the growth of the average global temperature at the level of 1.5°C, the existing global emissions would have to be halved even before 2030, i.e. over the nearest 10 years. In turn, the global net CO_2 emissions would have to fall to zero by 2050[44]. Therefore, despite the current UN "Race to Zero" campaign promoting higher climate ambitions, the 1.5°C target is practically unattainable. The actions taken to date and the earlier declarations of the Parties to the Paris Agreement do not inspire optimism. By the end of 2019, 37 States - Parties to the Agreement, which are responsible together for 12% of the present

[43] Conference of the Parties serving as the meeting of the Parties to the Paris Agreement.
[44] IPCC recommendation in SR15.

global greenhouse emissions, had declared their intention to update their NDCs by 2020. This group of countries included the EU. Further 108 countries, responsible for 15.1% of global emissions, announced their intention to enhance their ambition or the ambition of the particular actions within their NDCs in 2020. The other 39 the States – Signatories to the Paris Agreement (which submitted their INDCs in 2015[45] before the entry into force of the Agreement and which include several very large emitters) have not submitted their formal declarations regarding an adjustment or enhancement of the ambition of their NDCs in 2020 before the implementation of the Agreement begins on 1 January 2021. This does not mean that these countries will not submit new, adjusted or more ambitions versions of their NDCs.

> In order to halt the growth of the average global temperature at the level of 1.5°C, the existing global emissions would have to be halved even before 2030, i.e. over the nearest 10 years. In turn, the global net CO2 emissions would have to fall to zero by 2050

Exceptions include the United States which is withdrawing from the Agreement[46] and those countries that have declared that they will not enhance their ambitions: Australia, Japan, New Zealand, Singapore, Indonesia, Russia and Turkey. By the end of this September, the UNFCCC Secretariat had received barely 13 submissions of NDC adjustments. The countries which have submitted new versions of their NDCs include Surinam, Andorra, Jamaica, Rwanda, Moldova, Marshall Islands, Chile, Norway, Singapore, Japan, New Zealand and Vietnam.[47] Several other countries, including Laos, Georgia and Mongolia, formally announced that they would submit new, more ambitious NDCs. The other countries have not yet submitted their new declarations concerning the adjustment of their NDCs or new versions of their commitments. The UNDP, which supports 114 developing countries under its Climate Promise program, assumes that most notifications containing updated NDCs will be submitted to the UNFCCC Secretariat in 2021, in any case ahead of the COP.26 in Glasgow, currently scheduled for the end of next year.

The achievement of net zero greenhouse gas emissions[48] in 2050 has become a target which a number of countries, both developed and developing ones, have committed to implement. The target of net zero greenhouse gas emissions in 2050 has been adopted by a number of EU Member States, the United Kingdom as well as certain developed (as Japan) and developing countries, such as Chile, Mexico or South Korea. In December 2019, the European Council adopted the target of net zero greenhouse gas emissions for the EU as a whole, except for Poland, which will be given more time to achieve it. This target is consistent with the assumptions of the European Green Deal which provides that the net emissions of the entire EU will fall to zero in 2050.

[45] Intended Nationally Determined Contributions (INDCs) were the contributions proposed by the Parties to the Paris Agreement which had been submitted before the entry into force of the Agreement (4.11.2016 r.). After the entry into force of the Agreement INDCs have become nationally determined contributions (NDCs).
[46] The text is published before the formal end of the elections in the US elections. The victory of Joe Biden meant that the US would remain in the Paris Agreement.
[47] https://climateactiontracker.org/climate-target-update-tracker/
[48] The anthropogenic greenhouse gas emissions will only reach their net zero levels when all the unavoidable residual anthropogenic emissions are balanced by sinks (forests and vegetal cover) or the industrial process of carbon capture and storage (CCS).

After 2050 the absorption in the EU should continue to prevail over greenhouse gas emissions, since this is justified by the effect of greenhouse gases remaining in the atmosphere and the persistence of cumulative impacts of emissions for many years. As part of the preparations for the implementation of the European Green Deal, in March 2020 the European Commission published a proposal for European climate law (a Regulation of the European Parliament and of the Council). The preamble to the above proposal provided for the presentation of a comprehensive assessment of the impacts of enhancing the EU 2030 reduction target by to 50 – 55% relative to 1990 levels, along with further legislative proposals, enabling the achievement of the more stringent target for 2030, which will be presented by the end of June 2021. The Climate Law is expected to be adopted this year. On 16 September, in her State of the Union address delivered at European Parliament, Ursula von der Leyen proposed that emissions should be reduced by at least 55% by 2030. This proposal was outbid by European Parliament, which voted on 6 October for a 60% emission reduction by 2030 from 1990 levels. Therefore, it should be expected that the adjusted common contribution of the EU to the Paris Agreement which should be communicated to the UNFCCC Secretariat at the end of this year will enhance the EU ambition to at least 55% below 1990 levels.

However, is the example of the European Union sufficient to ensure that the other States – Parties to the Agreement rise to the challenge? We already know that several countries, including large developed countries or those with are relatively large contributors to global emissions, i.e. Japan, Russia and Australia, will not enhance the ambition of their first NDCs or that one country (USA) will withdraw from the Agreement although it will remain a Party to the Convention, which we will find out after December 14.[49] Given the growing rivalry between the USA and China, declaration of the largest emitter in the world its intention to achieve zero emissions in 2060 would encourage the USA to submit an ambitious NDC to the Agreement if the Democratic candidate becomes the President of the USA. Still, China's pathway to zero emission is not a reason for great optimism. Although the use of renewable energy and installed RES capacity are growing in China, unfortunately, at the same time, the consumption of fossil fuels is increasing, too. As a result of the higher consumption of fossil fuels in China, its CO_2 emissions grew by another 2.3% in 2018 and increased by another 4% in the 1st half of 2019. Although China's economic growth in 2020 slightly slowed down due to the COVID-19 pandemic and the general economic downturn in the world, it is known that the green house emissions of this country will freely grow at least until 2030. At present, China's share in global anthropogenic greenhouse gas emissions is estimated at about 27% (excluding the LULUCF sector) and the continuation of this trend until 2030 will substantially increase the cumulative gap between the ambitions of the Parties to the Agreement and the reduction level which should be achieved jointly by all the Parties to the Agreement. The first Chinese nationally determined contribution to the Paris Agreement has been considered to be highly insufficient by the Climate Action Tracker.[50]

[49] If the Democratic candidate, Joe Bidden, wins the election the USA will remain a Party to the Paris Agreement and submit its NDC to the-Agreement.

[50] The Climate Action Tracker is a project of Climate Analytics and the New Climate Institute, in cooperation with the Potsdam Institute for Climate Impact Research: https://climateactiontracker.org/countries/china/

Moreover, in contrast to the EU, China has invested in the development of coal-based energy generation abroad, thus causing global emissions to additionally grow. The cited report on China, which has been published on the website of the Climate Action Tracker, indicates that China funds one fourth of coal-based energy generation projects under construction or planned (as a total, 102 GW of installed capacity) outside its borders.[51]

When account is taken of the low involvement of several other rich countries, driven by an immediate economic interest, in the implementation of the goals of the Paris Agreement, one can hardly expect the other emitters to take greater action, not to mention the lesser importance of their reductionefforts, given that the emissions of the largest emitters will continue to grow. Therefore, the carbon border adjustment mechanism proposed by the EU makes sense – and, indeed, it has a double purpose, too.

Advocates of the EU's leadership in the global race to zero emissions (paraphrasing the UN slogan of a race to zero carbon recovery) received a gift on October 26 from the new Japanese government, which announced that its country would become carbon neutral in 2050, citing the EU as an example for action. Right after Japan, South Korea promised the world to achieve zero emissions in 2050. Will there be more such declarations and will it not end with declarations only? Much depends on the effectiveness of the process of cyclical NDCs unpdatesin combination with the periodic global stocktake.

The carbon border adjustment mechanism as a tool for influencing the actions of other countries

The carbon border adjustment mechanism (CBAM) mentioned previously can prevent not only further cases of carbon leakage from EU Member States, such as the cited relocation of coal-based electricity production to the immediate neighborhood countries, but also determine the real EU share in global emissions by imposing the tax on the consumption of products manufactured in countries which, in accordance with the underlying principles of the UNFCCC that are partly reflected in the Paris Agreement, have more time to reach zero emissions. This will thus enhance the competitiveness of the similar or the same production in Member States since cheap labour will cease to be a decisive factor when a decision is taken where goods for the European market should be manufactured. It should be expected that it will not be easy to introduce this mechanism and that it will meet with objections of international corporations and third countries which will cite the free trade principles and appeal to the WTO.[52] Russia has already voiced its objection to the plans to introduce the CBAM citing the WTO rules.[53] Intra-EU resistance should also be expected on the part of those entrepreneurs that have moved their production to Asia because of its lower labour costs and less demanding environmental standards. However, should the EU resign from this mechanism it would be a mistake and call into question its ambition to lead changes in global climate action.

[51] CThe countries investing in coal-based energy generation abroad also include Japan. South Korea and Australia, which exports its coal mainly, though not only, to China. Cf. https://climateactiontracker.org/countries/china/
[52] World Trade Organisation.
[53] https://www.climatechangenews.com/2020/07/28/russia-warns-eu-carbon-border-tax-plan-citing-wto-rules/

Given that the very provision of an example by taking such actions does not bring the expected results in the form of similar actions by other countries and that some time ago the EU already gave up the idea of making the enhancement of its actions dependent of the launch of actions at a similar scale by other countries, at least developed countries, then making access to the EU market dependent on compliance with the "polluter pays" principle is a correct decision. A separate issue is the design of this mechanism and its position in the set of measures which will be introduced as the toolkit for implementing the ambitions of the European Green Deal.

Obviously, there are not only proponents but also opponents to the introduction of the CBAM. E.g. in March 2020, the Breughel Institute published its analysis entitled "A European carbon border tax. Much pain, little gain".[54] The authors of this analysis argue that there is no evidence to carbon leakage from Europe in relation to the EU ETS and European climate policy. They also emphasise that it would be both difficult and costly to introduce and enforce the border tax. Without completely refuting these objections, it should be borne in mind, however, that carbon leakage is not only the direct relocation of a factory from a Member State to a country with no limits on CO_2 emissions but also failure to invest in countries which have such a policy in place in favour of those that have no such policy. And if, in addition, in the latter countries there is cheap labour and/or access to cheap raw materials and the transport cost does not include the related emissions, there is only one decision that an investor can take.

On 23 July 2020, the European Union launched the process of public consultations on the introduction of the CBAM and a review of the Energy Tax Directive (ETD). Amendments to the ETD, the implementation of the CBAM, the just transition mechanism and the green investment plan, along with the ETS reform and other measures foreseen in the European Green Deal, are expected to contribute to the achievement of zero emissions by the EU in 2050.

[54] https://www.bruegel.org/wp-content/uploads/2020/03/PC-05-2020-050320v2.pdf

Options and conditions for the introduction of the Carbon Border Adjustment Mechanism (CBAM) in the EU

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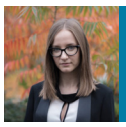
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The proposals for the introduction of a CBAM for greenhouse gas emissions have for many years appeared in the political debate.

The purposefulness of the introduction of such an instrument has been considered primarily in the European Union (EU) which has long pursued the most ambitious climate policy in the world[55] . Given that disproportions persist among the reduction ambitions of the largest world economies, in 2019 the EU addressed again the issue of the imposition of the carbon border adjustment mechanism referred to in the Communication from the European Commission The European Green Deal. In addition, along with the plans to enhance the greenhouse gases reduction targets of the EU by 2030 and also to achieve climate neutrality by 2050, it is worthwhile to consider the introduction of additional instruments to protect the industrial sectors covered by the EU ETS against the loss of their competitiveness. The European Commission carried out consultations on the introduction of a CBAM[56] and a proposal for a directive meeting the rules of the World Trade Organization (WTO) is expected in mid-2021.

Although the very idea of the carbon border adjustment takes on different names (border adjustment tax, border adjustment mechanism, carbon border tax) and is based on different concepts of solutions, its purposes are the same. They are expected to prevent carbon leakage from the EU to areas with lower ambitions in terms of GHG reductions or where equally rigorous environmental standards do not apply. By assumption, the aim of the implementation of this idea will be to preserve the competitiveness of EU industry with the growing costs of climate policy and to exert pressure on the countries which have not made any climate commitments. To date, the EU has not worked out the final form which such a tax would take. One of the possible options which can be applied is the idea of the introduction of a consumption charge in which the carbon footprint would be used to calculate the carbon

> CBAM (import duty) should be levied on imports from sectors with high energy and carbon intensity of their output

[55] For more information on the initiative to implement the CBAM in the EU see the EC website via the link: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12228-Carbon-Border-Adjustment-Mechanism

[56] The consultations were held until 28 October 2020.

border adjustment rate for the final product; work on this idea is now done, among others, by the European Roundtable on Climate Change and Sustainable Transition (ERCST)[57]. Another option which is considered, among others, by the Jacques Delors Institute, is the introduction of the carbon border adjustment mechanism only for two pilot sectors of the economy, i.e. electricity and cement production[58]. Other studies addressed the impact of the introduction of the carbon border adjustment mechanism on the world economy, including e.g. that by Christopher Böhringer from the University of Oldenburg[59], which indicated that this is an effective method for limiting carbon leakage and reducing global costs.

In the discussion in Brussels, several possible solutions appeared, among others, consisting in the implementation of an excise duty to be paid by goods suppliers or a CBAM (import duty). The latter would be imposed on products exposed to a risk of carbon leakage, i.e. carbon- and energy--intensive ones.[60] In accordance with the guidelines, it could also apply to other products related to the sectors included in the list of those exposed to a risk of carbon leakage. The aim of this carbon border adjustment mechanism would be to ensure that carbon prices corresponding to those applied in the EU are imposed on imported products. The other mechanisms which are now analysed include a carbon tax to be added at the particular stages of the supply chain (patterned on the VAT) and the inclusion of importers into the EU ETS by imposing on them the obligation to surrender an adequate number of emission allowances.

The Centre for Climate and Energy Analyses (CAKE) has prepared the Report entitled "The effects of the introduction of the carbon border adjustment mechanism in the context of more stringent EU climate policy by 2030" in which it attempted to answer at least some questions asked in relation to the implementation of the CBAM being now debated. This Report analysed the impact of the introduction of the CBAM (import duty) on the economies of EU Member States, among others, on price levels, changes in output, exports and imports, as well as emission levels. The analysis was performed using the global, multi-sectoral computable general equilibrium (CGE) model called CREAM (Carbon Regulation Emission Assessment Model). The timeframe of the analysis extends until 2030. The assumed scenario for the implementation of climate policy envisages that the EU will enhance the greenhouse gas emission reduction target for 2030 from 40% to 55% from 1990 levels and subsequently introduce the CBAM. The carbon border adjustment mechanism rate has been estimated using the difference between the emission allowance price in the EU ETS and the estimated marginal cost of emission reductions outside the EU which follows from the reduction commitments adopted under the Paris Agreement (NDCs[61]).

[57] https://ercst.org/event/border-carbon-adjustments-conceptual-stakeholders-meeting-on-alternatives/

[58] Europe Jacques Delors, Greening EU Trade 3, A European Border Carbon Adjustment Proposal, June 2020.

[59] Böhringer C, Carbone J. C, Rutherford T.F, Unilateral climate policy design: Efficiency and equity implications of alternative instruments to reduce carbon leakage, Energy Economics 34, 2012.

[60] For more information on the list of the sectors exposed to a risk of carbon leakage see the EC website via the link: https://ec.europa.eu/clima/policies/ets/allowances/leakage_en

[61] Nationally Determined Contributions.

Sectors covered by the carbon border adjustment mechanism

On the basis of the proposals described above, it was assumed that the CBAM (import duty) should be levied on imports from sectors with high energy and carbon intensity of their output. Energy-intensive sectors on which the CBAM might possibly be levied were selected on the basis of the list of sectors exposed to a risk of carbon leakage in the EU ETS in the period from 2021 to 2030. They included[62].

- oil (manufacture of coke and refined petroleum products),
- ferrous metals (iron and steel production),
- non-ferrous metals (aluminium production), chemical products (manufacture of chemicals),
- paper products (manufacture of paper and printing) and
- non-metallic minerals (cement, lime and glass).

In accordance with the projection for 2030, the sectors selected for the analysis have a significant share of about 48% emissions in the EU ETS. In addition, they are responsible for half of the emissions (about 455 $MtCO_2eq.$) generated in the manufacture of goods which are imported to EU Member States. Moreover, it should be pointed out that most of industrial emissions (both indirect and direct[63]) generated as a result of the manufacture of goods which are then imported to EU Member States come from a relatively few sectors and mostly from industries exposed to a risk of carbon leakage.

An increase in the prices of imports into the EU

The implementation of the CBAM would cause an increase in the prices of goods imported from countries outside the EU, with a simultaneous decrease in the value of imports. As shown in Fig. 1, the greatest decreases in imports into the EU would come in the following sectors:

- ferrous metals by 11.6%,
- oil by 4.8%,
- non-metallic minerals by 4.6%.

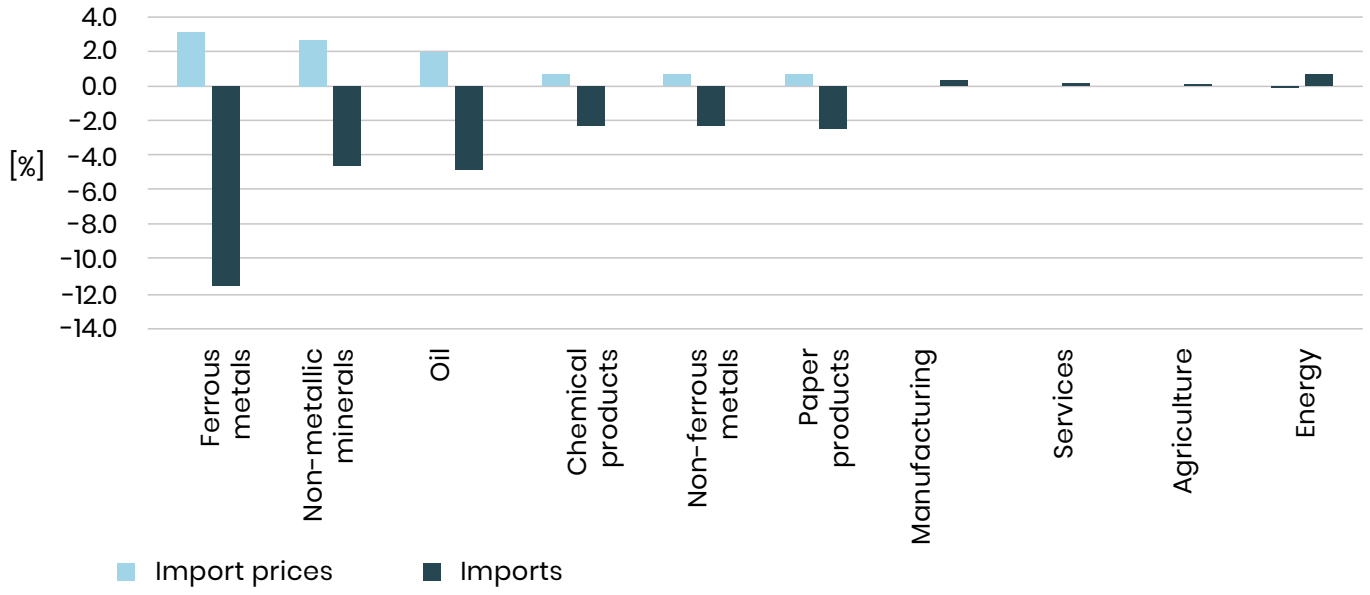
The value of imports would fall to a lesser extent in the sector of paper products, by about 2.5%, and in the sectors of chemical products and non-ferrous metals, by about 2.3%. In contrast, the other sectors of the economy would see an increase in the value of imports (on average by about 0.3%), among others, as a result of substitution for the goods subject to the CBAM and slight deterioration of the competitiveness of goods manufactured in EU Member States (the implementation of the CBAM could cause higher production prices in the EU).

[62] The sectors selected for the analysis include both activities directly exposed to a risk of carbon leakage and others that are part of the same sectors (up to the 2nd aggregation level based on NACE rev. 2) as the activities in the list of those exposed to a risk of carbon leakage. This results from the level of sectoral aggregation in the CREAM CGE model used.

[63] Direct GHG emissions are the sum total of emissions from fuel combustion and process emissions. Indirect GHG emissions are related to the electricity consumption in manufacture in a given sector.

Since the imports in the sectors covered by the carbon border adjustment mechanism are not of decisive importance in the total structure and volume of imports into EU Member States, there would not be a large decrease in the total volume of goods imported from outside the EU. The total decrease in the imports into the EU would be about 0.5% and would be fairly differentiated among EU Member States.

FIG. 1. PRICES AND VALUE OF IMPORTS FROM OUTSIDE THE EU IN EU-27.

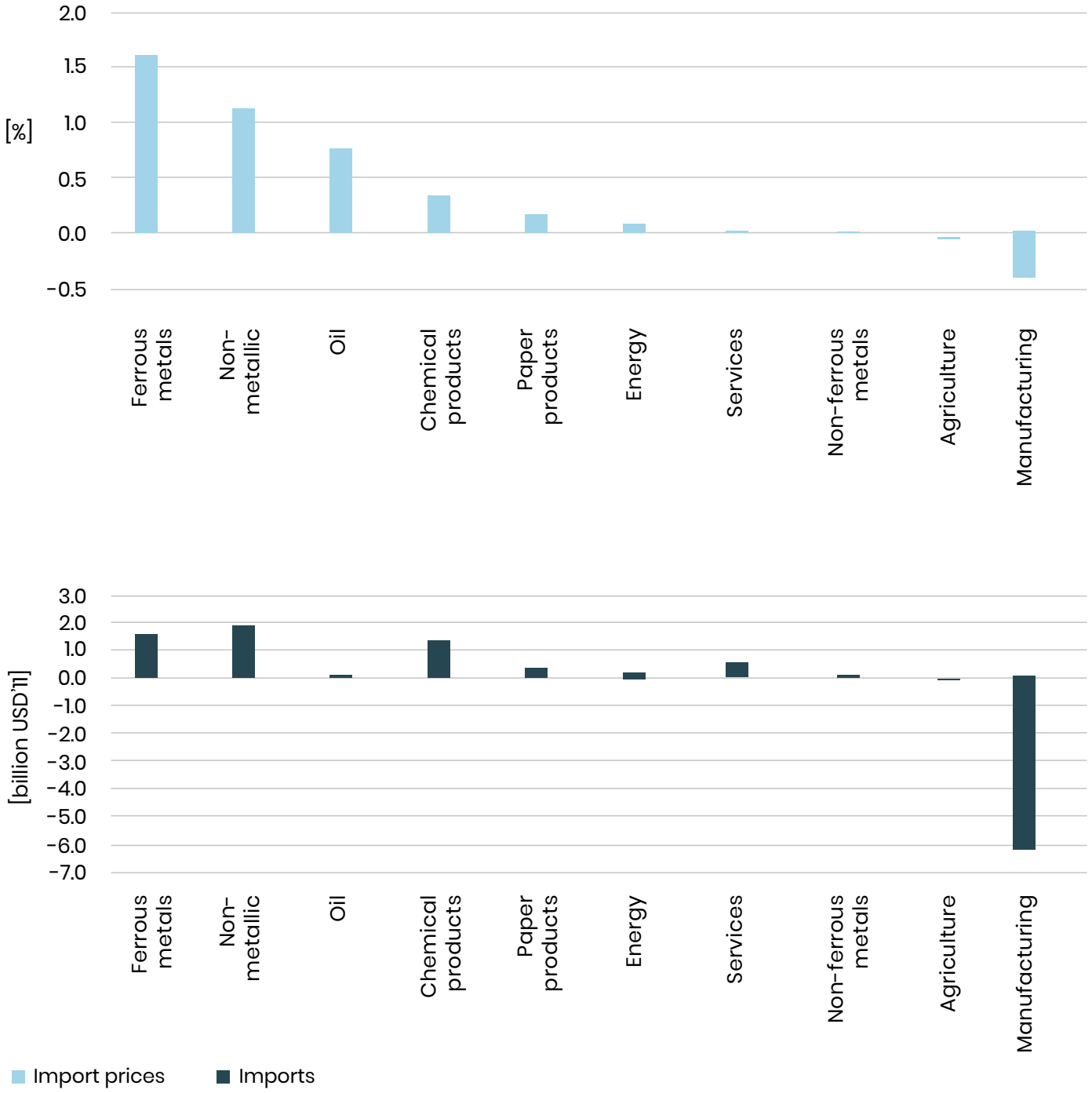


Source: Own elaboration by CAKE/KOBiZE

An increase in the value of the output in the EU

In general, the introduction of the CBAM would cause an increase in the output in the sectors covered by that adjustment by 0.4%, primarily, as a result of substitution of imports by production in EU Member States. Fig. 2 shows the foreseen output changes caused by the introduction of the CBAM. The greatest output increases would come in the sector of ferrous metals, by 1.6%, and the sector of non-metallic minerals, by 1.1%. Other significant output increases would come in such sectors as oil, by 0.7%, chemical products, by 0.3%, and, to a lesser extent, paper products, by 0.1%. The output value in the EU sector of non-ferrous metals would remain practically the same.

FIG. 2. THE OUTPUT IN EU-27.



Source: Own elaboration by CAKE/KOBiZE

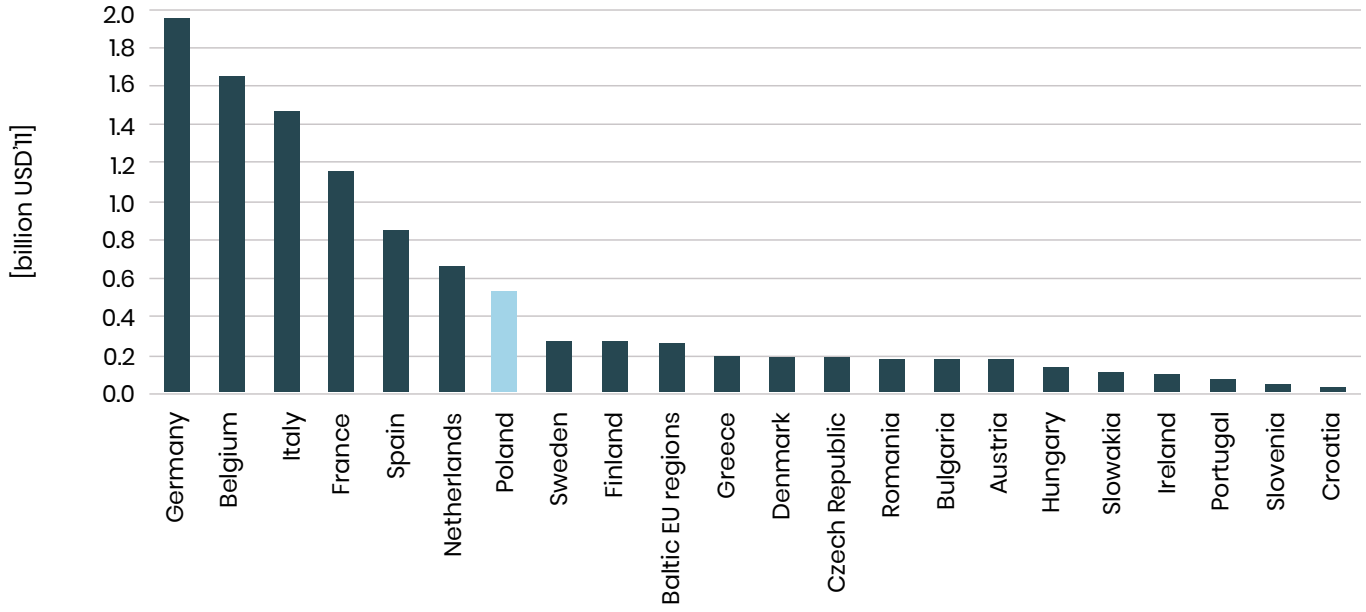
Budget revenues generated by the introduction of the carbon border adjustment mechanism

The introduction of the CBAM could generate additional revenues to the budgets of EU Member States. The largest revenues from the carbon border adjustment mechanism could be gained by Germany, i.e. USD 1.9 billion (EUR 1.36 billion[64]), while the lowest ones - Croatia, i.e. USD 0.04 billion (EUR 0.03 billion). The estimated proceeds from the carbon border adjustment mechanism in Poland could be USD 0.5 billion (EUR 0.36 billion), while the revenues from the CBAM in 2030 within the EU are estimated at about USD 10.6 billion (EUR 7.61 billion). The main factor affecting the value of revenues from the CBAM is the value of imports from outside the EU. In the discussion on the shape of the future EU climate policy, more and more often opinions can heard that the possible proceeds from the CBAM could be earmarked as

> Revenues from the CBAM in 2030 within the EU are estimated at about USD 10.6 billion (EUR 7.61 billion)

a contribution to the EU common budget. Next year, when the mechanisms under the European Green Deal are revised, the discussion on the budget issues can be resumed and it will become clear if and possibly what percentage of the resources from the CBAM could be revenues to the budgets of Member States and what percentage of them would go to the EU common budget. Nevertheless some part of the resources from the CBAM should be allocated to specific objectives related to climate action, e.g. to mitigate the effects of the transition and to speed it up in those EU Member States that are affected to the greatest extent by climate policy.

FIG. 3. THE PROCEEDS FROM THE CARBON BORDER ADJUSTMENT MECHANISM IN CONSTANT 2011 PRICES.



Source: Own elaboration by CAKE/KOBiZE

[64] The EUR/USD exchange rate = 1.392, according to Eurostat data (updated on 24.02.2020).

Changes in global emissions

The results of the analysis show that the relocation of production and a change in the intensity of the trade between the EU and the other regions resulting from the implementation of the CBAM would contribute to a decrease in global GHG emissions by about 24 MtCO_2eq. This change would be slight in relation to the total EU emissions. Still, it would represent about 30% of the emission reduction level which would have to occur in the industrial sectors covered by the CBAM (and 10% in the EU ETS as a whole) if the EU reduction target is raised to 55% in 2030 relative to 1990 levels. The slight change in global emissions also results from the account taken in the analysis of the carbon prices in the regions outside the EU (as an effect of NDCs) and the existing EU protection of the sectors exposed to a risk of carbon leakage in the form of free allocation of emission allowances within the EU ETS. If the carbon price in the regions outside the EU were taken into account the CBAM rate would be lower that the projected EUA price, since it would result from the difference between the price in the EU ETS and the price which would enable the fulfilment of NDCs in the other world regions outside the EU.

It should be noted that, apart from the positive effects of the implementation of the CBAM, it also poses many risks, e.g. the fact that the CBAM is a measure to protect industry within the EU and in the longer term it will lead to less efficient use of resources (capital and labour). In addition, it should be consider that the analysis did not address in detail the legal and political issues related to the introduction of the CBAM. These barriers can pose the main obstacle to the implementation of this type of solution. To date, the EU has not worked out a form of such a CBAM which would be acceptable to the Parties to the Paris Agreement and, therefore, difficult negotiations are needed in the nearest future to reach a compromise on this issue.

Opportunities for CO_2 emission reductions in the road transport sector in the context of the European Green Deal

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In December 2019, the European Commission published its Communication "The European Green Deal"[65]. This document brought the problem of climate change into the mainstream actions of the European Union and also conferred priority importance to it.

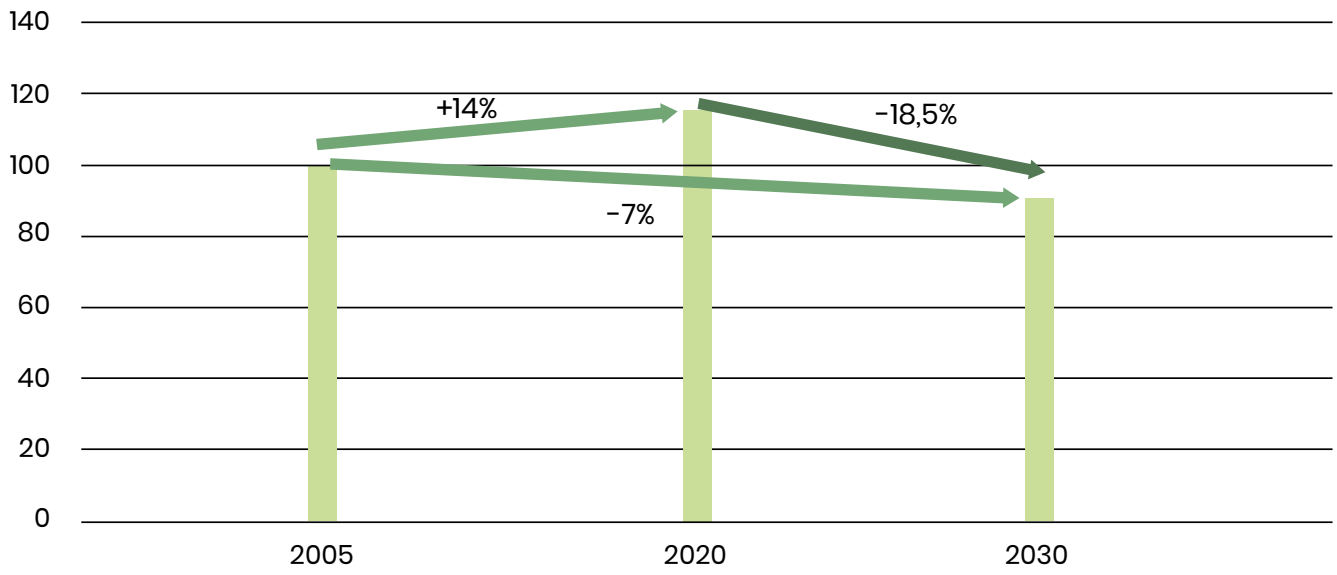
The Communication proposed that the issues of climate change should be taken into account in a cross-cutting manner in all the actions of both the European Commission itself and the particular Member States. One of the main assumptions of this document was the endorsement of the target of climate neutrality of the European economy by 2050, as proposed in an earlier document of the European Commission, "A Clean Plan for all" from 2018[66]. In this context, the European Commission proposed that the greenhouse gas reduction target for 2030 should be raised. The current target in effect was adopted by the European Council in October 2014 as 40% relative to 1990 levels[67].

This target applies to the European economy as a whole. Given the shape of the climate policy of the European Union and the role of the EU ETS as an instrument to reduce greenhouse gas emissions, this overall reduction target can be divided into two components. In the EU ETS, the emissions are expected to be reduced by 43% from 2005 levels. In turn, in the non-ETS area which includes all the sectors of the economy which are not covered by the EU ETS, the emission reduction target is 30% relative to 2005 levels, too. It is important to note that the European Green Deal provides that the 2030 target will be raised from 40% to date to 50-55% relative to 1990. In turn, in September of this year, in her State of the Union address delivered at European Parliament, Ursula von der Leyen proposed that greenhouse gas emissions should be reduced by at least 55% until 2030 from 1990 levels. This change proposed in the GHG emission reduction levels in the EU will require a new target to be set for the sectors covered by the EU Emission Trading System (one target for the EU ETS) and new targets to be laid down for the non-ETS sectors, broken down for the particular Member States (each Member State has its national target in the non-ETS area). It is also possible that new sectors will be included in the EU ETS or a separate emission trading system is established for selected sectors.

[65] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN
[66] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0773&from=EN
[67] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2014:0015:FIN:EN:PDF

It should be emphasised that in the non-ETS area until 2020 Poland could increase its GHG emissions by 14% from their 2005 levels[68]. Under the assumption that Poland will reach this target, in 2030 the emissions in the non-ETS area will have to be reduced by about 18.5% from 2020 levels (Fig. 1) so as to achieve the reduction target of -7% in 2030 relative to 2005 (this target has been set for EU Member States on the basis of the 2013 GDP per capita).

FIG. 1. REDUCTION TARGETS IN THE NON-ETS AREA IN POLAND FOR 2020 AND 2030 (2005 = 100%).



Source: CAKE/KOBiZE own study

In the EU ETS, the raising of the reduction target will increase the price of the emission allowances (EUAs) as their supply will diminish[69]. In the case of transport, which is not covered by the EU ETS, the raising of the reduction target will require the European Commission to present and Member States to accept a new division of reduction targets among all the Member States of the European Union; at this time, this will involve the adoption of new annual emission allocations (AEAs)[70].

According to the CAKE/KOBiZE analysis, the new intervals into which emission reductions should fall after the reduction target is raised as follows (Fig. 2):

from 0% to 55% - for the GHG50 scenario assuming the EU GHG reduction target of 50% in 2030 relative to 1990, including 42% in the non-ETS area in 2030 relative to 2005,

from 5% to 65% - for the GHG55 scenario assuming the EU GHG reduction target of 55% in 2030 relative to 1990, including 48% in the non-ETS area in 2030 relative to 2005[71].

[68] Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 (ESD).

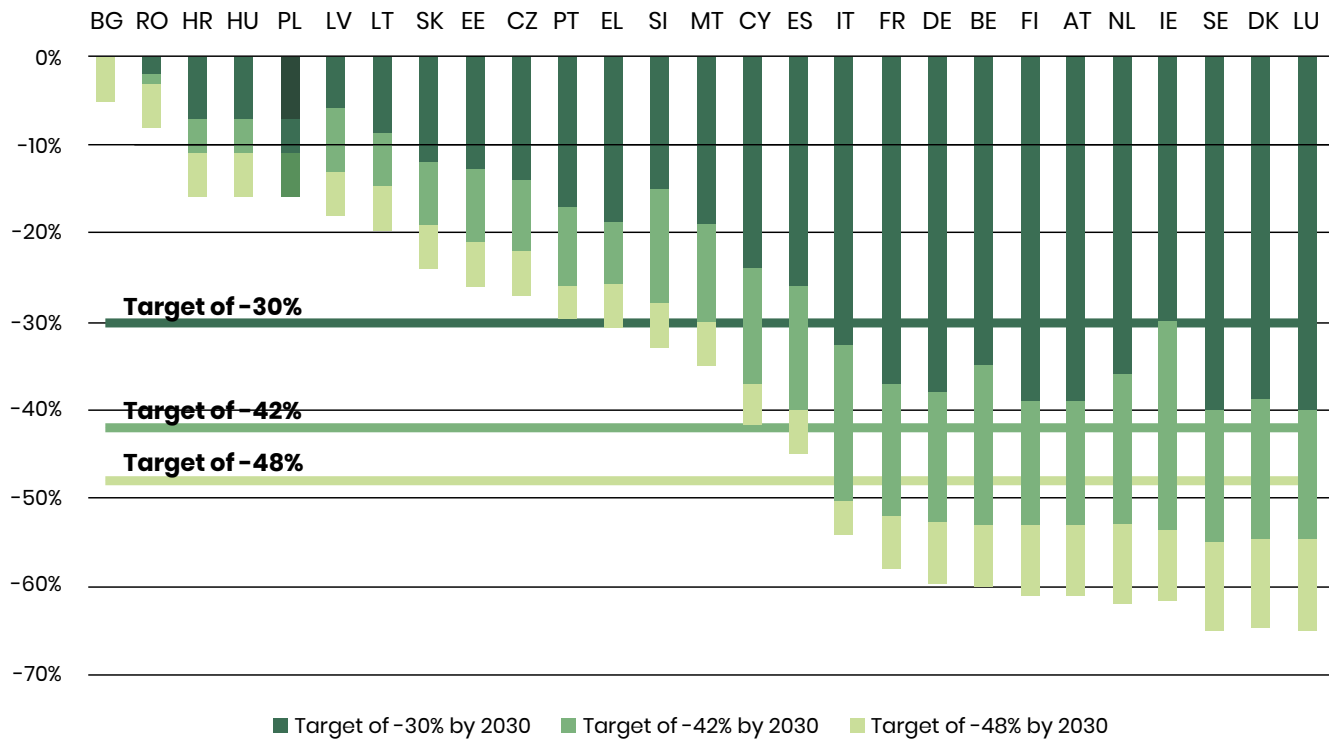
[69] In the EU ETS, EUAs (European Union Allowances) are used to account for annual emissions, where 1 EUA is equal to the emission of 1 tCO_2eq. As a rule, EUAs are sold at auctions; still, in the ETS there are exceptions to this rule; e.g. industrial sectors can receive part of allowances free of charge, in accordance with the allocation rules laid down in Commission Decision 2011/278/EU of 27April 2011.

[70] In the non-ETS area, annual emissions allocations (AEAs) are used to account for annual emissions at the level of the particular Member States, where 1 AEA is equal to the emission of 1 tCO_2eq.

[71] Pyrka M, Tobiasz I, Boratyński J, Jeszke R, Mzyk P, Zmiana celów redukcyjnych i cen uprawnień do emisji wynikająca z komunikatu "Europejski Zielony Ład", CAKE/KOBiZE/IOŚ-PIB, marzec 2020 r. http://climatecake.pl/wp-content/uploads/2020/03/CAKE_Zmiana-cel%C3%B3w-redukcyjnych-i-cen-uprawnie%C5%84-do-emisji-wynikaj%C4%85ca-z-komunikatu-Europejski-Zielony-%C5%81ad-1.pdf

For Poland the new reduction targets for 2030 in the non-ETS area can be at the level of -11% for the EU target of -42% and -16% if the EU target of - 48% is implemented. In case of the new division of the reduction targets in the non-ETS area among the particular EU Member States, the adoption of the GDP per capita criterion for a year other than 2013 can additionally affect the new national targets and the differences among them (the economic growth and demographic changes have different rates in the particular Member States).

FIG. 2. COMPARISON OF THE REDUCTION TARGETS IN NON-ETS SECTORS FOR 2030 (WHEN THE TOTAL EMISSION REDUCTION TARGETS IN THE EUROPEAN UNION ARE RAISED TO 50% AND 55%)



Source: Own elaboration by CAKE/KOBiZE after "The European Green Deal impact on the GHG's emission reduction target for 2030 and on the EUA prices"

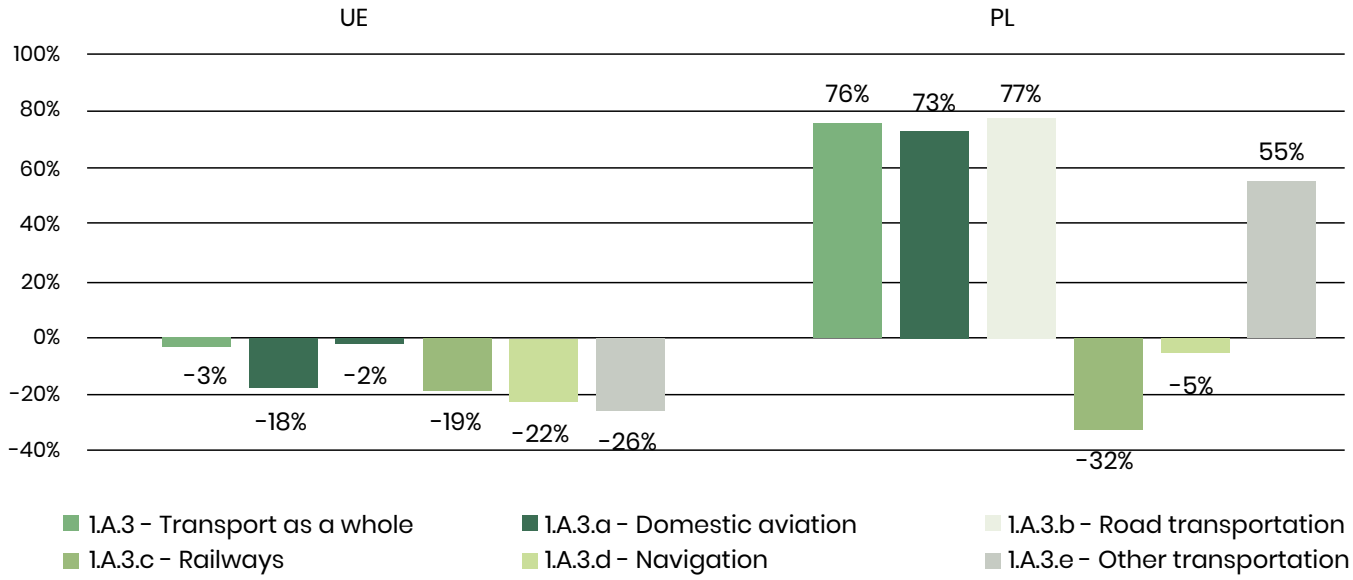
The non-ETS area includes many sectors of the economy[72], the transport sector and the municipal and housing sectors have the largest shares in CO_2 emissions. CO_2 emissions from the transport sector represented more than 40% of emissions in the non-ETS area in 2015 and about 24% of total GHG emissions in Poland. It is interesting to point out that in the EU transport sector the share of CO_2 emissions from passenger transport represents almost 70% of total emissions, while in passenger transport most emissions are generated by road transport. In light of this, the actions taken to reduce CO_2 emissions from this sector should address road car transport as the main source of emissions. When comparing historical data on CO_2 emissions from the transport sector in Poland and the EU as a whole, it is important to point a significant difference. In Poland, in the

[72] The emissions from the non-ETS area include those from the following sectors: transport, agriculture, waste, industrial emissions outside the EU ETS, the municipal and housing sector, buildings, small sources, households, services etc.

> In Poland, in the period from 2005 to 2017, CO_2 emissions from the transport sector grew by 76%, whereas in the same period the European Union saw a 3% drop in emissions

period from 2005 to 2017, CO_2 emissions from the transport sector grew by 76%, whereas in the same period the European Union saw a 3% drop in emissions (Fig. 3)[73]. There is no doubt that such a situation resulted from Poland's faster economic growth than the average economic growth of the European Union and the diminishing difference in the number of vehicles per 1,000 inhabitants between the new and old Member States of the European Union. What is also important is the imports of used vehicles from other EU Member States into Poland, most of which failed to meet the most recent emission standards.

FIG. 3. CHANGES IN CO_2 EMISSION LEVELS IN THE TRANSPORT SECTOR IN 2017 RELATIVE THE LEVELS IN 2005 IN THE EU AND POLAND.

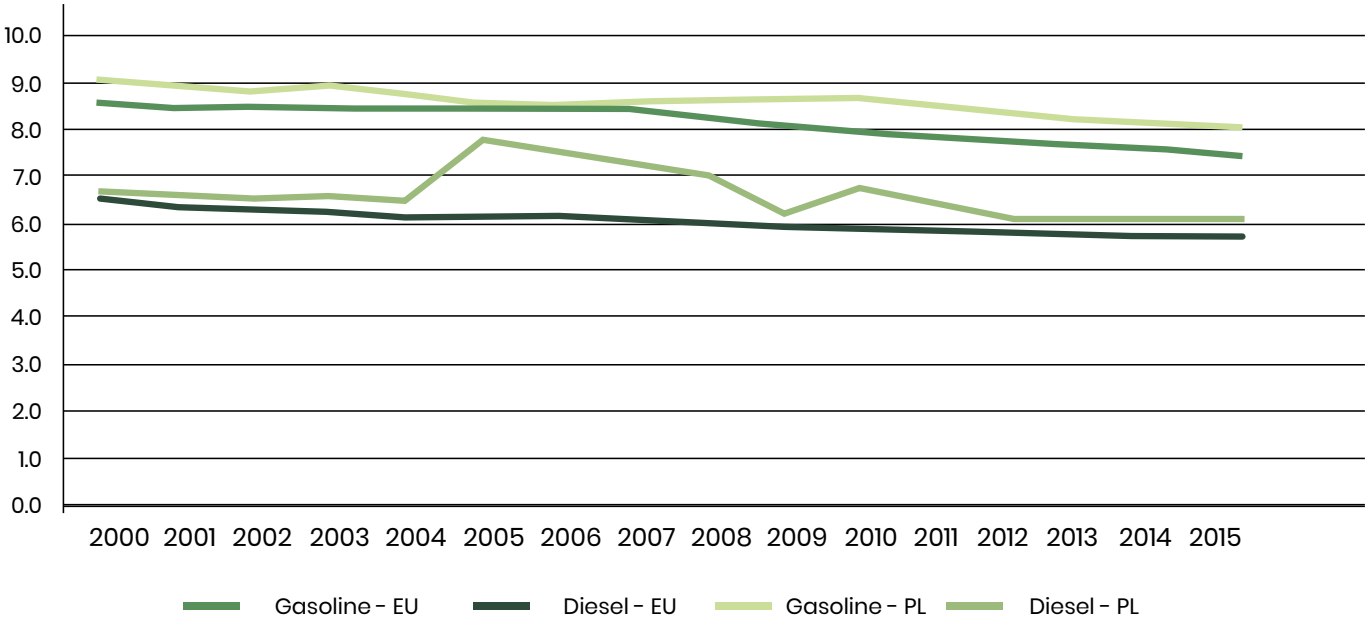


Source: CAKE/KOBiZE own study based on the EEA GHG data viewer.

Moreover, the difference between the CO_2 emission levels results from the fact that the passenger car fleet in Poland has different characteristics in terms of fuel consumption per 100 km. The average consumption of both gasoline-powered and diesel oil-powered vehicles in Poland is higher by about 0.5 litre of fuel than in EU Members States (Fig. 4).

[73] https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer

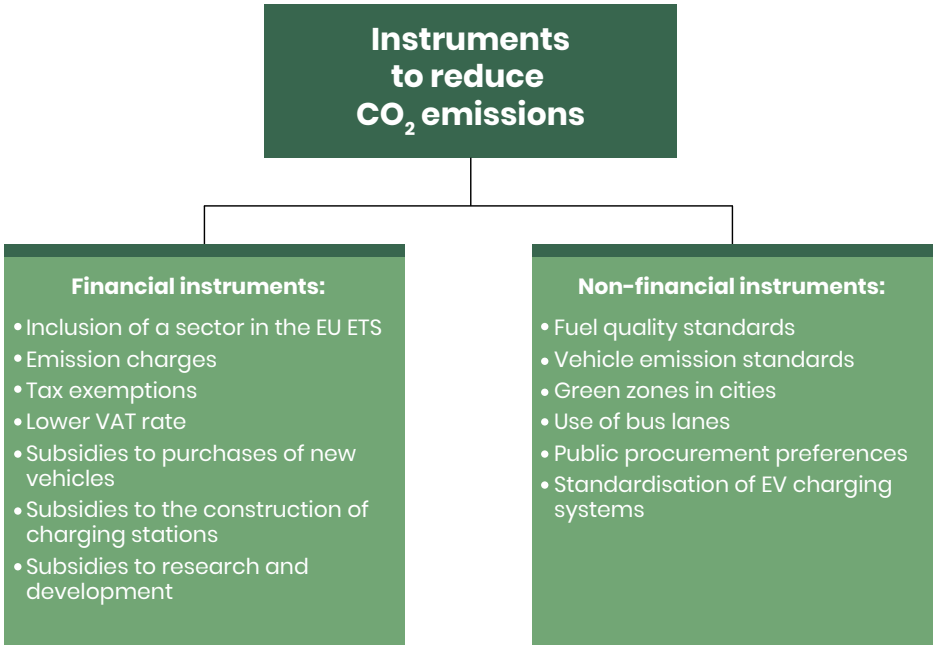
FIG. 4. AVERAGE CONSUMPTION OF GASOLINE AND DIESEL OIL BY PASSENGER CARS IN EU-28 AND POLAND IN THE PERIOD FROM 2000 TO 2015 (L/100 KM).



Source: CAKE/KOBiZE own study based on the IDEES database.

The opportunities and instruments to reduce CO_2 emissions from the transport sector are very diversified. Taking as the criterion whether instruments to reduce CO_2 emissions from the transport sector involve flows of financial resources, such instruments can be divided into two groups: financial and non-financial instruments (Fig. 5).

FIG. 5. INSTRUMENTS TO REDUCE CO_2 EMISSIONS FROM THE ROAD TRANSPORT SECTOR.



Source: CAKE/KOBiZE own study

In its research on the potential to reduce CO_2 emissions from the transport sector, CAKE/KOBiZE considered the introduction of several instruments of those presented as examples in Fig. 5. Among others, it investigated the effect of the levying of additional charges on vehicle users and the introduction of a scheme of subsidies to purchases of low-carbon vehicles.

There is no doubt that a scheme of subsidies to purchases of electric and/or hybrid vehicles is such a financial instrument. From the economic point of view, its purpose is to create a competitive advantage of this group of vehicles over relatively cheaper conventional vehicles. The lowering of the prices of low-carbon vehicles is intended to speed up the pace of the "entry" of these vehicles onto the market. However, given the fact that a scheme of subsidies is a non-market instrument, there may be certain difficulties in determining the level of co-financing for purchases of new electric or hybrid vehicles and the group of consumers eligible to receive support of this type. In case of the implementation of this instrument, another problem can be the efficiency and effectiveness of the subsidies. In this situation, the solution would be to create such a mechanism in which the level of subsidies would depend e.g. on household incomes. Higher subsidies to low-income households would ensure higher effectiveness of this mechanism[74]. Moreover, they can contribute not only to limiting CO_2 emissions but also to reducing the emissions of other pollutants, since old conventional vehicles would be replaced by low-carbon ones. Another solution contributing to emission reductions are charges levied on the users of vehicles powered by fossil fuels. They can include not only charges "hidden" in fuel prices, but also e.g. those annually collected during technical inspections after verifying the annual mileage and taking into account the average road emissions (per km).

Tax-like instruments related to pollutant emissions can be a tool encouraging vehicle owners to change behaviour, e.g. to give up an individual means of transport in favour of collective transport or to replace a conventional vehicle by a low-carbon one. The introduction of a fixed annual charge depending on the CO_2 emission level makes low-carbon vehicles more competitive than those with internal-combustion engines; this, in turn, stimulates an increase in the number of electric and hybrid vehicles entered into to the fleet in a given period of time. In consequence, cheaper travels by low-carbon vehicles boost the activity in the segment of hybrid and electric vehicles (we are more willing to drive cars which are cheaper to maintain). However, the estimates by CAKE/KOBiZE indicate that given these two antagonistic effects: on the one hand, the incentives encouraging the change of means of transport and, on the other hand, the opportunities for increasing mobility, the CO_2 emission reductions in the vehicle sector related to the introduction of such charges would be slight (of the order of 1-2% in 2030 relative to the baseline scenario).

> In order to reduce in 2030 the CO_2 emissions in this sector by 10% compared with the baseline scenario, the costs of using gasoline- or diesel oil-powered vehicles would have to be raised by almost 50%

[74] J. Xing, B. Leard, S. Li, "What Does an Electric Vehicle Replace?", Resources for the future, working paper 19-05, February 2019.

It should be emphasised that a fixed charge (depending on emissions) for the possession of a vehicle which is collected annually is a greater burden, firstly, for old vehicles and, secondly, for customers who use their vehicles sporadically. While the first effect is legitimate as to the greatest extent it pushes out of use vehicles which pollute the environment, in contrast, the imposition of substantial charges for the possession of an old vehicle on less affluent consumers is not entirely right.

The analyses performed by the CAKE/KOBiZE on the introduction of additional charges in the road transport sector have indicated that in order to reduce in 2030 the CO_2 emissions in this sector by 10% compared with the baseline scenario, the costs of using gasoline- or diesel oil-powered vehicles would have to be raised by almost 50%. In turn, a 16% increase in these costs would only bring a 4.5% emission reduction in 2030 compared with the baseline scenario, too.

An interesting solution is making the charges levied the users of vehicles powered by fossil fuels dependent on their mileage. In such a case, the charges would be a greater burden for consumers who travel extensively and a lesser burden for those who use their vehicles sporadically. Such a type of charges encourages the limitation of transport activity and this directly translates into emission reductions.

The latest CAKE/KOBiZE estimates has demonstrated that tax-like charges depending on the intensity of the emission of fuel consumed, levied on the users of vehicles with gasoline- or diesel oil-powered engines, a tax, may lead to emission reduction less than 7 Mt CO_2, in relation to the baseline scenario[75]. In other words, the potential reduction of CO_2 emissions in relation to the baseline scenario is at the level of approx. -12% in 2050. However, the largest reductions are achieved in the scenarios with assumed technological progress, where a significant decrease in the prices of electric and hybrid vehicles is visible. In the above mentioned CAKE/KOBiZE analysis, emission reductions in 2050 in such a scenario are at the level of about -23 Mt CO_2 compared to the baseline scenario. Such scenarios were also considered in another study performed by CAKE/KOBiZE[76].

Among others, on the occasion of the publication of the Communication from the Commission "The European Green Deal", it was proposed that the transport sector should be included in the EU ETS system, as one of market-based mechanisms to limit the CO_2 emissions from this sector. On the one hand, the inclusion of the transport sector in the EU ETS would cause a negligible increase in the costs in this sector, given the high marginal cost of emission reductions and the relatively low prices of emission allowances (EUAs). On the other hand, it could cause an increase in the demand for allowances on the EU ETS market, where the energy generation industry has a large share and the marginal cost of emission reductions is lower. Therefore, the main outcome of this inclusion might be higher prices of allowances in the

[75] "The CO_2 emissions reduction paths in the transport sector in Poland in the context of the European Green Deal", KOBiZE/CAKE http://climatecake.pl/aktualnosci/analysis-co2-emissions-reduction-paths-in-the-transport-sector-in-poland-in-the-context-of-the-european-green-deal/?lang=en

[76] Potencjał redukcji emisji CO_2 w sektorze transportu w Polsce i w UE w perspektywie roku 2050 [The potential for CO_2 emission reductions in the transport sector in Poland and the EU in the timeframe until 2050 – in Polish], CAKE/KOBiZE http://climatecake.pl/wp-content/uploads/2019/11/CAKE_Transport_emission_reduction_potential_2050_paper__final.pdf

EU ETS electricity prices; however, these increases would not be sufficient to ensure emission reductions in the transport sector. Moreover, in economic terms, higher prices of EUAs would be felt to a greater extent in the sectors covered by the EU ETS to date than in the transport sector. Refineries or other entities on which the obligation to surrender their emissions from the transport sector would be imposed to buy EUAs in a quantity corresponding to the CO_2 emissions from the fuels which they would sell. This would cause a decrease in the emissions in the EU ETS as a whole; however, this would not ensure that these reductions would be achieved in the transport sector, among others, given the fact that the emission reductions within the EU ETS would occur where they would be cheapest and due to the already mentioned differentiated marginal costs of emissions reductions among the sectors.

> The inclusion of the transport sector into the EU ETS alone will not raise CO_2 emission allowance prices in the EU ETS to the level which will ensure emission reductions

It should be emphasised that the inclusion of the transport sector into the EU ETS alone will not raise CO_2 emission allowance prices in the EU ETS to the level which will ensure emission reductions. This results from the high marginal reduction costs in the transport sector compared with the other sectors covered by the EU ETS. Moreover, this will be caused by the fact that the share of the emissions from the transport sector in total emissions in the EU ETS would be too low, while the electricity sector has the potential for further emission reductions with relatively low marginal reduction costs. In light of the above, it seems that the most effective form of emission reductions in the transport sector would be a change in users' behaviour, e.g. their shifting to purchases of low-carbon (EV or PHEV) vehicles combined with the levying of charges on the users of vehicles with internal-combustion engines. E.g. the authors of studies by Cambridge Econometrics[77]. Transport & Environment[78] and ZEW[79] suggested that the EU ETS might lead to the same emission reductions as the emission standards already in place in the European Union, but with much higher costs for consumers and industry. Moreover, all of these analyses emphasised that the current prices of EUAs were too low to enable the emission reduction target in the road transport sector to be achieved.

Significant emission reductions can be achieved by 2050 in the individual passenger transport on the condition that many measures are taken at a wide scale. Their set should include measures to increase the share of low-carbon vehicles (with electric or plug-in hybrid engines) by introducing a scheme of subsidies and incentives from producers encouraging purchases of the vehicles (as the higher sale volume will also make it possible to lower prices due to the economies of scale). It also important to ensure a competitive advantage of low-carbon vehicles over gasoline or diesel oil-powered ones. This would require the development of infrastructure for charging

[77] "The Impact of Including the Road Transport Sector in the EU ETS", Cambridge Econometrics, 2014.
[78] "Road transport in the EU ETS – why it is a bad idea", Transport & Environment, 2013.
[79] "Including road transport in the EU-ETS – An alternative for the future?", ZEW Mannheim, 29 April 2015.

these vehicles and also ensuring that the electricity prices at charging stations are close to the energy price at households.

Moreover, actions to reduce emissions require the imposition on conventional fuels of charges reflecting the CO_2 emissions from their combustion. This would enable a partial change in the behavior of consumers who would decide to buy vehicles with lower engine capacity (horsepower) and, hence, lower fuel consumption. Consideration should be given to the introduction of charges related to the possession of older cars (with more intensive emissions) as this would encourage the replacement of a vehicle by a new one (with a possible subsidy depending on the capacity of the internal-combustion engine in possession).

The series of actions described above can reduce emissions in 2050 to less than 30 Mt CO_2. However, goods transport will continue to have a significant share in emissions. The carriage of goods using lorries with load capacity of more than 3.5 t will still continue to be responsible for emissions of a dozen or so Mt CO_2. Some activity - about 10% - can be moved from goods road transport to low-carbon rail transport; however, its other part still remains at present a huge problem for the efforts to achieve the reduction targets for 2050 in the non-ETS area.

The development of the CCS/CCU technologies in Europe and the world: the status in 2019

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The development of the CCS/CCU technologies in Europe and the world: the status in 2019

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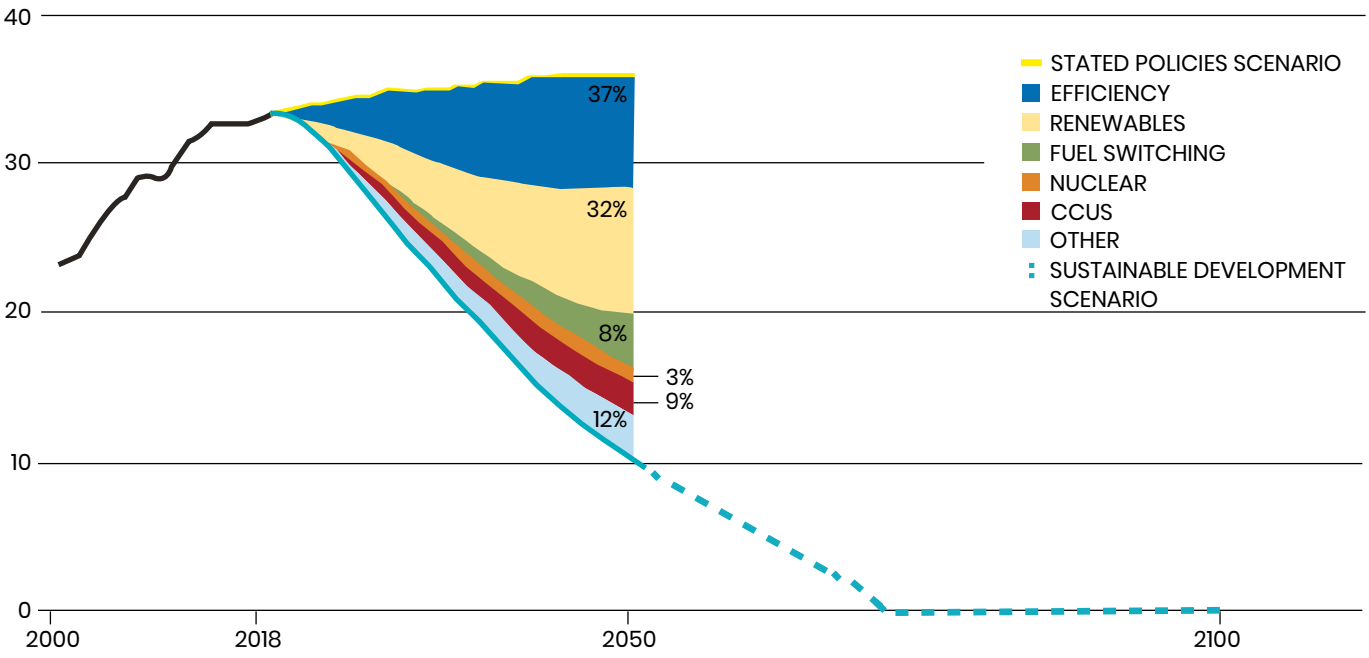
General information about the CCS technology

The carbon capture and storage (CCS) technology is one of low-carbon technologies which enable substantial reductions of CO_2 emissions from coal- and gas-fired power plants and those from energy - and carbon - intensive sectors of the economy, such as the cement, iron and steel or chemical sectors. In consists in the capture of CO_2 from fuel combustion and industrial processes, its transport by a pipeline or a ship and its storage deep underground in geological formations. The CCS technology prevents the CO_2 from entering the atmosphere. The carbon capture and utilisation (CCU) technology uses the CO_2 to produce new products, such as low-carbon fuels, chemicals and building materials. At present, 90% of the CO_2 captured in the world is injected into existing oil deposits to enhance oil recovery. The use of CO_2 as a raw material contributes to the development of the circular economy, the mitigation of climate change and the enhancement of the competitiveness of industry. The potential of the carbon capture, utilisation and storage (CCUS) technology to reduce emissions is very promising.

FIG. 1. EMISSION REDUCTION POTENTIALS OF THE PARTICULAR LOW-CARBON TECHNOLOGY BY 2050, ACCORDING TO THE SDS SCENARIO [IN Gt CO_2 AND IN %].



Source: World Energy Outlook, IEA, 2019

This was demonstrated, among others, by projections of the International Energy Agency (IEA); in the 2019 World Energy Outlook, in the Sustainable Development Scenario (SDS) it was estimated that the contribution of this technology to CO_2 emission reductions by 2050 in the world would be about 9%. According to the SDS, the IEA predicts that 350 Mt CO_2 from the global energy sector will be captured and stored by 2030. In turn, McKinsey & Company assessed the potential of the particular CCU technologies to utilise the captured CO_2. The most common CCU technology is the injection of CO_2 into existing oil deposits to ensure enhanced oil recovery (EOR). Its cost-effectiveness is higher if industrial CO_2 sources, such as power plants and refineries, are situated near the oil deposits. The McKinsey model[80] estimates the CO_2 utilisation potential by 2030 at about 80 Mt annually. Another CCU technology with a large potential is the use of CO_2 to produce concrete. This technology will enable CO_2 storage in buildings or sidewalks. It is estimated that by 2030 this technology will make it possible to use about 150 Mt CO_2 annually.

The IEA experts believe that CCUS technologies are indispensable to meet the very ambitious climate goals set, among others, by the Paris Agreement and necessary for the further operation of power plants using fossil fuels. Without CCUS technologies the costs of achieving the climate goals will be very high. However, in order to use the potential offered by CCUS, commercial-scale projects need to become economically viable. The carbon capture costs depend on many factors. About half the CO_2 emissions are generated by industrial plants, refineries and power plants. Certain emissions, e.g. those from ethanol producing facilities, are cleaner than others and can be relatively cheaply captured at about USD 25-30 per tonne. CO_2 can also be captured just as cheaply in the production and processing of natural gas. The cost is about USD 20-25 per tonne of emissions. In the case of less clean sources (such as emissions from plants producing cement and steel or coal- and gas--fired power plants), the costs increasingly grow, from USD 60 to more than USD 150 per tonne. The carbon capture cost is the highest for the direct carbon capture from the air where carbon oxide occurs in low concentrations. This cost exceeds USD 500 for a tonne of captured CO_2. The capture costs will fall from year to year. For example in the Petra Nova project (USA) using an amine--based process to capture CO_2, when it was set in operation in 2017 the cost was USD 100 per tonne and 3 years later the cost fell to about USD 65. The most recent studies also show that in the projects expected to start their operation in the period from 2024 to 2028 the cost will about USD 43 per tonne. It seems that the significant development of CCS and CCU technologies would require a decrease in the carbon capture costs and, at the same time, the creation of incentives for accounting for the costs of these projects and developing innovations and technologies which would make a CO_2 a valuable feedstock to existing or new projects.

> CCUS technologies are indispensable to meet the very ambitious climate goals set, among others, by the Paris Agreement

[80] https://www.mckinsey.com/business-functions/sustainability/our-insights/driving-co2-emissions-to-zero-and-beyond-with-carbon-capture-use-and-storage?cid=other-eml-alt-mip-mck&hlkid=5c981b042d1f49bc93b661770943c479&hctky=1188685&hdpid=07994205-41e5-4d7d--be2f-2acf2d17eac7

The development of CCS technologies in Europe

The European Union (EU), which is responsible for about 10% of global emissions, is the leader in the transition to an economy with net zero GHG emissions. Already in 2009, the EU set for itself the target of reducing its CO_2 emissions by 80–95% until 2050. In the EU, the CCS technology has not developed on a commercial scale because of the low CO_2 emission allowance prices and the lack of sites for storing the captured CO_2 due to residents' protests. It should be expected, however, that in the future CCS technologies will capture CO_2 or remove it from the atmosphere at more competitive costs. It is predicted that from year to year this technology will become cheaper and in the period from 2030 to 2040 it can be competitive with respect to other low-carbon technologies. Recognising a important role of the CCS technology in emission reductions by 2030 and 2050, within the EU Emissions Trading System EU ETS (in the trading period 2008-2012), the European Commission earmarked 300 million allowances for supporting the technology of CCS projects and innovative renewable energy projects. Although the programme was primarily expected to support CCS projects and a dozen or so demonstration projects qualified for the programme (including Bełchatów Power Plant), ultimately all the entities withdrew their grant applications. This was the result of the failure of most government to confirm their willingness to co-finance the qualified CCS projects, in particular, their operating costs, and the low prices of emission allowances. Some experts demonstrated that in order for the CCS technology to develop, the emission allowance price should reach EUR 60[81], whereas in that period it was barely several EUR. Under the allocation of the 2nd tranche of the NER300, 18 RES projects and 1 CCS project were co-financed with an amount of about EUR 1 billion. Co-financing in an amount of EUR 300 million was granted to a British project to build a carbon capture and storage facility on a large commercial scale at a coal-fired power plant at Drax near Selby in Yorkshire. The facility will capture 90% of CO_2 generated in the fuel combustion process. In terms of the number of large-scale CCS projects in operation, Norway is the leader in Europe, as it has set 2 projects in operation. One of them is the Sleipner

[81] Jak skutecznie wdrożyć CCS w Polsce? Polska Strategia CCS (How can CCS be effectively implemented in Poland? The Polish CCS Strategy - in Polish), Agata Hinc (Ed.), demosEUROPA, Warsaw, 2011 (p. 53).

project, which has operated since 1996, while the other is the Snøhvit project, which started to operate in 2008. Both projects involve large-scale geological storage sites into which to date about 22 Mt CO_2 has been injected under the floor of the North Sea. In Europe as a whole, work is underway on 10 CSS projects on a large industrial scale. Great Britain, where work is under on 6 projects, is becoming the leader in the development of the CCS technology in Europe. Two projects are launched in the Netherlands and so is one project apiece in Norway and Ireland. After they are set in operation all the countries mentioned above will capture altogether about 21 Mt CO_2 annually.

In 2018, in the Communication from the EC A Clean Planet for all – A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy it was stated that in order to limit temperature rise to 1.5°C by the middle of the century, the EU has to achieve net--zero emissions by 2050. One of the scenarios indicated that the implementation of CCUS was necessary, particularly, in energy-intensive sectors and – in the transitional phase – for the production of carbon-free hydrogen. CCS will also be required if CO_2 emissions from biomass-based energy and industrial plants are to be captured and stored to create negative emissions. In 2019, the EC presented its strategy called The European Green Deal, which confirmed the achievement of climate neutrality by 2050, while CCS and CCU technologies will be of essential importance for the European transition to carbon neutrality, ensuring that energy generation and industrial processes are safe, reliable and sustainable. CCUS technologies will play an important role in limiting emissions in energy-intensive sectors of industry across Europe and speeding up the production of low-carbon hydrogen in order to decarbonise key sectors, such as heating and transport.

On 27 February 2018, the EU Council accepted the reform of the EU Emissions Trading System (EU ETS) for the period after 2020.[82]

It approved a proposal for a Directive amending the EU ETS Directive, i.e. (EU) 2018/410, which will be in effect in the period from 2021 to 2030. One of the elements of the amended Direction is the operation of the Innovation Fund (IF). The purpose of the Fund is to finance innovative low-carbon technologies in energy-intensive industry, innovative solutions for RES and CCU/CCS technologies. These objectives will be financed with resources from the largest emissions trading system in the world (EU ETS). The Innovation Fund can acquire about EUR 10 billion (depending on allowance prices) from the auction of 450 billion allowances from 2020 to 2030 and also any unused resources of the NER300 programme. The Innovation Fund is the largest fund available for financing CCUS in Europe.

In the nearest future, the following project are expected to be setin operation: Porthos in the Netherlands (2021), Zero Carbon Humber and Net Zero Teesside in Great Britain (about 2025) and Ervia Cork in Ireland (2028). These European projects will be able to jointly capture and store

[82] https://www.consilium.europa.eu/en/press/press-releases/2018/02/27/eu-emissions-trading-system-reform-council-approves-new-rules--for-the-period-2021-to-2030/

about 10 Mt CO_2 annually. Over the last decade the manner of planning CCS projects in Europe substantially changed. Formerly, the focus was on planning capture, own transport and own storage site for one emission source. At present, most projects are planned as hubs and clusters. The carbon capture from clusters of industrial installations instead of single sources and the use of common infrastructure for another carbon transport and storage network will cut unit costs in the entire chain of CCS projects. The infrastructure and transport network will be available for other emission sources which will plan carbon capture. Several promising European CCS projects are being prepared; they will use a common carbon infrastructure which will be available to many emitters across Europe. The industrial regions planning to develop a CCS cluster include the Port of Rotterdam in the Netherlands, the Port of Antwerp in Belgium, Teesside and Humber in Great Britain or the Ruhr Basin in Germany. The ALIGN-CCUS project has been launched in Europe. The aim of the project is to transform 6 European regions into low-carbon and economically stable centres. 34 research institutes and industrial enterprises will take part in the project. They will mobilise European and national funds for 6 specific, but interlinked areas of research on carbon capture, utilisation and storage (CCUS). The results of this research will be used to prepare plans for the use of CCUS in the industrial regions of Teesside and Grangemouth in Great Britain, Rotterdam in the Netherlands, North Rhine-Westphalia in Germany, Grenland in Norway and Oltenia in Romania. The project will primarily focus on optimising and reducing the costs of carbon capture, planning large-scale carbon transport, ensuring sufficient and safe carbon storage under the seafloor, developing and using CO2 in energy storage and conversion, as well as on understanding and supporting the public acceptance of CCUS projects.

It is interesting to note the recently authorised giant carbon capture project with a value of EUR 2.1 billion which the Norwegian government will spend to build CCS facilities in two locations: one at the cement plant in Brevik and another at the Fortum Oslo Varme waste-to-energy power plant. The captured emissions will then be transported in liquefied form to the seashore and in pipelines into the sea where they will be stored under the seafloor. The other part of process will be implemented under the Northern Lights project, a joint venture of the fossil fuel companies Equinor, Shell and Total. The total cost of the project is EUR 2.57 billion. It will enable the construction of the CCS facility and ensure 10 years of its operation.

The development of CCS and CCU technologies in the world

The dynamic development of large-scale projects at different stages of development was followed by their systematic decline from 75 projects in 2012 to 39 projects in 2017. In turn, from 2017 the number of projects began to grow again. In 2019, their number increased to 51 projects. As shown in Table 1, the North America is the leading region in the planning, development and implementation of large-scale CCS and CCU projects. At present, in this region there are 22 CCS and CCU projects at different levels of advancement (18 in the USA and 4 in Canada). Many projects are in operation or planned in Europe, i.e. 12 projects, and in China, i.e. 9 projects.

TABLE 1. THE NUMBER OF CCS AND CCU FACILITIES IN THE WORLD AT DIFFERENT LEVELS OF ADVANCEMENT IN 2019.

World region	Number of CCS and CCU facilities				
	Facility development stage				Total
	In operation	Under construction	Advanced development	Early development	
USA	10		5	3	**18**
Canada	2	2			**4**
China	1	2	1	5	**9**
Europe	2 – Norway		2 – Netherlands, Norway	8 – Great Britain (6), Netherlands, Ireland	**12**
Australia	1		1	1	**3**
Other Asia				1 – South Korea	**1**
Middle East	2 – Saudi Arabia, Arab Emirates		1 – Arab Emirates		**3**
Brazil	1				**1**
Total	**19**	**4**	**10**	**18**	**51**

Source: Own elaboration of KOBiZE based on the Report GLOBAL STATUS OF CCS 2019[83], Global CCS Institute, Australia, 2019

At present, in the world there are 19 large-scale CCS and CCU facilities in operation which capture about 39 Mt CO_2 annually; i.e. more than in 2017 when these projects captured about 31 Mt CO_2. These facilities operate in the sectors of energy generation, natural gas processing and the production of iron and steel, hydrogen, plastics and chemical products. The largest number of facilities in operation, i.e. 10, can be found in the USA. In the other regions of the world, there are at most 2 large-scale facilities. At present, the costs of capture and storage of 1 tonne of CO_2 is much higher than emission allowance prices. In order to ensure that the global reduction targets can be achieved, also by using CCUS technology, this technology must be developed significantly in the nearest years by enhancing investments in the construction of facilities, increasing the number of facilities at an advanced stage of development and involving governments in co-financing of projects.

[83] https://www.globalccsinstitute.com/wp-content/uploads/2019/12/GCC_GLOBAL_STATUS_REPORT_2019.pdf

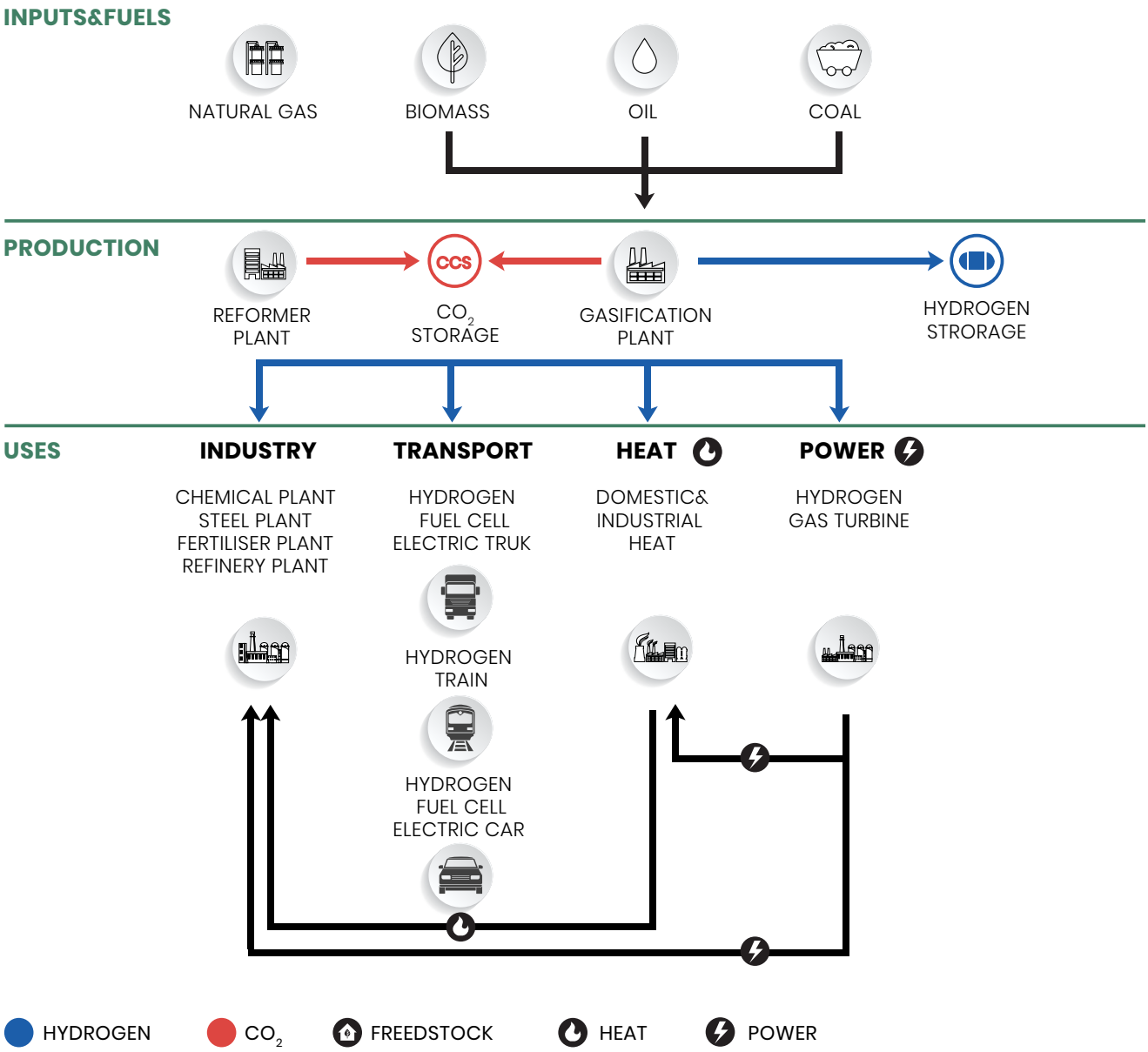
Over the last 2 years the development of CCU projects in the world picked up pace. In 2019, in the Canadian province of Alberta, known for oil production from oil sands and for natural gas production, the 240 km long Alberta Carbon Trunk Line pipeline for CO_2 transport was set in operation. The pipeline captures CO_2 emitted from an oil processing plant and a fertiliser producing plant and delivers it to an oil field where it is injected into the deposit in order to enhance oil recovery or is permanently stored. It is expected that 1.6 Mt CO_2 from these two sources will be captured annually, but the target is for the pipeline to be able to additionally transport about 13 Mt. In 2019, too, the largest geological carbon storage site in the world was set in operation on Barrow Island off the coast of Western Australia as part of the Gorgon Project. CO_2 captured from a natural gas processing plant in a quantity of about 4 Mt CO_2 annually will be delivered to the storage site. Santos, the Australian gas producer, has signed an initial, non-binding contract with BP on the funding of carbon capture and storage (CCS) providing for the capture of 1.7 Mt annually in Southern Australia. After the contract is finalised, BP can invest about USD 13.2 million in the Moomba CSS project. Santos is now implementing a front end engineering design (FEED) for the proposed CCS project. The project might be expanded at a later stage to reach an annual capacity of 20 Mt.

Hydrogen production using CCS

2019 saw a return of confidence in hydrogen as a multi-purpose, clean fuel necessary for the achievement of global reduction targets and carbon neutrality. Three main technologies are used in low-carbon hydrogen production, as shown in Fig. 2: reforming of natural gas (mostly from methane steam reforming - SMR) using CCS, coal gasification using CCS and electrolysis using energy from renewable sources.

> At present in the world CCS and CCU facilities capture about 39 Mt CO_2 annually

FIG. 2. METHODS FOR HYDROGEN PRODUCTION AND USE.



Source: The report GLOBAL STATUS OF CCS 2019, Global CCS Institute, Australia, 2019

Two of the technologies specified above use CCS facilities. Low-carbon hydrogen generated as a result of gas reforming and coal gasification using CCS has now been produced for 2 decades. These are proven technologies, operated on an industrial scale and available for implementation. The cost of low-carbon hydrogen produced on a large scale using CCS is now the lowest. It is just USD 1.70-2.40 per kilogramme. The cost of hydrogen production using electrolysis and powered by renewable energy sources is about 4 times higher, i.e. about USD 7.45 per kilogramme.

It should be emphasised that both the European Commission and other countries, such as Australia, New Zealand, Japan, China and the United States have established that both the development of CCS technologies and the hydrogen production using CCS are very important for achieving the climate goals.

Conclusion

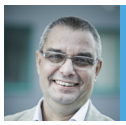
> CCS and CCU are forward-looking technologies and, as experts stress, these are technologies which are indispensable for achieving climate neutrality by 2050.

CCS and CCU are forward-looking technologies and, as experts stress, these are technologies which are indispensable for achieving climate neutrality by 2050. After many years when the number of large-scale CCS and CCU projects had fallen since 2017 they have been seen to significantly grow. As indicated by the recent data, as of 2019 there were 51 projects at different stages of development. It is important to emphasise that, following North America, Europe is the region of the world holding a second place in terms of the number of large-scale projects on which work is underway. The growing number of projects offers very optimistic prospects, giving hopes for a greater use of this technology in the future. On the other hand, however, in order for the number of projects to significantly increase, this technology needs to be economically viable. Therefore, the capture costs must be reduced and governments need to become involved in co-financing of projects (Great Britain and Norway can be examples of this). In this case, emission allowance prices will also be of large importance as the cost of the capture, transport and storage of 1 tonne of CO_2 should be lower than them. It is foreseen that CCS and CCU technologies will not become competitive with respect to other low-carbon technologies until the period from 2030 to 2040.

Is “clean hydrogen” the future energy source for Europe?

Author: Jerzy Janota-Bzowski, Climate Policy Instruments Unit, KOBiZE

Is “clean hydrogen” the future energy source for Europe?



Author: **Jerzy Janota-Bzowski**

Introduction

Hydrogen as a potential energy raw material, to be used in both the combustion process and the direct utilisation of its electrochemical energy in fuel cell prototypes, was known already in the 19th century. Therefore, when the boom started in the use of RES to replace traditional fossil energy carriers with their renewable substitutes, it seemed to be an enormously attractive option as a clean energy carrier or accumulator. Its additional advantage was the common availability, as its sources can include water, methane, oil and coal. There are attempts at producing hydrogen from biomass or waste. In each case, hydrogen production needs a substantial energy input; therefore, in terms of climate protection, it does matter whether it will be generated in a clean manner or one involving greenhouse gas emissions. In light of this, the optimum solution is the hydrogen production in the water hydrolysis process using RES, this generates the most desirable, so-called “green” hydrogen, as in the entire cycle of its production no CO_2 or any other substances are generated. A slightly less advantageous technology is the production of “blue” hydrogen from fossil hydrocarbons, most often natural gas in the reforming process using water steam, with the CO_2 arising in the process captured at a carbon capture and storage (CCS) facility. Such a solution significantly reduces CO_2, but does not eliminate it entirely. Another category is “turquoise” hydrogen generated in the methane pyrolysis process using heat from RES. The least advantageous method in environmental terms is the technology now applied to produce the so-called “grey” hydrogen, also by reforming a variety of hydrocarbon substances, with the energy input to this process supplied from the combustion of fossil fuels without any technology to reduce the CO_2 arising in this process. “Grey’ hydrogen is now produced as a feedstock for different industrial technologies, such as oil refining, ammonia or methanol production. When they are modernised by adding a CCS module, it will be possible to use these installations as the potential of “green” hydrogen – the share of which in the volume of hydrogen now produced is barely 4% – is expanded to produce low-carbon ”blue” hydrogen, thus justifying the development of transport, storage and distribution infrastructure for this gas[84]. The production of “green” hydrogen inseparably involves the issue of RES surplus generated as an effect of the operation of unstable energy sources, such as the wind or the sun. Excess energy generated can be utilised in the electrolytic production of hydrogen, which, in turn, can be used to meet the needs in periods of higher demand or natural stoppages of RES installations.

[84] https://repo.pw.edu.pl/docstore/download/WUT965fb612a1204e0da515e426312d3b63/-en+last+strona.pdf#page=147

The energy stored in hydrogen can be used by the direct combustion of this highly calorific fuel (the caloric value of hydrogen is 120 MJ/kg compared with 44.4 MJ/kg of gasoline or 55.5 MJ/kg of methane)[85] in an internal- combustion engine or a gas turbine. The fuel cell technology is already well developed, too. In this technology, hydrogen is the feedstock for the direct production of electricity which can be used further to power vehicles or other machinery or equipment.

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This means that having a sufficient quantity of clean energy, using hydrogen it can be converted into another energy carrier, for the purposes of both industry, transport, energy generation and many other uses, without emitting greenhouse gases or air pollutants, while the source of hydrogen in the form of water is practically unlimited on Earth.

The declaration of a group of European countries

In order to strengthen the message on the willingness of European countries to develop hydrogen technologies, on 19 May 2020, the Ministers of Energy of 7 countries: the Netherlands, Austria, Belgium, Germany, France, Luxembourg and Switzerland signed the Joint Political Declaration of the Pentalateral Energy Forum on the Role of Hydrogen to Decarbonise the Energy System in Europe[86]. This very brief document consists of three parts: the confirmation of the assumptions of the hydrogen programme, the specification of its objectives and the proposals addressed to the EC as the natural coordinator of such a programme.

The Ministers believe that hydrogen can play a significant role, particularly, when its production is based on RES, in achieving the reduction targets for 2030 and the planned attainment of climate neutrality in 2050. To this end, the scaling up of the hydrogen production in Europe needs to be coordinated, with particular focus on "green" hydrogen and increased cooperation to create a wide market for such an energy carrier ensuring compliance with common standards. Taking into account the high production costs of "green" hydrogen, they suggest that it should be gradually introduced in sectors where this will be the most competitive with respect to other energy carriers.

The objectives laid down in the document include, among others, designing a long-term vision for achieving the 100% RES-based hydrogen production, assessing the possibility of establishing common definitions and certification parameters or the principles of its labelling to enable a safe trade among countries. Other objectives include addressing safety aspects, ensuring public awareness to increase consumers' acceptance of hydrogen as an energy carrier and encouraging countries other than those of the authors of the Declaration to adopt a similar approach to this issue.

[85] https://pl.wikipedia.org/wiki/Wod%C3%B3r_jako_paliwo_konwencjonalne
[86] https://www.bmwi.de/Redaktion/DE/Downloads/P-R/penta-declaration-signed.pdf?__blob=publicationFile&v=4

The Ministers – Signatories to the Declaration call on the EC to secure the leading position of Europe in the processes related to innovation, industrial competitiveness and decarbonisation, laying down, however, very specific actions, such as developing a roadmap for the development of hydrogen production to achieve CO_2 reduction targets for 2030 The Ministers – Signatories to the Declaration call on the EC to secure the leading position of Europe in the processes related to innovation, industrial competitiveness and decarbonisation, laying down, however, very specific actions, such as developing a roadmap for the development of hydrogen production to achieve CO_2 reduction targets for 2030 and beyond or presenting a specific timely action plan with necessary proposals of legislative solutions to open the market for hydrocarbon, while taking into account the carbon footprint of its transport, as a fuel with low energy density, or, finally, assessing the possibility of using part of existing gas infrastructure for the transport of clean hydrogen, taking into account the costs of the indispensable modernisation of the networks. In the comments addressed to the EC, focus is also put on the stimulation of hydrogen investments in the EU using the existing EU funding sources, i.e. the Sustainable Europe Investment Plan, the Connecting Europe Facility, the Structural Funds or the European Investment Bank. Other measures will also be important, including the mobilisation of national funds, as well as the enhancement and special support for innovation and the research and development sector related to the production and use of hydrogen in the EU economies.

The Portuguese Hydrogen Strategy

On 21 May 2020, the Portuguese Government adopted the National Hydrogen Strategy (EN-H2)[87], which was available until 6 June for public consultations to enable the opinions of the public to be heard and to let the major stakeholders of this plan to engage in a close dialogue. In this document, the Government described its basic objectives, i.e. decarbonisation of the economy and the transformation of energy carriers by gradually introducing hydrogen into the energy sector and other sectors of the economy. This will be possible after an increase is achieved in hydrogen production and use and when the possibilities for its transport and storage are enhanced. State investment funds in an amount of PLN 7 billion are to be allocated for the 1st 10-year period (until 2030)[88].

A part of the strategy is the Sines project with the investment cost of EUR 2.85 billion, consisting in the construction of a large-scale PV (photovoltaic) facility which would produce hydrogen in an industrial-scale electrolysis process. This facility is expected to reach 1 GW capacity by 2030. In this context, the Portuguese Government announced a call for tender addressed to the interested companies and institutions which would like to participate in actions to enhance hydrogen use in the formula of important projects of common European interest (IPCEI).

[87] https://www.lexology.com/library/detail.aspx?g=7d176f4b-f457-4d0e-89bc-2a01c4a907eb
[88] https://fuelcellsworks.com/news/portuguese-government-approves-hydrogen-strategy-e7b-investments/

The German National Hydrogen Strategy

As part of its fight against the COVID pandemic, the German Government launched a series of ini--tiatives to strengthen the national economy. An example of the long-term vision in this field is that these action include the creation of a domestic system for the production and wide use of hydrogen as a universal and clean energy carrier enabling the achievement of the goal of decarbo-nisation of the economy in the timeframe until 2050.

As a specific step in this direction, 10 June 2020 the Government of the Federal Republic of Ger-many adopted the National Hydrogen Strategy[89], presenting in a comprehensive and forward-lo-oking manner the development of this innova-tive field of economy. The German Government stated that hydrogen produced using RES was an excellent solution for the sectors of the economy characterised by higher emissions, such as the heavy industry, cement or transport sectors, and aviation. The German Government recognised that Germany should become a global leader in hydrogen technologies. Moreover, it should be noted that the strategy for the dynamic develop-ment of the sector of renewable sources of ener-gy as implemented in Germany makes it possible to generate a zero-carbon product, which can serve as an energy source and also as a medium storing energy and, thus, enable the transfer of renewable energy to the sectors of the economy where it is impossible to directly use it. "Green" hydrogen, used in many chemical ad industrial processes, will enable them to cut their emission factors by eliminating the hydrogen which is now produced from hydrocarbon fossil fuels involving large emissions of both CO_2 and other substan-ces constituting atmospheric pollutants. In pa-rallel to the development of the technology for the production of "green" hydrogen, the Strategy envisages the development of almost carbon--neutral technologies for the production of "blue" hydrogen (generated from fossil fuels by using the CCS technology) and a neutral technology for the production of "turquoise" hydrogen. The preparation of the Hydrogen Strategy is closely related to the general policy of the German Go-vernment designed to reactivate the economy after the COVID pandemic passes, by allocating substantial resources for research and develop-ment work and adaptation of infrastructure, by both the Government and specifically identified sectors of the economy. For many years now the German Government has been aware of the importance of the hydrogen-related issues for achieving the climate neutrality of its economy. In the period from 2006 to 2016, EUR 700 million was allocated to the innovation programme in the field of hydrogen and fuel which was awarded another EUR1. 4 billion in the period from 2017 to 2026. Apart from this, over the nearest 3 years EU

The preparation of the Hydrogen Strategy is closely related to the general policy of the German Government designed to reactivate the economy after the COVID pandemic passes, by allocating substantial resources for research and development work and adaptation of infrastructure, by both the Government and specifically identified sectors of the economy.

[89] https://www.bmbf.de/files/bmwi_Nationale%20Wasserstoffstrategie_Eng_s01.pdf

510 million will be allocated to research, development and implementation work in the field of hydrogen technologies and EUR 600 million will be earmarked for the development of a legal environment for the efficient implementation of the energy transition, while in the period from 2020 to 2030 EUR 1 billion will be allocated to large industrial plants implementing the use of hydrogen in production processes with a view to decarbonising the economy. In order to enable the implementation of the Hydrogen Strategy, in early June 2020 a decision was taken to provide an amount of EUR 7 billion for the placing hydrogen technologies on the German market and another EUR 2 billion for the development of an international partnership in this field. It can be expected that the clearly outlined, long-term strategy will also cause a substantial mobilisation of private resources in order to correctly prepare for the upcoming "hydrogen era". An important signal for investors, indicating the consistency of actions by the German Government is the fact that the Strategy in question is the first specific continuation in the EU of the European Hydrogen Initiative adopted by all the Member States in September 2018. Germany also declared that the Hydrogen Strategy would be one of the priorities of the Presidency of this country which began in July 2020.

The document also laid down the goals and ambitions of the German Hydrogen Strategy:

Assuming global responsibility for decarbonisation, also by putting hydrogen technologies into use.

Making hydrogen use a competitive option in economic terms through technological progress in this field and the introduction of the economies of scale to lower the costs of already existing technologies. It is envisaged that they will be gradually implemented, starting with the areas which are already close to commercial viability or those that cannot be decarbonised in other ways.

Developing a domestic market for hydrogen technology in Germany and paving in parallel the way for imports of this raw material. The creation of a domestic market is a basic task, also because of the example it sets for other countries. The Federal Government predicts that the demand for hydrogen-generated energy will be 90 – 110 TWh in 2030. In order to meet the domestic part of this demand, 5 GW of renewables-based generation capacity is to be established by 2030 to ensure the production of the order of 20 TWh, enabling the "green" hydrogen generation of 14 TWh. Another 5 GW is to be established by 2035.

Establishing hydrogen as an alternative energy carrier in the sectors where it is difficult to directly use renewables, such as aviation, maritime transport etc.

Using hydrogen as a raw material in industry. The present demand in the chemical industry and steel production for hydrogen produced mostly from fossil fuels is about 55 TWh, but it is estimated that more than 80 TWh in the form of "green" hydrogen would be needed for the German steel production to become climate neutral in 2050 and that refineries and ammonia production would need additional 22 TWh of it.

Enhancing transport and distribution infrastructure for hydrogen, creating opportunities for imports of this raw material by using part of existing gas infrastructures and building dedicated networks.

Fostering research and training highly qualified experts in order to achieve the maturity and market usefulness of hydrogen technologies in the timeframe until 2030.

Shaping and accompanying the transformation process in the form of a dialogue with industry, science and the public.

Strengthening the German economy and securing market opportunities for German firms through the development and exports of hydrogen technologies. The German Government discerns opportunities for the national economy in the building of the position of a global leader in the field of hydrogen technologies and their use and sales as a particularly profitable innovative field.

Establishing and supporting international markets for "green" hydrogen which can be purchased to meet the needs of the German economy.

Regarding international cooperation as opportunities for the development of the both German, European and global economies. The development of hydrogen technologies leads to the building of climate-neutral and clean economies as well as international cooperation on new and better solutions.

Building and successfully implementing quality control systems for infrastructure for hydrogen production, transport, storage and use, and building public trust in this raw material.

In the Strategy, the current hydrogen consumption in Germany is estimated at 55 TWh, while the initial increase in its consumption by 2030, mainly in industrial sectors and transport, is to be additional 10 TWh. In turn, in the context of achieving climate neutrality in 2050, depending on stage of development of technologies and their economic viability, according to different experts, it can vary between 110 and even as much as 380 TWh. The actions described in the document target a number of strategic, future markets, such as the strongly developing domestic hydrogen production, complemented by imports from other countries, supported by Germany both financially and technologically, the creation of opportunities for using hydrogen as a clean energy carrier to the greatest extent possible: in industry and transport, or to heat buildings which have previously been designed to use gas for this purpose. The German Government is aware of the role of a consistent and complete system of research, education and innovation actions, as well as of the importance of involving the other European countries in the implementation of this Strategy.

The creation of a European market for hydrogen and energy generated from it is one of the proclaimed objectives of the future German presidency of the EU. The importance which the German Government attributes to the Hydrogen Strategy is perfectly well reflected in its governance system. The authority responsible for strategic governance, basic decisions and implementation at the national level is the Committee of State Secretaries from the Ministries related to the Strategy. In addition, the Government will appoint the National

Hydrogen Council, consisting of not more than 25 representatives of science, business and the Länder, to support the Committee. Finally, the Coordination Office will be established to support the interested Ministries and the Council, which will practically function as the Secretariat, responsible, among others, for preparing every 3 years a detailed report on progress in the implementation of the Strategy, to be presented to the Committee of State Secretaries. Such a structure ensures both strategic governance and implementation oversight at a high ministerial level and support from a substantive council, also ensuring coordination at the level of the particular Länder and regular services by the Secretariat of the Strategy.

An integral element of the Strategy is the Action Plan consisting of 38 steps and setting out the measures to be taken in the initial period of the implementation of the Hydrogen Strategy until 2023. It lays down specific measures to be taken in this period to achieve predetermined objectives:

In the scope of hydrogen production:

- Review and amendment of the Renewable Energy Sources Act in the context of "green" hydrogen as a new source;
- Exploration of new business and cooperation possibilities for electrolyser owners and network operators;
- Support for the introduction of electrolysers in industry;
- New ways of investing in the production of "green" hydrogen based on energy from offshore wind farms.

In the scope of identifying the optimum fields of application:

- Setting a priority for transport and industrial sectors where hydrogen use is close to market availability or those that cannot decarbonise in other ways;
- Putting hydrogen in use in transport by producing synthetic, renewable kerosene, building refuelling infrastructure for heavy-duty road haulage vehicles, ships and trains, enabling the introduction of at least a 2% share of "green" kerosene in aviation fuel in 2030;
- Using different programmes to assist in the introduction of hydrogen use in industry;
- Support for high-efficiency fuel cells in vehicles and heating systems.

In the scope of optimising the development of infrastructure:

- Planning the location of refuelling stations in a manner taking the users' demand into account.

In the scope of research, education and innovation:

- Germany will develop a roadmap to let it position itself as a lead provider of "green" hydrogen technology;
- Launching the "Hydrogen Technologies 2030" research programme;
- Establishing the conditions for the faster development of innovative solutions in this field.

Actions at the European level:

- The Government sees the need for introducing sustainability standards and proof of origin for renewable sources, "green" hydrogen and its derivatives;
- Speeding up research and development work at the European level by conferring the IPCEI status to hydrogen technologies;
- In the context of the European Green Deal, the German Government will push for the quick establishment of the EU hydrogen initiative.

It should be noted that the tasks in the last group of measures will be introduced by Germany as part of its Presidency of the EU.

In conclusion, it should be said that, in line with the EU arrangements made to date, preparing such a broad and important document, which is, at the same time, a part of this country's plan for recovery with the least losses from the economic crisis caused by the COVID-19 pandemic, the Federal Republic of Germany will be a successful driver of the hydrogen initiative in the EU.

Actions in the European Union

The European Union also addressed the issue of the development of hydrogen technologies as an effective measure to achieve climate neutrality in 2050 in the EU as a whole. Certainly, its actions are less dynamic than German ones because of the much more complicated process where agreement is reached by Member States which at times hold strongly divergent views, also on climate issues. The basic measure in this scope is the Green Deal strategy published in 2019, along with the just transition mechanism, which set out the main directions of the efforts to achieve climate neutrality in 2050. It should be pointed out that when this document was presented in December 2019, in the Roadmap, which is an attachment to the Green Deal, there was no mention of the Hydrogen Strategy yet[90]. Therefore, it cannot be excluded that it was the determined steps taken by the German Government, which, in addition, took over the EU Presidency on 1 July 2020, that also caused an acceleration of the actions in the EU to use "green" hydrogen with a view to reaching the EU climate goals. Indeed, hydrogen appeared as an element of the implementation of climate policy already in March as one of the 8 measures of the New Industrial Strategy for Europe[91], but it was not treated there as a leading strand. Apart from these speculations, as a matter of fact, in May 2020, on its website the EC presented the EU Hydrogen Strategy and submitted it for consultations[92]. In respect of technical and organisational issues, this document included fairly general proposals, rather expected to encourage the participants in the consultations to submit their specific comments and thus to contribute to shaping its final content. The next step was to draft an outline of the EU Hydrogen Strategy, the working version of which appeared in the Internet as a proposal for an EC communication on a hydrogen strategy for a climate neutral Europe and so did on 8 July the final version prepared for submission to the

[90] https://ec.europa.eu/info/sites/info/files/european-green-deal-communication-annex-roadmap_en.pdf
[91] https://ec.europa.eu/commission/presscorner/detail/en/ip_20_416
[92] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12407-A-EU-hydrogen-strategy

European Parliament, the European Council, the Economic and Social Committee and the Committee of the Regions[93].

Introducing the new concept of clean hydrogen, the authors already predetermined that both "green" hydrogen produced without emissions using RES and low-carbon "blue" hydrogen produced using the CCS technology would be treated in the same way; thus, in a veiled manner, accepting a less rigorous pathway to reaching the 2050 targets. This met with criticism on the part of European NGOs and the Greens Parties in certain Member States. This is also confirmed by the breakdown of the resources earmarked in the proposal for the Strategy for the particular categories of tasks: the EU provides for an allocation of EUR 13 – 15 billion to the construction of about 40 GW of electrolysers and EUR 50 – 150 billion to enhance the installed capacity in wind farms and PV to 50 – 75 GW. At the same time, it is envisaged that EUR 1 – 6 billion will be spent to transform the existing installations for hydrogen production from fossil fuels (mostly, by equipping them with CCS) and so will EUR 120 – 130 billion on transport, distribution and storage infrastructure. By 2050, an amount of EUR 50 – 200 billion is to be allocated to "green" hydrogen production alone. However, it is important to note the substantial spread of estimated outlays. Larger resources are foreseen for enabling the capacity to use hydrogen in different sectors, e.g. EUR 300 – 600 billion for modernisation of installations at steelworks, while the construction of a network of 400 hydrogen refuelling stations involves a cost of EUR 450 – 540 million.

[93] https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf

> The implementation and organisation of additional funding for the Hydrogen Strategy will be supported by a number of EU bodies and mechanisms, such as the Clean Hydrogen Alliance, the Strategic Forum for IPCEI, the new economic recovery instrument Generation Next or, finally, the Regional Development Fund and the Cohesion Fund.

The implementation and organisation of additional funding for the Hydrogen Strategy will be supported by a number of EU bodies and mechanisms, such as the Clean Hydrogen Alliance, the Strategic Forum for IPCEI, the new economic recovery instrument Generation Next or, finally, the Regional Development Fund and the Cohesion Fund. The EU ETS, with its Innovation Fund disposing of an amount of about EUR 10 billion for supporting low-carbon technologies, has also a role to play.

Given the high risk of carbon leakage in such sectors as refineries or fertiliser production, free allowances are allocated at 100% of the benchmark value; however, in light of the need to take hydrogen technologies into account, the benchmark will be revised in the nearest review of the EU ETS. In addition, differences in ambitions among different countries regarding the decarbonisation of their economy, the direct effect of which is carbon leakage,

could be neutralised by introducing a carbon tax in 2021. The draft EU Hydrogen Strategy also mentions the idea of carbon contracts for difference (CCfD) which make it possible to equalise costs between conventional and clean technologies by covering the difference between the strike price and the current carbon price in the EU ETS.

The Polish Hydrogen Strategy[94]

The Polish Ministry of Climate and Environment also dynamically joined the implementation of the idea of a modern national hydrogen economy. The first step was the signing of "The letter of intent on the establishment of a partnership for the building of the hydrogen economy and the conclusion of a sectoral hydrogen agreement". The document was signed by the Ministry of Climate and Environment and 17 enterprises and organisations of the energy and transport sectors which had positively responded to the invitation to join the hydrogen coalition in Poland. The entities which joined the Government's initiative include, among others, PGNiG, PKN Orlen, Grupa Azoty, Grupa Lotos, Tauron, JSW, Gaz-System or PKP Energetyka. These companies declare that they will closely cooperate with the Ministry of Climate in jointly developing the concept of the hydrogen economy in Poland. Our country is a significant producer of "grey" hydrogen and the challenge is to increase its clean production using RES for water electrolysis.

In parallel, the Ministry of Climate and Environment works on the Polish Hydrogen Strategy which has the following main goals:

- Creating the value chain for low-carbon hydrogen – it is envisaged that by 2030 2 – 4 GW from RES will be used for hydrogen production, that the domestic production of electrolysers will be developed, that hydrogen will be used to produce synthetic liquid fuels and that hydrogen will be used as an energy carrier in district heating;
- Strengthening the role of hydrogen in the building of Poland's energy security – among others, consideration is given to the construction of a dedicated pipeline enabling the transport of clean hydrogen from Northern Poland which has the largest concentration of renewable energy sources, which would make it less necessary to import foreign energy carriers;
- Implementing hydrogen as transport fuel – there are plans to both launch the construction of a network of hydrogen refuelling stations (15 stations by 2030) and also research and implementation work to design hydrogen-powered rail engines and buses;
- Preparing new legal regulations for the hydrogen market, covering the areas of hydrogen trade, transport, storage and use in different sectors of the economy.

It is expected that this work will be completed and the document will be subjected to public consultations in the autumn of this year and subsequently by the end of this year the Hydrogen Strategy will be tabled for consideration by the Council of Ministers.

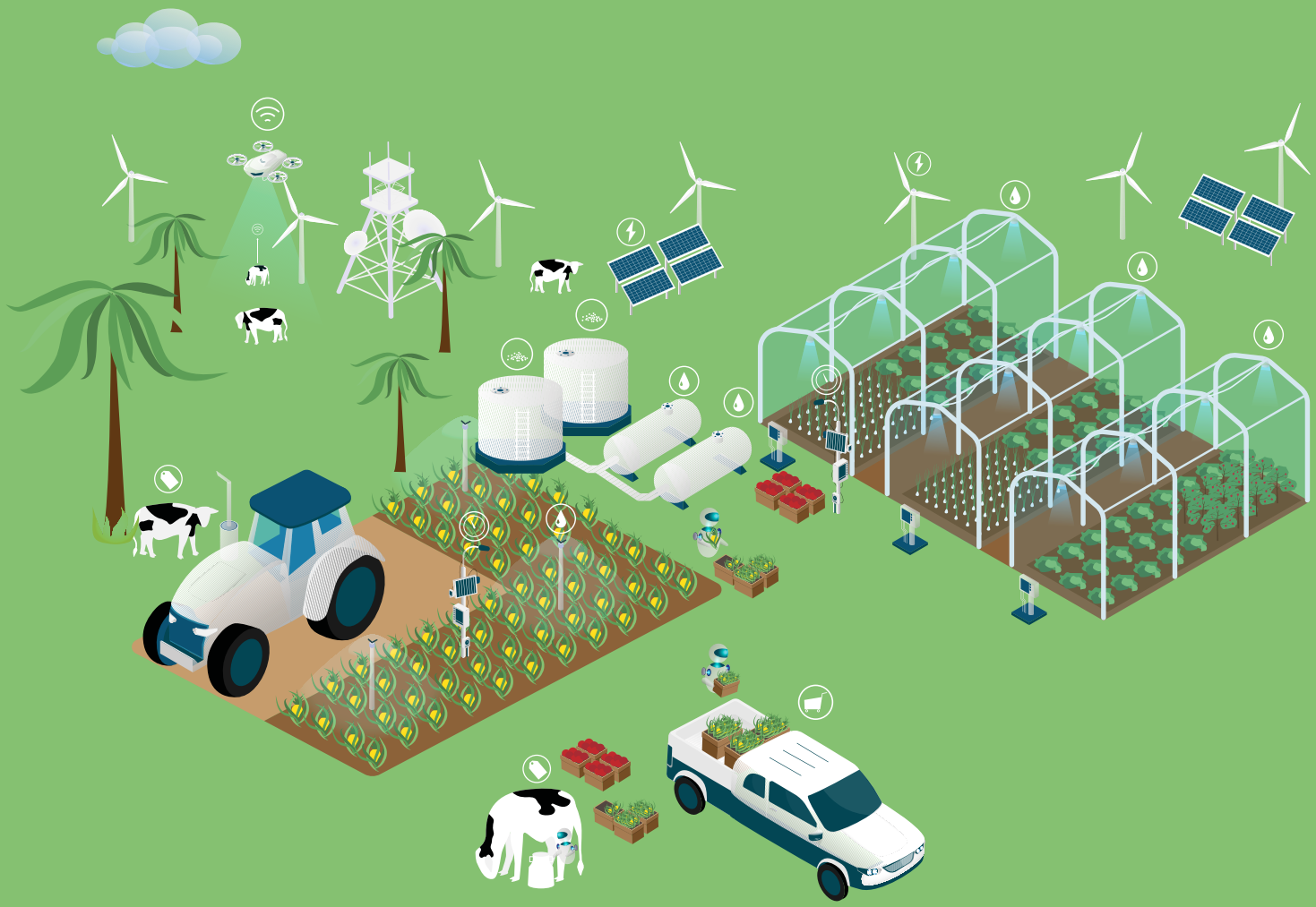
[94] https://cleanerenergy.pl/2020/07/07/17-firm-bedzie-wspolpracowac-nad-wykorzystaniem-wodoru/

Conclusion

In conclusion, it can be said that in 2020 EU Member States saw an extremely dynamic growth of interest in hydrogen technologies which were recognised to be one of the significant factors enabling the achievement of climate neutrality in 2050. This is the result of both the maturity attained by technologies for the production of "green" hydrogen using RES and the use of CCS facilities to reduce the carbon footprint of the traditional technology for steam reforming of fossil fuels, mainly natural gas. Paradoxically, it also results from a collapse of economies caused by the COVID-19 pandemic. This has been particularly clearly emphasised in the German strategy which sees opportunities for faster recovery of the country from the present crisis in the development of innovative hydrogen technologies, in Germany winning the leading position in their use and sales, and, finally, in the huge investment project to transform the economy to one based on hydrogen use. This is demonstrated by both the rank of the document as evidenced by the governance structure for this project and a very precise description of the particular stages of the transition of the German economy to the use of clean hydrogen.

> Our country is a significant producer of "grey" hydrogen and the challenge is to increase its clean production using RES for water electrolysis.

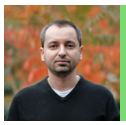
We should appreciate the activity of the Polish Ministry of Climate and Environment in joining this European, increasingly fast current of hydrogen transformation, as it increases the chances for achieving the goals of the Paris Agreement, which Poland has also ratified, and can also enable the economically viable development of its own hydrogen technologies, if domestic industrial giants join this project on an early basis.



Reductions of greenhouse gas emissions from the Polish sector of agriculture: Mission possible?

Author: PhD Vitaliy Krupin, CAKE/KOBiZE

Reductions of greenhouse gas emissions from the Polish sector of agriculture: Mission possible?



Author:
PhD Vitaliy Krupin

The report "Assessing climate policy impacts in Poland's agriculture. Options overview" recently published by the Centre for Climate and Energy Analyses indicates that the reduction of greenhouse gas (GHG) emissions from this sector is a difficult challenge; in particular, if the current approaches persist at the levels of both policies and production technologies applied at farms. The achievement of significant emission reductions would require essential changes in these areas.

The recent years saw an evident increase in GHG emissions from the agriculture sector. According to the data in the national emissions inventory (performed annually by KOBiZE), in 2018 they reached the level of 33.12 $MtCO_2eq$. This was an increase by 7.2% compared with 2015 when their growing trend could be seen again (on average by about 2.5% annually). It was also the highest level of emissions from agriculture after 1999 when their gradual fall was found. The causes of this situation include an increase in the national agricultural output and the still fairly traditional production technologies and farming practices. The key GHG emission sources in Polish agriculture (recalculated to CO_2 equivalent) include agricultural soils (46.6%) and enteric fermentation (39.4%). Agriculture is responsible for about 8% of the total national emissions and is, at the same time, the largest N_2O emitter in Poland (80% of the emissions of this gas) and the second largest source of CH_4 emissions representing 30% of the total national emissions of this gas.

> The reduction of greenhouse gas (GHG) emissions from this sector is a difficult challenge; in particular, if the current approaches persist at the levels of both policies and production technologies applied at farms.

The factor which especially contributed to the growth of emissions in several recent years was an increase in animal production (primarily, cattle breeding), which was caused by a favourable economic situation on key export markets. However, in addition, in Polish agriculture there are "permanent polluters"[95], which year after year make a significant contribution to the relatively high emissions – in both animal and crop production. There is an obvious need to intensify measures to reduce greenhouse gases; however, this is hindered by a conflict of interest. The goal of climate policy is absolute emission reductions; however, from the point of view of the Polish economy, there is an obvious need to balance the possible effects of emission reductions and the objective of ensuring the competitiveness of Polish agri-food production, including farm income.

[95] These are various types of farms which are difficult to classify in one group, but all of them are characterised by relatively high emission levels. They include e.g. large crop farms which apply intensive fertilisation practices or large animal farms (primarily, cattle-breeding ones) also using intensive production technologies. On the other hand, there are small farms which have a stable share in emissions as a result of their inefficient practices, although they apply extensive production technologies.

There are also complications in the area of organisation, since – in contrast to other sectors of the economy – Polish agriculture is highly differentiated and shaped by slightly more than 1.4 million farms, more than half of which (53.3% according to the GUS data) are the smallest farms, cultivating up to 5 ha of farmland. This complicates the effective introduction of regulations designed to reduce GHG emissions although the increasingly wide application seems inevitable.

What is the response of EU policies?

The European Union is now about to adapt a new Common Agricultural Policy (CAP) which, as indicated by the current arrangements, should be even more environment-friendly and designed to tackle climate change. The lessons learned from the current programming period (2014-2020) indicate the relatively low effectiveness to date of the priorities targeting an improvement in the state of the environment, among others, the greening policy (the low effectiveness of which found by the European Court of Auditors in 2017). The CAP supports and will support primarily farmers' income and thus it is important for food security (the global COVID-19 pandemic reminded, in particular, of this aspect) and for maintaining the pace of the development of agriculture and its positive effect on the national balance of trade. In issues relating to the environment, the new CAP is expected to be more understandable to farmers and, as a result, more effective. This is to be ensured by new approaches to payments for farmers, which are expected for be even more dependent on compliance with specific conditions and the launch of environment-friendly measures.

Moreover, the European Commission declares that the instruments of the new CAP will effectively support the efforts to implement the goals of the European Green Deal, i.e. the achievement of climate neutrality by 2050 and the further promotion of sustainable farming practices in the EU as a whole. And evidently this will entail the need for qualitative changes in Polish agriculture, too.

The assumptions of the analysis

The Centre for Climate and Energy Analyses performed this analysis using its EPICA model[96]. It was used to develop the baseline scenario for Polish agriculture and 7 scenarios providing for the implementation of different mechanisms to reduce GHG gas emissions from this sector. The assumptions adopted in the analysis stimulate emission reductions in different ways and with varying intensity, which makes it possible to estimate the possible responses of agriculture to more or less ambitious goals of climate policy.

Consideration was given to three potential directions of impacts on the sector of farms:

> From the point of view of the Polish economy, there is an obvious need to balance the possible effects of emission reductions and the objective of ensuring the competitiveness of Polish agri-food production, including farm incomes.

[96] Evaluation of the Policy Impacts –Climate and Agriculture (EPICA). The model can be used to analyse changes in Poland's agriculture; in particular, in agricultural activities and production intensity levels, which can take place as a result of the implementation of instruments designed to reduce GHG emissions of agricultural origin.

1) Forcing GHG emission reductions (as CO_2eq.) by 5%, 10% and 20% relative to the baseline scenario (the RE5, RE10 and RE20 scenarios). Apart from the instruments used to force emission reductions, the scenarios analysed make it possible to assess the sensitivity of Polish farms to the introduction of restrictions of this type and to understand the potential changes in the structure of their activities, output levels, the declared demand for production inputs and income.

2) Scenarios providing for possible taxes on nitrogen-based synthetic fertilisers at the rates of 10% and 20% of their prices in the baseline scenario, which make it possible to understand the possible consequences of the reduction in the use of nitrogen-based synthetic fertilisers (the N10 and N20 scenarios).

3) The direct imposition of equivalents to the EUA prices in the Emissions Trading System (EU ETS) on GHG emissions, i.e. the testing of the possible effects of the inclusion of agriculture into this system or the introduction of similar fiscal instruments. The ETS15 scenario assumes as the basis the EUA price (of about 30 PLN/tCO_2eq.) which could be seen in early 2015, while the ETS20 scenario uses a relatively high EUA price (of about 100 PLN/tCO_2eq.) from a similar period of 2020. With a similar approach, it is possible to analyse the sensitivity of the particular agricultural activities to the use of economic mechanisms to reduce emissions.

How much can emissions be reduced?

In accordance with the assumptions, the greatest emission reduction can be achieved by directly forcing a 20% reduction (the direct approaches entailing the imposition of taxes on fertilisers or emissions do not bring such a substantial reduction). This assumption seems to be a highly effective one as a measure to reduce the greenhouse effect, but it would be very difficult to achieve such a reduction in practice. At the same time, the results make it possible to understand how the agricultural sector would react to such a large emission reduction. Among the scenarios developed, it is exactly in this case that the largest drop in output can be seen. This confirms the hypothesis that the process of reducing emissions in agriculture by using the currently known and generally available technology is a highly complicated one and inevitably leads to a fall in its output. However, it should be pointed out that the emissions generated by the sector of agriculture decrease faster that the output level does. The scenarios introducing economic measures designed to reduce GHG emissions, such as a tax on nitrogen-based synthetic fertilisers (the N10 and N20 scenarios) and the direct imposition of emission costs (ETS15 and ETS20) are less effective than the scenario forcing the direct emission reduction by 20%. The emission reductions vary between 1 and 2% in the N scenarios and between 4 and 10% in the ETS scenarios. Even when assuming that in the future agriculture is treated in the same way as the other sectors of the EU ETS and the obligation to account for their emission allowances or its fiscal equivalent is imposed on farmers, the GHG emission reduction would be less than the one in the RE20 scenario. This proves that a significant reduction of GHG emissions from agriculture (estimated using the IPCC methodology) is a relatively difficult task.

What can be the effects of emission reduction for Polish agriculture?

Production levels. The results of the analysis indicate that when GHG emissions are reduced the crop area and the number of livestock also decrease since the production level falls. This fall is expressed by the value of agricultural products produced. The current version of the EPICA model does not use the market module (the work on its implementation is underway); therefore, the product prices are constant in all the scenarios.

The largest drop in production can be seen in the case of meat and milk cattle. In the most restrictive scenario (RE20), meat cattle production falls by 33% and milk production by 20%. Poultry production and also, to some extent, pig production are the least sensitive to emission reductions. In both cases, the production levels fall insignificantly even for the largest emission reductions. In the case of crop production in the RE20 scenario, the largest drop, of about 8%, occurs for cereals. It is a result of the lower emission intensities of these types of activities.

The scenarios introducing the economic measures designated to reduce GHG emissions, such as a tax on nitrogen-based synthetic fertilisers (N10 and N20) and the direct imposition of emission costs (ETS15 and ETS20) are less effective than the scenario forcing the absolute emission reduction by 20%. Even when assuming that agriculture is treated in the same way as the other sectors of the EU ETS and the obligation to surrender allowances to cover their emissions or its fiscal equivalent is imposed on farmers, the GHG emission reduction would be less than the in the RE20 scenario.

Production yields. An important effect of emission reductions is a change in agricultural production yields. The shifts primarily reflect changes in the structure of production practices. Yield shifts clearly illustrate how mitigation measures can be applied in the sector of agriculture. In the scenarios forcing emission reductions (RE) and imposing additional emissions-related costs (ETS), both meat and milk cattle production intensifies, while the herd size (the head of cattle) is reduced. However, the fall in production is less significant than emission reductions are. This is most evident in the case of dairy cows.

Yield changes in crop production are not so significant; still, their distribution shows certain regularities. The share of the yields of intensively fertilised crops, such as sugar beet, maize and, to some extent, wheat show a substantial decrease (compared with other crops) in all the scenarios. This is caused by the push for reducing the use of nitrogen-based synthetic fertilisers which are some of the key emission drivers in crop production. It is not so evident as in the case of other crops which need much less fertilisation.

Farmers' income. A decrease in production when, at the same time, constant prices are assumed, leads to lower farm income. Although the largest emission reduction takes place in the RE20 scenario, still the incomes fall to the greatest extent in the ETS20 scenario (with constant prices assumed). In the ETS scenarios, apart from the need to introduce changes designed to reduce emissions (which already cause the loss of part of the income), the other emissions of farms are accounted for in the EU ETS. As a result of this, the average fall in incomes reaches about 20% (in the case of ETS20) relative to the baseline income.

At the same time, a drop in farm incomes of the order of several percent can be considered an inevitable loss in the context of the global challenge to mitigate climate change. It should also be emphasised that it is an average drop in incomes as it can significantly vary among the particular farm types.

The highest income per farm is achieved in largest granivore farms (keeping pigs and poultry). In the baseline scenario, this amount exceeds PLN 1 million annually per farm. At the other end of the scale, there are semi-subsistence farms which are able to generate an annual income of barely PLN 1,700. It follows from this that semi-subsistence farms are not the main source of incomes for their holders and that the reasons why are maintained are not only economic factors.

Between these two extremes, there is a wide range of farms with diversified income levels. As a rule, small farms generate an annual income of several thousand PLN, which can barely be the minimum remuneration of one part-time employee. Depending on their specialisation, medium-sized farms can be treated as family farms generating an income for the family members employed at the farm, with, however, with a very low remuneration. The group of large farms consists of individual farms (the largest ones among family farms) and enterprises. Changes in the income level are an indicator of importance for the analysis of the potential economic effects of the scenarios considered here.

The largest drop in income can be seen in small cattle farms. In the ETS20 scenario, at farms of this type the income falls by up to 30% relative to the baseline level. At the same time, it should be noted that although in this case the drop in income is high in relative terms, still it is slight in absolute terms given the generally low income level at these farms.

The impact of the N scenarios can be seen in the case of crop farms, whereas animal production is practically insensitive to a similar potential climate policy instrument. The largest drop in farm income caused by the introduction of such a tax can be seen at small cereal farms. In this case, too, this can be explained by a low baseline income in this group of farms.

Conclusion

Forcing emission reductions by 20% leads to a 9.5% fall in the production value and a 14% drop in farm income (on average by 195 PLN/ha or PLN 2.78 billion for the country as a whole). However, the drop in income for the particular farm types can vary from 5% at large granivore farms to even as much as 70% at small meat cattle farms.

The effects of emission reductions which are similar to those of forced emission reductions can be achieved by using fiscal instruments. This involves a drop in farm income and is less effective in terms of emission reductions.

The introduction of a tax on mineral fertilisers resulting in a 20% increase in their prices in the N20 scenario raises the total fertilization costs by 3.9%, while, at the same time, diminishing their consumption by 10.3%.

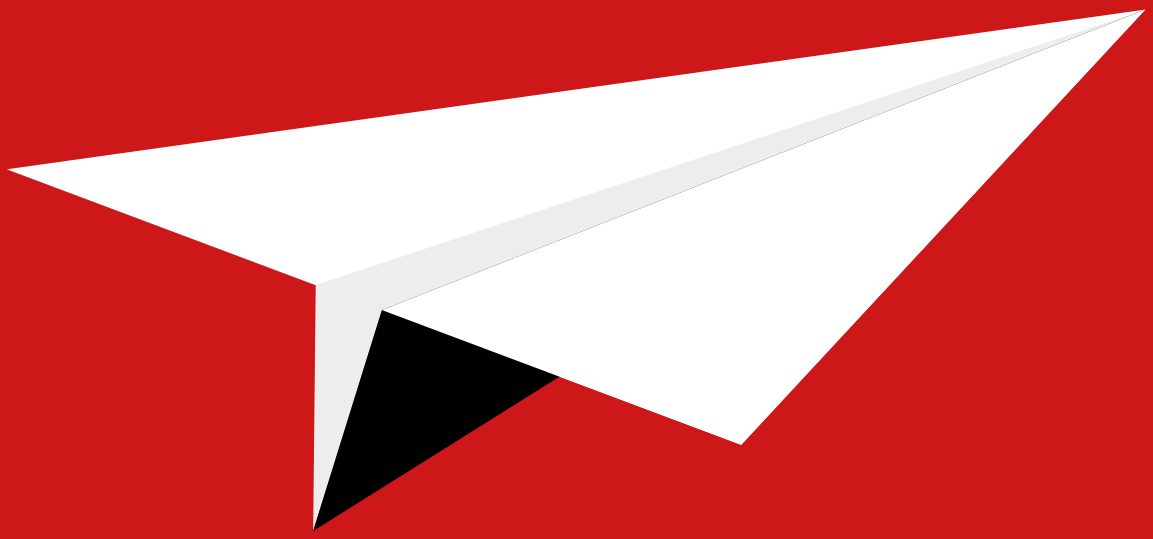
However, at the same time, this leads to a drop in farmers' income by 5.5% and only a 1.6% emission reduction. The direct imposition of emission costs at the level of 2015 EUA prices (the ETS15 scenario) leads to a 3.65% GHG emission reduction, but also means a 5% drop in farmers' incomes. The assumption of the emission cost rate at the level of 2020 EUA prices (the ETS20 scenario) produces a 9.8% emission reduction and a 16.5% drop in income.

The introduction of a direct tax on emissions at the level 20 EUR/tCO2eq. raises the costs of the sector of agriculture by PLN 2.78 billion annually, which translates into their increase by PLN 1,960 per farm and PLN 195 per hectare of utilised agricultural area (UAA). This value corresponds to about 11% of the average farm income in the Polish sector of agriculture.

Assuming the continued use of the present production technologies, it is very difficult to meet the ambitious goals of reducing the emissions from the sector of agriculture. Attempts to implement more ambitious reduction targets not only lead to a drop in farm income but also cause a relatively large fall in the production level, which can result in higher food prices.

Climate neutrality assumed in the European Green Deal cannot be achieved by simply applying "traditional" climate policy instruments to agriculture, including taxation, and introducing more stringent emission standards. This approach causes adverse impacts on agricultural production in all the scenarios providing for the implementation of the restrictions considered.

Climate neutrality assumed in the European Green Deal cannot be achieved by simply applying "traditional" climate policy instruments to agriculture, including taxation, and introducing more stringent emission standards.



Aviation in the light of the agreement on the linking of the EU and Swiss emissions trading systems

Author: Agnieszka Borek, Legal Unit, KOBiZE

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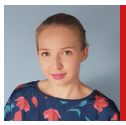

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The EU and Swiss emissions trading systems have been linked. The first agreement on the integration of the trading systems is expected to ensure the mutual recognition of allowances issued within both systems and to enable the fulfillment of obligations imposed on the entities participating in both ETS before the authorities of one country which administers them. This article presents some of the assumptions of this agreement concerning aircraft operators, as well as the possible doubts regarding the surrending allowances to cover emissions levels by operators carrying out their aviation activities between Switzerland and the European Economic Area countries.

The aviation sector prior to the Covid-19 pandemic

There is no doubt that globalisation of business processes, the growing affluence of society, measures facilitating the crossing of state borders in the EU as well as the popularity enjoyed by low-cost airlines contributed in recent years to the dynamic development of civil aviation services both in Poland and in Europe. The largest aerodrome in Poland – Chopin Airport in Warsaw – handled almost 18 million passengers in 2018, whereas 10 years before, i.e. in 2008, there were 9.4 million of them; thus, the number of passengers handled almost doubled over 10 years. The total data for all the Polish aerodromes look even better. It follows from the data made available by the Civil Aviation Authority that the total numbers of passengers handled in 2008 and 2018 in Polish aerodromes were, respectively, 20.6 million and 45.7 million, representing an imposing increase by 121%. In turn, in the analogous years 2008 and 2018, the EU-28 aerodromes handled, respectively, 798 million[97] and 1.106 billion[98] passengers, representing an increase by 38.2%. However, aviation consists not only of passenger transport but also of cargo flights. According to the data presented by the ATAG[99], air transport constitutes about 0.5% of the global trade volume, representing as much as 35% of its value, meaning that it is primarily expensive products, but also those requiring quick delivery and with short expiry dates that are transported by air. An increase in the volume of goods transported could also be seen in the cargo segment. In 2019, their weight was larger by as much as 7.9% than the previous year. The development of the air services market was only halted by the global COVID-19 pandemic. Because of the falling interest in travel and due to the decisions taken by the authorities of particular countries, in the 2nd quarter passenger flights were practically frozen and international trade fell.

[97] https://ec.europa.eu/transport/sites/transport/files/modes/air/observatory_market/doc/annual_2008.pdf
[98] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Overview_of_EU-28_air_passenger_transport_by_Member_States_in_2018_passengers_carried_(Thousands).png
[99] Air Transport Action Group.

Despite the lifting of restrictions on movement, including those applicable to air travels, the aviation sector seems to be in an extremely difficult situation[100]. It is, however, crutial to present the above mentioned data, due to the fact that under such conditions, the analysed agreement was negotiated.

Aviation emissions and the international efforts to reduce CO_2

Given the fuel and technologies which the aviation sector uses, it contributes to anthropogenic greenhouse gas emissions; in addition, to date gases other than CO_2 have not fallen within the scope of interest of the EU and national legislators[101]. Aviation is responsible for about 2% of global CO_2 emissions and until recently its share was projected to grow by 3-4% annually[102]. Certainly, the global COVID-19 pandemic will revise these projections, although given the gradual lifting of restrictions in the particular countries airlines are trying to restore their previous activities.[103] In the European Union, the share of aviation in CO_2 emissions has been about 3% to date, which translates into a 12% share[104] in the transport sector as a whole.

The impact of aviation on CO_2 emissions is a matter of concern for the international community, in particular, the European Union, as evidenced by the relevant provisions of international agreements concluded under the aegis of the UN and EU legislation, primarily including the EU Emissions Trading System (EU ETS). Emissions from domestic flights are included in nationally determined contributions NDCs[105] as part of efforts to reduce CO_2 emissions under the 2015 Paris Agreement. In turn, emissions from international flights are to be monitored as part of the CORSIA mechanism[106] established by the International Civil Aviation Organization (ICAO) to complement in a way the efforts taken under the Paris Agreement.

> Aviation is responsible for about 2% of global CO_2 emissions and until recently its share was projected to grow by 3-4% annually

The European Union has established the most advanced regime for monitoring and reducing CO_2 emissions from the aviation sector, by including aviation activities in the EU ETS in 2012, thus becoming a leader in this area of climate action. The issue of including aviation operations in the EU ETS was so controversial that it was referred to the Court of Justice, which in its 2011 judgment[107] found that the decision of Member States to include the aviation sector was not a breach of international law, including Chicago Convention[108].

[100] The IATA data clearly indicate that the second wave of the epidemic forecast in the 4th quarter of 2020 will have an adverse effect on consumers' choices as regards their resignation from air travels. See https://www.iata.org/en/iata-repository/publications/economic-reports/downgrade-for-global-air-travel-outlook/

[101] Apart from carbon dioxide (CO_2), greenhouse gases also include methane (CH_4), water steam (H_2O), ozone (O_3), nitrous oxide (N_2O), chlorofluorocarbons (CFCs) or perfluorocarbons (PFCs).

[102] Climate Change 2007. Mitigation of Climate Change. Contribution of Working Group III to the Fourth Assessment Report of the IPCC, s. 60.

[103] As the media have reported, the Irish Ryanair, the largest airline in Europe, was to restore 40% of the original flight schedule.

[104] For comparison the road transport emissions represent about 74% of CO_2 emissions from the transport sector.

[105] National Determined Contributions (NDCs).

[106] Ang. Carbon Offsetting and Reduction Scheme for International Aviation.

[107] The judgment of 21 December 2011 in Case C-366/10.

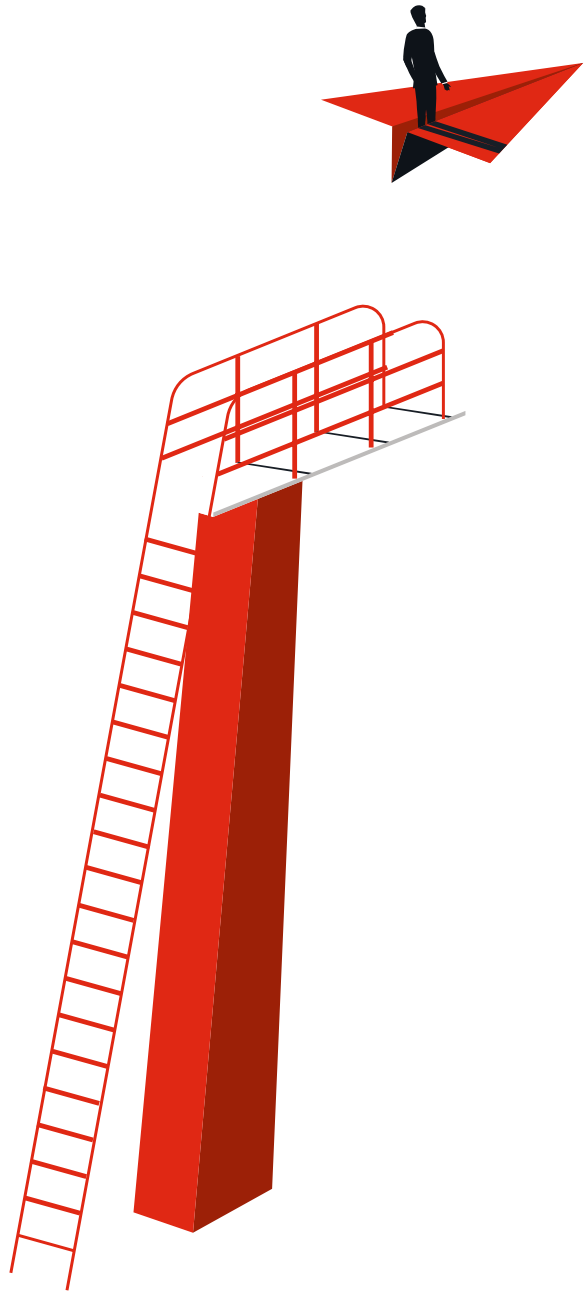
[108] The Convention on International Civil Aviation signed in Chicago on 7 December 1944 (Official Journal of the Laws of 1959, No. 35, Item 212, as amended).

The EU ETS vs. the Swiss ETS

As pointed out above, the aviation sector was included into the EU ETS only in 2012. In the scope of aviation activities, the EU ETS covers flights departing or arriving at aerodromes in countries which are members of the European Economic Area (EEA). Given the difficulties with working out within the ICAO the so-called global market-based measure designed to offset aviation emissions, the European Union decided to temporarily limit certain reporting obligations of operators regarding flights within the EEA. This mechanism, in force since 2013, is to be maintained until 2023, i.e. until a consistent global approach to the issue of reductions of CO_2 emissions from aviation is worked out.

However, the EU ETS is not the only regime designed to control and monitor CO_2 emissions from aviation. The Swiss Confederation has also its own regulations; however, given the number of entities covered by the EU ETS (about 11,000 installations and 500 aircraft operators), the Swiss ETS looks quite modest. The Swiss ETS was established in 2008 and now covers 50 large installations representing about 10% of national emissions. On 1 January 2020, the system also included aircraft operators. The main legal acts governing the operation of the Swiss ETS include the Federal Act on the Reduction of CO_2 Emissions of 23 December 2011[109] and the Ordinance on the Reduction of CO_2 Emissions of 30 November 2012[110].

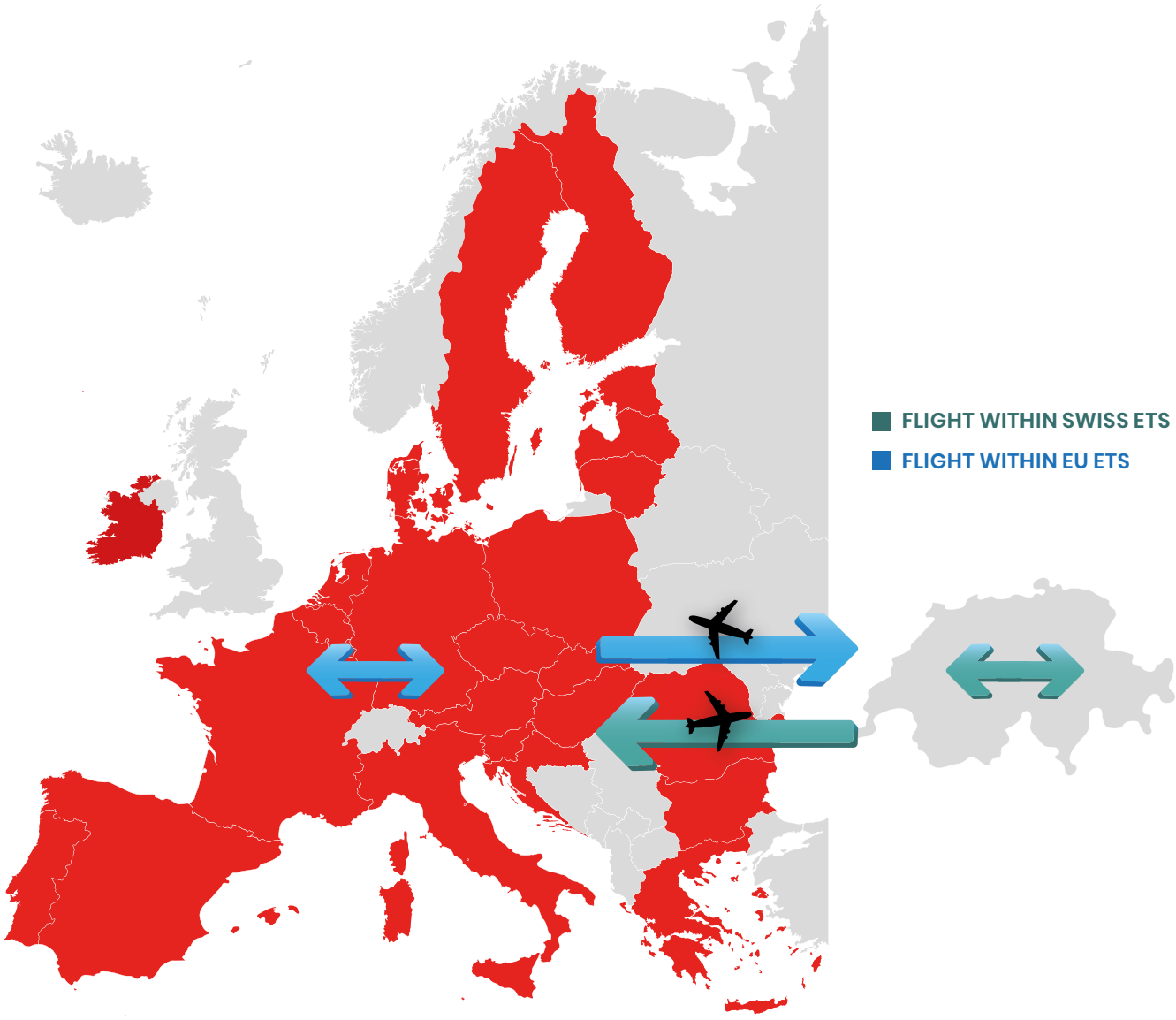
For aircraft operators the Swiss ETS covers flights within Switzerland and flights departing from Switzerland and arriving in the EEA countries.



[109] Federal Act on the Reduction of CO_2 Emissions (CO_2 Act) of 23 December 2011. See: https://www.admin.ch/opc/en/classified-compilation/20091310/index.html

[110] Ordinance on the Reduction of CO_2 Emissions (CO_2 Ordinance) of 30 November 2012. See: https://www.admin.ch/opc/en/classified-compilation/20120090/index.html

FIG. 1. THE RELATIONSHIP BETWEEN THE EU ETS AND THE SWISS ETS.



The agreement between the European Union and the Swiss Confederation on the linking of their greenhouse gas emissions trading systems

Directive 2003/87/EC[111] (often also referred to as the EU ETS Directive) provides that agreements may be concluded with third countries on the linking of their emissions trading systems with the EU ETS. The first such agreement[112] is exactly the agreement between the European Union and the Swiss Confederation on the linking of their greenhouse gas emissions trading systems which was concluded in 2017.[113]

[111] 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.

[112] OJ L 322, 7.12.2017, p. 3–26.

[113] Given that the Swiss Confederation is not a Party to the Agreement on the European Economic Area, the mutual relations between this country and the EU are governed by bilateral agreements. This is problematic since there are no provisions in place yet which would establish an institutional framework for their cooperation, so each time these rules need to be set out for the purposes of a specific agreement.

It was signed on 23 November 2017 in Bern and had been preceded by a long negotiation process which started as early as 2011. The Agreement was ratified by both Parties in 2019 and entered into force on 1 January 2020. Importantly, the agreement was amended by Decision 2/2019[114] of the Joint Committee as a result of the legislative procedures underway in Switzerland to align the assumptions of the Swiss ETS with the requirements laid down in the Agreement and the scope of Directive 2003/87/EC as regards aviation, including the extension until 2023 of the temporary limitation of the reporting obligations of aircraft operators to flights departing and arriving in the EEA territory (ensuing a symmetrical distribution of the scopes of the Swiss and EU ETS for aviation).

The Agreement and its Annexes lay down the general operating rules for the linking of both ETS. For the purposes of the present article, it is important to consider the provisions on the coverage by the linked systems in respect of aviation. The EU ETS covers flights within the EEA and flights from aerodromes located in EEA to aerodromes located in Switzerland (thus, this coverage reflects the changes made by Regulation 2017/2392 of the European Parliament and the Council). In turn, the Swiss ETS covers flights within Switzerland and flights departing from aerodromes located in Switzerland to aerodromes located in the EEA, as provided for by the Swiss CO2 Ordinance (in accordance with the legal status as of 1 January 2020).

The fundamental assumption of the integration is the mutual recognition of emission allowances allocated free of charge; as a result of this, the entities covered by the regimes of the EU ETS and the Swiss ETS will be able to use allowances issued in one system to surrender their covered emissions in the other system. As the European Commission has explained, the aircraft operators will also be able, for the purposes of surrending their covered emissions, to use allowances allocated to installations, irrespective of whether these are allowances issued as part of the EU ETS or the Swiss ETS[115] To this end, the transfer of allowances between registries and an exchange of information between the administrators of the systems will be ensured. Just as in the case of allowances sold through auctioning, access to "Swiss" auctions is to be given to EU participants under the same rules as those for Swiss entities[116].

Allowances are to be "recognised" on the basis of the country code assigned to them, which can be of importance in case of suspension of the application of Art. 4(1) of the Agreement and the related inability to surrender their covered emissions using allowances issued in the linked system (Article 15).

"The fundamental assumption of the integration is the mutual recognition of emission allowances allocated free of charge; as a result of this, the entities covered by the regimes of the EU ETS and the Swiss ETS will be able to use allowances issued in one system to surrender their covered emissions in the other system.

[114] OJ L 314, 29.9.2020, p. 68–86
[115] https://ec.europa.eu/clima/sites/clima/files/ets/markets/docs/faq_linking_agreement_part1_en.pdf
[116] Ibidem.

While for installations the issue of the integration of the system does not raise major concerns, the inclusion of aircraft operators in the regime of the Swiss ETS can impose new obligations on the participants in the EU ETS.

However, the Agreement provides for a temporary character of such suspension. While for installations the issue of the integration of the system does not raise major concerns, the inclusion of aircraft operators in the regime of the Swiss ETS can impose new obligations on the participants in the EU ETS. Given that many operators carry out flights between the EEA countries and Switzerland, they will have reporting obligations related to the separate monitoring and reporting of the emissions from the operations performed as part of the EU ETS and the Swiss ETS before the authorities of the country which has to date been their administering State (it should be recalled that aviation was included in the Swiss ETS only on 1 January 2020). Therefore, each operator will continue to be administered by one state (EU Member State or Switzerland) and will have an account in the registry (the Union registry or the Swiss registry) via which allowances corresponding to emissions from aviation activities carried out in both systems will be surrendered ("one-stop-shop" formula). In turn, the administering State will be responsible for supervision over the fulfilment of all the reporting obligations of operators (both in the EU ETS and in the Swiss ETS). This means that Member States will have additional burdens related to an expanded scope of duties of the competent authorities. In Poland, the authorities participating in the emission trading system in respect of aircraft operators primarily include the Minister responsible for the Climate and Environment, the National Centre for Emissions Management (KOBiZE) and the authorities of the Inspectorate for Environmental Protection. In passing, it should be pointed out that the aircraft operators administered by Poland[117] which have approved monitoring plans in place are not obliged to submit an additional monitoring plan to be approved under Swiss regulations. These operators will monitor the emissions from flights covered by the Swiss ETS on the basis of a monitoring plan as approved to date (still, information about this should be forwarded to the Federal Office for the Environment in Switzerland). However, interestingly, allowances will be surrendered separately under each of the systems; moreover, in the case of operators administered by Member States, allowances will first be surrendered towards the accounting for emissions from aviation activities covered by the Swiss ETS. Still, there are no clear provisions of the Agreement to provide whether this "priority" will also apply in the case where the operator is in default with surrendering allowances from previous years. The content of the Agreement suggests that for operators administered by Member States the obligations under the Swiss ETS will take precedence over the obligations under the EU ETS. The future will show what the exchange of information between the authorities of EU Member States and Switzerland will look like.

[117] https://ec.europa.eu/clima/policies/ets/monitoring/operators_pl_

Will the Member States and Switzerland be willing to effectively enforce the obligations of operators arising from the fact that operate under the linked trading system?

Does the linking of the systems pose a challenge for airlines?

It will turn out in 2021 what the integration of the EU ETS and the Swiss ETS will look like since by 31 March all the aircraft operators are obliged to submit reports on their emissions in 2020, while by 30 April they are expected to surrender an adequate number of emission allowances in the Union registry. Not only Swiss legislation had had to be amended to ensure its consistency with the Agreement. With a view to aligning the scope of Directive 2003/87/EC with the realities of the linked trading systems, on 21 July the European Commission published its Delegated Decision[118] providing for the exclusion of flights from Switzerland to the EEA from the scope of the Directive (the emissions from these flights will be monitored and surrended by allowances under the Swiss ETS). For now this is the only legal act published by the Commission which is related to the Agreement concluded with Switzerland. The change in the scope of application of the EU ETS Directive will most likely require consideration of the introduction of possible changes to the national legal systems of Member States in the scope of their regulations implementing the provisions of the Directive.

It seems that the linking of the EU ETS and the Swiss ETS will not affect significantly the existing burdens of the aviation sector. However, taking into account the implementation of the CORSIA mechanism in the EU and the unforeseeable impacts of the global COVID-19 pandemic on the aviation sector (certainly, such an impact is and will be an adverse one; there is still an open question as to how strongly the crisis caused by the pandemic will affect the results of the sector), it may be considered whether this is the right time for such changes. Therefore, it is important to ensure that when drafting regulations affecting aircraft operators the EU legislator takes into account the general condition of the participants in the EU ETS and that new obligations do not impede a return to the development pathway of airlines as in the years preceding the pandemic.

[118] Commission Delegated Decision (EU) 2020/1071 of 18 May 2020 amending Directive 2003/87/EC of the European Parliament and of the Council, as regards the exclusion of incoming flights from Switzerland from the EU emissions trading system.

The Modernisation Fund – it is the set and go time for the modernisation of the energy sector

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The Modernisation Fund – it is the set and go time for the modernisation of the energy sector

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The present situation of the energy sector and the resources for its transformation

In terms of its energy Poland is unique on a global scale as about 74% of its electricity is generated from coal. In the world, Poland can be compared e.g. to China, although even there the share of coal in electricity production is about 50%. Still 10-20 years ago the coal-based pathway was one of the best solutions for the countries in Central and Eastern Europe as the cheap and available commodity made it possible to satisfy even those quickly growing energy needs of the catching up countries. Particularly so as alternatives included: the more expensive technology for energy generation from nuclear fuels, hydropower, which primarily needs the adequate geographical conditions, and wind and solar energy generation which was still fledgling then. In turn, the use of gas would mean a weakening of energy security, given the source of supply of this gas (mainly from Russia).

However, the present situation is completely different. Europe strongly focuses on the combat against climate change and a direct effect of this is its support for investments in renewable sources, through not only its technological leadership, e.g. wind turbines or PV (photovoltaic), but also the operating rules for reduction mechanisms, as well as the manner of spending resources from the EU budget, or the functioning of the European Investment Bank (EIB). The results of the five-day summit in July 2020 also confirm this direction of action, among others, with the principle which it adopted that 30% of the EU budget should be spent for climate-related purposes or the "no harm" principle for the other 70% expenditures. The other decisions of the summit included a number of support mechanisms – both new and those already in operation; specifically, the Recovery Plan for Europe, the InvestEU Programme, the Just Transition Fund, the Structural and Cohesion Funds.

These are not the only resources which can be used to modernise the energy sector. In the present trading period of the EU ETS (2013-2020), the mechanism dedicated to the energy sector is the derogation laid down in the provisions of Article 10c of the EU ETS Directive, which was expected to support investments, among others, in the modernisation of the existing coal-fired units. According to the most up-to-date data from the Commission (as of April 2020), to date Poland has managed to use about 65% of resources for this purpose (i.e. about 265 million allowances out of 404 million available in this pool) and 2020 is the last year when expenditures can be incurred for this purpose.

The Modernisation Fund (MF) is another of a number of the EU funding sources targeting the modernisation, development and support for innovation in the area of low-carbon economy and, at present, also the tackling of the recession caused by the COVID-19 pandemic. The pool of the Fund is perhaps not as spectacular as the climate earmarked 30% of the EU budget; on the other hand, this has its advantages as it is an instrument targeting the specific needs of chosen sectors in selected Member States.

As intended by the Commission (based on the statement by the Deputy Director-General in the DG Climate Action during the EUSEW2020 meeting on 25 June 2020), "the Modernisation Fund is expected to be a new programme to assist selected EU Member State in their energy transformation. It can play a significant role as part of the EU support mechanisms, such as the Renovation Wave, by improving energy efficiency or increasing the share of RES".

The Modernisation Fund is a new financial instrument foreseen as part of the operation of the EU ETS in the period from 2021 to 2030. The provisions in relation to governance are laid down in Article 10d of the EU ETS Directive and a Commission Regulation[119]. The financial resources available from the Modernisation Fund will come from the sales of 2% of the total number of allowances in the EU ETS, representing about 280 million European Union Allowances (EUAs), as calculated by KOBiZE (taking Brexit into account). The allowances will be sold in equal tranches throughout the period from 2021 to 2030, which is important from the point of view of the value of the pool in EUR and the availability of the resources.

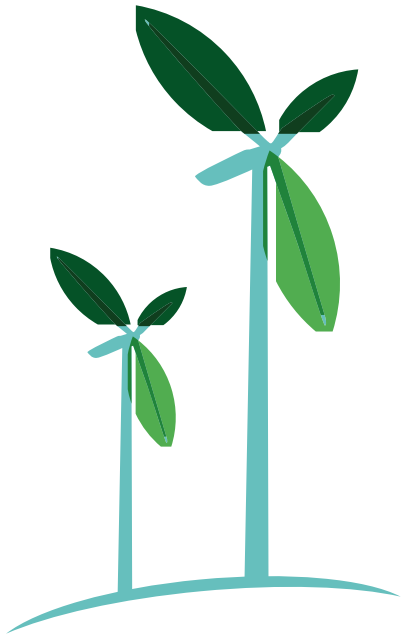
The beneficiaries of the Modernisation Fund will be 10 Member States (the Czech Republic, Estonia, Slovakia, Lithuania, Latvia, Poland, Croatia, Hungary, Romania and Bulgaria). Poland has the largest share and will receive 43.41% of all the resources, which will translate into the pool of about 122 million EUAs (taking Brexit into account, as estimated by KOBiZE).

If the EU increases the GHG reduction target from 40% to 55% in 2030 vs. 1990, then, as estimated by KOBiZE, as a result of a decrease in the number of allowances in the EU ETS, the Modernisation Fund can be diminished from the level of 250 million EUAs (taking Brexit into account), of which Poland would receive about 109 million EUAs. Obviously, an increase in the allowance price after the reduction target is raised would more than compensate for the level of difference in the payments of financial resources available from the Fund.

> The Modernisation Fund is expected to be a new programme to assist selected EU Member State in their energy transformation. It can play a significant role as part of the EU support mechanisms, such as the Renovation Wave, by improving energy efficiency or increasing the share of RES.

[119] Commission Implementing Regulation (EU) 2020/1001 of 9 July 2020 laying down detailed rules for the application of Directive 2003/87/EC of the European Parliament and of the Council as regards the operation of the Modernisation Fund supporting investments to modernise the energy systems and to improve energy efficiency of certain Member States.

As estimated by KOBiZE, the market value of the allowances allocated to the Fund can vary between about EUR 6.5 billion (under the current climate policy with its reduction target of 40%) and EUR 11.8 billion (after the reduction target is raised to 55%[120]) depending on the scenario adopted for the EUA prices and the operation of the EU ETS in the period from 2021 to 2030. According to the estimates published on the EC website, this value is as high as EUR 14 billion. Firstly, in its calculations, the Commission did not take Brexit into account, so the number of allowances is higher than estimated by KOBiZE. Secondly, probably the average EUA price in the period from 2021 to 2030 as adopted for these calculations must be at least EUR 45. It is a very high value. The projected value of the Modernisation Fund is strictly related to the EUA price increase pathway adopted. This indicates that the European Commission has assumed high emission EUA prices already from the beginning of the period from 2021 to 2030.



> The priority areas where support from the Fund can be received include, among others, renewable energy sources, improvements in energy efficiency, energy storage, modernisation of the energy systems and just transition in mining regions.

The value of the resources available to Poland can be estimated at about **EUR 2.8–5.1 billion (as estimated by KOBiZE).** When using the data on the total resources of the Fund as published by the EC, this value would be about EUR 6 billion (assuming that Poland's share in EUR 14 billion is 43.41%).

The areas to be financed by the Modernisation Fund

The priority areas where support from the Fund can be received include, among others, renewable energy sources, improvements in energy efficiency, energy storage, modernisation of the energy systems and just transition in mining regions. In the case of regions in priority areas the support intensity can be up to 100% of eligible costs. One of the key differences for the Polish energy sector with regard to the previous period is the principle that no support may be given from the Fund to energy plants using solid fossil fuels[121].

[120] Maciej Pyrka, Izabela Tobiasz, Jakub Boratyński, Robert Jeszke, Paweł Mzyk, "Zmiana celów redukcyjnych i cen uprawnień do emisji wynikająca z Komunikatu "Europejski Zielony Ład" ["Changes in the reduction targets and emission allowance prices resulting from the Communication "The European Green Deal"- in Polish], CAKE, Warsaw, 2020.

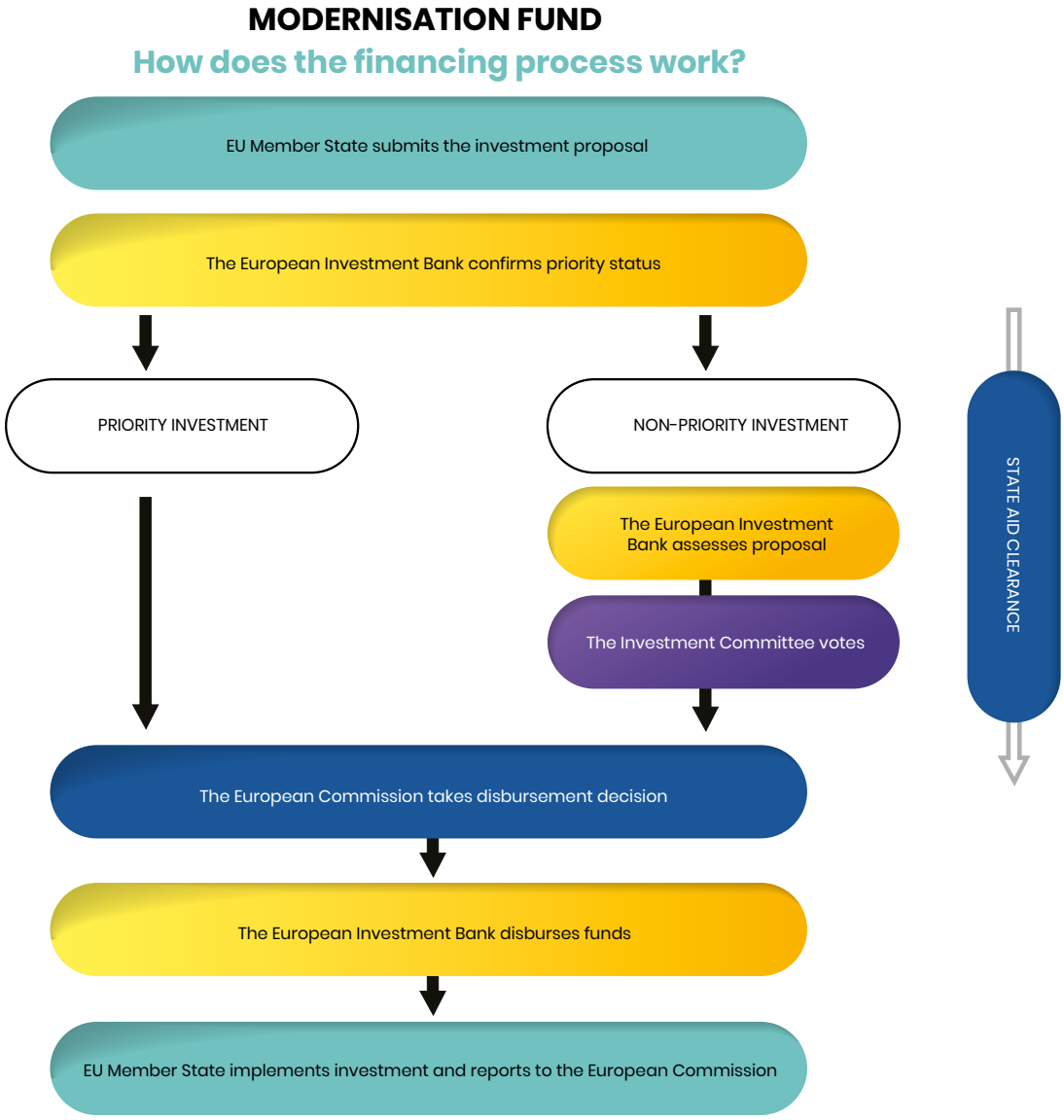
[121] This rule does not apply to projects implemented as part of an efficient and sustainable district heating system in the Member States where the GDP per capita in market prices in 2013 was less than 30% of the EU average (Romania and Bulgaria), provided that a certain number of allowances, with at least an equivalent value, is used for investments consistent with Article 10c which do not provide for the use of solid fossil fuels.

Another difference is the manner of approval: in the case of derogation the list was approved by the Commission only, now the responsibility for this has been transferred to the European Investment Bank and, in the case of non-priority investments, also to the Commission and other Member States which constitute the Investment Committee.

Investments from outside the list of priority areas are to be financed in a less favourable manner. Member States can use not more than 30% of resources for these projects. Moreover, they will have to be approved by the Investment Committee consisting of the representatives of 10 beneficiary Member States and also the representatives of the European Commission, EIB and selected Member States which are not beneficiaries. The intensity of support to investments from outside the list of priority areas is not more than 70% of eligible costs provided that the other costs are covered from own resources.

The approved projects will also have to undergo the state aid-related procedure. Fig. 1 shows schematically the project approval process.

FIG. 1. THE COURSE OF THE PROJECT APPROVAL PROCESS AS PART OF THE MODERNISATION FUND.



Source: European Commission

Poland has already started its preparations for the implementation of the Fund. In early 2019, there were meetings between the Commission, the sector and the government administration which were expected to work out the priorities of actions. Moreover, in accordance with the draft greenhouse gas emission allowance trading system act,[122] the National Fund for Environmental Protection and Water Management will be the implementing body – responsible for the national procedure for managing the resources from the Modernisation Fund. It was expected that the draft act will be adopted in the 3rd quarter of 2020. It follows from the analysis "Scenarios of low-emission energy sector for Poland and the EU until 2050"[121] by CAKE/KOBiZE that the total investment revenues[122] in the period from 2021 to 2050 only on new capacity in Poland will be **EUR 153 to 206 billion** – depending on the scenario (for comparison, KOBiZE estimates the value of the modernisation fund for Poland at **EUR 2.8–5.1 billion**). Therefore, it is important to start the investment processes as soon as possible, use as much of the EU resources as possible and reach the fruitful outcome in the form of structural changes in the fuel mix used and social changes, e.g. assistance in mining regions.

Its ultimate value and effectiveness of its use - and, thus, its effects in the form of reduced emissions or a change in the fuel mix to meet the rules which have been introduced – will be known only after 2030.

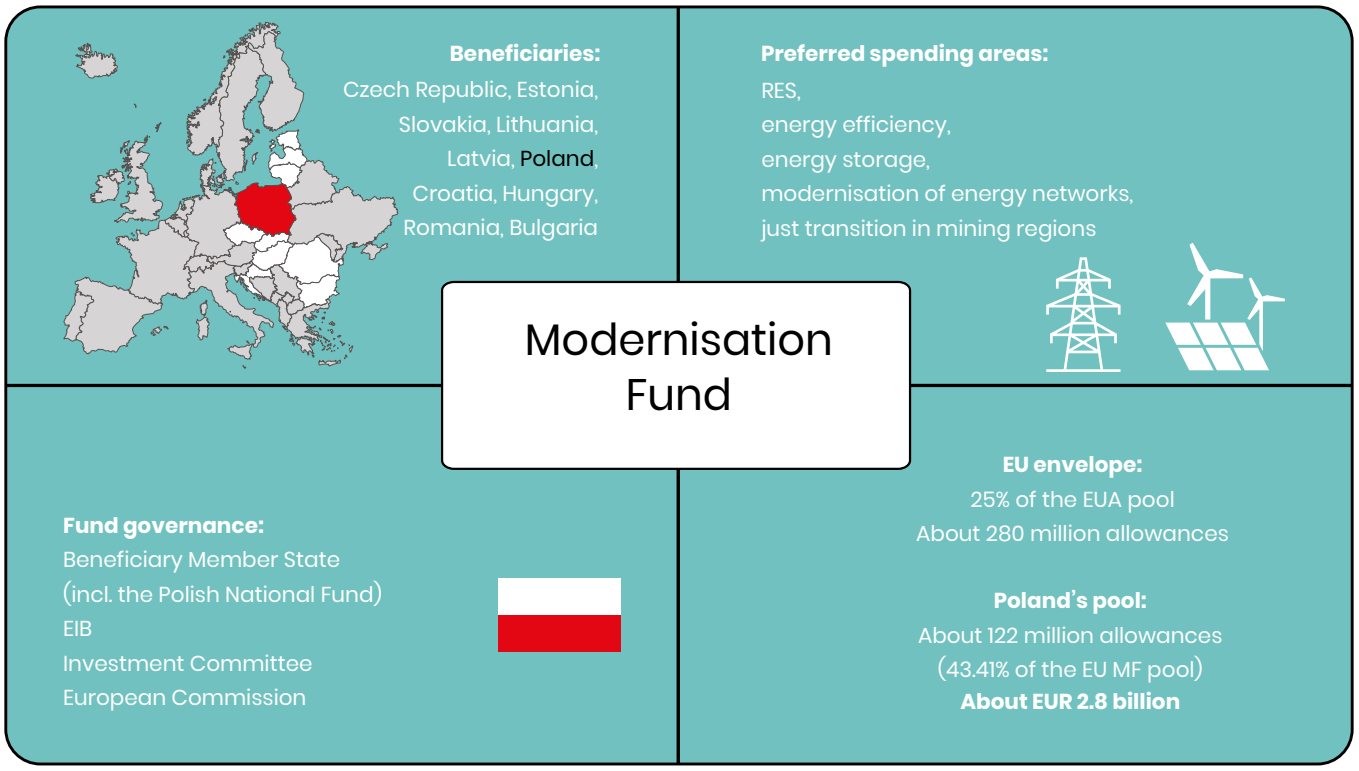
The first payments from the Fund should go to Member States in 2021. Before that date the Commission and the EIB should know the list of investment measures which a given country would like to support with the resources of the Fund. Its ultimate value and effectiveness of its use - and, thus, its effects in the form of reduced emissions or a change in the fuel mix to meet the rules which have been introduced – will be known only after 2030. The condition of such important segments of the Polish economy as the mining and energy sectors will depend, among others, on the manner in which these resources will be used.

[122] https://bip.kprm.gov.pl/kpr/bip-rady-ministrow/prace-legislacyjne-rm-i/prace-legislacyjne-rady/wykaz-prac-legislacyjny/r894467727264,Projekt-ustawy-o-zmianie-ustawy-o-systemie-handlu-uprawnieniami-do-emisji-gazow-.html

[123] Tatarewicz, I., Lewarski, M., Skwierz, S. (2019). Scenarios of low-emission Energy sector for Poland and the EU until 2050, Institute of Environmental Protection - National Research Institute / National Centre for Emissions Management (KOBiZE), Warsaw.

[124] These revenues include new generation units, i.e. power plants, heat and power plants, renewable sources and heating plants. The numbers given above do not take into account either the costs of modernisation of the existing units or the costs of the expansion of the transmission and distribution network.

FIG. 2. THE MODERNISATION FUND IN ACCORDANCE WITH CURRENT EU CLIMATE POLICY UNTIL 2030 (WITH ITS GHG REDUCTION TARGET OF 40% FOR 2030 VS. 1990) – CONCLUSION.



Source: Own elaboration

[121] Tatarewicz, I., Lewarski, M., Skwierz, S., Scenarios of low-emission Energy sector for Poland and the EU until 2050, Institute of Environmental Protection - National Research Institute / National Centre for Emissions Management (KOBiZE), Warsaw, 2019 r.

[122] Nakłady te obejmują nowe jednostki wytwórcze w tym elektrownie, elektrociepłownie, źródła odnawialne a także ciepłownie. Powyższe liczby nie uwzględniają kosztów modernizacji istniejących jednostek ani kosztów rozbudowy sieci przesyłowej i dystrybucyjnej.

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