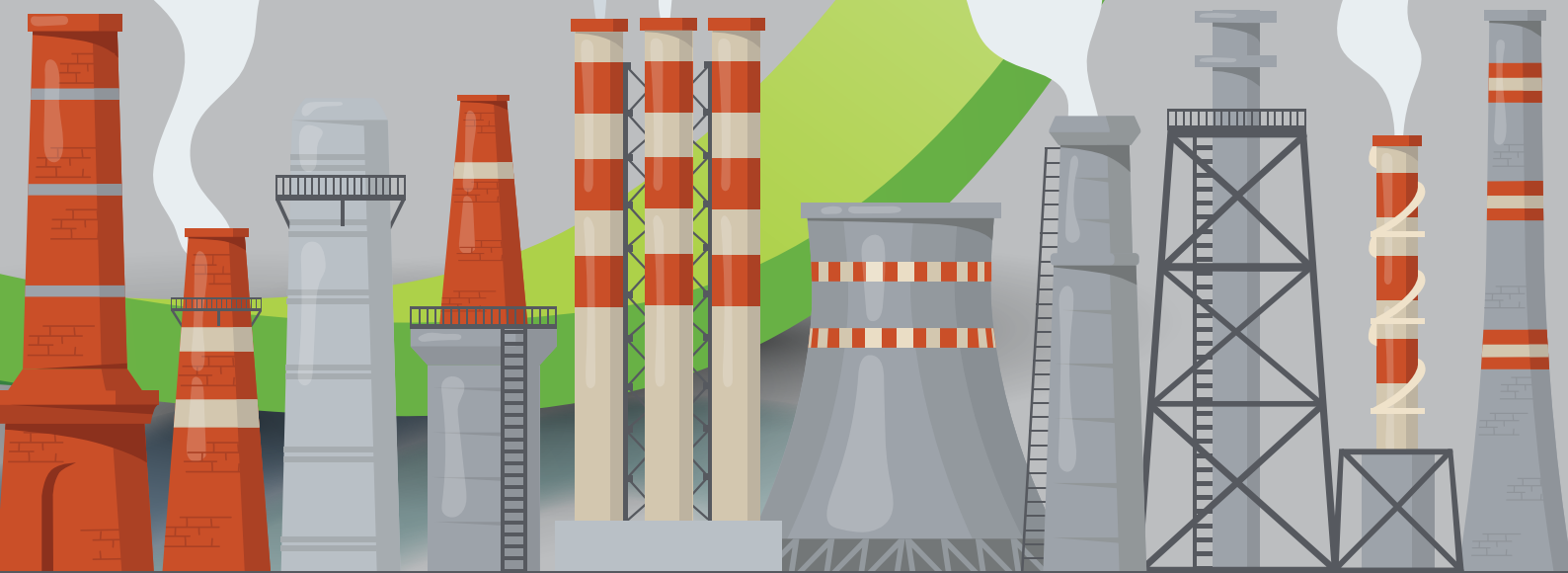


JUNE 2023

Trends in the Emissions Trading System in the European Union and Greece 2005–2022



Trends in the Emissions Trading System in the European Union and Greece 2005-2022

Text:

Ioanna Souka, Data Analyst

Nikos Mantzaris, Partner & Energy and Climate Policy Analyst

Cite as:

The Green Tank (2023) "Trends in the Emissions Trading System in the European Union and Greece 2005-2022"

Copyright © The Green Tank, 2023



50 Vas.Sofias Avenue,
Athens 11528, Greece
Tel. +30-210 7233384
<https://thegreentank.gr>
Email: info@thegreentank.gr

Contents

Introduction	1
Emissions in the European Union	2
Emissions in Greece	5
Electricity and Heat Production	8
Industry	9
Emissions by Activity	11
Top 10 Polluters	11
Summary - Conclusions	12

Introduction

The reboot of the global economy after the pandemic crisis, together with Russia's war in Ukraine, caused large fluctuations in fossil gas prices, which, in turn, triggered prolonged uncertainty in energy markets. As a result, the European states changed their energy planning, seeking alternatives to meet their energy needs. In most cases, the development of Renewable Energy Sources (RES) and electricity storage technologies was accelerated. In a few cases, lignite- and coal-based electricity production increased in the first months of the crisis, without, however, altering long-term commitments to completely phase-out these solid fossil fuels.

In addition, the European Union decided to reduce fossil gas use and electricity consumption, both overall and at peak times, in view of the winter of 2022-23. Furthermore, under the "fit for 55" legislative package, it completed major reforms across climate dossiers to harmonize them with the Union's more ambitious targets of reducing net emissions by at least 55% (compared to 1990 levels) by 2030, as reflected in the European Climate Law. The most important revision concerned the directive governing the cornerstone of European climate policy, namely, the EU's Emissions Trading System (EU ETS).

Launched in 2005, the EU ETS covers approximately 40% of Europe's total emissions, which come from installations and companies in the electricity and heat production, energy-intensive industry and aviation sectors. The EU ETS is currently in the fourth phase of its operation (2021-2030) and the most recent revision of the relevant directive covers the period 2024-2030. The decisions introduced in this revision are expected to make a key contribution to achieving both the overall climate target for 2030 and the longer-term climate neutrality target for 2050.

In particular, the latest EU ETS revision¹ instituted a speedier reduction of the maximum annual quantity of available allowances, while setting further restrictions on the supply of allowances on the market. Combined, these decisions aim at reducing emissions from the two sectors covered by the EU ETS since its launch (electricity and heat production and energy-intensive industry) by 62% by 2030, as compared to 2005 levels. In addition, the allocation of free allowances to the energy-intensive industry sector will be phased out, so as to induce changes in production processes to reduce their carbon footprint. All of the above reforms are expected to further elevate carbon prices on the emissions exchange by 2030. Indeed, in the first months following the revision, carbon prices increased and for the first time rose above the €100/ton mark in February 2023². In this context, the following questions arise:

- How have emissions in electricity production, industry and aviation evolved and where are we in relation to the new target of -62% for 2030 in the EU-27 and Greece?
- How do emissions in 2022 compare with those in 2021, the year the energy crisis started, and with those in 2005, the first year of EU ETS operation?
- Who were the top polluters in Greece and which sector has polluted the most since 2005 to date?

¹ DIRECTIVE (EU) 2023/959 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system <https://bit.ly/3qU2p5B>

² Reuters 21.2.2023 "EU carbon hits 100 euros taking cost of polluting to record high" <https://bit.ly/3qu3Uad>

These questions will be answered by analyzing the official data from the European Environment Agency and the Union Registry on the emissions of sectors covered by the EU ETS.

Emissions in the European Union

The analysis of the data on the two sectors covered by the EU ETS since its launch in 2005 (electricity and heat production and energy-intensive industry)³ reveals that, in 2022, the EU-27 reduced its emissions by 37.9% compared to 2005. This performance is below the minimum achieved in the first year of the pandemic crisis, 2020, when emissions from EU ETS sectors in the EU-27 decreased by 40.7% compared to 2005 levels. In addition, the 2022 performance is far off the target of a 62% reduction in 2030 compared to 2005, which was set by the recent revision of the Directive¹. Nonetheless, this target can still be met, especially if carbon prices remain at current high levels or even rise, as projected in relevant analyses⁴.

As illustrated in Figure 1, Greece performs well above the EU-27 average. It ranks among the best performing Member States, as it has achieved a 57.1% reduction in emissions in the EU ETS sectors in 2022 compared to 2005. Greece occupies the 6th place, very close to Denmark and Portugal (-57.6% and -57.8%, respectively) and 4.1% behind the best-performing country, Luxembourg (-61.2%). The latter displaced last year's leader, Malta, which now ranks 3rd (-59.6%), behind Romania (-60.8%), far ahead of the EU-27 (18th position).

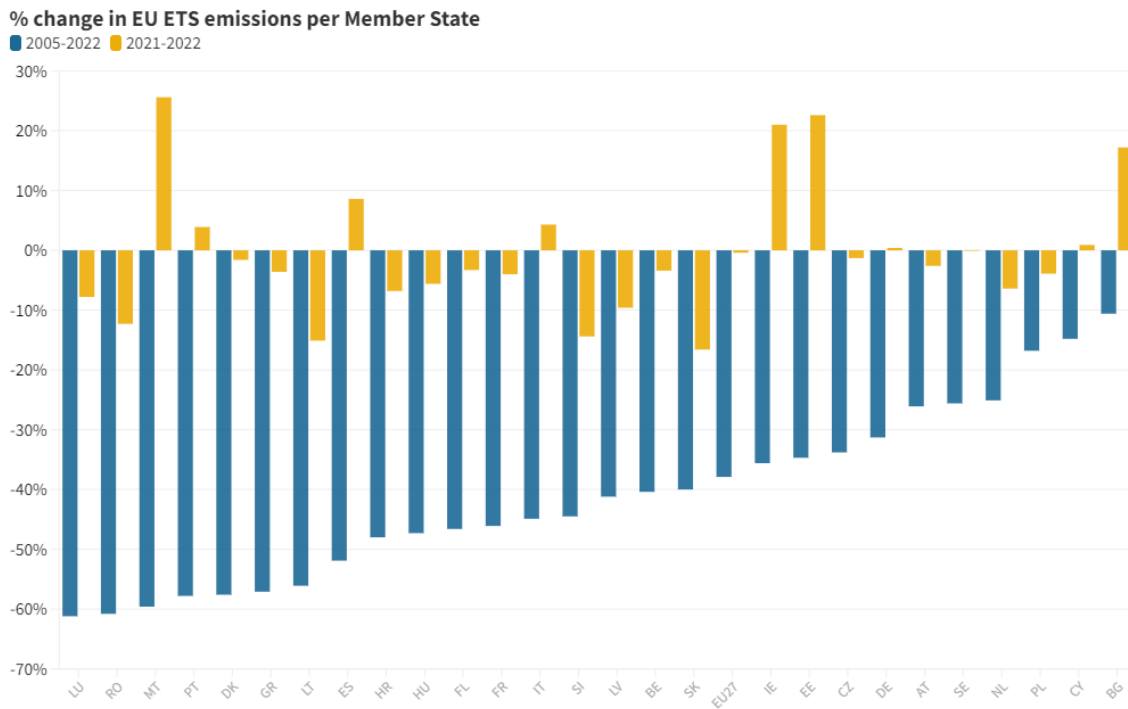
The last two places in climate performance compared to 2005 are occupied by Cyprus and Bulgaria. In the penultimate position, Cyprus decreased its emissions by 14.8% compared to 2005; however, over the past year, its total emissions were up by 0.9%, due to an increase in emissions from the aviation sector (+0.026 million tons in 2022 compared to 2021). Finally, Bulgaria's emissions rose by 17.2% in 2022 compared to 2021, mainly due to an increase in the use of lignite in electricity production (+25.2% compared to 2021); therefore, its climate performance in the ETS sectors worsened (-10.6% compared to 2005).

Compared to 2021, in 2022, the EU-27's overall performance improved by a mere 0.4%⁵. Emissions increased in 9 of the 27 EU Member States, with the largest rise recorded in Malta (+25.6%), followed by Estonia (+22.6%) and Ireland (+21%). In Estonia, the increase in emissions came from the heat and electricity production sector (+30.5%). On the other hand, in the other two countries, this rise was mainly -and decisively- driven by aviation (+94.2 in Ireland and 94.1% in Malta), reflecting this sector's rapid recovery following the pandemic crisis.

³ Each country's total emissions from the two sectors include the estimated emissions for the years 2005-2012, according to the [European Environment Agency](#), based on Directive [2003/87/EC](#) as in force, with regard to the inclusion of installations and countries in the EU ETS.

⁴ Kopernikus Projekte 30.12.2022 "The EU-ETS price through 2030 and beyond: A closer look at drivers, models and assumptions" <https://bit.ly/3N4lCjk>

⁵ The comparison between 2022 and 2021 also takes into account intra-EEA aviation as incorporated under EU ETS in 2012.



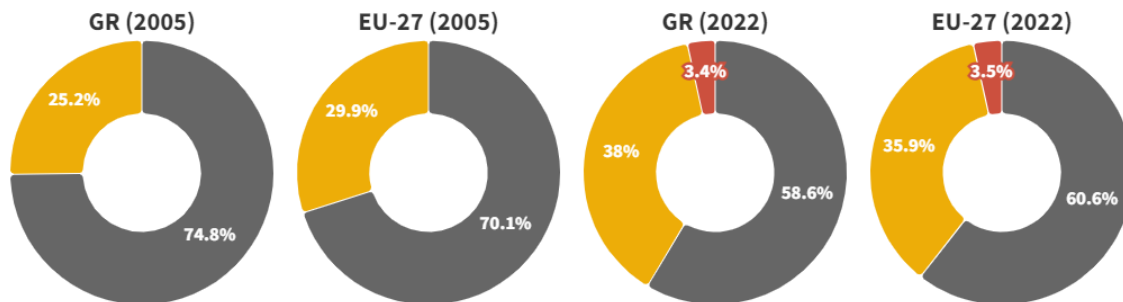
Source: EEA

Figure 1: Change in EU ETS emissions for each EU-27 Member State in 2022 compared to the EU ETS baseline year (2005) and the previous year (2021). Source: European Environment Agency

As illustrated in Figure 2, electricity and heat production constitutes the EU ETS sector with the highest emissions over time in both the EU-27 and Greece. However, its share has been restricted significantly over the 17 years of EU ETS operation, as all reforms throughout the four phases have principally aimed at restraining emissions from this sector. Thus, while in 2005 the share of electricity and heat production in Greece (74.8%) was higher than the EU-27 average (70%), in 2022, it fell to 58.6%, below the respective EU-27 average, which also decreased (60.6%). The opposite trend was observed in the case of industry. When the EU ETS was established, this sector accounted for 25.2% of emissions in Greece, 4.7% below the EU-27 average; however, in 2022, this share climbed to 38%, namely, 2.1% above the corresponding EU-27 average, which also rose. Finally, the contribution of aviation to total EU ETS emissions in 2022 was low and almost identical in Greece and the EU-27 (3.4% and 3.5%, respectively).

Emissions per sector for 2005 & 2022

■ Combustion ■ Industry ■ Aviation



Source: EEA

Figure 2: Percentage of emissions by sector (electricity and heat production; industry; and aviation) in Greece and the EU-27 for 2005 and 2022. Source: European Environment Agency

As illustrated in Figure 3, overall, most of the progress made in the EU ETS since 2005 -at European level- is due to changes in the quantitatively dominant sector of electricity and heat production. Between 2005 and 2022, this sector's emissions were reduced by 35%, making a decisive contribution to the 37.9% total decline achieved from all EU ETS sectors. In particular, following minor fluctuations between 2005 and 2009, from 2010 and up to 2021, the sector's emissions continuously decreased. In 2021, however, this downward trend was reversed and, due to the pandemic crisis subsiding, a year-on-year increase was recorded. In 2022, sector emissions were maintained at approximately the same level as in 2021; records show just a slight increase (+0.9%), as the effect of different parameters offset counteracting actions. On the one hand, the energy crisis accelerated the development of RES, thus, displacing fossil fuels from several Member States' electricity production mix. On the other hand, certain Member States -notably Germany, Italy, Bulgaria and the Czech Republic- significantly increased lignite and coal production in order to fill the huge gap created by the collapse of nuclear and hydroelectric power production and the reduction in the use of gas.

In the industrial sector, the reduction in emissions is much less impressive than in the electricity and heat production sector: between 2005 and 2022, emissions from industrial installations decreased by less than 10%. In addition, the emissions of the industrial sector show more fluctuations. The first significant fluctuation occurred in 2009, with a 18.7% decrease in emissions -as compared to 2008- due to the start of the economic crisis. The latter mainly affected the construction sector, namely steel, cement and metal production, whose emissions, in 2009, showed a year-on-year decrease of 30.7%, 19.4% and 31.3%, respectively; emissions in other industrial sectors such as ceramics, paper, glass and chemical production fell by 17.9%. Refineries -whose emissions, overall, show little annual variation- were affected to a much smaller degree (-6.6%). The following two years (2010-2011) saw minor increases in emissions (5.9% and 5.2%, respectively, compared to 2009), caused mainly by steel and metal production installations, while emissions from refineries and the cement production industry slightly decreased. In 2012, overall emissions from the industrial sector returned to 2009 levels, as higher emissions from smelters and steelworks were offset by fewer emissions coming from refineries and cement units. During the third phase of the EU ETS, and particularly from 2013 to 2019, industrial production recovered but did not reach the pre-crisis levels of 2008. The first year of the period, 2014, saw a 14.4% increase in emissions compared to 2013; subsequently, during the remainder of this period, emissions remained stable with insignificant annual deviations (<1%). In 2020, due to the Covid-19 crisis, emissions decreased significantly compared to the previous year (-7.4%); decline was mainly noted in the metalworking industry (-18.3%) and less so in cement plants (-5%) and refineries (-7.8%). The following year, 2021, saw a rise in emissions, due to the recovery from the pandemic; nevertheless, in 2022, industrial emissions returned to 2020 levels, with the exception of steelworks and refineries, which increased their emissions compared to 2020 (3.9% and 9%, respectively). The upsurge of energy prices in 2022 negatively affected sectors such as cement production and metalworks but favored industrial activities using fossil fuels⁶; these effects, combined, resulted in an overall decline in emissions in 2022 (-6.4%).

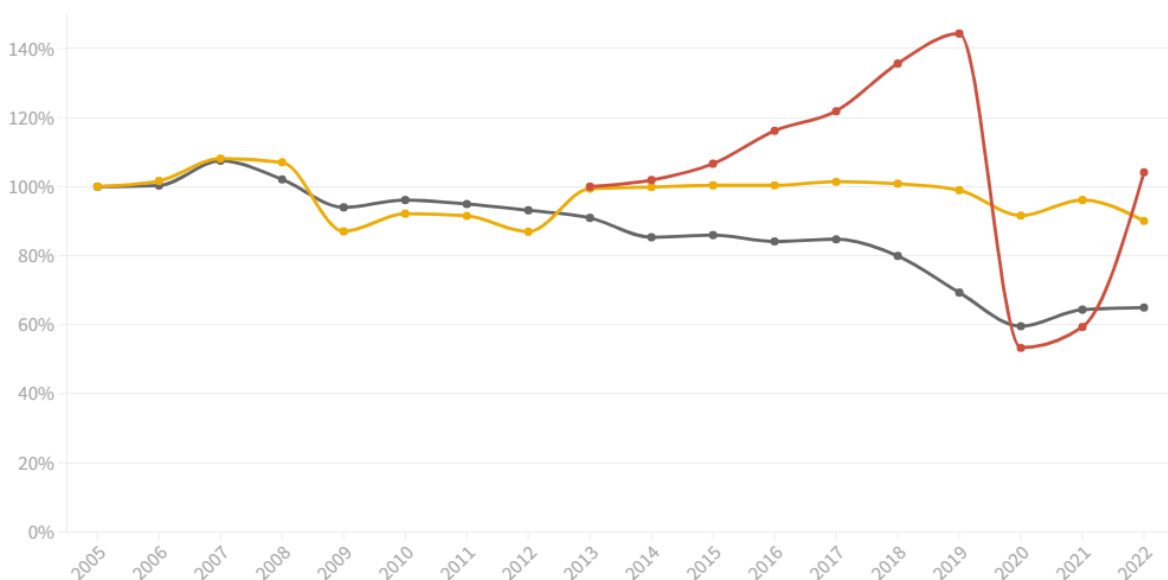
⁶ European Commission, 24.4.2023 Slight upturn in 2022 ETS emissions due to energy crisis and rebound in aviation <https://bit.ly/3J2Ll3u>

The aviation sector was included in the EU ETS for the first time in 2012, under a broad framework that included international flights to and from the European Union. This framework was amended in 2014⁷ and, since then, for the period 2013-2020, the EU ETS only includes emissions from flights within the European Economic Area (EEA). In addition, emission thresholds were introduced for both commercial and non-commercial flights to be included in the EU ETS, thus, further limiting the emissions from aviation that are admissible for trading. Following these changes, overall, between 2013 and 2022, emissions coming from aviation within the EEA increased by 5.2%; this decade, however, was marked by large fluctuations. Specifically, between 2013 and 2019, the sector saw exponential growth (+44.4% in emissions). In 2020, nonetheless, the slowdown caused by the pandemic affected aviation more than any other sector, leading to a 63% drop in emissions compared to 2019. In the following two years, emissions rose again (+95.3% in 2022 compared to 2020) but did not reach the pre-pandemic levels of 2019 (-27.9% in 2022 compared to 2019).

EU ETS Emission Sectoral Change in EU-27

combustion, industry: (100%=2005) aviation: (100%=2013)

■ Combustion ■ Industry ■ Aviation



Source: EEA

Figure 3: Annual change in Europe's emissions from the three EU ETS sectors, normalized in relation to 2005 for the electricity and heat production and industry sectors and in relation to 2013 for aviation. Source: European Environment Agency

Emissions in Greece

In order to fully understand Greece's overall performance, which is well above the EU-27 average, we must first focus on the percentage changes in emissions coming from the three sectors in relation to the EU ETS baseline year (2005 for electricity and heat production and industry; 2013 for aviation).

⁷ Regulation (EU) No 421/2014 of the European Parliament and of the Council of 16 April 2014 amending Directive 2003/87/EC <https://bit.ly/3P44V37>

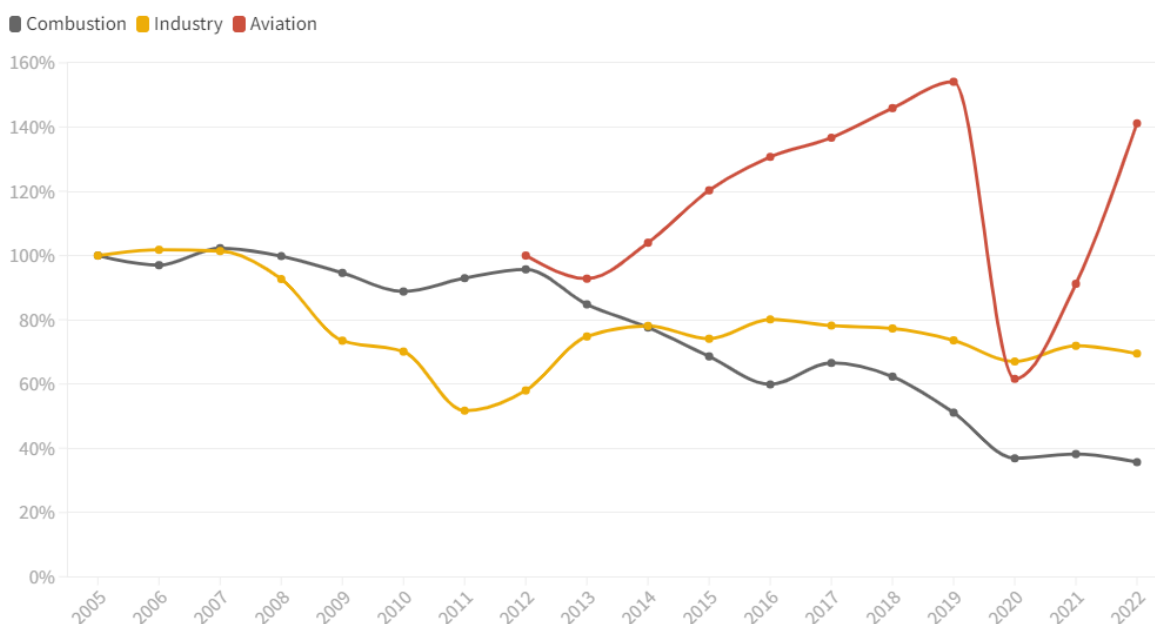
As illustrated in Figure 4, the largest decrease was noted in the electricity and heat production sector, especially from 2013 onwards (EU ETS phase 3), namely, soon after the allocation of free allowances to power plants was discontinued. Overall, between 2005 and 2022, Greece cut emissions in this sector by 63.9%; this reduction makes a decisive contribution to improving the country's climate performance and far exceeds the -35% achieved in the same sector by the EU-27. Most of this reduction occurred from 2017 onwards, due to the gradual decline in lignite production; the trend became even more pronounced from mid-2018 onwards, due to the increased cost of emission allowances on the emissions exchange. An exception to this downward trend was 2021; despite the fact that the contribution of lignite reached an all-time low in that year, the use of fossil gas in electricity production skyrocketed and the sector saw a 3.3% year-on-year increase in emissions.

In the industrial sector, emissions between 2005 and 2022 fell by 30.5%; again, this reduction far exceeds the corresponding EU-27 average (-10%). However, this performance was affected to a greater extent by the economic crisis that hit Europe in 2008 and affected Greece much more severely from 2009 onwards, rather than by systemic changes in production processes. As a result of the economic crisis, emissions from the industrial sector dropped to a minimum in 2011 (9.3 million tons); subsequently, however, emissions were pulled upward by the gradual recovery of the economy and continuously increased up to 2014. Since then, they have remained relatively stagnant each year, with the exception of 2020, which saw a 9% year-on-year decline due to the pandemic crisis.

As in the case of the EU-27, and even more so in Greece, the aviation sector registers the largest percentage changes in the EU ETS. Overall, between 2013 and 2022, emissions from the intra-EEA aviation sector in Greece surged by 54.7%. In particular, between 2013 and 2019 there was an increase close to 66%, namely, 20 percentage points higher than the corresponding EU-27 average. As in the whole of Europe, 2020 saw a sharp decrease in aviation emissions in Greece (-60%), due to the Covid-19 crisis. However, just two years later, in 2022, emissions from this sector had matched 2018 levels, following a 129.1% rise compared to 2020 -a quite larger increase compared to the EU-27 average (+95.3%).

EU ETS Emission Sectoral Change in Greece

combustion, industry: (100%=2005) aviation: (100%=2012)



Source: EEA, Union Registry

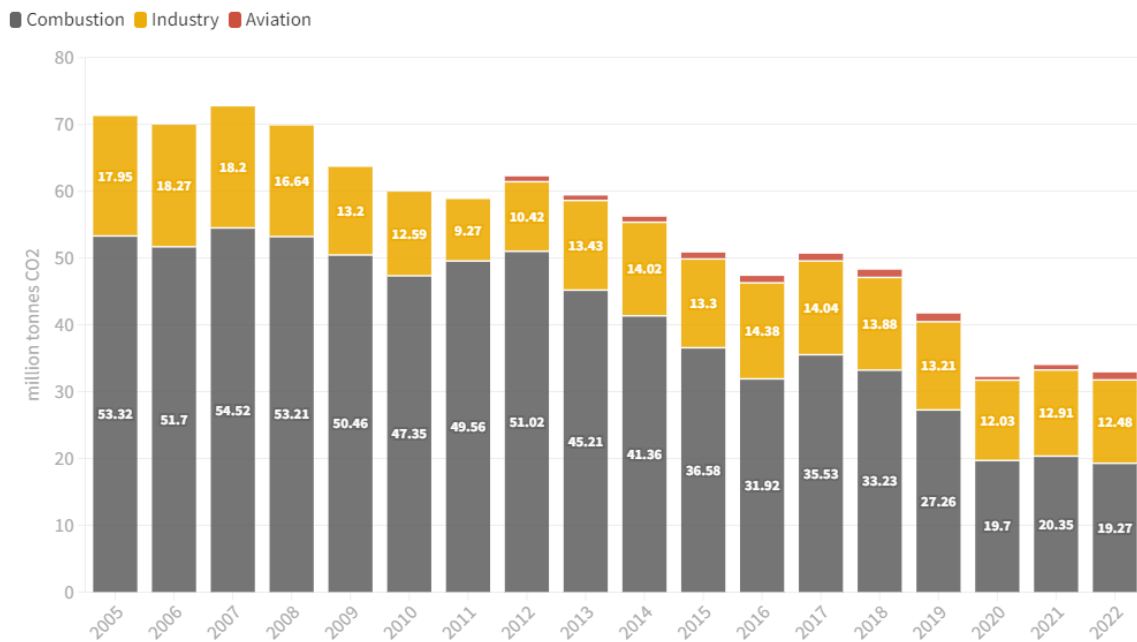
Figure 4: Annual change in emissions from the three EU ETS sectors in Greece, normalized in relation to 2005 for the electricity and heat production and industry sectors and in relation to 2012 for the aviation sector. Source: European Environment Agency; Union Registry

In absolute terms, in 2022, the EU ETS sectors in Greece emitted a total of 32.9 million tons. Despite the energy crisis, emissions were lower than in 2021 (34 million tons) and greatly reduced compared to the 71.3 million tons of 2005. In 2022, the country achieved its second-best performance after 2020, when Greece's EU ETS installations had emitted a total of 32.2 million tons. Electricity and heat production continues to hold the lion's share among sectors, with 19.3 million tons of emissions in 2022⁸, down by 5.3% compared to 2021. This performance constitutes an all-time low for the sector, even compared to 2020, the first year of the pandemic crisis (19.7 million tons). The industrial sector emitted 12.5 million tons⁹, achieving a 3.3% year-on-year decrease; however, emissions remain high compared to 2020, which marked the lowest level of emissions in the last decade (12 million tons). Conversely, emissions from aviation maintained their upward trend, reaching 1.1 million tons. This increase in the aviation sector, together with higher emissions coming from industry -compared to 2020- account for the fact that Greece's overall EU ETS performance in 2022 was slightly worse than in 2020.

⁸ Emissions include an estimate of emissions from the "Ptolemaida 5" lignite power plant and the "Agios Nikolaos 2" fossil gas fired TPP, both of which started trial operation in December 2022 (emitting a total of 0.13 million tons) but are not yet officially included in the list of EU ETS installations.

⁹ Industrial emissions also include part of the emissions from the Aluminium plant, even though, according to the official classification of the EU ETS, this installation falls under the electricity and heat production sector. Specifically, based on the average obtained from the Ministry of Environment's official data for the years 2019-2021, the plant's emissions are allocated to electricity and heat production (56%) and industry (44% of total emissions), for all years from 2005 to 2022, due to the plant's distinct processes for electricity production and other industrial activities.

Greece's EU ETS Emissions per sector



Source: EEA, Union Registry

Figure 5: Emissions in Greece from the three EU ETS sectors (electricity & heat production; industry; and aviation) for each year from 2005 to 2022. Source: European Environment Agency; Union Registry.

The following section further explores the course of emissions from the two -quantitatively- more important EU ETS sectors, namely, electricity and heat production and energy-intensive industry.

Electricity and Heat Production

As illustrated in Figure 6, over time, lignite has been consistently the leading source of emissions in the electricity and heat production sector. The only exception occurred in 2021, when the contribution of fossil gas to electricity production reached an all-time high; as a result, total emissions from fossil gas plants exceeded those from the much more polluting lignite units by 0.3 million tons.

As lignite has been predominantly accountable for the emissions coming from this sector, the drastic decline of lignite production has played a key role in improving the country's climate performance. Specifically, compared to 2005, emissions from lignite-fired power plants have been reduced by 80.3%.

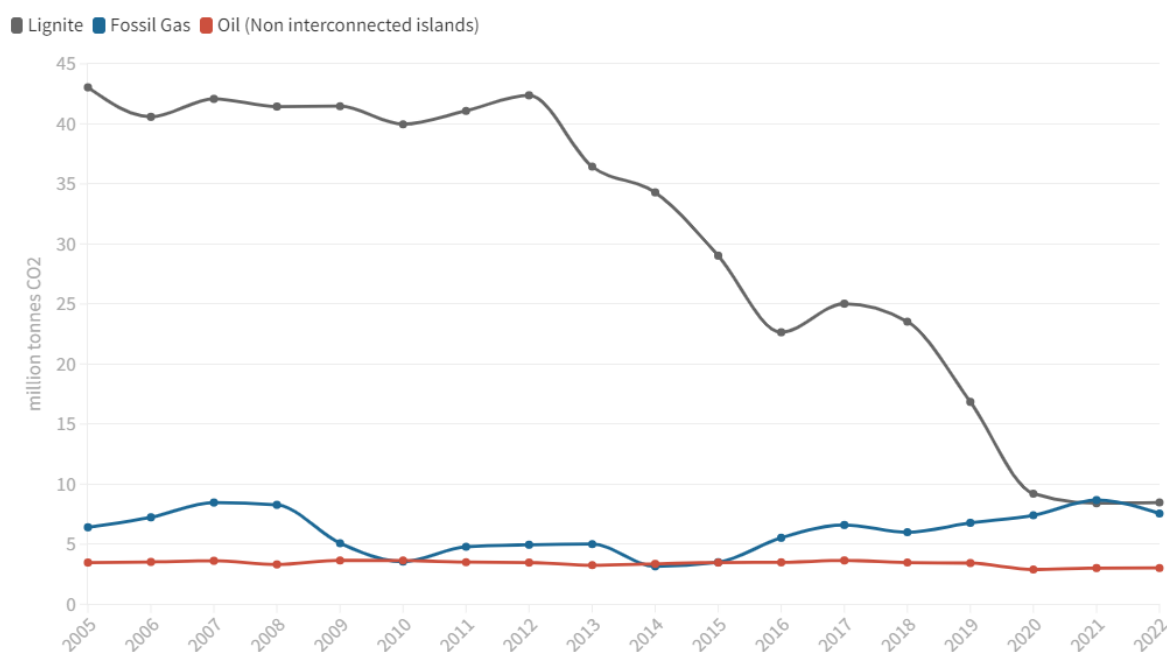
The milestone in this declining course was 2022, when the energy crisis peaked. In that year, RES (mainly wind and photovoltaic) became for the first time the main source of electricity production in Greece. Together with large hydro plants, they surpassed the cumulative contribution of lignite and fossil gas, meeting 46.7% of electricity demand in the interconnected grid and 50.1% of electricity production. In addition, the rapid growth in fossil gas use during 2019-2021 was halted in 2022, when gas contribution to electricity production fell by 14% compared to 2021. Moreover, despite announcements regarding a return to lignite, lignite-fueled electricity production increased by just 0.24 TWh or 4.6% compared to 2021¹⁰.

¹⁰ The Green Tank, 12.2022 "Trends in Electricity Production -December 2022" <https://bit.ly/42KL5Nr>

Combined, all the above changes in electricity production resulted in reducing the sector's emissions by 1 million tons, or 5.3% compared to 2021. In particular, emissions from fossil gas plants decreased by 13.6% compared to 2021, while emissions from lignite plants increased by 0.7%, a rate that fails to match the corresponding 4.6% increase seen in lignite-fired electricity production; this discrepancy can be attributed to the definitive withdrawal of the highly polluting plants of Kardia and Amyntaio in 2021¹¹. Emissions from oil-fired plants on islands -typically totaling approximately 3.4 million tons per year- presented a slight increase (4.7%) in 2022 compared to 2021, probably due to the revitalization of tourism following the pandemic. Finally, emissions from other plants in the sector -mainly small combined heat and power (CHP) plants aimed at meeting self-consumption needs- have remained stable, cumulatively emitting an average of approximately 0.27 million tons per year.

Despite the improvement noted in emissions from the electricity and heat production sector, the 19.3 million tons emitted in 2022 are a long way from the approximately 7 million tons projected in the National Energy and Climate Plan (NECP)¹² for 2030. Therefore, in order to meet the national climate goals, in the coming years, electricity production both in the interconnected grid and on the islands will have to shift more decisively towards renewables.

Electricity Production EU ETS Emissions in Greece



Source: Union Registry

Figure 6: Emissions by electricity and heat production fuel in Greece, from 2005 to 2022^{8,9}. Source: Union Registry

Industry

Cement manufacture and refineries constitute the two industrial sectors with the highest emissions in Greece. Between 2005 and 2022, cement production plants emitted 119.7 million tons, while refineries emitted 88.1 million tons (47.8% and 35.2% of total emissions,

¹¹ The Green Tank, 06.04.2021 "Official end for four of Greece's lignite units" <https://bit.ly/43Q3IB9>

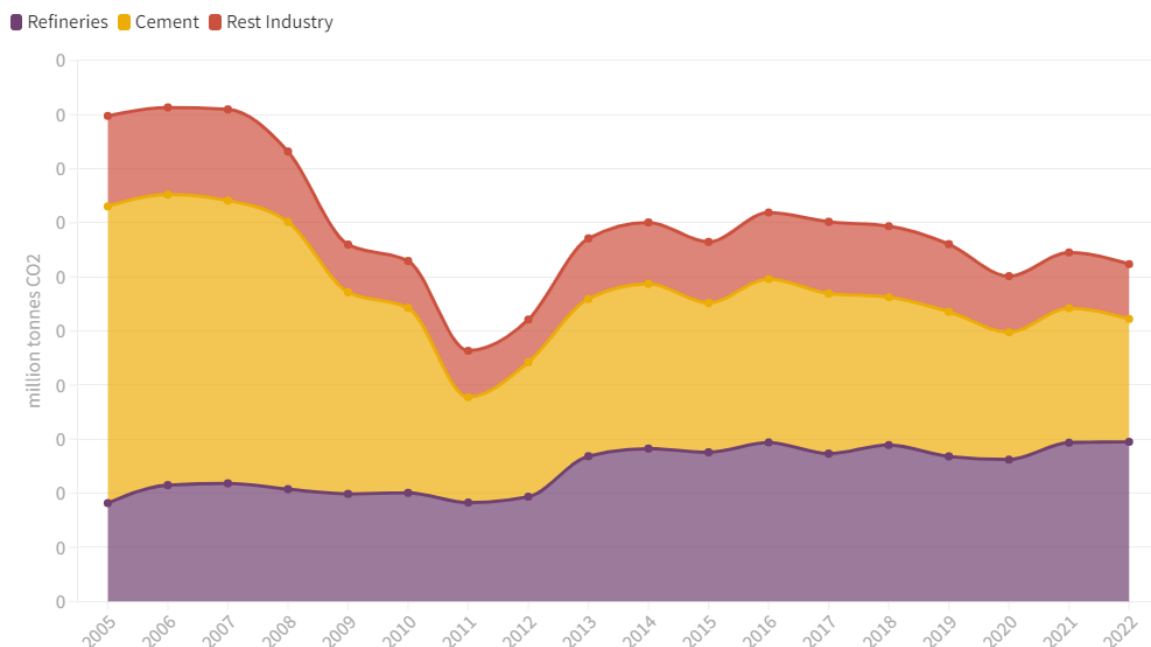
¹² Ministry of Environment and Energy, 12.2019, NECP, GG B/4893 <https://bit.ly/3MWN3e>

respectively). The remaining industrial activities (aluminum production, fertilizer production, mining, etc.) emitted cumulatively 42.5 million tons (17% of total emissions).

As illustrated in Figure 7, the first decrease in emissions coming from industry occurred in 2008, mainly driven by a decline in cement production and other industrial sectors (primarily aluminum production, mining and fertilizer production). Two years after the economic crisis hit Greece, emissions from cement units had decreased by 64.5% compared to 2005. In 2013, the sector was revitalized but emissions remained at lower levels compared to both 2009 and 2010; in fact, in the following 9 years, emissions from the cement industry never exceeded the levels recorded in 2010 (6.8 million tons). Refineries followed the opposite trend. Specifically, between 2005 and 2012, they emitted approximately 4 million tons per year, on average. However, the annual average emissions increased significantly in 2013, reaching 5.6 million tons, and have remained at these levels until today. Thus, even though cement production has been the major contributor to industrial emissions when looking at all years from 2005 to 2022 cumulatively, in recent years, this trend has been reversed. Consequently, in 2022, refineries held the largest share of the sector's emissions (47.3%), leaving cement production plants in second place (36.4%); the remaining industrial activities accounted for 16.3% of total emissions.

Compared to 2021, and despite the increasing trends noted in cement production in recent years¹³, it is in this sector that the largest reduction in emissions was recorded (-8.5%), while emissions from refineries remained stagnant (+0.4%). With regard to other industrial activities, aluminum production, mining, and fertilizers accounted for 5.5%, 3% and 2.1% of industrial emissions, respectively.

Greece's EU ETS Industry emissions by sector



Source: Union Registry

Figure 7: Greece's emissions from industrial installations included in the EU ETS from 2005 to 2022⁹. Source: Union Registry

¹³ Hellenic Cement Industry Association <https://bit.ly/3CBjXps>

Emissions by Activity

Comparing the course of emissions in all the aforementioned production activities from 2005 to 2022, it becomes evident (Figure 8) that lignite is the leading emitter every year, except for 2021, when fossil gas occupied the first place. Indicative of Greece's climate progress is the fact that in 2005, when the EU ETS was launched, emissions from lignite plants amounted to 43 million tons, which corresponds to an additional 31% of the total emissions in 2022 from all EU ETS sectors (32.9 million tons). Very far behind lignite, cement production constitutes the second most polluting activity throughout the whole period 2005-2022, followed by fossil gas, refineries, oil-fired electricity production and other industrial activities. This ranking was first disrupted in 2010, with refineries overtaking the position of fossil gas; in 2011, however, the latter climbed to 2nd place, to which it returned in 2017. Fossil gas maintained this position until 2020, then briefly took the lead in 2021, to fall back behind lignite in 2022, slightly up compared to 2005 (+1.1 million tons). Similarly, refineries saw an increase of 2.2 million tons of emissions compared to 2005. In contrast, cement production units and oil-fired plants -ranking 4th and 5th, respectively- have reduced emissions compared to 2005 (-6.4 and -0.4 million tons, respectively). Finally, the aviation sector has ranked last continuously since 2012, the year of its official inclusion in the EU ETS.

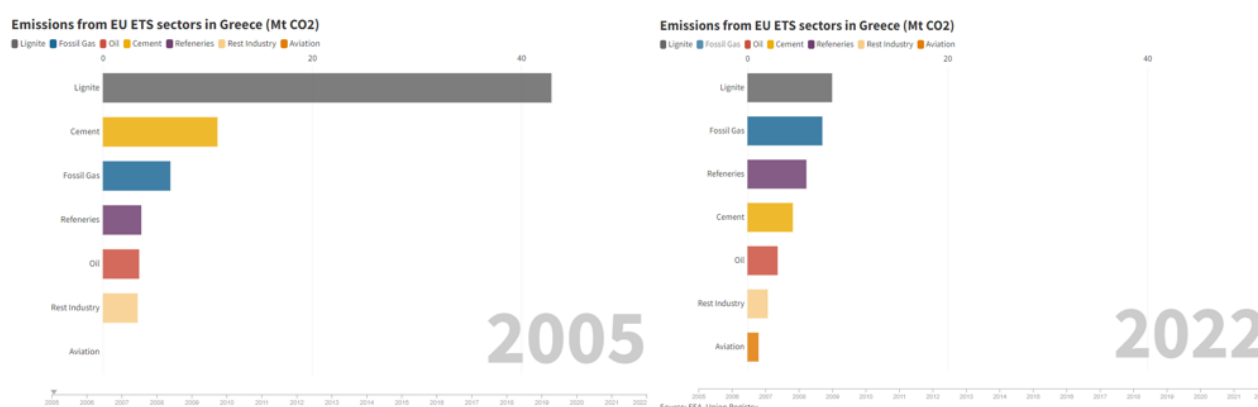


Figure 8: Annual emissions by sector in Greece for 2005 (left) and 2022 (right)¹⁴.

Top 10 Polluters

The significant changes recorded in the activities covered by the EU ETS are also reflected in the shifts observed in the ranking of the top ten polluters in Greece. In 2005, this list comprised of seven lignite plants, one fossil gas plant -the Lavrio thermal power plant (TPP)- and two cement production units, Titan-Boeotia and the Heracles G.C.C- Volos. From 2012 to 2018, fossil gas was absent from the 'top ten', only to return in 2019 with the reappearance of a high-efficiency combined heat and power (CHP) plant (Aluminium).

In 2022, the top four places were occupied by the Agios Dimitrios TPP and three refineries: Motor Oil in Korinthos, ELPE in Elefsina and ELPE in Aspropyrgos. While the top three were exactly the same as in 2021, ELPE's refineries in Aspropyrgos moved up one place in 2022.

¹⁴ This figure presents just two snapshots of an animation illustrating emissions for all years from 2005 to 2022. <https://bit.ly/3NoFC9I>

Since the EU ETS launch in 2005 to date, the country's largest lignite plant, Agios Dimitrios TPP, has steadily ranked first in terms of emissions; in 2022, it accounted for 5.87 million tons, which, nonetheless, represent a reduction of 7.76 million tons (-57%) compared to 2005. Specifically, from 2012 to 2020, the plant's emissions followed a steady downward course, and only partially increased in 2021, as Agios Dimitrios TPP covered part of the electricity production contributed by the TPPs of Amyntaio and Kardias in the previous years¹¹.

The two cement production units that complete the 'top ten' in 2022 rank 6th (Titan- Boeotia) and 10th (Heracles G.C.C Volos); both were on this list in 2005 as well. Finally, with regard to fossil gas plants, Aluminium ranked 7th, moving up from the 10th place (2021), followed by Megalopolis 5 and Lavrio TPP, whose emissions were reduced by 23% during the 2022 energy crisis.

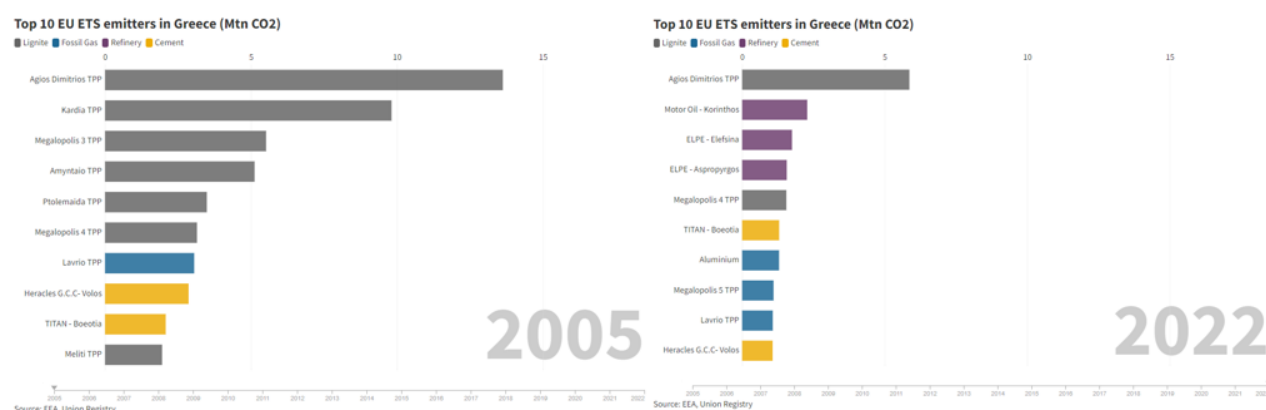


Figure 9: Annual emissions per plant in Greece in 2005 (left) and 2022 (right)¹⁵.

Summary - Conclusions

The marginal decline of EU emissions (-0.4%) in the EU ETS sectors over the past year can be mainly attributed to energy-intensive industry, as the latter offset the increase in emissions from heat and electricity production and aviation. Overall, 9 out of 27 Member States saw an increase in emissions in 2022 compared to 2021.

Compared to the baseline year (2005), in 2022, Greece achieved a 57.1% decrease in emissions from all installations in the sectors of electricity and heat production and energy-intensive industry; this performance puts Greece in the 6th place in the EU-27 ranking, 12 places above the EU-27 average (-37.9%). Compared to 2021, total emissions in Greece from all three EU ETS sectors show a 3.2% decline, which is significantly superior to the corresponding feeble decrease (-0.4%) recorded in the EU-27.

In absolute terms, in 2022, the EU ETS sectors in Greece cumulatively emitted 32.9 million tons. Despite the energy crisis, emissions in 2022 were lower than in 2021 (34 million tons) and well below the 71.3 million tons emitted in 2005. The 2022 performance was the country's second best after 2020, when Greece's EU ETS installations emitted a total of 32.2 million tons.

¹⁵ This figure presents just two snapshots of an animation illustrating emissions for all years from 2005 to 2022. <https://bit.ly/3qIgwL1>

The largest contribution to the country's progress towards cutting EU ETS emissions was made by the electricity and heat production sector, which has over time held the lion's share among the three sectors covered by the EU ETS. Between 2005 and 2022, Greece reduced emissions in this sector by 63.9%, well above the EU-27 corresponding average (-35%). This performance was overwhelmingly driven by the decline of electricity production from lignite-fired power plants; throughout the 17 years of EU ETS operation, the latter have cut their emissions by 80.3%. Specifically, in 2022, and despite the energy crisis, emissions from the heat and electricity production sector decreased by 5.3% compared to 2021, due to the substitution of fossil fuels - and in particular fossil gas- by RES. As a result, the sector's emissions reached an all-time low of 19.3 million tons, which is, nonetheless, a long way from the target set by the NECP for 2030 (7 million tons).

The industrial sector emitted a total of 12.5 million tons of CO₂ equivalent in 2022, which represents a 30.5% cut compared to 2005, once again exceeding the corresponding decrease in the EU-27 (-10%). However, this decline in emissions between 2005 and 2022 was driven to a greater extent by the economic crisis that hit Greece since 2009, rather than by systemic changes in production processes. Compared to 2021, industrial emissions in Greece were reduced by 3.3%; this decrease fails to match the corresponding EU-27 average (-6.4%). Interestingly, despite a growth in production, the largest decrease in emissions was recorded in the cement industry (-8.5%), which holds the second largest share of total industrial emissions in Greece (36.4% in 2022). Emissions from refineries -which have the lead in industrial emissions with 47.3% in 2022- remained stagnant (+0.4%). With regard to other industrial activities, in 2022, 5.5% of emissions came from aluminum production, 3% from mining and 2.1% from fertilizer production.

As in the case of the EU-27, but even more pronounced in Greece, the largest fluctuations across EU ETS sectors are observed in intra-EEA aviation. With 1.1 million tons emitted in 2022, the aviation sector in Greece showed a 54.7% increase compared to 2013, despite having 'suffered' a heavy blow (-60%) from 2019 to 2020, due to the pandemic crisis. In 2022, just two years after the 2020 minimum, sector emissions surged by 129.1%, approaching 2019 pre-pandemic levels; this increase is significantly greater than that recorded in the EU-27 (+95.3%).

Despite lignite production being phased out, lignite plants still have the highest emissions among all EU ETS sectors with 8.5 million tons. Fossil gas plants -following a peak in 2021- fell to 2nd place with 7.5 million tons and are followed by refineries (5.9 million tons), cement production (4.5 million tons) and oil-fired electricity production (3 million tons).

In 2022, the top four polluters in Greece were the Agios Dimitrios lignite plant -the enduring leader of this list- and three refineries: Motor Oil in Korinthos, ELPE in Elefsina and ELPE in Aspropyrgos. Another lignite plant, Megalopolis 4 TPP, occupied the 5th position, while three fossil gas plants (Aluminium, Megalopolis 5 TPP and Lavrio TPP) ranked 7th, 8th and 9th, respectively. Finally, the 2022 'top ten' also included two cement production units, namely, Titan-Boeotia (6th place) and Heracles G.C.C in Volos (10th place); both were on this list in 2005 as well.

The EU ETS reforms -completed in December 2022- guarantee that carbon prices will remain at very high levels throughout the 4th phase of the EU ETS, which ends in 2030. Together with the phasing-out of free allowances to industry, they are expected to further drive down emissions from EU ETS sectors in Greece. Nevertheless, in the electricity & heat production and energy-

intensive industry sectors, Greece's performance to date remains a long way from the climate target set for 2030 in the first National Climate Law and, in particular, in the National Energy and Climate Plan. Reducing the carbon footprint of these two key sectors requires, therefore, a more proactive national energy and industrial policy. The preparation of the respective sectoral carbon budgets -which, according to the National Climate Law, shall be finalized in 2024 for the five-year period 2026-2030- and the revision of the NECP will both play a key role in this direction.

