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EMISSION ALLOWANCES, ETHICAL ASPECTS, AND IMPACTS ON PUBLIC HEALTH – A REVIEW

COTAS DE EMISSÃO, ASPECTOS ÉTICOS E IMPACTOS NA SAÚDE PÚBLICA – UMA REVISÃO

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Abstract
Air pollution represents one of the most significant environmental determinants of public health in modern industrial societies. High concentrations of pollutants generated by the combustion of fossil fuels have long been associated with increased morbidity and mortality in the population. The European Union's primary and common tool for environmental protection is the European Union Emissions Trading System (EU ETS). However, its implementation and application raise serious ethical dilemmas regarding the interrelationships between human responsibility for the environment, well-being, and the health of the population. The authors of this article have reflected on these dilemmas and set a research objective: to examine the current state of affairs and identify the best possible solutions. After conducting research and a qualitative analysis of expert sources relevant to the topic, the authors reflect on the connections between emissions

Resumo
A poluição atmosférica representa um dos determinantes ambientais mais significativos para a saúde pública nas sociedades industriais modernas. As altas concentrações de poluentes geradas pela combustão de combustíveis fósseis têm sido, há muito tempo, associadas ao aumento da morbidade e da mortalidade na população. A principal e comum ferramenta da União Europeia para a proteção ambiental é o Sistema de Comércio de Emissões da União Europeia (EU ETS). No entanto, sua implementação e aplicação levantam sérios dilemas éticos relativos às inter-relações entre a responsabilidade humana pelo meio ambiente, o bem-estar e a saúde da população. Os autores deste artigo refletiram sobre esses dilemas e estabeleceram um objetivo de pesquisa: examinar a situação atual e identificar as melhores soluções possíveis. Após realizar uma pesquisa e uma análise qualitativa de fontes especializadas relevantes para o tema, os

allowances, the health of the population, and the need for fair distribution and protection of the economically vulnerable segment of the EU population. The qualitative analysis conducted demonstrates a direct link between the introduction of emission allowances and improvements in public health, alongside the need to provide financial subsidies to economically vulnerable segments of the population, with the aim of eliminating adverse health consequences associated with poverty and threats to well-being. The ethical debate on emissions trading systems can be simply interpreted as a tension between two fundamental normative principles of public policy: the principle of harm prevention and the principle of distributive justice.

Keywords: Emissions Allowances. Environment. Ethical Aspects. Public Health. Harm Prevention. Environmental Law. Distributive Justice.

autores refletem sobre as conexões entre as licenças de emissão, a saúde da população e a necessidade de distribuição justa e proteção do segmento economicamente vulnerável da população da UE. A análise qualitativa realizada demonstra uma ligação direta entre a introdução de licenças de emissão e melhorias na saúde pública, juntamente com a necessidade de fornecer subsídios financeiros aos segmentos economicamente vulneráveis da população, com o objetivo de eliminar consequências adversas à saúde associadas à pobreza e ameaças ao bem-estar. O debate ético sobre os sistemas de comércio de emissões pode ser simplesmente interpretado como uma tensão entre dois princípios normativos fundamentais da política pública: o princípio da prevenção de danos e o princípio da justiça distributiva.

Palavras-chave: *Licenças de Emissão. Meio Ambiente. Aspectos Éticos. Saúde Pública. Prevenção de Danos. Direito Ambiental. Justiça Distributiva.*

1 INTRODUCTION

Air pollution is one of the most significant environmental determinants of public health in modern industrial societies. High concentrations of pollutants generated by the combustion of fossil fuels have long been associated with increased morbidity and mortality in the population. The most significant pollutants include, in particular, fine particulate matter PM2.5, sulfur dioxide (SO_2), nitrogen oxides (NO_x), and ground-level ozone, which are primarily emitted by the energy sector, transportation, and industrial production (Basaglia *et al*., 2024). Epidemiological research over the past three decades demonstrates a strong association between long-term exposure to these substances and the incidence of cardiovascular disease, chronic respiratory diseases, asthma, ischemic heart disease, and premature mortality. For example, large-scale meta-analyses published in medical journals show that long-term exposure to fine particulate matter PM2.5 significantly increases the risk of myocardial infarction, stroke, and chronic obstructive pulmonary disease (Tobias Aurelio *et al*., 2025). According to estimates by the World Health Organization (WHO), air pollution causes approximately seven million premature deaths worldwide each year. These health impacts, however, do not arise solely as an individual health problem but represent a systemic externality associated with economic production based on the combustion of coal, oil, and natural gas (Fernandez *et al*., 2025). The costs of these externalities are generally not included in the market price of energy and are passed on to healthcare systems, public budgets, and the population itself. In economic theory, this phenomenon is referred to as a negative externality. A negative externality arises when the economic activity of one entity imposes costs on other entities without these costs being incorporated into the market pricing mechanism (Guo *et al*., 2025). In the case of fossil fuel combustion, these are primarily health externalities resulting from the emission of pollutants into the atmosphere. Policies aimed at reducing greenhouse gas emissions, including in particular emissions trading schemes, can partially internalize these externalities through a price signal (Bayer, 2020). The introduction of a carbon price increases the costs of emission-intensive production, creating an economic incentive to reduce emissions and transition to less polluting technologies. However, current research shows that climate policy not only affects greenhouse gas concentrations but also generates significant so-called health co-benefits (Libin Cao, 2021). These co-benefits arise from the reduction of local air pollutants, which are produced alongside greenhouse gases during the combustion of fossil fuels. Model studies published in the journals *Nature Climate Change* and *The Lancet Planetary Health* show that policies aimed at reducing emissions can lead to a significant decrease in concentrations of PM2.5, SO_2, and NO_x, which in turn translates into lower mortality and morbidity in the population (Shindell *et al*., 2018; Vandyck *et al*., 2022). Some models even suggest that the health benefits associated with improved air quality may, in the short term, outweigh the economic costs of climate measures. From this perspective, the debate over emissions allowances extends beyond the realm of climate policy and becomes a matter of public health as well. The fundamental question, therefore, is not only whether emissions permits affect the global climate, but also whether their introduction—or lack thereof—has direct and indirect consequences for the health of the population. These impacts must be assessed across several analytical dimensions. The first level concerns the direct effect on air quality, i.e., changes in pollutant concentrations resulting from reduced emissions. The second level consists of indirect economic impacts, particularly the influence of climate policies on energy prices and their effects on households and industry. The third level consists of the distributional aspects of these policies, namely the question of how the costs and benefits of climate regulation are distributed among different socioeconomic groups of the population.

Together, these three dimensions form an analytical framework within which not only the environmental effectiveness of emissions permits but also their ethical and social consequences can be assessed. In this article, therefore, the issue of emissions permits is analyzed from the perspectives of health externalities, distributive justice, and the political economy of regulation. The authors of this study employed qualitative analysis as their research method, with the aim of identifying the extent to which emissions trading systems can contribute to improving the health of the population and what ethical issues are associated with these policies.

2 MATERIALS AND METHODS

The primary scientific methods of this study are literature review, theoretical research, and qualitative analysis of theoretical sources (Harman, 2018). The literature review and subsequent qualitative analysis involve searching for relevant sources in representative databases such as Web of Science, Scopus, and Open Access, studying materials, comparing them, and selecting and applying research findings (Bailey and Shingruf, 2024). Given the publication's theoretical ethical-philosophical focus, the authors chose a structure divided into logical chapters and subchapters. This style of presentation is appropriate in the philosophical disciplines of environmental philosophy and environmental ethics (Lang, 1988). This theoretical literary form also allows for the presentation of the author's subjective ideas, unlike in the exact sciences.

3 RESULTS

This chapter presents the results of a qualitative analysis of relevant scientific sources and is divided into individual sections based on the topic under study.

3.1 Theoretical framework: externalities, carbon pricing, and public health

The theoretical foundation of the issue of emission allowances is based on classical economic theory of externalities, which analyzes situations where the economic activity of one entity generates costs or benefits for other entities without these effects being reflected in market prices (Reyes-Garcia, 2025). In the case of fossil fuel combustion, a complex set of negative externalities arises, encompassing not only climate impacts in the form of greenhouse gas emissions but also local health impacts caused by emissions of air pollutants.

The basic analytical framework for addressing externalities was formulated by Arthur C. Pigou in his work *The Economics of Welfare* (1920). Pigou pointed out that in situations involving negative externalities, market failure occurs because private production costs are lower than social costs. As a result, there is overproduction of goods whose production generates externalities. Economic theory therefore recommends internalizing externalities through regulatory instruments that shift social costs back to producers.

One of the most significant tools for internalizing environmental externalities is carbon pricing. This can take the form of a carbon tax or an emissions trading system. While a carbon tax sets a fixed price for emissions, emissions trading systems create a market mechanism in which the total amount of emissions is capped and the price of emissions is determined by the supply and demand for allowances (Zheng *et al*., 2026).

In the European context, the EU ETS (European Union Emissions Trading System), introduced in 2005, is a key climate policy tool. This system operates on the "cap and trade" principle, whereby the regulatory authority sets a maximum emission limit for specific economic sectors, and companies must hold emission allowances corresponding to the amount of emissions they release. If a company reduces its emissions below the allocated limit, it can sell the surplus allowances to other entities on the market (Wang *et al*., 2021).

The economic logic of this system is that emissions reductions occur where it is most economically efficient. Firms with low emission reduction costs have an incentive to cut emissions and sell allowances, while firms with higher costs can buy allowances. This minimizes the total cost of achieving the environmental goal (Wennick, 2023).

From a public health perspective, however, it is crucial that measures aimed at reducing greenhouse gas emissions often simultaneously lead to a reduction in emissions of local pollutants. This phenomenon is referred to as the health co-benefit of climate policy. Reducing the burning of coal and other fossil fuels leads not only to lower carbon dioxide emissions but also to a decrease in emissions of PM2.5 particles, nitrogen oxides, and other substances that have a direct impact on human health (Bredin and Muckley, 2011).

Research published in the field of environmental epidemiology shows that even a relatively small reduction in concentrations of fine particulate matter can have a significant impact on the health of the population. For example, a study published in the journal *Nature Climate Change* (Shindell *et al*., 2018) shows that policies reducing greenhouse gas emissions can simultaneously lead to a significant reduction in premature mortality associated with air pollution. Similar conclusions are also presented in a modeling study published in *The Lancet Planetary Health*, which analyzes the health benefits of European climate policy (Vandyck *et al*., 2022).

From an economic perspective, these health benefits can be interpreted as an additional societal benefit of climate measures. If these benefits were fully incorporated into the economic evaluation of climate policies, they could significantly alter the resulting cost-benefit assessment of individual regulatory instruments (Menon-Choudhary and Shukla, 2009).

However, in addition to environmental effectiveness, emissions trading systems also raise questions of distributional justice. This is because increases in the price of emissions often translate into higher energy prices, which can have a disproportionate impact on lower-income households. Energy expenses constitute a relatively larger share of the budget for low-income households, and therefore these groups may be affected more significantly by climate regulation than households with higher incomes (Azar and Johansson, 2025).

This problem is referred to in the literature as the regressivity of climate policies. If climate regulation is not accompanied by compensatory mechanisms, it can lead to an increase in social inequalities. For this reason, the political economy of climate regulation increasingly discusses how to design redistributive mechanisms that would mitigate the social impacts of carbon pricing (Corburn, 2001).

Among the most frequently discussed tools are, for example, the use of revenues from emission allowances to finance social compensation, investments in household energy efficiency, or direct financial transfers to the population. These mechanisms can reduce the negative impacts of climate policies on vulnerable population groups while simultaneously increasing the political acceptability of these measures (Wiese *et al*., 2020).

The theoretical framework for analyzing emissions trading cannot therefore be reduced solely to the question of economic efficiency. It is also necessary to take into account the broader contexts of public health, social justice, and the political economy of regulation. Emissions trading represents not only an environmental policy tool but also a mechanism that redistributes economic costs and benefits among various societal actors.

For this reason, when evaluating these policies, it is essential to analyze not only their impact on greenhouse gas emissions but also their broader health and social consequences. It is precisely these dimensions that form the key analytical framework for the subsequent sections of this study.

3.2 Health externalities of air pollution

Health externalities associated with air pollution are among the best empirically documented environmental externalities in current scientific literature. The combustion of fossil fuels in the energy sector, industry, and transportation produces a wide range of pollutants that have a direct impact on human health. The most significant of these are fine particulate matter (PM2.5), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and secondary aerosols formed by chemical reactions in the atmosphere (Sakulniyomporn *et al*., 2011).

Fine particulate matter PM2.5 is considered one of the most dangerous components of air pollution because its very small diameter allows it to penetrate deep into the respiratory system and subsequently into the bloodstream. Long-term exposure to these particles is associated with an increased risk of cardiovascular disease, ischemic heart disease, stroke, and chronic respiratory diseases. Epidemiological studies also show that air pollution may contribute to the development of metabolic diseases, including type 2 diabetes (Zheng *et al*., 2026).

A major review of epidemiological studies published in the scientific journal *The Lancet Commission on Pollution and Health* states that air pollution is one of the leading environmental risk factors for mortality at the global level. According to this analysis, pollution causes approximately nine million premature deaths annually, with the majority of these deaths linked specifically to air pollution caused by the combustion of fossil fuels (Landrigan *et al*., 2018).

Other large-scale studies confirm that the relationship between PM2.5 concentrations and health impacts is largely linear even at relatively low concentrations. This means that even a small reduction in the concentration of these particles can yield significant health benefits at the population level. This fact has fundamental implications for environmental policy, as it suggests that even relatively modest regulatory measures can lead to measurable improvements in public health (Yan *et al*., 2024).

However, the health externalities of air pollution cannot be understood solely as a problem of individual health risk. These externalities also have significant economic impacts, manifesting in increased healthcare costs, lower labor productivity, and higher rates of work disability. Studies published in the field of environmental economics estimate that the economic costs associated with the health impacts of air pollution can reach several percent of gross domestic product in industrialized countries (Brandt *et al*., 2013).

Economic assessments of these externalities often use the concept of the "Value of a Statistical Life" (VSL), which allows for the conversion of reduced mortality into an economic value. This approach is commonly used, for example, in cost-benefit analyses of environmental regulations. When the health benefits of reducing air pollution are included in these analyses, it often turns out that the overall benefits of environmental measures can exceed their economic costs (St-Amour, 2024).

In the context of climate policy, it is important to note that a large portion of greenhouse gas emissions arises from the same processes that also produce local pollutants. Measures aimed at reducing carbon dioxide emissions thus often simultaneously lead to a reduction in emissions of substances that have a direct impact on public health. This effect creates a so-called synergy between climate policy and public health policy (Fox *et al*., 2019).

Model studies analyzing the impacts of climate measures show that reducing emissions in the energy and transportation sectors can significantly improve air quality, particularly in urbanized areas. The high population density in these areas means that emission reductions can yield relatively large health benefits per unit of reduced emissions (Fine *et al*., 2025).

However, health externalities are not distributed evenly across the population. Empirical research shows that higher exposure to air pollution often affects socially and economically vulnerable groups. Low-income households and marginalized communities are more likely to live in areas with higher concentrations of industrial emission sources or near major transportation corridors. This reality creates environmental inequalities that have significant social and ethical implications (Alfaro *et al*., 2022).

From the perspective of the political economy of regulation, it is therefore important to analyze not only the overall health benefits of environmental measures but also their spatial and social distribution. Policies to reduce emissions may have different impacts across regions and on different population groups. Some regions may benefit more from improved air quality than others, while others may be more affected by the economic impacts of the energy transition (Everett *et al*., 2025).

An analysis of the health externalities of air pollution thus provides a key argument for regulating emissions not only from an environmental perspective but also from a public health perspective. If these externalities are included in the evaluation of public policies, emissions regulation becomes not only a tool for climate protection but also a tool for disease prevention and improving the health of the population.

In this context, emissions trading systems can be understood as a mechanism that can indirectly contribute to reducing health externalities through economic incentives to reduce emissions. Evaluating these systems therefore requires not only an analysis of their environmental effectiveness but also of their impacts on public health and social justice.

3.3 How the ETS works: from carbon pricing to health

Emissions trading systems represent one of the most significant market-based tools of environmental regulation. Their underlying mechanism is based on the economic theory of internalizing negative externalities. Emissions of greenhouse gases and other pollutants are a typical example of an externality, where energy producers or industrial enterprises do not incorporate the full social costs associated with the environmental and health impacts of their activities into the prices of their products (Shiyan Chang, 2020).

The introduction of a carbon price through an emissions trading system increases the marginal costs of emission-intensive production. Companies are subsequently incentivized to reduce emissions, either through technological innovations, improving energy efficiency, or substituting coal and other fossil fuels with lower-emission energy sources. This mechanism creates economic pressure for the gradual decarbonization of the energy sector and industrial production (Cuevas *et al*., 2024).

From the perspective of economic theory, this process is considered an effective way to achieve environmental goals, as emissions reductions occur where they are least costly. Firms with lower costs of reducing emissions have an incentive to cut emissions and sell surplus allowances on the market, while firms with higher costs can purchase allowances. The total emissions cap set by the regulator ensures that the total amount of emissions does not exceed the established ceiling (Biancalani *et al*., 2024).

Empirical evidence from the European Union shows that this mechanism is not merely a theoretical construct but has measurable environmental impacts. An analysis by Basaglia, Grunau, and Drupp (2024), published in the journal *Proceedings of the National Academy of Sciences (PNAS)*, shows that the EU ETS has led to a statistically significant decline in emissions of several key pollutants, including sulfur dioxide (SO_2), nitrogen oxides (NO_x), and fine particulate matter PM2.5. These pollutants are of critical importance to public health because they are directly linked to an increased risk of cardiovascular and respiratory diseases.

Particular attention in the epidemiological literature is devoted to fine particulate matter PM2.5. These particles represent one of the most dangerous components of air pollution, as their very small size allows them to penetrate deep into lung tissue and subsequently into the bloodstream. Long-term exposure to PM2.5 is associated with an increased risk of ischemic heart disease, strokes, chronic respiratory diseases, and premature mortality (Lu *et al*., 2019).

In addition to reducing local pollutants, there is also extensive empirical evidence on the EU ETS's impact on greenhouse gas emissions. A study by Bayer and Aklin (2020), also published in *PNAS*, estimates that the introduction of the EU ETS led to a reduction in carbon dioxide emissions of approximately 10 to 15 percent compared to a scenario without this regulation. Similar results are also achieved by a more recent empirical analysis by Biancalani *et al*. (2024), published in the journal *Scientific Reports*, which reports an approximately 15 percent decline in emissions compared to a counterfactual scenario.

From a public health perspective, however, it is crucial to emphasize an aspect that is often mentioned only marginally in the economic literature. Emissions trading systems are not merely a climate policy tool but can also function as an indirect health intervention. Reductions in greenhouse gas emissions in the energy sector and industry are closely linked to reductions in emissions of local pollutants, which have a direct impact on public health.

This synergistic effect between climate policy and public health protection was analyzed, for example, in a systematic review published by Cuevas *et al*. (2024). The authors show that policies reducing fossil fuel emissions lead to improved air quality, which in turn results in a decrease in the incidence of cardiovascular diseases, a reduction in the number of asthma exacerbations, and a decline in premature mortality in the population.

Similar conclusions are also confirmed by studies analyzing emissions trading systems in other institutional and economic contexts. Chinese ETS pilot programs provide interesting empirical data, as they allow for the observation of the impacts of these policies in a rapidly industrializing economy with relatively high levels of air pollution.

For example, the study by Shao *et al*. (2022) analyzes the health impacts of pilot ETS programs and shows a statistically significant decline in infant mortality in regions where these programs were implemented.

An economic evaluation of these health impacts suggests that the benefits of improved air quality may, in some cases, offset the macroeconomic costs associated with climate regulation. The study by Yang, Xie *et al*. (2023), for example, quantifies that the health benefits resulting from reduced air pollution can significantly exceed the economic costs of implementing emissions policies.

From an epidemiological perspective, it is crucial that the relationship between PM2.5 concentrations and mortality is approximately linear across a wide range of concentrations. This means that even a relatively small reduction in the concentrations of these particles can lead to a measurable reduction in health risks among the population. This fact has fundamental implications for the evaluation of environmental policies, as it suggests that even a relatively small percentage reduction in emissions can generate disproportionately large health benefits (Pisoni *et al*., 2023)

The mechanism of action of emissions trading systems can thus be understood as a chain of causal relationships that begins with the introduction of a carbon price and ends with an improvement in the health of the population. The price of emissions creates economic pressure to reduce the emission intensity of production, which leads to a reduction in both greenhouse gas emissions and local pollutants. The resulting improvement in air quality then yields health benefits in the form of lower morbidity and mortality (Vandyck *et al*., 2018).

From this perspective, emissions trading systems can be interpreted not only as a tool for climate regulation but also as an indirect mechanism for protecting public health. An assessment of their effectiveness should therefore include not only environmental indicators but also health impacts, which represent a significant component of the overall societal benefits of these policies.

3.4 Counterfactual scenario: the health cost of inaction

The debate on emissions trading is often conducted primarily in terms of the economic costs of climate regulation. The discussion focuses on issues of industrial competitiveness, energy prices, or impacts on households. From this perspective, regulatory tools are sometimes interpreted as an intervention in market functioning that generates additional economic costs. However, this framework often overlooks one crucial fact: the absence of regulation is not a neutral state. Inaction in the area of emissions regulation represents an implicit policy decision that has its own economic, environmental, and health consequences (Shao *et al*., 2022).

For the analytical evaluation of environmental policies, it is therefore important to use counterfactual scenarios—that is, model situations that estimate how emissions, air quality, and health impacts would have evolved had regulatory measures not been implemented. These scenarios allow for a comparison of actual policy outcomes with hypothetical developments in the absence of regulation, thereby quantifying the real benefits of environmental measures (Bull *et al*., 2014).

Research published in the fields of climate economics and environmental epidemiology shows that scenarios without climate policy could have significant health impacts on a global scale. The study by Pisoni *et al*. (2023), published in the journal *Environment International*, analyzes various emission scenarios in Europe and shows that the absence of climate measures would lead to significantly higher concentrations of air pollutants. These concentrations would subsequently lead to a higher incidence of respiratory and cardiovascular diseases and an increase in premature deaths.

The study's authors point out that climate policies generate significant health benefits precisely through improvements in air quality. If these policies were not implemented, it would mean maintaining or even worsening current pollution levels. On a global scale, scenarios without climate policies could thus lead to millions of additional premature deaths annually, particularly in regions with high dependence on fossil fuels.

Similar conclusions are also drawn by the study by Shindell *et al*. (2018) published in the journal *Nature Climate Change*. The authors analyze the health impacts of various climate policy scenarios and conclude that delaying regulatory measures can lead to a significant increase in health risks associated with air pollution. Model calculations show that delays in implementing climate policies lead to higher concentrations of fine particulate matter and other pollutants, which in turn result in higher morbidity and mortality.

From a public health perspective, therefore, inaction represents a specific form of cost that is not always explicitly included in policy debates. If regulatory measures are not implemented, this implies an implicit acceptance of a higher health burden on the population. This burden manifests itself not only in the form of premature deaths but also in an increased incidence of chronic diseases, higher hospitalization rates, and greater pressure on healthcare systems (Weishaar, 2007).

Another important aspect of the counterfactual scenario is the distribution of these health impacts within society. Empirical research shows that the environmental burden associated with air pollution is not distributed evenly. Socially and economically vulnerable groups are often exposed to higher levels of pollution than other segments of the population. Low-income households and marginalized communities often live in areas with higher concentrations of industrial emission sources or near major transportation corridors (Derambarsh, 2024).

This phenomenon is referred to in the literature as environmental inequality or environmental injustice. Environmental inequalities arise when environmental risks and burdens are systematically concentrated in certain social or geographic groups of the population. In the context of air pollution, this means that some communities are exposed to a higher health burden than others (Najafi *et al*., 2025).

The inaction scenario can thus have a twofold negative impact. On the one hand, it leads to a higher overall health burden in the population because pollutant emissions are not reduced. On the other hand, it can reproduce or even exacerbate existing social inequalities, as it is often the economically vulnerable groups of the population that are most affected.

From the perspective of public policy ethics, therefore, emissions regulation cannot be evaluated solely on the basis of its direct economic costs. It is also necessary to take into account the costs of inaction, which manifest themselves in the form of health impacts and social inequalities. When these factors are included in the analysis, the perspective on the evaluation of climate policies changes.

Emissions regulation then represents not only an environmental or climate intervention, but also a tool for preventing health risks and a potential mechanism for reducing environmental inequalities. A counterfactual scenario without regulation thus provides an important analytical framework for understanding the true costs and benefits of climate policies, including emissions trading systems.

3.5 High permit prices and the regressive effect

Emissions trading systems function as a pricing tool for environmental regulation. The introduction of a carbon price through emissions permits increases the costs of emission-intensive production and creates economic pressure to reduce emissions. This mechanism is based on the principle of internalizing negative externalities, whereby environmental costs are gradually reflected in the prices of energy, industrial production, and other economic activities (World Bank, 2022).

At the same time, however, this mechanism creates indirect distributional impacts in the economy. Increases in the price of emission allowances are typically passed on to higher prices for electricity, heat, and energy-intensive goods. Energy costs are a significant component of the household consumption basket, meaning that changes in energy prices can have a significant impact on their real incomes.

In the literature on public finance, this type of policy is often analyzed through the concept of regressivity. A regressive policy is one whose relative impact is greater on low-income households than on households with higher incomes. The reason is that lower-income households typically spend a larger share of their budget on basic necessities such as energy, housing, or food (Bah *et al*., 2020).

The analysis of the impacts of pricing instruments on public health has certain parallels in the literature on health taxes, such as taxes on tobacco, alcohol, or sugary drinks. These taxes are also often described as regressive because they place a relatively greater burden on low-income households. At the same time, however, there is extensive empirical evidence that they can yield significant health benefits.

For example, the study by Wright *et al*. (2017) shows that indirect health taxes may be regressive in terms of their short-term impact on household income, yet they can simultaneously contribute to improved health outcomes in the long term. This is because such policies alter price signals in the economy and reduce the consumption of products associated with negative health impacts.

A similar mechanism has been observed, for example, with tobacco taxes. A study by Bannon *et al*. (2025) shows that increases in tobacco taxes have led to a decline in child mortality and a reduction in health inequalities among social groups in a number of countries. This effect arises primarily because price sensitivity of consumption is often higher among low-income groups, leading to more pronounced behavioral changes.

At the same time, however, the literature points out that without adequate compensatory mechanisms, price-based tools can also have negative social impacts. Honoré *et al*. (2011) note that additional taxation or price burdens may in some cases worsen the living conditions of low-income households if not accompanied by redistributive policies. In an environment of economic vulnerability, an increase in the cost of living can lead to reduced spending on health, nutrition, or housing.

Another significant factor is the broader socioeconomic context. Case and Kraftman (2024) note that income inequality is one of the key determinants of the population's health status. Higher levels of economic inequality are often associated with poorer health outcomes, higher mortality, and a greater burden of chronic diseases.

In the context of emissions allowances, an indirect mechanism may therefore arise that, under certain conditions, could negatively impact the health of low-income groups. This mechanism can be analytically described as a chain of several interrelated effects.

The first step is an increase in energy prices resulting from rising emission allowance prices. Energy companies and industrial firms often pass these costs on to end-user prices for electricity, heat, or energy-intensive products. The second step is a reduction in household disposable income, as higher energy expenditures reduce the amount of funds households can use for other needs (Do and Zhang, 2025).

The third step in this mechanism may involve cutting back on spending on high-quality food, healthcare, or other factors affecting health. In response to higher living costs, low-income households may reduce their consumption of healthier foods, preventive healthcare, or other health-promoting activities. A fourth possible effect is the emergence or deepening of energy poverty , i.e., a situation where households are unable to secure adequate heating or energy services without an unreasonable financial burden.

If emission allowance prices were to rise significantly without corresponding compensatory measures, the standard of living for some low-income groups could deteriorate in the short term. This problem is one of the reasons why the issue of the social design of climate policies is increasingly discussed in the political economy literature (Do and Zhang, 2025).

However, it is important to distinguish between two analytically distinct concepts. The first is the regressivity of the pricing instrument itself—that is, the fact that higher energy prices place a relatively greater burden on low-income households. The second is the regressivity of the resulting policy system after accounting for redistributive measures (Kettner *et al.*, 2026).

Empirical research shows that these two dimensions can differ significantly. If revenues from carbon pricing are returned to households through social transfers, reductions in other taxes, or direct financial compensation, the overall distributional effect of climate policy can be neutral or even progressive. In some cases, low-income households may even receive more funds from redistribution mechanisms than they pay in increased energy prices.

For this reason, when evaluating emissions trading schemes, it is necessary to analyze not only the pricing mechanism itself but also the institutional design of the entire system. The social impacts of climate policy are not determined solely by the existence of a carbon price, but primarily by the way in which the revenues from this price are utilized and redistributed within the economy (Kettner *et al*., 2026).

3.6 Ethical dimension: harm prevention versus distributive justice

The analysis of emissions allowances is not merely a matter of economic efficiency or environmental effectiveness. The ethical dimension of public policy also constitutes a significant part of this debate. Regulation of greenhouse gas emissions and pollutants affects not only the state of the environment but also public health, the distribution of economic costs, and social justice within society.

The ethical discussion regarding emissions trading systems can be simply interpreted as a tension between two fundamental normative principles of public policy. The first is the principle of harm prevention, which is based on the assumption that public institutions have a duty to minimize foreseeable and scientifically proven harm caused by human activity (Duvic-Paoli, 2018). The second is the principle of distributive justice, which emphasizes that the costs and benefits of public policies should be distributed in a manner that is socially just and does not place an undue burden on vulnerable groups of the population.

In the field of environmental policy, the principle of harm prevention is often linked to the concept of the precautionary principle, which is also enshrined in a number of international environmental agreements and European legislation. This principle is based on the assumption that if there is scientific evidence of potentially serious impacts of a particular activity on human health or the environment, public institutions should take measures to mitigate these risks, even if there is a degree of uncertainty (Davies and Vinders, 2025).

In the context of air pollution, the scientific evidence regarding health impacts is exceptionally extensive. Epidemiological studies have long confirmed that exposure to fine particulate matter PM2.5 and other pollutants significantly increases the risk of cardiovascular and respiratory diseases as well as premature mortality. If regulatory measures lead to a reduction in emissions of these substances, they can be interpreted as a form of preventive health policy (Lin *et al*., 2025).

From this perspective, a scenario without emissions regulation may pose an ethical problem, as it implies tolerating higher levels of health risks that are empirically documented. If public policy tools exist that can reduce these risks, the absence of regulation can be interpreted as a failure in the area of harm prevention.

On the other hand, however, regulating emissions through pricing instruments, such as emissions permits, can raise questions of distributive justice. An increase in the price of carbon often translates into higher prices for energy and other basic goods. These changes may place a relatively greater burden on lower-income households, as energy expenses constitute a larger portion of their consumption budget (Ekardt and Von Hovel, 2009).

The principle of distributive justice emphasizes that public policies should not place a disproportionate burden on socially vulnerable groups. If climate policy were to lead to a significant deterioration in the standard of living of low-income households, this could be interpreted as an ethically problematic distribution of the costs of the energy transition (Ekardt and Von Hovel, 2009).

This normative conflict can be illustrated using two hypothetical scenarios. The first scenario depicts a situation without emissions regulation systems. In this case, energy prices do not rise, but air quality remains at a higher level of pollution, leading to a greater health burden on the population and a higher rate of premature mortality. The second scenario depicts a situation where emissions permits are introduced, but the price of emissions is very high and is not accompanied by any redistributive measures. In such a case, climate regulation may lead to improved air quality, but at the same time may place significant economic pressure on low-income households.

Empirical studies, however, suggest that these two principles are not necessarily in direct conflict. Research on the health impacts of air pollution shows that the benefits of reducing emissions can be far-reaching, particularly in terms of reduced mortality, morbidity, and healthcare costs. At the same time, the political economy literature on climate policy emphasizes that the regressive effects of carbon pricing are not an inherent feature of these instruments, but rather a consequence of specific institutional design.

If revenues from emission allowances are used to finance social compensation, investments in household energy efficiency, or direct financial transfers, the regressive effect of carbon pricing can be significantly mitigated or even completely eliminated. Some climate policy proposals even include mechanisms that allow for the redistribution of revenues so that low-income households receive relatively greater support than higher-income households.

From this perspective, it can be argued that the ethical problem is not inherent in the very existence of an emissions trading system. Rather, it is a matter of institutional design and the implementation of specific policy measures. Emissions regulation can be designed in a way that simultaneously respects both the principle of harm prevention and the principle of distributive justice.

An ethical analysis of emissions allowances therefore shows that the key issue is not merely whether there should be a carbon price, but above all how this policy is implemented. The design of climate policy can fundamentally influence whether the energy transition is perceived as socially just or whether it is associated with a sense of unequal cost distribution.

4 DISCUSSION

The analyzed literature review allows us to formulate three key conclusions:

1. **Failure to implement an ETS leads to higher mortality and health inequalities.**
2. **The implementation of an ETS yields measurable health co-benefits.**
3. **The regressive effect is not a structural necessity but a design risk.**

From a public health perspective, the riskiest option is the absence of regulation. From a social policy perspective, the riskiest option is a pricing instrument without redistribution. The optimal policy combines emissions allowances with revenue returns to households.

The existing analysis of the literature on emissions trading, health externalities, and the social impacts of climate policy allows us to formulate several fundamental conclusions that are significant for environmental economics and philosophy, as well as for the fields of public health and the political economy of regulation. A synthesis of available empirical studies suggests that the debate on emissions trading systems should not be reduced solely to the question of climate effectiveness or economic costs. These systems also have significant health and social implications that can fundamentally influence their overall evaluation.

The first key conclusion is that the absence of emissions regulation is not a neutral baseline. Empirical studies analyzing counterfactual scenarios show that the failure to implement climate policies leads to higher concentrations of pollutants in the air, which in turn results in higher morbidity and mortality in the population (Shindell *et al*., 2018; Vandyck *et al*., 2022). Air pollution is one of the most significant environmental determinants of health, and its impacts have long been documented in the epidemiological literature (Landrigan *et al*., 2018).

A scenario without emissions regulation thus represents not only an environmental problem but also a public health problem. Higher levels of air pollution increase the incidence of cardiovascular and respiratory diseases, raise the number of hospitalizations, and lead to higher rates of premature mortality (Shindell *et al*., 2018). At the same time, there is empirical evidence that the environmental burden disproportionately affects socially vulnerable population groups, who are more likely to live in areas with higher concentrations of emission sources (Case & Kraftman, 2024).

The second conclusion drawn from the literature review is that emissions trading systems can generate measurable health benefits. This is because the reduction of greenhouse gas emissions is closely linked to a reduction in emissions of local pollutants generated by the combustion of fossil fuels. This synergistic effect creates the so-called health co-benefits of climate policy (Cuevas and Haines, 2016).

Empirical studies analyzing the impacts of the EU ETS show that the introduction of a carbon price has led not only to a reduction in carbon dioxide emissions but also to a decrease in emissions of substances such as sulfur dioxide, nitrogen oxides, and fine particulate matter (Basaglia, 2024). Similar results are also reported by studies focusing on the climate impacts of this system, which estimate a reduction in CO_2 emissions of approximately 10–15% compared to a scenario without regulation (Bayer and Aklin, 2020; Biancalani *et al*., 2024).

The third conclusion is that the potential regressive effects of carbon pricing are not a structural feature of the instrument itself, but rather a consequence of a specific institutional design. While an increase in the price of emission allowances often translates into higher energy prices and may place a relatively greater burden on low-income households, this effect can be significantly influenced by how the revenues from emission allowances are utilized (Wright *et al*., 2017).

The political economy literature on climate policy shows that appropriately designed redistribution mechanisms can significantly mitigate or even completely eliminate the regressive impacts of carbon prices (Honoré *et al*., 2011). If revenues from emission allowances are returned to households through social transfers or other compensatory measures, the overall impact of climate policy can be socially neutral or progressive (Bannon *et al*., 2025).

Based on these findings, a broader analytical conclusion can be drawn regarding the relationship between environmental regulation, public health, and social policy. From a public health perspective, the scenario of no emissions regulation represents the highest-risk option. This scenario leads to the maintenance of high levels of air pollution and a continuing health burden on the population.

Conversely, from a social policy perspective, a situation where a pricing instrument is introduced without accompanying redistributive measures may pose a risk. In such a case, climate regulation may create a disproportionate economic burden on low-income households.

The optimal policy design therefore combines a pricing mechanism in the form of emission allowances with redistributive mechanisms that return a portion of the revenues to households. This approach makes it possible to simultaneously achieve environmental goals, improve health outcomes, and minimize the negative social impacts of climate regulation.

5 CONCLUSION

This article analyzed emissions trading systems from the perspective of public health, health externalities, and distributive justice. The aim was to integrate insights from environmental economics, epidemiology, and the political economy of regulation and to assess the extent to which emissions allowances can influence the health of the population and the social distribution of climate policy costs.

Empirical literature published in high-impact scientific journals provides a relatively consistent picture of the environmental and health impacts of these policies. Studies focusing on the EU ETS show that the introduction of a carbon price has led to a measurable reduction in greenhouse gas emissions as well as local pollutants such as sulfur dioxide, nitrogen oxides, and fine particulate matter. These changes have a direct impact on air quality and, consequently, on health outcomes in the population.

From an epidemiological perspective, it is crucial that reductions in PM2.5 concentrations are associated with a decrease in the incidence of cardiovascular and respiratory diseases and a decline in premature mortality. Model studies focusing on the health co-benefits of climate policies show that reducing fossil fuel emissions can lead to a significant decrease in the health burden associated with air pollution. In some cases, the economic benefits of these health effects may be comparable to or even exceed the costs associated with implementing climate measures.

From this perspective, it is important to emphasize that a scenario without the introduction of emissions regulations cannot be interpreted as a neutral alternative. The absence of climate policy means maintaining or exacerbating current levels of air pollution and the associated health burden. Empirical evidence suggests that such a scenario would lead to a higher number of hospitalizations, chronic diseases, and premature deaths in the population.

At the same time, however, the analysis shows that climate regulation through pricing instruments can raise questions of distributional justice. An increase in the price of emissions often translates into higher energy prices, which can place a relatively greater burden on lower-income households. These impacts, however, are not an inherent feature of the emissions trading system as such, but depend on the specific institutional design of the policy.

The political economy literature on climate policies repeatedly shows that the regressive impacts of carbon prices can be significantly mitigated through redistributive mechanisms, such as returning a portion of the proceeds from emission allowances to households or investing in the energy efficiency of low-income households. In some cases, these mechanisms can be designed so that the resulting system even has a progressive redistributive effect.

From the perspective of ethical analysis, it can thus be concluded that the legitimacy of emission allowances depends primarily on the institutional architecture of the entire system. On the one hand, there is a strong argument based on the precautionary principle, according to which public policies should aim to minimize the health impacts of air pollution. On the other hand, it is necessary to respect the principle of distributive justice and ensure that the costs of the energy transition are not disproportionately borne by socially vulnerable groups of the population.

The results of this analysis therefore suggest that the key issue in current climate policy is not the very existence of emissions trading systems. Much more important is the way they are institutionally designed. A policy that combines the pricing mechanism of emissions allowances with revenue redistribution and social compensation measures can simultaneously maximize the health benefits of emissions regulation and minimize its social risks.

The debate on emissions allowances should therefore not be limited to the binary question of whether or not to implement these systems. A more relevant question is how to design an emissions trading system so that it contributes to improving air quality and protecting public health while preserving social justice in the energy transition process.

Limitation: The analysis was based on sources available as of February 28, 2026, the current status, and the current price of EU ETS allowances. Given that intensive discussions are currently underway regarding possible modifications to the proposed EU ETS 2 system and the price cap for the EU ETS 1 system, it will be necessary in the future to conduct updated research and a new qualitative analysis and to verify the current conclusions of this study through comparison.

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AUTHOR CONTRIBUTIONS

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REFERENCES

Alfaro, L., Faia, E., Lamersdorf, N., & Saidi, F. (2022). Health externalities and policy: The role of social preferences. *Management Science*, *68*, 6751–6761. https://doi.org/10.1287/mnsc.2022.4461

Azar, C., & Johansson, D. J. A. (2025). Climate justice and a fair allocation of national greenhouse gas emissions. *Climate Policy*, *25*(5), 815–822. https://doi.org/10.1080/14693062.2024.2415400

Bah, M. M., & Saari, M. Y. (2020). Quantifying the impacts of energy price reform on living expenses in Saudi Arabia. *Energy Policy*, *139*, Article 111352. https://doi.org/10.1016/j.enpol.2020.111352

Bailey, M., & Shingruf, A. (2024). Considerations for relational research methods for use in indigenous contexts: Implications for sustainable development. *International Journal of Social Research Methodology*, *27*(4), 431–446. https://doi.org/10.1080/13645579.2023.2185345

Bannon, A., Olivia, S., *et al*. (2025). Cigarette taxation and socioeconomic inequalities in under-5 mortality across 94 low-income and middle-income countries: A longitudinal ecological study. *The Lancet Public Health*, *10*(5), 380–390.

Basaglia, P., Grunau, J., & Drupp, M. A. (2024). The European Union Emissions Trading System might yield large co-benefits from pollution reduction. *Proceedings of the*

National Academy of Sciences, *121*(28), Article 2319908121. https://doi.org/10.1073/pnas.2319908121

Bayer, P., & Aklin, M. (2020). The European Union Emissions Trading System reduced CO_2 emissions despite low prices. *Proceedings of the National Academy of Sciences*, *117*(16), 8804–8812. https://doi.org/10.1073/pnas.1918128117

Biancalani, F., Gnecco, G., Metulini, R., *et al*. (2024). The impact of the European Union emissions trading system on carbon dioxide emissions: A matrix completion analysis. *Scientific Reports*, *14*, Article 19676. https://doi.org/10.1038/s41598-024-70260-6

Brandt, J., Sigsgaard, T., Geels, C., Gross, A., & Kaas, E. (2013). Assessment of past, present, and future health-cost externalities of air pollution in Europe and the contribution from international ship traffic using the EVA model system. *Atmospheric Chemistry and Physics*, *13*, 7747–7764. https://doi.org/10.5194/acpd-13-5923-2013

Bredin, D., & Muckley, C. (2011). An emerging equilibrium in the EU emissions trading scheme. *Energy Economics*, *33*(2), 353–362. https://doi.org/10.1016/j.eneco.2010.06.009

Bull, J. W., Gordon, A., Law, E. A., Suttle, K. B., & Milner-Gulland, E. J. (2014). Importance of baseline specification in evaluating conservation interventions and achieving no net loss of biodiversity. *Conservation Biology*, *28*(3), 799–809. https://doi.org/10.1111/cobi.12243

Cao, L., Tang, Y., Cai, B., Wu, P., Zhang, Y., Zhang, F., Xin, B., Lv, C., Chen, K., & Fang, K. (2021). Was it better or worse? Simulating the environmental and health impacts of emissions trading scheme in Hubei province, China. *Energy*, *217*, Article 119427. https://doi.org/10.1016/j.energy.2020.119427

Case, A., & Kraftman, L. (2024). Income inequality and health outcomes. *Oxford Open Economics*, *3*(Supplement 1), i499–i528. https://doi.org/10.1093/ooec/odad060

Chang, S., Yang, X., Zheng, H., Wang, S., & Zhang, X. (2020). Air quality and health co-benefits of China's national emission trading system. *Applied Energy*, *261*, Article 114226. https://doi.org/10.1016/j.apenergy.2019.114226

Corburn, J. (2001). Emissions trading and environmental justice: Distributive fairness and the USA's Acid Rain Programme. *Environmental Conservation*, *28*(4), 323–332.

Cuevas, S., Nachtigall, D., Jaber, A. A., Belesova, K., Falconer, J., Haines, A., Reynolds, T., Schuster, T. M., Whitmee, S., & Green, R. (2024). Health co-benefits and trade-offs of carbon pricing: A narrative synthesis. *Climate Policy*, *24*(10), 1346–1364. https://doi.org/10.1080/14693062.2024.2356822

Davies, G., & Vinders, J. (2025). Geoengineering, the precautionary principle, and the search for climate safety. *European Journal of Risk Regulation*, *16*(4), 1223–1234. https://doi.org/10.1017/err.2025.14

Derambarsh, A. (2024). The adoption of an effective European bill will be necessary to reduce food waste. *Journal of Science Lyon*, *2024*. https://doi.org/10.5281/zenodo.11114260

Do, K., & Zhang, Y. (2025). Assessing health risks and socioeconomic disparities associated with ambient air pollution and point sources across the United States. *Environmental Pollution*, *375*, Article 126311. https://doi.org/10.1016/j.envpol.2025.126311

Duvic-Paoli, L.-A. (2018). *The precautionary principle in international environmental law*. Cambridge University Press. https://doi.org/10.1017/9781108553728

Ekardt, F., & Von Hovel, A. (2009). Distributive justice, competitiveness, and transnational climate protection: One human – one emission right. *Carbon*, *3*(1), 102–113.

Everett, K., de Bruin, K., & Yakut, A. (2025). Co-benefits of the Irish carbon tax and the European Emissions Trading System on outdoor air pollution in Ireland. *Economic and Social Review*, *56*(4), 421–448. https://www.esri.ie/publications/co-benefits-of-the-irish-carbon-tax-and-the-european-emissions-trading-system-on

Fernandez, A. C. G., Pelnekar, S., Robinson, J. F., Shaw, G. M., Padula, A. M., *et al*. (2025). Climate change and reproductive health. *Endocrine Reviews, 46*(6), 908–921. https://doi.org/10.1210/endrev/bnaf026

Fine, J., Ettinger, J., Kotcher, J., Mildenberger, M., Leiserowitz, A., *et al*. (2025). Advancing and integrating climate and health policy in the United States: Insights from national policy stakeholders. *The Journal of Climate Change and Health*. Advance online publication. https://doi.org/10.1016/j.joclim.2025.100485

Fox, M., Zuidema, C., Bauman, B., Burke, T., & Sheehan, M. (2019). Integrating public health into climate change policy and planning: State of practice update. *International Journal of Environmental Research and Public Health*, *16*(18), 211–224. https://doi.org/10.3390/ijerph16183232

Guo, X., Xu, L., Liu, R., & Zhong, Z. (2025). Who will pay for the 'mine toxic land'? — A dynamic game and simulation study of negative externality governance in rare earth mines based on prospect theory. *Managerial and Decision Economics*, *46*, 3448–3466. https://doi.org/10.1002/mde.4543

Haines, A. (2017). Health co-benefits of climate action. *The Lancet Planetary Health*, *1*(1), 4–5. https://doi.org/10.1016/S2542-5196(17)30003-7

Harman, E., & Azzam, T. (2018). Towards program theory validation: Crowdsourcing the qualitative analysis of participant experiences. *Evaluation and Program Planning*, *66*, 183–194. https://doi.org/10.1016/j.evalprogplan.2017.08.008

Honoré, P. A., Fos, P. J., Wang, X., & Moonesinghe, R. (2011). The effects on population health status of using dedicated property taxes to fund local public health agencies. *BMC Public Health*, *11*, Article 471. https://doi.org/10.1186/1471-2458-11-471

Kettner, C., Bock-Schappelwein, J., Kletzan-Slamanig, D., Sommer, M., Pfaffenbichler, P., *et al*. (2026). Socially fair decarbonization pathways for housing and mobility – Insights from a multi-model analysis for Austria. *Energy Economics*, *157*, Article 109281. https://doi.org/10.1016/j.eneco.2026.109281

Landrigan, P. J., Fuller, R., Acosta, N. J. R., Adeyi, O., Arnold, R., Basu, N. N., Baldé, A. B., & Bertollini, R. (2018). The Lancet Commission on pollution and health. *The Lancet, 391*(10119), 462–512. https://doi.org/10.1016/S0140-6736(17)32345-0

Lang, B. (1988). Literary philosophy: The anatomy of philosophical style. *Colby Library Quarterly*, *24*(2), 101–112.

Lin, Y., Xi, Y., Chen, J., Cui, Y., Wang, Z., *et al*. (2025). Health effects and economic losses due to PM2.5 pollution from oil consumption by mobile sources in China. *Frontiers in Environmental Science*, *13*, 211–222. https://doi.org/10.3389/fenvs.2025.1554150

Lu, Y., Lin, S., Fatmi, Z., Malashock, D., Hussain, M. M., *et al*. (2019). Assessing the association between fine particulate matter (PM2.5) constituents and cardiovascular diseases in a mega-city of Pakistan. *Environmental Pollution*, *252*(Part B), 1412–1422. https://doi.org/10.1016/j.envpol.2019.06.078

Menon-Coudhary, D., & Shukla, P. R. (2009). An integrated strategy for urban air quality management in India. *International Journal of Environment*, *39*(3/4), 233–252. https://doi.org/10.1504/IJEP.2009.028688

Najafi, M., Dehnavi, H., Shams, L., Wakde, T., Rajaee, R., Shahmoradi, S., & Javadinasab, H. (2025). Facilitators and barriers of implementing sin-tax policies: A scoping review. *BMC Public Health*, *25*(1), Article 3902. https://doi.org/10.1186/s12889-025-25188-5

Pigou, A. C. (1920). *The economics of welfare*. Macmillan & Co.

Pisoni, E., Thunis, P., De Meij, A., Wilson, J., Bessagnet, B., Crippa, M., Guizzardi, D., Belis, C. A., & Van Dingenen, R. (2023). Modelling the air quality benefits of EU climate mitigation policies using two different PM2.5 related health impact methodologies. *Environment International*, *172*, Article 107760. https://doi.org/10.1016/j.envint.2023.107760

Reyes-García, V., Villasante, S., Benessaiah, K., Pandit, R., Agrawal, A., *et al*. (2025). The costs of subsidies and externalities of economic activities driving nature decline. *Ambio*, *54*(7), 1128–1141. https://doi.org/10.1007/s13280-025-02147-3

Riungu, M., Nyamute, W., *et al*. (2025). Intervening role of the poverty level on public health care and tax revenues linkage: Evidence from the East Africa Community Member Countries. *European Journal of Development Studies*, *5*(2), 11–19. https://doi.org/10.24018/ejdevelop.2025.5.2.402

Sakulniyomporn, S., Kubaha, K., & Chullabodhi, C. (2011). External costs of fossil electricity generation: Health-based assessment in Thailand. *Renewable and Sustainable Energy Reviews*, *15*(8), 3470–3479. https://doi.org/10.1016/j.rser.2011.05.004

Shao, S., Xu, L., & Fan, M. (2022). The effect of emission trading system on infant health: Evidence from China. *Environmental Geochemistry and Health*, *44*(9), 3021–3033. https://doi.org/10.1007/s10653-021-01173-w

Shindell, D., *et al*. (2018). Health and climate benefits of mitigation. *Nature Climate Change*, *8*(4), 291–295. https://doi.org/10.1038/s41558-018-0108-y

St-Amour, P. (2024). Valuing life over the life cycle. *Journal of Health Economics*, *93*, Article 102842. https://doi.org/10.1016/j.jhealeco.2023.102842

Tobias, A., Querol, X., Roque, M., Suu Lwin, K., Yuan, L., *et al*. (2025). Short-term exposure to desert dust and sandstorms and all-cause and cause-specific mortality and morbidity: A systematic review and meta-analysis. *Environment International*, *196*, Article 109277. https://doi.org/10.1016/j.envint.2025.109277

Vandyck, T., Keramidas, K., Kitous, A., *et al*. (2018). Air quality co-benefits for human health and agriculture counterbalance costs to meet Paris Agreement pledges. *Nature Communications*, *9*, Article 4939. https://doi.org/10.1038/s41467-018-06885-9

Wang, Z., & Zhao, L.-T. (2021). The impact of the global stock and energy market on EU ETS: A structural equation modeling approach. *Journal of Cleaner Production*, *289*, Article 125140. https://doi.org/10.1016/j.jclepro.2020.125140

Weishaar, S. (2007). CO2 emission allowance allocation mechanisms, allocative efficiency and the environment: A static and dynamic perspective. *European Journal of Law and Economics*, *24*(1), 29–70. https://doi.org/10.1007/s10657-007-9020-z

Wennick, D. (2023). How ideas shape the EU's climate policy: Moving toward the sufficiency paradigm for the EU ETS. *European Policy Analysis*, *10*, 206–224. https://doi.org/10.1002/epa2.1186

Wiese, C., Cowart, R., & Rosenow, J. (2020). The strategic use of auctioning revenues to foster energy efficiency: Status quo and potential within the European Union Emissions Trading System. *Energy Efficiency*, 1–12. https://doi.org/10.1007/s12053-020-09894-0

World Bank. (2022). *The distributional impacts of health taxes*. World Bank.

Wright, A., Smith, K. E., & Hellowell, M. (2017). Policy lessons from health taxes: A systematic review of empirical studies. *BMC Public Health*, *17*(1), Article 583. https://doi.org/10.1186/s12889-017-4497-z

Xie, Y., Liu, X., Li, D., Zhao, M., Weng, Z., Zhang, L., & Xu, M. (2023). Health and economic benefits of reducing air pollution embodied in the GBA's green and low-carbon development. *Urban Climate, 52*, Article 101755. https://doi.org/10.1016/j.uclim.2023.101755

Yan, D., Ji, H., Fu, H., Jiang, J., Su, B., *et al*. (2024). The effect of fine particulate matter (PM2.5) pollution on health inequality: An intergenerational perspective. *Environmental Geochemistry and Health*, *46*(6), Article 195. https://doi.org/10.1007/s10653-024-01982-9

Zheng, J., Bo, Y., Wang, Y., Liu, G., Lu, X., *et al*. (2026). Research on government carbon allowance allocation mechanism from the perspective of the differential game. *Clean Technologies and Environmental Policy*, *28*(4), 1–21. https://doi.org/10.1007/s10098-026-03448-1

Zheng, Y., Wang, J., Zhao, Z., & Guo, J. (2026). Evaluating the well-being effects of a carbon emissions trading system: Evidence from 273 Chinese cities. *Systems*, *14*(1), Article 59. https://doi.org/10.3390/systems14010059

Authors’ Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study’s findings are fully available within the article.

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