



## **Anna Bałamut**

Andrzej Frycz Modrzewski Krakow University  
ORCID: 0000 0001 7300 7367

# The Impact of Greenhouse Gas Emissions on Human Health Across Europe

## Introduction

Admittedly, climate is changing. There is extensive scientific evidence that proves that the average global temperature is rising, and the rainfall structure is changing, which can be noticed by simply looking out of the window. Sometimes it is difficult to determine the actual season due to the diversity of climatic phenomena. At the same time, many towns and cities are dealing with smog – a mixture of fog, smoke, and exhaust fumes – especially in the autumn and winter. In light of these facts, it is possible to put forward the following hypothesis: the poor condition of air affects human health and leads to an increased number of respiratory diseases.

This paper has been divided into three sections. First, it looks at the EU's strategy towards air pollution – what position the EU presents with regard to greenhouse gas emissions, what solutions it proposes, and whether they are beneficial for countries or not. Second, it discusses air quality in Europe – whether smog can be found in European countries, and if so, where, and how these countries are dealing with the problem. Third, it looks at the impact of air pollution on human health – whether smog affects human health and life, and if so – whether there are any statistics available. That is why the paper rests on the analysis of the content of international documents, or websites. Empirical methods have also been applied, i.e. observation (learning the phenomenon through publications), description (the outcome of observation), and general technology, i.e. analysis, synthesis,

induction (transition of general conclusions based on specific premises), and deduction (whereby general premises give rise to specific conclusions).

## The EU's strategy towards air pollution

In 1979, the United Nations Economic Commission for Europe adopted the Convention on Long-Range Transboundary Air Pollution. The main guidelines of the convention are to limit and gradually reduce air pollution, and to prevent such pollution. So far, eight protocols have been attached to it, including the protocol from Gothenburg to Abate Acidification, Eutrophication and Ground-level Ozone. The protocol was agreed in November 1999 and has contributed to creating the NEC Directive (2001/81/EC). The protocol was revised in 2012 and was made into EU law by the Directive on National Emission Reductions (Directive 2016/2284/EU). The amended protocol was ratified by the Council Decision (EU) 2017/1757.<sup>1</sup> On 7 October 2019, the amendments to the Gothenburg Protocol became effective. 18 countries were covered by the protocol: Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Finland, Germany, Latvia, Luxembourg, the Netherlands, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, the United Kingdom, and the US, as well as the EU. The main goal was still to reduce the emissions of sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), ammonia (NH<sub>3</sub>), volatile organic compounds (VOCs), and fine Particulate Matter (PM<sub>2.5</sub>). For example, reduction of PM 2.5 reached 46% for Cyprus; 37% for the Netherlands; 36% for Slovakia; 35% for Greece; 33% for Denmark; 30% for Finland and the UK; and 22% for the European Union.<sup>2</sup>

In June 2012, the United Nations Conference on Sustainable Development was held in Rio de Janeiro. One of its key outcomes was the decision taken by the member states of the UN to inaugurate the process geared towards developing a set of new Sustainable Development Goals (SDGs) to pursue the Millennium Goals. The formulation of SDGs was part of the work done on the global development agenda after 2015, i.e. the Post-2015 Development Agenda. It was also the first step to The 2030 Agenda for Sustainable Development. The document encompasses 17 sustainable development goals. The underlying assumptions concern not only reduction of poverty, the fight against hunger, or safeguarding health, but also such issues as sustainable use of the natural environment, reduction of social inequality, or ensuring access to energy.<sup>3</sup>

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<sup>1</sup> The coming into force of the amended Gothenburg Protocol is a landmark for actions taken in the field of clean air and climate. *Entry into force of amended Gothenburg Protocol is landmark for clean air and climate action*, UNECE, 2019, <https://www.unece.org/info/media/presscurrent-press-h/environment/2019/entry-into-force-of-amended-gothenburg-protocol-is-landmark-for-clean-air-and-climate-action/doc.html> [accessed: 18.11.2019].

<sup>2</sup> *Ibid.*

<sup>3</sup> *Transforming our World: The 2030 Agenda for Sustainable Development*, UN, 2015 <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf> [accessed: 18.11.2019].

The EU's clean air policy is also based on:

- Directive 2008/50/EC on ambient air quality and cleaner air for Europe;
- Directive 2015/1480/EC of 28 August 2015 amending several annexes to Directives 2004/107/EC and 2008/50/EC – data validation and location of sampling points for the assessment of ambient air quality;
- Commission Implementing Decision 2011/850/EU: Commission Implementing Decision of 12 December 2011 laying down rules for Directives 2004/107/EC and 2008/50/EC of the European Parliament and of the Council as regards the reciprocal exchange of information and reporting on ambient air quality (notified under document C(2011)).<sup>4</sup>

The above listed documents set the standards for emission and created certain resolutions for the problem with limit values. For example, Directive 2008/50/EC assumed cooperation between several stakeholders: the Member States, governance, the private economic sector, various trade organisations, civil society, or citizens.

On 28 November 2018, the European Commission put forward a long-term strategic vision for the economy: by 2050 it should be modern, competitive, and climate-neutral. The strategy shows whether Europe can lead in the pursuit of climate neutrality, and how it can do so, e.g. by investing in realistic technological solutions.<sup>5</sup> The Commission adopted its strategic vision on 28 November 2018, before the UN Climate Summit (COP24), which took place in Katowice from 2 to 14 December 2018. The final document is a so-called “road map” for the implementation of the Paris Agreement of 2015. The countries have pledged to take action to halt global warming at 2 degrees Celsius – even at 1.5 degrees Celsius – above the average pre-industrial temperatures.

“Less than 1 % of EU cohesion policy funding is directly allocated to air quality measures. However, other cohesion policy actions can indirectly benefit air quality.”<sup>6</sup> That’s why the report prepares recommendations for the countries. The report recommends launching a policy that aims at air quality, and making use of EU support for air quality to tackle air pollution, in particular PM, NO<sub>x</sub> and SO<sub>x</sub>. The time line for implementation has been set by 2022.<sup>7</sup>

It should be noted that by adopting the monthly package of decisions on the issue of failure to fulfil their obligations, the European Commission is taking legal action against the Member States that have not complied with their obligations under EU law. These measures are infringement procedures, based on the main decisions taken in July, for example:

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<sup>4</sup> *Air Quality – Existing Legislation*, EU, August 2019, [https://ec.europa.eu/environment/air/quality/existing\\_leg.htm](https://ec.europa.eu/environment/air/quality/existing_leg.htm) [accessed:18.11.2019].

<sup>5</sup> *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank a Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy, 28 November 2018*, (COM/2018/773 final).

<sup>6</sup> Official website of COP 24 Katowice 2018, <https://cop24.gov.pl/pl> [accessed: 18.11.2019].

<sup>7</sup> *Air pollution: Our health still insufficiently protected*, ECA, Luxembourg, 2018, p. 47.

- The Commission has brought a case before the Court against Bulgaria and Spain over exposing citizens to poor air quality.<sup>8</sup> Bulgaria does not comply with the limit values for sulphur dioxide (SO<sub>2</sub>), and Spain for nitrogen dioxide (NO<sub>2</sub>). There have been cases of exceeding standards in the south-eastern part of the country, where four of Bulgaria's largest power plants are located. In Spain, there were breaches of EU legislation on nitrogen dioxide (NO<sub>2</sub>) emissions, legally binding since 2010;
- The Commission calls on Croatia and Romania to address systemic irregularities in monitoring pollution (based on EU law: Directive 2004/107/EC and Directive 2008/50/(EC). In the case of Romania, the lack of an adequate number and type of air quality measurement points was revealed. For Croatia, one of the discernible weak points in its domestic includes the incorrect transposition of the definition of "air" and "share of pollutants from natural sources."<sup>9</sup>

The EU has set a policy framework for both energy and climate change. However, some areas, such as the choice of the energy mix, are left to the Member States. The differences found in the Member States' strategies and the diversity of energy mixes make it difficult to achieve the goals set. Energy the notion of neutrality, promoted by the EU, can be difficult to achieve, let alone the goal of maintaining a temperature rise well below 2°C. What is needed is increased cooperation of states, organisations and entities in the area of a common, uniform strategy and an increase in the EU budget for combating not only the emission of greenhouse gases, but also the fight against the effects of smog.

## Air quality in Europe

The European Environment Agency (EEA) is an analysis centre of air pollution. It cooperates with the EU, develops statistical data and monitors the problem of air pollution across Europe. The data that are collected and elaborated are available on the agency's website in the form of reports or publications. The agency also investigates the side effects of air pollution, and their impact on climate change, energy, transport, industry, and human health. Three pollutants have been indicated as those that have the greatest impact on human health: particulates, nitrogen dioxide and ground-level ozone that cause respiratory damage and even death. 90% of Europe's population is located in cities where concentrations exceed safe air health standards. Numerous studies show that inhaling fine particles (PM<sub>2.5</sub>) can shorten people's lives in the EU by about eight months. Another example is benzo(a)pyrene, which is a carcinogen component.<sup>10</sup>

In 2019, a new European Environment Agency report occurred, which sets out the analysis of air quality in Europe from 2000 to 2017. Just as in the 2018 report,

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<sup>8</sup> *July infringements package: key decisions*, EC, July 2019, [https://ec.europa.eu/commission/press-corner/detail/pl/inf\\_19\\_4251](https://ec.europa.eu/commission/press-corner/detail/pl/inf_19_4251) [accessed: 18.11.2019].

<sup>9</sup> *Ibid.*

<sup>10</sup> *Air pollution*, October 2017, EEA, <https://www.eea.europa.eu/pl/themes/air/intro> [accessed: 12.11.2019].

the findings are the same: high concentrations of air pollutants have a negative impact on Europeans, mainly those who live in cities. Air pollution affects not only the economy, but also the lives of residents, a case in point being the rising medical costs, and the growing number of working days lost due to poor health. Air pollution affects ecosystems, destroying soil, forests, lakes and rivers, and reducing agricultural yields.<sup>11</sup>

The EU ETS system, launched in 2005 within the EU, is the first international emissions trading system in the world. It also remains the largest, as it covers over three-quarters of international emissions trading. It operates in 31 countries (28 EU countries and Iceland, Liechtenstein, and Norway). Companies receive or buy emission allowances that they can trade according to their needs. In addition, they reduce emissions from over 11 thousand energy-intensive industrial installations and airlines.<sup>12</sup> Through the Emissions Trading System (ETS), the EU governs about 40% of total EU greenhouse gas emissions. The goal is to decrease the amount of emissions by 2040, which is a consequence of, among others, the following events:

- abandoning nuclear energy for fossil fuels (e.g. Belgium);
- increase in energy-consuming energy production (e.g. Ireland, Denmark, Malta);
- increase in industrial processes (e.g. Ireland, Lithuania, Poland, Romania);
- increasing the share of renewable energy (e.g. Ireland);
- withdrawal from coal-fired power plants (e.g. France, Spain);
- withdrawal from bituminous shale (Estonia);
- increase in biomass co-firing (e.g. Ireland).<sup>13</sup>

Checking the current state of air in a given country, or even an individual town or city, can be done by means of a dedicated website that features a real-time visual air quality map illustrating air pollution across Europe. In addition, it is possible to trace the following contaminants: PM 2.5 (atmospheric aerosols), PM10 mixture of heavy metal particles – benzopyrenes, furans, dioxins, O<sub>3</sub> (tropospheric ozone), NO<sub>2</sub> (nitrogen oxides), SO<sub>2</sub> (sulphur dioxide) and CO (carbon monoxide) in the perspective of e.g. the last 24 hours, or look at the ranking of the last four hours for the most polluted countries. Here, Poland came ninth (in a group of 100), and the most polluted city was Zgierz (air quality rankings).<sup>14</sup> As of 11 November 2019, there are a lot of European countries that are ahead of Poland (170); for example: Turkey 862, Ukraine (189), Italy (159), Spain (158), and Bulgaria (152). The ranking is updated on a regular basis, which proves its accuracy.<sup>15</sup>

The second source of information can be the website with the World's Air Pollution: Real-time Air Quality Index.<sup>16</sup> In a nutshell, the World Air Quality Index project is a non-profit project launched in 2007. It collects information from over 100 countries, where there are over 12,000 stations. The information is published on

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<sup>11</sup> *Air quality in Europe – 2018 report*, EEA, Luxembourg, 2018.

<sup>12</sup> See: Official website of European Commission: <https://ec.europa.eu> [accessed: 12.11.2019].

<sup>13</sup> *The EU Emissions Trading, System in 2019: trends and Projections*, EEA Luxembourg 2019, p. 4

<sup>14</sup> See: Official website of Real-time Air Quality Index (AQI), <https://aqicn.org/rankings> [accessed: 12.11.2019].

<sup>15</sup> *Ibid.*

<sup>16</sup> Official website of World's Air Pollution, *Real-time Air Quality Index*, <https://waqi.info/pl> [accessed: 12.11.2019].

two websites: *aqicn.org* and *waqi.info*. The idea originated in China and was over time joined by Singapore, India, Australia, and the US. Anyone can download the Widget – the Air Quality Index for Android, iPhone & iPad, Google Chrome, Firefox, WordPress, and Cloud API.<sup>17</sup>

Another example is the European Air Quality Index. This is an EEA and European Commission initiative. It gathers air quality measurements from over 2,000 air quality monitoring stations across Europe, and it discloses the following impurities: fine dust (PM<sub>2.5</sub> and PM<sub>10</sub>), ground-level ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>) and sulphur dioxide (SO<sub>2</sub>). The concentration levels indicated in the small table are: the hourly concentrations for NO<sub>2</sub>, O<sub>3</sub> and SO<sub>2</sub> and based on 24-hour running means for PM<sub>10</sub> and PM<sub>2.5</sub>.<sup>18</sup>

The European Union distinguishes between two air quality standards: short-term (hourly/daily), and long-term (annual). The European air indicator has one drawback: it does not reflect the long-term (annual) issue. It should be emphasised that the results obtained on the basis of this approach may be different than those presented on an ongoing basis on the website, which points to the number of problems that EU members must face. First of all, it requires a change in the way of thinking – understanding that the problem of air pollution will not disappear, and the effects will be visible not only in the short-term perspective, but also in the long-term perspective, which can be dangerous for social life.

Among other things, greenhouse gas emission leads to the creation of smog. It arises as a result of mixing air with various impurities, or exhaust fumes. They are generic as a result of human activity. Its appearance may also be caused by the climate and the condition of the area. Smog causes a number of negative effects on human health: it hinders breathing and causes several diseases – like e.g. asthma, affects the quality of vegetables or meat offered on the market. Its effects can also be seen in the construction of buildings that over time start to be covered with a strange-looking coating. The effects can be indicated in both the short and long term, a case in point being the 1952 smog in London, which caused more than 4,000 casualties.<sup>19</sup> Apparently, European countries are dealing with smog in various ways:

- in Paris, passenger cars registered before 1997 have been banned from entering the city from 1 July 2015, just like all motorcycles registered before 1 June 1999; and trucks and buses from before 1 October 2001. On specific days, only cars with even or odd registration numbers have access to the heart of the city. Vignettes, similar to the German ones, were introduced in Paris, where individual colours indicate the level of vehicle emissions. Drivers who do not have the “CritAir” badge can pay a high fine. From July 2019, it is prohibited to enter Paris with a diesel car manufactured prior to 2006, as well as on motorcycles and tricycles (with gasoline engines) that were produced before 30 June 2004;<sup>20</sup>

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<sup>17</sup> *Ibid.*

<sup>18</sup> *European Air Quality Index*, November 2019, <https://www.eea.europa.eu/themes/air/air-quality-index> [accessed: 12.11.2019].

<sup>19</sup> See: Official website of Airly, <https://airly.eu/pl> [accessed: 12.11.2019].

<sup>20</sup> A. Kubik, *Do Paryża nie wjedziesz starym dieslem. Kto poczuje to w kieszeni?*, July 2019, <http://wyborcza.pl/7,155287,24957051,do-paryza-nie-wjedziesz-starym-dieslem.html?disableRedirects=true> [accessed: 12.11.2019].

- in London, by 2020, selected streets are due to be banned for vehicles with diesel engines; currently, drivers must pay 12.5 pounds a day for moving around the centre during rush hour; in addition, a fee is charged for the entry of lorries, buses and vans to the gates of London, which can go up to 200 pounds per day;<sup>21</sup>
- in Germany, the badge for cars is available in different colours, depending on the Euro emission class; entry to the centre of Berlin is possible with a green badge and number 4 gasoline engines produced at least in 1993. On 7 October 2019, a decision was made to ban diesel vehicles on eight Berlin streets: Leipziger Straße, Brückenstraße, Reinhardtstraße, Alt-Moabit, Friedrichstraße, Stromstraße, Hermannstraße and Silbersteinstraße (blue badge);<sup>22</sup>
- as for Rome, the number of cars with oil fuel-driven engines is growing, the increase in exhaust emissions contributes, for example, to the deterioration of Italians' health and the destruction of historic buildings. This is to change: by 2024, a ban will be introduced for diesel cars to enter the city centre;<sup>23</sup>
- in 2019, Oslo removed all public parking spaces in its city centre; in this car-free zone, people can travel by public transport, ride a bike, or go on foot. Norway aims to become "carbon neutral" by 2030, but hopes are high that this will happen already by around 2025. In addition, it is expected to suspend the sale of cars powered by fossil fuels.<sup>24</sup>

The above solutions indicate that the states do not want to be indifferent to the problems of combating air pollution, including smog. However, it is commonly regarded as a drop in the ocean because not only capital cities, but also other towns and cities, are struggling with the issue. You need not only good ideas, but also funds that will allow you to modernise the available solutions. Air pollution is a tangible problem for most European countries. Their actions are visible, but the question arises whether these actions are indeed sufficient. The answer is certainly not, and these actions ought to be intensified.

## The impact of air pollution on human health

An alternative source of reliable greenhouse gas emissions information and their effects is the World Health Organization. According to the Organisation, around seven million people die each year due to poor air conditions. Pregnant women, infants and children are exposed to the biggest risk. Breathing poor quality air may lead to several disturbances of the immune system in an unborn child, hinder the development of children's cognitive functions, or be the cause of numerous

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<sup>21</sup> *Smog w Europie. Jak inne miasta walczą z trującym powietrzem?*, luty 2017, <https://superbiz.se.pl/wiadomosci/smog-w-europie-jak-inne-miasta-walcza-z-trujacym-powietrzem-aa-oxKE-Qar5-r1Zg.html> [accessed: 19.11.2019].

<sup>22</sup> See: Official website of GEMB mbH and Green-Zones GmbH, <https://www.blaue-plakette.de/pl.html> [accessed: 19.11.2019].

<sup>23</sup> *Samochody z silnikiem diesla w Europie – gdzie nie wjedziesz i gdzie zapłacisz karę?*, March 2018, <https://autempoeuropie.pl/aktualnosci/samochody-z-silnikiem-diesla-w-europie-gdzie-nie-wjedziesz-i-gdzie-zaplacisz-kare> [accessed: 19.11.2019].

<sup>24</sup> See: <https://www.mojanorwegia.pl> [accessed: 19.11.2019].

diseases – such as asthma, or respiratory infections.<sup>25</sup> How and where we live, what we eat, what lifestyle we are leading – whether it is in the countryside or in the city – will significantly affect our health. That’s why air quality depends not only on emissions, but also on the distance from which and the height at which pollutants are released, the meteorological conditions, e.g. wind, the chemical transformations, and the geographical conditions.<sup>26</sup>

The world health statistics of 2018 focus on the health and health-related Sustainable Development Goals (SDGs). They are also linked to the three SDG-aligned strategic priorities of the WHO’s 13<sup>th</sup> General Programme of Work, 2019–2023. The WHO report of 2018 divided health-related indicators in the following way: “reproductive, maternal, new-born and child health, infectious diseases, noncommunicable diseases (NCDs) and mental health, injuries and violence, universal health coverage (UHC) and health systems, environmental risks, health risks and disease outbreak.”<sup>27</sup>

The report states that the transition to clean fuels and technologies is still a major problem. It is estimated that three billion people use unsuitable furnaces and fuels. In 2016, household air pollution caused 3.8 million deaths from heart disease, stroke and cancer, or lower respiratory tract infections. According to WHO, in 2016, about 91% of the world’s population didn’t have access to clean air, and more than half of the cities were exposed to levels at least 2.5 times above the WHO safety standard. It is estimated that in 2016, air pollution caused 4.2 million deaths worldwide.<sup>28</sup> Across the EU, air pollution causes on average more than 1,000 premature deaths each day, which is more than ten times the number of casualties reported in road accidents. Modern society is affected by respiratory and cardiovascular diseases caused by air pollution.<sup>29</sup> According to EEA data, in 2014 fine dust (PM<sub>2.5</sub>) caused the deaths of around 400,000 people in the EU: NO<sub>2</sub> caused 75,000 deaths, and O<sub>3</sub> resulted in as many as 13,600 deaths.<sup>30</sup>

Several studies have proven the correlation between polluted air and the risk of low birth weight of new-borns or their prematurity, e.g. half a million births in London were tested for the impact of NO<sub>2</sub>, NO<sub>x</sub>, O<sub>3</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> on the child’s life, which confirmed the correlation. As a consequence, symptoms of inflammation of the upper and lower respiratory tract, and even a change in the capacity of the sexes are the leading factors revealed among new-borns.<sup>31</sup>

<sup>25</sup> *Daly’s attributable to ambient air pollution*, 2016, [http://gamapserver.who.int/gho/interactive\\_charts/phe/aap\\_mbd/atlas.html](http://gamapserver.who.int/gho/interactive_charts/phe/aap_mbd/atlas.html) [accessed: 19.11.2019].

<sup>26</sup> *Air pollution: Our health still insufficiently protected*, European Court of Auditors, 23/2018, <https://op.europa.eu/webpub/eca/special-reports/air-quality-23-2018/pl/> [accessed: 19.11.2019].

<sup>27</sup> *World Health Statistic 2018, Monitoring health for the SDGs*, WHO, Geneva 2018, p 4.

<sup>28</sup> *Ibid.*, p. 10.

<sup>29</sup> *Mapping the sources and level of air pollution in Europe: Commission publishes new Air Quality Index and Atlas*, Brussels, 2017.

<sup>30</sup> *Air quality in Europe — 2017 report*, EEA, Luxembourg, 2017, p. 56.

<sup>31</sup> M. Krzyżanowski, *Wpływ zanieczyszczeń powietrza na zdrowie*, Global Compact Network Poland, article is from: *GCNP „SDG 11 – Zrównoważone Miasta – 2018”*, <https://ungc.org.pl/programy/zrownowazone-miasta> [accessed: 16.11.2019].

In 2018, scientists from the Barcelona Institute for Global Health and the Erasmus University Medical Centre in Rotterdam published the results of their work in *Biological Psychiatry* journal. In total, 783 children participated in the experiment, whose development was observed from the foetal stage. The researchers confirmed the relationship between fine dust pollution and brain changes, as well as a number of other related problems, such as e.g. self-control, or hyperactivity (including ADHD). Interestingly, such a relationship occurs not after exceeding the norms, but within their scope.<sup>32</sup>

One of the latest publications is the State of Global Air 2019 report, which looks at pollution caused by fine air particles (i.e. the particles with an aerodynamic diameter smaller than 2.5 microns, also known as PM2.5), and ozone found near ground level (tropospheric ozone). Air pollution is a major risk factor for death and disability in the world. Polluted air can cause heart and chronic respiratory diseases, lung infections, and cancer. In 2017, it was the fifth highest risk of mortality in the world, causing 4.9 million deaths and the loss of 147 million years of healthy life.<sup>33</sup> The top ten countries with the lowest national PM2.5 exposure levels were the Maldives, the United States, Norway, Estonia, Iceland, Canada, Sweden, New Zealand, Brunei, and Finland. Population-weighted PM 2.5 concentrations oscillated around 8 µg/m<sup>3</sup> or less in these countries on average. Another factor is ozone, a gas that commonly found in the stratosphere, that serves to protect the Earth from harmful ultraviolet radiation. The problem arises when it is too close to the ground, i.e. in the troposphere, when accumulates gases and pollution, thus being harmful to people's health. Its appearance so close to the earth is caused by human activity related to industrial activities, or transport. The underlying causes of ozone are volatile organic compounds and nitrogen oxides, as well as regresses to sunlight. The ozone found in the troposphere, the lower layer of the atmosphere, causes respiratory and lung diseases.<sup>34</sup>

The report also discusses the impact of air pollution on people's lives around the world, based on three elements:

- 1) analysis of PM2,5 and ozone standards;
- 2) mathematical functions derived from epidemiological studies;
- 3) death rates: the relationship between disease and air pollution.<sup>35</sup>

Air pollution is commonly known as one of the key factors that leads to the shortening of human life. According to the report, a child born today will die 20 months earlier due to poor air conditions.<sup>36</sup> In the summary, it is argued that the governments of individual countries are facing a very big challenge: on the one hand, economic development is their core; on the other hand, there is the issue of air pollution, which is quite relevant. Nobody argues with the fact that it exists; however, the difficulty arises when it comes to understanding, i.e. determining

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<sup>32</sup> *Badania: smog a cięża – skutkiem mogą być zaburzenia neurologiczne u dziecka*, March 2018, <http://www.rynekzdrowia.pl> [accessed: 16.11.2019].

<sup>33</sup> *State of Global Air 2019 report*, Health Effects Institute, Boston 2019.

<sup>34</sup> *Ibid.*, p. 11

<sup>35</sup> *Ibid.*

<sup>36</sup> *Ibid.*, p.16

the level of air pollution, population structure, basic and economic diseases, or determining factors that burden health.

An example of cooperation undertaken in the field of environmental protection can be The European Environment Agency's (EEA), which includes several recommendations of the World Health Organization (WHO). It can be seen in the relationship between air pollution and health outcomes, by looking e.g. at the data on diseases, or the death rates. The EEA also takes into account the WHO factors for calculating health risk:

- functions of concentration response – risk of health effects, and basic health statistics.

In addition, in its reports, it uses concentration response functions specified by the WHO in 2013, which are based on relative risk, i.e. increase in mortality due to air pollution. The results relate to the general population, and they are not assigned to specific people. The risk allows you to determine the percentage of cases. They can be attributed to air pollution. The relative risk estimates the number of deaths. These results are obtained at the so-called grids and are later summed for an individual country, or for Europe.<sup>37</sup>

## Conclusions

To sum up, looking at the vast research available and the numerous analyses of WHO, EEA and EU presented above, one can fully agree with the hypothesis put forward at the beginning of this paper. Air pollution is indeed a significant factor that has a major influence on the environment, the health risk, not to mention its role as a cause of cancer. The WHO, EEA and the EU point to the undeniable correlation between air pollution and its impact on human health and human life. The impact of NO<sub>2</sub>, NO<sub>x</sub>, O<sub>3</sub>, PM<sub>10</sub> or PM<sub>2.5</sub> is discernible not only in the natural environment that we live in and enjoy on a daily basis, but it also affects each of its members. Emission standards in European cities often exceed the accepted limits, which distorts the picture of healthy living. All this leads to the question whether bio food is really bio, since it is frequently grown in areas affected by air pollution. Do air purifiers really protect people from smog? These are just a few of the many questions that cannot be answered. People have to work, go to school, do their shopping even on the days when emission standards are exceeded. On other days, when the information about the clean air appears, we are happy that nothing is wrong with us. Studies show, however, that indexes should be modified, because often the information about clean air is a threat to our lives. Recent studies have shown that even low gas concentrations are dangerous for humans. Worse still, unborn children are already exposed, as they experience the effects of so-called smog and may be born with respiratory diseases, asthma, or even ADHD.

WHO, EEA and EU reports clearly indicate that the problem of protection of human life against polluted air requires more intensive activities and closer

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<sup>37</sup> *Assessing the risks to health from air pollution*, EEA, January, 2019, <https://www.eea.europa.eu/themes/air/health-impacts-of-air-pollution/assessing-the-risks-to-health> [accessed: 15.11.2019].

cooperation. Countries, entities and organisations alike should build upon available research, exchange experiences, and cooperate for clean air. The effects of non-cooperation can be seen not on the regional level, but they apply to the entire European continent. What is happening in China and India has an impact on the lives of people in Europe, and vice versa. Countries cannot live alone today, so they need to look at the problem of air pollution as a multidimensional problem with an increasing risk scale, which is an inseparable element of the development of the economies of the countries in the twenty-first century.

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## *Wpływ emisji gazów cieplarnianych na zdrowie ludzi w Europie* *Streszczenie*

Zmiany klimatu mają wpływ na nasze życie w sposób pośredni, np. zacieranie się różnic między porami roku, oraz bezpośredni, np. anomalie pogodowe – powodzie, wysokie lub niskie temperatury, mgły które często stają się smogiem, tzw. zanieczyszczenia powietrza. Europejczycy mają dostęp do statystyk analizujących stan powietrza, jednak nie oznacza to, że coś się zmienia. Ciągłe widoczny jest wzrost zachorowalności na choroby związane z układem oddechowym. Pomocne jest WHO, które zajmuje się skutkami zmian klimatu, udziela państwom pomocy w celu adaptacji zmian. Emisje w państwach członkowskich

## *The Impact of Greenhouse Gas Emissions on Human Health Across Europe*

UE stanowią tylko 10% globalnej emisji gazów cieplarnianych. Sytuacja ta pokazuje, że ochrona klimatu wymaga intensyfikacji działań nie tylko członków Wspólnoty, ale i pozostałych państw europejskich oraz organizacji rządowych i pozarządowych, wszystkich uczestników rynku, w tym osób fizycznych. W świetle tych faktów można postawić następującą hipotezę: zły stan powietrza wpływa na ludzkie zdrowie i prowadzi do zwiększonej liczby zachorowań na choroby układu oddechowego. Celem pracy jest wskazanie wpływu emisji gazów cieplarnianych na zdrowie ludzi. W rezultacie praca została podzielona na 3 rozdziały. Pierwszy opisuje strategię UE wobec zanieczyszczenia powietrza, drugi analizuje jakość powietrza w Europie, a trzeci skupia się na wpływie zanieczyszczenia powietrza na ludzkie zdrowie. Praca została zaopatrzona we wstęp i zakończenie zawierające końcowe wnioski. Informacje zostały przygotowane na podstawie nie tylko polskich, ale także zagranicznych źródeł. W pracy wykorzystano analizę zawartości dokumentów międzynarodowych i stron internetowych.

**Słowa kluczowe:** zanieczyszczenie powietrza, zdrowie, Europa, choroby, strategia

## *The Impact of Greenhouse Gas Emissions on Human Health Across Europe*

### *Abstract*

Climate change can be seen every day. It affects our lives indirectly, e.g. by blurring the differences between the seasons, and directly by causing weather anomalies such as floods, high or low temperatures, mists that often become smog, and so-called air pollution. Europeans have access to statistics analysing the state of the air they breathe, but this does not mean that something is changing. There is still a visible increase in the incidence of respiratory diseases. The WHO, which deals with the effects of climate change, helps countries to adapt to change. Emissions in EU Member States represent only 10% of global greenhouse gas emissions. This shows that climate protection requires intensification of actions not only of the Community members, but also of other European countries, as well as governmental and non-governmental organisations, market participants, including individuals. In light of these facts, it is possible to make the following hypothesis: air pollution is a threat to the environment, health, and a major cause of death. The goal of this paper is to indicate the impact of greenhouse gas emissions on human health. As a result, it has been divided into 3 sections. The first section describes the EU's strategy on air pollution; the second section looks at air quality in Europe; and the third section focuses on the impact of air pollution on human health. The paper rests on the analysis of international documents and/or websites.

**Key words:** air pollution, health, Europe, diseases, strategy

## *Die Auswirkungen der Treibhausgasemissionen auf die menschliche Gesundheit in Europa*

### *Zusammenfassung*

Der Klimawandel ist jeden Tag sichtbar. Er beeinflusst unser Leben indirekt, z. B. durch immer unschärfere Abgrenzung zwischen den Jahreszeiten und direkt, z. B. extreme Wettererscheinungen, Überschwemmungen, hohe oder niedrige Temperaturen, Nebel, der oft zum Smog wird, die sog. Luftverschmutzung. Die Europäer haben Zugang zu

Статистики, welche den Luftzustand analysieren, aber das bedeutet nicht, dass sich etwas ändert. Wir beobachten eine immer höhere Inzidenz von den mit dem Atemsystem verbundenen Krankheiten. Die WHO, die sich mit den Auswirkungen des Klimawandels beschäftigt, hilft Staaten bei der Anpassung an den Klimawandel. Die Emissionen in den Mitgliedsländern stellen nur 10% der globalen Treibhausgasemissionen dar. Diese Situation zeigt, dass der Klimaschutz die verstärkten Anstrengungen nicht nur seitens der Mitgliedsstaaten der Gemeinschaft, sondern auch sonstiger europäischen Länder, Regierungs-, und Außerregierungsorganisationen, aller Marktteilnehmer und jedes Einzelnen erfordert. Angesichts dieser Tatsachen kann man folgende Hypothese aufstellen: schlechter Luftzustand hat einen Einfluss auf die menschliche Gesundheit und führt zu einer höheren Inzidenz von den mit dem Atemsystem verbundenen Krankheiten. Das Ziel dieses Artikels ist, auf den Einfluss der Treibhausgase auf die menschliche Gesundheit hinzuweisen. Somit wurde die Arbeit in drei Kapitel aufgeteilt. Das erste beschreibt die Strategie der EU gegen Luftverschmutzung. Das zweite analysiert die Luftqualität in Europa und das dritte konzentriert sich auf den Einfluss der Luftverschmutzung auf die menschliche Gesundheit. Für die Analyse wurden internationale Dokumente oder Internetseiten benutzt.

**Schlüsselwörter:** Luftverschmutzung, Gesundheit, Europa, Krankheiten, Strategie

## *Влияние выбросов парниковых газов на здоровье людей в Европе Резюме*

Изменение климата влияет на нашу жизнь косвенно, например, нивелируя отличия между временами года и прямо, например, вызывая погодные аномалии – наводнения, крайне высокие или низкие температуры, туманы, которые часто становятся смогом – так называемые загрязнения. Европейцы имеют доступ к статистике, указывающей на состояние воздуха, однако это не означает, что они могут что-то изменить. Постоянно можно наблюдать возрастание числа острых респираторных вирусных инфекций. Всемирная Организация Здравоохранения, которая занимается последствиями изменения климата, помогает государствам адаптироваться к этим изменениям. Выбросы парниковых газов в государствах-членах ЕС, составляют лишь 10% глобальных выбросов парниковых газов. Эта ситуация показывает, что охрана климата требует активизации деятельности не только членом ЕС, но и остальных европейских государств, а также правительственных и неправительственных организаций, всех участников рынка, включая физические лица. В свете этих фактов можно выдвинуть следующую гипотезу: плохое состояние воздуха влияет на здоровье человека и ведет к увеличению числа острых респираторных вирусных инфекций. Целью статьи является указание влияния выбросов парниковых газов на здоровье человека. Исследование состоит из трех глав. В первой описана стратегия ЕС, связанная с уменьшением загрязнения воздуха, во второй – анализируется качество воздуха в Европе, а в третьей рассмотрено влияние загрязнения воздуха на здоровье человека. Статья была подготовлена на основе не только польских, но и зарубежных источников. В ней дан анализ содержания международных документов, а также веб-сайтов.

**Ключевые слова:** загрязнение воздуха, здоровье, Европа, болезни, стратегия