

Relationship between Covid-19 and Air Emissions in Post-integration Period of Romania

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Abstract: *In the most Member States, the EU citizen's quality of life continues to be affected because the air quality standards are not yet met. The situation is serious, especially in urban areas, where most Europeans live.*

The EU has been working for decades to improve air quality by controlling emissions of hazardous substances into the atmosphere with the aim to reduce air pollution to levels that minimize harmful effects on human health and the environment throughout the EU. Air pollution goes beyond national borders and therefore coordination at EU level is important. EU laws in force leave up to the Member States to choose the means to comply with the limit values agreed at EU level.

Keywords: *Economic Integration, Air Pollution, Environmental Degradation*

JEL Classification F02, Q53

1. Introduction

Awareness regarding the air pollution is high, and citizens are expecting measures from the authorities. In a recent survey regarding the environment in the EU, air pollution was mentioned as the problem of most concern to citizens after climate change⁴.

In order to solve this problem, the EU has set, through the legislation approved by the Member States and the European Parliament, the goal of achieving air quality levels

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⁴ Special Eurobarometer 468: Attitudes of European citizens towards the environment

that do not have negative impacts on human health and the environment and do not involve risks for human health and environment¹. In order to achieve this goal, effective air quality policies require the adoption of measures and cooperation at global, European, national and local level. In accordance with the principle of subsidiarity, implementation is largely based on individualized national, regional and local measures according to specific needs and circumstances

Air is identified as an environmental factor of particular importance, its quality having major implications in all social and economic life areas, on the population health and the environment.

Government air quality policies are embodied in legislation and regulations aimed at reducing emissions into the atmosphere and aim at measures and interventions at source, define responsibilities in this area and establish ways to monitor, control, inform citizens and plan economic development in relation to this indicator.

The local public administration has an extremely important role in the elaboration of the perspective plans which, as the case may be, must determine, in a reasonable period of time, the improvement of air quality where there are exceedances of regulated indicators or its maintenance at county level.

Current national legislation aims to protect human health and the environment, by regulating measures to maintain ambient air quality where it meets the objectives for ambient air quality set by law and to improve air quality in urban areas where quality overruns are recorded.

Alternative public policies that can be developed in this area complement government policy and can make a significant contribution to increasing / maintaining air quality in smaller communities facing air pollution problems.

2. European Union air quality policy

The Clean Air for Europe Programme from 2013 reaffirmed the goal of achieving as soon as possible the full compliance with existing air quality standards across the EU and set targets for 2020 and 2030. Thus, EU policy is based on three main pillars.

The first pillar includes the ambient air quality standards set out in the Ambient Air Quality Directives² for tropospheric ozone, particulate matter, nitrogen oxides,

¹ Hussen A. M., Principles of environmental economics and sustainability: an integrated economic and ecological approach, 4th ed., Editura Routledge, Abingdon, 2019, p.34

² Directives 2004/107/CE and 2008/50/CE

hazardous heavy metals and other pollutants¹. These air quality standards had to be met by all Member States in their territories starting with 2005 or 2010, depending on the pollutant. In case the established limit value are exceeded, Member States must adopt air quality plans in which to present in detail measures to shorten the exceedances periods as much as possible.

The second pillar is represented by the national emission reduction targets set out in the National Emission Ceilings Directive for the most important trans-boundary air pollutants: sulphur oxides, nitrogen oxides, ammonia, volatile organic compounds and particulate matter². The national emission reduction targets have recently been revised in order to include new limits which have to be reached in 2020 and 2030, as well as another pollutant - fine particulate matter (PM_{2.5}). By 2019, Member States needed to develop National Air Pollution Control Programs in order to meet their emission reduction commitments.

The third pillar includes emission standards for the main sources of pollution, from the vehicle and ship emissions to energy and industry. These standards are set at EU level in the legislation covering industrial emissions³, emissions generated by the power plants⁴, vehicles⁵ and transport fuels⁶, and the energy performance of products⁷.

The European Commission also has proposed new CO₂ emission standards for cars and vans to help manufacturers further promote innovation and to introduce to the market a significantly higher number of low-emission or zero-emission vehicles⁸. It is expected that the European Commission's first legislative proposal on CO₂ emission standards for new heavy duty vehicles, presented in the third mobility package, will also have long-term indirect effects on air quality, further improving fuel efficiency and

¹ A total of 12 pollutants are covered by this legislation: sulfur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter (PM₁₀ and PM_{2.5}), ozone, benzene, lead, carbon monoxide, arsenic, cadmium, nickel and benzo (a) pyrene

² Directive 2001/81/CE, as replaced by de Directive 2016/2284/UE

³ Directive 2010/75/UE on industrial emissions

⁴ Directive 2010/75/UE on industrial emissions and Directive 2015/2193/UE on medium combustion plants

⁵ Regulation (EC) no. Laying down CO₂ emission performance standards for new passenger cars and Regulation (EC) No 443/2009 Amending Regulation (EC) No 510/2011 laying down CO₂ emission performance standards for new light commercial vehicles, CO₂ regulations for new passenger cars and light commercial vehicles

⁶ Directive 97/70/CE on fuel quality

⁷ Directive 2009/125/CE on ecodesign

⁸ Proposal for a Regulation setting emission performance standards for new passenger cars and light commercial vehicles (COM (2017) 676]

greenhouse gas emissions in this segment and providing incentives for the placing on the market of low-emission and zero-emission heavy vehicles, including buses, with a positive domino effect on air pollutant emissions.

Over the years, various sets of measures have been taken at EU, Member States and local level in order to successfully reduce the air pollutants emissions, including those generated by large combustion plants, industrial plants and the transport sector, including road vehicles (for example, by improving fuel quality and successive Euro emission standards). This shows that there are cost-effective solutions that can support innovation and have a net positive impact on EU competitiveness, in line with the European Commission's broader priorities for sustainable growth and job creation¹.

The EU combats air pollution by setting limit values for the pollutants concentration from the air and standards for the air pollutants emissions sources. The Ambient Air Quality Directive provides the obligation for Member States to define on their territory areas of air quality management and assessment. Member States shall carry out preliminary air quality assessments for each demarcated area and establish measuring stations networks at fixed points in the polluted areas.

Member States collect data through their networks and report it to the European Commission every year. The Commission assesses this data against the standards set at EU level in the Ambient Air Quality Directive. When the concentrations exceed those standards, Member States must draw up air quality plans to remedy the problem as soon as possible. The Commission evaluates these plans and takes legal actions when it considers that Member States do not comply with the provisions of the Directive. The Directive imposes to the Member States a number of obligations regarding the public information, including the setting of alert and information thresholds.

In this paper we have tried an analysis of the main air pollutants. According to the latest available data, the categories of pollutants with the greatest importance in the analysis of air pollution are carbon dioxide, nitrogen oxides and airborne particles.²

As it can be seen from the data presented in Annex 1, during the analysed period there was a trend of reduction of the main air pollutants at the level of each European Union country. Overall, in the period 2009-2018, considering 2009 as the reference year, the emissions of the main air pollutants decreased between 10% (Malta) and 70% (Lithuania).

¹ Impact assessment underlying the Clean Air for Europe program, SWD (2013) 532, Annex 9

² EEA (2017), report "Air quality in Europe - 2017"

The analysis of the air pollution trend over the two periods, respectively 2009-2013 and 2014-2018, reveals a decreasing trend of carbon dioxide, nitrogen oxide and particulate matter emissions in each of the EU countries. However, emissions of carbon dioxide (CO₂) and nitrogen oxides (NO_x) from diesel cars and light-duty vehicles are systematically much higher than the limit values set out in the approval requirements. For fine particulate matter (PM_{2.5}), up to 8% of the urban population was exposed to concentrations above the EU limit value and over 82% at levels higher than the much stricter guideline set by the WHO¹.

Even though emission reductions have proven to be beneficial for air quality, citizens' health is still significantly affected by air pollution. Many of the EU's air quality standards are less demanding than existing evidence regarding the effect of air pollution on health. Member States are often in a state of non-compliance with these standards and haven't taken sufficient effective actions to improve air quality.

Targets set in the EU framework regarding the climate and energy policies for 2030, namely reducing greenhouse gas emissions by 40%, energy production by at least 27% from renewable sources and improving energy efficiency by at least 27%, can contribute to reducing emissions²

3. European collaboration to ensure clean air

Air quality standards have been approved by both the Member States in the Council and the European Parliament in order to respond to citizens' legitimate concerns about their health. Common air quality standards ensure that every person enjoys a minimum level of air quality anywhere in the EU and creates a fair level of competition for the industry across the EU. A prerequisite for their effective implementation is the establishment of effective measures at national, regional and local level among public authorities, going beyond administrative boundaries. If the lack of measures leads to non-compliance with EU air quality legislation, national courts have jurisdiction to rule on this issue, as recently has happened in court rulings in several Member States.

Also the EU financial support and close cooperation between Member States' authorities and the European Commission are essential. Therefore, The European Commission has stepped up the cooperation with the Member States to facilitate their efforts through various initiatives and measures. The European Commission is ready to further intensify this cooperation, including on the basis of national energy and climate plans.

¹ <https://www.who.int/>

² <https://ec.europa.eu.>

The European Commission has already organized a series of clean air dialogues with Member States to support their implementation efforts. Also, the European Commission is trying to seek synergies with energy union and climate change policies, including the Clean Mobility Package, as well as with dialogue initiatives, such as the Platform for Transitional Coal Regions, set up under the package.

In addition, the European Commission is ready to continue discussions with the Member States, through a tour of their capitals to conduct "Clean Air Dialogues"¹ with those facing significant implementation shortcomings. The aim is to facilitate the full implementation of EU and national air pollution policies in all economic sectors, while raising awareness and enabling citizens to become directly involved in measures to improve air quality. The European Commission will ensure a high level of political representation in these dialogues and invites the Member States to use them to develop an integrated approach to meet the challenge of air quality at all levels of governance and in all economic sectors.

This will complement existing cooperation, which takes place in the context of the evaluation of the implementation of environmental policies and the peer review tool launched in 2017 to improve the implementation of environmental legislation in the EU. For the same purpose and to encourage the adoption of measures at Member States level in order to solve the situations of air quality overruns, the European Commission will use the newly established Forum on Compliance with Environmental Law and Environmental Governance.

The EU's Urban Agenda and Innovative Urban Actions will further facilitate cooperation with and between urban actors within the EU in order to approach the air pollution problem in urban areas, with a budget of EUR 372 million allocated in the current funding period². They aim to support concrete measures to meet urban challenges, from combating pollution to mobility and sustainable urban development.

The Clean Air Forum, launched by the European Commission in November 2017 in Paris, as well as the Green Week from 2018³, dedicated to urban challenges, lay the groundwork for the good practices exchange between all public and private actors, while increasing the relevant stakeholders capacity to improve air quality. This will also strengthen the cohesion of actions at all levels of governance.

¹ Ibidem

² With regard to air quality, the relevant action plan has already been adopted:
<https://ec.europa.eu/futurium/en/air-quality>

³ <https://www.eugreenweek.eu>

To facilitate investments in sustainable projects in European cities - including those that support the clean air agenda - the European Commission and the European Investment Bank have launched URBIS, a new specific consultancy initiative for urban authorities¹. URBIS was established to improve the access of cities to the technical and financial consultancy needed for the development of the urban investment projects, programs and innovative financing / investment platforms. It is already clear that there is a significant demand from urban authorities for this type of service.

EU funds have been made available in various financial flows, and Member States have successfully used this funding to meet the challenge of air quality, either by directly supporting air quality projects or by effectively integrating air quality objectives into other investments (eg infrastructure, agriculture and rural and regional development). The European Commission will step up its collaboration with the Member States to help them make the best use of the funds remaining available during this programming period

Under the current programming period 2014-2020, Member States have allocated EUR 1.8 billion to support air quality measures under the European Structural and Investment Funds. In addition, other indirect contributions that can contribute to ensuring clean air are expected to come from investments in the European Structural and Investment Funds for the period 2014-2020 in the low-carbon economy (EUR 45 billion), in environmental protection and resource efficiency (EUR 63 billion in total) and network infrastructure (EUR 58 billion in total), in particular in support of vulnerable regions and vulnerable citizens

Currently, one third of all investments in the European Fund for Strategic Investments (approximately EUR 80 billion) have been made in the energy, transport and environment sectors. All this has an indirect positive effect on air quality. In addition, the EU's research and development program, Horizon 2020, brings indirect benefits for reducing emissions and air quality. Funding includes research components for cleaner transport solutions.

The European Commission has recently proposed to invest € 1 billion in 39 clean transport projects to modernize the European rail network, further developing the alternative fuels infrastructure and pave the way for zero-emission water transport. The Commission's contribution will release a total of EUR 4.5 billion, representing public and private co-financing under the European Interconnection Mechanism. In the context of the call for joint proposals for infrastructure projects for alternative fuels and cleaner mobility, 69 project proposals were submitted, the amount requested being three times

¹ <http://eiah.eib.org/about/initiative-urbis.htm>

higher than the available grant amount of EUR 350 million, with a value of total investment of EUR 4.2 billion.

The LIFE program has also been essential for the benefits of clean air. For example, the LIFE integrated project 'Małopolska in a healthy atmosphere' - which had an initial budget of around EUR 16 million and mobilized over EUR 800 million - facilitated the implementation of the Małopolska region's air quality plan and improved quality of life for about 20 million citizens in the Małopolska and Silesian regions of Poland, but also in other Member States, such as Slovakia and the Czech Republic. Integrated air quality projects under the LIFE program will be especially encouraged in future calls of project.

The multiannual financial framework for 2021-2027, as proposed by the European Commission¹ will continue to support measures to improve air quality, including by targeting 25% of EU spending to contribute to climate goals, as well as strengthening the program LIFE, which will also support measures to promote clean energy, energy efficiency and the reformed common agricultural policy.

4. The impact of air pollution on comorbidities infected with coronavirus

According to a study realized by the "Romanian Health Observatory", air pollution causes over 23,000 deaths in Romania every year, because it has a major contribution to the onset of:

- *Coronary Heart Diseases (CHD)*- are considered the number one cause of mortality worldwide, having a particularly high impact on the Romanian population. They are responsible for over 9 million deaths per year across the globe, according to the World Health Organization (WHO) ². Even though their mortality has progressively decreased over the last years in Western countries, thanks to the advancements in primary prevention and the improvement of diagnosis and treatment, they still represent a significant burden for developing countries
- *Cancer*- represents the second cause of morbidity and mortality in the world. In Romania, cancer of all causes is responsible for ~20% of deaths, the most frequent types being lung cancer, colon cancer, breast cancer and stomach cancer³
- *Stroke* is also one of the leading causes of death around the world. In Romania, it is responsible for ~17% of all deaths ¹

¹ COM(2018) 321

² <https://www.frontiersin.org/articles/10.3389/fmed.2020.567199/full>

³ <https://www.frontiersin.org/articles/10.3389/fmed.2020.567199/full>

- *End Stage Renal Disease* is estimated to affect around 2 million people worldwide, with an increase of 5–7% per year. There are only two treatment options for these patients at the moment, which are transplantation or dialysis.
- Chronic Pulmonary Diseases (CPD) are represented by asthma and chronic obstructive pulmonary disease (COPD). COPD is currently the third leading cause of death around the world, with 384 million people suffering from this disease and 3 million people dying each year. At the same time, 334 million people are known to be diagnosed with asthma, therefore making it the most prevalent chronic childhood disease.
- Chronic Liver Disease (CLD) is another global health challenge and it is defined as a hepatic suffering for more than 6 months.
- Diabetes and Hypertension were considered in most cases to be predictors of mortality for the abovementioned diseases. In the cases where they could not be associated with another illness, the difference between the two was made based on the number of deaths caused by each one in the Romanian population. The results lead to the conclusion that hypertension should be placed ahead of diabetes, with a number of 8,900 reported deaths caused by it in one year, against 2,700 caused by diabetes².

According to the study, the number of deaths caused by pollution with particulate matter is 10 times higher than the number of deaths caused by road accidents. Particulate matters (PM) are responsible for premature deaths from stroke, lung cancer and cardiovascular disease. There are two types of PM: coarse (PM10) and fine (PM2.5). The latter are harmful to health even at low concentrations in the air, because they enter the lungs. Fine particulate matter inhaled from polluted air reduce life more than directly inhaled cigarette smoke, which can shorten life by only 1.6 years, on average, and are more dangerous than other public health threats, such as war or HIV virus.

In some parts of the world, the situation is very dramatic. For example, the University of Chicago's air quality index shows that people in some parts of India, the second most populous country in the world, are losing 11 years of life due to high levels of air pollution. China and Indonesia are also among the countries where fine particulate matters affect the population, reducing their life expectancy by seven and five and a half years, respectively³.

¹ <https://www.frontiersin.org/articles/10.3389/fmed.2020.567199/full>

² <https://www.frontiersin.org/articles/10.3389/fmed.2020.567199/full>

Nitrogen oxides, NO_x, are other health risk factors generated by pollution. The report made by the "Romanian Health Observatory" mentions that 8,430 premature deaths occur in Romania due to NO_x pollution.

The main source of NO_x pollution is road traffic. Nitrogen oxides cause premature death from respiratory diseases, liver disease and blood diseases. Romania's annual average in terms of NO_x concentrations is close to the EU average.

Although diesel engine emissions are carcinogenic group 1, representing one of the causes of lung cancer, eight of the largest municipalities in Romania have purchased public transport vehicles equipped with such engines. Only three town halls purchased electric-powered public transportation.

Bucharest, Brașov and Cluj are the cities with the most public transport diesel vehicles registered per 1,000 inhabitants in 2017. At county level, the urban areas of Timiș, Bihor and Cluj are the ones with the largest number of older cars of 20 years registered per 1,000 inhabitants, the authors of the report also specify¹.

Air pollution shortens the life expectancy of Romanians, on average, by six months, according to a study realized by the University of Chicago, published in November 2018. According to this study, the most affected region in Romania is Satu Mare County, where pollution cut a year from the life expectancy of the inhabitants. At the opposite pole, the inhabitants of Covasna and Tulcea are the least affected by pollution. In the two counties, pollution reduces life expectancy by only three months, on average. The inhabitants of Bucharest lose an average of nine months of life expectancy due to pollution, according to the study. Globally, air pollution reduces the life expectancy of the population by 1.8 years, on average, being considered "the biggest killer in the world," said the study's authors,

The annual costs generated to the health budget in Romania by the diseases caused by the pollution generated by the road traffic amount to 12 billion euros.

Official data presented by the World Health Organization and the European Commission show that overcrowded traffic in major Romanian cities has become a serious public health problem, Romania being fifth in the EU in terms of the number of years of healthy life lost due to air pollution.

¹ <https://360medical.ro/fara-categorie/bolile-provocate-de-poluare-ne-costa-pest-un-miliard-de-euro-anual-23-de-mii-de-romani-ucisi-de-smog/2018/11/28/>

5. Conclusions

To facilitate domestic funding schemes, EU state aid rules provide a framework that allows Member States to facilitate investments in low-emission and zero-emission mobility, for the benefit of clean air and to combat climate change¹, while promoting the competitiveness of EU industry. Member States (at national, regional or local level) can use these rules to effectively approach the emissions issue, for example those generated by road transport. The German state aid scheme, approved in February 2018, is just one of many examples of how EU rules help Member States facilitate investments in the purchase of rechargeable electric and hybrid buses and related recharging infrastructure to limit air pollution².

In the last years, the European Commission has closely collaborated with national authorities to impulse the progressive change and to help them comply with air quality legislation³. This has led to improvements, but some key issues remain. The European Commission is particularly concerned that there are still persistent exceedances of the limit values for two essential pollutants, which have significant impacts on health: nitrogen oxide, which is mainly generated by road traffic and industry⁴, and suspended particulate matter, which are mainly present in emissions from industry, traffic, home heating and agriculture. The European Commission is committed to continuing to work with Member States to meet agreed air quality standards and to use its legal powers to ensure compliance with relevant EU legislation.

Romania's integration into the European Union has determined the adoption of the European vision and strategic development objectives at national level. The transposition of Community legislation in the field of environmental protection has meant addressing the issue of the environment at a higher level, requiring the development of public policies aimed at improving and / or maintaining the quality of all environmental factors.

Air is identified as an environmental factor of great importance, its quality having major implications in virtually all areas of social and economic life, on public health and the environment. Government air quality policies are embodied in legislation and regulations

¹ Hymel M., Kreiser L., Milne J.E., Ashiabor H., *Innovation addressing climate change challenges: market-based perspectives*, Editura Edward Elgar, Cheltenham, 2018, p. 56

² http://europa.eu/rapid/press-release_IP-18-1222_en.htm

³ Ioniță Gh.I., Ioniță-Burda Ș.D., *Dreptul protecției mediului*, Editura Pro Universitaria, București, 2016, p.23

⁴ Road traffic is responsible for around 40% of nitrogen oxide emissions in the EU. Of the total nitrogen oxide emissions generated by traffic, about 80% come from diesel vehicles

aimed at reducing emissions into the atmosphere and aim at measures and interventions at source, define responsibilities in this area and establish ways to monitor, control, inform citizens and plan economic development in relation to this indicator.

Romania constantly monitors the quality indicators of the atmosphere through the National Air Quality Monitoring Network (RNMCA), established in 2004 by Government Decision 586/2004.

According to the European Commission's report "Assessment of the implementation of EU environmental policies, Country Report - ROMANIA", "Emissions of several air pollutants have decreased significantly in Romania. The decreases recorded between 1990 and 2014 for sulfur oxides (-79%), nitrogen oxides (-53%), ammonia (-46%), as well as for volatile organic compounds (-10%) guarantee that the emissions generated by these pollutants fall within the currently applicable national emission ceilings. "

At the level of 2019, according to the Report on air quality, prepared by the National Agency for Environmental Protection, for the nitrogen oxides indicator were exceeded the annual limit value for human health ($40 \mu\text{g}/\text{m}^3$) at 6 stations : BV-1 Brașov (traffic station), BV-3 Brașov (traffic station), CJ-1 Cluj (traffic station), HD-1Deva (urban background station), TM-1 Timișoara (traffic station) and TM-5 Timișoara (traffic station).

In 2019, for the suspended particle indicator (PM₁₀), there were no exceedances of the annual limit value ($40 \mu\text{g} / \text{m}^3$) at any station from the number of stations considered in the report. Exceedances of the daily limit value were registered at 54 stations, and at 5 stations more than 35: 49 overtaking at AB-2 Sebeș (industrial station), 46 overtaking at B-3 Bucharest (Mihai Bravu) (traffic station), 38 overtaking at B-6 Bucharest (Military Circle) (traffic station), 54 overtaking at IS-1 (Podul de Piatra) (traffic station) and 36 overtaking at IS-2 Iași (Decebal) (bottom station urban).

At national level, air pollution comes mainly from the following emission sources:

- fixed sources: these are industrial sources, usually concentrated on large industrial platforms, but also interspersed with densely populated residential areas;
- mobile sources: personal property cars, especially those with a high degree of use, as well as heavy traffic, especially obsolete bus fleets circulating in large urban agglomerations;
- surface sources: the category of surface sources includes in particular residential heating based on coal and biomass, but also other diffuse combustion sources which are deprived of the relative advantage of dispersion through high chimneys.

A special category is the construction sites, sources that can be framed, depending on the objective, both at fixed sources (for building construction) and at surface sources (for repairs, modernization of road arteries). These sources, if not properly organized, make a major contribution to particulate matter pollution.

References

- Ioniță Gh.I., Ioniță-Burda Ș.D., Dreptul protecției mediului, Editura Pro Universitaria, București, 2016
- Hymel M., Kreiser L., Milne J.E., Ashiabor H., Innovation addressing climate change challenges: market-based perspectives, Editura Edward Elgar, Cheltenham, 2018
- Hussen A. M., Principles of environmental economics and sustainability: an integrated economic and ecological approach, 4th ed., Editura Routledge, Abingdon, 2019
- Repez F., Protecția mediului: necesitate, reglementare și implementare, Editura Centrului Tehnic-Editorial al Armatei, București, 2016
- Directiva 2016/2284/UE
- Directiva 2015/2193/UE privind instalațiile medii de ardere
- Directiva 2010/75/UE privind emisiile industriale
- Directiva 2009/125/CE privind proiectarea ecologică
- Directiva 2008/50/CE
- Directiva 2004/107/CE
- Raportul „Calitatea aerului în Europa” – 2017
- Regulamentul (CE) nr. 510/2011 de stabilire a unor standarde de performanță privind emisiile de CO2 pentru vehiculele utilitare ușoare noi
- Regulamentul (CE) nr. 443/2009 de stabilire a standardelor de performanță privind emisiile de CO2 pentru autoturismele noi
- <http://eiah.eib.org/about/initiative-urbis.htm>
- <https://www.eugreenweek.eu>
- <https://www.europa.eu>

Annex 1

Table 1 - Carbon dioxide emissions at EU level 2009-2018 (%)

TIME/GEO	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
European Union - 28 countries	100,00	99,40	94,61	90,98	87,30	81,50	77,76	76,42	75,10	71,03
Belgium	100,00	101,01	90,77	85,70	81,62	76,68	76,84	73,92	70,56	69,29
Bulgaria	100,00	102,63	104,68	93,95	83,45	85,89	85,90	75,77	73,67	63,27
Czechia	100,00	96,83	89,84	87,36	85,61	84,56	77,76	76,41	68,89	64,35
Denmark	100,00	93,05	89,41	79,89	76,32	68,83	67,25	67,72	65,04	64,34
Germany	100,00	100,55	94,12	93,22	92,22	85,42	82,51	80,24	76,37	70,92
Estonia	100,00	124,89	107,30	96,60	100,68	90,94	72,24	78,04	74,97	65,19
Ireland	100,00	128,15	117,33	118,44	105,98	100,74	78,07	81,07	76,13	68,53
Greece	100,00	100,14	105,82	114,52	108,34	105,28	98,64	94,53	100,94	n.a.
Spain	100,00	96,01	99,45	102,10	91,70	92,55	95,68	86,18	88,56	82,96
France	100,00	99,83	92,38	90,95	90,13	81,66	80,65	79,04	78,15	71,89
Croatia	100,00	97,04	96,29	90,72	89,95	85,77	82,78	79,86	78,29	n.a.
Italy	100,00	100,45	95,87	91,79	83,90	79,31	78,87	76,76	75,89	73,51
Cyprus	100,00	90,75	80,95	74,66	71,97	80,52	76,00	76,63	76,39	70,89
Latvia	100,00	128,10	101,63	87,65	82,41	77,24	78,35	75,05	71,21	73,09
Lithuania	100,00	104,80	100,87	95,33	88,03	90,06	88,98	91,65	95,06	90,62
Luxembourg	100,00	92,89	77,32	76,23	72,24	68,08	71,96	66,68	64,37	60,77
Hungary	100,00	97,23	93,45	88,87	82,02	80,02	79,77	76,09	72,13	67,36
Malta	100,00	100,58	96,83	92,84	79,01	72,37	55,97	48,91	54,30	42,34
Netherlands	100,00	102,88	96,08	93,43	92,10	91,22	92,72	90,10	85,40	79,27
Austria	100,00	103,30	96,81	89,48	85,88	79,18	78,01	73,49	75,12	68,66
Poland	100,00	92,95	89,70	84,34	81,70	76,12	73,63	77,09	74,75	71,19
Portugal	100,00	88,60	89,99	92,02	86,60	86,05	91,27	84,64	88,70	79,61
Romania	100,00	100,44	104,08	96,78	79,34	76,21	73,22	66,01	58,58	54,03
Slovenia	100,00	99,71	98,74	96,79	93,25	80,32	78,80	79,17	76,98	73,18
Slovakia	100,00	94,63	92,11	81,79	79,84	74,25	72,13	72,06	71,20	68,51
Finland	100,00	111,83	95,55	84,85	85,29	76,73	68,91	73,05	65,96	65,88
Sweden	100,00	94,14	79,00	71,91	66,84	65,76	63,30	62,94	62,43	64,38
United Kingdom	100,00	96,49	90,27	83,06	80,89	69,08	57,47	57,77	57,18	54,16

Source: data processed by the authors, <https://ec.europa.eu/eurostat/data/database>

Table 2 - Carbon dioxide emissions at EU level (2009-2013) - grams per euro-

TIME/GEO	2009	2010	2011	2012	2013	Average
European Union - 28 countries	281,94	280,26	266,73	256,51	246,14	266,32
Belgium	260,78	263,42	236,72	223,49	212,86	239,45
Bulgaria	1346,37	1381,79	1409,40	1264,89	1123,59	1305,21
Czechia	703,62	681,34	632,16	614,65	602,38	646,83
Denmark	399,84	372,04	357,48	319,43	305,14	350,79
Germany	300,29	301,95	282,62	279,93	276,94	288,35
Estonia	1156,32	1444,14	1240,73	1116,95	1164,21	1224,47
Ireland	181,80	232,98	213,31	215,32	192,68	207,22
Greece	386,56	387,11	409,04	442,68	418,78	408,83
Spain	237,75	228,27	236,44	242,74	218,02	232,64
France	149,23	148,97	137,86	135,73	134,50	141,26
Croatia	419,63	407,19	404,08	380,70	377,47	397,81
Italy	219,11	220,10	210,06	201,13	183,83	206,85
Cyprus	443,95	402,88	359,37	331,45	319,50	371,43
Latvia	416,04	532,96	422,81	364,64	342,85	415,86
Lithuania	510,11	534,57	514,54	486,31	449,04	498,91
Luxembourg	223,88	207,97	173,11	170,66	161,72	187,47
Hungary	485,12	471,67	453,34	431,12	397,89	447,83
Malta	624,38	627,98	604,59	579,65	493,31	585,98
Netherlands	266,43	274,09	255,99	248,93	245,37	258,16
Austria	198,20	204,75	191,88	177,35	170,22	188,48
Poland	981,37	912,21	880,27	827,69	801,81	880,67
Portugal	314,87	278,97	283,36	289,74	272,68	287,92
Romania	653,57	656,42	680,24	632,53	518,54	628,26
Slovenia	421,51	420,28	416,18	407,98	393,04	411,80
Slovakia	556,40	526,51	512,48	455,10	444,23	498,94
Finland	325,89	364,45	311,40	276,51	277,95	311,24
Sweden	161,80	152,32	127,82	116,35	108,14	133,29
United Kingdom	256,24	247,24	231,30	212,83	207,27	230,98

Source: data processed by the authors, <https://ec.europa.eu/eurostat/data/database>

Table 3 - Carbon dioxide emissions at EU level (2014-2018) - grams per euro-

TIME/GEO	2014	2015	2016	2017	2018	Average
European Union – 28 countries	229,78	219,25	215,47	211,75	200,25	215,30
Belgium	199,97	200,39	192,77	184,00	180,69	191,56
Bulgaria	1156,34	1156,59	1020,12	991,83	851,85	1035,35
Czechia	595,01	547,10	537,62	484,69	452,76	523,44
Denmark	275,22	268,89	270,77	260,07	257,25	266,44
Germany	256,50	247,77	240,94	229,34	212,98	237,51
Estonia	1051,53	835,29	902,42	866,84	753,76	881,97
Ireland	183,15	141,94	147,39	138,41	124,59	147,10
Greece	406,96	381,32	365,40	390,20	:	308,78
Spain	220,03	227,48	204,90	210,54	197,23	212,04
France	121,86	120,35	117,95	116,63	107,28	116,81
Croatia	359,92	347,38	335,10	328,51	:	274,18
Italy	173,78	172,82	168,18	166,28	161,07	168,43
Cyprus	357,47	337,38	340,19	339,14	314,70	337,78
Latvia	321,34	325,97	312,24	296,28	304,08	311,98
Lithuania	459,43	453,91	467,50	484,90	462,26	465,60
Luxembourg	152,41	161,11	149,28	144,12	136,06	148,60
Hungary	388,18	386,97	369,15	349,93	326,76	364,20
Malta	451,84	349,47	305,36	339,01	264,36	342,01
Netherlands	243,04	247,03	240,05	227,53	211,19	233,77
Austria	156,93	154,61	145,66	148,88	136,09	148,43
Poland	746,98	722,60	756,51	733,54	698,66	731,66
Portugal	270,93	287,39	266,52	279,30	250,66	270,96
Romania	498,06	478,53	431,42	382,83	353,15	428,80
Slovenia	338,56	332,14	333,69	324,49	308,45	327,47
Slovakia	413,14	401,33	400,94	396,16	381,21	398,56
Finland	250,05	224,57	238,05	214,97	214,70	228,47
Sweden	106,40	102,42	101,83	101,01	104,16	103,16
United Kingdom	177,00	147,26	148,04	146,52	138,79	151,52

Source: data processed by the authors, <https://ec.europa.eu/eurostat/data/database>

Table 4 – Nitrogen oxide emissions at EU level (2009-2017) - percent-

TIME/GEO	2009	2010	2011	2012	2013	2014	2015	2016	2017
European Union - 28 countries	100,00	95,59	89,71	85,29	79,41	75,00	70,59	67,65	66,18
Belgium	100,00	94,87	87,18	79,49	76,92	71,79	66,67	61,54	56,41
Bulgaria	100,00	91,94	94,84	86,13	77,74	78,06	73,23	66,13	42,26
Czechia	100,00	91,67	82,41	78,70	75,00	71,30	62,96	55,56	50,00
Denmark	100,00	89,92	94,21	85,39	75,82	71,03	73,55	71,54	73,55
Germany	100,00	98,04	88,24	92,16	88,24	82,35	78,43	74,51	72,55
Estonia	100,00	90,98	87,45	81,96	74,90	67,45	56,47	64,31	54,12
Ireland	100,00	93,62	80,85	80,85	78,72	72,34	53,19	51,06	46,81
Greece	100,00	87,41	85,93	81,48	82,96	82,22	80,74	82,22	82,22
Spain	100,00	94,12	94,12	94,12	82,35	82,35	80,88	73,53	72,06
France	100,00	94,74	89,47	86,84	84,21	73,68	71,05	65,79	60,53
Croatia	100,00	89,19	83,78	79,28	81,08	74,77	72,07	66,67	61,26
Italy	100,00	95,65	93,48	86,96	82,61	76,09	76,09	71,74	76,09
Cyprus	100,00	87,78	90,00	85,56	66,67	72,22	54,44	50,00	50,00
Latvia	100,00	119,43	95,43	81,71	80,00	77,71	76,57	70,86	66,86
Lithuania	100,00	103,01	93,37	91,57	89,76	90,96	88,55	93,37	86,75
Luxembourg	100,00	88,24	74,51	72,55	70,59	70,59	76,47	70,59	68,63
Hungary	100,00	94,07	86,44	83,05	82,20	77,97	75,42	65,25	59,32
Malta	100,00	89,32	86,41	88,35	66,99	59,22	42,72	35,92	30,10
Netherlands	100,00	94,74	85,96	82,46	82,46	77,19	73,68	70,18	66,67
Austria	100,00	94,44	86,11	80,56	75,00	69,44	63,89	61,11	58,33
Poland	100,00	91,90	85,71	79,52	73,33	67,62	62,38	65,71	67,62
Portugal	100,00	88,76	83,15	82,02	77,53	76,40	74,16	69,66	67,42
Romania	100,00	100,00	100,78	104,69	92,19	86,72	83,59	78,91	73,44
Slovenia	100,00	95,19	91,35	87,50	81,73	68,27	58,65	58,65	50,96
Slovakia	100,00	87,37	76,84	70,53	68,42	67,37	62,11	55,79	52,63
Finland	100,00	104,82	92,77	89,16	86,75	78,31	71,08	71,08	66,27
Sweden	100,00	80,56	68,06	61,11	56,94	58,33	52,78	55,56	58,33
United Kingdom	100,00	93,65	90,48	77,78	71,43	65,08	57,14	57,14	50,79

Source: data processed by the authors, <https://ec.europa.eu/eurostat/data/database>

Table 5 – Nitrogen oxide emissions at EU level (2009-2013)- grams per euro

TIME/GEO	2009	2010	2011	2012	2013	Average
European Union - 28 countries	0,68	0,65	0,61	0,58	0,54	0,61
Belgium	0,39	0,37	0,34	0,31	0,30	0,34
Bulgaria	3,10	2,85	2,94	2,67	2,41	2,79
Czechia	1,08	0,99	0,89	0,85	0,81	0,92
Denmark	3,97	3,57	3,74	3,39	3,01	3,54
Germany	0,51	0,50	0,45	0,47	0,45	0,48
Estonia	2,55	2,32	2,23	2,09	1,91	2,22
Ireland	0,47	0,44	0,38	0,38	0,37	0,41
Greece	1,35	1,18	1,16	1,10	1,12	1,18
Spain	0,68	0,64	0,64	0,64	0,56	0,63
France	0,38	0,36	0,34	0,33	0,32	0,35
Croatia	1,11	0,99	0,93	0,88	0,90	0,96
Italy	0,46	0,44	0,43	0,40	0,38	0,42
Cyprus	0,90	0,79	0,81	0,77	0,60	0,77
Latvia	1,75	2,09	1,67	1,43	1,40	1,67
Lithuania	1,66	1,71	1,55	1,52	1,49	1,59
Luxembourg	0,51	0,45	0,38	0,37	0,36	0,41
Hungary	1,18	1,11	1,02	0,98	0,97	1,05
Malta	1,03	0,92	0,89	0,91	0,69	0,89
Netherlands	0,57	0,54	0,49	0,47	0,47	0,51
Austria	0,36	0,34	0,31	0,29	0,27	0,31
Poland	2,10	1,93	1,80	1,67	1,54	1,81
Portugal	0,89	0,79	0,74	0,73	0,69	0,77
Romania	1,28	1,28	1,29	1,34	1,18	1,27
Slovenia	1,04	0,99	0,95	0,91	0,85	0,95
Slovakia	0,95	0,83	0,73	0,67	0,65	0,77
Finland	0,83	0,87	0,77	0,74	0,72	0,79
Sweden	0,72	0,58	0,49	0,44	0,41	0,53
United Kingdom	0,63	0,59	0,57	0,49	0,45	0,55

Source: data processed by the authors, <https://ec.europa.eu/eurostat/data/database>

Table 6 – Nitrogen oxide emissions at EU level (2014-2017) - grams per euro

TIME/GEO	2014	2015	2016	2017	Average
European Union - 28 countries	0,51	0,48	0,46	0,45	0,48
Belgium	0,28	0,26	0,24	0,22	0,25
Bulgaria	2,42	2,27	2,05	1,31	2,01
Czechia	0,77	0,68	0,60	0,54	0,65
Denmark	2,82	2,92	2,84	2,92	2,88
Germany	0,42	0,40	0,38	0,37	0,39
Estonia	1,72	1,44	1,64	1,38	1,55
Ireland	0,34	0,25	0,24	0,22	0,26
Greece	1,11	1,09	1,11	1,11	1,11
Spain	0,56	0,55	0,50	0,49	0,53
France	0,28	0,27	0,25	0,23	0,26
Croatia	0,83	0,80	0,74	0,68	0,76
Italy	0,35	0,35	0,33	0,35	0,35
Cyprus	0,65	0,49	0,45	0,45	0,51
Latvia	1,36	1,34	1,24	1,17	1,28
Lithuania	1,51	1,47	1,55	1,44	1,49
Luxembourg	0,36	0,39	0,36	0,35	0,37
Hungary	0,92	0,89	0,77	0,70	0,82
Malta	0,61	0,44	0,37	0,31	0,43
Netherlands	0,44	0,42	0,40	0,38	0,41
Austria	0,25	0,23	0,22	0,21	0,23
Poland	1,42	1,31	1,38	1,42	1,38
Portugal	0,68	0,66	0,62	0,60	0,64
Romania	1,11	1,07	1,01	0,94	1,03
Slovenia	0,71	0,61	0,61	0,53	0,62
Slovakia	0,64	0,59	0,53	0,50	0,57
Finland	0,65	0,59	0,59	0,55	0,60
Sweden	0,42	0,38	0,40	0,42	0,41
United Kingdom	0,41	0,36	0,36	0,32	0,36

Source: data processed by the authors, <https://ec.europa.eu/eurostat/data/database>

Table 7 – Emissions of particulate matter (<2.5µm) at EU level (2009-2017) (%)

TIME/GEO	2009	2010	2011	2012	2013	2014	2015	2016	2017
European Union - 28 countries	100,00	87,50	87,50	75,00	75,00	62,50	62,50	62,50	62,50
Belgium	100,00	100,00	75,00	75,00	75,00	50,00	50,00	50,00	50,00
Bulgaria	100,00	94,74	89,47	89,47	78,95	78,95	89,47	63,16	57,89
Czechia	100,00	100,00	88,89	77,78	77,78	77,78	66,67	66,67	55,56
Denmark	100,00	80,00	82,86	77,14	68,57	65,71	51,43	51,43	51,43
Germany	100,00	85,71	71,43	71,43	71,43	71,43	57,14	57,14	57,14
Estonia	100,00	152,46	178,69	70,49	101,64	65,57	68,85	54,10	57,38
Ireland	100,00	100,00	75,00	75,00	75,00	75,00	50,00	50,00	50,00
Greece	100,00	77,78	66,67	66,67	66,67	66,67	61,11	61,11	55,56
Spain	100,00	100,00	100,00	100,00	100,00	100,00	100,00	80,00	80,00
France	100,00	100,00	100,00	80,00	80,00	80,00	80,00	80,00	80,00
Croatia	100,00	93,33	86,67	80,00	80,00	73,33	73,33	73,33	73,33
Italy	100,00	100,00	100,00	83,33	83,33	66,67	66,67	66,67	83,33
Cyprus	100,00	90,00	70,00	50,00	50,00	50,00	50,00	50,00	50,00
Latvia	100,00	108,57	91,43	91,43	94,29	97,14	100,00	97,14	94,29
Lithuania	100,00	68,00	128,00	68,00	80,00	64,00	52,00	44,00	56,00
Luxembourg	100,00	75,00	75,00	75,00	50,00	50,00	50,00	50,00	50,00
Hungary	100,00	81,82	72,73	63,64	63,64	72,73	63,64	63,64	54,55
Malta	100,00	120,00	140,00	120,00	80,00	100,00	60,00	40,00	40,00
Netherlands	100,00	100,00	100,00	66,67	66,67	66,67	66,67	66,67	66,67
Austria	100,00	100,00	100,00	75,00	75,00	75,00	75,00	50,00	50,00
Poland	100,00	93,33	86,67	83,33	80,00	73,33	70,00	73,33	73,33
Portugal	100,00	100,00	104,55	104,55	95,45	90,91	90,91	86,36	81,82
Romania	100,00	100,00	100,00	90,48	76,19	71,43	66,67	61,90	52,38
Slovenia	100,00	90,00	90,00	90,00	80,00	80,00	80,00	70,00	70,00
Slovakia	100,00	100,00	85,71	71,43	71,43	71,43	71,43	57,14	57,14
Finland	100,00	100,00	75,00	75,00	75,00	62,50	50,00	50,00	50,00
Sweden	100,00	77,78	66,67	66,67	55,56	55,56	44,44	44,44	44,44
United Kingdom	100,00	80,00	80,00	60,00	60,00	60,00	60,00	60,00	60,00

Source: data processed by the authors, <https://ec.europa.eu/eurostat/data/database>

**Table 8 – Emissions of particulate matter (<2.5µm) at EU level (2009-2013)
- grams per euro-**

TIME/GEO	2009	2010	2011	2012	2013	Average
European Union - 28 countries	0,08	0,07	0,07	0,06	0,06	0,07
Belgium	0,04	0,04	0,03	0,03	0,03	0,03
Bulgaria	0,19	0,18	0,17	0,17	0,15	0,17
Czechia	0,09	0,09	0,08	0,07	0,07	0,08
Denmark	0,35	0,28	0,29	0,27	0,24	0,29
Germany	0,07	0,06	0,05	0,05	0,05	0,06
Estonia	0,61	0,93	1,09	0,43	0,62	0,74
Ireland	0,04	0,04	0,03	0,03	0,03	0,03
Greece	0,18	0,14	0,12	0,12	0,12	0,14
Spain	0,05	0,05	0,05	0,05	0,05	0,05
France	0,05	0,05	0,05	0,04	0,04	0,05
Croatia	0,15	0,14	0,13	0,12	0,12	0,13
Italy	0,06	0,06	0,06	0,05	0,05	0,06
Cyprus	0,10	0,09	0,07	0,05	0,05	0,07
Latvia	0,35	0,38	0,32	0,32	0,33	0,34
Lithuania	0,25	0,17	0,32	0,17	0,20	0,22
Luxembourg	0,04	0,03	0,03	0,03	0,02	0,03
Hungary	0,11	0,09	0,08	0,07	0,07	0,08
Malta	0,05	0,06	0,07	0,06	0,04	0,06
Netherlands	0,03	0,03	0,03	0,02	0,02	0,03
Austria	0,04	0,04	0,04	0,03	0,03	0,04
Poland	0,30	0,28	0,26	0,25	0,24	0,27
Portugal	0,22	0,22	0,23	0,23	0,21	0,22
Romania	0,21	0,21	0,21	0,19	0,16	0,20
Slovenia	0,10	0,09	0,09	0,09	0,08	0,09
Slovakia	0,07	0,07	0,06	0,05	0,05	0,06
Finland	0,08	0,08	0,06	0,06	0,06	0,07
Sweden	0,09	0,07	0,06	0,06	0,05	0,07
United Kingdom	0,05	0,04	0,04	0,03	0,03	0,04

Source: data processed by the authors, <https://ec.europa.eu/eurostat/data/database>

**Table 9 - Emissions of particulate matter (<2.5µm) at EU level (2014-2017)
- grams per euro -**

TIME/GEO	2014	2015	2016	2017	Average
European Union - 28 countries	0,05	0,05	0,05	0,05	0,05
Belgium	0,02	0,02	0,02	0,02	0,02
Bulgaria	0,15	0,17	0,12	0,11	0,14
Czechia	0,07	0,06	0,06	0,05	0,06
Denmark	0,23	0,18	0,18	0,18	0,19
Germany	0,05	0,04	0,04	0,04	0,04
Estonia	0,40	0,42	0,33	0,35	0,38
Ireland	0,03	0,02	0,02	0,02	0,02
Greece	0,12	0,11	0,11	0,10	0,11
Spain	0,05	0,05	0,04	0,04	0,05
France	0,04	0,04	0,04	0,04	0,04
Croatia	0,11	0,11	0,11	0,11	0,11
Italy	0,04	0,04	0,04	0,05	0,04
Cyprus	0,05	0,05	0,05	0,05	0,05
Latvia	0,34	0,35	0,34	0,33	0,34
Lithuania	0,16	0,13	0,11	0,14	0,14
Luxembourg	0,02	0,02	0,02	0,02	0,02
Hungary	0,08	0,07	0,07	0,06	0,07
Malta	0,05	0,03	0,02	0,02	0,03
Netherlands	0,02	0,02	0,02	0,02	0,02
Austria	0,03	0,03	0,02	0,02	0,03
Poland	0,22	0,21	0,22	0,22	0,22
Portugal	0,20	0,20	0,19	0,18	0,19
Romania	0,15	0,14	0,13	0,11	0,13
Slovenia	0,08	0,08	0,07	0,07	0,08
Slovakia	0,05	0,05	0,04	0,04	0,05
Finland	0,05	0,04	0,04	0,04	0,04
Sweden	0,05	0,04	0,04	0,04	0,04
United Kingdom	0,03	0,03	0,03	0,03	0,03

Source: data processed by the authors, <https://ec.europa.eu/eurostat/data/database>