

UDC 349.6:330.322.01:341.23:656.13(477)

Malykhina Y.

*Doctor of Pedagogy, Ph. D. in Law,
Head of the Department of Legal Support and Administration of Transport Activities,
Ukrainian State University of Railway Transport, Kharkiv, Ukraine;
e-mail: yana_malykhina@ukr.net; ORCID ID: 0000-0002-3188-7033*

Protopopova Y.

*Ph. D. in Law,
Associate Professor of the Department of Legal Support and Administration of Transport Activities,
Ukrainian State University of Railway Transport, Kharkiv, Ukraine;
e-mail: sprindis11@ukr.net; ORCID ID: 0000-0001-9858-489X*

Pavlichenko O.

*Doctor of Law,
Associate Professor of the Department of Sanitation, Hygiene and Forensic Veterinary Medicine,
State Biotechnological University, Kharkiv, Ukraine;
e-mail: pavlichenkoelena@gmail.com; ORCID ID: 0000-0002-6577-6577*

Pavlichenko V.

*Doctor of Law,
Professor of the Department of Legal Support and Administration of Transport Activities,
Ukrainian State University of Railway Transport, Kharkiv, Ukraine;
e-mail: pedkopavlik@gmail.com; ORCID ID: 0000-0002-6740-3387*

ECONOMIC AND LEGAL WAYS OF TRANSPORT INDUSTRY MODERNIZATION IN UKRAINE IN THE CONTEXT OF CLIMATE CHANGE

Abstract. There is substantiated the need to modernize the transport area of Ukraine in the view of state obligations adopted during the signing of international environmental agreements. It is argued that the adoption of the United Nations Framework Convention on Climate Change and its further implementation by the Kyoto Protocol and the Paris Agreement require the signatory States to take measures to minimize the anthropogenic impact of CO₂ emissions in the earth's atmosphere. A comparative analysis of the qualitative and quantitative composition of the fleet of transport industries of European countries and Ukraine proves that the minimization of environmental pollution by Ukraine should be done by renewal the fleet. Based on the statistics of the quality fleet of transport industries of European countries that practice CO₂ emissions and those that who does not tax harmful CO₂ emissions, it is demonstrated the dependence of the age — related conditions of the fleet, where the taxation demonstrates its incentive properties to modernize transport industries and renew fleets to modern vehicles. The characterization of global trends in minimizing of harmful emissions into the atmosphere of greenhouse gases gave a reason to argue that the implementation of an environmental tax has a dual nature. On the one hand, the tax encourages owners of enterprises, institutions, organizations of transport industry to invest in environmentally friendly transport to minimize the tax burden, and on the other hand, the taxation influences on the environmental situation in the regions and on the planet as a whole. It is substantiated that regulations aimed at minimizing harmful emissions into the atmosphere allow at the state level to implement policies on the formation, distribution and use of tax revenues for fighting climate change. It is concluded that tax revenues from the taxation of CO₂ emissions into the atmosphere can be used to support the transport industry through public-private partnerships. It also emphasizes that Ukraine should intensify international cooperation and agree with developed countries to support the modernization of the Ukrainian transport industry using financial mechanisms and technology transfer agreements to increase resistance to climate change and reduce greenhouse gas emissions enshrined in the Paris Agreement.

Keywords: climate change, harmful CO₂ emissions, transport area, vehicles, international environmental agreements, regulations, environmental tax.

JEL Classification F21, E62, K32, K34, R42, R48

Formulas: 0; fig.: 0; tabl.: 6; bibl.: 16.

Малихіна Я. А.

доктор педагогічних наук, кандидат юридичних наук,
завідувач кафедри правового забезпечення та адміністрування транспортної діяльності,
Український державний університет залізничного транспорту, Харків, Україна;
e-mail: yana_malyhina@ukr.net; ORCID ID: 0000-0002-3188-7033

Протопопова Я. С.

кандидат юридичних наук,
доцент кафедри правового забезпечення та адміністрування транспортної діяльності,
Український державний університет залізничного транспорту, Харків, Україна;
e-mail: sprindis11@ukr.net; ORCID ID: 0000-0001-9858-489X

Павліченко О. В.

доктор юридичних наук,
доцент кафедри санітарії, гігієни та судової ветеринарної медицини,
Державний біотехнологічний університет, Харків, Україна;
e-mail: pavlichenkoelena@gmail.com; ORCID ID: 0000-0002-6577-6577

Павліченко В. М.

доктор юридичних наук,
професор кафедри правового забезпечення та адміністрування транспортної діяльності,
Український державний університет залізничного транспорту, Харків, Україна;
e-mail: pedkopavlik@gmail.com; ORCID ID: 0000-0002-6740-3387

ЕКОНОМІКО-ПРАВОВІ ШЛЯХИ МОДЕРНІЗАЦІЇ ТРАНСПОРТНОЇ ГАЛУЗІ УКРАЇНИ В КОНТЕКСТІ КЛІМАТИЧНИХ ЗМІН

Анотація. Обґрунтовується необхідність модернізації транспортної галузі України з огляду на зобов'язання держави, ухвалені при підписанні міжнародних екологічних угод. Наголошено, що ухвалення Рамкової Конвенції ООН про зміну клімату і подальша її реалізація Кіотським протоколом і Паризькою угодою вимагають від держав-підписантів ужиття заходів щодо мінімізації антропогенного впливу викидів CO₂ в атмосферу планети. Порівняльний аналіз якісного і кількісного складу автопарку транспортних галузей європейських держав та України доводить, що мінімізація екологічного забруднення з боку України повинна відбуватися шляхом оновлення автопарку. На основі статистичних даних якості автопарку транспортних галузей європейських держав, що практикують оподаткування викидів CO₂ в атмосферу і тих, що не оподатковують шкідливі викиди CO₂, продемонстровано залежність вікового стану автопарку, де оподаткування демонструє свої стимуляційні властивості до модернізації транспортних галузей та оновлення автопарків на сучасні транспортні засоби. Характеристика глобальних тенденцій мінімізації шкідливих викидів в атмосфері парникових газів дала підставу стверджувати, що запровадження екологічного податку має двоєдину природу. З одного боку, податок стимулює власників підприємств, установ, організацій транспортної галузі здійснювати капіталовкладення в екологічний транспорт задля мінімізації податкового навантаження, а з другого — оподаткування впливає на поліпшення екологічної ситуації в регіонах і на планеті в цілому. Обґрунтовується, що нормативно-правові акти, спрямовані на мінімізацію шкідливих викидів в атмосферу, дозволяють на рівні держави впроваджувати політику щодо формування, розподілу і використання податкових надходжень для боротьби з кліматичними змінами. Зроблено висновок, що податкові надходження від оподаткування викидів CO₂ в атмосферу можуть спрямовуватися на підтримку транспортної галузі через приватно-державне партнерство. Також наголошується на тому, що Україна має активізувати міжнародну співпрацю і домовитися з розвиненими державами світу про підтримку модернізації української транспортної галузі з використанням фінансових механізмів та угод про передавання технологій задля підвищення рівня спротиву кліматичним змінам і скорочення викидів парникових газів, що закріплені в Паризькій угоді.

Ключові слова: кліматичні зміни, шкідливі викиди CO₂, транспортна галузь, транспортні засоби, міжнародні екологічні угоди, нормативно-правові акти, екологічний податок.

Формул: 0; рис.: 0; табл.: 6; бібл.: 16.

Introduction. Climate change leading to negative consequences on the planet, has long time been already discussed by the world community at the highest level. Today it is generally accepted that «human activities have been substantially increasing the atmospheric concentrations of greenhouse gases, that these increases enhance the natural greenhouse effect, and that this will result on average in an additional warming of the Earth's surface and atmosphere and may adversely affect natural ecosystems and humankind» [1]. The United Nations Framework Convention on Climate Change is a framework international environmental agreement signed by almost 200 countries, including Ukraine, aimed at preventing dangerous anthropogenic impacts on the Earth's climate. The signing of this international agreement on June 11, 1992 and the ratification of this international agreement on October 29, 1996 imposes on our state the obligations aimed at counteracting the dangerous anthropogenic impact on the Earth's climate change by minimizing greenhouse gas emissions.

Taking into account the fact that oil and natural gas used in particular for the operation of vehicles, and it is the main cause of anthropogenic CO₂ emissions, there is the issue of implementation of ecological transport in order to minimize the negative impact on the planet's climate that is relevant today. At the same time, the economic opportunities of the world's countries in terms of financial costs for the implementation of environmentally friendly technologies are different. Thus, Ukraine, which belongs to the developing countries, mainly concentrates its financial resources on overcoming socio and economic problems related to the welfare of the population and aimed at ensuring the viability of the State economy. Unfortunately, the issue of modernization of the transport sector is not a priority today and, accordingly, remains the need to determine the best ways for the state to participate in supporting the transport sector by taking measures to minimize CO₂ emissions.

Research analysis and problem statement. The issues of climate change have long time been among the relevant issues of global scale. The search for ways to minimize harmful greenhouse gas emissions is carrying out both at the international level and at the level of industry sciences. Some problems of this issue are revealed in the scientific researches of foreign and domestic researchers such as: Assaad Ghazouani, Borysova T. M., Matisoff D. C., Chandler D. L., Mistur E. M., Kingsley G., Patomäki H., Ilchenko S. V., Morgan J., Kushnir N., Malin Aldenius, Mashkantseva S. O., Jebli M. B., Monastyrskyi H. L., Siusko O., Umer Shahzad, Wanjun Xia, Xiang Gao, Xiaohua Zhang, Yehyun Anc, Yun Gao and others.

The purpose of the article is to substantiate the need for the implementation of an environmental tax on CO₂ emissions into the atmosphere and the redistribution of tax revenues from this tax for the modernization of the transport sector of Ukraine.

Materials and methods. There are used both general scientific and special scientific methods for achieving the tasks, which are set in the article. The research methodology has included the use of a dialectical method to determine the need to implement an environmental CO₂ tax. The deductive method is used to justify the need to fight against climate change through the use of legal tools. The theoretical and prognostic method is used by formulations of proposals for the redistribution of tax revenues from the tax on the modernization of the transport sector of Ukraine. In addition, the abstraction method and generalization one are used to justify the taxation of harmful anthropogenic emissions into the atmosphere in order to fight against climate change, which will affect not only the environmental situation in Ukraine and the world as a whole, but also the efficiency of the transport industry and its competitiveness.

Research results. According to the Article 2 of the Kyoto Protocol it was made an agreement at the international level on «implement and/or further elaborate policies and measures in accordance with its national circumstances, such as: a) Enhancement of energy efficiency in

relevant sectors of the national economy; b) Research on, and promotion, development and increased use of, new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies; c) Measures to limit and/or reduce emissions of greenhouse gases not controlled by the Montreal Protocol in the transport sector...» [2]. «Recognizing the need for an effective and progressive response to the urgent threat of climate change on the basis of the best available scientific knowledge» to replace the Kyoto Protocol, which was an international agreement to limit greenhouse gas emissions in 2015, the Paris Agreement was adopted, which emphasizes on «the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity, recognized by some cultures as Mother Earth, and noting the importance for some of the concept of «climate justice», when taking action to address climate change» [3]. Ratification of Paris Agreement (2015) by Ukraine on July 14, 2016 requires our State to take measures aimed at «Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development» [3]. This shows that the transport sector of Ukraine should be modernized as close as possible to the environmental one. And the question is how to minimize the negative impact of the transport sector of Ukraine on climate change on the planet.

Global trends in minimizing greenhouse gas emissions. Foreign researchers note that «the adoption of the Paris Agreement has manifested the determination and wisdom of global cooperation to address climate change and low-carbon and sustainable development. It represents the new starting point of the international system in coping with climate change» [4, p. 278]. Global climate challenges to society have recently become threatening to the further normal functioning of humankind, and therefore the indisputable fact today is the desire of the world community to work together to overcome the negative effects of industrialization. Taken into account the uniqueness of the problem of overcoming climate change on the planet it has led to a revision of world environmental policy, where legal means are one of the effective tools to minimize the negative impact of human activities on the planet's climate.

Thus, according to the results of the 15th International Conference on Competition and Ownership in Land Passenger Transport (the Thredbo Series) «recommendation was made for a greater focus on transit modal integration focusing on the users, not the modes, to ensure transit systems better address the growth, social and environmental challenges of future cities» [5, p. 3]. In fact, researchers justify the need to modernize the transport industry not only to meet the needs of the population, but also to solve environmental problems caused by CO₂ emissions into the planet's atmosphere.

Scientific and technological progress also contributes to solving the problems caused by climate change, but the implementation of environmentally friendly technologies is associated with the need to redirect cash flows to implement such technologies. «The development of new renewable fuel and technologies occurs quickly, and the future vehicle fleets will probably consist of a more diverse fuel pallet in order to meet climate and environmental goals, assure the availability of fuel and meet regional needs. It is therefore reasonable to assume that regions will continue to battle with how they can best introduce new renewable fuels or technologies. With the continued use of functional requirements, only the cheapest and already commercially viable renewable fuels can enter the market and it is up to the national governments to decide which fuel is “the winner” through taxation, funding, and legislation. At the moment, most regions are starting to think about the possibility to introduce electric buses in their city traffic» [6, p. 114]. So, if we talk about the development of transport services for the population, one of the main tasks is to update the fleet of transport industries, where environmentally friendly transport will contribute to minimizing greenhouse gas emissions.

For example, in the United States «state transportation projects implementing the National Environmental Policy Act (NEPA). State departments of transportation (DOTs) develop environmental review processes that comply with NEPA on all federally funded projects in order to ensure that the local environment is not irreparably or unnecessarily damaged» [7]. This indicates that the world countries with developed economies prefer business projects that have an

environmental component. But the introduction of new business projects which minimize the negative impact on the planet's climate is not enough.

The Paris Agreement and the subsequent IPCC Global Warming of 1.5 °C report signal a need for greater urgency in achieving carbon emissions reductions. We make argument for greater use of carbon taxes and for a global approach to this. First, we argue that current modelling tends to lead to a «facts in waiting» approach to technology, which takes insufficient account of uncertainty. Rather than look to the future, carbon taxes that facilitate social redesign are something we have control over now. Second, we argue that the «trade» in «cap and trade» has been ineffective and carbon trading has served mainly as a distraction. Carbon taxes provide a simpler more flexible and pervasive alternative» [8]. In other words, the implementation of carbon taxes at the legislative level is also one of the economic and legal means for fighting against climate change.

With growing concerns about climate change, global warming and greenhouse gas emissions, environmental taxes, renewable energy consumption, and environmental technologies have caught attention from researchers, policymakers, and concerned organizations in developed and developing world. The environmental-related taxes and carbon and energy taxes are considered as effective tool and highly recommended by economists and environmental scientists in developed nations (e.g., European economies). The empirical estimates of quantile regression, FMOLS, and DOLS revealed that environmental taxes and promotion of cleaner energy sources can be effective to reduce overall pollution efflux [9].

Ecological taxes in the modern conditions of human development, in our opinion, have a significant potential in the fight against climate change. For example, revenues from different budget levels generated from environmental taxes can be distributed and used for financing the equipment modernization that is used in State and by municipal enterprises, institutions, organizations, and to finance public and private partnership projects to modernize the production of goods and services, which are produced by technologies that negatively affect the planet's climate.

Nowadays, countries with developed economies have already introduced environmental taxes, and as practice shows, this has yielded positive results in terms of minimizing greenhouse gas emissions, in particular CO₂ emissions into the planet's atmosphere. «That starting with a \$50 per ton carbon tax and increasing it by 5 percent per year would lead to a 63 percent reduction in total U.S. greenhouse gas emissions by 2050, Reilly says. “So that's in line with what people are talking about, which is needing a 50 percent reduction by 2050, globally”, he says, “and getting to net zero beyond that”. Caron, says that all of the different research teams largely found similar results, though there were differences in the details. “Qualitatively, we all agree on many of the main conclusions”. That includes the fact that carbon taxes can indeed be an effective way to curb emissions» [10].

After analyzing the actual data of countries that have implemented carbon taxation, researchers have concluded that «the environmental and carbon tax regulations are widely used and adopted as the most effective means of reducing emissions among other climate protection policies, which has been applied in developed nations» [11, p. 13]. This, in turn, shows that we have reasonable data that show the feasibility and effectiveness of implementing an environmental tax to overcome the environmental problems caused by climate change.

The quality of the fleet as a basic condition for the transport sector of developed countries to fulfill the obligations of the Paris Agreement (2015)

European countries, like most countries in the world, build their policies based on statistics. The collection of such data in the transport sector is no exception. In particular, Eurostat data cover the following countries: Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, Iceland, Liechtenstein, Norway, Switzerland, United Kingdom, North Macedonia, Turkey, Kosovo. At the same time, in this article we present data on those countries that have the practice of environmental taxation and those that have not implemented such tax. So, let's consider the quantitative and

qualitative indicators of the transport sector of individual EU countries for 2014—2019 years [12] (Tables 1—5).

Table 1

Total number of vehicles (Motor coaches, buses and trolley buses)

GEO / TIME	2014	2015	2016	2017	2018	2019
Czech Republic	20 511	20 667	20 876	21 442	22 027	22 206
Denmark	13 408	13 383	13 417	13 482	13 158	13 003
Germany	77 501	78 345	78 949	79 438	80 519	81 364
Ireland	10 407	10 878	11 446	11 955	12 500	12 990
France	96 467	98 746	100 082	100 657	100 511	101 519
Italy	97 914	97 991	97 817	:	100 042	100 149
Latvia	5 102	5 066	4 986	4 955	4 885	4 808
Poland	106 387	110 186	113 483	116 351	119 471	122 879
Slovenia	2 559	2 631	2 679	2 782	2 834	2 884
Finland	16 202	16 812	17 491	18 067	18 467	19 086
Sweden	13 987	14 109	13 886	14 418	14 377	14 913
United Kingdom	:	162 696	161 500	158 432	154 990	:

Table 2

Vehicles that are less than 2 years old

GEO / TIME	2014	2015	2016	2017	2018	2019
Czech Republic	2 710	3 177	3 171	2 995	2 920	3 183
Denmark	2 067	2 232	2 665	3 134	3 080	2 927
Germany	10 774	11 126	12 154	12 644	12 702	12 546
Ireland	1 939	2 297	2 792	3 284	3 709	3 772
France	12 797	13 218	13 926	12 916	12 504	12 921
Italy	4 623	4 661	5 307	:	7 935	8 685
Latvia	418	452	459	435	368	248
Poland	4 262	4 928	5 383	5 621	6 526	6 961
Slovenia	335	344	369	394	370	362
Finland	1 203	1 314	1 223	1 222	1 071	1 133
Sweden	4 062	3 696	3 591	3 779	3 168	3 323
United Kingdom	:	17 843	19 202	18 292	16 389	:

Table 3

Vehicles aged from 2 to 5 years

GEO / TIME	2014	2015	2016	2017	2018	2019
Czech Republic	2 524	2 298	2 406	2 596	3 153	3 180
Denmark	2 474	2 101	1 806	1 925	2 033	2 358
Germany	14 373	14 638	15 040	15 997	16 862	17 985
Ireland	1 234	1 136	1 400	1 796	2 105	2 672
France	18 655	19 744	18 840	20 078	19 755	20 149
Italy	13 167	12 746	10 984	:	11 595	12 755
Latvia	441	518	506	677	667	688
Poland	4 485	4 587	4 781	4 637	4 957	5 368
Slovenia	386	396	447	532	580	581
Finland	1 638	1 541	1 851	1 846	2 006	1 847
Sweden	4 311	4 730	4 301	3 944	3 731	3 820
United Kingdom	:	26 774	26 385	25 943	26 583	:

Table 4

Vehicles aged from 5 to 10 years

GEO / TIME	2014	2015	2016	2017	2018	2019
Czech Republic	4 754	4 397	4 181	4 143	3 923	3 887
Denmark	3 446	3 471	3 581	3 276	3 132	2 820
Germany	23 213	23 375	22 873	22 362	22 210	21 916
Ireland	4 557	4 408	3 909	3 071	2 404	1 829
France	30 727	31 141	31 980	31 814	32 191	30 548

Table 4 (continued)

GEO / TIME	2014	2015	2016	2017	2018	2019
Italy	18 591	16 596	15 952	:	12 932	12 544
Latvia	998	1 013	1 062	976	908	992
Poland	15 580	15 668	15 093	14 461	10 377	9 662
Slovenia	787	795	822	785	760	803
Finland	3 283	3 419	3 386	3 388	3 126	3 277
Sweden	4 079	4 304	4 411	4 976	5 667	6 083
United Kingdom	:	49 244	45 669	43 103	40 424	:

Table 5

Vehicles aged from 10 to 20 years

GEO / TIME	2014	2015	2016	2017	2018	2019
Czech Republic	9 820	10 078	10 339	10 985	11 275	11 234
Denmark	4 075	4 205	4 045	3 796	3 557	3 485
Germany	25 022	25 244	25 090	24 842	25 349	25 493
Ireland	2 677	3 037	3 345	3 804	4 282	4 717
France	34 288	34 643	35 336	35 849	36 061	37 901
Italy	61 533	63 988	65 574	:	67,58	66 165
Latvia	2 230	2 243	2 059	2 010	2 150	2 051
Poland	33 162	34 129	35 090	35 749	38 915	39 002
Slovenia	994	1 026	1 001	1 013	1 041	1 038
Finland	6 395	6 543	6 620	6 755	6 945	6 943
Sweden	1 359	1 222	1 434	1 574	1 658	1 539
United Kingdom	:	58 307	59 212	59 556	59 394	:

To analyze the statistical indicators of transport in European countries, it is necessary to keep in mind the following data, namely: «The carbon tax was first introduced in Finland in 1990. In 2004, Latvia introduced the carbon tax in their system of environmental taxes established since 1990. Denmark adopted a proposal to levy a carbon tax in 1991 and put it into practice in 1992. Slovenia has applied a carbon tax since 1996 for CO₂ emissions resulting from the combustion of fossil fuels. In 1991, Sweden introduced a carbon tax of 24/ton of CO₂, which covered all fuels. In France, the carbon tax was introduced in 2014. The United Kingdom introduced the carbon tax in 2001. Ireland introduced a carbon tax in 2010» [11, p. 8]. The tax implementation in these countries had a positive effect on reducing harmful emissions into the atmosphere.

The data given in *Tables 1—5* for 2014—2019 years, show that in Denmark there was a tendency to renew the vehicles fleet, in particular, it has increased the number of vehicles aged under 2 years, and there are slightly more vehicles aged from 10 to 20 than the number of vehicles aged from 2—5 years and 5—10 years. In fact, out of a total of 13003 vehicles, 8105 are aged less than 10 years. The total fleet of less than 10 years in Denmark is 62.3% of the total number of vehicles. In France, the number of new vehicles is also gradually increasing, and from the total number of 105119 transport units, there are 6318 — aged less than 10 years, i.e. 62.6% of the total number of vehicles. In Sweden, the vehicle fleet includes 14913 transport units. Vehicles aged less than 10 years are 13226. So, in Sweden, the vehicle fleet aged less than 10 years is 88.6% of the total number of units. The situation is similar in other countries where CO₂ emissions are taxed.

The situation in countries where environmental taxes on CO₂ emissions have not been implemented is as follows. For example, in the Czech Republic, the total number of vehicles is 22206 units, of which 3183 units are less than 2 years; 3180 units — less than 2—5 years; 3887 — less than 5—10 years. That accordingly is 10250 units, which is 46.1% of the total number of transport units. In Germany, there is 64.4% of the total number of vehicles less than 10 years. In Poland, the number of vehicles is 122879 units, where the number of vehicles less than 10 years is 17.9%. In Italy, vehicles less than 10 years are 33.9% of the total number of vehicles.

Statistics show that the taxation of harmful emissions into the atmosphere stimulates the renewal of the fleet of transport industries of European countries, while those countries where such taxation is not used are slower to renew vehicles. And here it is important to pay attention to the

dual nature of taxation. On the one hand, environmental taxes increase the cost of transport services and increase the cost of production, on the other hand, the income from taxation is a cash flow that budget managers have the opportunity to direct to renewal of vehicles, and actually help to minimize anthropogenic CO₂ emissions that corresponds to the international agreements in the field of ecology and fighting against climate change.

The quality of the fleet as a basic condition for the transport industry of Ukraine to fulfill the obligations of the Paris Agreement (2015)

In Ukraine, the statistics on the transport sector are summarized by State Statistics Service of Ukraine in terms of services' realization by enterprises in the transport industry, and the Ministry of Infrastructure covers only the total number of vehicles in Ukraine by their types (*Table 6*) [13].

Table 6

Information about the number of vehicles (by types) which are assigned to licensees as a means of economic activity

Vehicle type	Total number of vehicles
Buses	51 909
Minibuses	2 426
Cars	16 997
Other passengers cars	1 199
Tractors	43 907
Board cars	3 541
Vans	3 873
Other trucks	7 727
Load — passengers cars	131
Other vehicles	11 049
Total	142 759

The data show that in Ukraine there are much less vehicles than, for example, in the Czech Republic, Germany, France, Poland, Finland, and Sweden. At the same time, there are no data on the quality of vehicles by age in open databases. Such data are collected by researchers by appealing to the executive authorities, and such data collected by researchers show that «the average age of urban public transport in Ukraine is 8.5 years (bus), trolleybus — 21 years, minibuses — 12.7 years» [14, p. 28]. If we take into account the given average age, it becomes clear that the environmental friendliness of vehicles in Ukraine is not high. Among vehicles that use electricity — trolleybuses, the situation is extremely difficult, because despite their conditional environmental friendliness, the average age of 21 years indicates the need to renew the fleet. These data show that the transport sector of Ukraine does not have competitive fixed assets that would give this industry the development potential in the context of environmental safety, which in turn indicates the need to revise state policy on transport development, in particular in financing environmental projects to renew the domestic fleet, in particular, to improve the environmental situation in the cities of Ukraine, and to ensure the implementation of obligations under international environmental agreements ratified by our state.

Ways to modernize the transport industry of Ukraine in modern conditions of development

Domestic researchers emphasize that «in the future the development of the transport services market will be formed around the latest advances in technological progress. The current shortcomings of the industry will be reflected in the trends of further computerization and digitalization. Among the leading technologies that can be implemented in the transportation process, we can highlight intelligent transport systems, block chain technology, artificial intelligence, etc. In general, the transport sector will be characterized by automation of all processes through the modernization of existing basic technologies» [15, p. 145]. «In order to ensure the development of the transport sector of the region within the investment climate, it is advisable to implement a set of measures: state support for investment projects that are intersectoral or interregional in their nature; implementation of a mechanism to support investment in the transport

sector through credit emission, which is to provide emission resources to the “growth points” of the transport system on preferential terms; development of investment projects aimed at modernization of the transport network and transport infrastructure, implementation of information technologies; use of leasing as a source of financing; improving the use of the depreciation fund as an important internal source of investment; promoting the attraction of foreign investment in the transport system of the region» [16, p. 405]. So, for the modernization of the transport industry of Ukraine it is necessary not just to renew the fleet of enterprises, institutions, organizations working in the market of transport services, but to renew it taking into account modern advances in science and technology. To achieve economic, social and environmental effects from the modernization of the industry it is necessary to make a number of investments, in particular in the implementation of environmentally friendly projects it is necessary to activate international cooperation and agree with developed countries to support the modernization of the Ukrainian transport industry with the use of financial mechanisms and technology transfer agreements to improve the level of resistance to climate change and reduce greenhouse gas emissions enshrined in the Paris Agreement (2015).

Conclusions. First, climate change on the planet actualizes international cooperation and cooperation between the world’s countries in fighting the negative effects of anthropogenic emissions of greenhouse gases, including CO₂ into the atmosphere. Ukraine, as a signatory to international environmental agreements, must intensify its efforts to prevent environmental hazards from the use of obsolete vehicles that pollute the air. Second, the achievement of the goals of fighting climate change must come from the use of legal tools. Regulations as ways to consolidate state environmental policy and policy to fight climate change should not only declare the aspirations and goals of such policy, but also to establish specific mechanisms for its implementation. Third, taking into account the unsatisfactory condition of the fleet of the transport sector of Ukraine in comparison with the condition of the fleet of European countries, it is necessary to define at legislative level the financial mechanisms for modernization of transport sector, in particular through public and private partnerships and targeted programs. Fourth, world experience shows that the introduction of environmental taxes for CO₂ emissions significantly affect the renewed fleet of transport industries, which has a positive effect on reducing greenhouse gas emissions. At the same time, taxation of harmful anthropogenic emissions into the atmosphere, in particular CO₂ enables the state to generate, distribute and use tax revenues to achieve the goals of fighting climate change, which will affect not only the environmental situation in Ukraine and the world as a whole, but efficiency the transport industry and its competitiveness.

Література

1. United Nations Framework Convention on Climate Change / United Nations. 1992. URL : https://unfccc.int/sites/default/files/convention_text_with_annexes_english_for_posting.pdf.
2. Kyoto Protocol to the United Nations Framework Convention on Climate Change / United Nations. 1998. URL : <https://unfccc.int/resource/docs/convkp/kpeng.pdf>.
3. Paris Agreement / United Nations. 2015. URL : https://unfccc.int/sites/default/files/english_paris_agreement.pdf.
4. Yun Gao, Xiang Gao, Xiaohua Zhang. The 2 °C Global Temperature Target and the Evolution of the Long-Term Goal of Addressing Climate Change — From the United Nations Framework Convention on Climate Change to the Paris Agreement. *Engineering*. 2017. № 3. P. 272—278.
5. Editorial: Thredbo 15 conference. *Research in Transportation Economics*. 2018. № 69. P. 3—8.
6. Aldenius M. Influence of public bus transport organisation on the introduction of renewable fuel. *Research in Transportation Economics*. 2018. № 69. P. 106—115.
7. Mistur E. M., Kingsley G., Matisoff D. C., Anc Ye. Green rules and green tape: Streamlining the environmental review for transportation projects. *Transportation Research Part D: Transport and Environment*. 2021. Vol. 97.
8. Morgan J., Patomäki H. Planetary good governance after the Paris Agreement: The case for a global greenhouse gas tax. *Journal of Environmental Management*. 2021. Vol. 292.
9. Assaad Ghazouani, Mehdi Ben Jebli, Umer Shahzad. Impacts of environmental taxes and technologies on greenhouse gas emissions: contextual evidence from leading emitter European countries. *Environmental Science and Pollution Research*. 2021. Vol. 28. P. 22758—22767.
10. Chandler D. L. Carbon taxes could make significant dent in climate change, study finds. *Massachusetts Institute of Technology News Office*. 2018. URL : <https://news.mit.edu/2018/carbon-taxes-could-make-significant-dent-climate-change-0406>.
11. Assaad Ghazouani, Wanjun Xia, Mehdi Ben Jebli, Umer Shahzad. Exploring the Role of Carbon Taxation Policies on CO₂ Emissions: Contextual Evidence from Tax Implementation and Non-Implementation European Countries. *Sustainability. Special Issue Energy Economics in Sustainability*. 2020. Vol. 12 (20).
12. Motor coaches, buses and trolley buses, by age / Eurostat. Translat. 2021. URL : https://ec.europa.eu/eurostat/databrowser/view/road_eqs_busage/default/table?lang=en.

13. Статистичні дані по галузі автомобільного транспорту / Міністерство інфраструктури України. 2021. URL : <https://mtu.gov.ua/content/statistichni-dani-po-galuzi-avtomobilnogo-transportu.html>.
14. Борисова Т. М., Монастирський Г. Л. Соціально-економічні передумови та перспективи розвитку ринку послуг міського громадського транспорту Тернополя. *Економічний аналіз*. 2018. Т. 28. № 1. С. 23—29.
15. Кушнір Н., Сюсько О. Аналіз сучасного стану світового ринку транспортних послуг. *Геополітика України: історія і сучасність*. 2019. Вип. 2 (23). С. 135—146.
16. Ільченко С. В., Машканцева С. О. Інвестиційний клімат розвитку транспортної галузі в контексті економічних тенденцій регіону. *Вісник Харківського національного технічного університету сільського господарства. Економічні науки*. 2019. Вип. 202. С. 398—408.

Статтю рекомендовано до друку 19.12.2021

© Малихіна Я. А., Протопопова Я. С., Павліченко О. В., Павліченко В. М.

References

1. United Nations. (1992). United Nations Framework Convention on Climate Change. Retrieved from https://unfccc.int/sites/default/files/convention_text_with_annexes_english_for_posting.pdf.
2. United Nations. (1998). Kyoto Protocol to the United Nations Framework Convention on Climate Change. Retrieved from <https://unfccc.int/resource/docs/convkp/kpeng.pdf>.
3. United Nations. (2015). Paris Agreement. Retrieved from https://unfccc.int/sites/default/files/english_paris_agreement.pdf.
4. Yun Gao, Xiang Gao, & Xiaohua Zhang. (2017). The 2 °C Global Temperature Target and the Evolution of the Long-Term Goal of Addressing Climate Change — From the United Nations Framework Convention on Climate Change to the Paris Agreement. *Engineering*, 3, 272—278.
5. Editorial: Thredbo 15 conference. (2018). *Research in Transportation Economics*, 69, 3—8. doi:10.1016/j.retrec.2018.07.007.
6. Aldenius, M. (2018). Influence of public bus transport organisation on the introduction of renewable fuel. *Research in Transportation Economics*, 69, 106—115. doi:10.1016/j.retrec.2018.07.004.
7. Mistur, E. M., Kingsley, G., Matisoff, D. C., & Anc, Ye. (2021). Green rules and green tape: Streamlining the environmental review for transportation projects. *Transportation Research Part D: Transport and Environment*, 97. doi:10.1016/j.trd.2021.102937.
8. Morgan, J., & Patomäki, H. (2021). Planetary good governance after the Paris Agreement: The case for a global greenhouse gas tax. *Journal of Environmental Management*, 292. doi:10.1016/j.jenvman.2021.112753.
9. Assaad Ghazouani, Mehdi Ben Jebli, & Umer Shahzad. (2021). Impacts of environmental taxes and technologies on greenhouse gas emissions: contextual evidence from leading emitter European countries. *Environmental Science and Pollution Research*, 28, 22758—22767.
10. Chandler, D. L. (2018). Carbon taxes could make significant dent in climate change, study finds. *Massachusetts Institute of Technology News Office*. Retrieved from <https://news.mit.edu/2018/carbon-taxes-could-make-significant-dent-climate-change-0406>.
11. Assaad Ghazouani, Wanjun Xia, Mehdi Ben Jebli, & Umer Shahzad. (2020). Exploring the Role of Carbon Taxation Policies on CO₂ Emissions: Contextual Evidence from Tax Implementation and Non-Implementation European Countries. *Sustainability. Special Issue Energy Economics in Sustainability*, 12 (20). doi:10.3390/su12208680.
12. Eurostat. Translat. (2021). Motor coaches, buses and trolley buses, by age. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/road_eqs_busage/default/table?lang=en.
13. Ministerstvo infrastruktury Ukrainy. (2021). *Statystichni dani po haluzi avtomobilnogo transportu [Statistical data on road transport]*. Retrieved from <https://mtu.gov.ua/content/statistichni-dani-po-galuzi-avtomobilnogo-transportu.html> [in Ukrainian].
14. Borysova, T. M., & Monastyrskiy, H. L. (2018). Sotsialno-ekonomichni peredumovy ta perspektyvy rozvytku rynku posluh miskoho hromadskoho transportu Ternopolia [Socio-economic preconditions and prospects for the development of the market of urban public transport services in Ternopil]. *Ekonomichnyi analiz — Economic analysis*, 28 (1), 23—29 [in Ukrainian].
15. Kushnir, N., & Siusko, O. (2019). Analiz suchasnoho stanu svitovoho rynku transportnykh posluh [Analysis of the current state of the world market of transport services]. *Heopolityka Ukrainy: istoriia i suchasnist — Geopolitics of Ukraine: history and modernity*, 2 (23), 135—146. doi:10.24144/2078-1431.2019.2(23).135-146 [in Ukrainian].
16. Ilchenko, S. V., & Mashkantseva, S. O. (2019). Investytsiyni klimat rozvytku transportnoi haluzi v konteksti ekonomichnykh tekhnedentsii rehionu [Investment climate of transport industry development in the context of economic trends in the region]. *Visnyk Kharkivskoho natsionalnoho tekhnichnoho universytetu silskoho hospodarstva. Ekonomichni nauky — Bulletin of Kharkiv National Technical University of Agriculture. Economic sciences*, 202, 398—408 [in Ukrainian].

The article is recommended for printing 19.12.2021

© Malykhina Y., Protopopova Y., Pavlichenko O., Pavlichenko V.