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CONCEPTUAL APPROACHES TO IMPROVING CARBON DIOXIDE TAXATION IN UKRAINE

The domestic carbon tax needs to improve tax administration to ensure its fiscal efficiency and reduce transaction costs for tax compliance. Despite the fact that in the Tax Code of Ukraine the calculation of such a tax is based on the actual indicators of CO_2 emissions, in practice it is based on the amount of resources consumed and the characteristics of the production process. Accordingly, the difficulties in administering this tax are the complexity of tax audits and the need to involve environmental experts. All this does not allow to adhere to the principle of cost-effectiveness of taxation and highlights the need to find opportunities to simplify the process of tax administration on the basis of world best practices.

The purpose of the article is to outline conceptual approaches to improving carbon taxation, which will allow Ukraine to simplify tax administration and together with the EU to effectively combat the effects of climate change in order to increase security and create new opportunities for Ukrainian business under the European Green Deal.

The methodological basis of the study was the use of a set of general and special methods: generalizations and scientific abstraction, historical and logical, extrapolations, spatial and graphical and tabular methods of visualization. The application of the SWOT analysis method and the systematization of European practice revealed that the most acceptable for Ukraine is the use of tax on CO_2

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emissions in the form of an indirect tax on energy consumption. Coefficients of carbon content in fuel, calorific value of fuel and its oxidation factor were used to convert the emission base carbon tax into the fuel base carbon tax. The implementation of these proposals will help increase the efficiency of administration of such a tax, as it will: 1) reduce the number of taxpayers through the introduction of the institution of tax agents while increasing the amount of tax paid by one taxpayer; 2) simplify the procedure for calculating the tax base by taxpayers and employees of tax authorities; 3) increase the fiscal efficiency of the environmental tax on carbon dioxide emissions from stationary sources by 50% in the case of setting the CO_2 price at UAH 10 per ton (5-fold when setting the CO_2 price at UAH 30 per ton in accordance with the proposals of the bill No 5600) and to attract potential revenues from the transport sector in the amount of 0.06% of GDP.

The use of practical proposals and recommendations obtained in the article will increase the effectiveness of Ukraine's tax policy by forming a set of measures which will reduce the energy dependence of the national economy, including through incentives for energy-saving and climate-neutral technologies, reduce the burden on the environment, and will help simplify the administration of environmental taxes while increasing their fiscal efficiency.

Research materials can be used in the preparation of draft regulations and policy documents in the field of environmental and excise taxation, which is within the competence of the Ministry of Finance of Ukraine, as well as in the formation of proposals, reservations and recommendations to other regulations on improving environmental and excise taxation initiated both by the authorities of the executive power of Ukraine, and the Verkhovna Rada of Ukraine on improving environmental and excise taxation. The theoretical results are the development of a general theory of fiscal administration for environmental and excise taxation[4]**.**

Keywords: *European Green Deal, environmental taxation, tax on carbon dioxide emissions, emissions trading scheme, excise duty on energy resources, price instruments for reducing greenhouse gas emissions, Carbon Border Adjustment Mechanism*

The need for countries around the world to change their economic course and move towards a climate-neutral economy is driven by increasing global environmental challenges, which significantly undermine the sustainability of economies around the world. The escalating problem of climate change affects all spheres of social life and necessitates the incorporation of greenhouse gas emission

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reduction goals into economic development strategies. Ukraine is no exception, because according to the Second Nationally Determined Contribution approved by the government on 30 July 2021 - in fulfilment of its commitments under the Paris Climate Agreement - Ukraine commits to achieve ambitious targets to reduce greenhouse gas emissions (hereinafter - GHG) by 65% in 2030 from 1990 levels and achieve climate neutrality no later than 2060, as stated in the National Economic Strategy until 2030, approved by the Cabinet of Ministers on 03 March 2012.

Ukraine also intends to synchronize its climate policy with the European Green Deal, which sets out measures to transform Europe into the world's first climate-neutral continent by 2050. Such EU initiatives are aimed at stimulating the development of member states' economies, improving the health and quality of life of people living there, as well as the use of all opportunities of spheres and types of EU policies to overcome climate and environmental challenges, ensuring a fair and inclusive green transition [3].

In this context, a review of the types of carbon dioxide pricing policies and instruments necessary to meet Ukraine's climate goals is of particular relevance.

The theoretical foundations of environmental taxation, in particular the taxation of greenhouse gas emissions, are formulated in the works of foreign and Ukraine's scientists: A. Pigou [4], W. Baumol [5], A. Sandmo [6], D. Fullerton [7], M. Hoel [8], R. Podolets and O. Diachuk [9], Ya. Petrakov [10], A. Sokolovska [11], etc. At the same time, the issues of improving the fiscal and regulatory efficiency of the tax on carbon dioxide emissions in Ukraine and this country's ability to effectively influence the behavior of taxpayers towards reducing their CO_2 emissions remain open.

In this regard, the article **aims to** outline conceptual approaches to improve carbon dioxide taxation, which would allow Ukraine to simplify its tax administration and, together with the EU, effectively deal with the consequences of climate change to enhance security and create new opportunities for Ukrainian businesses under the European Green Deal.

Carbon dioxide abatement pricing instruments and particularities of CO_2 taxation in EU countries

As the problem of climate change intensifies, the search for effective instruments for limiting greenhouse gas emissions becomes more relevant. And pricing instruments are among the most effective ones, including the emissions trading scheme (ETS) and taxes: excise duty on energy and taxes on carbon dioxide emissions directly related to emissions or the carbon content of fuels (Figure 1). With these taxes, governments set the price that taxpayers have to pay for each ton of CO_2 emissions, thereby leveraging their static and dynamic efficiency. The former consists of the ability to reduce CO_2 emissions in the least costly way, and the latter, respectively, helps to influence technological change by creating incentives for the development and deployment of innovative technologies to reduce emissions.

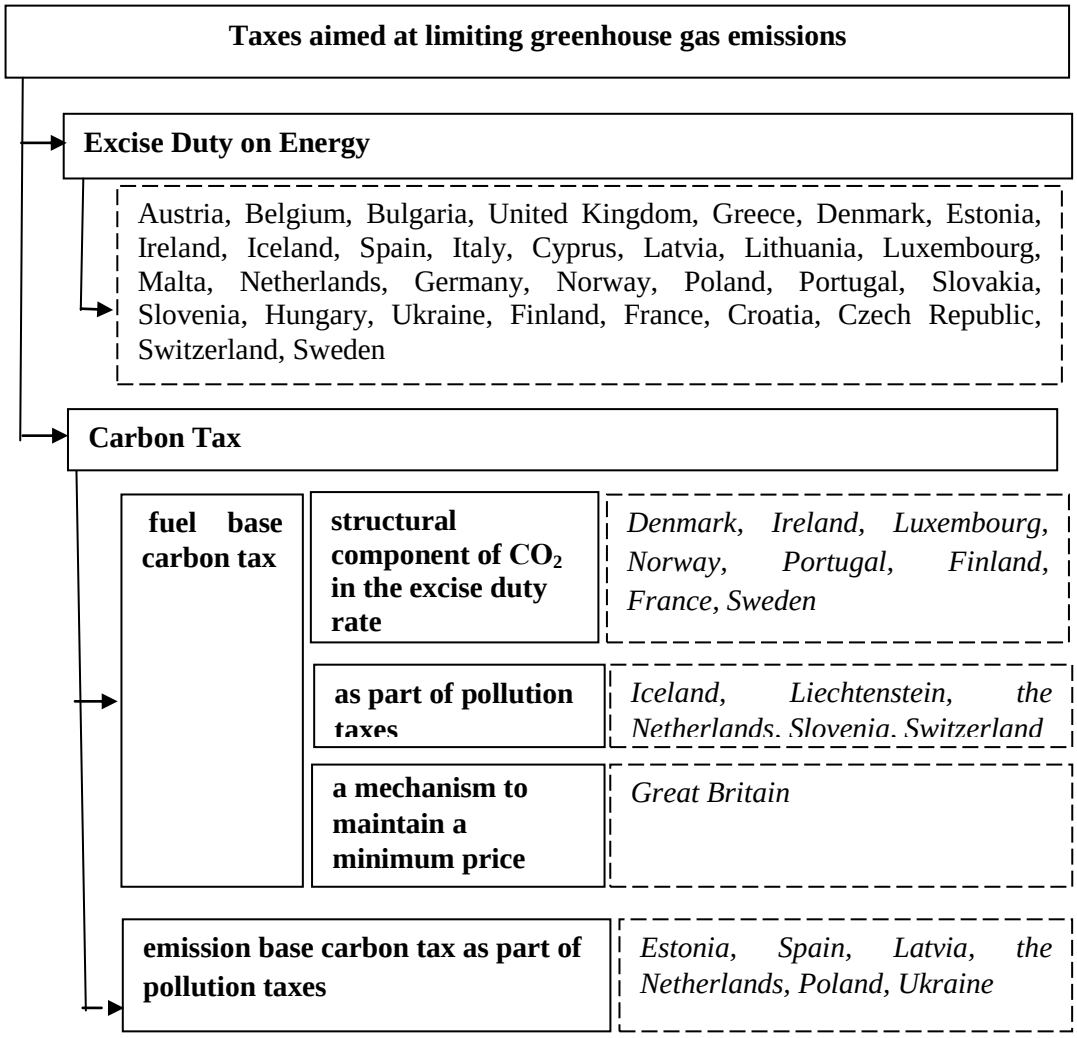

Figure 1. Taxes aimed at limiting greenhouse gas emissions in European countries

Source: compiled by the authors according to the data [15].

Although the objects of energy excise duty and carbon dioxide taxes are usually similar, excise duty rates are largely independent of the carbon content of the fuel. At the same time, they are differentiated to compensate for unintended distortions in the labor market due to environmental taxation (applying a lower rate for diesel compared to gasoline), to create a competitive advantage for environmentally friendlier fuels (lower rate for low sulphur diesel); to protect domestic producers (energy intensive industries); and to avoid energy poverty.

The rate of tax is made up of the Pigou and Ramsey components[5], whose share is determined by the need to realize the fiscal potential. As a result, excise duty on energy take up a large share of budget revenues, usually earmarked to provide a source of financial security for transport infrastructure spending. In addition, they create price signals for the value of negative externalities due to greenhouse gas and other air pollutant emissions from energy combustion, congestion, accidents, and noise. Therefore, the predominant function of this type of taxes is regulatory, realized by manipulating the size of the tax burden and rate differentiation. The desired effect of environmental taxes is a substitution effect aimed at improving the behavior of economic agents in the market, and the circulation of higher quality fuels in the market. The short-term desired effects of taxes on petroleum products include a reduction in energy consumption, and the long-term effects include influencing the behavior of private car users to reduce the distance between work and home, substitution of cars with less energy intensive vehicles, rational choices on the length and duration of trips by private transport, and substitution of private transport with public transport. This type of tax, along with ETS, functions most effectively in conjunction with environmental fuel quality standards, tax incentives to encourage the introduction of energy efficiency measures, increasing the share of alternative fuels in a country's energy mix and measures to rationalize energy subsidies. Energy excise taxes are harmonized at EU country level, so the approaches to taxation are similar at member state level.

Taxes of the second type provide for direct taxation of CO_2, and their rate only includes Pigou components. Countries choose the form of tax themselves: the tax on the measured or estimated emission base carbon tax, or fuel base carbon tax, whose rates are differentiated depending on the carbon content of fuel. Objects of taxation include both energy resources for the transport sector (petrol, diesel fuel) and energy resources used by households, industry and utilities (liquid fuels, natural gas, coal, and electricity).

As the CO_2 tax is not harmonized at EU level, there are different approaches to its implementation in the Community. A summary of the characteristics of the main elements of different types of carbon dioxide tax is shown in Table 1. The countries that prioritized minimizing transaction costs[6] (in other words, simplifying administration) to meet the tax obligation, introduced an energy consumption tax with a rate dependent on the carbon content of the fuel for all energy resources.

[5] A. Sandmo, investigating optimal environmental tax (ET) rates, concluded that for goods whose production or consumption creates an excessive burden on the environment, the rate should be set not only according to the social cost of pollution, but also taking into account the demand elasticity of the taxable goods. The researcher proved that the indirect EF rate should be composed of the Pigou and Ramsey components, whose share is determined by the need to realize fiscal potential. If the proportion of the Ramsey component is *a* and the Pigou component is *(1–a)*, then the environmental tax rate will be: T = a TR + (1–a) MSPC $0 < a < 1$, where T is the environmental tax rate; a TR is the fiscal component; (1-a) MSPC is the environmental component; TR is the inverse price elasticity of demand for tax base goods; MSPC is the marginal public cost of pollution [6].

[6] The costs related to the calculation of tax liabilities, tax collection and security; and all other costs incurred by any party to secure the relationship between taxpayers and the tax authorities.

This type of tax is a "second-best solution"[7] for achieving a socially efficient level of pollution and makes it possible to influence the behavior of taxpayers towards reduced share of fuels that produce the highest CO_2 emissions when combusted. It is worth noting that under this approach, the same object is taxed twice, moreover, both final products and factors of production are taxed (e.g. coking coal used in steel production, and petrol and diesel fuel, which are petroleum products for final consumption)[8]. However, the violation of the optimality criteria of the tax system is justified by the need to achieve climate policy objectives. Of the nineteen countries in Europe, most chose this type of tax. In particular, the tax as a structural component of CO_2 in the fuel excise tax rate was introduced in Denmark, Finland, France, Ireland, Luxembourg, Norway, Portugal and Sweden. Iceland, Liechtenstein, the Netherlands, Slovenia and Switzerland use a similar approach, but the tax is separated from the excise tax.

Table 1

Summary of the main elements of the different types of carbon dioxide tax

Elements of the tax	TYPES OF CARBON DIOXIDE TAX			
	Structural component of carbon dioxide in the excise tax rate *(Fuel base)*	**Component of environmental pollution taxes**		**Mechanism to maintain a minimum price level for carbon dioxide**
		tax on measured/estimated emissions *(Emission base)*	**energy consumption tax *(Fuel base)***	
Taxpayers	Producers and importers of fossil fuels and petroleum products (except crude oil)	Economic operators using fossil fuels as a factor of production		
The object of taxation	Fossil fuel and petroleum product sales operations	Actual or estimated CO_2 emissions	Consumption of fossil fuels	
Tax base	The amounts of fossil fuels and petroleum products	The volume of CO_2 emissions	The amounts of fossil fuels	
Criteria for rate differentiation	Depending on the type and origin of the fuel and its carbon content	Not available	Depending on the type of fossil fuel and its carbon content	
Benefits	Exemption, reimbursement	Establishment of polluter's capacity limit and/or taxable emission limits	Exemption	Small power producers, standby generators, geographical redundancies, cogeneration plants

Source: compiled by the authors according to the data [15].

[7] In case when fulfilling as many Pareto conditions of optimality as possible is not the most reliable way of achieving maximum efficiency, and yet certain conditions are violated and the "first-best-solution" is not attainable, a search for a "second-best-solution", which is sub-optimal and involves a conscious departure from the options that appear to be most efficient in a partial equilibrium context [12].

[8] According to the production efficiency theorem of P. Diamond and J. Mirrlees, the condition for an optimal tax system is that taxes are levied on finished products rather than intermediate products [13].

The question of introducing it on European level is still under discussion. Due to the risk to lose competitiveness of companies, some EU members, in particular Austria, Belgium, Greece, Italy, Lithuania, Germany, Slovakia, Hungary and the Czech Republic, refused to introduce the tax unilaterally. It is up to each EU member state to decide on its implementation. Countries that did not introduce a direct tax on CO_2, participate in the European ETS, so the carbon dioxide emissions have a cost form.

The CO_2 tax was not harmonized by the EU countries. However, unlike the ETS, which sets a maximum level of emissions without defining the price of CO_2 emissions and at the same time sets a certain environmental target, the CO_2 tax takes into account both factors. On the one hand, the European Commission declares the effectiveness of the ETS, which over the last fifteen years provided a 35% reduction in greenhouse gas emissions [14]. In addition, carbon dioxide taxes are intended to improve environmental and climate performance, increase the efficiency of the tax system and promote fairness, welfare and competitiveness of the country.

When developing public policy measures for the transition to a climate-neutral economy in Ukraine, it is necessary to consider the experience of the mutually coordinated functioning of CO_2 and ETS taxes in order to choose an effective pricing model for carbon dioxide emissions. A systematization of European practices [15] for the implementation of climate change mitigation measures suggests a combination of these pricing instruments in the form of the following models:

– *model 1* - countries use an emissions trading system to cap carbon dioxide emissions and energy excise duties, which are indirectly price-based instruments to reduce greenhouse gas emissions. There are no direct taxes on CO_2 emissions (in Austria, Belgium, Czech Republic, Greece, Italy, Lithuania, Germany, Slovakia, and Hungary);

– *model 2* - countries combine an emissions trading system with a CO_2 tax. The CO_2 tax can be of two types: 2 a) fuel base carbon tax (in Denmark, Finland, France, Iceland, Ireland, Liechtenstein, Luxembourg, Norway, Netherlands, Slovenia, Portugal, Sweden, and Switzerland); 2 b) emission base carbon tax charged on actual or measured CO_2 emissions (in Estonia, Latvia, Netherlands, Poland, Spain, and Ukraine);

– *model 3* - countries combine ETS with a tax/levy and the Carbon Price Floor (CPF) mechanism, which is used to balance the pricing of ETS (UK). The essence of the instrument is that if the price of allowances in the ETS is below the minimum price level for carbon dioxide emissions in the country, producers pay the difference in the form of a tax/levy. This ensures a stable price level for CO_2 emissions, encourages investment in climate-neutral technologies and does not distort market conditions for different economic sectors.

It should be noted that all models operate in conjunction with existing

harmonized energy excise duty regimes in the EU. EU member states as well as the UK[9], Iceland, Liechtenstein, Norway and Switzerland[10] [16] that apply a carbon dioxide tax are also part of the EU ETS. In some countries, companies in certain sectors covered by the ETS are granted exemptions from the carbon dioxide tax in the form of a refund. There are also countries where both instruments are applied simultaneously to the same entities (e.g. Finland, UK, and Ireland) [17].

Proposals for improving Ukraine's carbon dioxide tax

In Ukraine, tax instruments for limiting greenhouse gas emissions include excise duties on petroleum products and electricity and a tax on carbon dioxide emissions, which is an environmental tax. Payers of the ecological tax in terms of carbon dioxide emissions include entities with an aggregate annual emission of carbon dioxide exceeding 500 tons. Accordingly, the tax base of the tax on CO_2 emissions is the volume of CO_2 emissions into the atmosphere by stationary sources reduced by 500 tons according to the results of the tax (accounting) year. It should be noted that CO_2 emissions from the transport sector, amounting to about 15-19%, are not taxed at all.

According to the Tax Service of Ukraine, the number of taxpayers of this tax reaches 20,000 legal entities in 2020. The annual tax revenues per taxpayer are extremely low at around 47,500 UAH, which - by comparison - is 0.01% of a similar figure for the excise duty on fuels. At the same time, in some types of economic activity CO_2 emissions are not fully covered by the tax. In particular, in ferrous metallurgy, one of the largest polluters of atmospheric air and thus the largest payer of carbon dioxide tax, only 79% of CO_2 emissions are taxed[11].

The problem is that in the Ukrainian Tax Code, the tax calculation must be based on actual CO_2 emissions, but in practice it is based on a special

[9] The UK ETS became operational on 1 January 2021, as the UK officially withdrew from the EU and the EU ETS on 31 December 2020. The design characteristics of the UK ETS are very similar to those of the EU ETS, but the UK ETS has a more stringent emissions limit (5% lower than the EU ETS limit), which will be reduced by 4.2 million tons annually [16].

[10] The Swiss ETS began in 2008 with a five-year voluntary phase as an alternative to a CO_2 tax on fossil fuels. Revised regulations came into force in January 2013. Subsequently, the system became mandatory for large energy-intensive enterprises, while medium-sized ones could join voluntarily. The Swiss ETS is linked to the EU ETS from January 2020 and extended the sector coverage to Swiss domestic aviation (including flights to the European Economic Area) and fossil thermal power plants. In addition, the ETS applies to industrial companies from the sectors of cement, chemicals, pharmaceuticals, paper and paper products as well as oil refining and metallurgical production. The participants of the ETS are exempted from the CO_2 emission tax [16].

[11] The indicator is calculated as the ratio of the taxable base - according to the State Tax Service of Ukraine - to the amount of carbon dioxide emissions into the atmosphere from stationary sources of pollution. If we use the data of the National Inventory of Anthropogenic Emissions from Sources and Absorption by Greenhouse Gas Absorbers in Ukraine, the share of taxable emissions in ferrous metallurgy will be 40%.

methodology[12] - at best, based on the amount of resources consumed and the characteristics of the production process - which is rather complicated. Sometimes businesses estimate their tax obligations "by eye"[13] - based on emissions allowance data obtained before the start of operations. This ultimately leads to inefficiencies in the functioning of the tax, and to reduced compliance of taxpayers due to the existence of opportunities to avoid penalties for violations of the tax law.

Given European practice, it is most appropriate for Ukraine to use carbon dioxide taxes in the form of an indirect tax on energy consumption. This simplifies the administration of such a tax and encourages economic agents to change their consumption and production behavior, which will ultimately contribute to reducing the energy intensity of GDP and counteracting climate change.

An analysis of best practices in countries around the world helped to find that carbon content, calorific value and oxidation factor factors are used to convert a tax on assessed carbon dioxide emissions into a tax on fuel consumption. Such factors also form the basis of an inventory of greenhouse gas emissions in each country party of the Kyoto Protocol. In particular, the Intergovernmental Panel on Climate Change (IPCC) developed model fuel carbon content factors [18]. Given the national characteristics of each country's fuels, the carbon content factors need to be adjusted by the corresponding fuel rates determined by the institutions that compile the greenhouse gas inventories. For example, in Ireland, the rates are based on factors determined annually by the Environmental Protection Agency.

It is advisable to use such experience in Ukraine. The relevant indicators, taking into account national characteristics of fuel characteristics, are determined by the National Centre for GHG emissions accounting, and their data form the basis for the National Inventory of anthropogenic emissions from sources and removals by sinks of greenhouse gases for a given year [19]. If this approach is taken as a basis for transformational processes of ecological taxation of carbon dioxide emissions, the need for annual approval of such indicators by the Ministry of Environmental Protection of Ukraine should be taken into account.

The formula to convert the tax rate from a carbon dioxide emission-based tax to one based on physical units of mass/volume of fuel is as follows

$$Rate_{FB_n} = Rate_{EB} \cdot CC_n \cdot NCV_n \cdot COF_n \cdot D_n \cdot \frac{44}{12} \cdot \mathbf{10^{-3}}, \qquad (1)$$

where $Rate_{FB_n}$ is carbon dioxide tax rate per unit mass/volume of the *n* -th energy resource, UAH/t(cu m);

[12] Emission values of pollutants are determined in accordance with the governing document in force in Ukraine - "GKD 34.02.305-2002 Emissions of Pollutants to the Atmosphere from Power Plants. Methodology of determination". Although this document does not contain a rule that it should be used for the calculation of environmental tax liabilities, the STS refers to it in the notional examples of calculation of carbon dioxide emissions by power plants from combustion of various fuels.

[13] According to surveys of taxpayers and monitoring of accounting websites.

$Rate_{EB}$ is carbon dioxide tax rate based on estimated emissions, UAH/ton CO_2;

CC_n – the carbon content of the *n*-th energy resource (tC/TJ) (ton C/TJ is identical to kg C/GJ);

NCV_n – is the net calorific value of the *n*-th energy resource (GJ/t);

COF_n – is the carbon oxidation factor of the *n*-th energy resource (typically a value of 1, reflecting complete oxidation. Lower values are used only to account for carbon unrestricted in ash or soot);

D_n – is density of the *n*-th kind of energy resource, if it is necessary to convert units of taxable base from mass units to volume units, t/thousand cubic meters;

44/12 – is the ratio of the molecular weight of CO_2 to C.

The calculation of carbon dioxide emission tax rates for energy consumption performed based on formula 1 and on the governmental draft Law No. 5600 on the increase of the ecological carbon dioxide emission tax rate to 30 UAH/t [20], which was adopted on 1st July, 2021 by the Parliament of Ukraine on first reading is presented in Table 2.

Table 2

Proposed carbon dioxide tax rates based on physical units of measurement for selected energy resources (equivalent to the price of CO_2 emission of UAH 10 and UAH 30 per ton)

Type of fuel	CO2 emission price - 10 UAH/t	CO2 emission price - 30 UAH/t
	Tax rate, UAH/year/t (thousand cubic meters)	
Coal	20.07	60.20
Lignite	8.73	26.20
Peat non-agglomerated fuel	10.89	32.68
Crude oil, including oil obtained from bituminous	30.47	91.41
Gas condensate	24.36	73.09
Natural gas	19.27	57.81
Motor gasoline	31.01	93.03
Diesel fuel	31.76	95.28
Propane and butane liquefied	28.60	85.80

Source: authors' calculations.

It should be noted that such rates are differentiated according to the types of fuel consumed by the national economy in terms of carbon content. Also, when implementing the changes for setting the tax on energy consumption, a tax exemption for the use of biomass should be envisaged, in line with European practice, since the carbon dioxide emissions from burning wood are compensated by the absorbed CO_2 while the living tree is growing. In addition, there should be a zero tax rate or a mechanism to offset the tax paid on fuels to be used as raw materials for industrial processes, e.g. in the chemical industry. A mechanism similar to the excise duty on light and heavy distillates used for ethylene production could be applied. Specifically, such energy resources are taxed at a zero

rate and the tax authorities monitor their intended use. Producers issue a tax bill for the amount of excise duty assessed on the volume of petroleum products received based on the rate, which is defined as the difference between the basic and zero rate of excise duty. The tax bill is considered repaid in the case of documentary evidence of the intended use of light and heavy distillates exclusively as raw materials in the production of ethylene.

In modelling carbon dioxide tax revenues based on physical units of fuel, a number of econometric models were constructed to estimate the inelasticity of demand for fuel, both for the transport sector (petrol 0.47; diesel 0.25; LPG 0.28) and other sectors (natural gas 0.002), and to take into account the impact of a certain reduction in demand on potential revenues (Table 3).

Table 3

Econometric models of the price elasticity of fuel demand (based on 2016-2019 SSSU data)

Type of fuel	Type of model
Transport sector	
Petrol	$\widehat{Cons}_{gas_t} = \underset{t}{69\,590\,000} - \underset{4.105}{1\,411\,000} \cdot Price_{gas_t} + \underset{-3.299}{0.6202} \cdot LnCons_{gas_{t-1}} \quad \underset{6.478}{}$
	R^2 = 0.6874, Elasticity coefficient = -0.47
Diesel	$\widehat{Cons}_{diesel_t} = \underset{t}{59\,810\,000} - \underset{3.265}{1\,036\,000} \cdot Price_{diesel_t} + \underset{-2.130}{0.6992} \cdot LnCons_{diesel_{t-1}} \quad \underset{7.352}{}$
	R^2 = 0,6149, Elasticity coefficient = -0.25
Liquefied gas	$Ln(\widehat{Cons}_{LPG_t}) = \underset{t}{3.27} - \underset{3.163}{0,28} \cdot Ln(Price_{LPG_t}) + \underset{-2.786}{0,86} \cdot Ln(Cons_{LPG_{t-1}}) \quad \underset{16.1}{}$
	R^2 = 0.8570, Elasticity coefficient = -0.28
Stationary sources of pollution	
Natural gas	$Cons_{NG_t} = \underset{t\ (1.36)}{57.8} - \underset{(-2.36)*}{0.001} \cdot Price_{NG_t} + \underset{(13.66)***}{1.7} \cdot Cons_{NG_{t-1}} \underset{(-5.45)***}{-0,7} \cdot Cons_{NG \cdot t-2}$
	R^2 = 0.994, Elasticity coefficient = – 0,002

Denomination: $Cons_{petr_t}$, $Cons_{gasoil_t}$, $Cons_{LPG_t}$, $Cons_{NG_t}$ – consumption of petrol, diesel, LPG and natural gas in the current period;

$Price_{gasoline_t}$, $Price_{diesel_t}$, $Price_{LPG_t}$, $Price_{NG_t}$ – prices of petrol, diesel, LPG and natural gas in the current period;

$Cons_{petr_{t-1}}$, $Cons_{gasoil_{t-1}}$, $Cons_{LPG_{t-1}}$, $Cons_{NG_{t-1}}$, $Cons_{NG_{t-2}}$ – the amounts of gasoline, diesel, LPG and natural gas consumption in previous periods.

Source: authors' calculations.

Taking into account that the market for petroleum products is oligopolistic, this burden will be borne by fuel consumers. However, we calculate that in the ecological taxation system the impact of such transformations on consumer welfare will be negligible. For example, the price of gasoline, diesel and LPG will increase by 3-8 kop. per liter compared to the January 2021 level, in other words, by 0.2-0.4%. The price of natural gas and fuel oil will increase on average by 0.3% and that of thermal coal by 0.9% (Table 4).

Table 4

The impact of the proposed CO_2 emissions tax on the price of fuel for the transport sector and stationary sources of pollution

Type of fuel	A unit of measurement	Prices for January 2021, *UAH*	Proposed tax rate on CO_2 emissions, *UAH*	New price, *UAH*	*% price increase*
1	**2**	**3**	**4**	**5**	**6**
Transport sector					
price CO_2 – 10 UAH per ton					
Gasoline A-92	*л*	24.52	0.02	24.54	0.09
Gasoline A-95	*л*	25.66	0.02	25.68	0.09
Diesel	*л*	24.84	0.03	24.87	0.11
Gas liquefied for cars	*л*	12.67	0.02	12.69	0.12
price CO_2 – 30 UAH per ton					
Gasoline A-92	*л*	24.52	0.07	24.59	0.28
Gasoline A-95	*л*	25.66	0.07	25.73	0.27
Diesel	*л*	24.84	0.08	24.92	0.32
Gas liquefied for cars	*л*	12.67	0.05	12.72	0.36
Stationary sources of pollution					
price CO_2 – 10 UAH per ton					
Natural gas	*UAH per thousand cubic meters*	7056.00	19.27	7075.27	0.27
Fuel oil	*T*	11850.00*	31.09	11881.09	0.26
Steam coal	*T*	2220.00**	20.07	2240.07	0.90
price CO_2 – 30 UAH per ton					
Natural gas	*UAH per thousand cubic meters*	7056.00	57.81	7113.81	0.82
Fuel oil	*T*	11850.00*	93.26	11943.26	0.79
Steam coal	T	2220.00**	60.20	2280.20	2.71

* As of February 2020.

** As of January 2020

Source: compiled by the authors according to data from the State Statistics Service of Ukraine and [21, 22].

As a result of improved institutional framework for the administration of the environmental tax on carbon dioxide emissions by converting the tax on estimated carbon dioxide emissions into a tax on fuel consumption, a significant increase in

tax revenues can be achieved even without increasing the price of CO_2. Thus, according to the results of simulation of data on the consumption of certain fuels by stationary sources of pollution in 2019 - Q1 2021, the potential tax revenues, while maintaining the current price of CO_2 at UAH 10 per ton, were on average by 70% higher than the actual figures (Figure 2). If the price of CO_2 is increased to 30 UAH per ton, as proposed in the recent government bill No. 5600 [20], taking into account the reduction of fuel consumption by the elasticity factor, such potential revenues could increase by an average of 5.1 times. Calculations made based on 2019 data from the State Statistics Service of Ukraine on the use of all fuels for the purposes of conversion into other fuels and energy, own consumption by the energy sector, final consumption, losses during distribution, and transportation and storage demonstrated that the revenues from stationary sources can be doubled at the price of 10 UAH/ton CO_2 and 6.3 times higher at the price of 30 UAH/ton CO_2.

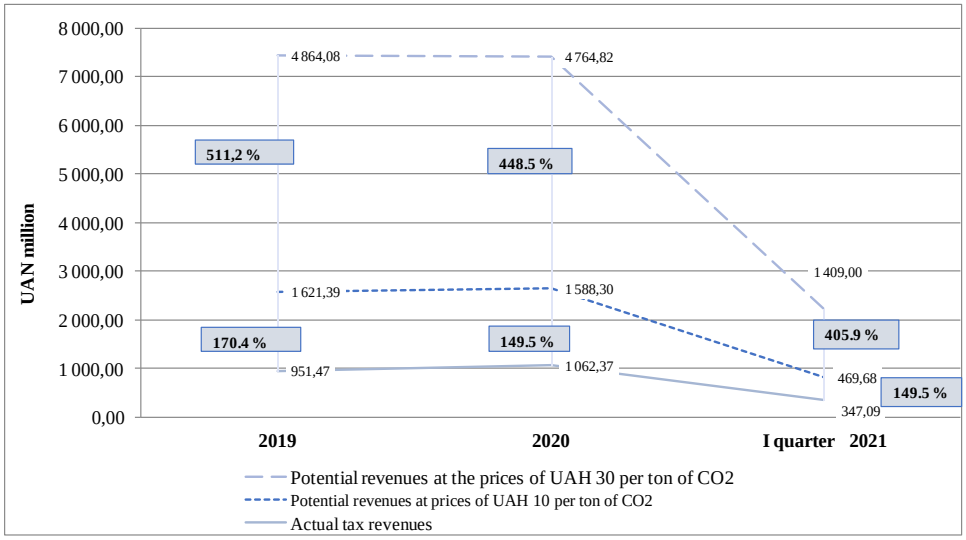

Figure 2. The comparison of actual and potential revenues of the ecological tax on CO_2 emissions based on simulation of the consumption of selected fuels by stationary sources of pollution in 2019 - I quarter of 2021.

Source: compiled by the authors using data from the State Statistics Service of Ukraine and the State Treasury Service of Ukraine.

In addition, the taxation of fuels for the transport sector will increase budgetary revenues. At the price of UAH 10 per ton of CO_2, revenues will amount to UAH 1,151.7 million, or 0.06% of GDP. In case of a price increase up to 30 UAH per ton of CO_2, the revenues are expected to be 5,357.7 million UAH, or 0.17% of GDP. In addition to improving the fiscal efficiency of the ecological tax on CO_2 emissions, proposed measures would create opportunities to simplify the process of calculating the tax liability, tax audits and reliable representation of taxable objects in taxpayers' tax returns. Also they would promote the compliance of the tax legislation with the principles of economy of taxation and inevitable responsibility for violations of tax laws; they would increase the amount of tax paid

by one taxpayer from 47.6 to 2,103.1 thousand UAH with a simultaneous reduction in the number of taxpayers from 20,000 to 1,000 entities through the institution of tax agents. In addition they would increase the taxable base, eliminate the cap on taxable emissions at 500 tons per year and provide a fuller coverage of the carbon dioxide emissions from fuel combustion.

However, an increase in the tax rate without a corresponding structural shift towards eco-modernization of companies would create an additional tax burden and would not result in a significant reduction of energy consumption and, consequently, of CO_2 emissions. In other words, it will not be possible to achieve the climate goals by raising the tax rate alone. Therefore, when making a decision to increase the level of the carbon dioxide tax, it seems necessary to ensure that the budget revenues received are earmarked for climate, environmental and resource-saving activities.

Conclusions

The proposed measures to improve the institutional capacity of tax administration while introducing effective mechanisms for financing environmental decarburization measures will contribute to reducing greenhouse gas emissions without impairing the competitiveness of Ukraine's enterprises. In addition, by changing the taxable base of carbon dioxide emissions tax, the number of taxpayers can be reduced from 20 thousand to 1 thousand legal entities with a simultaneous increase of the average tax liability per taxpayer from 47.57 UAH to 2,103.12 UAH. It is proposed to impose the obligation to pay this tax on tax agents - producers and importers of energy resources. In addition, accounting for the tax base will become simple and transparent, making it easy to verify the correctness of the tax liability and the inevitability of penalties for understatement. Thus, the regulatory potential of the tax would be significantly increased. If this model of CO_2-targeted taxation is implemented, the ability to meet climate objectives and decarbonize the economy will be improved.

The prospects for further research. Further research by the authors of this paper aims to develop science-based proposals for the transformation of environmental taxation of carbon dioxide emissions in connection with the implementation of emissions trading, the expansion of the tax base for carbon dioxide emissions in agriculture, the impact of increased CO_2 taxation on subsidies for low-income groups, and development of recommendations on the application of modern fiscal tools for transition to a climate-neutral economy.

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КОНЦЕПТУАЛЬНІ ПІДХОДИ ДО УДОСКОНАЛЕННЯ ОПОДАТКУВАННЯ ВИКИДІВ ДВООКИСУ ВУГЛЕЦЮ В УКРАЇНІ

Вітчизняний податок на викиди двоокису вуглецю потребує вдосконалення податкового адміністрування задля забезпечення його фіскальної ефективності та зменшення трансакційних витрат на виконання податкового обов'язку. Незважаючи на те, що в Податковому кодексі України розрахунок такого податку базується на фактичних

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показниках викидів CO_2, на практиці він здійснюється на основі кількості спожитих ресурсів та характеристики виробничого процесу. Відповідно, складнощі щодо адміністрування цього податку викликають трудомісткість податкових перевірок та необхідність залучення фахівців природоохоронних органів. Усе це не дає змоги дотримуватися принципу економічності оподаткування та актуалізує необхідність пошуку можливостей спрощення процесу податкового адміністрування на основі кращих світових практик.

Метою статті є окреслення концептуальних підходів до удосконалення оподаткування викидів двоокису вуглецю, що допоможе Україні спростити податкове адміністрування та спільно з ЄС ефективно протидіяти наслідкам зміни клімату задля підвищення безпеки та створення нових можливостей для українського бізнесу в рамках Європейського зеленого курсу.

Методологічною основою виконання дослідження стало використання сукупності загальнонаукових та спеціальних методів: узагальнень та наукової абстракції, історико-логічного екстраполяції, просторового графічного й табличного методів візуалізації. Застосування методу SWOT-аналізу та систематизація європейської практики дало змогу з'ясувати, що для України найбільш прийнятним є використання податку на викиди CO_2 у вигляді непрямого податку на споживання енергоресурсів. Для переведення податку з оціненої емісії у форму податку на споживання енергоресурсів використано коефіцієнти вмісту вуглецю у паливі, теплотворну здатність палива та його коефіцієнт окислення. Впровадження зазначених пропозицій сприятиме підвищенню ефективності адміністрування такого податку, оскільки дозволить: 1) скоротити кількість платників податків через впровадження інституту податкових агентів за одночасного зростання суми сплаченого податку одним платником; 2) спростити порядок розрахунку бази оподаткування платниками податків та працівниками податкових органів; 3) збільшити фіскальну ефективність екологічного податку на викиди двоокису вуглецю від стаціонарних джерел на 50 % у разі встановлення ціни CO_2 на рівні 10 грн за т (у 5 разів при встановленні ціни CO_2 на рівні 30 грн за т відповідно до пропозицій законопроєкту № 5600) та залучити потенційні надходження від транспортного сектора в обсязі 0,06% ВВП.

Використання практичних пропозицій та рекомендацій, отриманих у результаті дослідження, допоможе підвищити ефективність реалізації податкової політики України шляхом формування комплексу заходів, реалізація яких сприятиме зниженню енергозалежності національної економіки, у тому числі шляхом формування стимулів до запровадження енергозберігаючих та кліматично-нейтральних технологій; зниження надмірного навантаження на довкілля; спрощення адміністрування екологічних податків за одночасного зростання їх фіскальної ефективності.

Матеріали дослідження можуть бути використані при підготовці проєктів нормативно-правових актів та програмних документів у сфері екологічного та акцизного оподаткування, що входить до компетенції МФУ України, а також при формуванні пропозицій, застережень та рекомендацій до інших нормативно-правових актів щодо вдосконалення екологічного та акцизного оподаткування, ініціаторами яких виступають як органи виконавчої влади України, так і Верховна Рада України. Теоретичне значення досягнутих результатів полягає у розвитку загальної теорії фіскального адміністрування щодо екологічного та акцизного оподаткування[17].

Ключові слова: *Європейський зелений курс, екологічне оподаткування, податок на викиди двоокису вуглецю, система торгівлі квотами на викиди парникових газів, акцизний податок на енергоресурси, цінові інструменти зменшення викидів парникових газів, механізм регулювання вуглецю на кордоні*

[17] Публікацію підготовлено у межах НИТР "Оптимізація екологічного оподаткування діяльності, яка створює надмірне навантаження на навколишнє природне середовище" (№ ДР 0120U104522).