

ANALYSIS VOLUNTARY CARBON PRICING PROGRAMS FOR THEIR FURTHER ADOPTION BY UKRAINIAN ENTERPRISES

АНАЛІЗ ПРОГРАМ ДОБРОВІЛЬНОГО ЦІНОУТВОРЕННЯ НА ВИКИДИ ВУГЛЕЦЮ ДЛЯ ЇХ ПОДАЛЬШОГО ВПРОВАДЖЕННЯ УКРАЇНСЬКИМИ ПІДПРИЄМСТВАМИ

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The wide spreading of the voluntary carbon pricing practice will lead to the efficiency of governmental policies towards low-carbon an economy, since they will be able to adopt clearly anticipated price policies in Ukraine and other countries. But adopting the internal carbon pricing programs by domestic enterprises is challenging due to expose to political, energy, financial and other crises in Ukraine and should be carefully studies in prior. Thus we offer considering best experiences of European companies that have already effectively and efficiently incorporated carbon pricing schemes into their management processes and strategic decisions. For this purpose, the theoretical issues of implementing voluntary carbon pricing programs by domestic enterprises have been investigated. Theoretical and practical base of the article consists of general economic and environmental economic principles, works of international and national scientists in the field of carbon pricing. This study provides analysis of the effective tools of mitigating risk associated with climate change policy and regulations, which can be applied by domestic

firms in Ukraine. Using internal carbon pricing programs as a risk management tools, we described potential benefits, costs and limitations of the program. We also introduced the business study case how to apply the internal carbon pricing tool, in particular, shadow price by a company. This example proposes a methodological approach to implementing a shadow price tool. Thus, can be applied by domestic company in order to identify the feasibility of low-carbon emission investment and make right investment decision towards decarbonisation. Further analysis reveals that internal carbon pricing programs can be implemented by domestic firms as an efficient strategy and enable a greenhouse gas emissions reduction in compliance with the future or current national target. Our study provides practical recommendations through which Ukrainian companies can address climate risk and provide guidance to governments and regulators for the forming and further implementation of national environmental policies. **Key words:** climate change, decarbonisation, internal carbon pricing, low carbon investment.

Сьогодні помітна тенденція ціноутворення на викиди вуглецю міжнародними підприємствами. Це зумовлено певними причинами: впровадження економічно ефективного способу досягнення бажаного рівня екологічної безпеки; зменшення ризиків, пов'язаних з декарбонізацією інвестицій та підвищення їх прибутковості; зменшення використання викопного палива та пом'якшення ефекту відскоку у поведінці споживачів тощо. Оскільки ціноутворення на вуглець та інші викиди регламентується державними органами, то потребує багато часових та інших ресурсів. Проте, час є одним із найцінніших ресурсів, тому багато компаній, незалежно від їх розміру та масштабів діяльності, намагаються впровадити добровільні механізми ціноутворення на вуглець (зокрема, внутрішні програми ціноутворення на вуглець) до їх визнання державними установами. Це означає, що компанії вирішили самостійно застосовувати ціну на викиди вуглецю до моменту прийняття та схвалення на місцевому чи державному рівні урядовими органами. Ця тенденція є особливо сприятливою для економіки та вуглецевого ринку і може принести користь усім компаніям, діяльність яких пов'язана з низьковуглецевими рішеннями. Варто зауважити, що застосування внутрішніх програм ціноутворення на вуглець відбувається по-різному і залежить від самої організації, її діяльності, місця розташування, стратегічних цілей щодо декарбонізації та інших внутрішніх і зовнішніх чинників. Поширення добровільного ціноутворення на викиди вуглецю дозволить сформувати ефективну державну політику щодо низько-вуглецевої економіки, оскільки останні зможуть прийняти чітко передбачувану цінову політику в Україні та інших країнах. Запровадження внутрішніх програм ціноутворення на викиди вуглецю вітчизняними підприємствами ускладнюється політичною, енергетичною, фінансовою та іншими кризами в Україні під час війни проти російської агресії та потребує попереднього ретельного вивчення. Таким чином, ми пропонуємо розглянути найкращий досвід європейських компаній, які вже ефективно та результативно запровадили програми ціноутворення на вуглець під час управління та прийняття стратегічних рішень. Такий аналіз допоможе вітчизняним підприємствам визначитися з програмою добровільного ціноутворення, а також, у перспективі, зменшити викиди вуглецю на національному рівні. Із цією метою досліджено теоретичні засади впровадження вітчизняними підприємствами програм добровільного ціноутворення на вуглець. Теоретичну та практичну базу статті складають загальноекономічні та еколого-економічні положення, праці зарубіжних та вітчизняних вчених у галузі вуглецевого ціноутворення. Наукові методи, які використано у статті: - системний підхід, метод аналізу та узагальнення використували під час збирання та систематизації інформації; - методи абстракції та дедуції - для уточнення понять та їх систематизації відповідно до існуючих класифікаційних напрямків; - узагальнення - для розроблення рекомендацій та пропозицій і висновків; - методи інвестиційного менеджменту було застосовано для оцінювання інвестиційних можливостей підприємств щодо декарбонізації. Дане дослідження містить аналіз ефективних інструментів зменшення ризиків, пов'язаних із політикою та нормативними актами щодо зміни клімату, які можуть застосовуватися вітчизняними підприємствами в Україні. Авторами було проведено аналіз існуючих добровільних програм ціноутворення на викиди вуглецю, визначено потенційні переваги, витрати та їх обмеження у застосуванні. Авторами також було розроблено показовий приклад бізнес-дослідження (методичний підхід) щодо практичного застосування інструменту ціноутворення на викиди вуглецю, зокрема такий як «тіньова ціна». Методичний підхід до впровадження інструменту тіньових цін може бути використаний вітчизняними компаніями для перевірки доцільності інвестицій, що направлені на викиди вуглецю, та прийняття правильного інвестиційного рішення щодо декарбонізації. Подальший аналіз існуючих добровільних програм ціноутворення на викиди вуглецю показав, що вони можуть бути реалізовані вітчизняними компаніями як ефективні стратегії та дозволяють скоротити викиди парникових газів відповідно до майбутньої або поточної національної мети. У статті розроблено практичні рекомендації для українських компаній щодо керування кліматичними ризиками, які також можуть бути використані урядом для подальшого формування та реалізації національної екологічної політики. **Ключові слова:** зміна клімату, декарбонізація, внутрішнє ціноутворення на викиди вуглецю, низьковуглецеві інвестиції.

Statement of the problem in a general form and its connection with important scientific or practical tasks. In the Paris Agreement many countries set the ambitious goal of achieving zero net emission before the end of the century, in order

to comply with the average global warming cap of 2°C or less, if possible. They agree that assigning a price to greenhouse gas emissions (GHG) has an influence on their decisions and is an effective way of encouraging economic decision-makers to

invest in clean energy, low-carbon technologies and even in different products and services that meet the same requirements. Thus, assigning a price on pollution (internalising the economic cost of greenhouse gas emissions) makes it costly for all participant of the transaction which occurs in the market for a product that generates this pollution. Consequently it reduces market activities with some level of pollution. In this way, the overall environmental goal is achieved in the most flexible and least-cost way to society. There are two main types of carbon pricing: emissions trading systems (ETS) and carbon taxes [1, p.1-10].

Government authorities of many countries have already taken decisions along these agreements. There are now 61 carbon pricing initiatives in place or scheduled for implementation, consisting of 31 ETSs and 30 carbon taxes, covering about 22 percent of global GHG emissions in 2020 [1, p. 10-14]. According to the report we can notice active contribution to the program by Ukraine as well.

Analysis of the latest research and publications in which it was initiated solution of this problem and on which the author relies.

The transition towards the low-carbon involves every sector of an economy, including energy, transport, housing, production, farming, saving and consumption, etc. Hence, the carbon strategies and carbon management practices are actively and widely discussed by many researchers. In particular, studies on corporate carbon management have been made, which cover outputs of low-carbon operations on economic performance [2, 3]; carbon strategies and management practices [4-7]; drivers and challenges [8,9]; carbon disclosure and accounting [11,12]; and GHG emissions [13] and carbon risk [14-17] and others.

Highlighting previously unresolved parts of the general problem. Due to literature review we can notice that there are many factors the short, mid and long term decarbonisation goals are not achievable by organizations at national and international levels. Which points on increasing mobility and concerns of all actors towards reducing carbon dioxide emissions. But There no generally accepted methodological approach to implementing voluntary carbon price tools which can facilitate these process. Hence, this creates a gap between studying and implementing carbon price tools and becomes an unsolved part of the problem of voluntarily internalising economic cost of greenhouse gas emissions at national level.

Formulation of the goals of the article (statement of the task). The main purpose of the article is to show how the internal carbon pricing can be implemented by a domestic enterprise in order to proactively anticipate the upcoming climate change policy imposed by government authority in the nearest future.

In order to achieve the aim of the article, we will solve the following tasks:

1) provide analysis of the internal carbon pricing forms in order to identify their benefits and potential costs and limitations associated with implications by domestic companies;

2) show a business study case, which describe how to apply the internal carbon pricing tool. This example proposes a methodological approach to implementing a shadow price tool.

Presentation of the main research material.

Companies are subject of the risks linked to climate change and the need to transition to a low-carbon economy even if the policy has not imposed yet. However, it is very important to be aware of the effectiveness of carbon pricing mechanisms and their contributions to decarbonisation. Domestic companies should pay close attention and move forward, at the same time make an active contribution towards this trend. This is possible through the development of voluntary pricing tools. The voluntary pricing tools can be viewed as a risk management tool or/and as part of a company's decarbonisation strategy, since it can facilitate company's global strategies to become more resilient to regulatory climate policies and more favorable to emission reductions. It works in this way, an internal carbon price is a value that companies voluntarily set for themselves for internalising the economic cost of their greenhouse gas emissions.

Depending on the companies, carbon pricing may takes different forms [18]:

- a shadow price: which represents a carbon value (determined by the company) that is incorporated into investment decisions and applied to the greenhouse gas emissions generated by projects;

- an internal carbon tax: a levy that companies voluntarily apply to their operations and that increases operating costs depending on the resulting greenhouse gas emissions; the company then uses the proceeds of this tax as it sees fit.

Firstly we have analyzed a shadow price. Shadow price as a method consists of incorporating a «carbon value», decided by the company, into each investment decision (research and development, infrastructure, financial assets, etc.) and applying it to the resulting GHG emissions. The aim is to understand the impact a carbon price would have on the company strategy and on the calculation of its investments' internal rate of return (IRR) [1, p.16].

Shadow price can be considered as a risk management tool, since testing the sensitivity of investment plans in this way enables companies to improve their risks management relating to future regulatory carbon pricing systems.

We can notice that this risk management approach is quite typical for project approval process and has an impact on the project's profitability ratio and predicted cash flows in relatively short term. However, the entire process has a long-term influence on the company's business model. There are two possible scenarios with favorable outcomes from economics perspective: if regulatory carbon prices are close to the shadow price (set by a company) in the future, so its risk reduced; if the shadow price is higher in the long-term than regulatory prices, the company will adopt a more ambitious decarbonisation approach than what has been implemented.

Analyzing a shadow price we can point on main benefits and costs associated with its implementation by companies.

Benefits: A shadow price enables firms to assess the resilience of capital investments to the risk of potential domestic and regional regulations regarding climate change and related risks; it facilitates setting up strategic plans that include GHG emission reduction targets guides research and development towards products and solutions that take climate change into account and raise employee and other stakeholders awareness of pricing signals for GHG emissions.

Costs: A shadow price testing and implementation require additional time and other resources consumption such as an expert knowledge in decision making process, educational and other support programs for employees, therefore additional costs may arise. However, these costs can be reduced if statistical softwares will be used in order to automate the assessment process.

The method has some limitations such as: there no standard criteria for a corresponding economic variable to set a carbon value, hence a company may under or over estimates it, which may lead to additional company's costs; this method is often applied to major investment projects individually but not for all projects at once.

In general, there is no significant costs and limitations in implementation by a domestic company.

Internal carbon tax is a tax that companies decide to voluntarily apply to their operations. The tax consists of adding a cost relating to generated GHG emissions to the operational costs. By increasing operating expenses, it results in short-term emission reductions while driving innovation in the longer term, thanks to the general awareness of increasing climate-related constraints [1, p.18].

The internal carbon tax basically associated with internal transfers of company's funds assigned to decarbonisation policy, activities. In particular, offsetting GHG emissions by purchasing offset credits externally or/and financing internal projects

or any other environmentally friendly operations relating to the reduction or elimination of GHG emissions.

Benefits: An internal carbon tax enables firms to immediately issue a price signal for GHG emissions and thus provide support for its internal and public policy designed at reducing these emissions; provides the cost breakdown is performed on an entity- by-entity basis; displays the emission reduction initiatives carried out or suggested by its employees; offset all or part of its GHG emissions.

Costs: this tool implementation requires additional time and other resources consumption, such as an expert knowledge in decision making process, educational and other support programs for employees, therefore additional costs will arise. However, these cost can be reduced by using statistical softwares which facilitate some calculations and generate results.

Limitations: the method requires continues monitoring the GHG emissions entity by entity (business units, geographical regions, subsidiaries, divisions). In addition, it also raises certain practical issues for new countries introduce carbon pricing and as pricing levels make these internal and external charges more sensitive. But in the near future, this process should be approved by the government, so these issue will either eliminated or clarified.

In general, there is no significant costs and limitations in implementation this tool by a domestic company.

Thus, based on the analysis of these two methods, a domestic company may choose an objective based approach, which will fit it the best. In practice, the choice between two approaches is highly correlated to the company's sector of activities and both (hybrid) can be used at the same time. However, here we collected short practical recommendations for domestic companies based on best practice of European companies:

- companies which generate high levels of emissions (energy, transport and manufacturing companies) generally use a shadow;
- companies which generate lower emissions (banking, services, finance) usually apply a carbon tax;
- if companies activities are related to investment activities, so shadow price is recommended;
- if companies activities are focusing more on operations rather than investment, so internal carbon tax or/and shadow price can be used;
- if the time frame is critical for a company's decision, so internal carbon tax is associated with short term activities, while medium and long-term with shadow price projects.

Based on the best experience of European companies, companies choosing a shadow price method more frequently rather than an internal tax.

Here we will present an example how to apply a shadow price method. This example is based on hypothetical data and described calculations and implementations instructions for any domestic company. Suppose an imaginary company is considering to increasing its engagements in the renewable energy sector by investing into a project A, which can contribute a low-carbon emissions.

If a project offers a series of cash flows with a Net Present Value (NPV) about 60000 EUR and the company has to pay 200000 EUR for it, then the project's NPV is positive, which means the company will earn internal rate of return (IRR) greater than the cost of capital (discount rate) in the table 1. But this information is not enough to make right decision.

Table 1

Net Present Value and Internal Rate of Return calculations for the project A

Project A, discount rate 10%				
Period	Cash flows	Amount, EURO		
2022	Investment cost	-200000		
2023	Cash inflow 1	42210		
2024	Cash inflow 2	42290		
2025	Cash inflow 3	51210		
2026	Cash inflow 4	32210		
2027	Cash inflow 5	39210		
2028	Cash inflow 6	45210		
2029	Cash inflow 7	42210		
2030	Cash inflow 8	62210		
2031	Cash inflow 9	22210		
2032	Cash inflow 10	42120		
NPV =	€ 60,004.15	IRR =	17%	
Testing NPV				
Scenarios	Probabilities	Discount rate	NPV	
1	33%	10%	€	60,004.15
2	32%	12%	€	39,264.63
3	35%	8%	€	83,702.78
Expected NPV:			€	61,662.02

Source: systematized by the authors according to [17].

Next step is the testing the projects' sensitivity depending on carbon pricing scenarios. So ideally, we should develop at least three scenarios according to the table 1: Scenario 1, if the «carbon value» is included in the discount rate, hence the discount rate is the same; Scenario 2, if the «carbon value» is greater that the estimated discount rate, hence the discount rate will be greater than the current used in calculation; Scenario 3, the «carbon value» will be less than the discount rate in case of some subsidies program assigned by government.

Based on calculated an expected NPV we can draw the conclusion regarding the investment. Projects with negative NPV should be rejected and projects with positive NPV should be accepted. In addition, we can prioritize them by using profitability index. In case, all project are with negative NPV, this requires rework in order to make to be profitable even in scenarios that include carbon pricing, otherwise they should be abandoned, since lead to inefficient use of a company resources.

Conclusions. We provided analysis of the internal carbon pricing forms and identified their benefits and potential costs and limitations associated with implications by domestic companies.

Consequently, there are no significant limitations and costs and domestic companies may implement these practices. Based on the best experience of European companies, we collected some practical recommendations on how and when the internal carbon pricing forms should be implemented. We provided the hypothetical practical example that showed how a shadow price as a method can be applied. This practical example can be applied by a typical domestic company in order to identify the feasibility of low-carbon emission investment and make right investment decision.

This example proposes a methodological approach to implementing a shadow price tool. We do not recommend accept the project with negative or zero expected NPV values, since it leads to inefficient usage of resources, from economics perspective. Predicting the impacts of climate change and the effects of the transition to low-carbon economies helps manage or reduce these risks.

Introducing an internal carbon pricing system can protect against risks relating to compliance with future decarbonisation policies, hence helps a company act proactively. Internal carbon pricing

programs are considered to be effective tools, thus companies can effectively reach established emission reduction targets, direct investments to low-carbon technologies more effectively and identify new markets. However, these programs are

not perfect since have some drawbacks mentioned in our analysis. Thus, creating a plan on how to avoid and eliminate limitations and cost associated with these programs will improve their effectiveness and efficiency in practical usage.

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