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# The Impact of Carbon Tax on Greenhouse Gases Emission Reduction and Economy

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*Some policies are conflicting in a wide range of economic, social and environmental effects. It is impossible to imagine a process in which all policies were set simultaneously, taking into account all interlinkages and to achieve a coherent set of economic, social and environmental goals and implement sustainable development objectives. The article deals with carbon tax and discusses its possible influence on economy, which can be quite contradictive. The theoretical issues of green tax reform and double dividend are discussed in the article. Experience of other countries in the field of green budget reform is provided. Based on the analysis of carbon tax and pollution trading schemes implementation results in other countries the problems and the way of their solution are developed for Lithuania. The main aim of the article is to raise questions and indicate problems as well as present possible solutions.*

Keywords: *environmental policy, carbon tax, green budget reform*

## Introduction

Internalization of externalities in the price of energy is the main approach dealing with the market failure in the field of environment. Energy production and consumption is the main source of GHG emissions. Therefore the integration of climate change mitigation and energy policies is an imperative issue in the light of sustainable development. Market based climate change mitigation policy instruments are taxes, pollution trading schemes and other Kyoto flexible mechanisms. The main driving forces of future greenhouse gas trajectories will continue to be demographic change, social and economic development, and the rate and direction of tehcnological change (IPCC, 2000). Integrating environmentally related economic instruments into economic decision-making is a new concept in Lithuania though pollution charges have been applied for the years (Forsstrom, 2001).

The main policy objective of a carbon or energy tax is to raise the price of different commodities based on their energy or carbon content and thereby provide the markets with appropriate price signals and incentives to reduce pollution either by switching to less polluting alternatives (fuels and technologies) or energy conservation and increase of energy efficiency.

Taxes and subsidies are financial mechanisms for the distribution of wealth in society. Thus, a revenue-optimal set of taxes minimizes its effect, as measured by a distortionary cost on the actions of market participants. Introduction of environmental taxes, for example $CO_2$ tax, aimed at GHG emissions reduction may have a significant effect on the national economy. Discussions on double dividend of green tax reform are currently very popular among environmental economists.

The goal of the article is to analyse the possibilities to introduce the $CO_2$ tax in Lithuania based on national modelling results and the experience of other countries.

**The objectives** of the article are as follows:

- to discuss green budget reform and double divident approach;
- to describe methodological approach for evaluation of $CO_2$ tax influence on the national economy;
- to analyze Norwegian, Finish and Swedish $CO_2$ tax schemes;
- to present the results of $CO_2$ tax introduction in Lithuanian electricity and heat sector using partial equilibrium analysis.

**The methods applied:** comparative analysis, partial equilibrium analyse, evaluation and synthesis.

## Green budget reform

The term “green tax reform” has been used since the beginning of the 1980s. The concept of green budget reform is a switch to environmental taxation, combined with a reduction in employment tax or other taxes in a fiscally neutral way that would lead to a “double dividend”. The idea behind this suggestion is that environmental taxes not only stimulates environmental improvements but generate substantial amounts of government revenue as well. This new government revenue would allow governments to reduce the rates of other taxes in the economy while maintaining a constant level of total revenues and expenditure. The other taxes are generally regarded as distortionary (interfering with the efficient functioning of markets) and the reduction of the rates can be seen as improving efficiency and, thus producing a second benefit from the adoption of pollution charges. A green tax reform can be seen as a tool to improve the environmental performance of the tax system but it can also be seen in a wider perspective in the development of environmental sound tax system.

The literature in this area indicates two double dividends: a gross welfare dividend and employment dividend. The gross welfare dividend arises as the tax changes reduce the distortions in consumer choice that result from sales and other taxes. The way by which such tax reductions might increase employment depends on whether or not the labour market is in equilibrium, with demand equal to supply. If there is disequilibrium in the labour market, with supply greater than demand and consequent involuntary unemployment, employment creation requires an increase in labour demand. This could be achieved by reducing the cost of employing labor, for example by reducing employers' social security taxes. On the other hand, if the labour market is in equilibrium, with demand equal to supply and no involuntary unemployment, an increase in employment requires an increase in labour supply. This could be achieved by increasing the returns to work, by reducing direct taxes on labour income or by reducing sales taxes on goods that workers wish to buy.

The primary purpose of pollution tax is to reduce damage to the environment by increasing the costs of harmful actions such as the burning fossil fuels that produce $CO_2$ or integration of external costs of pollution into the price of energy. The idea is to force consumers and firms to take account of the effects of their actions on the environment and to follow the "polluter pays principle". Theoretically, the proper size of the taxes should equal the monetary value of the environmental damage that the actions have caused.

The welfare economic foundation for an extended net national product was set out by Weitzman (Weitzman, 1976). A number of researchers applied Weitzman's model to economies where natural and environmental capital consitute important parts of the economic system (Backlund K., 2002). Pezzey (Pezzey, 2003) states that in order to achieve long run maximization of of the net social benefits of abating emissions, firms must pay for all inframarginal emissions under a tax.

It is worth to be mentioned that the theory of optimal taxation has not investigated environmental issues in detail so far. As the enviornmental taxes were concerned as revenue raising measure, the taxes could be treated as revenue-optimal. If country has adopted a revenue-optimal set of taxes, the taxes that raise the same revenues at smaller distortionary costs could not be amended. Imposition of a higher rate of tax on a good that damages environment cannot reduce the distortionary cost of the tax system, and can generally be expected to increase it. Thus, before the $CO_2$ tax is imposed in the existing taxation system, it should be tested whether the existing system is revenue-optimal. For such purpose general equilibrium analysis can be used.

## General and partial equilibrium analysis

There are a number of methodologies for the essesment of the economic impact of $CO_2$ tax. Data availability and other institutional constraints may limit their applicability in particular countries and regions. The range of methodologies presented here is by no means comprehensive, but is intended to reflect those that are well established as well as those that are under development.

The existing methodologies appropriate for the assessment of the economic impacts of the imposing of $CO_2$ tax are based on econmic models that examine the correlation between key economic variables within a market or markets. Such models are based on theoretical and empirical assumptions of those relationships.

The simplest type of analysis, known as partial equilibrium analysis, considers only the market directly impacted by the proposed tax reform and identifies price and output changes in that market. The analytical framework is known as demand and supply analysis.

Partial equilibrium analysis of this type makes the economic implications of the introdution of $CO_2$ tax more transparent in the sector directly affected. However, it cannot provide answers to the certain questions. For example, price increases in the energy sector will affect the input mix in other sectors of the economy that use energy as an input for production. If no substitution is possible, these higher prices will be passed on to some degree. In the absence of similar reforms in other countries, the international competitiveness of domestic industries will be efected as well. There may also be upward pressure on domestic inflation. These sectoral and macroeconomic effects are not addressed in partial equilibrium analysis, nor are efficiency gains in resource allocation throughout the economy. These effects, therefore, need to be identified and quantified using a wider framework. Computable general equilibrium models are the most common approach for analysing the impact of a subsidy reform.

General equilibrium analysis involves a complex set of calculations to solve the market prices via a set of demand and supply equations. The analysis is therefore most frequently undertaken using a computer. Computable general equilibrium (CGE) models essentially simulate markets for production factors and goods using systems of equations specifying supply and demand behaviour across all markets. The accuracy of data and resource requirements are substantial for the development of CGE models. However, this drawback should be weighed against the gains in accuracy of simulation to actual market changes that such modelling allows.

## $CO_2$ taxes

Economic theory implies that the optimal production level for a commodity is achieved when the marginal benefits of consumption equal the marginal social cost of production. The social cost typically includes items not factored into private production cost, such as damage costs resulting from air pollution (i.e., increased health costs, damaged crops, etc.). Thus, the government can use a pollution tax to rebalance the social costs and benefits by imposing a tax that equals the marginal cost of pollution or external cost. Determining the marginal cost of pollution to set the tax at the most efficient level is rather challenging which is why significant research effort has been spent in recent

years to determine "externality" costs.

The main goal of pollution (carbon) or energy tax is to raise the price of different commodities and thereby provide the markets with appropriate incentives to reduce pollution. The pollution charges should carry out the main functions: incentive, compensation and accumulative.The carbon tax does not eliminate carbon emissions, but rather establishes the optimal level at which they are to be emitted for each source. The difference to "command and control" measure is that a pollution tax does not dictate what this switch should be or how quickly the shift should occur. It could also be an attempt to internalize certain external costs.

$CO_2$ is by far the most important and most studied greenhouse gas (GHG). $CO_2$ emissions account for approximately 80% of the impact when gases in the basket are weighted according to Global Warming Potential (GWP) and are mostly linked to energy use and production of fossil fuels (Danish Energy Authority, 2002). Taxation is the main domestic fiscal measure for $CO_2$ mitigation policy.

Norway, Finland and Sweden have been among the pioneers of ecological tax reform over the past five years, incorporating carbon, energy and sulphur taxes. The Swedish carbon tax raises USD 1,600 mill per annum, with a nominal tax rate of USD 27/t $CO_2$, and major exemptions for industry. Finland and Norway have set taxes which raise the order of USD 580 mill each, with tax rates ranging from USD 10.4/ $CO_2$ (Finland) to USD 212 /tCO2 in Norway. Ecological taxes in the Nordic countries and Netherlands now generate between 1.4% and 3% of the GDP ().

### Finish $CO_2$ tax scheme

Finland was the first country to introduce a CO2 tax in 1990. This tax was based on the carbon content of fuels. Since its introduction the tax system has been modified and tax rates adjusted several times (Finland's Third National Communication under the UNFCCC, 2001). The present energy taxation consists of three tax components:

- a basic excise tax that is levied on transport and heating fuels,
- an additional $CO_2$ –based excise tax that is levied on fossil fuels and peat,
- additional differentiated (industrial and other use) excise tax that is levied on electricity consumption.

The present tax rates come into force in September 1998. The basis for the traditional tax on transport and heating fuels is 17.2 EUR /t of $CO_2$. The tax on electricity is 4.2 EUR/MWh for industrial users and 6.9 EUR/MWh for other users. Vehicle and fuel taxation have traditionally been at a relatively high level in Finland (International Energy Agency, 2000).

The fuel taxation in Finland contains differentiation scheme according to which the price of diesel fuels is differentiated taking into account the sulphur content. The differentiation of petrol fuels is based on leaded and non-leaded petrol.

Few studies (Forstrom et al., 2001, Kemppi et. al., 2001) were conducted to asses the impact of the implementation of Finnish National climate strategy (2001) which foresees the increase of energy taxes and alleviation of other taxes using the increasing energy tax revenues for example, bringing down the income tax and social security tax.. Results of studies show that implementation of the Finnish National Climate Strategy would impair the development of national economy. However, the intensity of the effects will mainly depend on the structure of electricity procurement chosen and, to a lesser degree, on the energy taxation alternatives. The climate change strategy would lead to a decrease in employment by 6000-11000 person/year in 2010. So double dividends of green budget reform will have a negative effect.

### The Norwegian CO2 tax scheme

Norwegian commitment under the Kyoto protocol allows increase of GHG by 1% compared with the level of 1990 (Ministry of Environment of Norway, 2002). Climate change and emissions of GHG have been a concern of Norwegian policy since the late 1980s. The first measure that directly addressed GHG emissions was $CO_2$ tax introduced in 1991. The $CO_2$ tax is levied on about 64% of total $CO_2$ emissions, corresponding to about 47% of total GHG emissions.

The study on the implication the introduction of the $CO_2$ tax in sectors other than offshore petroleum industry was based on estimation of macroelasticities and used a long-term dynamic equilibrium econometric model (Bruvol, et al. 2002). This approach showed that the tax had only limited impact corresponding to 1.5% of national emissions. It is possible that this relative minor impact can partly be explained by rebound effects through income effects that were reflected in the counterfactual simulation. Another study (Larsen, at al. 1995) used partial analysis to study the effects of the $CO_2$ tax based on data for the years up to 1993. Given the limited changes that have been made since then in the structure of the tax and tax rates, the results from this study may still be relevant. In the period studied, the effect of the tax varied from 0 to 10-20% reduction in emissions in the sector studied, which covers about 25% of Norwegian GHG emissions. On average, emissions in the sectors studied were reduced by 3-4%. Such econometric approaches reflect historical changes related to price signals. However, if the tax would have been effected the facing out of coal from the Norwegian energy system, this would not be reflected in such simulations. To some extent such an effect could have happend,, as coal could be a possible energy source for some industries. At the same time it is obvious that the design of the $CO_2$ tax scheme – exemptions and high degree of differentiations – has also limited its environmental impact. The exemptions from the tax are given aiming to protect regional employment and the competitive position of certain industries as well as to avoide carbon leakage.

## Swedish experience

In Sweden the energy policy has varied significantly over time and that international and technical aspects have played a vital roll. Special occurrences such as the energy crises in the beginning of 1970th and 1980th, the development of the nuclear energy program and the environmental issues have had a large influence on the energy policy.

The general position for the Swedish energy taxation is that fossil fuels, which are used for, engine operation or heating shall be taxed. Biomass based fuels shall not be taxed. Crude tall oil is, however, taxed due to industrial political reasons. Fossil fuels that are used for other purposes than engine operation or heating i.e. mostly as raw material, will not be taxed. There are a number of detailed tax exemptions.

Compared with other industrialised countries, per capita carbon dioxide emissions in Sweden are relatively low. Emissions of carbon dioxide total some 6 tonnes per person and year, which may be compared with the OECD average, which is approximately 11.5 tonnes per person annualy. This is because the proportion of fossil fuels in the Swedish energy system is 40 per cent, compared with an average of 80 per cent in the rest of the OECD (Zonnekeyn, 1996).

In order to promote environmental friendly and renewable electric power production the quota- based electric power certificate system is under development**.** Although interest in and development of a certificate trade system has not advanced to the same stage in Norway and Finland as in Sweden and Denmark, it has been considered that these countries can be included in a common Nordic certificate trading system. Simulations that have been made indicate that a reduction in the emissions of carbon dioxide in Sweden will result from the introduction of a quota-based certificate system in Sweden. The reduction in Sweden is primarily due to the replacement of fuel in the Swedish combined heating and power production in the district heating systems. At the Nordic level, investments in Sweden in electricity production from renewable energy sources will supersede investments in fossil power in the rest of the Nordic area (Swedish Envioronmental Institute, 2003).

Changes in Swedish environmental taxation significantly reduced carbon dioxide emissions. State revenues from carbon dioxide taxes and energy taxes totalled in about SEK 65 billion in 1999; almost double total revenue from energy taxes in 1990. Total environmental taxes in Sweden made 3,2 % DGP in 1999.

The green tax reform committee (Swedish Third National Communicaiton, 2001) model suggested that the tax should be as general as possible to achieve the best control result. It is proposed that all fossil and biomass based fuels should be taxed with the sum of the following components:

- Energy tax proportional to the energy content in the fuel.
- Carbon dioxide tax proportional to the net emission of carbon dioxide.
- Sulphur tax proportional to the sulphur content in the fuel.
- Traffic and environmental tax which amount can be varied between different fuels to adjust for special traffic related situations.

Moreover, estimated using the MARKAL model, which also included the effect of subsidies for renewable electric energy generation, indicate that emissions of carbon dioxide in 2000 were at least 5000 ktonnes less than they would have been if no changes had been made in the 1990s (Swedish Third National Communicaiton, 2001). Furthermore, the carbon dioxide tax is one of the main reasons behind the dramatic increase in the use of biomass fuels in the district-heating sector.

## Implications of introduction of $CO_2$ tax in Lithuania

Domestic GHG mitigation options on consumer side are related to the $CO_2$ tax rates. Pollution charge is the main economic tool in Lithuanian energy sector. The current system of pollution charges was elaborated during 1993-1996 that resulted in considerably simplified system. The pollution charges are levied on 18 pollutants instead of 151. The individual tariffs are established only for principal pollutants ($SO_2$, NOx, $V_2O_5$ and dust), which are easier to control. The rest of pollutants were grouped according to the level of toxicity into the classes (IV classes for air pollutants) and the same tariff for the class is defined.

During the initial stage of the development of a new tax system the $CO_2$ tax was proposed and a rate of 5 USD/t was proposed based on the experience of foreign countries. However, later this tax was eliminated from the environmental tax system (Implications of the Kyoto Protocol, 2000).

A comprehensive energy analysis is based on the evaluation of the configurations of alternatives of the energy system that will balance energy supply and demand. The BALANCE module developed by IAEA (IAEA, 2001) can be used for this purpose. The module uses an energy network that is designed to trace the flow of energy from primary resources (crude oil, natural gas, coal, etc.) to final energy demand (diesel, fuel oil) and /or useful energy demand (hot water, industrial steam). Demand is sensitive to the prices of energy supplied. Supply price is sensitive to the quantity demanded. BALANCE seeks to find the intersection of the supply and demand curves simultaneously and tries to find the intersection for all energy supply forms and all energy uses that are included in the energy network. The equilibrium is reached than the model finds a set of prices and quantities that satisfy all relevant equations and inequalities. This model can be treated as partial equilibrium model, which takes into account the effect of $CO_2$ tax introduction on electricity and heat production sector.

A several runs of energy system simulation model BALANCE was made using $CO_2$ tax as a mitigation option for the baseline scenario. The tax rates from 5

USD/t to 60 USD/t (including tax rate of 10, 20, 40 USD/t) were applied. The tax was introduced in electricity and heat sector. The results of the simulation revieled that the application of the tax rate lower than 60 USD/t is not worth, as it does not created the incentrive to reduce $CO_2$ emissions to fulfill Kyoto obligations. A level of $CO_2$ emissions for baseline scenario when the $CO_2$ tax rate is 20 USD/t shows that applying this tax rate Kyoto targets will be reached in 2015. Than $CO_2$ tax rate of 60 USD/t is introduced the Kyoto limit will be reached only in the end of the study period (2020).

Based on the study conducted in the framework of project "Enhancement of the Use of Local and Renewable Energy Sources-Lithuania" results the introduction of $CO_2$ tax of 13.3 EUR/ton causes about 6% of $CO_2$ reduction comparing with "doing nothing scenario" and leads to significant additional income to the state budget but, at the same time, causes one of the highest level of electricity and heat price (Danish Energy Authority, 2003). The energy system model MESSAGE was used to investigate impact of $CO_2$ tax introduction. Taking into account the foreseen implementation of GHG emission trading scheme since 2005 the possibilities to introduce $CO_2$ tax in Lithuania needs more investigation especially the cross-sectoral analysis of different GHG mitigation measures is necessary seeking to define the most efficient solution for the whole economy.

Before making decision regarding impementation of $CO_2$ tax in Lithuania general equilibrium analysis is necessary seeking to define the optimal tax level $CO_2$ and necessary reduction of other taxes (profit or/and income tax) by mainatianing the same level of revenues to state budget and not increasing the burden of new tax on enterprises. Therefore the implementation of $CO_2$ tax in Lithuania should be carried out through the green budget reform. Only budget reform implementing new environmental tax and reducing other taxes, which implies the clear double didvidends, can be accepted in Lithuania.

## Conclusions

1. Green budget reform implies the rise of environmental taxes by reduction of the income, social security and value-added or profit taxes and maintaining budget revenues constant. Such reform does not have negative impact on small enterprises and not increase tax burden in general.
2. Norway, Finland and Sweden have been among the pioneers of ecological tax reform over the last years, incorporating carbon, energy and sulphur taxes and reducing other taxes.
3. Various methodologies that are appropriate for the assessment of economic impacts of $CO_2$ tax implementation are based on models of the economy that detail the relationships between key economic variables within a market or markets. Such models are built using theoretical and empirical estimates of these relationships and are called general equilibrium models.
4. The results of general equilibrium and partial equilibrium analysis for Finland indicates that double dividends will not be achieved because the environmental tax increase will impair the development of national economy and decrease in employment. At the same time results of general equilibrium analysis for Norway and Sweden showed that $CO_2$ tax increase has the positive impact on emissions, deployment of renewable energy sources and whole economy.
5. Integrating environmentally related economic instruments into economic decision-making is a new concept in Lithuania. Some studies on investigation of $CO_2$ tax impact on GHG emission reduction and electricity prices carried out in Lithuania were based on partial equilibrium models restricted by analysis of impacts in energy markets. The results of this analysis can be used just for the evaluation of impact on GHG emission reduction.
6. For the evaluation of $CO_2$ tax impact on Lithuanian economy the general equilibrium analysis is necessary which allows evaluating the impact of increased environmental taxes on GDP growth and employment. Analysis of green budget reform in Lithuania applying general equilibrium models should investigate the optimal level of $CO_2$ tax and necessary reduction of other taxes by maintaining the same level of revenues to the state budget and not increasing the tax burden. In such case the implementation of $CO_2$ tax will not have a negative impact on small enterprises but will allow to receive double dividends: reduction of pollution and growth of GDP and employment by reducing distortions in economy caused by taxing positive stuff (profit or income) instead of negative stuff (pollution).

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Dalia Štreimikienė, Rūta Bubnienė

**$CO_2$ mokesčio įtaka šiltnamio dujų išmetimų kiekio mažinimui ir šalies ekonomikai**

Santrauka

Straipsnis supažindina su žaliojo biudžeto reformos koncepcija bei anglies dioksido ar energijos mokesčio sistema Šiaurės šalyse. Remiantis modeliavimo rezultatais ir kitų šalių patirtimi, analizuojamas galimas anglies dioksido mokesčio įvedimo poveikis Lietuvoje.

Straipsnyje aptariamos dvigubų dividendų ir žaliojo biudžeto reformos koncepcijos, aprašoma anglies dioksido mokesčio poveikio šalies ūkiui įvertinimo metodika, analizuojamos Norvegijos, Suomijos ir Švedijos anglies dioksido mokesčio schemos, aprašomos anglies dioksido mokesčio įvedimo Lietuvos elektros energijos ir šilumos ūkyje pasekmės taikant dalinės pusiausvyros modelį. Nors pagrindinid anglies dioksido mokesčio įvedimo tikslas yra sumažinti anglies dioksido emisijas, šis mokestis gali gerokai veikti ūkio vystymąsi.

Viena aktualiausių aplinkos apsaugos temų yra rinkos nesėkmių eliminavimas, įtraukiant išorinius kaštus į energijos kainą. Energijos gamyba ir vartojimas yra pagrindinis šiltnamio efektą sukeliančių dujų šaltinis, taigi siekiant darnaus vystymosi, svarbu suderinti energetikos plėtros ir klimato kaitos švelninimo tikslus. Ekonominės priemonės, taikomos klimato kaitos politikoje, yra mokesčiai, prekyba apyvartiniais taršos leidimais ir kiti lankstūs Kioto mechanizmai. Šiltamio efektą sukeliančių dujų išmetimo kiekius ateityje daugiausia lems demografiniai pokyčiai, socialinė ir ekonominė plėtra bei technologinės plėtros lygis ir kryptys. Nors mokestis už aplinkos teršimą Lietuvoje įvestas jau seniai, vis dėlto ekonominių instrumentų aplinkosaugoje integravimas į ekonominių sprendimų priėmimą šalyje yra nauja koncepcija.

Mokesčiai ir subsidijos yra finansiniai instrumentai, naudojami gerovei paskirstyti visuomenėje. Vadinasi, optimalus mokesčių rinkinys sumažina mokesčio efektą, kuris pasireiškia iškreipdamas kainą ir rinkos dalyvių veiksmus. Mokesčiai už aplinkos teršimą, pavyzdžiui, anglies dioksido ($CO_2$) mokestis, kuriuo siekiama sumažinti šiltnamio efektą sukeliančių dujų kiekį, gali turėti ryškią įtaką šalies ūkiui, todėl dvigubų dividendų ir žaliojo biudžeto reformos tematika šiuo metu yra labai populiari tarp aplinkos apsaugos ekonomistų.

Ekonomikos teorija teigia, kad produkto optimalus gamybos kiekis pasiekiamas tuomet, kai ribinė vartojimo nauda yra lygi ribiniams socialiniams kaštams. Vadinasi, vyriausybė gali panaudoti mokestį už taršą socialinei naudai ir kaštams subalansuoti, įvesdama mokestį, kuris lygus taršos ribiniams kaštams arba išoriniams kaštams. Nustatyti efektyviausią mokesčio lygį pagal taršos ribinius kaštus labai sudėtinga. Būtent todėl pastaruoju metu labai daug tyrimų skiriama išoriniams kaštams nustatyti.

Esminis anglies dioksido arba energijos mokesčio politikos uždavinys – padidinti skirtingų prekių kainą, atsižvelgiant į esamą anglies ar energijos kiekį. Tada rinkose atsiranda kainos signalai – paskata sumažinti taršą naudojant švaresnes technologijas arba taikant energijos taupymo priemones. Anglies dioksido mokestis visiškai nepanaikina taršos anglies dioksidu, tačiau optimizuoja kiekvieno kurą deginančio įrenginio taršos lygį. Be to, anglies dioksido mokesčiu stengiamasi internalizuoti išorinius kaštus.

Žalioji biudžeto reforma – tai aplinkosauginių mokesčių didinimas mažinant pajamų, socialinio draudimo, pridėtinės vertės arba pelno mokesčius ir išlaikant pastovias biudžeto pajamas.

$CO_2$ mokesčio poveikį ekonomikai galima vertinti remiantis įvairiomis metodologijomis. Esamos $CO_2$ moksčio poveikio ekonomikai metodologijos remiasi ekonominiais modeliais, kurie tiria koreliaciją tarp ekonominių kintamųjų rinkoje arba rinkose. Šie modeliai pagrįsti teorinėmis ir empirinėmis prielaidomis apie šių ekonominių kintamųjų ryšius ir vadinami bendrosios pusiausvyros modeliais.

Norvegija, Suomija ir Švedija buvo tarp pirmųjų šalių, pritaikiusių aplinkosauginių mokesčių reformą pastaraisiais metais, įvedant anglies dioksido, energijos ir sieros mokesčius. Bendrosios pusiausvyros or dalinės pusiausvyros modeliavimo rezultatai parodė, kad Suomijoje nebus pasiekti dvigubi dividendai, kadangi anglies dioksido mokesčio įvedimas susilpnins ekonomikos augimą. Tačiau šio poveikio intensyvumas daugiausia priklausys nuo pasirinktos elektros energijos tiekimo struktūros ir mažiau – nuo energijos mokesčių alternatyvų. Mokesčio padidinimas sukeltų užimtumo sumažėjimą.

Bendrosios pusiausvyros modeliavimo rezultatai parodė, kad $CO_2$ mokesčio įvedimas paveiks tik 1,5 proc. Norvegijos anglies dioksido emisijų kiekio. Toks nežymus poveikis gautas galbūt dėl reakcinio efekto pajamoms, kuris išaiškėjo kontramodeliavimo metu. Dalinės pusiausvyros modelio rezultatai parodė nežymų $CO_2$ mokesčio poveikį. Vidutiniškai emisijų kiekiai tirtuose sektoriuose sumažėjo 3 – 4 proc. Kita vertus, akivaizdu, kad $CO_2$ mokesčio sistemos struktūra – išimtys ir didelio laipsnio diferenciacija – apribojo mokesčio sistemos teigiamą aplinkosauginį poveikį.

Pokyčiai Švedijos aplinkos apsaugos mokesčių sistemoje gerokai sumažino anglies dioksido emisijas. Be to, 1999 metais valstybė surinko 65 mlrd. Švedijos kronų pajamų iš anglies dioksido ir energijos mokesčių, o tai bemaž du kartus daugiau negu surinkta 1990

metais iš energijos mokesčio. Analizė, atlikta MARKAL modeliu, kuris įvertina ir subsidijų elektros energijos gamybai iš atsinaujinančių energijos šaltinių poveikį, parodė, kad 2000 metais anglies dioksido išleista bent jau 5000 kilotonų mažiau, palyginti su situacija, jeigu mokesčių sistema nebūtų pakeista 1999-aisiais. Be to, anglies dioksido mokestis ryškiai paskatino naudoti biokurą centrinio šildymo sektoriuje.

Nors Lietuvoje mokestis už aplinkos teršimą – vienas pagrindinių ekonominių instrumentų – aplinkosaugoje taikomas jau seniai, tačiau ekonominių instrumentų integravimas į ekonominių sprendimų priėmimą yra vis dar nauja koncepcija.

Dabartinė mokesčio už aplinkos teršimą sistema buvo tobulinama ir supaprastinta 1993 – 1996 metais. Šiuo metu mokestis taikomas 18 teršalų (vietoj 151 teršalo). Atskiri tarifai yra nustatyti tik 5 pagrindiniams teršalams (sieros dioksidui – $SO_2$, anglies oksidams – $NO_x$, vanadžio pentoksidui – $V_2O_5$ ir dulkėms), kas palengvina jų kontrolę. Kiri teršalai sugrupuoti pagal toksiškumą į klases (aplinkos oro teršalams išskirtos IV klasės) ir kiekvienai klasei nustatytas atskiras tarifas.

Kuriant naują mokesčių sistemą buvo siūloma įvesti anglies dioksido mokestį, kurio dydis, remiantis kitų šalių patirtimi, būtų 5 JAV dol. už toną. Tačiau vėlesniame etape šis pasiūlymas atmestas, ir anglies dioksido mokestis nebuvo įvestas.

Išsami energetikos analizė remiasi energijos sistemų alternatyvų konfigūracijų įvertinimu, kuris subalansuoja energijos paklausą ir pasiūlą. Šiam tikslui galima naudoti Traptautinės atominės energetikos asociacijos (IAEA, 2001) sukurtą BALANCE modelį. Modelis naudoja energijos tinklą energijos srautams sekti nuo pirminės energijos (žalios naftos, gamtinių dujų, anglies ir pan.) iki galutinės energijos paklausos (dyzelinis kuras, krosnių kuras) ir (arba) naudingos energijos paklausos (karštas vanduo, pramoninis garas). Paklausa jautriai reaguoja į tiekiamos energijos kainas, o pasiūlos kainos priklauso nuo reikalingo kiekio. BALANCE modelis tuo pačiu metu ieško paklausos ir pasiūlos kreivių susikirtimo ir susikirtimo taškų tarp visų energijos tiekimo formų ir visų energijos vartotojų, prijungtų prie energijos tiekimo tinklo. Pusiausvyra pasiekiama, kai modelis suranda kainų ir kiekių rinkinį, kuris patenkina visas susijusias lygtis ir nelygybes. Šis modelis laikomas dalinės pusiausvyros modeliu, kadangi jis apskaičiuoja anglies dioksido mokesčio įvedimo poveikį elektros ir šilumos gamybos sektoriams.

Taikant $CO_2$ moekstį kaip anglies dioksido kiekio mažinimo priemonę ir naudojant bazinį scenarijų, BALANCE modelyje buvo išanalizuota keletas modeliavimo atvejų, kur mokesčio dydžiai svyravo nuo 5 JAV dol./t iki 60 JAV dol./t (tarp jų ir 10, 20, 40 JAV dol./t). Modeliuojant daryta prielaida, kad mokestis bus taikomas elektros energijos ir šilumos sektoriuose. Modeliavimo rezultatai parodė, kad $CO_2$ emisijų kiekis taikant bazinį scenarijų ir 20 JAV dol./t mokestį, Kioto protokolo užbrėžta emisijų riba bus pasiekta jau 2015 metais. Jeigu būtų įvestas 60 JAV dol./t anglies dioksido mokestis, Kioto reikalavimai 2012 metams būtų lengvai pasiekti ir pasiektų nustatytą limitą tiriamojo laikotarpio pabaigoje (2020). Tačiau toks aukštas mokesčio tarifas Lietuvos sąlygomis nerealus.

Neseniai atliktų tyrimų rezultatai rodo, kad, įvedus 13,3 EUR/t $CO_2$ mokestį, anglies dioksido sumažėtų apie 6 proc., palyginti su nuliniu scenarijumi. Be to, valstybės biudžetas surinktų papildomų pajamų. Kita vertus, elektros ir šilumos kainos taptų vienomis aukščiausių. Kadangi nuo 2005 metų Lietuva turės prisijungti prie šiltnamio efektą sukeliančių dujų prekybos apyvartiniais taršos leidimais sistemos, būtina daugiau dėmesio skirti $CO_2$ mokesčio Lietuvoje įvedimo analizei. Šiltnamio efektą sukeliančių dujų mažinimo priemonių tarpsektorinei analizei būtinas ypatingas dėmesys, siekiant surasti efektyviausią sprendimą visam Lietuvos ūkiui.

Raktažodžiai: *anglies dioksido mokestis, prekyba apyvartiniais taršos leidimais, žalioji biudžeto reforma.*

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