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The use of carbon taxes and charges in climate policy

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Abstract: The main aim of this article is to discusses theoretical issues regarding the use of carbon taxes in climate policy. The issues include inter alia: the definition of carbon and CO_2 taxes, the objectives of these instruments and the tax design (the point at which the tax is levied, tax rates, tax exemptions). Attention is paid to the advantages and disadvantages of carbon taxes over another climate policy instrument which is the tradable emissions allowances system. Carbon or CO_2 taxes (charges) have been introduced in a number of European countries. The article presents experience gained by those countries in the field of carbon taxation and results of ex post studies evaluating environmental impact of carbon taxes.

Keywords: *climate change, carbon taxes, CO_2 taxes*

1. Introduction

One of the most serious global environmental problems is climate change (global warming). To achieve climate policy objectives (such as reduction of greenhouse gas emissions) governments can use a package of instruments. The set of instruments may include carbon taxes (carbon charges), which under certain conditions are effective and efficient policy tools. Carbon taxes (carbon charges) can be defined as taxes (charges) levied on the carbon content of fuels. These taxes set a uniform price for carbon across different types of carbon-based fuels (petrol, diesel oil, heating oils, natural gas, coal or liquefied petroleum gas) (Epps and Green, 2011: 84). Alternatively, taxes or charges can be imposed directly on carbon dioxide emissions. These taxes are sometimes called CO_2 taxes (CO_2 charges). Carbon dioxide taxes are emission (pollution) taxes levied on emissions that occur when generating energy from carbon-based fuels. It should

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be noted that a carbon tax can be converted into a CO_2 tax: the carbon tax rate should be multiplied by 12/44.[1] The terms carbon taxes and CO_2 taxes are often used interchangeably. Taxes on carbon can be primary or final taxes. Primary (upstream) carbon taxes are levied on fossil fuels (oil, coal, natural gas) where they are mined or extracted. Carbon taxes can also be imposed at later stages in the energy production and processing, i.e., on final fuel products sold to energy users or on emissions from combustion of fuels (so called final or downstream taxes) (Smith, 2002: 507; Vollebergh, 2008: 663). Primary carbon taxes involve lower administrative (collection and monitoring) costs due to the fact that there are fewer taxable producers (Epps and Green, 2011: 85).

In Eurostat statistics both carbon and CO_2 taxes are classified as energy taxes, i.e., taxes on energy products used for transport purposes or stationary use. This group includes also energy taxes *sensu stricto* levied according to the energy content of fuels (both fossil fuel and non-fossil energy sources, including renewable or nuclear energy) and "traditional" energy taxes (excise duties) levied on various energy carriers (Baranzini et al., 2000: 396-397). Of course, many of the latter taxes have purely a fiscal purpose and have not been introduced for environmental reasons.

The main aim of the article is to assess theoretical issues regarding the use of carbon taxes in climate change mitigation policy. Attention is paid to the choice of an appropriate tax rate, obstacles to greater use of carbon taxes, use of tax revenues and advantages and disadvantages of carbon taxes over emission trading schemes. The other aim of the paper is to review European countries' experience with carbon taxes and to discuss the concept of "implicit carbon taxes."

2. Objectives of carbon taxes and recommendations for carbon tax design

Carbon taxes correct a market failure by internalizing the external effects associated with energy products consumption (CO_2 and other greenhouse gas emissions) into prices (Creedy and Sleeman, 2006: 69; Speck, et al., 2006: 221). The optimal carbon tax rate should be equal to the marginal external cost at the socially optimal level of production and pollution. A more practical solution is to set the carbon tax rate equal to the marginal external cost at the current production level (which of course does not necessarily correspond to the optimal level) (Wallart, 1999: 53).

[1] 1 tonne of carbon corresponds to 44/12 tonnes of carbon dioxide.

Another option for finding an appropriate rate of carbon tax is trying to set the tax level in order to reach a desired abatement level (The Royal Society, 2002: 7). Authorities should observe the response (emission reduction) of agents.

The estimates of external costs of CO_2 emissions are difficult and controversial because some damages are unknown and have an impact on future generations (The Royal Society, 2002: 7). The long-term nature of the climate change problem is associated with the discounting question (Chupka, 2004: 301; Epps and Green, 2011: 88). Additionally, the carbon tax rate should be continuously changed (increased) over time to reflect the rising external cost due to rising CO_2 concentration in the atmosphere (Zhang and Baranzini, 2004: 509).

There has been an ongoing debate in the literature about the optimal (appropriate) carbon tax rate. In 100 different studies the estimates of the tax rates have ranged from 3 to 95 dollars per tonne of CO_2 (Epps and Green, 2011: 88). The estimates for tax rates required to achieve the Kyoto Protocol targets for European OECD countries ranged to 665 dollars (The Royal Society, 2002: 10).

There are two behavioral responses to carbon taxes. These taxes by increasing prices of fuels encourage adoption of energy saving technologies (e.g., insulation of buildings) and create an incentive to switch from carbon-intensive fuels to lower-carbon fuels (e.g., from coal to gas). Both responses may bring incidental environmental benefits, such as the improvement of local air quality (due to reduction of air pollutants such as NO_x, SO_2 or particulates) (Pearce, 1991: 939; Baranzini et al., 2000: 405). It should be noted that carbon taxes also provide incentives towards carbon sequestration.

It is important that uniform taxes on carbon reduce CO_2 emissions in a cost effective manner. With such taxes, marginal cost of CO_2 abatement cost across fuels is equalized, therefore the overall emission abatement cost is minimized. Taxes levied on other basis, particularly energy content of fuels are less effective approach of reducing carbon emissions (Stavins, 1997: 11). The reason is that energy taxes provide weaker incentive for fuel substitution (Zhang and Baranzini, 2004: 508).

The efficiency of carbon taxes can be undermined by tax exemptions or reduced tax rates granted to certain sectors, such as energy-intensive industries or industries exposed to international competition (Baranzini et al., 2000: 397). Implications for the competitive position of domestic firms is one of the main obstacle to greater use of carbon taxes in climate change policy. Such taxes could lead national firms to relocate production to other countries. However, it should be noted, that carbon tax can build comparative advantage in the future, if other countries later introduce such taxes.

The other important obstacle to the implementation of carbon taxes are distributional effects of taxes. The carbon taxes (or other energy taxes) can be regressive, since lower-income households spend a relatively larger share of their total income on energy than higher-income consumers. Empirical studies confirm that carbon taxes are (weakly) regressive. However, there are also studies which indicate progressive impact of carbon taxes (Baranzini et al., 2000: 404). Carbon taxes can be designed to minimize competitive and distributional effects. Policy options include not only tax exemptions or tax exceptions but also: tax refunds, tax-free energy allowances (energy is taxed only above a certain consumption level) and gradual implementation (phasing-in).

Much of the literature on environmental policy calls for the implementation of an international carbon tax. International coordination of CO_2 tax policies (for example the international carbon tax accompanied by exemptions for sectors covered by emission trading schemes) would avoid the risk of "carbon leakage" (meaning that when one country has a strict CO_2 reduction policy, the decrease in emissions can be offset by an increase in another country). Revenues from the harmonized (worldwide) carbon tax can be used to finance energy R&D. However, the largest part of R&D investments should be implemented as a result of higher carbon price (Galiana and Green, 2010: 309, 341).

Carbon taxes can raise significant revenues. Therefore, the economic analysis of the overall impact of carbon taxes should include the use of tax revenues. The carbon tax revenues can be used to:

- finance environmental investments (particularly projects that reduce GHG emissions) reinforcing the direct effects of the tax itself (Baranzini et al., 2000: 396),
- reduce government fiscal deficits,
- reduce other distortionary taxes (e.g., income taxes) – so called revenue recycling or environmental tax reform.

The appropriate use of carbon tax revenues improves acceptability of the new or increased taxes. Using tax revenues to finance environmental protection investments or to reduce 'traditional' taxes can reduce industry opposition (Wallart, 1999: 127-133). Carbon taxes often take form of specific[2] excise taxes (Pearce, 2000: 344). In order to maintain the tax revenues (and the appropriate price signal) the carbon tax rates should be adjusted annually to account for inflation.

3. Carbon (CO_2) taxes vs. cap and trade system

Carbon taxes are only one instrument in a package of policy measures aimed to tackle climate change (Baranzini et al., 2000: 397). Other possible measures include inter alia: command-and-control instruments (e.g., building energy efficiency standards, vehicle fuel-efficiency regulations, fuel quality standards), subsidies, tradable carbon rights, joint implementation, voluntary agreements between government and industry or renewable energy certificates.

The main economic (market-based) instruments for greenhouse policy are carbon taxes and emission trading schemes (The World Bank, 2010: 268). In theory, these instruments can be cost-efficient and environmentally effective measures for reducing emissions. Both instruments (assuming no uncertainty and transaction costs) allow to achieve the environmental standard at the same, minimal social cost.

In practice (under uncertainty), there are some differences between carbon taxes and cap-and-trade system. Table 1 presents simultaneously some advantages and disadvantages of the two market-based instruments.

[2] A specific tax on a given product is a tax of a fixed amount on each unit sold. The tax does not depend on the actual selling price (Pearce, 2000: 344).

Table 1. Carbon (CO_2) taxes vs. cap and trade scheme

CO_2 tax	Cap and trade system
Price (the tax rate) is known. The energy prices are predictable.	Price (of permits) is uncertain. Prices are set by markets. Price instability makes it difficult to plan abatement measures.
Taxes do not assure there will be the desired reductions of CO_2 emissions. In order to achieve the desired reductions the government has to estimate the price elasticities of demand for fuels (and inter-fuel elasticities). However, tax rates can be changed gradually (adjusted) according to the observed emission reduction.	Certainty about the quantity of emissions. The overall level of emissions is determined in advance.
It is possible to use existing administrative structures (tax collection mechanisms, enforcement).	Complex systems (for compliance reporting, monitoring) must be established.
Taxes can be implemented more quickly and easily.	The comprehensive systems are difficult to design. Issues that require consideration include inter alia: the number of tradable permits, allocation of permits (for free or by auction) or offsets for carbon sequestration projects. Cap and trade are less transparent and it may be easier to enact hidden exemptions for given sectors.
Taxes can provide substantial revenues. Recycling of revenues by lowering or eliminating distortionary taxes can increase the overall efficiency of the tax systems.	When emission permits are auctioned by the government, then these can also become a source of fiscal revenue.
Opposition to taxes by industry. Carbon tax approach (without any redistribution of tax revenues) is generally more costly to polluters than marketable permit approaches with grandfathered (distributed for free) emission permits. The reason taxes impose higher costs is that, in addition to abatement costs, polluters still have to pay the tax on their residual pollution.	Grandfathered tradable permits are preferred by industry.

Source: Baranzini et al., 2000: 399; The Royal Society, 2002: 5; Epps and Green, 2011: 88-89; Hicks and Nelder, 2008: 195; Moavenzadeh and Markow, 2007, 50; Pearce, 1991: 942; The World Bank, 2010: 268; Zhang and Baranzini: 2004: 516; Zimmer, 2008: 68.

Some authors prefer carbon taxes over cap and trade systems (because of the predictability of energy prices, transparency or immediacy of taxes). For example, Hicks and Nelder (2008: 195) state that “carbon taxes are the most sensible, direct, economic, and effective approach to reducing greenhouse gases, by steering the economy toward renewable and sustainable sources and away from fossil fuels.” One of the most important disadvantages of carbon taxes is the lack of control over CO_2 emission levels and industry opposition to taxes (Stavins, 1997: 22).

Carbon taxes and tradable emission permits can be used simultaneously. For example: the European Union Emission Trading Scheme (EU ETS) covers emissions from large sources. Carbon taxes (and other environmental policy instruments) can be levied on emissions from other non-trading sources (transport, households, services) (The World Bank, 2010: 268).

Theoretically, effective mix of taxes and tradable emission allowances requires that the tax rate should be equal to the permit price. This will provide appropriate incentives for different sectors to seek ways to reduce CO_2 emissions (European Environmental Agency, 2005: 36).

4. European countries experience with carbon taxes

The first carbon taxes were implemented in the early 1990s in the Scandinavian countries and Netherlands (Table 2). The objective of these taxes levied on petroleum products, natural gas and – in some cases – coal, were to reduce or at least stabilize energy consumption and CO_2 emissions. Carbon taxes in Finland, Netherlands, Norway and Sweden are general government revenues and are not rather earmarked for environmental purposes. However, in all four countries carbon taxes were part of a broader environmental tax reforms designed to the overall shift tax burden from labor to environmental degradation (see Hoerner and Bosquet, 2001: 11-26). The carbon and other environmental tax revenues have been used to reduce income taxes and social security contributions.

In later years product carbon taxes (levied on motor or heating oils) were introduced in other European countries, such as Slovenia, Switzerland and Ireland. In the latter country the tax rate (of 15 euro per tonne of CO_2) was intended to reflect the price of carbon allowance under the EU Emissions Trading System (Perthuis, 2011: 109).

Table 2. Carbon (CO_2) taxes and charges in European countries

Country	Year of introduction	Tax rate (euro per tonne of CO_2)	(year)	Product/emission tax
Finland	1990	20.0	(2010)	P/E
Netherlands	1990	.		.
Norway	1991	11.1-43.9[a)]	(2009)	P/E
Sweden	1991	103.1	(2010)	P/E
Denmark	1992	12.1	(2008)	P/E
Poland	1993	0.1	(2010)	E
Slovenia	1997	.		P/E
Estonia	2002	2.00	(2010)	E
Latvia	2006	0.2	(2008)	E
Switzerland	2008	7.2	(2008)	P/E
Ireland	2010	15.0	(2010)	P/E

a) The lowest tax rate applies to heavy fuel oil, the highest rate applies to petrol.

Source: own elaboration based on: Statens Energimyndighet, 2010: 28; Finnish Ministry of the Environment, [Online] Available at: http://www.environment.fi/default.asp?contentid=147208&lan=en [Accessed 15 March 2011]; Haugland, 1993: 7-27; Klavs and Kudrenickis, 2009: 14; Lindhjem, et al., 2009: 25, 66; Obwieszczenie Ministra Środowiska z dnia 18 sierpnia 2009 r. w sprawie wysokości stawek opłat za korzystanie ze środowiska na rok 2010 (M.P. 2009 nr 57 poz. 780); Perthuis 2011: 109; Speck, et al., 2006: 131; The OECD/EEA Database on Instruments used for Environmental Policy and Natural Resources Management, [Online] Available at: http://www2.oecd.org/ecoinst/queries/index.htm [Accessed 28 March 2011].

Three Central and Eastern European countries (Estonia, Latvia, Poland) impose charges on CO_2 emissions. The rates of these charges are relatively low. However, it should be remembered that emission charges in these countries cover many types of air pollutants. For example, emission charge in Poland is levied on 67 substances emitted to the atmosphere. In case of motor fuels (petrol, diesel oil, liquefied petroleum gas and compressed natural gas) the charge, for simplicity, depends on the amount of fuel burned. The emission charge in Poland mainly affects companies (not individuals). Revenues from the charge are earmarked for environmental purposes.

In previous years countries with high carbon taxes (particularly Scandinavian countries) used special tax provisions for industrial energy users in the form of reduced carbon tax rates or tax exemptions (Hoerner and Bosquet, 2001: 11-25). Such tax reductions have undermined environmental effectiveness and economic efficiency of carbon taxes. Currently, tax exemptions in carbon taxes are in some countries (e.g., Ireland, Sweden) granted for ETS sectors. The companies covered by the EU ETS are levied only by “traditional” excise duties (European Commission, 2011: 15, 51).

There are some ex-post evaluations of carbon (or carbon-energy) taxes used in some European countries. These studies show that carbon and energy taxes have rather been environmentally effective (Table 3). However, ex post studies of environmental effectiveness of carbon taxes should be viewed with caution. This is because CO_2 emission were often reduced because of many factors (other policy instruments, industrial restructuring) (Speck et al., 2006: 219). Additionally, evaluations have to compare the actual environmental effects with the hypothetical situation without a tax on carbon (The Royal Society, 2002: 8).

Table 3. Results of ex-post evaluations of carbon and energy taxes in European countries

Author	Results
The Danish Ministry of Finance	Energy taxation (including CO_2 tax) provided 4.7% reduction in CO_2 emissions in years 1988-2000.
The Danish Environmental Protection Agency	Reduction of 13.5 million tonnes of emissions (CO_2 equivalents) in 2001, compared with a business-as-usual scenario. The reduction was caused by (inter alia) changes in energy taxation introduced during the period 1990-2001 (including carbon tax).
Finland's Economic Council	7 percent reduction of CO_2 emissions in Finland in 1998, compared with the situation, if taxes on energy remained at the level of 1990.
The Dutch Ministry of Housing, Spatial Planning and Environment	The CO_2/energy tax contributed to 1.5% reduction of CO_2 in Netherlands.
The Swedish Institute for Transport and Communications Analysis	Increases of taxes on motor fuels implemented during the period 1990-2005 have reduced CO_2 emissions from road transport by 1.5 to 3.2 million tonnes of carbon dioxide per year.

Source: Speck et al., 2006: 217-218; Baranzini et al., 2000: 407; Swedish Ministry of the Environment, 2007: 1.

In some countries endeavors to implement a carbon tax have failed. For example, France attempted to introduce a carbon tax (for households and non-ETS sectors) at a rate of 17 euro per tonne of carbon dioxide. In 2009 the French Constitutional Court rejected the tax plan as inconsistent with the principle of equality. The Court argued that the tax would cover only a part of industrial CO_2 emissions. The EU-ETS sectors should not be exempted from the tax, as emission allowances are distributed for free (OECD, 2011: 132).

In the coming years, the energy taxation systems in the EU member states are likely to change. In April 2011, The European Commission presented the proposal to restructure the energy taxation rules by revising the existing Directive 2003/96/EC which obliges member states to respect minimum levels of taxation for energy products and electricity. According to the proposal, the minimum tax rates for energy products would be divided into two parts: a CO_2-

related part and an energy part. The former part of taxation would be based on carbon dioxide emissions of the energy products. The tax rate would be 20 euro per tonne of CO_2. Emitters covered by the EU-ETS will be exempted from the tax. The energy part would be based on energy content of the fuel. For motor fuels the minimum tax rate would be 9.6 euro per GJ, and for heating fuels would be fixed at 0.15 euro per GJ.[3]

One intention of the reform of energy taxation system is to contribute to fulfill objectives of energy and climate change policy of the European Union. Current minimum rates specified in the Directive 2003/96/EC are in some cases contrary to this policy, as they lead to inefficient use of energy or promote coal. The new energy taxation system would levy a CO_2 tax on sectors which are not included in the EU ETS (households, transport, small industry, agriculture).[4]

5. Implicit carbon taxes

All European countries use some forms of energy taxes affecting the prices of energy. It can therefore be assumed that carbon dioxide emissions are taxed (at least directly) in all member states (Baranzini et al., 2000: 396-397). The sum of various taxes levied on energy sources per unit of carbon dioxide may be treated as "implicit carbon taxes" (OECD, 2001: 116; Lachapelle, 2011: 2). The rate of implicit carbon tax on particular fuel (also called the implied carbon price) may be calculated as the tax rates per unit of fuel multiplied by the units of fuel that need to be burnt to reach a CO_2 emission of one tonne (table 4)[5] (OECD, 2011: 134). The tax rates in Table 4 are based on taxes meeting the requirements of Directive 2003/96/EC.[6]

[3] Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee, COM(2011) 168/3.
[4] Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee, COM(2011) 168/3.
[5] In fact, energy taxes can be used to internalize some other externalities than climate effects (for example local air pollution or noise). Therefore, part of the taxes should be ascribed to those effects (OECD, 2011: 134-135).
[6] According to the Directive 2003/96/EC Directive the minimum level of taxation laid down at Community level is the total charge levied in respect of all indirect taxes (except VAT) calculated directly or indirectly on the quantity of energy products and electricity at the time of release for consumption.

Table 4. Implicit carbon taxes (in euro per tonne of CO_2) in the European Union countries (2011)[a)]

Country	Petrol	Diesel oil	Light heating oil	Heavy fuel oil	Coal
Austria	212-227	153-163	38-49	19	19
Belgium	270-277	151-157	7	5	4
Bulgaria	160	121	10	8	3
Cyprus	158	127	48	5	3
Czech Republic	232	172	172	6	4
Denmark	254	151	129	122	109
Estonia	186	151	43	5	3
Finland	276	140-140	62	60	56
France	260-267	165	22	6	4
Germany	288-295	181-187	17-23	8	3
Great Britain	299	261	50	40	0
Greece	295	158	158	6	3
Hungary	193	137	137	5-134	4
Ireland	254	179	34	19	2
Italy	248	163	155	10-20	2
Latvia	167	127	8-22	5	3
Lithuania	191	116	8	5	2
Luxembourg	204-205	123-124	0	5	0
Malta	207	147	147[b)] 55[c)]	10	3
Netherlands	316	163-167	98	11	6
Poland	186-215	126	23	5	0
Portugal	257	140	82	5	2
Romania	158	116	116	5	2
Slovakia	227-243	142-149	142-149	8	35
Slovenia	211	162	40	17	15-18
Spain	187-201	127	33	5	2
Sweden	182-239	189-206	48[b)] 159[c)]	41-138[b)] 0[c)]	41[b)] 137[c)]
Min	**158**	**116**	**0**	**0**	**0**
Max	**316**	**261**	**172**	**138**	**137**
Minimum tax rate in Directive 2003/96/EC	**158**	**127**	**8**	**5**	**2.0[b)]** **3.0[c)]**

a) Rates of taxes meeting the requirements of Directive 2003/96/EC in particular member states and the minimum tax rates in Directive are originally based on the volume or energy content of energy products. The rates of energy taxes in member states may depend on sulphur content, octane number, CN code, biofuel content, environmental class of the fuel or region of a given country. Calculations of implict carbon taxes are based on emissions factors used by the European Commission. Implict carbon taxes are given to the nearest whole number. b) Business use. c) Non-business use.

Source: own elaboration based on: Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275 of 25 October 2003); European Commission, 2011: 1-53; OECD, 2011: 134; Paper Impact Assessment. Accompanying document to the Proposal for a Council Directive amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity (Commission Staff Working), SEC(2011)409.

The data in Table 4 show that the most popular motor fuels (petrol and diesel oil) are generally taxed at higher rates than fuel oils. Implicit carbon taxes for coal (the most carbon-intensive fossil fuel) are very low (OECD, 2001: 116). It should be noted, that the use of coal and some other fuels is to some extent covered by the European Union Emission Trading Scheme.

Implicit carbon taxes may be perceived as less efficient and effective instruments for reducing CO_2 emissions than specific carbon taxes (The Royal Society, 2002: 8). However, in case of motor fuels carbon taxes have similar effects to traditional excise duties, as non-carbon fuels are not popular. The main difference is that carbon taxes can be applied to all sectors whereas excise duties are differentiated across sectors of the economy (Transport Research Centre, 2008: 22).

6. Concluding remarks

Carbon taxes can promote climate policy objectives by switching to lower carbon emitting alternatives and encouraging energy efficiency. The environmental effectiveness of carbon taxes depends on the level of tax rates and other issues such as point at which the taxes are levied or tax exemptions. Some of these issues (especially tax exemptions and tax reductions) may also affect the economic efficiency of carbon taxes.

Carbon or CO_2 taxes (charges) have been introduced in a number of European countries. The rates of these taxes vary widely (from 0.1 to more than 100 euro per tonne of carbon dioxide). Implicit carbon taxes in the European Union countries are also differentiated. These differences could be reduced by the EU carbon tax putting a price on CO_2 emissions which are not covered by the EU Emission Trading System. Harmonization of tax rates throughout Europe would contribute to the achievement of environmental objectives.

Literature

Baranzini, A.; Goldemberg, J.; Speck S. (2000). A Future for Carbon Taxes. *Ecological Economics* 32: 395-412.

Chupka, M. (2004). *Carbon Taxes and Climate Change*. In: Cleveland, C.; Ayres, R. (eds.). *Encyclopedia of Energy*: 299-306. Elsevier Academic Press.

Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee, COM(2011) 168/3.

Creedy, J.; Sleeman, C. (2006). *The Distributional Effects of Indirect Taxes: Models and Applications from New Zealand*. Cheltenham: Edward Elgar Publishing.

Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275 of 25 October 2003).

Epps, T.; Green, A. (2011). *Reconciling Trade and Climate: How the Who Can Help Address Climate Change*. Cheltenham: Edward Elgar Publishing.

European Commission (2011). *Excise Duty Tables. Part II – Energy Products and Electricity* (January 2011). Brussels: European Commission. Available at: http://ec.europa.eu/taxation_customs/resources/documents/taxation/excise_duties/energy_products/rates/excise_duties-part_ii_energy_products_en.pdf [Accessed 30 March 2011].

European Environmental Agency (2005). *Market-Based Instruments for Environmental Policy in Europe*. Copenhagen: European Environmental Agency. Available at: http://www.eea.europa.eu/publications/technical_report_2005_8. Accessed 30 January 2011.

Finnish Ministry of the Environment. Available at: http://www.environment.fi/default.asp?contentid=147208&lan=en. Accessed 15 March 2011.

Galiana, I.; Green, C. (2010). *Technology-Led Climate Policy*. In: Lomborg, B. (ed.). *Smart Solutions to Climate Change*: 292-359. Comparing Costs and Benefits: Cambridge University Press: Cambridge.

Haugland, T. (1993). *A Comparison of Carbon Taxes in Selected OECD Countries*. Paris: OECD.

Hicks, B.; Nelder, C. (2008). *Profit from the Peak: the end of Oil and the Greatest Investment Event of the Century*. New Jersey: John Wiley and Sons.

Hoerner, A.; Bosquet, B. (2001). *Environmental Tax Reform: The European Experience*. Washington: Center For A Sustainable Economy.

Klavs, G.; Kudrenickis, I. (2009). *Energy Efficiency Policies and Measures in Latvia*. Riga: Institute of Physical Energetics.

Lachapelle, E. (2011). *The Hidden Factor in Climate Policy: Implicit Carbon Taxes*. Ottawa: Sustainable Prosperity.

Lindhjem, H. et al. (2009). *The Use of Economic Instruments in Nordic Environmental Policy 2006-2009*. Copenhagen: Nordic Council of Ministers.

Moavenzadeh, F.; Markow, M. (2007). *Moving Millions: Transport Strategies for Sustainable Development in Megacities*. Dordrecht: Springer.

Obwieszczenie Ministra Środowiska z dnia 18 sierpnia 2009 r. w sprawie wysokości stawek opłat za korzystanie ze środowiska na rok 2010 (M.P. 2009 nr 57 poz. 780).

OECD (2001). *Environmentally Related Taxes: Issues and Strategies*. Paris: OECD. Available at: http://www.peblds.org/files/Publications/OECD/OECD_Environmentally_Related_Taxes.pdf. Accessed 10 February 2011.

OECD (2011). *OECD Economic Surveys: France 2011*. Paris: OECD. Available at: http://books.google.pl/books?id=wlSKzcitAaMC&printsec=frontcover&dq=OECD+Economic+Surveys:+France+2011&hl=pl&ei=Z78aTt6xH8-p8QPW0NwW&sa=X&oi=book_result&ct=result&resnum=1&ved=0CCgQ6AEwAA#v=onepage&q&f=false. Accessed 20 March 2011.

Paper Impact Assessment. Accompanying document to the Proposal for a Council Directive amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity (Commission Staff Working), SEC(2011)409.

Pearce, D. (1991). The Role of Carbon Taxes in Adjusting to Global Warming. *Economic Journal* 101: 938-948.

Pearce, D. (2000). *Economics and Environment: Essays on Ecological Economics and Sustainable Development*. Cheltenham: Edward Elgar Publishing.

Perthuis, C. de (2011). *Economic Choices in a Warming World*. New York: Cambridge University Press.

Smith, S. (2002). *Tax Instruments for Curbing CO_2 Emissions*. In: Bergh, J. van den (ed.). *Handbook of Environmental and Resource Economics*: 505-521. Cheltenham: Edward Elgar Publishing.

Speck, S. et al. (2006). *The Use of Economic Instruments in Nordic and Baltic Environmental Policy 2001-2005*. Copenhagen: Nordic Council of Ministers.

Statens Energimyndighet (2010). *Energy in Sweden 2010. Eskilstuna: Statens Energimyndighet*. Available at: http://webbshop.cm.se/System/ViewResource.aspx?p=Energimyndigheten&rl=default:/Resources/Permanent/Static/b4cea7b00212456b9bdbdbe47a009474/ET2010_47w.pdf. Accessed 20 January 2011.

Stavins, R. (1997). *Policy Instruments for Climate Change: How Can National Governments Address a Global Problem?* Washington: Resources for the Future.

Swedish Ministry of the Environment (2007). *The Budget Bill for 2008. Stockholm: Swedish Ministry of the Environment*. Available at: http://www.regeringen.se/content/1/c6/09/02/67/927d2026.pdf. Accessed 10 February 2011.

The OECD/EEA Database on Instruments used for Environmental Policy and Natural Resources Management. Available at: http://www2.oecd.org/ecoinst/queries/index.htm. Accessed 28 March 2011.

The Royal Society (2002). *Economic Instruments for the Reduction of Carbon Dioxide Emissions*. London: The Royal Society. Available at: royalsociety.org/WorkArea/DownloadAsset.aspx?id=5775. Accessed 15 March 2011.

The World Bank (2010). *World Development Report 2010: Development and Climate Change*. The World Bank. Available at: http://books.google.pl/books?id=MGOJs900Q-MC&printsec=frontcover&dq=World+Development+Report+2010:+Development+and+Climate+Change&cd=1#v=onepage&q&f=false. Accessed 10 February 2011.

Transport Research Centre (2008). *Oil Dependence: Is Transport Running out of Affordable Fuel?* Paris: Transport Research Centre. Available at: http://www.internationaltransportforum.org/jtrc/DiscussionPapers/DP200805.pdf. Accessed 20 March 2011.

Vollebergh, H. (2008). Lessons from the Polder: Energy Tax Design in The Netherlands from a Climate Change Perspective. *Ecological Economics* 3: 660-672.

Wallart, N. (1999). *The Political Economy of Environmental Taxes*. Cheltenham: Edward Elgar Publishing Limited.

Zhang, Z.; Baranzini, A. (2004). What Do We Know about Carbon Taxes? An Inquiry into Their Impacts on Competitiveness And Distribution of Income. *Energy Policy* 32: 507-518.

Zimmer, M. (2008). Carbon Tax: Ready for Prime Time? *Sustainable Development Law and Policy* 8: 67-71.

Wybrane problem związane z podatkami i opłatami węglowymi

Streszczenie

W artykule omówione zostały podstawowe zagadnienia związane z wykorzystaniem podatków węglowych w polityce ochrony klimatu. Zagadnienia te obejmują definicję podatków węglowych i podatków od CO_2, cele tych podatków i ich konstrukcję (moment powstania obowiązku podatkowego, stawki i zwolnienia podatkowe). W opracowaniu szczególną uwagę zwrócono na zalety i wady podatków węglowych w porównaniu z innym instrumentem polityki ochrony klimatu, jakim jest system zbywalnych uprawnień emisyjnych.

Podatki (opłaty) węglowe zostały wprowadzone w niektórych krajach europejskich. Artykuł zawiera krótką analizę doświadczeń tych krajów związanych z opodatkowaniem emisji dwutlenku węgla, a także przegląd wyników badań dotyczących skutków ekologicznych podatków węglowych.

Słowa kluczowe: zmiany klimatu, podatki węglowe, podatki od emisji CO_2