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Application of CO_2 Taxes for Combustion Installations in Latvia until 2020

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***Abstract* – In 2009 the European Parliament adopted a climate and energy package, which set ambitious targets for climate and energy policy until 2020, including certain requirements in relation to the total quantity of emissions allowances in Emission trading system from 2013.**

Emission trading is one of the main mechanisms to reduce greenhouse gas emissions. The emission trading system has been operating in the European Union (EU) since 2005. The third phase will start in 2013 when stricter allocation rules will be applied. The system will also allow exclusion of small installations that annually emit less than 25 thousand tCO_2 and their installed capacity are 35 MW and less. However, other equal mechanisms should be applied to the excluded installations instead.

A study was carried out to evaluate other mechanisms for small installations. The study included a calculation of different CO_2 tax rates and a comparison of different CO_2 tax rates with the Emission trading system for 2013-2020.

The study has estimated that the rate of CO_2 tax in Latvia should range from € 3 to € 30 per tCO_2.

***Keywords* – CO_2 tax, CO_2 emissions, emission allowances, EU Emission trading system**

I. INTRODUCTION

Currently in Europe there are several political and fiscal instruments introduced to reduce CO_2 emissions. One of the most important measures for reducing CO_2 emissions is environmental taxation. The CO_2 tax is considered to be a cost-effective and economical price mechanism, that promotes the use of efficient and environmentally friendly technologies, in that way reducing damage to the environment, and increasing government revenue. However, the CO_2 tax cannot be the only and main mechanism to limit CO_2 emissions. It should be implemented together with other economic incentives to reduce CO_2 emissions. It is estimated, that the International Emission trading scheme is one of the most flexible Kyoto Protocol mechanisms that allows reducing greenhouse gases (GHG) in an economic and cost-effective way [1].

The global economic turmoil and its repercussions for the carbon market, a lack of an international agreement on climate change defining the Post-Kyoto commitments, and unfavourable policy shifts in some countries, cast serious doubts on the expansion of emissions trading as the main political mechanism for reducing CO_2 emissions and indicate that carbon trading enters an uncertain period [2].

At the same time, there are notable intentions within the current schemes to expand geographically and temporary and include more sectors and GHG emissions. Furthermore, new schemes are being planned around the world and there are indications that some of them would be linked or merged with the current emission trading mechanisms. This raises the possibility for a global carbon market to emerge [2]. An expansion of current emissions trading schemes and their possible interlinkage depends not only on technical solutions and harmonization of different trading systems, but also on clear policy signals, continual political support and a more stable economic environment [2].

One of the trading systems operating since 2005 is the European Union Emission trading scheme (ETS). The revised ETS was adopted in December 2008 and the revised system responded to the problems experienced in the ETS I period by introducing one EU-wide cap on the number of emission allowances that will decrease annually in the ETS III period (2013–2020) and beyond [3]. In addition, the allocation of allowances will be based on harmonized rules and auctioning will be the main allocation method.

The new rules for phase 3 also foresee an exception. This exception is for small installations that annually emit less than 25 thous. t CO_2 and their installed capacity are 35 MW and less. The European Commission has calculated that 38% of the total number of installations are the small installations that generate annually only around 3% of total CO_2 emissions [5]. In the event that small installations are excluded from the EU ETS, Member States will need to implement other measures that will achieve an equivalent reduction of CO_2 emissions. The new rules also determine requirements for the total quantities of emission allowances from 2013-2020 and auctioning of allowances, as well as terms of allocation of free allowances and harmonized rules for emission reduction projects in the member states [4].

In 2010, the EC has presented that the minimum tax rates for pollution on the European scale should be set up and imposed in accordance with the EU ETS [6]. One of the main activities is to set a minimal rate for the CO_2 tax. According to the EC, if the plan is implemented, companies will have to pay the minimum CO_2 tax rate for t CO_2 emissions. EC predicts that the rates of CO_2 tax could be in the range between €4 and €30 per t CO_2 [6].

The rate of CO_2 tax in Latvia is 0.92 €/t. It is projected that the CO_2 tax rate will rise every six months until 2013-2015, when the rate will be 2.82 €/t.

The rate of the CO_2 tax in Latvia currently and up to 2015 is not a sufficiently fair measure to encourage companies to invest in measures for reducing CO_2 emissions.

The current price of EU ETS allowances is 12.43 € /t [7]. Comparing this price with the CO_2 tax applied in most EU countries, the price of the ETS allowance is many times less

than the CO_2 tax rate. However, to reach targets for GHG emission reduction, the price of ETS allowances should be no less than 30 - 40 € / t in 2020 [8].

II. Development of a Tool for CO_2 Tax Comparison with ETS

An algorithm was created (see Fig. 1) to compare the impact of different CO_2 tax rates with the different alternatives for price development of the ETS allowances for ETS installations.

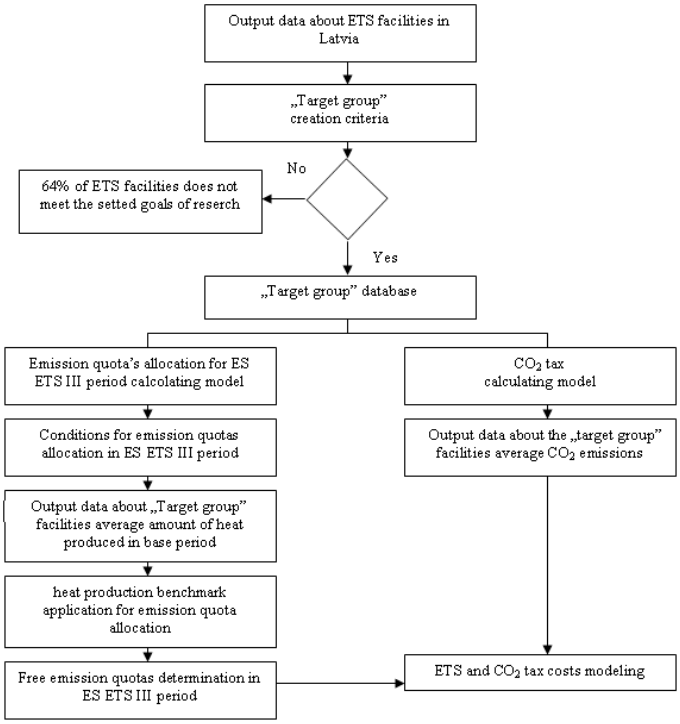

Fig. 1. CO_2 tax and ES ETS emission allowances modelling algorithm.

According to the ETS directive, installations corresponding to the following requirements can be excluded from the ETS [4]:

1. emissions are less than 25 000 t CO_2/year;
2. installed fuel capacity is less than 35 MW.

The Directive foresees that combustion installations that correspond to these requirements must have equal measures to Emission trading system that will achieve equivalent reduction of CO_2 emissions [4].

According to the Latvian National Allocation Plan 2008-2012 (NAP), 26 out of 76 installations meet the conditions. These installations emitted almost 165 thous. t CO_2 in 2009. This corresponds to 5% of the total emitted CO_2 emissions by ETS installations in Latvia.

The output data of the ETS installations in Latvia were obtained from the Latvian National Allocation Plan 2008-2012 [9]:

1) installed nominal capacity in the period from 2005 till 2009, MW;
2) heat energy production 2005-2009, MWh;
3) CO_2 emissions 2005-2009, t CO_2.
4) fuel consumption 2005-2009, tons or thousand m^3.

A. Calculation of allowances for ETS installations 2013-2020

Emission allowances for the third period for combustion installations were calculated taking into account the following assumptions [4, 10, 11, 12, 13, 14, 15]:

1. The base year is determined based on the average heat production amounts in combustion installation in:

a) 2005-2008, if the combustion installation was operating in the EU ETS Phase I;

b) 2009, if the combustion installation was operating from the EU ETS Phase II.

2. Allowances in the third period will be allocated based on one general heat production benchmark 0.2241/MWh for all installations. The total amount of the allowances for an installation is calculated by equation (1):

$$EA = Q \cdot 0{,}2241 \quad (1)$$

where EA – emission allowances, Q – annual heat energy production (readings from heat meters), MWh.

3. Since 2013 free allowances will be fixed at 80% of the total amount of calculated allowances by equation 1. In calculation of allowances for 2014-2020, the following factors must be applied:

2013	2014	2015	2016	2017	2018	2019	2020
0.8	0.7286	0.6571	0.5857	0.5143	0.4429	0.3714	0.3

4. The price of the ETS allowances in 2013 is 30 €/t CO_2, increasing about 2 €/t CO_2 until 2020.

B. Calculation of CO_2 tax rate

The calculation of the CO_2 tax rate was done based on the following assumptions:

1. The same base year was selected as calculating emission allowances of the installation.
2. Data on CO_2 emissions were taken from the monitored GHG reports of the installations.
3. The CO_2 tax rate can be in the range between 3 and 30 €/t.

To analyse the impact of the CO2 tax and to compare it with ETS costs for installations, three scenarios were developed:

First scenario: the CO_2 tax rate in 2013 is 3 €/tCO_2 and rises until 24 €/tCO_2 in 2020.

Second scenario: the CO_2 tax rate in 2013 is 6 €/tCO_2 and rises until 27 €/tCO_2 in 2020.

Third scenario: the CO_2 tax rate in 2013 is 9 €/tCO_2 and rises until 30 €/tCO_2 in 2020.

C. ETS and CO_2 tax expenditure modelling. Assumptions

An important aspect to model ETS and CO_2 tax expenses is the prediction of possible costs.

To predict the possible costs of ETS emissions allowances in the future for combustion installation, the price of the emission allowances was assumed to be in the range of 30-44 €/t for the period 2013 - 2020 [8]. It was presumed that the annual growth of the price will be 2 € a year. The increase of the price is based on the assumption that the annually allocated free allowances are diminishing and there will be a demand for allowances on the market. In 2020 there will be

only 30% of free allowances for combustion installations. European Commission foresees that in 2027 there will be no free allowances allocated to the combustion installations. Consequently, it is predicted that the price of emission allowances in the international market will grow quite significantly.

To predict the possible costs of CO_2 tax, the rate of CO_2 tax was presumed in the range between 3 to 30 € in 2013-2020. The annual growth of allowances price is projected 3 €/t per year. The increase of the tax rate is based on the assumption that the CO_2 tax should promote the implementation of the energy efficiency measures in the companies. It has been calculated that the rate of CO_2 tax should be at least 3.6-4.3 €/t of CO_2 [15].

Since 2013 the CO_2 tax rate will be 2.82€/t CO_2. It is clear that the existing CO_2 tax rate is not an equal measure to the ETS and with these conditions the small Latvian combustion installations cannot be excluded from the ETS.

Three scenarios were developed during the study. The main objective of these scenarios was to identify the most appropriate CO_2 tax rate for Latvia that would correspond to the requirements of exclusion of small installations from the ETS. In the meantime, it should be mentioned that the existing CO_2 tax rate does not facilitate implementation of energy efficiency measures in combustion and industrial installations. In the modelling of CO_2 tax a gradual increase of the rate of CO_2 tax is included. This way the companies will have an opportunity to take action to reduce the use of fossil fuels and increase the use of renewable energy resources [8].

III. ANALYSIS OF SCENARIOS

There were constant and variable values used in the calculation tool of the CO_2 tax rate and ETS costs for 26 combustion installations.

The fixed values were the price of ETS allowances that was assumed to be at the rate of 30 €/t CO_2 in 2013, with an increase of 2 €/t per year. Consequently, the ETS allowances price in 2020 is projected at 44 €/t. The variable value was the CO_2 tax rate (3-30 €/t for 2013-2020).

The aim of the tool is to determine the optimal rate value of the CO_2 tax that in the case of different size combustion power plants and used fuel should be estimated.

The 26 combustion installations can be divided into 10 sub-groups. The groups were split based on the use of different fuels and the amounts of the CO_2 emissions:

1) natural gas combustion installations, with CO_2 emissions more than 10 000 t CO_2 per year (6 installations);
2) natural gas combustion installations, with CO_2 emissions in the range of 5000-10000 t CO_2 per year (6);
3) natural gas combustion installations, with CO_2 emissions are less then 5000 t CO_2 per year (3);
4) combined natural gas and HFO combustion installation (1);
5) HFO combustion installations (3);
6) combined natural gas and biomass combustion installation (3);
7) combined natural gas and peat combustion installation (1);
8) combined natural gas and biogas combustion installation (1);
9) combined HFO and biomass combustion installation (1);
10) combined natural gas, HFO and biomass combustion installation (1).

A. First scenario

The first scenario was developed based on the assumption that the CO_2 tax rate will be in the range from 3 € t in 2013 and will increase linearly 3 €/t a year. The rate of CO_2 tax is 24 €/t in 2020.

Considering that 58% of the target group combustion installations are natural gas facilities, that in the analysis of the results and for determination optimal rate of the CO_2 tax, mainly there were taken into account the modelling results of these natural gas combustion installations.

The results of the first scenario simulation for the 15 natural gas combustion installations are shown in Fig. 2.

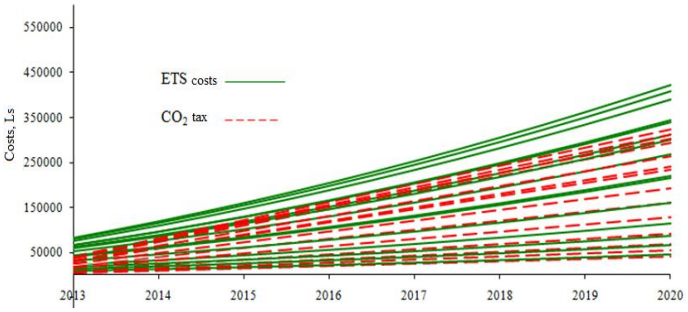

Fig. 2. The results of the first scenario simulation for natural gas combustion installations.

As it can be seen in Fig. 2, the costs of the ETS (Fig. 2 continuous line) and CO_2 tax (Fig. 2 dashed line) gradually increase for natural gas installations. The costs for ETS are the expenses that installation will have to pay for the allowances. The costs of CO_2 tax are the expenses that the installation would have to pay for emitting CO_2 emissions, if it did not participate in the ETS. The maximum ETS costs for the company emitting the most CO_2 emissions in 2013 will be around 82 170 € and reach 421 806 € in 2020. The costs for the company, if they pay CO_2 tax, would be 40 905 € in 2013 and 327 240 € in 2020.

Assuming that equal measures to ETS are determined by comparing the costs of ETS and CO_2 tax, results show that the CO_2 tax rate of this scenario have not reached the equal effect. In almost all cases of natural gas combustion installations with different CO_2 emission levels, the costs of the ETS are higher than the costs of the CO_2 tax. This is associated to the relatively high price of ETS allowances.

B. Second scenario

The second scenario was developed based on the assumption that the rate of CO_2 tax is in the range from 6 €/ t in 2013 and increases linearly 3 €/t a year. The CO_2 tax rate in 2020 is 27 €/t.

The results of the second scenario simulation for 15 natural gas combustion installations are shown in Fig. 3.

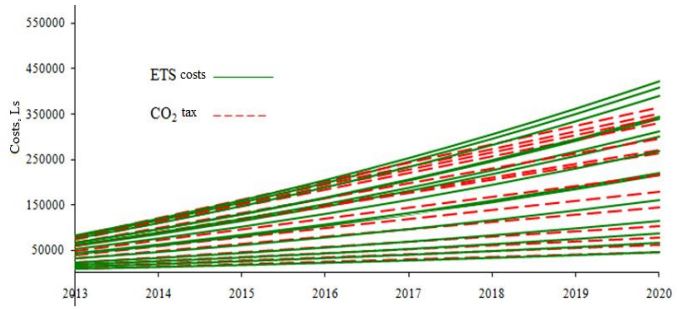

Fig. 3. The results of the second scenario simulation for natural gas combustion installations.

As it can be seen in Fig. 3, practically in all cases the ETS costs are equal to the CO_2 tax costs. In this case, the maximum ETS costs will be 82 170 € in 2013 and 421 806 € in 2020. In the meantime, the costs for CO_2 tax for this company would be 81 810 € in 2013 and 368 145 € in 2020.

C. Third scenario

The third scenario was developed based on the assumption of a CO_2 tax rate from 9 €/t in 2013 increasing by a linear value of 3 €/t per year. The rate of CO_2 tax in 2020 is assumed to be 30 €/t.

The results of the third scenario simulation for the 15 natural gas combustion installations are shown in Fig. 4.

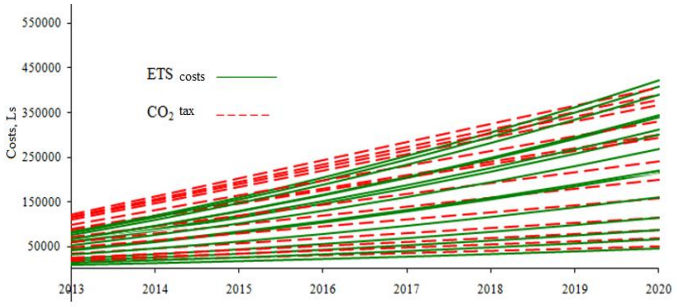

Fig. 4. The results of the third scenario simulation for natural gas combustion installations.

From Fig. 4 it follows that the CO_2 tax costs are higher than costs about the ETS allowances for the natural gas combustion installations. This is because, in this scenario, higher CO_2 tax rate was assumed.

IV. Conclusions and Recommendations

In order to achieve the emission reduction targets, it is necessary to develop higher emission targets in the future.

The reduction of GHG emissions must be achieved through economic incentives for innovative technologies that can be developed with an application of the CO_2 tax. Other EU Member States are introducing CO_2 taxes more as a political mechanism to solve question of reduction of GHG emissions. Therefore, a methodology is developed to compare the CO_2 tax and the EU ETS and the methodology for the approval algorithm is established to compare the model of CO_2 tax and the EU ETS allowances.

Based on the developed methodology, a group of combustion installations was established that could be excluded from the European Emission trading scheme. To make a CO_2 tax calculation and compare it with the EU ETS allowances, three scenarios were carried out with different CO_2 tax rates in 2013-2020. In the first scenario, the CO_2 tax rate was between 3 and 24 €/t, in the 2nd scenario – 6-27 €/t, but in the 3rd scenario – 9-30 €/t. In all scenarios, it was predicted that the rate of the CO_2 tax will increase about 3 €/t per year. In the meantime, it was assumed that the price of the ETS allowance would be 30€/t in 2013, with the increase of about 2 €/t per year until 44€/t in 2020.

The cost comparison for the CO_2 tax and ETS, in the case of the 1st scenario, shows, that 27% of the facilities costs of the CO_2 tax is higher than the costs of ETS allowances. In the case of the 2nd and 3rd scenario, the CO_2 tax costs are higher, than the costs of ETS allowances - 46% and 92% respectively.

When comparing the three scenarios for natural gas combustion installations, the more equal (optimal) measure for the exclusion from the EU ETS and CO_2 emissions reduction is provided by the 2nd scenario, where the rate of the CO_2 tax was adopted from 6 €/t – 27 €/t.

Generally, analysis of the three scenarios shows that, in the case of the combined combustion installations, where renewable energy sources are mainly used and a small share of fossil energy resources, even in the event of high rates of the CO_2 tax, it would be not possible to provide an equal measure of these installations to be excluded from the ETS.

As the emission allowances allocation is carried out in accordance with the application of heat benchmarks for the average amount of heat produced during the base period, in order to increase the company's opportunity to earn from the sale of quotas in the ETS market, companies are profitable to increase the using of renewable energy for producing thermal energy. In this case, the goal would be achieved to reduce CO_2 emissions at combustion installations.

With predictable rates of the CO_2 tax in Latvia and Latvia's national policy, it is necessary to create a stable market for local renewable energy resources producers and give support for cogeneration station construction, which are running on renewable energy. Therefore, in order to maximize the use of renewable energy, the optimal case would be the rates of CO_2 tax, accepted in the third scenario.

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Ilze Laicāne, Marika Rošā, Ilze Dzene. Sadedzināšanas iekārtu CO_2 nodokļa modelēšanas līdz 2020. gadam.

ES 2009.gadā pieņēma klimata un enerģētikas tiesību aktu kopumu, kuros tika noteikts, ka elektrostacijām, katlumājām un energoietilpīgām rūpniecības nozarēm, kuras piedalās ETS, emisiju daudzums līdz 2020. gadam jāsamazina par 21% no 2005. gada līmeņa. Tika izvirzīti nosacījumus arī attiecībā uz „mazo iekārtu" izslēgšanu no Kopienas ETS, to pamatojot, ka šādi mazie uzņēmumi veido 38% īpatsvaru no kopējiem ES ETS II posma uzņēmumiem, bet šo uzņēmumu CO_2 emisijas ir tikai 3% no kopējām ES ETS emisijām.

Pētījuma ietvaros veikta CO_2 nodokļa un ES ETS kvotu modelēšana Latvijas mērķgrupas iekārtām laika posmam no 2013. – 2020.gadam. Ir izveidots minētās metodikas aprobācijas algoritms CO_2 nodokļa un ES ETS modeļu salīdzināšanai Latvijas apstākļiem. Lai veiktu CO_2 nodokļa modelēšanu un salīdzināšanu ar ES ETS, tika ES ETS II posma datu analīze Latvijas Nacionālā emisiju kvotu plāna iekārtām un izveidota mērķgrupa ar to iekārtu sarakstu, kam būs iespēja izstāties no ES ETS. Analīzes rezultātā tikai noteikts, ka no 76 Latvijas ETS iekārtām, 26 iekārtas atbilst minētajiem EK nosacījumiem attiecībā uz iekārtu izslēgšanu no ETS. Microsoft Excel programmā tika izveidoti 2 datormodeļi:

1. Emisiju kvotu piešķiršanas aprēķina modelis ES ETS III posmā. Šis modelis balstās uz ETS kvotu modelēšanu saskaņā ar saražotās siltumenerģijas līmeņatzīmes piemērošanu vidējām saražotās siltumenerģijas apjomam bāzes periodā, bezmaksas emisiju kvotu piešķiršanu 80 % apmērā no kopējā piešķirtā kvotu daudzuma un bezmaksas emisiju kvotu apjoma samazināšanos līdz 30% 2020.gadā. ES ETS kvotu modelēšanā tika pieņemts, ka kvotu cena modelēšanas periodā ir nemainīga 30 – 44 €/t, pieaugot par 2 €/t gadā.

2. CO_2 nodokļa aprēķina modelis. Modelis balstās uz iekārtu vidējām CO_2 emisijām bāzes periodā. CO_2 nodokļa modelēšanā tika pieņemts, ka nodokļa likme modelēšanas periodā mainās robežās no 3 – 30 €/t CO_2, pieaugot par 2 €/t gadā.

Modelējot tika izveidoti 3 scenāriji, kur tika pieņemtas mainīgas CO_2 nodokļa likmes laika posmā no 2013. – 2020.gadam. 1.scenārijā tika pieņemta CO_2 nodokļa likme no 3 €/t – 24 €/t. 2.scenārijā CO_2 nodokļa likme tika pieņemta no 6 €/t – 27 €/t. 3.scenārijā CO_2 nodokļa likme tika pieņemta no 9 €/t – 30 €/t. Visos scenārijos tika pieņemts CO_2 nodokļa likmes pieaugums 3 €/t gadā un nemainīga ETS kvotu cena no 30 €/t – 44 €/t ar pieaugumu 2 €/t gadā.

Izpētē tika konstatēts, ka no izmaksu līdzvērtīguma viedokļa, optimālāks ir 2.scenārijā pieņemto CO_2 nodokļa likmju modelis ar CO_2 nodokļa likmi no 6 € / t – 27 €/t, kas ļautu izpildīt nosacījumus attiecībā uz iekārtu izslēgšanu no ETS.