THE LONG ROAD FROM LJUBLJANA TO KYOTO: IMPLEMENTING EMISSIONS TRADING MECHANISM AND CO_2 TAX

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Abstract

According to the Kyoto Protocol, Slovenia is required to reduce GHG emissions to an average of 8% below base year 1986 emissions in the period 2008-2012. Slovenia established different measures for reducing GHG emissions long before its ratification. It was first transition country who implemented CO_2 tax in the 1997. Several changes in CO_2 tax have not brought the desired results. CO_2 emissions have actually increased. At the beginning of 2005, Slovenia joined other EU member states by implementing the emissions trading instrument, defined by new EU Directive. At the same time, Slovenia has adopted a new CO_2 tax system, which is compatible with the new circumstances. The main purpose of this paper is to present the characteristics of Slovenian approach to national allocation plan for emissions trading and analyze the problems of the CO_2 tax in Slovenia. Paper also describes the compliance cost of achieving the Kyoto target and expected movements on the Slovenian allowances market.

Keywords: CO_2 tax, Kyoto Protocol, emissions trading, national allocation plan, emissions allowances

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1 Introduction

The Kyoto Protocol was established with the main aim of preventing further increases in greenhouse gas (GHG) emissions and global warming. Overall GHG emissions should be reduced to at least 5.2% below the 1990 level in the commitment period 2008 to 2012. Slovenia ratified the Kyoto Protocol on June 21, 2002 and agreed to reduce GHG emissions to an average of 8% below base year 1986 in the period 2008-2012.

The Kyoto Protocol includes economic instruments, called flexible mechanisms, which are International Emissions Trading, Joint Implementation (JI) and the Clean Development Mechanism (CDM). The emissions trading mechanism in the EU is defined by the Directive establishing a scheme for GHG emission allowance trading, adopted on October 13, 2003 (Directive 2003/87/EC). The Clean Development Mechanism and Joint Implementation are defined by the so-called Linking Directive, which was adopted by the EU Parliament on April 21, 2004 and by the Council of Ministers on September 13, 2004 (Geres, 2004).

The emissions trading is divided into two phases in the EU. The first phase, in the period 2005-2007, includes only emissions trading of carbon dioxide (CO_2). The EU emissions trading scheme includes energy activities, production and processing of ferrous metals, cement, lime, glass, ceramic and kiln production, and pulp and paper production. Energy activities include combustion installations with a rated thermal input exceeding 20 MW (Directive 2003/87/EC, Annex I). Emission trading is built on the allocation of allowances. Total allocation means the upper limit of the GHG emissions, which is defined by the agency responsible for a given period of time. Companies with lower emissions reduction costs may sell the surplus of their allowances to companies with higher emissions reduction costs that cannot reduce their emissions efficiently.

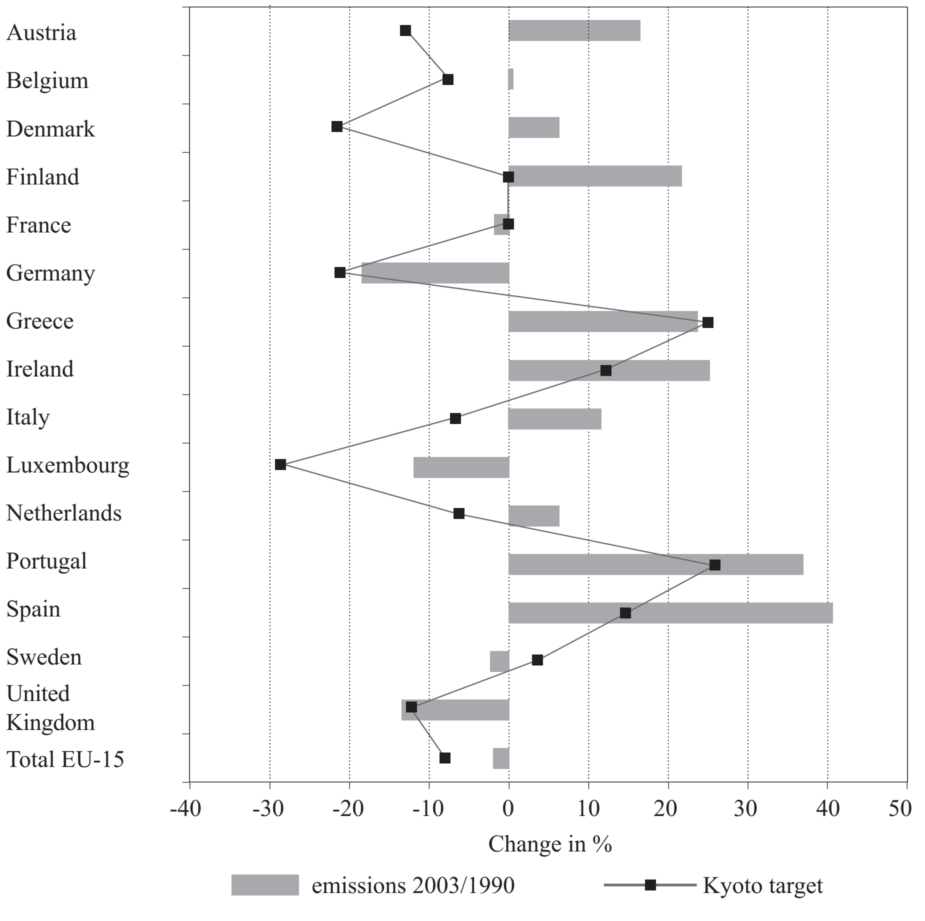
The main purpose of emissions trading in Slovenia is to supplement domestic measures in order to reach the required reductions in GHG emissions. The most important domestic measures are the existing CO_2 tax, increasing energy efficiency, encouraging the consumption of renewable energy (biomass, solar energy and wind energy), switching to fuels with a lower carbon content (e.g. from coal to gas), environmentally sound waste management, encouraging public transport, stimulating combined heat and electrical energy production, energy labeling of household devices, improving energy efficiency of buildings (MOPE, 2003).

In this paper we will analyze only the CO_2 tax and the emissions trading mechanism for GHG. Our main purpose is to present the establishment of the national allocation plan in Slovenia, the expected compliance costs for achieving the Kyoto target, and expected movements on the emissions allowances market in Slovenia. We will also present the main characteristics and efficiency of the CO_2 tax in Slovenia.

2 The distance from the Kyoto Protocol target in the EU member states

The EU was enlarged on May 1, 2004, when ten new member states, including Slovenia, joined the existing members. According to current data, Slovenia is the only new member state that is not fulfilling the Kyoto commitment. Among old member states, the situation is worse: only France, Greece, Sweden, and the United Kingdom fulfill the Kyoto target, while only Germany is on the right path. The distance of the old member states (EU-15) from the Kyoto protocol targets is shown in Figure 1.

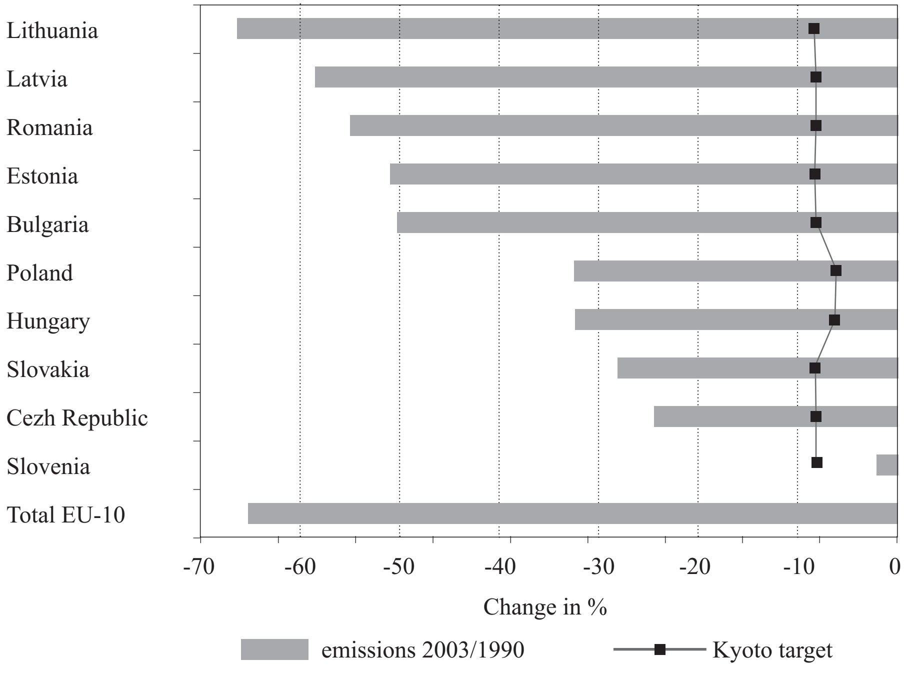
Figure 1 Distance from the Kyoto target of the EU-15



Data source: EEA (2005), CDR (2005) and own calculations.

Figure 2 illustrates the distance from the Kyoto target of the new member states (EU-10) and of Romania and Bulgaria. Among the new EU member states, Slovenia is the only one, which does not fulfill the Kyoto target. GHG emissions in the year 2002 were 20.2 million tons CO_2, which is only 1.9% lower than in the year 1986. In the year 2003 the emissions have been reduced for 3.4% according to the base year 1986 and were 19.9 million tons CO_2. The Kyoto requirement for Slovenia is 8% lower GHG emissions in 2008-2012 than in the base year 1986. This means that Slovenia is still 4.6% away from the Kyoto target in the year 2003. Thus Slovenia will be a net buyer of allowances. According to some authors, the main reasons why some transition countries are in a better position than Slovenia in reducing the required emissions levels, include the following: higher efficiency in decreasing fuel consumption in industry and electricity and heat production, more successful reductions of energy inefficiency in heavy industry and an efficient overall restructuring of the economy in the late 1980s and early 1990s, which was followed by the closing down of some energy intensive companies (EEA, 2004b). Emissions intensity data for the period 1997-2002 (Table 5), which we will address later, show that other transitional countries have managed to reduce their emissions intensity more than Slovenia, although the emissions intensity was at a higher level in these countries through the whole period.

Figure 2 Distance from the Kyoto target of new member states (EU-10), Romania and Bulgaria



Source: Kolar (2004), EEA (2005), CDR (2005) and own calculations.

The biggest potential net seller of allowances is Poland, with around 55 million tons of CO_2 per year (the current allocation is 246.7 million tons CO_2 in 2005, 240.1 million tons CO_2 in 2006 and 226.4 million tons CO_2 in 2007, Poland's CO_2 emissions were calculated at 219.7 million tons of CO_2 in 2004 for total ETS[1] sectors) (Carbon Market Eu-

[1] Emissions trading scheme.

rope, May 27, 2005). However, results of recent research have shown that Polish installation operators would rather produce more electrical energy than sell the allowance surpluses (Atkins, 2005). Analysis shows that all EU member states will produce around 84 million tons of CO_2 surpluses per year in the period 2005-2007. Poland is followed by the Czech Republic (with more than 10 million tons of CO_2 per year), Lithuania (around 7 million tons of CO_2 per year), Estonia (with more than 5 million tons of CO_2 per year), Slovakia (around 5 million tons of CO_2 per year) and Latvia (around 2 million tons of CO_2 per year) (Carbon Market Monitor, March 18, 2005).

Slovenia followed the GHG emissions reduction target before the ratification of the Kyoto Protocol – that is, before June 21, 2002. In the beginning of 1997, Slovenia was the first of the transition countries to introduce a CO_2 tax. European countries that implemented a CO_2 tax before Slovenia are: Finland (1990), Norway and Sweden (1991), Denmark (1992), and the Netherlands (1996) with ecological tax reform; the tax was applied since 1980 in different forms in Germany and Italy (1999) and in the United Kingdom (2001) (Gee, 1996; EEA, 2004a). In the following chapter the main characteristics of the CO_2 tax in Slovenia are presented.

3 Slovenia and the CO_2 tax

When the CO_2 tax was implemented in Slovenian tax legislation, it was 1 SIT/kg CO_2 (UL RS 68/96). In the year 1998, the tax was increased to 3 SIT/kg CO_2[2] (UL RS 24/98). An additional change in the CO_2 tax was introduced on January 1, 2003 (UL RS 91/02). Since then the tax has remained unchanged until 2005, when it was supplemented due to the emissions trading mechanism.

In the year 1997, when the CO_2 tax was implemented, it was not originally intended to reduce CO_2 emissions. It was implemented because of the additional demands of the national budget, due to the decline of some other budget revenues (at that time, the country had reduced social insurance contributions, which were paid by employers and in such a way it was hoped to unburden the labor factor). Beside this, the biggest CO_2 emissions producers were exempted from paying the CO_2 tax (in the year 1997, thermal power stations, heating stations and boiler houses for heating produced more than 50% of total CO_2 emissions). As we have already mentioned, the tax in the year 1997 was set at a very low level (1 SIT/kg CO_2). Considering such a low CO_2 tax level and the many exemptions for its payment, nobody expected that the CO_2 tax could significantly influence emissions reductions.

In the year 1998, the tax level was increased to 3 SIT/kg CO_2, but other big changes were not made to the tax. The detailed reasons behind this threefold increase in the tax level are not known, but we can assume that the main reason was: higher budget revenues and the realization that the tax level was insufficient to achieve the required or needed effects. In December 1997, the Kyoto Protocol was signed and the estimation that prevailed at that time was that the costs of CO_2 emissions reduction to the required level should be between 10 and 20 EUR/t CO_2. The suggested tax level of 3 SIT/kg

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[2] See more about this tax in Markovič-Hribernik and Schlegelmilch, 1999; Schlegelmilch and Markovič-Hribernik, 2002.

CO_2 (16.1 EUR/t CO_2) was within the expected costs range. In the year 1998, the biggest CO_2 producers still did not have to pay the tax, which was supported by the political background, because these biggest CO_2 producers were (and still are) state owned. The country also protected domestic coal producers, especially to maintain social peace in regions where the population is very dependent on the existence of coalmines. The threefold increase in the CO_2 tax level had a negative influence on the industry producers with a high share of fuel costs in the total value added (pulp and paper, industry of building materials and basic chemistry), which led to a worse competitive position for these producers.

The CO_2 tax was once again changed in the year 2000. Changes have included the possibility for delaying repayments of already paid CO_2 tax until 2009. The percentage of the repayment is smaller every year, with 2009 being the last year in which repayment can be required. The repayment can be claimed on the basis of the permit with the tax-free use of fuels, issued by the Ministry of the Environment and Spatial Planning. Due to this change, revenues generated from the CO_2 tax have since been reduced. The data presented in Table 1 show the revenues generated from the CO_2 tax and CO_2 emissions.

Table 1 Revenues generated from CO_2 tax and CO_2 emissions in Slovenia for the period 2000-2004

	2000	2001	2002	2003[a]	2004[a]
CO_2 tax revenues (in billions of SIT)	7.6	7.5	6.5	9.2	9.6
CO_2 emissions (in millions of tons)	15.2	16.3	16.4	16.1	–
CO_2 tax				3000 SIT/t CO_2	

[a] In the years 2003 and 2004 repayments on the basis of permits with the tax-free use of fuels were paid out (7.1 billion SIT). Repayments are included in Table 1.

Source: Ministry of finance (internal data) and Ministry of Environment and Spatial planning (internal data); Agencija Republike Slovenije za okolje (2005).

From Table 1 we can see that CO_2 emissions have increased since 2000, while in 2003 a reduction can be noticed. With a more detailed analysis (Table 2) we discover that the biggest CO_2 emissions reduction is located in the item "other sectors" within the energy sector. The item "other sectors" includes the commercial sectors, households and agriculture and forestry.

From Table 2 we can also see that the electricity and heat producers also reduced CO_2 emissions in the year 2003, relative to the year 2002. We could say that the main reason for this 3% reduction of CO_2 emissions was smaller electricity production in thermal-power stations in the year 2003 compared to 2002. It was actually smaller by 206 GWh, which means a 2% reduction in electricity production. Smaller electricity production in thermal-power stations is directly connected with the reduced use of lignite (from 4.3 million tons in the year 2002 to 4.1 million tons in the year 2003). Also, the import of electricity was increased (by 2,191 GWh) in the year 2003 relative to the year 2002, while the export of electricity was increased by only 897 GWh.

Table 2 Movements of CO_2 emissions in Slovenia from 2000 to 2003 (in thousand tons)

	2000	2001	2002	2003
Energy	14,362	15,409	15,474	15,141
A. Fuel combustion	14,325	15,349	15,416	15,072
Energy industries	5,487	6,233	6,402	6,222
Manufacturing industries and construction	2,300	2,358	2,384	2,367
Transport	3,653	3,786	3,800	3,935
Other sectors	2,885	2,972	2,830	2,548
B. Fugitive emissions from fuels	37	60	58	69
Industrial processes	840	880	871	934
Solvent and other product use	36	37	37	37
Total CO_2 emissions	15,239	16,325	16,382	16,113

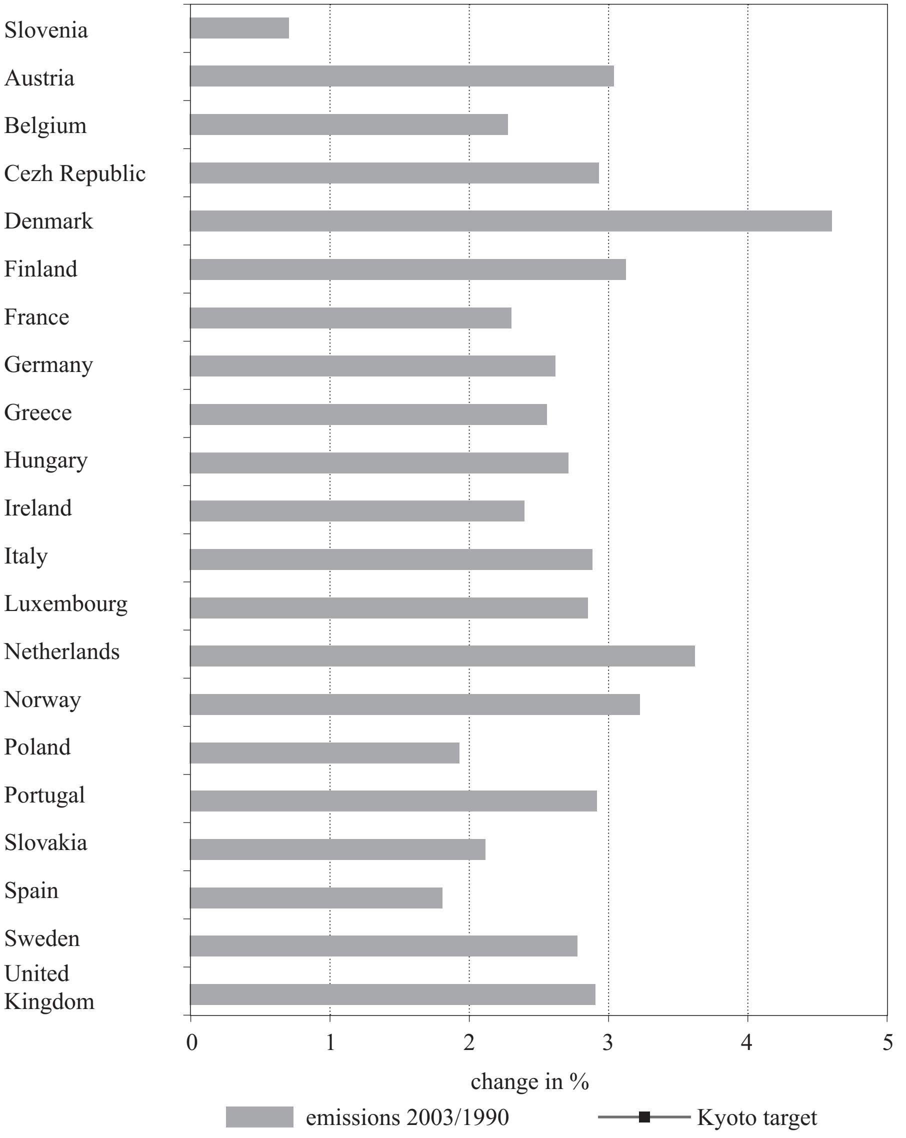
Source: UNFCCC (2005).

On the basis of the above-mentioned facts, it is again very difficult to say how much the CO_2 tax has contributed to CO_2 emissions reduction in the year 2003, as compared to the year 2002. Also, the biggest defenders of this tax, did not expect that the tax would be a solution for substantial CO_2 emissions reduction in the short run or that the tax could play a crucial role in achieving the Kyoto target, but it can play an important role in changing the behavior of economic agents in the longer run.

To achieve higher CO_2 tax efficiency, a substantial change was made in the CO_2 tax legislation in the year 2003, when the tax was subject to major turn-over with acceptance of a new decree on the CO_2 emissions tax, and cancellation of all the old decrees concerning the CO_2 tax (UL RS 91/02). According to this change, a person that produces CO_2 emissions due to the consumption of fossil fuels must pay the tax. The CO_2 tax must be also paid by the operator of a boiler installation, industry furnace, or incineration installation, which produces CO_2 emissions by burning volatile organic compounds. Volatile organic compounds are not just fuels used in boilers or industry furnaces, but also organic wastes that are co-burned in boilers and furnaces, or burned in incinerators. This new decree was modified with two additional changes (UL RS 8/03 and 46/04).

The biggest change in the new decree was about the maximum quantity of CO_2 emissions allowed for installation operators. For example, a company that got a permit for the tax-free use of fuels for the years 2002, 2003 and 2004, has a right for tax repayment in the amount of 67%. This percentage changes for the year 2005 to 19% of the repayment. In subsequent years, the percentage of the repayment decreases by 8%, which means in the year 2006 the repayment is 11%, in 2007 it is only 3%, and in 2008 no repayment is possible. All other companies have a right for repayment until 2009, which is the last year a company can claim the repayment of the CO_2 tax. These percentages are also included in the new decree of the CO_2 tax connected with the emissions trading scheme, which was adopted by the Slovenian government on April 21, 2005 and published in UL RS 43/05. With the change in the CO_2 tax, the measures for air pollution have been harmonized with the policy of government grants.

Figure 3 Revenues from environmentally related taxes in percentage of GDP for 2001



Source: OECD (2003); Agencija Republike Slovenije za okolje (2003).

The new decree of the CO_2 tax in Slovenia has been adopted due to a new instrument of emissions trading, which started in the EU and in Slovenia on January 1, 2005. Both mechanisms are instruments of the economic policy for reducing GHG emissions. In the year 2004, the Commission approved the Slovenian draft in this field. According to the new legislation, a company with an exempted fuel producer permit does not pay the CO_2 tax. Exempted fuel producer permits are issued by customs to the installation operator who has a permit for producing GHG emissions and is an energy intensive company. An energy intensive company is a company whose costs for the purchase of fuels and electricity exceed 3% of the product value. Product value means sales revenues which are increased or reduced by changes in the stock of both final and unfinished products, reduced for goods and services purchasing costs. Companies with the exempted fuel producer permit have also right to claim back already paid CO_2 tax for the period from January 1, 2005 until the acquisition of the permit. The new decree also enables the payback of the CO_2 tax for the combined heat and power producers and installation operators that have made a contract, with the Ministry of the environment, for reducing the CO_2 emissions within certain period (New Decree on the Tax on CO_2 Emissions, published in UL RS 43/05, April 29, 2005).

It can be concluded that current and previous measures for reducing GHG emissions in Slovenia were not enough to reach the Kyoto target. The quantity and forecast of GHG emissions deviates from the Kyoto target. Present projections show that Slovenia would need to reduce GHG emissions by 9% to reach the Kyoto target. Target GHG emissions according to the Kyoto Protocol are 19 million tons of CO_2 equivalent.[3] Average GHG emissions 2008-2012 are estimated at 20.7 million tons of CO_2 equivalent. GHG emissions in 2000 exceeded the base level emissions in the year 1986 (Burja et al, 2004). The data presented in Figure 3 show that Slovenia is a country with the lowest share of all environmental taxes in GDP, what can be also proved with the CO_2 tax level, which is among the lowest. Beside this, the biggest CO_2 emissions producers were exempted from the payment of the CO_2 tax. This included the thermal power stations Šoštanj and Trbovlje, which produced 5.1 million tons of CO_2 in the year 2003, and comprise around 32% of the total CO_2 emissions in Slovenia. The most important reason for this is the high expense of domestic coal and consequently, the low competitive position of the Slovenian thermal power stations using coal as a fuel.

4 Establishing the national allocation plan for emissions trading

4.1 Guidelines for establishing national allocation plans

The allocation of allowances in individual countries and all conditions for the undisturbed operation of the emissions trading scheme are defined by the national allocation

[3] CO_2 equivalent is a general unit for calculating the emissions impact of other GHG: 1 kg methane – CH_4 represents 21 and 1 kg C_2F_6, which is a PFC, represents 9.200 kg CO_2 equivalent. Every GHG represents a global warming danger: 1 ton CH_4 has a global warming potential, which is 21 times stronger than 1 t CO_2 in a period of 100 years. 1 t HFC has from 140 to 11.700 times and 1 t SF_6 has 23.900 times stronger global warming potential than 1 t CO_2 (EPA, 2002).

plans (NAP). EU countries had to publish their plans and notify the European Commission by March 31, 2004 (for old members) or by May 1, 2004 (for new members). The Commission decided if it will accept or reject the NAP. In the first phase (2005-2007) only CO_2 emissions will be traded (DEFRA, 2004b). In the second phase, 2008-2012, emissions trading will be expanded to include other GHG and other activities. The NAP for this period must be submitted to the Commission by July 1, 2006. A final decision about the allowances allocation must be made no later than January 1, 2007. The installation[4] operator is required to report on emissions to the relevant authority at the end of each calendar year. A number of allowances equal to the total emissions from the installation shall be surrendered by April 30 of each year. If the operator does not surrender sufficient allowances by April 30 of each year to cover its emissions during the preceding year, an excess emissions penalty shall be paid. During the first phase 2005-2007, a lower excess penalty will be applied in the amount of 40 EUR/t CO_2. In the second phase 2008-2012, a higher excess emissions penalty was adopted in the amount of 100 EUR/t CO_2 equivalent. Although the operator will pay the excess emissions penalty, the missing allowances shall be surrendered in next trading year.

National allocation plans (NAPs) in the individual member states are defined by the Directive 2003/87/EC together with the criteria for the establishment of NAPs. These criteria are stated in Directive COM(2003) 830 final. NAPs can vary among member states in the following elements: allocation method, choice of the base period or year, possibility of transferring the emissions allowances in the next trading period 2008-2012 and the percentage of the new entrants reserve. If we compare the Slovenian NAP with the NAPs of other member states, the following can be seen: as is the case with many other countries, Slovenia has used the combination of two allocation methods, this is grandfathering and benchmarking (ten EU countries have used the same combination as Slovenia, seven countries have used only grandfathering and other countries have used a combination of grandfathering, benchmarking, growth factors and early actions); by choosing the base year or period, Slovenia does not deviate from other countries; transferring the unused emissions allowances to the next period 2008-2012 is not allowed, as in almost all other member states (with the exception of France and Poland); solutions for the new entrants reserves are very different among countries.

4.2 Possible methods for allocating allowances

The agency responsible for controlling GHG emissions in an individual country defines the total quantity of allowed emissions by setting up the emissions trading scheme. The second step is to divide the total quantity of emissions into trading units, which are called allowances. After distribution, the allowances are allocated to individual participants that are taking part in the emissions trading scheme.

The main allocation methods are grandfathering, auctioning and benchmarking. Grandfathering can be done on the basis of historical emissions, input quantity, pro-

[4] Installation means combustion installation, which is defined as a stationary technical unit. This unit uses different kinds of fuel for the production of energy. Energy can be electricity, heat, or mechanical power. In the emissions trading scheme guidelines, combustion installations include electric boilers, generators, co-generation of heat and electrical energy, and gas turbines (including compressors) (DEFRA, 2004a).

duction, and indirect or direct emissions. The main difference between grandfathering and auctioning is that under grandfathering, existing sources have only to purchase any additional allowances they may need over and above the initial allocation. Under auctioning, all allowances need to be purchased, not just the missing allowances (Tietenberg, 1999).

The main criteria for assessing the cost efficiency of various allocation methods are compliance costs, administrative costs (borne by the government to operate the emissions trading scheme), transaction costs, product market distortions and tax distortions (Baron and Bygrave, 2002; Harrison and Radov, 2002). In Table 3 we present a comparison of the cost efficiency for the above-mentioned allocation methods.

Table 3 Comparison of the cost efficiency of allocation methods – grandfathering, auctioning and benchmarking

Efficiency criteria	Grandfathering	Auctioning	Benchmarking
compliance costs	minimized costs	minimized costs	minimized costs
administrative costs	initial costs of data collection and allocation administration – allocation of the allowances	no data collection or initial allocation costs, auction design and development costs	initial costs of data collection (BAT standards for each installation)
transaction costs	costs on the secondary market – trading after the initial allocation	costs on the primary market – initial allocation and on secondary market	costs on the secondary market – trading after the initial allocation
product market distortions	indirect costs – influence of other markets on the emissions market	indirect costs – influence of other markets on the emissions market	indirect costs – influence of other markets on the emissions market
tax distortions	limited influence on the existing tax legislation	influence on the tax legislation, due to auction revenues	very limited influence on the existing tax legislation

Source: Vis (2003), PWC (2003), Harrison, Radov (2002: 163-168) and UNCTAD (2001:126).

Most countries defend the efficiency of grandfathering with the fact that they cannot use auctioning without having a negative influence on the industry. The industry must pay for every additional unit of emissions produced, which in turn affects prices, production, and technology (Bohm, 2002). Recently the benchmarking method has become more and more popular. This method is especially appropriate when comparing the energy efficiency of the participating installations. Many countries (including Slovenia) use a combination of at least two methods, most commonly grandfathering and benchmarking. Some countries have also used auctioning.

4.3 Preparations for establishing a national allocation plan in Slovenia

Directive 2003/87/EC for the greenhouse gas emissions allowance trading scheme sets the groundwork for establishing the national allocation plan (NAP) in Slovenia and other EU member states. Besides the Directive, the Guidance of the European Commission to assist member states in the implementation of Directive COM(2003)830 final is also very important for establishing the NAPs. This document contains the following 11 criteria relating to the NAP (Directive COM(2003) 830 final):

1. fulfilling the Kyoto Protocol commitments;
2. assessments of current and future emissions development;
3. potential to reduce emissions;
4. consistency with other legislative frameworks;
5. non-discrimination between companies, installation operators, and sectors;
6. new entrants (operators or installations);
7. early actions;
8. clean technology, including energy efficient technologies;
9. involvement of the public;
10. list of installations;
11. competition from outside the EU.

Of the above criteria, numbers 2, 5, 9 and 10 are mandatory, while numbers 6, 7, 8 and 11 are optional. Numbers 1, 3, and 4 are partly mandatory and partly optional. Slovenia has included all of the criteria in its NAP except 7, the criterion of early actions.

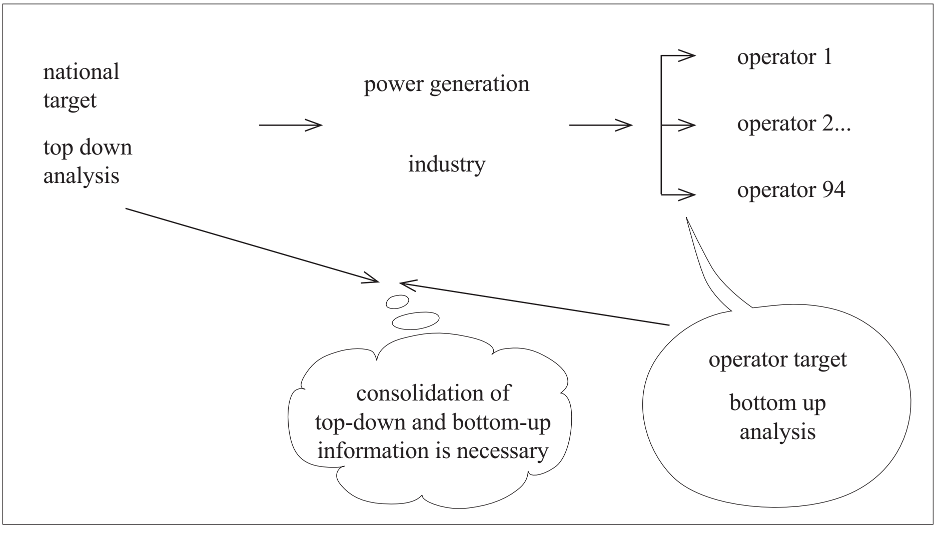
The procedure for establishing the NAP in Slovenia has started with the collecting of data on CO_2 emissions (consumption of fuels, number of installations, type of installation, and installations' accordance with BAT[5] technology). The following were included in the procedure following installation: production of electricity and heat; production and processing of ferrous metals, cement, glass, lime, ceramic, and kiln production; pulp and paper production; and other industry engaged in energy activities that exceed 20 MW or 15 MW[6] of rated thermal input. Installation operators had to assure accurate data on the quantity of production (output) and the emissions per separate installation for the period 1999-2002. They also had to provide information about activating new installations in 2005-2007, and about expected output and CO_2 emissions for 2005-2007. Allowances allocation was based on the highest annual CO_2 emissions in the period 1999-2002. By establishing the NAP, Slovenia has taken into consideration first the top-down or macro allocation, where the target on the state level is considered; and second the bottom-up or micro allocation, where the target on the operator level is considered (Figure 4). The allocation of allowances was first made on the sector level. Two sectors were included: power generation and industry. Further allocation was made on the installation level within these

[5] Best available techniques.

[6] Installations exceeding 20 MW are automatically included in the NAP according to Directive 2003/87/EC Annex I. Installations exceeding 15 MW are included in the NAP on a voluntary basis.

two sectors. The allocation of allowances was based on the highest annual emissions in the period 1999-2002. The government's goal was not to sell the allowances on auction, but to allocate them for free, i.e. the grandfathering method. The plan also incorporates the new entrants reserve (NER) in the amount of 200 thousand tons of CO_2, which represents around 0.8% of total allocated allowances. If some of this reserve remains unused at the end of 2005-2007, this quantity will be sold on auction. By establishing the NAP, Slovenia has taken into consideration the criteria stated by the EU, except for early actions on the installation level. Only emissions reductions after the year 1999 have been included and they bring a reward to installation operators in the form of additional allowances. On the other side, reductions before the year 1999 do not bring such a reward (which would mean an early action on the installation level).

Figure 4 Allocation method of establishing the NAP in Slovenia



Source: MOPE (2004)

The government sent the first version of the Slovenian national allocation plan for 2005-2007 to the European Commission (EC) on April 29, 2004. In this version the allocated quantity of allowances was calculated at 26.3 million for 2005-2007 (where 1 allowance equals 1 ton of CO_2). At that time 98 installations were included (MOPE, 2004).

The EC had some remarks on this first version, of which the most important were (Tavzes, 2004):

- projections of GHG emissions up to 2012;
- forecasted emissions reduction in other sectors (transportation, households, and the commercial sector);

- expected economic growth and emissions intensity, which is calculated by the coefficient of CO_2 emissions per unit of GDP (in euros);
- coordination with other legislation;
- new entrants: it pertains to how the allowances from the closed installation can be transferred to the new (substitutive) installation. Allowances can be transferred only if we are dealing with the same new installation, or if the new installation is directly included into the production process at the same installation operator's location;
- allowances allocation to new installations (Slovenia has decided that new installations will not be entitled to 100% allocation of allowances from the new entrants' reserve, but only to 80% - factor 0.8. The reason for this decision on the state level is that as many new installation operators as possible could get allowances from the NER's);
- NER's (the reserve was initially estimated in the amount of 300 thousand tons of CO_2, but in the final version this number was changed to 200,000 tons of CO_2 or 0.76% of the total quantity of sector allowances. In most cases only the repairs etc. were considered, which does not require allowances from the NER).

Slovenia considered all remarks from the European Commission and from installation operators when it established the NAP. According to the latest data, 94 installation operators will participate in the emissions trading scheme for the period 2005-2007. The total quantity of allocated allowances is 26.3 million (1 allowance = 1 CO_2 ton, including the NER in the amount of 200 thousand CO_2 tons).

Table 4 Emissions intensity in Slovenia (in CO_2 kg per 1 euro of GDP)

	1999	2000	2001	2002	2003	2008
CO_2 emissions (in million of tons)	15.1	15.2	16.3	16.4	16.1	–
GDP (in billion of euros)	19.8	20.7	21.9	23.5	24.6	–
Emissions intensity	0.76	0.73	0.74	0.70	0.66	0.57

Source: Bank of Slovenia (2003; 2005); MOPE (2004); AMOPE-EIONET (2004); Agencija Republike Slovenije za okolje (2005); Kranjčevič (2004); Own calculations.

Remarks from the European Commission took into consideration so-called emissions intensity. The emissions intensity coefficient, which measures CO_2 emissions per GDP (in euro), is expected to be smaller in the coming years. The emissions coefficient should be lowered especially because of CO_2 emissions reduction after the year 2008, due to fulfilling the Kyoto protocol commitments (see Table 4).

At this point, a comparison of the Slovenian emissions intensity with that of other selected countries is very interesting. We have chosen those countries for which we could find all necessary data for calculating the emissions intensity. The comparison is presented in Table 5.

Table 5 Emissions intensity in selected countries (in kg CO_2 per 1 euro of GDP)

	1997	1998	1999	2000	2001	2002
Slovenia	0.94	0.86	0.76	0.73	0.74	0.70
Austria	0.36	0.35	0.33	0.31	0.33	0.32
Belgium	0.57	0.58	0.53	0.51	0.49	0.49
Czech Republic	3.15	2.77	2.66	2.12	1.88	1.57
Denmark	0.44	0.39	0.35	0.30	0.30	0.29
Estonia	4.70	3.66	3.23	2.86	2.55	2.31
Finland	0.62	0.56	0.53	0.47	0.50	0.50
France	0.32	0.33	0.30	0.29	0.28	0.27
Greece	0.87	0.90	0.83	0.84	0.81	0.75
Ireland	0.54	0.52	0.47	0.43	0.41	0.35
Italy	0.43	0.43	0.42	0.40	0.39	0.37
Latvia	1.61	1.38	1.10	0.83	0.81	0.75
Hungary	1.46	1.37	1.33	1.16	1.02	0.83
Germany	0.48	0.46	0.43	0.42	0.42	0.41
Netherlands	0.50	0.49	0.45	0.42	0.41	0.40
Poland	2.66	2.24	2.14	1.74	1.53	1.52
Portugal	0.57	0.58	0.60	0.55	0.52	0.52
Slovakia	2.41	2.22	2.25	1.85	1.85	1.65
Spain	0.52	0.51	0.52	0.50	0.47	0.47
Sweden	0.27	0.27	0.24	0.21	0.23	0.21
United Kingdom	0.46	0.43	0.39	0.35	0.35	0.32
Norway	0.29	0.31	0.28	0.23	0.22	0.20
Switzerland	0.19	0.19	0.18	0.17	0.16	0.15
Canada	0.93	0.97	0.89	0.74	0.72	0.74
Japan	0.33	0.34	0.29	0.24	0.26	0.29
USA	0.76	0.72	0.65	0.55	0.51	0.52

Source: Bank of Slovenia (2003; 2004; 2005), EUROSTAT (2002; 2003; 2004); MOPE-EIONET (2004), UNFCCC (2004; 2005); UNFCCC (2005) and EEA (2004a); Own calculations.

It is possible to see movements in the emissions intensity coefficient in each country from 1997 to 2002, and at the same time to compare the emissions intensity coefficients between countries. Higher or lower emissions intensity is not only a consequence of changes in the quantity of emissions, but also due to changes in GDP. Data for CO_2 emissions in 2002 show that CO_2 emissions have increased in Slovenia, Austria, Belgium, Estonia, Finland, Portugal, Spain, Sweden, Canada, Japan and the US in comparison to 2001. In the remaining 15 selected countries, CO_2 emissions have been reduced. Data for GDP show a bit different picture. In 2002, GDP has been nominally reduced in only three countries – Canada, Japan and the US – in comparison to 2001. GDP data for Poland in 2002 were not available. Although CO_2 emissions have increased in most countries, the emissions intensity coefficient has fallen in all countries except Canada, Japan, and the US (the coefficient has fallen due mainly to reduced GDP, and partly to increased CO_2 emissions). In the remaining eight countries, where emissions have increased in 2002 in comparison with 2001, emissions intensity has fallen because of sufficiently high increases in GDP.

In Table 5 we can also notice countries whose emissions intensity has fallen throughout the 1997-2002 period. These countries are Slovenia, Czech Republic, Denmark, Estonia, Ireland, Italy, Latvia, Hungary, Germany, Netherlands, Poland, UK and Switzerland. It can also be noted that the emissions intensity for 2002 is substantially higher in Czech Republic, Estonia and Slovakia (the highest was reached in Estonia at 2.31 kg CO_2 per euro of GDP). Very low emissions intensities can be seen in Austria, Denmark, France, Sweden, UK, Norway, Switzerland and Japan (the lowest is Switzerland at 0.15 kg CO_2 per euro of GDP). Slovenia, with an emissions intensity coefficient of 0.70 kg CO_2 per euro of GDP, is in the middle. It is very interesting to compare Slovenian emissions intensity with the emissions intensity of other transitional countries. Slovenia has the lowest emissions intensity of them all, although other countries managed to achieve a greater drop in the emissions intensity of the observed period.

4.4 Allocation plan for emissions allowances

4.4.1 Determination of the total quantity of allowances

Due to ratification of the Kyoto protocol, Slovenia is required to reduce GHG emissions to an average of 8% below base year 1986 emissions in the period 2008-2012. Base year emissions were 20,601 thousand tons CO_2 equivalent. Emissions in the period 2008-2012 must therefore be limited to 19 million tons CO_2 equivalent, including sinks[7] (Burja et al, 2004). According to data on GHG emissions for the year 2002, they are exceeding target emissions (which are 19 million tons CO_2 equivalent) by 7.5% (UNFCCC, 2004). Target emissions in Slovenia shall be achieved with the following additional measures: GHG emissions trading scheme, trading with gas and electricity, changing the CO_2 tax, encouraging combined heat and power production, encouraging the production of electricity from renewables and increasing their usage, reducing emissions of F-gases, informing consumers about CO_2 emissions from motor vehicles, and reducing waste (Burja et al, 2004). Expected GHG emissions reduction to 2008 is presented in Table 6.

The estimated contribution (according to the national "OPGHG")[8] from Slovenian EU ETS participants by the year 2008 is emissions reduction of 4.2% for the industry sector and 10.6% for the power generation sector. Emissions from participants in 2002 represent approximately 60% of total national CO_2 emissions.

Slovenia has allocated 99.24% of the total quantity of allowances to existing installations on a free basis, and the remaining 0.76% will form a reserve for new entrants. If there are any surplus allowances in the NER after allocation to the relevant installation, these will be auctioned at the end of the 2005-2007 trading period.

[7] Sinks in the Kyoto Protocol can be any process, activity or mechanism that takes GHG from the atmosphere. This commonly refers to vegetation (such as forests) which takes CO_2 from the atmosphere.

[8] Operational Plan for GHG Emissions Reduction.

Table 6 GHG emissions in Slovenia in the years 1986, 2002, 2003 and 2008 by including additional measures (in thousands of tons CO_2 equivalent)

	1986	2002	2003	2008
Energy	15,603	16,080	15,796	15,651
Industrial processes	1,309	1,083	1,164	1,138
Solvent and other product use	128	73	70	37
Agriculture	2,564	2,050	1,967	2,146
Waste	997	916	898	904
TOTAL emissions	20,601	20,202	19,895	19,875
Total sinks	-2,950	-5,561	-5,561	-3,754
allowed sinks				-1,708
estimated used sinks[a]				-840
TOTAL emissions + sinks	20,601	20,202	19,895	19,035
Distance from target emissions	1,648	1,249	942	82
Target emissions 2008-2012 (-8 %)	18,953			

[a] Due to the fact that sinks must be caused directly by human activity, a conservative estimate has been used. According to this, only a half of the allowed sinks can be used: 840.000 tons CO_2 equivalent in the period 2008-2012.

Source: Burja et al (2004), UNFCCC (2004, 2005).

4.4.2 Determination of the quantity of allowances at the sector level

Slovenia has decided to use a two-stage approach for allocating allowances. First, the total number of allowances has been allocated to two sectors (power generation and industry). Second, allowances within each sector have been calculated for each installation (UL RS 112/04).

The total quantity of allowances (EK) was calculated as follows:

$$EK = EK_{Energ} + EK_{Ind} + NV \quad (1)$$

EK_{Energ}: allocation for the power generation sector;
EK_{Ind}: allocation for the industry sector;
NV: new entrants reserve allocation.

For each installation, an historical baseline is calculated as the highest annual emissions in the period 1999-2002. By summing up all baseline emissions for each installation, the baseline allocation at sector level was calculated. The sector allocation for industry also includes process emissions, which are not based on fuel usage.

The sector allocation for 2007, based on fuel usage in the relevant period, is calculated taking into account the “sector emissions reduction factor” (SFZ). SFZ is based on each sector’s Kyoto emissions reduction target according to the national “OPGHG.” The

SFZ for the power generation sector amounts to 0.894 (or 10.6% reduction), and for the industry sector amounts to 0.958 (or 4.2% reduction by 2008).

Allocation of allowances for the power generation sector (EK_{Energ}):

$$EK_{Energ} = \sum EK_{Energ,\ god} = EK_{Energ,\ 2005} + EK_{Energ,\ 2006} + EK_{Energ,\ 2007} \quad (2)$$

$$EK_{Energ,\ 2005} = \sum IEN \quad (2.1)$$

$$EK_{Energ,\ 2007} = (\sum IEN) \text{ x } SFZ_{Energ} = (\sum IEN) \text{ x } 0{,}894 \quad (2.2)$$

$$EK_{Energ,\ 2006} = (EK_{Energ,\ 2005} + EK_{Energ,\ 2007})/2 \quad (2.3)$$

Allocation of allowances for the industry sector (EK_{Ind}):

$$EK_{Ind} = (\sum EK_{Ind,\ god}) + EK_{Ind,\ proc} = EK_{Ind,\ 2005} + EK_{Ind,\ 2006} + EK_{Ind,\ 2007} + EK_{Ind,\ proc} \quad (3)$$

$$EK_{Ind,\ 2005} = \sum IEN \quad (3.1)$$

$$EK_{Ind,\ 2007} = SE_{Ind,\ 1999} \text{ x } SFZ_{Ind} = SE_{Ind,\ 1999} \text{ x } 0{,}958 \quad (3.2)$$

$$EK_{Ind,\ 2006} = (EK_{Ind,\ 2005} + EK_{Ind,\ 2007})/2 \quad (3.3)$$

$$EK_{Ind,\ proc} = 3\text{x} \sum IEN_{Ind,\ proc} \quad (3.4)$$

IEN: baseline installation emissions from fuel usage (highest annual emission in 1999-2002);
SFZ: sector emissions reduction factor (0.894 for power generation and 0.958 for industry);
$SE_{Ind,1999}$: emissions in the industry sector in 1999 from fuel usage;
$EK_{Ind,proc}$: sector allocation for process emissions.

4.4.3 Determination of the quantity of allowances at the installation level

Slovenia has determined two different allocation methods for each sector. However, the allocation method within each sector is the same for all installations within the sector (UL RS 112/04).

Allocation of allowances at the installation level within the power generation sector (IA_{Energ}):

For allocation at the installation level within the power generation sector, a method based on forecasted emissions according to the national "OPGHG" has been used.

$$IA_{Energ} = \sum PE_{Energ,\ year} = PE_{Energ,\ 2005} + PE_{Energ,\ 2006} + PE_{Energ,\ 2007} \quad (4)$$

IA_{Energ}: allocation at the installation level for the power generation sector;
$PE_{Energ,year}$: forecasted emissions at the installation level consistent with the national "OPGHG" for the years 2005, 2006 and 2007.

Allocation of allowances at the installation level within the industry sector (EK_{Ind}):

For allocation at the installation level within the industry sector, a combination of grandfathering and the BAT-benchmarking method was used.

$$IA_{Ind} = \sum IA_{Ind,\ year} = IA_{Ind,\ 2005} + IA_{Ind,\ 2006} + IA_{Ind,\ 2007} + IA_{Ind,\ proc} \quad (5)$$

Allocation at the installation level (not for combined heat and power production) based on baseline emissions from fuel usage was:

$$IA_{Ind,\ year} = IEN \text{ x } A \text{ x } K_{Ind,\ year} \quad (6)$$

IA_{Ind}: allocation at the installation level for the industry sector;
IEN: baseline installation emissions from fuel usage (highest annual emission in 1999-2002);
A: the allocation factor is determined by the installation's BAT compliance (0.90 means BAT compliant installation, and 0.85 means BAT non-compliant installation);
$K_{ind,year}$: correction or balancing factor for the industry sector for each year.

The correction or balancing factor for the industry sector (K_{Ind}) has been calculated as follows:

$$K_{Ind,\ year} = (SE_{year})/(\sum IEN \text{ x } A) \quad (7)$$

SE_{year}: emissions for the industry sector for each trading year (2005-2007).

High efficiency CHP (combined heat and power) installations are considered in different ways. First, the contribution from the electricity and heat production side must be determined:

$$IA_{Electricity} = EEF \text{ x } EP \quad (8)$$

$$IA_{Heat} = A \text{ x } (IEN - IA_{Electricity}) \quad (9)$$

$$IA_{year} = (IA_{Electricity} + IA_{Heat}) \text{ x } K_{ind,year} \quad (10)$$

$IA_{Electricity}$: allocation at the installation level for the industry sector for electricity production;
EEF: emissions factor for electricity production (0.44 kgCO_2/kWh);
EP: electricity production in CHP in kWh for the baseline year in the period 1999-2002;
IA_{Heat}: allocation at the installation level for the industry sector for heat production;
A: the allocation factor is determined by the installation's BAT compliance (0.90 means BAT compliant installation, and 0.85 means BAT non-compliant installation);
IEN: baseline installation emissions from fuel usage (highest annual emission in 1999-2002);
$K_{ind,year}$: correction or balancing factor for the industry sector for each year.

Emissions allowances for the production of electricity by high efficiency CHP in industry will be granted at a BAT norm of 0.44 kg CO_2/kWh for production of the same quantity of electricity as during the relevant year of the reference period 1999-2002. Emissions allowances for electricity is now dependent only on the correction factor ($K_{ind,year}$).

Allocation at the installation level within the industry sector for emissions from processes (non-combustion activities) was calculated as follows:

$$IA_{Ind,\ proc} = 3 \text{ x } IEN_{Ind,\ proc} \quad (11)$$

$IA_{Ind,proc}$: allocation at the installation level within the industry sector for process emissions;
$IEN_{Ind,proc}$: highest annual emissions from processes at the installation level in the period 1999-2003.

The main reasons why Slovenia has decided to use a different allocation method for each sector are following (MOPE, 2004):

- forecasted emissions in accordance with the national "OPGHG" at the installation level are controllable because they include only six installation sites and operators (the public companies Energetika Ljubljana and Toplotna Oskrba Maribor; Termoelektrarna Brestanica, Šoštanj, and Trbovlje; and Termoelektrarna-Toplarna Ljubljana);
- forecasted emissions at the industry sector level were done only at the sector level, but not at the installation level. This is why the allocation from the first paragraph cannot be used;
- production data for energy activities in the industry sector are reliable, whereas heat production data are not. A method needing both power and heat production data cannot be applied uniformly for this sector;
- the industrial sector is very heterogeneous. The IPPC[9] directive with its BAT standards is not suitable for all industry activities. Thus two methods were used. Due to differences between individual activities, a combination of grandfathering (based upon historical emissions) and the benchmarking method (based upon fulfilling BAT standards) was used.

The Slovenian NAP shall also consider termination of installations. If an installation is permanently put out of service during the year 2005 and 2007, the operator may retain and freely dispatch the allowances allocated for the calendar year in which the installation is terminated. Allowances allocated to the installation for the remaining years of the trading period will not be given to the operator, but will be transferred to the new entrants' reserve. All unused allowances (after February 28, 2007) will be sold at auction.

4.4.4 Allowances reserves for new entrants

Slovenia was also required to adopt the decision on the new entrants' reserve (NER). The Slovenian NER for the period 2005-2007 is estimated at 200 thousand tons CO_2 or 0.76% of the total allowances allocated to the installations. The largest amount of the allowances, allocated to the operator for new installation, is limited by 1/15 of the total new entrants' reserve; this is 13.3 thousand tons CO_2 per year.

[9] Integrated Pollution Prevention and Control.

There are three different approaches for determining the new entrants: a) a new installation; b) replacement of an existing installation with a new one; c) extension (reconstruction) of an existing installation.

The allocation formula for allowances arising from new entrants is as follows (UL RS 112/04):

a) $IA_{New\ entry} = 0{,}8 \times APE$ (12)

$IA_{New\ entry}$ – allowances allocation on the new installation level;
APE – forecasted emissions in accordance with BAT standards.

The factor 0.8 is used for two reasons. First, a 20% lower allocation shall act as an additional stimulus for operators in future emissions reduction. Second, the new entrants' reserve shall be accessible to a larger number of operators. This is important especially due to the fact that the reserve is smaller than the expected demand. The current situation shows that actual CO_2 emissions from new installations are going to be around 300,000 tons, but the ministry must also include the state target (-8%), therefore is not possible to include this quantity.

b) The operator retains all allowances from the replaced installation(s). The surplus of allowances can be considered a reward for emissions reduction.

c) The formula presented under approach a) can be used only for the extended (reconstructed) part of the installation(s).

The allowances from the new entrants' reserve will be allocated only to those installations that are fully in accordance with the BAT standards. When this is possible, the values from the BREF documents[10] are mandatory to be considered. Operator, who wishes to get the allowances from the NER, must prove that he uses the newest (up-to-date) technology available on the EU market (UL RS 53/05).

All unused allowances will be sold at auction after February 28, 2007. The Slovenian Environmental Protection Act (UL RS 41/04, Article 126) states that in the first period 2005-2007 at most 5%, and in the Kyoto period 2008-2012 at most 10%, of the total allocated allowances can be sold at auction.

4.5 Some remarks on the Slovenian national allocation plan

The accepted NAP has raised several questions about the suitability of the solutions that were emphasized during the establishment process by industry and energy representatives. The main questions are:

- The suitability of the chosen base year or period: companies had the possibility to choose between the years 1999 and 2002, by which the year with the highest emissions could be chosen. The primary question is why the possibility only extended until the year 2002. In the time when the NAP was established, data for the year 2003 would also have been available and a lot of companies had made many investments

[10] Reference Document on Best Available Techniques.

(precisely in the discussed period), that increased production and at the same time CO_2 emissions as well. Let us take one such example – TALUM ltd., Kidričevo - which deals with aluminum production. TALUM activated a lot of installations in 2003, which were the result of one of the biggest investments in the field of industry in Slovenia. All of these new installations utilize the latest technology, which has been proven to fulfill very strict BAT standards. It can be said that a company with investment growth contributes to higher economic growth at the state level, but on the other hand, the company did not get a chance to use higher reference emissions in the year 2003. From the company's point of view, we are dealing with the question of a rightful choice for a base year or period;

- The possibility of transferring the unused emissions allowances in the next trading period 2008-2012: most of the member states (including Slovenia) have not allowed the possibility of transferring emissions allowances in the next period 2008-2012. This means that all unused allowances by the end of the year 2007 must be sold, either on the market or through an auction. If the quantity of unused allowances were to be too big, some companies could be in worse position, because they would not be able to sell their allowances at attractive prices. But, if we consider data on emissions in 2003 and suppose that this situation remains unchanged until the end of 2007, then the data shows the following: despite the expected sales of the emissions allowances, especially by new EU member states, there is going to be a shortage of allowances, due to the higher quantity of demand. In Table 7 we present the emissions situation in the year 2003 and target emissions for both old and new EU member states. Data shown in Table 7 indicate that the old member states (EU-15) had higher emissions in the year 2003 compared to the target emissions for 2008-2012. These higher emissions are estimated at 272.59 million tons CO_2 equivalent. While the new member states (EU-10) had lower emissions in the year 2003 compared to the target emissions - lower emissions are estimated at 272.72 million tons CO_2 equivalent. It can be concluded that the demand (with unchanged conditions in the field of GHG emissions) exceeds supply by 136 thousand tons CO_2 equivalent.

Table 7 Greenhouse gas emissions in CO_2 equivalents and Kyoto Protocol targets for 2008-2012

	Base GHG emissions in million	Target GHG emissions	2003 GHG emissions
	(in million of tons CO_2 eq.)		
EU-15	4,253	3,907	4,180
EU-10	1,100	1,018	745
Total EU-25	5,352	4,925	4,925

Note: Cyprus and Malta do not have Kyoto targets

Source: Carbon Market Analyst (2005b) and EEA (2005)

- New entrants reserve: emissions allowances for covering CO_2 emissions due to activating new installations are included in the new entrants reserve. At first, the new entrants reserve in Slovenia was set at 300 thousand tons CO_2. The foundation for this quantity of reserve was data collected by installation operators. They were obliged to supply data on how many new installations they intended to activate in the period from 2005-2007 and what the emissions produced by these new installations would be. The government later reduced this reserve to 200 thousand tons CO_2 and thereby "cut down" the companies by 100 thousand tons CO_2. Reduction was necessary, in order to fulfill the state's target (-8%). The question that rises at this point is did the installation operators "over-blow" their own needs in the beginning.
- Allocation methods for emissions allowances: as we have already mentioned, Slovenia used a combination of two methods – grandfathering and benchmarking. The main reason for using these two methods was to ensure a correct as possible allocation of emissions allowances. Benchmarking is only used for the industry sector at the installation level, while it was not used for the energy sector. For this sector, only the projection of the emissions was considered (in accordance with the Operational Plan for GHG Emissions Reduction – UL RS 112/04). The consequence of such an unequal emissions allowances allocation is that the energy sector gained more emissions allowances than the industry sector, according to historical emissions. Representatives of the energy sector even negotiated with the government so that the initial emissions allowances allocation was increased by 739 thousand tons, while the industry did not reach any kind of increase in spite of the many complaints addressed to the Ministry of the Environment and Spatial Planning.

5 The Kyoto Protocol and its target costs

In accordance with EU guidelines for establishing the national allocation plan, the total potential for reducing GHG emissions should also be considered. The total potential for reducing GHG emissions is estimated to be 4.5 million thousand tons CO_2 equivalent in the period 2008-2012.

It has been estimated that 1.7 million tons CO_2 equivalent could come from the first group of contributors (e.g. switching from coal to natural gas with the liberalization of the energy markets, emissions standards, CO_2 tax, purchase of more efficient motor vehicles, etc., where specific annual reduction costs for GHG emissions are under 5 EUR/t CO_2 equivalent). It has been estimated that 2.5 million tons CO_2 equivalent could come from the second group (e.g. emissions trading instrument, regular control over exhaust gases, use of economic instruments in the transportation sector, thermal insulation of buildings and heating systems, use of renewable energy, containing HC/PFC and reducing use of these substances as coolants etc., where the specific annual reduction costs are between 5 and 20 EUR/t CO_2 equivalent). It has been estimated that 302 thousand tons CO_2 equivalent could come from the last three groups (301 thousand tons CO_2 equivalent for specific annual reduction costs between 20 and 100 EUR/t CO_2 equivalent; and thousand tons CO_2 eq. for specific annual reduction costs over 100 EUR/t CO_2 equivalent).

At this point in the paper, we should emphasize the fact that with a different range of estimation an uncertainty of the actual individual costs of measures has been given, as well as the inaccurate choices of these measures or instruments. Not only will the cheapest measure be used, but the combination of different measures as well.

Table 8 Movement of the Kyoto target emissions reduction costs

	Potential (in thousand tons CO_2 eq.)	Annual GHG emissions reduction costs (in EUR/t CO_2 equivalent)				
Total potential	4,506	<5	5-20	20-50	50-100	>100
1. Highest costs						
used potential	1,694	433	1,081	90	90	0
considered price in EUR/t CO_2 eq.		5	16	50	100	150
Average annual costs in millions of euros	33	2,17	17,30	4,50	9,00	0,00
2. Lowest costs						
used potential	1,694	1,219	446	29	0	0
considered price in EUR/t CO_2 eq.		5	16	50	100	150
Average annual costs in millions of euros	15	6.10	7.14	1.45	0	0

Source: Burja et al. (2004).

From Table 8 we can see that total costs for achieving the Kyoto targets are expected to be in the best case around 15 million euros per year, and in the worst case around 33 million euros per year. By this we have considered the price of the reduction potential in the second group at 16 EUR/t CO_2 equivalent. If we assume that the price is not 16 but 20 EUR/t CO_2 equivalent, this change would increase the Kyoto Protocol compliance costs to 16.5 and 37.3 million euros per year. In fact, actual costs will depend on the actual achieved GHG emissions reductions and on the market price of the allowances.

We can say that Kyoto targets can be achieved with relatively acceptable costs, and emissions trading in this case is one of the important economic instruments for achieving these targets. The actual potential for reduction, which meets the Kyoto targets, amounts to 1.7 million tons CO_2 equivalent (this is the difference between the target emissions of 19 million tons CO_2 equivalent and the actual forecasted emissions of 20.6 million tons CO_2 equivalent). Thus the potential in the first two groups should be enough for achieving the Kyoto targets (Burja et al, 2004).

Actual GHG emissions reduction will, of course, depend on the efficient implementation of the planned measures. The most important anticipated measures for individual sectors according to the expected reduction potential of the GHG emissions are shown in Table 9. A reduction potential in GHG emissions assumes specific annual reduction costs from 5 to 20 EUR/t CO_2 equivalent.

Table 9 Most important measures for reaching the Kyoto target in Slovenia and their reduction potential

Sector	Measure	Reduction potential (in thousand tons CO_2 eq.)
Energy	Switching from coal to natural gas, new small hydro and wind power stations	1,469
Industry and construction	Increasing the energy efficiency, co-generation, switching fuels with low carbon content	705
Transport	Higher energy efficiency of vehicles, higher importance of public transport	475
Other sectors (households)	Heat protection for buildings, efficient heating systems	399
Industrial processes	Adopting the IPPC directive, reducing the HFC/PFC as a cooling substance	260
Agriculture	Increasing the intensity of breeding, reduction of nitrogen fertilizers	61
Waste	Sanitation of existing, and building of new, garbage dumps in accordance with EU standards	126
TOTAL		3,495

Source: MOPE (2003)

The total potential for the reduction of GHG emissions, as seen in Table 9, amounts to 3.495 thousand tons CO_2 equivalent. This means that Slovenia could, with the realization of all the most important measures, exceed the required reduction of GHG emissions by 1.8 million tons CO_2 equivalent or 106%. Among the measures that would influence GHG emissions reduction on a small scale, are especially: the reduction of losses in the current system of distance heating (total reduction by 70 thousand tons CO_2 eq.), the use of renewable energy sources (wooden biomass – total reduction by 40 thousand tons CO_2 eq.), sustainable usage of space (total reduction by 65 thousand tons CO_2 eq.) and higher energy efficiency of installations in the commercial sector (total reduction by 99 thousand tons CO_2 eq.).

Two measures that are treated as the most expensive (their specific annual costs exceeds 20 EUR/t CO_2 equivalent) are: encouraging the construction of a Hydro power station chain on the river Sava (total reduction by 120 thousand tons CO_2 eq.) and the consumption of bio-fuels (total reduction by 106 thousand tons CO_2 eq.). We should not forget that the emissions trading instrument is only foreseen for the power sector, industry sector, and construction and industrial processes.

Among the instruments that Slovenia has already accepted or is in the process of accepting and that will help carry out the measures presented in Table 9, are the following:

an emissions trading instrument, liberalization of the natural gas and electricity market, a CO_2 tax, industry adoption of the ecological standards (e.g. IPPC directive until the year 2007), excises on fossil fuels and electricity, stimulations for combined heat and power production, stimulations for electricity production from renewable sources, the promotion of energy efficiency in the public sector, stimulations for consumers on the efficient use of energy, energy labeling of household appliances, energy certificates for buildings, informing consumers about motor vehicles' CO_2 emissions, stimulations for the consumption of bio-fuels, reduction of F-gases, specific agriculture policy measures and waste treatment. By analyzing the situation in the field of CO_2 emissions in Slovenia, we should not forget the importance of the transport sector, in which CO_2 emissions amount to 24% of total CO_2 emissions. At the moment, the instrument of emissions trading is not foreseen in this sector. Instead, three main measures are imagined: informing the consumers about a motor vehicle's CO_2 emissions, encouraging the use of bio fuels (direct payments from the government budget and exemption of the excise payment) and increasing public transport and expanding bicycle paths).

When we talk about the possible ways to reach the Kyoto target, we should also mention two other Kyoto mechanisms; this is the clean development mechanism (CDM) and joint implementation (JI). At the moment, Slovenia does not have the intention of using these two mechanisms, due to the government's opinion that they would cause too high of an administrative burden. Project mechanisms require very precise control and actual emissions reduction must be constantly proven, which on the other hand demands a long-lasting and very expensive procedure. Besides this, Slovenia does not have the appropriate available technology for such cooperation.

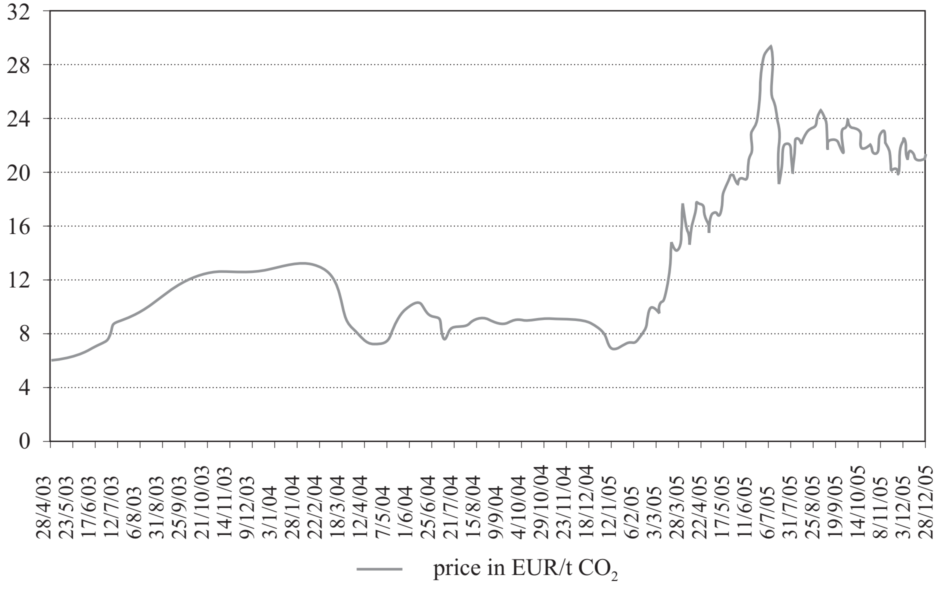
6 Trading with emissions allowances and determining their price

One of the most important aspects of the emissions trading scheme will definitely be change in the prices of the allowance. Nowadays it is very difficult to predict very precisely what the price of the allowances will be in the future, but for sure we can say, that they are influenced by the prices of oil, coal and electricity.

The European market for CO_2 emissions is working, but has not fully come to life. Europe has been dealing with emissions trading since April 2003. The last quarter of 2004 registered about 7.1 million tons of CO_2 trades on the emissions market. In the entire year, approximately 88.2 million euros worth of coupons were traded with the average price of 8.82 EUR/t CO_2 (Carbon Market Daily, 2005).

The bear trend was present on the emissions market in January and February 2005, when the price fell to under 7 EUR/t CO_2. The main reason for such a low price was the weather: a very mild winter resulted in reduced electrical energy and heat production, and in the end lower CO_2 emissions. A big turnover occurred in March 2005, when the price went mad and the bullish trend caused record allowance prices. The price of allowances increased in March 2005 by almost 50%, from 9.49 to 14.26 EUR/t CO_2. According to actual data for the 1st Quarter 2005, almost 27 million tons of CO_2 were traded, with an average price of around 9 EUR/t CO_2. In April 2005 the price exceeded the level of 17 EUR/t CO_2 several times. According to actual data for the 2nd Quarter 2005, almost 50 million ton of CO_2 were traded, with an average price of around 18 EUR/t CO_2.

Figure 5 Movements in the price of allowances for 2005 delivery



Source: Carbon Market Daily (2005) and Point Carbon Daily (2003-2005)

A surprised situation appeared on the market, when the magical level of 20 EUR/t CO_2 was exceeded and continued with daily rise on average of 0.50 EUR/t CO_2 until the middle of July. From the end of July and until the end of September the price did not move much, it has stayed almost at the same level, between 20 and 23 EUR/t CO_2. More changes happened in the traded quantities, which have risen in the 3rd Quarter 2005 to almost 100 million tons of CO_2 (4th Quarter exceeded this limit), mainly due to the quantities traded on the exchange markets and wider OTC market of the emissions allowances. An average price in the 3rd Quarter 2005 was calculated at 23.21 EUR/t CO_2 and in the 4th Quarter 2005 at 21.76 EUR/t CO_2. Total average price for the year 2005 was calculated at 18.19 EUR/t CO_2. The comparison of the average price between 4th Quarter 2005 and whole year 2005 shows, that the latter is smaller due to low prices at the beginning of the year 2005.

It is very interesting to observe how emissions trading on European markets is gradually developing. We already mentioned that trading started in the year 2003, although with minimum quantities. In 2004 the quantities rose by about 32 times. Predictions for the year 2005 are for an increase of about 26 times of trading quantities (Table 10).

Movements in the price of allowances from 2003 to 2005 are illustrated in Figure 5. Key parameters or factors that have caused situation on the emissions market are: temperature changes, an allowances deficit on the agent side, and the Commission's decision about the Czech and Polish NAPs. The Commission decided that these two countries must reduce the allocation if they want their NAPs to be approved. On the other side, we have a bullish trend on the oil market, where the price of the Brent barrel exceeded 65 USD/barrel.

Table 10 Development of the EU emissions trading scheme

Year	Quarter	Quantity (inthousand tons)	Index Qt/Qt-1
Total 2003	Q2 – Q4	302	–
2004	Q1	181	–
	Q2	437	241
	Q3	1,970	451
	Q4	7,065	359
Total 2004		9,653	
Forecast 2005	Q1	24,000	340
	Q2	52,500	219
	Q3	72,000	137
	Q4	105,000	146
Total forecast 2005		253,500	
Actual 2005	Q1	26,646	–
	Q2	49,154	184
	Q3	98,141	200
	Q4	117,723	112
Total 2005		291,664	115

Source: Carbon Market Analyst (2005a; 2005b); Carbon Market Daily (2003-2005).

Past experiences with price movements on the emissions market are very diverse. In the future the supply of allowances will be fixed, and restrictions are on the national allocation plans. Demand will depend on the production of CO_2 emissions on the companies' side. In general, the production of CO_2 emissions depends on weather conditions (temperatures, rain and wind speed), oil prices, fuel prices, carbon prices, and economic growth. Among the many factors, weather conditions have a double effect: first, low temperatures increase energy consumption and with this CO_2 emissions, through increased electricity and heat production. Second, rain and wind speed have an impact on electricity production from clean sources, and with this on the emissions level. Thus weather conditions are a very important element that will definitely influence the creation of the allowances price, and which was clearly illustrated on the emissions market in January 2005.

6.1 Expected movements on the emissions allowance market in Slovenia

The biggest CO_2 emissions producers in Slovenia are thermal power stations (in the year 2002, thermal power-stations and heating stations produced 6.4 million tons CO_2 equivalent of GHG emissions, which amounted to almost 40% of total GHG emissions produced in the power generating sector, and more than 30% of total GHG emissions. The number did not change in 2003 for the share in the power sector, but has risen to the

31% of total GHG emissions). The situation described above is also reflected in the national allocation plan**.**

From Table 11 we can conclude that only two power-stations – Šoštanj (the biggest Slovenian power station) and Trbovlje – will get 59.13% of the total allocated allowances for the period 2005-2007. The total allocation is 26.3 million allowances. Meanwhile, the share of the allocated allowances for the power-generating sector is 70%, and for the industry sector just 30%, of total allocations. Thus it can be concluded that Slovenian thermal power stations have the potential for GHG emissions reduction. How? With the investments into changing the fuel consumption from coal to gas. As we know we still have some stations or parts of them, that are using coal as a fuel and therefore this can be changed to gas.

Table 11 shows the allocation of allowances for some thermal power stations and some companies participating in the EU emissions trading scheme.

Table 11 Number of allocated allowances of some selected Slovenian companies and thermal power stations in the period 2005-2007

Installation operator	Sector	2005	2006	2007	Total
Termoelektrarna Šoštanj	power	4,740	4,465	4,190	13,396
TE-toplarna Ljubljana	power	836	803	770	2,409
TE Trbovlje	power	743	714	684	2,141
Salonit Anhovo - cement	industry	487	479	470	1,436
Lafrage cement	industry	314	308	302	924
Vipap Videm Krško	industry	262	248	235	744
Slovenske Železarne – Acroni	industry	87	84	80	251
TE Brestanica	power	86	83	79	249
Količevo Karton	industry	74	70	66	210
Nafta - Petrochem	industry	66	63	59	189
JP Energetika Ljubljana	power	49	47	45	141
JP Toplotna Oskrba Maribor	power	33	32	31	96
Total allowances in thuosand tons		7,778	7,395	7,012	22,185
Share of total allowances, in %		84.50	84.40	84.40	84.43

Source: UL RS (112/04; 131/04).

However, power stations are the ones that do not see a lot of possibilities for the reduction of GHG emissions in the coming years. The first problem is coal, which is used by thermal power plants. Coal is one of the biggest burdens for the environment, especially when it is used in old power plants. Slovenian coal, which is used by power plants, is of very low quality and low energy value. On the other hand, high-quality coal, which could be imported from abroad, is not suitable for use in old (out-of-date) boilers. If some technological movements will be made in the energy sector, the allocated quantity of allowances would also assure an adequate volume of production.

In the present situation, we are dealing with the question of whether the purchase of missing allowances will still enable competitive electricity production in thermal power stations. The question is very convenient because the Slovenian electro-energy balance for the year 2005 anticipates from two to three percent growth in final energy consumption. This means higher production and consequently higher GHG emissions. Due to everything aforementioned, thermal power stations will not be sellers of allowances.

In comparison to power stations, industry has very limited and narrow room to move. In cement, pulp and paper, lime, and glass factories, emissions depend on the quantity of production. Coal has been nearly replaced in industry by other energy sources (e.g. gas), and some improvements have been made. Some industry has been destroyed due to the transition process. Revenue from selling allowances is not enough for investment in technical improvements, energy co-generation, or switching to renewable energy.

If we want to estimate how many missing emissions allowances the companies that are participating in the emissions trading scheme will have to buy, if they do not manage to reduce CO_2 emissions in another way, problems arise. OPGHG does not consider the impact of each individual instrument (e.g. precise GHG emissions reduction in tons), but it analyzes the total impacts of all possible instruments on the movement of GHG emissions. The impact of the emissions trading instrument is thus included among the impacts of other measures. Therefore, we will try to estimate the potential missing emissions allowances from the available and accessible data. Total CO_2 emissions for the period 2005-2007 are estimated at around 47.2 million tons CO_2, this means around 15.7 million tons CO_2 per year. In comparison, the CO_2 emissions for the year 2003 were calculated at 16.1 million tons. The total quantity of the allocated emissions allowances for the period 2005-2007 amounts to 26.3 million, which represents a 56% share of planned emissions in the period 2005-2007 and a 54% share of total emissions in the year 2003. If we anticipate that the situation will remain the same and that the planned annual CO_2 emissions for the electricity and heat-production sector are estimated at 6.1 million thousand tons CO_2 and that the quantity of the allocated allowances for the year 2007 is 5.8 million, this would mean, that this sector is going to have a shortage of emissions allowances in the amount of 288.784 - and it should buy them in the future. But if we also include the shortage of emissions allowances in the industry sector, then the total annually missing allowances would be at around 500 thousand tons CO_2, as is likewise foreseen in OPGHG.

In the year 2005 and 2006, the energy sector will probably not be a net buyer of allowances, while the situation is different in the industry sector. According to available information, which originates from industry representatives, the industry will face a shortage of allowances already in the year 2005. But it is very difficult to estimate to what extent the industry is going to be a net buyer of allowances, because no publicly accessible data is available. Partly, the results from the questionnaire executed in July 2005 could be of great assistance. Sixty-four percent of all participating companies in the emissions trading scheme have responded to the previously mentioned questionnaire. The most important results of the survey are as follows (Murks, 2005):

- 78% of inquired companies will actively participate in the emissions allowances market;
- 42% of inquired companies will be forced to buy emissions allowances, according to production volume;
- 39% of inquired companies will participate in the emissions allowances market already in the year 2005, 32% will be active in the following years;
- 64% of inquired companies are satisfied with the emissions allowances allocation procedure, 28% are not satisfied (it should be mentioned, that a lot of representatives from the energy sector took part and that they have achieved very favorable allowance allocations for the years 2005 and 2006);
- opinions regarding the usefulness, efficiency and effectiveness of the emissions trading scheme are very diverse: 1/3 had a positive opinion, 1/3 had a negative opinion and 1/3 had no opinion..

In the future, the Slovenian market for emissions allowances will share the movements of the European emissions allowances market, because its share is 0.4% of the total allocated allowances in all the member states of the EU25. Such a small market cannot operate successfully and efficiently, which means, that it should be a part of the larger market. It is estimated that Slovenian companies will mostly trade with companies from the Czech Republic, Slovakia, Hungary and Poland. As we have already mentioned, the traded quantity of the emissions allowances in Slovenia will be between 300 thousand and 500 thousand tons CO_2 per year, depending on the measures that will be used by individual companies within the OPGHG. According to this, the final costs of reaching the Kyoto target will depend on the effectiveness of the chosen measures and movements on the emissions allowances market.

7 Conclusion

Protection and awareness of a cleaner environment is becoming one of the most important considerations, especially in developed countries. In light of protecting the environment, the Kyoto Protocol represents a special turning point. Slovenia ratified the Kyoto Protocol in the year 2002 and agreed to reduce GHG emissions by 8% in the period 2008-2012 relative to the base year 1986. Slovenia already started with the implementation of the economic instrument for reducing GHG emissions in the year 1997, when the CO_2 tax was established and it became the first of the transition countries to implement this instrument. Although this tax was not implemented for reducing CO_2 emissions in the first place (very low prices and payment exemptions for many main polluters), but rather for additionally supplementing the state budget because of a reduction in other budgetary revenues (lower social insurance contribution, which are paid for by employers). The CO_2 tax went through several changes, the last one was in the year 2005, when the emissions trading instrument was adopted in Slovenia. There was a threefold increase in the CO_2 tax and this new level could have had much more influence on polluters' behavior and CO_2 emissions reduction, if the country did not introduce a permit for the tax-free use of fuels. The main reason for this was pressure from industrial producers with a high share of fuel costs in total value added. A threefold increase of the CO_2 tax, without the introduction of special permits, could also contribute to higher budgetary revenues from a tax source. But, on the contrary, CO_2 tax revenues have been lower from the year 2000 onward. The CO_2 tax can be also blamed for the fact that tax revenues have not been used for CO_2 emissions reduction projects.

In the year 2005, Slovenia has, as other EU member states, implemented another economic instrument for reducing GHG emissions: the emissions trading scheme. In accordance with the EU emissions trading scheme, Slovenia established a national allocation plan (NAP). Slovenia has used two different methods for the allocation of allowances, separated between two sectors – the power generation sector and the industry sector. Allocation at the sector level is calculated taking into account the sector emission reduction factor, which is based on each sector's Kyoto emissions reduction target. The factor for the power generation sector is 0.894 (or 10.6% reduction), and for the industry sector 0.958 (or 4.2% reduction). Besides the grandfathering method (the highest emissions between 1999-2002), the benchmarking method was also used. Benchmarking was based on the BAT values for the power generation sector and the industry sector. BAT values were included according to the installation's efficiency. More efficient installations received a higher quantity of allowances, while less efficient installations received fewer allowances.

A comparison of the Slovenian NAP with the NAPs of other EU member states shows the following: Slovenia has used a similar combination of two methods as most other EU member states, this is grandfathering and benchmarking; by choosing the base allocation year or period, Slovenia does not deviate from other countries; transferring the emissions allowances to the next trading period 2008-2012 is not allowed in most EU countries, also in Slovenia; new entrants reserves show a different picture, because their percentages are very different among individual countries.

Naturally, a question that arises is: are Slovenian solutions optimal, especially from the Kyoto target compliance costs and rightful allocation point of view and so on? Some remarks were given from the industry and energy side. These remarks were connected with the choice of the base year or period (companies had the possibility to choose between 1999 and 2002, although at that time, when the NAP was being prepared, emissions for the year 2003 were already known). If emissions in the year 2003 were also included, this would have meant a better position for some of the participants. The government also reduced the initially set new entrant reserve from 300 to 200 thousand tons CO_2 (this data was collected directly from the installation operators, according to the activation of new installations and their planned emissions) and therefore the operators fell short by 100 thousand tons CO_2. Although the country wanted the most correct emissions allowances allocation, some deviations from the principle can be seen. This deviation is present between the industry sector and the power generation sector. Benchmarking has been used only for the industry sector, while for the power sector only emissions projections in accordance with the OPGHG were used. Representatives of the power generation sectors have been successful in their negotiations with the government, meanwhile the industry has not been successful in any claim.

Slovenia has decided not to use two other flexible mechanisms; that is Joint Implementation and the Clean Development Mechanism. The main reason, given by the government, was the high administrative burden, beside this Slovenia did not have the appropriate available technology. Besides the emissions trading instrument and CO_2 tax, Slovenia is going to use (or is already using) other instruments (measures) that will more or less reduce GHG emissions. A special problem in all of this is the transportation sector, which has a 24% share in total CO_2 emissions. At the moment, transport is not included in the emissions trading scheme, but increasing the energy efficiency of vehicles and giving a major role to public transport could reduce emissions in this sector.

What the Kyoto Protocol compliance costs will be in Slovenia at the end will depend on the efficiency of the already implemented and planned measures or instruments for reducing the emissions, as well as on the emissions allowances price. Present price is around 23.50 EUR/t CO_2, mainly because of the exceeded demand, while it was in January and February around 7 EUR/t CO_2. Such extreme movement means high uncertainty for the potential buyers of the emissions allowances and higher risk on the emissions market. To what degree the participating companies will need to buy the missing emissions allowance, if they do not manage to reduce the required CO_2 emissions, is very difficult to predict. The estimated quantity is around 500 thousand tons CO_2 per year.

The Kyoto Protocol compliance costs in Slovenia were estimated between 15 million euros per year (in the best case) and 33 million euros per year (in the worst case). Actual movements can also mean a deviation from the included presumptions; therefore the final outcome could be less favorable than the expected one. A change in the price of the reduction potential in the second group (annual GHG emissions reduction costs are between 5 and 20 EUR/t CO_2 eq.) from 16 to 20 EUR/t CO_2 equivalent (see Table 8) would increase the Kyoto Protocol compliance costs to 16.47 and 37.29 million euros per year.

The fact is that the process of reducing GHG emissions will demand a different approach from the approaches used to solve other environmental problems. GHG emissions are connected with much more dispersed sources of direct and indirect emissions, therefore their future reduction will depend on a wide range of decisions of economic agents. The government could affect those decisions through a wide spectrum of available instruments: economic instruments (taxes, price regulations, financial incentives, tax exemptions, emissions allowances), decisions about managing public property and performing public services (e.g. decisions about energy activities, energy-efficient consumption in public buildings and so forth), legal regulations (technical and ecological standards, operation conditions, legal and institutional framework for efficient markets, etc.), indirect stimulating activities (promotional projects, information campaigns, advise services etc.), R&D and other instruments. We must say that we are dealing with a very complex task, but we cannot just take into account the costs criteria, but also the following criteria: enabling international competitiveness of the economy, adjustments to financial possibilities, enabling reliable energy, food and other strategic goods supply, social justice and acceptability, increasing employment, adaptability and the long-run sustainability of accepted decisions. Only time will show what price we will have to pay for the accepted targets.

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