



British Embassy
Warsaw



Demonstrative Report
on
the "Evaluation of the Implementation Effects
of Directive 2009/29/EC on Poland up to 2020"
with the use of elements of the British Impact
Assessment methodology

The Report has been prepared on the basis of an expert analysis by Badania Systemowe "EnergSys" Sp. z o.o. as a part of the Strategic Programme Fund Low Carbon High Growth project "Impact Assessment for Poland of the EU ETS Directive". The scope of the Report is limited to the EU ETS Directive. It does not cover broader policy issues.

Warsaw, October 2009

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1. Introduction

This Report presents the impact assessment of the implementation of Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ No L275, 25.10.2003, p. 32) hereinafter referred to as the “EU ETS Directive” within the scope amended by Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (OJ No L140, 5.6.2009, p. 63), hereinafter referred to as “Directive 2009/29/EC”.

The analysis covers the time-period up to 2020.

This report has a demonstrative nature only. To a great extent it is based on the British Impact Assessment methodology. However, the main disparity regards the way of calculating the benefits of CO₂ reductions. The scope of the report is limited to the EU ETS Directive. It does not cover broader policy issues.

The report has been prepared on the basis of an expert analysis by Badania Systemowe “EnergSys” Sp. z o.o. under a Project on Impact Assessment for Poland of the EU ETS Directive. The Project is being implemented by the Office of the Committee for European Integration (UKIE) in cooperation with the British Department of Energy and Climate Change (DECC), the British Embassy and a foundation demosEUROPA – European Strategy Centre (Polish: demosEuropa – Centrum Strategii Europejskiej). It is financed out of a grant from the Strategic Programme Fund Low Carbon High Growth¹, which is the Foreign and Commonwealth Office (FCO) programme promoting a low carbon, high growth, global economy.

2. Description of amendments to the EU ETS Directive

Directive 2009/29/EC has introduced the following substantial changes to the scheme for greenhouse gas emission allowance trading within the Community (Emission Trading Scheme [ETS]):

- **A change in the basic task of the ETS:**

¹<http://ukinpoland.fco.gov.uk/en/working-with-poland/climatechange/fundingopportunities/startegicfund>

The system changes from the tool for the economization of greenhouse gas emission reduction ("promotion of the reduction of greenhouse gases in a profitable and efficient way") into a self-existing tool for the establishment of emission reduction tasks ("it also provides an increase in the greenhouse gas emission reduction level..."). The tasks of the climate policy are to be implemented by introducing an annual linear decrease in the allowances pool within the Community;

- **A change in the principles of the establishment and role of national allocation plans** at national and unit levels (allocation of allowances to installations):

Previously the allocation of allowances to the EU Member States and installations was made on the basis of projected reasonable emission needs of the national sector of ETS being compared with the country's commitments to reduce GHG emissions in accordance with the Kyoto protocol; a national allocation plan was formulated irrespective of analogical national allocation plans in other countries, and installations were given allowances free of charge on the basis of the National Allocation Plan.

In accordance with the new legal act, the allocation of allowances to an EU Member State will depend on the Community-wide quantity of allowances, and the allocation of allowances to an installation in a given country will depend on the adopted volume of free-of-charge allowances. Transitional free allocation of allowances for the generation of electricity in an EU Member State on the basis of conditional derogations will be made out of the national pool of allowances to be auctioned and will diminish the emission allowances auctioning revenues of the EU Member State's budget. Also the new legal act introduces a number of new criteria for free allocation to installations that differ by sectors (no concrete principles of the allocation have been determined yet)².

- **Changes in the range of installations covered by the EU ETS:**

The ETS has covered the following:

- new types of installations in the metallurgical, mineral and chemical industries;
- greenhouse gas capture, transport and storage installations;

² Generally, the quantities will gradually decrease in subsequent years from 80 per cent in 2013 to 30 per cent in 2020 provided that:

- There will be no allocations of free-of-charge allowances for electricity generation taking into account the derogation allowing for conditional and transitional allocation of free-of-charge emission allowances for electricity generation in the industrial energy sector (partial and gradually decreased from 70 per cent in 2013 to 0 per cent in 2020);
- The basis for the free-of-charge allocation of 100 per cent of emission allowances is that certain sectors are considered as sensitive to the carbon leakage problem in accordance with the criteria laid down in the Directive (the qualification of sectors can change during the calculation period).

- selected branches of non-ferrous metallurgy (production of primary aluminium) and chemical industry emitting greenhouse gases other than CO₂;
- non-stationary greenhouse gas emission sources;
- the air transport sector.

The exemption has been introduced from the principle of aggregation of installations of thermal capacity below 3 MW for the purpose of including them into the ETS. In addition to the above, quantitative criteria have been specified, including an increase in the capacity threshold for small-sized installations which can be temporarily exempted from the ETS.

Additionally, such provisions have been introduced that will make it possible to reduce emission allocations for installations in the case of a significant reduction of their production capacities.

The above changes should bring about the reduction of emissions by increasing the costs of emissions for installations which will result from the following:

- The introduction of a determined *ex-ante* principle of decreasing an admissible level of emissions in subsequent years which is the total pool of emission allowances for the whole Community in the EU ETS which will be an incentive to increase the emission prices in the market;
- The decrease in allocations to EU Member States, and as a consequence, to the country's installations together with the reduction of free-of-charge allowances including a lack or substantial reduction of free-of-charge allowances for electricity generation that will mean a need to incur costs for a growing part of GHG emissions (not only for the excess of emissions over the justified plan adopted under the National Allocation Plan)^{3,4};
- The transfer of certain branches from the non-ETS to the ETS will mean the introduction of financial restrictions related to GHG emissions because:
 - the non-ETS is covered by an admissible 14-per-cent emission growth for Poland in the time-period 2005-2020 and it is not an obligation to reduce emissions,

³ In the case of the Polish energy sector, another incentive strengthening the impact will be a preferred principle of allocation on the basis of product factors, in accordance with the requirement stating that the way of allocation should be an incentive to use energy-saving and low-emission technologies.

⁴ Changes imposed by Directive 2009/29/EC will concern also the introduction of a wider possibility to balance emissions by using CER and ERU units from projects under the EU-system which, in accordance with model calculations, should slightly decrease the average price for CO₂.

- installations operating in the sector have not been imposed with an obligation to balance the emissions with possessed allowances and to additionally purchase more allowances in the case of the allowances deficit in comparison with their own GHG emissions;
- The specification of permanent or temporary exclusion of low-emission installations from the ETS means their transfer to the non-ETS and thus diminishes a restrictive (cost-related) impact of incentives to reduce emissions; however, in the case of temporary exclusions the impact will be minimised by an obligation to cover such installations with equivalent instruments of a GHG emissions reduction policy.

The national pool of allowances decreased by the allowances given free-of-charge to the country's installations can be auctioned and thus become a source of additional financial revenues of the EU Member State budget⁵ which are to balance the effects of an increase in costs incurred by enterprises due to the internalization of GHG emission costs to the whole country's economy. Simultaneously, Directive 2009/29/CE provides that at least 50 per cent of the revenues will be spent on selected energy and environment-related purposes as well as administrative ones connected with the functioning of the EU ETS.

The changes introduced by Directive 2009/29/EC will come into force as of 2013.

3. Methodology of the legal act's impact assessment

The description standards used in this analysis come from the "*Greenhouse Gas Policy Evaluation and Appraisal in Government Departments*" prepared by the inter-departmental analysts group (IAG) of the Government of the United Kingdom. Those elements of the British methodology have been applied in this analysis which can be used in the work of the Polish governmental administration sector.

The new legal act's impact assessment has been made for the variant based on the provisions of Directive 2009/29/EC (**an ETS-Auctioning scenario**) in relation to a comparative scenario based on the assumption that the emission allowances trading scheme will continue in the years 2013-2020 following the same principles as today (**an ETS-Continuation scenario**).

⁵ The term „auctioning of allowances” is used in relation to the governments of the EU Member States. The term concerns the auctioning of this part of the country's allowances which will not be allocated free-of-charge.

The methodology used for this impact assessment is based on an analysis of social and economic consequences as well as of the analysed problem's impact on Poland's energy sector and the natural environment on the basis of prognoses (in the fixed time-horizon) of:

1. the macroeconomic development;
2. the demand for fuels and energy;
3. the generating capacities of the National Energy System and related investments and costs;
4. CO₂, SO₂, and NO_x emissions from the energy system and other branches of the economy.

The new legal acts's impact assessment has been based on the following assumptions:

Table 3.1. Framework assumptions in the analysed scenarios

Assumptions	ETS-Continuation scenario	ETS-Auctioning scenario
Macro assumptions	Changes in the structure and level of GNP as well as in the structure and level of trade exchange caused by the achievement of objectives included in the ETS Directive in comparison with the assumptions of the Reference Scenario (the result of the analysis)	Changes in the structure and level of GNP as well as in the structure and level of trade exchange caused by the achievement of objectives included in the ETS Directive in comparison with the assumptions of the Reference Scenario (the result of the analysis)
National Emission System limitations	Capacity withdrawal programme, new determined capacity, transmission infrastructure limitations	As in the ETS-Continuation Scenario
Energy and climate package objectives	Achievement of the objective of a 15-per cent share of renewable energy sources in the energy balance (including a 10-per cent share of biofuels)	As in the ETS-Continuation Scenario
	Use of a real potential of the economy's energy consumption growth at a 20-per cent level as a minimum	As in the ETS-Continuation Scenario
	CO ₂ emission reduction – the fulfillment of the Kyoto Protocol obligations ⁶ , allocation of free-of-charge allowances for CO ₂ emissions to installations at the same level as in the calculating period of 2008-2012, the price for CO ₂ will be about EUR 22/tonne in 2020.	Objectives in the area of the ETS (national allocation, allocation of allowances and share of free-of-charge allowances to installations in accordance with Directive 2009/29/EC, price for CO ₂ will be about EUR 39/tonne in 2020.
	The range of the EU ETS is in	As in the ETS-Continuation Scenario

⁶ The Kyoto Protocol to the Framework Convention of United Nations on Climate Change made in Kyoto on 11 December 1997 (Journal of Laws of 2005, No. 203, item 1684).

	accordance with Directive 2003/87/EC	
	Admissible increase in CO ₂ emissions by 14 per cent in comparison with the 2005 emissions	As in the ETS-Continuation Scenario
NO _x and SO ₂ emission standards	In accordance with the current LCP Directive including derogations. More rigid obligations concerning No _x as of 2016 and new standards of the IPCC Directive after 2020	As in the ETS-Continuation Scenario

A prognostic set consisting of the following three models has been used for the development of the prognoses of:

- a macroeconomic model of general balance (CGE-PL);
- a model of prognosing the demand for energy PROSK-E;
- an optimization model of the whole energy system of Poland EFOM-PL.

To estimate the costs and benefits of the implementation of the new ETS Directive, the 2005 prices have been used and to value NPV, a discount rate of 3.5 per cent has been applied in accordance with the British recommendations⁷.

For the needs of this impact assessment an assumption has been adopted according to which the Polish energy sector meets the requirements specified in Article 10c of Directive 2009/29/EC that will make it fully use a limit quantity of free-of-charge CO₂ emission allowances for electricity producers in the years 2013-2020. An assumption has been adopted that there will be a linear decrease in the use of free-of-charge allowances: from 70 per cent in 2013 to 0 per cent in 2020.

The prognoses of economic development and a final demand for energy prepared under the above calculating scenarios have been based on the following assumptions:

Table 3.2. Expected external conditions of the economic development of Poland up to 2020 divided into subperiods

Group of conditions	2009-2015	2016-2020
Macro		
- Economy	Economic recession in developed countries and the then Soviet Union republics The demand growth dynamics in the	Accelerating of globalization processes Boosting of market circumstances in developed countries

⁷ A discount rate of such value is not used in business applications

Group of conditions	2009-2015	2016-2020
	world-wide economy is supported by the development in China and India	Slowing-down of economic development dynamics in China and India Accelerating of the development of Thailand, Philippines, Vietnam and other countries in Oceania ⁸
- Crude oil prices	Crude oil prices stabilization Attempts of OPEC to boost an increase in prices through supply limitations	Accelerating of increase in crude oil prices
Poland in the EU		
- EU budget	The 2007-2013 financial perspective is about to be over In the new perspective the energy sector has a greater priority (RES and pro-saving investments) Poland maintains a significant positive net balance of budget transfers	Continuation of processes started at the end of the previous sub-period
- Currency integration	Due to an increase in the budget deficit caused by an economic slow-down, Poland's joining the ERM II will postpone up to 2012-2013	At the end of the period Poland will enter the EUR zone which will result in a slow-down of the pace of economic development for a short time-period
Energy policy		
- Policy of supporting more efficient energy use	Introduction of new initiatives under the policy	Monitoring of objectives and modification of tools supporting an improved consumption of energy in EU Member States

In accordance with the adopted assumptions, the present world-wide economic downturn will seriously slow down Poland's GNP development pace. The main reasons for the assumptions are: a significant economic potential of the country, well-educated (currently young) society, still low labour costs, and in the nearest future, a steady inflow of capital from EU structural funds for the modernization and development of the existing infrastructure.

Poland will experience a period of continuous economic growth of a changing development ratio as well as considerable structural changes. The main change will consist in a decrease in the share of industry sectors connected with the stabilization or even a decrease in energy-consuming branches of industry and a significant increase in commercial services while creating the added value.

⁸ In accordance with the International Energy Agency (*World Energy Outlook 2008*).

4. Summary of the results of the analysis

A general impact assessment of the introduction of Directive 2009/29/EC expressed by NPV for 2013-2020 is negative and varies **from PLN -46.7 billion to PLN -41.4 billion** taking into account the purchase value of 2005 if it is to be compared with the ETS-Continuation scenario.

4.1. Impact assessment on the energy system of Poland

Assuming that, in accordance with the comparative scenario, the trading scheme will continue in its present form (the ETS-Continuation scenario), the new legal act will affect only the costs of heat and energy production in Poland in the analysed time-period. The assumptions concerning the pricing of emission allowances are crucial as it comes to the volume of the impact. Up to 2020 both the fuel structure of the energy sector and the scope of modernization of the generating infrastructure will be almost identical in both scenarios. The effect of the limitation of national demand for electricity is little.

The detailed data concerning the impact of the new legal act on the energy system of Poland are presented in Section 6.3.

4.2 Impact assessment on the economy

Directive 2009/29/EC will have a negative impact on the Polish economy as a whole as it will cause a slow-down in the economic development pace. Indeed, higher prices for heat and electricity will diminish the attractiveness of the Polish export not only in the industry sectors participating in the CO₂ emission allowances trading scheme but also in other branches of the economy. An equally important factor slowing down the economic development is the reduction of the national demand. The data showing the impact assessment on GNP are presented in Section 6.2.

The Directive will generate substantial budget revenues over the whole time-period but its provisions point out, however, the directions of spending 50 per cent of the revenues on fixed purposes. The analysis assumes that all the budget revenues will be spent out of which 50 per cent will be allocated to companies and another 50 per cent will go to households. In the model assessment the assumption lessened a negative impact of Directive 2009/29/EC on the economy leaving almost a "zero" impact of the legal act on the budget. Budget losses caused by smaller tax revenues connected with lower GNP have been evaluated. In

accordance with the method followed, the results of the estimates show that the legal act has little impact on the finances of the state. The data concerning the public finance sector are included in Section 6.4.

Model simulations did not show any big impact of Directive 2009/29/EC on the employment in Poland. Although little, the impact is negative. In real-life economic processes, a slow-down in the development of certain industrial branches can be connected with the closing-down of the least effective industrial plants and with some painful group dismissals at a local level. The analysis regards the Directive impact by regions in Section 6.9. The results concerning the employment in Poland are presented in Section 6.5.

The impact of Directive 2009/29/EC on the change in the Polish export structure and on the general competitiveness of the Polish economy is presented in Section 6.6. Relatively, the biggest impact on the export level has been valued for the following branches of industry participating in the CO₂ emission allowance trading scheme: papermaking, mineral and metallurgical industries. However, changes in the export in all the branches of the economy badly affect the foreign trade balance of Poland; particularly important are changes in the export of commercial services and machine industry products

4.3. Impact assessment on households

The impact assessment of Directive 2009/29/EC on the living standard of households in Poland is presented in Section 6.7, and the method followed for the calculations as well as its basic assumptions are included in Section 8.7.

It is worth mentioning here that the implementation of the EU climate policy combined with new object emission standards in the energy sector and an increase in the world prices for fuel will result in an increase in Polish households' expenditures on energy even if the emission allowances trading scheme is not continued. The Directive only intensifies the already existing tendencies. In accordance with the estimates, the average expenditures of Polish households on fuels and energy in 2020 can account for 20 per cent of home budgets, including the expenditures on heating of 7.5 per cent. Particularly alarming is a high share of expenditures on heating which means that a substantial number of households can join a group of "energy poverty" ones in accordance with the British standards.

4.4. Impact assessment on the natural environment

The impact assessment of Directive 2009/29/EC regards two basic air pollutants emitted into the air in the process of the combustion of fossil fuels such as sulfur dioxide (SO₂) and nitric oxides (NO_x). The analysis shows that the impact is so little that it can be neglected in the assessment of benefits connected with the Directive. The data are presented in Section 6.8.

4.5. Impact assessment on the situation and development of regions

The assessment of the spread of revenues (costs) by regions due to the implementation of Directive 2009/29/EC is presented in Section 6.9, and the set of statistical data used to evaluate the spread is included in Section 8.8. The impact assessment has been made for two major elements: the employment and GNP generated in the region. The analysis shows that the negative effects of the Directive implementation will be more visible in the southern, northern and south-western regions of Poland as well as in the Świętokrzyskie Voivodeship.

5. Summary of the legal act's impact assessment

Summary: Interventions and Options		
Authority: <i>(Name of the Authority making the impact assessment of a legal act)</i>	Title: Report on the Impact Assessment of Directive 2009/29/EC on Poland up to 2020	
Status: <i>(to be consulted)</i>	Version: <i>(No of version)</i>	Date: <i>(dd-mm-yyyy)</i>
Related publications: <i>(documents connected with a report on the impact assessment of a legal act such as a Directive)</i>		

Available for reading or downloading: *(place where it has been made available for reading or a website)*

Contact with the authors: *(First name and family name of the author)* **Phone Number:** *(...)*

What sort of problem do we face? Why is the governmental intervention necessary?

The new Directive extends the duration of the EU ETS of CO₂ emission allowances beyond the time-period of Poland's obligations resulting from the Kyoto Protocol. The Polish energy sector combusting mainly coal faces a significant increase in energy generation costs which will bring about serious changes for the whole economy, particularly for energy-consuming industrial production and poor households. The provisions of the Directive require the redistribution of substantial funds via the budget or a governmental agency. Additionally, the government should consider a possibility of providing social welfare to households and the protection of jobs in endangered industrial plants.

What are the objectives and expected results of the adopted policy?

The Directive is a part of the energy and climate package which shall achieve the objective set by the European Council in March 2007, i.e. the reduction of GHG emissions in the EU Member States by 20 per cent below the 1990 emission level. The greenhouse gas emission allowances trading scheme is to minimise (in Europe) the costs of the achievement of the objective with regard to selected production processes. The effects of the whole European climate policy in the form of "a lack of dramatic climate change all over the world" will be experienced in the distant future (100 years ahead and later) and are not possible to achieve if the European initiative is not shared by other countries. Additionally, European companies shall become more competitive thanks to the development of greenhouse gas emission reduction methods.

What options of political actions were considered? Please justify each chosen option.

Only one option of political actions was considered. The Directive should be implemented in such a way so as the costs to be incurred by Poland will be as little as possible.

The assessment was made for two reference levels. The first one [a] means there is no new ETS Directive and therefore the EU ETS for CO₂ emission allowances will be over in 2012. The other assumption [b] provides the ETS will continue on the basis of previous principles.

When will the policy be overviewed to identify the real costs and benefits and to find if the legal act helped to achieve the required results?

June 2021

Minister's approval for the Impact Assessment consultation phase:

I have read the Impact Assessment and I am convinced it presents a reliable estimate of likely costs, benefits and effects of the specified options on the basis of the available data.

Signature of the competent Minister: _____ Date: _____

Summary: Analyses and Data – ETS-Continuation scenario

Policy option: 1
- ETS-Continuation

Description: Control of the implementation costs of Directive 2009/29/EC in Poland

ANNUAL COSTS		Description and scope of costs by basic groups. The assessment includes the total costs of the implementation of Directive 2009/29/EC in the form of loss of revenues in the whole economy estimated by the loss of GNP in the analysed time-period. Direct costs incurred by industrial electric power stations on the purchase of missing allowances or investments to decrease GHG emissions were evaluated separately and amounted to PLN 36.0 billion ₍₂₀₀₅₎ .
Single	Years	
PLN billion ₍₂₀₀₅₎ 0	8	
Annual average cost (without single costs)		
PLN billion ₍₂₀₀₅₎ 5.2		Total costs (PV) PLN billion₍₂₀₀₅₎ 46.7
COSTS	<p>Other costs by basic groups. The costs of the introduction of Directive 2009/29/EC through the impact of energy prices and reduction of the demand will appear practically in each branch of the economy, also in households. The biggest costs will be incurred by the participants in the emission allowances trading scheme. But other entrepreneurs can also be quite heavily burdened with the introduced changes particularly those which have a significant share in the costs of energy expenditures or energy-consuming materials.</p> <p>A model analysis did not show any negative impact of the legal act on the employment rate in Poland. Nevertheless, in the regions of high concentration of heavy industry (Silesia), an increase in unemployment is quite likely. A similar situation will occur when a closing down or employment reducing company is the only big employer in the region.</p>	
ANNUAL BENEFITS		Description and scope of benefit values by basic groups. The benefits from the reduction of expenditures for the adjusting of Poland to climate changes in the distant future were taken into account.
Single	Years	
PLN ₂₀₀₅ 0	8	
Annual average profit (without single costs)		
PLN billion ₍₂₀₀₅₎ 0.049		Razem korzyści (PV) mld PLN₂₀₀₅ 0.444
BENEFITS	<p>Other benefits by basic groups.</p> <p>The introduced legal act has an impact on the reduction of cross-border gas emissions (SO₂ and NO_x) and a high emission of dusts. The related benefits will concern the territory of Poland only in part and the effect will be rather little taking into account high European emission standards for these substances.</p> <p>Social benefits resulting from the concentration of greenhouse gases in the air calculated in accordance with Stern report will amount to PLN 5.3 billion₍₂₀₀₅₎.</p>	

Key assumptions/Analysis of sensibility/Risk

The price for CO₂ emission allowances will be 40 €/tonne of CO₂. In the years 2013-2020 the capital engaged in the Polish economy will increase by 16.6 per cent. The quantity of jobs will decrease by 7.4 per cent. The production effectiveness of capital and energy will grow in the pace exceeding 0.8 per cent annually. The effectiveness of work will grow by 0.25 per cent annually. The prices for hydrocarbons in the world market in 2020 will be 40 per cent higher than in 2012.

/The analysis of sensibility was made for various levels of social valuation of one tonne of CO₂ emission reduction.

Due to a lack of precision in the Directive provisions concerning the directions of spending auction revenues, the forms of public help for national companies can be considered illegal.

Basic prices in 2005	Analysed period: 2013-2020	Net benefit. Range (NPV) PLN billion ₍₂₀₀₅₎ (-46,3) - (-41,0)	Net benefit. (NPV the best estimate) PLN billion ₍₂₀₀₅₎ -41,0
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What is the territorial range of the legal act?	Poland			
What is the expected date of coming into force of the legal act (give the date)?	1 January 2013			
What organization (organizations) is (are) responsible for the implementation of the legal act?	Ministry of Economy and Ministry of Environment			
What is the total annual cost of the implementation of the legal act for the organization?	PLN billion ₍₂₀₀₅₎ 0			
Does the way of the implementation of the legal act follow Hampton's principle?	N/A			
Does the implementation of the legal act exceed the minimum requirements laid down by the EU?	No			
What is the annual value of proposed offset activities?	PLN billion ₍₂₀₀₅₎ 0			
What is the value of changes in the emission of greenhouse gases?	PLN billion ₍₂₀₀₅₎ 0 - 0,4			
Will the implementation of the legal act have a significant impact on competitiveness?	It is possible			
Annual costs (PLN-PLN) for enterprises/organizations (without single costs) (bez kosztów jednorazowych)	Micro N/A	Small N/A	Medium N/A	Large N/A
What enterprises/organizations are concerned? Which of them are exempted?	N/A	N/A	Yes	Yes

Impact on the expenses for public administration (the 2005 prices)		(Increase - Decrease)	
Increase by:	PLN billion ₂₀₀₅ 13.3	Decrease by:	PLN billion ₍₂₀₀₅₎ 14.3
Net impact		PLN billion ₍₂₀₀₅₎ -1.0	

Footnote: Annual costs and benefits: Fixed prices

(Net) Present Value

6. Justifications and data base

6.1. Assessment of benefits

It has been assumed that the benefit of the implementation of the new legal act is the reduction of CO₂ emissions in Poland in the ETS-Auctioning scenario in comparison with the volume of emissions of CO₂ in the ETS-Continuation scenario. The volumes of emissions have been determined in the optimization model of the national energy system EFOM-PL on the basis of prognoses of a final demand for energy formulated in accordance with the PROSK model. Due to high uncertainty of the “value” of a reduced tonne of CO₂, the calculations have been made for “probable” estimates only.

While valuating the emission reduction in calculating variants, a possibility of use of the “dual prices” for CO₂ emissions was analysed to reflect social costs incurred world-wide due to an increase in the global temperature in the distant time-horizon. An efficient reduction of anthropogenic greenhouse gas emission up to 2050 will protect people against the incurrance of such costs, i.e. the benefit will be so called “avoided costs”.

While assessing the impact of a legal act for Poland, the economic and ecological situation of a given country should be taken into consideration both as costs and benefits, therefore the assessment of avoided costs should be based on the assessment of possible external effects of CO₂ emissions in our region of Europe. Also, in accordance with the Stern Review⁹, in this area favourable effects of climate change can exceed related losses.

Table 6.1. Reduction of the national emission of CO₂ and estimates of the reduction value for Poland in accordance with the analysed calculating variants

YEAR	Price [PLN]	Volume of national CO ₂ emission [million tonnes]		Reduction of emission [million tonnes]	Current values of emission reductions [PLN billion]	Updated values of emission reductions [PLN billion]
		ETS-Continuation	ETS-Auctioning			
	1	2	3	[3- 2]	-[41]	PV ₂₀₀₅ [4]
2013	43,0	298,1	296,9	-1,2	0,051	0,037
2014	43,8	296,5	295,0	-1,5	0,068	0,048
2015	44,7	294,9	293,1	-1,8	0,078	0,054
2016	45,6	289,1	286,9	-2,2	0,100	0,066
2017	46,5	283,3	281,1	-2,2	0,104	0,067
2018	47,5	277,5	275,6	-1,9	0,090	0,055
2019	48,4	271,7	269,7	-2,0	0,096	0,057
2020	49,4	265,8	263,7	-2,1	0,104	0,060
The 2005 updated value of CO ₂ emission reduction in the years 2013-2020 in PLN billions as of the 2005 purchase value						0,444

⁹ STERN REVIEW: PART II: The Impacts of Climate Change on Growth and Development (Page 7)

The higher is the level of GNP in the ETS-Auctioning scenario, the higher are CO₂ emissions which means that the effects of their reduction, and consequently, the benefits get lower. However this effect is considerably less spectacular than in the case of lowering the costs.

The emission reduction values presented in the Table have been calculated on the basis of the assumption that the Polish reduction of 1 tonne of CO₂ will bring about the benefit equal to one-fourth of the assessment included in the Stern Review calculated for the 450ppm-SCC scenario. Also the value of CO₂ emission reduction has been calculated for the period of 2013-2020 with the use of BAU SCC¹⁰ values. The ETS-Auctioning scenario in comparison with the ETS-Continuation scenario will result in PLN 5.3 billion₍₂₀₀₅₎ thanks to the adopted valuation of benefits related to 1 tonne of CO₂ emission reduction.

During the analysis of the sensibility of the solution as regards the valuation of social costs of the current GHG emission, the costs resulting from its reduction in the years 2013-2020 have been calculated with the use of the highest estimates of single benefit regarding the reduction of one tonne of CO₂ in accordance with the Stern Review.

In accordance with the British method, the basic and synthetic measure of the impact assessment of an amendment to a legal act (or a change in political actions) is the estimate of NPV values on the basis of a temporary stream of benefits and costs related to its introduction. As far as the analysed case is concerned, a single valuation of costs has been made related to the implementation of Directive 2009/29/EC. Therefore the changeability range of the calculated NPV is connected with the range of the assessment of benefits brought about by the reduction of CO₂ emissions. The bottom limit of the range is a zero value with the assumption that future benefits and losses related to climate change in Poland will balance each other (the benefit from the reduction of 1 tonne of CO₂ is zero). The upper limit of the range of benefits is determined by national reductions within the whole time-period valuated with the "price" fixed in the BAU SCC scenario included in the Stern Review.

6.2. Assessment of costs

The authors consider the changes in the GNP level as the basic and "best" measure of the costs related to the implementation of Directive 2009/29/EC affecting the whole economy. It

¹⁰ The value is three times as big as in the 450ppm-SCC variant estimates

is also the basic assessment measurement of the costs of neglecting the reduction of the anthropogenic emission of GHG used in the estimates in the Stern Review¹¹.

The basic reason for such an attempt is the fact that from an economic point of view, the costs of a certain group of economic life participants constitute the incomes of the other group of economic life participants. Therefore the detailed estimates of costs for various groups which are the most exposed to concrete expenditures are not additive. In the analysed example increased expenditures on the energy experienced by households and national companies cover the direct costs of the industrial energy sector related to the implementation of Directive 2009/29/EC. They do not, however, compensate the losses resulting from the decreasing of the production level.

Higher prices for energy (and for energy-consuming products) will reduce the demand for other goods and services thus diminishing the absorption of the domestic market and limiting export possibilities which will decrease the GNP level. In accordance with the analyses, the effect lessened by an assumption about the full allocation of all revenues from CO₂ emission auctions by the state administration.

Table 6.2 presents a comparison of the GNP level changes in the calculations made in accordance with the CGE-PL model and their valuation in the 2005 prices.

Table 6.2. The GNP losses and their valuation for Poland in accordance with the analysed calculating variants

YEAR	GNP in PLN billion (2005)		GNP relations	Differences of GNP in PLN billion (2005)	Discounted values at the beginning of 2005
	ETS-Continuation	ETS-Auctioning	[2/1]	[2-3]	PV ₂₀₀₅ [5]
	1	2	3	4	5
2013	1365	1364	99,9%	1,1	0,8
2014	1435	1433	99,9%	1,8	1,3
2015	1513	1510	99,8%	2,6	1,8
2016	1591	1583	99,5%	8,2	5,3
2017	1665	1652	99,2%	12,9	8,1
2018	1729	1715	99,2%	14,2	8,6
2019	1756	1740	99,1%	16,3	9,6
2020	1782	1762	98,9%	19,9	11,3
Total implementation costs of the ETS Directive discounted at the beginning of 2005					46,7

¹¹ STERN REVIEW: The Economics of Climate Change Part III: The Economics of Stabilisation (p. 239)

Using in full of free-of-charge emission allowances in the Polish energy sector will considerably reduce the implementation costs of Directive 2009/29/EC. Nevertheless they are still considerable. In comparison with the ETS-Continuation scenario, the estimated costs amount to nearly PLN 47 billion due to a difference in the GNP levels.

The GNP losses are only partially caused by a slow-down of the export dynamics in accordance with the ETS-Auctioning scenario (and the ETS-Continuation scenario). An equally important reason is the limitation of the national demand. In 2020 real incomes of households will be more than 0.9 per cent lower in the ETS-Auctioning scenario than in the ETS-Continuation scenario in spite of the taking into account of the redistribution of 50 per cent of auction revenues for households¹² in the model simulation.

As far as the model simulation made for Poland is concerned, the most sensitive segment of the economy are coal and mineral industries (the ETS limits an increase in the "coal" energy production) but almost all the industry branches as well as the agricultural production suffer due to a smaller dynamics of the national demand for food products. Light industry and food industry are relatively "resistant" to the impact of the new ETS Directive. The impact of the new legal act on energy sectors is presented in detail in Section 3.4.

6.3. Impact assessment on the energy system of Poland

The energy sector is the biggest source of GHG emissions in Poland and the most important participant in the ETS. Electricity prices have a significant influence on the production costs in the whole economy and its competitiveness in the world market. The other product of the energy sector, i.e. heat distributed via networks is used by 80 per cent of municipal households. This results in the fact that an increase in the costs of the energy sector has a direct impact on the living standards of the country's population.

6.3.1. Prices for electricity and heat

Table 6.3 presents the results of the EFOM-PL model showing the differences in the marginal costs of electricity and heat generation in the industrial energy sector for the years 2010, 2015 and 2020. The results of the model simulation show that in the ETS-Auctioning scenario the cost incentive related to the implementation of the ETS Directive is not only stronger than in the comparative scenario but it will also occur earlier. Additionally, much bigger differences concern the marginal costs of heat generation than the costs of electricity generation. The comparison results of marginal costs in the ETS-Auctioning scenario with

¹² The remaining 50 per cent of the auction revenues were allocated to enterprises in the form of lowering the income tax in accordance with the model simulation.

the ETS-Continuation scenario show the importance of the ETS for cost levels irrespective of any concrete form of it. In this case the marginal costs of heat generation and electricity generation are higher by about 15-25 per cent and 8-16 per cent respectively.

Table 6.3. Changes in the marginal costs of electricity and heat generation in accordance with the ETS-Auctioning scenario compared to the marginal costs of electricity and heat generation in the ETS-Continuation scenario

Years	2010	2015	2020
ETS-Auctioning/ETS-Continuation variants			
Marginal cost of network heat	100,0%	124,2%	116,6%
Marginal cost of electricity	100,0%	108,0%	116,2%

One should remind here that the above presented marginal costs will increase due to the new ETS Directive only. All the calculating variants take into account costs related to the use of RES for energy sector and the adjustment of the energy sector to new emission requirements by basic types of air pollutants.

6.3.2. Changes in the generating base of industrial power engineering

The presented results of the EFOM-PL model cover the years 2005-2030. While analysing the generating base of industrial power engineering, the above time-period is justified because a more than 8-year-long horizon of the 3rd phase of the ETS is even more important in the investment planning in this sector. Concrete investment decisions are made on the basis of the prognoses concerning 20-25 years to come.

General knowledge as to the directions of change in the energy system results from the levels of electricity generation by types of used fuels.

They are presented in Tables 6.4.-6.5.

Table 6.4. Generation of electricity by types of fuels, the **ETS-Continuation** scenario

Type of fuel	2005	2010	2015	2020	2025	2030
Hard coal	86,5	75,4	78,6	62,5	63,8	66,1
Brown coal	55,7	60,4	58,6	52,1	50,4	58,6
Natural gas	5,6	4,6	6,2	15,5	18,9	12,3
Nuclear fuel	0,0	0,0	0,0	5,3	5,3	15,8
Renewable energy	2,8	8,3	13,7	24,6	22,7	23,0
Other fuels	4,9	5,4	6,1	5,9	5,8	5,9
Total	155,5	154,0	163,2	165,9	166,7	181,6

[TWh/a]

Table 6.5. Generation of electricity by types of fuels, the **ETS-Auctioning** scenario

[TWh/a]

Type of fuel	2005	2010	2015	2020	2025	2030
Hard coal	86,5	75,3	74,3	61,1	45,3	44,2
Brown coal	55,7	60,4	58,6	52,0	49,9	56,9
Natural gas	5,6	4,6	8,0	15,5	19,4	14,6
Nuclear fuel	0,0	0,0	0,0	5,3	21,0	31,5
Renewable energy	2,8	8,3	15,9	23,8	25,4	26,2
Other fuels	4,9	5,5	6,1	5,9	5,7	5,9
Total	155,5	154,0	162,8	163,5	166,7	179,3

Impact of the emission allowances trade under the ETS on the fuel structure of electricity generation is quite considerable and it will occur before 2020. A significant decrease in hard coal electricity generation will take place as well as an increase in the natural gas electricity generation. The nuclear power sector appears in both scenarios. An increase in the use of various RES technologies is maintained at the same level in all the calculation variants in accordance with the assumptions about the achievement of the energy and climate package objectives. These changes will result in a decrease in cross-border gas emissions except for the CO₂ emission reduction.

The following comparative tables numbered from 6.6 to 6.7 show changes in the level and structure of the generating capacities in the national energy system. The national level of the sources capacity in all the variants in 2020 will amount to about 40 GW which will be caused by small differences in the level of demand for electricity. In the analysed time-period basic differences concern the proportions between the capacities in the existing sources and the capacities in the sources ready for operation after 2009.

Table 6.6. Balance of generating capacities in the NES by the type of producer and by existing and new sources, the **ETS-Continuation** scenario

[MW]

	2005	2010	2015	2020	2025	2030
A. By the type of producer						
Industrial thermal power stations	24567	24600	22733	20577	20739	22560
Industrial heat and power stations	5725	5971	6087	7036	7004	7377
Industry heat and power stations	2522	2449	2246	2162	2243	2192
RES electric power stations	1067	2308	3725	8959	8958	9189
Pumped-storage power stations	1406	1406	1406	1406	1406	1406
TOTAL	35287	36734	36197	40140	40351	42724

B. By the type of existing and new sources						
Existing electric power stations and heat and power stations	35287	32909	30308	23673	20909	16854
New electric power stations and heat and power stations	0	3825	5889	16468	19442	25869
TOTAL existing and new electric power stations and heat and power stations	35287	36734	36197	40140	40351	42724

Table 6.7. Balance of generating capacities in the NES by the type of producer and by existing and new sources, the **ETS-Auctioning** scenario

	[MW]					
	2005	2010	2015	2020	2025	2030
A. By the type of producer						
Industrial thermal power stations	24567	24600	22980	20268	20996	22363
Industrial heat and power stations	5725	5971	6085	7033	6754	7347
Industry heat and power stations	2522	2449	2246	2150	2207	2166
RES electric power stations	1067	2308	4988	8429	8615	8659
Pumped-storage power stations	1406	1406	1406	1406	1406	1406
TOTAL	35287	36734	37705	39286	39977	41942
B. By the type of existing and new sources						
Existing electric power stations and heat and power stations	35287	33009	30408	23685	20720	16624
New electric power stations and heat and power stations	0	3725	7297	15600	19258	25318
TOTAL existing and new electric power stations and heat and power stations	35287	36734	37705	39286	39977	41942

The presented results show the following tendencies:

- 1) There will be a systematic decrease in the capacity of the existing generating sources from about 35 GW to 22-24 GW in 2020 and to 17-19 GW in 2030;
- 2) A particularly big decrease will occur in the group of existing thermal power stations from 25 GW to 13-14 GW in 2020 and to 8-11 GW in 2030.
- 3) An increment of generating capacities will occur in all the groups of producers: heat and power stations, thermal power stations as well as in RES electric power stations and heat and power stations and it will amount to about 14-17 GW in 2020 and to 24-29 GW in 2030 in total.
- 4) An increase in the generating capacities will amount to 4-7 GW in 2020 and to 10-15 GW in 2030 in the group of industrial electric power stations;

- 5) An increment of generating capacities in new thermal power stations will depend not only on the general level of demand but also on market conditions. High prices for fuels and emission allowances will accelerate the pace of withdrawing the capacities in the existing sources and accelerate the construction of new sources.

The data showing in more detail the structure of the generating capacities of thermal plants as well as RES sources are presented in tables 6.8-6.9 in accordance with the calculating scenarios. In both groups of electricity producers the biggest changes regard the production technology.

Table 6.8. Generating capacities in industrial thermal power stations (without thermal plants) and in RES sources, the **ETS-Continuation** scenario

	[MW]					
	2005	2010	2015	2020	2025	2030
A. Thermal electric power stations (without heat and power stations)						
A.1. Existing electric power stations						
Existing brown coal electric power stations	8879	7568	7614	6514	6274	5394
Existing hard coal electric power stations	15688	15250	13084	8112	5869	3066
A.2. New stations						
New brown coal electric power stations	0	1322	1322	1322	1322	3160
New hard coal electric power stations	0	460	460	2379	3636	4301
Gas and steam electric power stations	0	0	253	1500	2500	4000
Gas and pumped turbines	0	0	0	0	389	389
Nuclear power plants	0	0	0	750	750	2250
B. RES sources						
Biomass and biogas heat and power stations	31	387	672	812	811	1187
Water electric power stations	915	926	1150	1150	1150	1150
Wind power stations	121	994	1903	6998	6998	6853
C. Total thermal power stations and RES sources						
Brown coal electric power stations	8879	8890	8936	7836	7596	8554
Hard coal electric power stations	15688	15710	13544	10491	9505	7367
Gas electric power stations	0	0	253	1500	2889	4389
Nuclear power electric power stations	0	0	0	750	750	2250
Renewable energy electric power stations	1067	2308	3725	8959	8958	9189
Water pumped-storage electric power stations	1406	1406	1406	1406	1406	1406
Total	27040	28314	27864	30943	31104	33155

Table 6.9. Generating capacities in industrial thermal power stations (without thermal plants) and in RES sources, **ETS-Auctioning** scenario

[MW]

	2005	2010	2015	2020	2025	2030
A. Thermal electric power stations (without heat and power stations)						
A.1. Existing electric power stations						
Existing brown coal electric power stations	8879	7568	7614	6514	6274	5394
Existing hard coal electric power stations	15688	15250	13084	8112	5830	2736
A.2. New stations						
New brown coal electric power stations	0	1322	1322	1328	1328	2914
New hard coal electric power stations	0	460	460	2064	2064	2064
Gas and steam electric power stations	0	0	500	1500	2500	4000
Gas and pumped turbines	0	0	0	0	0	755
Nuclear power plants	0	0	0	750	3000	4500
B. RES sources						
Biomass and biogas heat and power stations	31	387	672	812	997	1187
Water electric power stations	915	926	1150	1150	1150	1150
Wind power stations	121	994	3166	6467	6467	6322
C. Total thermal power stations and RES sources						
Brown coal electric power stations	8879	8890	8936	7842	7602	8308
Hard coal electric power stations	15688	15710	13544	10176	7894	4800
Gas electric power stations	0	0	500	1500	2500	4755
Nuclear power electric power stations	0	0	0	750	3000	4500
Renewable energy electric power stations	1067	2308	4988	8429	8615	8659
Water pumped-storage electric power stations	1406	1406	1406	1406	1406	1406
Total	27040	28314	29374	30103	31017	32428

Differences between the capacities in the ETS-Auctioning and ETS-Continuation scenarios up to 2020 are considerably small (among others, identical capacities in nuclear power plants and gas electric power stations) and concern mainly the capacities in coal electric power stations. Any more serious differences relate to the period not covered by this analysis.

6.3.3. Estimating of the direct costs of industrial power engineering in Poland

The costs of industrial electric power stations will account for about 40 per cent of costs incurred by the energy sector due to the implementation of the new ETS Directive. Table 6.10 shows the comparison of average costs of electricity generation in industrial electric power stations on the basis of the results of the EFOM-PL model. One should pay attention to the fact that up to 2020 there will be no significant differences (except for the cost of

emission allowances) between the ETS-Auctioning and ETS-Continuation scenarios. The differences in fuel, capital and labour costs will occur as late as in the years coming after the analysed period.

Table 6.10. Average costs of electricity generation in industrial electric power stations

	[PLN/MWh]					
	2005	2010	2015	2020	2025	2030
ETS-Continuation scenario						
Non-fuel costs	62,3	81,7	81,3	124,8	129,2	142,4
Fuel cost	66,2	77,9	90,4	96,1	96,9	82,6
Emission allowances cost	0,0	7,7	7,3	5,8	5,6	5,3
Total costs without CO ₂	128,5	159,6	171,7	220,8	226,2	225,0
Total (including the allowances cost)	128,5	167,3	179,1	226,6	231,8	230,3
ETS-Auctioning scenario						
Non-fuel costs	62,3	81,7	82,9	124,3	154,9	167,1
Fuel cost	66,2	77,9	90,9	96,1	84,4	76,3
Emission allowances cost	0,0	7,7	72,5	116,3	94,6	83,6
Total costs without CO ₂	128,5	159,6	173,8	220,4	239,2	243,4
Total (including the allowances cost)	128,5	167,3	246,3	336,7	333,8	327,0

Table 6.11 presents the estimates of the increment of direct costs of industrial electric power stations caused by the implementation of the new ETS Directive. The impact on the direct production costs of other participants¹³ in the CO₂ emission allowances trading scheme is probably nearly two times bigger and, as in the case of industrial electric power plants, the main reason is a need to purchase some missing allowances for emissions.

Table 6.11. Estimated increase in costs in industrial electric power stations caused by the implementation of the new ETS Directive

Year	Costs of industrial electric power stations in PLN billion ₍₂₀₀₅₎	Differences in costs of industrial electric power	Discounted values at the beginning of 2005

¹³ Using other combustion installations – heat and power stations and heat-generating plants

			stations in PLN billion ₍₂₀₀₅₎		
	ETS-Continuation scenario	ETS-Auctioning scenario	[2 -1]	PV ₂₀₀₅ [3]	PV ₂₀₀₅ [4]
	1	2	3	4	5
2013	24,8	26,8	2,0	1,9	1,5
2014	25,2	27,9	2,7	2,4	1,9
2015	25,7	29,0	3,4	2,9	2,3
2016	26,7	32,2	5,6	4,4	3,7
2017	27,7	35,4	7,8	5,7	5,0
2018	28,7	38,7	10,0	7,0	6,2
2019	29,7	41,8	12,2	8,1	7,3
2020	30,7	45,1	14,4	9,2	8,3
Total increase in costs of industrial electric power stations caused by the implementation of the new ETS Directive				41,6	36,0

The direct costs of industrial power engineering in the case of a full use of free-of-charge emission allowances are lower than in the case of a partial use of the above allowances. It is also important that the lowering of the burden concerns first of all the initial years of the analysed period which should ease the pressure of increasing production costs on an increase in energy prices.

6.4. Impact on the public finance sector

The presented estimates concern direct budget revenues and expenditures related to the emission allowances auctioning as well as the amount of "losses" of budget revenues from taxes caused by a slow-down of the economic development pace which has been taken into account in the macroeconomic assessment.

6.4.1. Auction revenues

It is assumed that the budget revenues related to the ETS Directive implementation are determined by the pool of emission allowances allocated to Poland and decreased by the quantities of allowances allocated in the benchmark system to those installations which face the closing-down due to a carbon leakage problem and industrial power engineering installations meeting certain conditions specified in the provisions of the new Directive. The quantities of sold allowances and their discount values at the beginning of 2005 are compared in Table 6.12. The estimates concern the discount rate of 3.5 per cent and the

price for allowances¹⁴ which will not change in the whole time-period in the amount of € 40/tonne of CO₂.

Table 6.12. Budget revenues from the auctioning of CO₂ emission allowances in the years 2013-2020

Year	National allocation	Allocated allowances	Sold allowances	Budget revenues	Discounted values at the beginning of 2005
	Million tonnes of CO ₂			PLN billion (2005)	
	1	2	3	4	5
2013	238	140	97	17,7	13,0
2014	234	125	109	19,8	14,0
2015	230	109	120	21,9	15,0
2016	226	94	132	24,0	15,9
2017	222	78	144	26,2	16,7
2018	218	62	156	28,3	17,5
2019	214	47	167	30,4	18,2
2020	210	31	179	32,6	18,8
Total budget revenues from the ETS auctioning discounted at the beginning of 2005					129,2
Average annual budget revenues from the ETS auctioning in the period of 2012-2020					14,3

The above estimates show the new ETS Directive will replenish the budget with substantial and systematic revenues in the whole time-period of 2013-2020. However, the revenues impose on public administration certain directions of their spending. In model calculations for the ETS-Auctioning scenario it is assumed that all the revenues will be allocated to entrepreneurs and households. The average annual revenues are considerable and exceed PLN 14 billion equivalent of the 2005 purchase value.

6.4.2. Impact of slowed down economic development on budget revenues

The new ETS Directive, in addition to systematic revenues from the auctioning of emission allowances will also slightly decrease budget tax revenues due to a slow-down of the economic development pace in accordance with the ETS-Continuation and ETS-Auctioning calculating scenarios. Table 6.13 presents the estimated decrease in budget revenues from taxes due to a slow-down of the economic development pace compared to the level determined in the ETS-Continuation scenario provided that the tax rates do not change.

¹⁴ In accordance with the 2005 rate of exchange of €, the price for one allowance for the emission of one tonne of CO₂ = PLN 182₍₂₀₀₅₎

Table 6.13. Differences in budget revenues from taxes in accordance with the analysed calculating variants in the years 2013-2020

Years	Taxes in PLN billion ₍₂₀₀₅₎		Differences in tax revenues in PLN billion ₍₂₀₀₅₎	Discounted values at the beginning of 2005
	ETS-Continuation scenario	ETS-Auctioning scenario	[1-2]	PV ₂₀₀₅ [3]
	1	2	3	4
2013	193	192	0,6	0,4
2014	203	202	0,7	0,5
2015	214	213	0,9	0,6
2016	225	223	1,7	1,1
2017	235	233	2,4	1,5
2018	244	241	2,6	1,6
2019	248	245	2,9	1,7
2020	251	248	3,4	1,9
Total decrease in tax revenues in the years 2012-2020 due to the implementation of the ETS Directive				9,4
Average annual decrease in tax revenues in the years 2012-2020 due to the implementation of the ETS Directive				1,0

6.5. Impact on the labour market

Changes in the labour market in the model simulation will match, as to the direction, the changes in the added value specified in Section 6.3 but the impact is considerably less radical than the differences in the created added value between the scenarios. Smaller employment in the economy branches mostly threatened with a slow-down of the production development pace is compensated almost in whole with an increase in employment in public services and transport sector. The unemployment rate in 2020 will amount to 3.8 per cent in the ETS-Continuation scenario. The results of calculations for the ETS-Auctioning scenario in 2020 show the unemployment rate will be nearly 4 per cent but they will not exceed the threshold. However, one should remember the model has at its disposal almost fully mobile labour force, but the analysed period in Poland will suffer from an absolute decrease in people at the working age.

In real economic processes the differences in production levels in the most affected sectors of industry will mean the closing-down of the less effective plants and be a reason for a local or regional increase in unemployment.

In accordance with the model, in addition to the state administration, the public services sector will also cover educational and healthcare services which require special qualifications so structural unemployment can possibly occur. However, the implementation of the new ETS Directive should not have a significant impact on the labour market in Poland.

6.6. Impact on the competitiveness of the economy

The economic development of Poland does not depend much on foreign trade although foreign trade had a higher and higher importance over the past decade (See: Table 6.14).

Table 6.14. Poland's foreign trade turnover in the years 1999-2008 and its impact on GNP [current prices]

Year	GNP	Export	Import	Export/GNP	Import/GNP	Foreign trade balance/GNP
	PLN billion	PLN billion	PLN billion	%	%	%
1999	616	161	200	26,1%	32,5%	-6,4%
2000	744	202	250	27,1%	33,5%	-6,4%
2001	779	211	239	27,1%	30,7%	-3,7%
2002	808	232	259	28,7%	32,1%	-3,4%
2003	842	281	302	33,4%	35,9%	-2,6%
2004	923	347	365	37,5%	39,5%	-2,0%
2005	983	365	372	37,1%	37,8%	-0,7%
2006	1 060	428	447	40,4%	42,2%	-1,8%
2007	1 175	480	513	40,8%	43,6%	-2,8%
2008	1 267	499	543	39,4%	42,8%	-3,4%

In model simulations for the ETS-Continuation scenario the balance of foreign trade is positive and amounts to PLN 26 billion₍₂₀₀₅₎ i.e. about 0.7 per cent of GNP. The implementation of the new ETS Directive will further decrease the export development pace and allow to even the balance of foreign trade. The scale of decrease in the export level (and import level) in other scenarios does not look so dramatic but it is also a serious reason for a slow-down of the GNP pace due to the introduction of the new ETS Directive.

In 2020 the level of export in accordance with the ETS-Auctioning scenario will be lower than in the ETS-Continuation scenario in almost all the sectors of the economy. Only in one case (the coal sector) the level of export will increase due to a decrease in the demand of the national energy sector.

The most injured sectors due to the implementation of the new ETS Directive are:

- Papermaking industry – the level of export will be lower by 6.9 per cent in the ETS-Auctioning scenario than in the ETS-Continuation scenario;
- Mineral industry – the level of export will be lower by 4.4. per cent in the ETS-Auctioning scenario than in the ETS-Continuation scenario;
- Metallurgical industry – the level of export will be lower by nearly 7 per cent in the ETS-Auctioning scenario than in the ETS-Continuation scenario.

Although the above presented "losses" caused by the loss of competitiveness of national production in industrial sectors taking part in the ETS will certainly affect the condition of those industries in Poland, they will not be the key reason for the loss of competitiveness of the whole economy of Poland. What is important is the fact that the introduction of the new Directive will badly affect the competitiveness of all the economic sectors which will certainly influence the level of the Polish export.

6.7. Impact on households

The starting point is an analysis of the expenditures of households on energy carriers and their shares in home budgets. The analysis covers the changes observed in the period of 2000-2007, differentiation of expenditures by types of households and the comparison of energy-consumption of households in Poland and in the EU. The following factors have been taken into account during the impact assessment of the implementation of amendments to the ETS Directive in accordance with the scenarios:

- Impact of the GNP dynamics on changes in the disposable incomes of people;
- Estimated impact of the redistribution of a part of additional budget revenues from emission allowances auctioning on the support for poor households to limit the energy poverty problem;
- Impact of changes in people's incomes and energy prices on the consumption of energy;
- Impact of changes in marginal costs of electricity and thermal energy generation by model calculations and changes in the import prices for gas and domestic prices for coal determined by the import parity on the changes in fuel and energy prices for end-users;
- Impact of changes in energy carriers prices on households' expenditures and their share in the total expenditures.

It is assumed that the relation of households' expenditures to the disposable incomes will remain unchanged. Therefore households' expenditures account for 90 per cent of people's incomes (89 - 91 per cent in the years 2005-2007).

The results achieved in accordance with various scenarios are shown in Table 6.15.

Table 6.15. Comparison of scenarios including an increase in households' incomes and expenditures on energy

	Unit	2005	2006	2010	2015	2020
ETS-Continuation scenario						
Disposable incomes per person	PLN/person/month	761	835	908	1 091	1 250
Expenditures on energy carriers	PLN/person/month	76	86	127	150	196
Including:						
- electricity	PLN/person/month	25,6	28,0	42,9	56,3	78,8
- natural gas	PLN/person/month	14,1	16,6	30,7	34,6	44,6
- furnace fuel	PLN/person/month	16,0	20,2	28,5	31,1	31,8
- heating	PLN/person/month	20,2	21,4	25,4	27,7	40,5
% of total expenditures						
Energy carriers	%	11,0	11,6	15,6	15,3	17,4
Including:						
- electricity	%	3,7	3,8	5,2	5,7	7,0
- natural gas	%	2,0	2,2	3,8	3,5	4,0
- furnace fuel	%	2,3	2,7	3,5	3,2	2,8
- heating	%	2,9	2,9	3,1	2,8	3,6
ETS-Auctioning scenario						
Disposable incomes per person	PLN/person/month	761	835	908	1 086	1 239
Expenditures on energy carriers	PLN/person/month	76	86	127	166	218
Including:						
- electricity	PLN/person/month	25,6	28,0	42,9	63,9	89,5
- natural gas	PLN/person/month	14,1	16,6	30,7	34,6	44,6
- furnace fuel	PLN/person/month	16,0	20,2	28,5	31,1	31,8
- heating	PLN/person/month	20,2	21,4	25,4	35,9	52,6
% of total expenditures						
Energy carriers	%	11,0	11,6	15,6	16,9	19,6
Including:						
- electricity	%	3,7	3,8	5,2	6,5	8,0
- natural gas	%	2,0	2,2	3,8	3,5	4,0
- furnace fuel	%	2,3	2,7	3,5	3,2	2,8
- heating	%	2,9	2,9	3,1	3,7	4,7

An increase in the living costs and expenditures on energy carriers in households in accordance with the ETS-Continuation and ETS-Auctioning scenarios with a simultaneous slow-down of incomes pace will deepen the unfavourable tendency of an increase in the share of those expenditures in relation to the total expenditures of households:

- In the ETS-Continuation scenario the energy-related expenditures will increase additionally by 13 PLN/person which, taking into account the PLN 5 less disposable income per person will make people's expenditures on energy increase by 17.4 per cent;
- In the ETS-Auctioning scenario the energy-related expenditures will increase by another 22 PLN/person, taking into account the PLN 11 less disposable income per

person which will make people's expenditures on energy increase by 19.6 per cent in 2020.

An increase in energy-related expenditures can exceed the level of the commercial availability of energy for medium and lower-income households.

A term of a socially sensitive user on the energy or gas market has not been defined yet in the European Union. The obligation to protect such users has been imposed on the EU Member States by the Electrical and Energy Directive 2003/54/EC and the Gas Directive 2003/55/EC. Some EU Member States implement the Directive provisions through general forms of social welfare (e.g. Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Norway and Slovakia). In Finland social welfare covers those who are permanently ill or unemployed. The exception is the UK where the energy poverty has already been defined as a state of a household which allocates more than 10 per cent of its income on sufficient heating.

A significant increase in the basic components of fixed costs of living in the ETS-Auctioning scenario would lead to a dramatic worsening of the living standard of socially sensitive energy users. By including expenditures on heating, furnace fuel, 10 per cent expenditures on gas and 5 per cent expenditures on electricity, the total share in such constructed pool of heating costs will reach 8.4 per cent of expenditures in 2020 which in the situation of the existing differentiation of incomes and expenditures by types of households will make a significant number of households enter the energy poverty zone in accordance with the British criterion, including a dramatic worsening of the living standard of particularly old-age and disabled pensioners and also of labour workers whose numbers are the biggest in Poland.

6.8. Impact assessment on the natural environment

This study includes also the impact assessment of the new ETS Directive on the natural environment. The most serious pollutants emitted into the air in installations covered by the emission allowance trading scheme are nitric oxides and sulfur dioxide¹⁵. Both gases have an intensive effect on the natural environment mainly by acidifying surface waters and the soil. The deposition of those gases causes measurable economic losses due to a bigger corrosivity of steel constructions and buildings. Big concentrations of the gases at low heights pose a real danger to human health. Another important feature of these pollutants is that they are cross-border. Emissions from Polish electric power stations move largely to

¹⁵ It concerns mainly the energy sector and other combustion installations

Belaruss and Ukraine. In turn, pollutants from northern and western European energy systems deposit in Poland.

In the analysed period the whole Polish energy sector will meet new rigid requirements concerning emission thresholds of both types of pollutants concerning large fuel combustion sources which has been included in the calculating scenarios. In addition to the challenges set by the climate policy, new emission requirements for the energy sector are one of the reasons for an expected increase in energy prices in Poland.

Table 6.16 presents the emission levels of NO_x and SO₂ in 2020 calculated in accordance with the EFOM-PL model for the analysed scenarios. In addition to the national emission, we also present emissions from the key groups of fuel combustion installations.

Table 6.16. Levels of sulfur dioxide and nitric oxides emissions in 2020 in accordance with the analysed calculating scenarios

	2010	2020	
		ETS-Continuation	ETS -Auctioning
SO₂ emissions	Thousand tonnes of SO ₂		
Poland, including:	732	542	540
<i>Industrial electric power stations</i>	132	50	50
<i>Industrial heat and power stations</i>	96	79	78
<i>Industry heat and power stations</i>	69	82	81
<i>Industry heat-generating plants</i>	27	11	11
NO_x emissions	Thousand tonnes of NO _x		
Poland, including:	783	681	678
<i>Industrial electric power stations</i>	162	79	78
<i>Industrial heat and power stations</i>	60	62	61
<i>Industry heat and power stations</i>	32	41	40
<i>Industry heat-generating plants</i>	9	4	4

The data show that the impact of the new ETS Directive on the level of emissions of the two most important cross-border air pollutants will be little as it will not exceed a single thousand tonnes of the gases per annual emission. This effect can be omitted in the valuation.

6.9. Impact assessment on the situation and development of regions

The impact assessment of the implementation of the ETS Directive has been made in accordance with the spatial division of Poland used in the public statistics of the Central Bureau of Statistics, including the voivodeships and regions. The authors of this report focused on the main tendencies of changes in the key regions, in accordance with the agreed scope of the analysis.

Some projected changes have been estimated in the GNP dynamics and number of employees assuming that the changes will be proportional to:

- the territorial spread of GNP and the structure of the labour market in the basic year and
- projected relations of change in the GNP dynamics in the years 2005-2020 for the comparative variant of the ETS-Auctioning/ETS-Continuation scenarios.

The impediment to the economic growth will be mostly experienced by those regions where there is a concentration of business activities of the most sensitive branches due to an increase in energy and CO₂ emission costs, i.e particularly by mineral, papermaking, metallurgical, cokemaking, extracting, chemical, machine and energy industries situated in the following regions of Poland:

- southern (concentration of metallurgical, machine and chemical industries);
- northern (concentration of extracting, papermaking and chemical industries);
- south-western (concentration of extracting and mineral industries);
- the Świętokrzyskie Voivodeship in the eastern region (concentration of mineral industry).

The main incentive for GNP changes in the regions is caused by changes in the dynamics of the added value created in the industry as other branches of the economy (such as agriculture, construction, transport and services) will react to less changes in the growth dynamics in accordance with each scenario of the amended ETS Directive implementation.

Table 6.17 presents an estimated decrease in GNP in 2020 in comparative variants in all the voivodeships and regions. The yellow background is for such voivodeships where a decrease in GNP does not exceed 1 per cent in the ETS-Auctioning/ETS-Continuation scenarios (the Małopolskie, Śląskie, Świętokrzyskie, Opolskie, Kujawsko-Pomorskie and Pomorskie Voivodeships). The light green background has been used for the highlighting of such voivodeships where a decrease in GNP will be absolutely the biggest which depends

on a decrease in the dynamics and the amount of the initial GNP in the given voivodeship (the Mazowieckie, Lubelskie, Wielkopolskie and Dolnośląskie Voivodeships).

Table 6.17. Impact of the amended ETS on the changes in GNP in 2020 by regions

Regions and voivodeships	Auctioning/Continuation variant	
	Decrease in GNP	Share in GNP
	[PLN million ₍₂₀₀₅₎]	[%]
POLAND	-7 862	-0,9
Central Region	-1 502	-0,6
- Łódzkie Voivodeship	-174	-0,3
- Mazowieckie Voivodeship	-1 328	-0,7
Southern Region	-2 631	-1,4
- Małopolskie Voivodeship	-1 135	-1,7
- Śląskie Voivodeship	-1 496	-1,3
Eastern Region	-702	-0,6
- Lubelskie Voivodeship	-353	-1,0
- Podkarpackie Voivodeship	-38	-0,1
- Podlaskie Voivodeship	-26	-0,1
- Świętokrzyskie Voivodeship	-285	-1,2
North-western Region	-913	-0,6
- Lubuskie Voivodeship	-150	-0,7
- Wielkopolskie Voivodeship	-523	-0,6
- Zachodniopomorskie Voivodeship	-239	-0,6
South-western Region	-816	-0,9
- Dolnośląskie Voivodeship	-451	-0,6
- Opolskie Voivodeship	-365	-1,8
Northern Region	-1 299	-1,1
- Kujawsko-Pomorskie Voivodeship	-516	-1,2
- Pomorskie Voivodeship	-695	-1,3
- Warmińsko-Mazurskie Voivodeship	-88	-0,3

In general, it is projected that a decrease in unemployment will be lower because the labour factor will gradually substitute the capital factor which will be more and more expensive. An estimated impact on the changes in the labour market differs a bit from the GNP level changes by regions due to different work effectiveness in various branches of the economy.

As Table 6.18 shows, the following voivodeships: Łódzkie, Mazowieckie, Podkarpackie, Lubuskie, Wielkopolskie, Zachodniopomorskie and Warmińsko-Mazurskie will suffer from a decrease in employment by 0.4÷0.5 per cent in the ETS-Auctioning/Continuation scenarios.

However, any unfavourable changes in the Świętokrzyskie Voivodeship will be relatively smaller in comparison with the GNP dynamics.

Table 6.18. Impact of the amended ETS on the changes in the labour market in 2020 by regions

Regions and voivodeships	Auctioning/Continuation variant	
	Decrease in employment	Share in employment
	[thousand of people]	[%]
POLAND	57	0,4
Central Region	14	0,5
- Łódzkie Voivodeship	4	0,4
- Mazowieckie Voivodeship	10	0,5
Southern Region	12	0,5
- Małopolskie Voivodeship	4	0,4
- Śląskie Voivodeship	7	0,5
Eastern Region	8	0,4
- Lubelskie Voivodeship	2	0,3
- Podkarpackie Voivodeship	3	0,4
- Podlaskie Voivodeship	2	0,4
- Świętokrzyskie Voivodeship	2	0,3
North-western Region	9	0,5
- Lubuskie Voivodeship	2	0,5
- Wielkopolskie Voivodeship	5	0,4
- Zachodniopomorskie Voivodeship	3	0,5
South-western Region	6	0,5
- Dolnośląskie Voivodeship	5	0,5
- Opolskie Voivodeship	1	0,3
Northern Region	8	0,4
- Kujawsko-Pomorskie Voivodeship	3	0,4
- Pomorskie Voivodeship	3	0,5
- Warmińsko-Mazurskie Voivodeship	2	0,5

7. Selected issues in detail

7.1. Projected scope of use of fuel specific benchmarks while allocating emission allowances

Emission benchmarks as a basis for the calculation of emission allowances allocation to sectors and installations

Rules of allocation of emission allowances to sectors and subsectors which, in accordance with Article 10a(1) of the EU ETS Directive, will be presented by the European Commission up to 31 December 2010 will determine ex-ante benchmarks that should be an incentive to use energy-saving and greenhouse gas emission-low technologies as well as an incentive to reduce emissions. Emission benchmarks will be calculated for products rather than for inputs such as fuel specific benchmarks. For defining the rules of setting benchmarks, the European Commission will take into account the average performance of the 10 per cent most efficient installations in a sector or subsector in the years 2007-2008.

The provisions of the Directive allow for a relatively big flexibility for a future Regulation of the European Commission. The rules will concern benchmarks for the whole Community to the highest possible extent. Sector benchmarks will be defined, in principle, on the basis of product specific benchmarks. Any solutions should be consulted with sectors, subsectors and other interested parties (stakeholders). However, the major role that will be played by the benchmarks (they should be an incentive to use energy-saving and greenhouse gas emission-low technologies) makes us expect they will make up the difference between higher levels of production emissions in the coal and gas based energy sectors to the least possible extent.

Fuel specific benchmarks have been provided for transitional allocations only in the case of modernization in the industrial energy sector, in accordance with Article 10c(5) of the Directive. Free allocation to electricity producers will be based on verified average emissions of 2005-2007 or on ex-ante benchmarks achieved as an average of benchmarks for the most emission-effective installations in the EU using various fuels balanced with the share of various fuels in the electricity production in a given EU Member State, in accordance with the guidelines formulated by the European Commission.

Use of ex-ante benchmarks and a possibility of windfall profits

A possibility to follow an auctioning-benchmarking method instead of auctioning will help, among others, to avoid an excessive increase in prices for electricity. The essence of an auctioning-benchmarking method is not only an allocation of allowances on the basis of benchmarks for the best technologies but also referring them to the real production which will

require the verification of ex-post allocations. The allocation of emission allowances for real production will cause the liquidation of a windfall profits problem which was the major reason against the allocation of free-of-charge emission allowances and justified the introduction of full auctioning.

However, the provisions of the new Directive show that the allocation of emission allowances should be made before a new calculating period on the basis of ex-ante benchmarks so one cannot introduce the allocation of allowances on the basis of real production. The adoption of a principle of ex-ante benchmarks will not eliminate a threat of generating windfall profits and a relatively higher increase in the prices for energy and energy-consuming products. Although Article 10a (20) connected with Article 7 of the ETS Directive says about a possibility to limit the disposal of allocated free-of-charge emission allowances and a possibility to reduce them in the case of an important reduction of generating capacities or the partial close-down of an installation but the deadlines have not been fixed yet. Therefore one can expect they will cover only such cases where the allowances will be used for the calculation of the real level of emissions only when the production will be substantially reduced. In the case of allocation of free-of-charge emission allowances of not more than 70 per cent of emission needs such limitation will not avoid a windfall profits effect nor it will reduce marginal costs in the system. The marginal costs will be influenced by the energy produced on the basis of purchased allowances so they will include a full cost of emission allowances.

The deterioration of a windfall profits mechanism and a decrease in marginal costs with the partial allocation of free-of-charge emission allowances could be possible if producers achieved a fixed number of free-of-charge emission allowances per each generated MWh which would be completed with emission allowances purchased on the market instead of being given a fixed pool of free-of-charge emission allowances that cannot be sold.

Benchmarks and reduction of allocation of emission allowances to sectors and installations

As mentioned before, the rules of allocation of emission allowances should be determined by ex-ante benchmarks which should constitute an incentive to use energy-saving and greenhouse gas low emission technologies as well as an incentive to reduce emissions. As a rule of defining benchmarks the European Commission will take into account the average performance of the 10 per cent most efficient installations in a sector or subsector in the Community in the years 2007-2008. It means that the proportion of free allocation will not be determined on the basis of projected emission needs but it will be reduced twice:

- In the base year on the basis of average allocations for 2008-2012 – on the basis of a difference between average emission benchmarks of an installation in a sector in a given country and benchmarks for the 10 per cent most efficient installations in a sector or subsector in the Community;
- Then, annually reduced allocation by 1.74 per cent starting in 2013.

An expert assessment of a projected reduction of allocations in comparison with average 2008-2012 allocations has been based on differences dependable on the differences between average energy- and electricity-consumption of the manufacture of selected industrial products in various sectors of the ETS with the Best Available Technique (BAT) benchmarks published in a report by Euroelectric¹⁶ in 2006. It will allow to initially assess (in numbers) to which extent the adopted benchmarks in the EU can result in a decrease in the allocation of emission allowances to installations in Poland which certain free-of-charge emission allowances will be referred to.

The comparison of values in Table 7.1. shows that the possibilities to achieve considerable savings on final energy by modernizing installations in energy-consuming industrial branches in Poland have already been used to a big extent. A bit stronger but still weak possibilities concern the improvement in electricity use in such processes.

Table 7.1. Energy consuming indices of selected industrial products for BAT technologies

Product	Branch	Unit	Poland 2005	BAT	BAT/Poland 2005
Converter furnace steel	Iron and steel metallurgy	MJ/tonne	14 698 ¹⁾	14 600	99,3%
Including electricity		kWh/tonne	113	100	88,4%
Arc furnace steel		MJ/tonne	2 481	2 310	93,1%
Including electricity		kWh/tonne	543	422	77,7%
Hot-rolled products		MJ/tonne	2 173	2 190	100,8%
		kWh/tonne	97	103	106,2%
Electrolytic copper	Non-ferrous metallurgy	MJ/tonne	7 432	b.d	
Including electricity		kWh/tonne	846	b.d	
Electrolytic zinc		MJ/tonne	15 760	15 760	100,0%
Including electricity		kWh/tonne	3 555	3 383	95,2%
Cement clinker	Mineral industry	MJ/tonne	3 482	2 900	83,3%
Including electricity		kWh/tonne	73	55	75,7%
Lime		MJ/tonne	3 979	3 800	95,5%
Including electricity		kWh/tonne	19	18	92,8%

¹⁶ *Role of Electricity Demand Report Industry* Euroelectric, 28 August 2006

Paper cellulose	Papermaking industry	MJ/tonne	13 496	13 500	100,0%
Including electricity		kWh/tonne	425	600	141,2%
Paper		MJ/tonne	8 874	8 000	90,2%
Including electricity		kWh/tonne	624	700	112,3%
Ammonia	Chemical industry	MJ/tonne	34 133	28 500	83,5%
Including electricity		kWh/tonne	377	b.d	
Urea		MJ/tonne	4 069	b.d	
Including electricity		kWh/tonne	111	50 ²⁾	45,0%
Nitro-chalk		MJ/tonne	928	b.d	
Including electricity		kWh/tonne	36	30	84,0%

1) Energy use including energy use in the blast-furnace process and for the preparation of sinter. The calculation of the index with the assumption of 10-per cent share of scrap in the heat.

2) The publication does not cover an index for various types of fertilizers; it is stated that BAT technologies use 30-50 kWh/tonne of product in the production of NPK fertilizers.

Source: own studies and a report entitled *Role of Electricity Demand Report Industry* Euroelectric, 28 August 2006

Sector allocation which forms a basis for the allocation of free-of-charge emission allowances can be estimated with the product of quantities achieved in accordance with the provisions of the Directive and relations between the average performance of the 10 per cent most efficient installations in a sector or subsector in the Community in the years 2007-2008 and the average performance in a given sector in Poland.

Assuming that the effectiveness indices of the 10 per cent most efficient installations in sectors in the years 2007-2008 will reach a level of 5 per cent higher than the 2005 BAT benchmarks (due to the inclusion in the BAT benchmarks of a requirement of their availability as well as a lapse of time and technical progress), it has been assumed that the allocation of emission allowances to each ETS sector in Poland which is a basis for the calculation of the allocations of free-of-charge emission allowances to installations in those sectors will be reduced in the following proportion relations to average annual emissions calculated for Poland in accordance with Article 10a (5a) of Directive 2009/29/EC¹⁷:

Table 7.2. Assumed base reduction of calculated allocations of emission allowances to ETS sectors as in the case of Poland

Symb.	Sectors	Average NAP	Reduction of	Base Allocation ^{3/}
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¹⁷ Maximum quantities of allocations which constitute a basis for the calculation of allocations for installations which are not covered by Article 10a(3) of the Directive (industrial producers of electricity, CCS installations, CO₂ transport pipelines and CO₂ deposit sites) and are not new operators cannot exceed the sum of components of a total number of allocations within the Community as defined in Article 9 and multiplied by a proportion of emissions from installations not covered by Article 10a(3) in global verified average emissions in the period of 2005-2007 from installations covered by the EU ETS in the years 2008-2012 (those installations have been neglected which will be covered by a broadened ETS as late as in 2013).

		2008-2012 ^{1/}	Allocation ^{2/}	
		[thousand tonnes of CO ₂ /a]	[%]	[thousand tonnes of CO ₂ /a]
E2	Refineries	3 250	10	2 925
E3	Coking plants	2 939	12	2 586
F1	Roasting and sintering	1 757	7	1 634
F2	Production of pig iron or steel + COS	5 610	7	5 217
M1.1	Cement plants	11 566	20	9 253
M1.2	Lime	2 367	10	2 130
M2	Glass	1 558	10	1 402
M3	Ceramic products	937	15	796
O1	Paper pulp	0	5	0
O2	Paper and cardboard	1 638	15	1 392
	Total	31 621	x	27 336
	including: - without F1 ^{4/}	29 864	x	25 702

1/ Annual average allocation to sectors in the 2008-2012 NAP;

2/ Assumed reduction due to lower emission factors for the 10 per cent most efficient installations in the EU ETS sectors in the years 2007-2008;

3/ Allocation which, after the annual reduction ratio of 1.74 per cent will be a basis for the calculation of the allocation of free-of-charge emission allowances in a given sector as of 2013;

4/ F1 sector installation in Poland was not covered by the EU ETS in the period of 2005-2007.

Source: own calculations

The sum of so called base allocations except for emissions from electricity and heat generation process (E1) and emissions from F1 sector installations amounts to 25,702.00 thousand tonnes of CO₂ annually whereas the proportion of annual average allocations of emission allowances within the whole Community in the calculating period of 2008-2012 equal to the share of the above sectors in verified emissions in the period of 2005-2007 will amount to 25,748 thousand tonnes of CO₂ yearly. So the above estimate satisfies the requirement specified in Article 10a (5a) of the Directive.

7.2. Possibility of free allocation to sectors exposed to a significant risk of moving high-emission production to third countries (carbon leakage)

Subject to Article 10a (12) of Directive 2009/29/EC, in 2013 and in each subsequent year up to 2020 installations in sectors which are exposed to a significant risk of moving high-emission production to third countries will be allocated allowances free of charge at 100 per cent of the quantity of allocations (determined in accordance with the provisions of Article 10a (2) to (6) of the Directive. A list of the sectors will be drawn up by the European Commission by 31 September 2009 and then it will be updated every 5 years. Also an

annual modification of the sectors is admissible with 100 per cent free-of-charge emission allocations. While determining the sectors, the European Commission will take into account certain possibilities of a given sector or subsector to include the costs of required allocations of emissions into the prices of products without a simultaneous significant loss of a market share in favour of an installations situated outside the Community which are less effective as it comes to the reduction of greenhouse gas emissions.

The criteria which a given sector or subsector must fulfil so that it will be deemed to be exposed to a significant risk of moving high-emission production to third countries are specified in Article 10a (14) to (17) of the EU ETS Directive. They are the following:

1. Quantitative criteria:

- a) the sum of direct and indirect additional costs calculated as a proportion of the gross value added is **at least 5 %**;
- b) the intensity of trade with third countries, defined as the ratio between the total value of exports to third countries plus the value of imports from third countries and the total market size for the Community (annual turnover plus total imports from third countries) is **above 10 %**;
- c) the sum of direct and indirect additional costs is **at least 30 %**;
- d) the intensity of trade with third countries is **above 30 %**.

2. Qualitative criteria

- a) the extent to which it is possible for individual installations in the sector or subsector concerned to reduce emission levels including, as appropriate, the increase in production costs that the related investment may entail, for instance on the basis of the most efficient techniques (BAT);
- b) current and projected market characteristics, relevant geographical markets and product markets, intensity of international competitiveness in a sector (particularly when the increase level of costs or trade intensity is close to 30 per cent);
- c) profit margins as a potential indicator of long-run investment or relocation decisions;
- d) the extent to which the carbon efficiency of installations located in third countries is comparable to that of the Community
- e) the extent to which third countries, representing a decisive share of global production of products in sectors or subsectors firmly commit to reducing greenhouse gas emissions under international agreements concerning the reduction of greenhouse gas emissions.

Subject to Article 10b of the EU ETS Directive, by June 2010 at the latest the European Commission will submit an analytical report assessing the situation with regard to energy-intensive sectors or subsectors that have been determined to be exposed to significant risks of moving high-emission production to third countries. This will be accompanied by any appropriate proposals, which may include:

- the adjustment of the proportion of allowances received free of charge by those sectors or subsectors under Article 10a;
- the inclusion in the Community scheme of importers of products which are produced by the sectors or subsectors determined in accordance with Article 10a;
- the assessment of the impact of carbon leakage on Member States' energy security, in particular where the electricity connections with the rest of the Union are insufficient and where there are electricity connections with third countries, and appropriate measures in this regard.

In accordance with the Directive, up to 30 June 2009 the European Commission will prepare an analytical report including an analysis of EU ETS sectors regarding their exposure to a risk of moving high-emission production to third countries.

Table 7.3. below presents certain (selected) data of the Commission's analyses valid at the time of preparing of this study; sectors have been classified as sensible ones:

Criterion (a) – increase in costs \geq 5% and trade index > 10%
Criterion (b) – increase in costs \geq 30%
Criterion (c) – increase in costs > 30%

The table includes also the types of activities in accordance with a GNP classification which are close to subsectors covered by the ETS. However, in accordance with the data for 2005, there were no installations covered by the ETS among the below mentioned sections and groups (the subsectors are marked with different types and colour).

Table 7.3. A list of sectors covered by the ETS by the type of classification criterion into sectors exposed to a risk of carbon leakage

Symb.	Sector	Total costs of CO ₂ ^{1/}	Trade index ^{2/}	Section of Polish Classification of Activities (PKD)	Sector exposed to carbon leakage
		%	%	%	YES/NO (outside the ETS)
E2	REFINERIES	15,06	17,83	23.20	YES
E3	COKING PLANTS	> 30%	b.d.	23.10	YES

F1, F2	ROASTING AND SINTERING. PRODUCTION OF PIG IRON AND STEEL +COS. NON-FERROUS METALS - production of cast iron and steel as well as ferrous alloys	11,26	31,17	27.10	YES
	- production of cast iron pipes	0,04	27,96	27.21	(outside the ETS)
	- production of steel pipes...	0,84	45,33	27.22	(outside the ETS)
	- production of steel heavy bars and bars...	< 5%	23,57	27.31	(outside the ETS)
	- production of cold rolling products	0,16	20,06	27.32	NO
	- production of cold formed and composed products	0,26	4,94	27.33	(outside the ETS)
	- production of wires	1,49	22,83	27.34	(outside the ETS)
	- production of precious metals	d.b.	81,99	27.41	(outside the ETS)
	- production of aluminium	11,81	37,99	27.42	YES
	- production of lead, zinc and tin	0,19	31,49	27.43	(outside the ETS)
	- production of copper	2,40	40,06	27.44	YES
	- production of remaining non-ferrous metals	1,98	80,33	27.45	(outside the ETS)
	- founding of cast iron	0,71	No data available	27.51	???
	- founding of cast steel	11,68	No data available	27.52	(outside the ETS)
	- founding of light metals	3,12	No data available	27.53	(outside the ETS)
	- founding of remaining non-ferrous metals	1,51	No data available	27.54	(outside the ETS)
M1.1	CEMENT PLANTS	55,33	6,87	26.51	YES
M1.2	LIME	45,16	2,56	26.52	YES
M2	GLASS				
	- production of flat glass	7,11	21,01	26.11	YES
	- production of flat glass and glass products	1,04	13,48	26.12	NO
	- production of domestic glassware	8,84	24,32	26.13	YES
	- production of glass fibers	3,37	23,54	26.14	NO
	- production of technical glass	2,73	49,00	26.15	YES
M3	CERAMIC PRODUCTS				
	- production of table and decorative ceramic products	0,69	57,09	26.21	YES
	- production of sanitary ceramic products	0,51	30,21	26.22	YES
	- production of refractory ceramic materials and products	2,22	37,36	26.26	YES NO (at the margin)
	- production of ceramic tiles	2,14	28,61	26.30	
	- production of construction ceramic products	5,07	2,67	26.40	NO
O1	PAPER PULP	4,65	46,13	21.11	YES
O2	PAPER AND CARDBOARD	7,80	21,21	21.12	YES

1/ sum of the direct and indirect increment of costs in % of the gross added value

2/ share in the trade with third countries

Source: on the basis of the *Results of the quantitative assessment of sectors at NACE 4 level (state of 29-04-09)*¹⁸.

As one can see in Table 8.4., the majority of activities covered by the ETS are in sectors exposed to a risk of moving high-emission production to third countries, in accordance with

¹⁸ See: http://ec.europa.eu/environment/climat/emission/carbon_en.htm

the adopted quantitative criteria. The exemption are those groups of the Polish Classification of Activities (PKD) which, except for the ceramic industry, are relatively little represented in the ETS¹⁹. This means that if a further verification of data does not substantially change the results and the European Commission does not use any additional restrictions justified by qualitative criteria, the majority of installations in Poland, including all the refineries, coking plants, cement, lime, paper and cardboard producers as well as steel mills and steelworks (group 27.10) can count on 100 per cent allocation of free-of-charge emission allowances up to 2020. It should be reminded here that the reference point for this 100 per cent will not be projected emission needs but annually reduced allocation set on the basis of emission benchmarks for the 10 per cent most efficient installations in sectors in the EU.

7.3. Impact mechanisms of changes in the EU ETS on the economy and natural environment

Changes in the ETS as introduced by Directive 2009/29/EC will be mostly experienced by enterprises covered by the scheme and forced to pay much higher costs of greenhouse gas emissions. In the scale of the whole economy it will compensate additional auctioning revenues to the state budget. Impact mechanisms of the above changes and their analyses are different. A further effect of the processes are consequences for the natural environment, labour market and regional transformations.

7.3.1. Direct impact of an increase in greenhouse gas emissions costs on the economy

An increase of greenhouse gas emissions has a direct impact on an increase in production costs in the ETS activities. The impact varies in accordance with the sector. An increase in product prices resulting from the above (such as electricity and heat) will cause indirect cost effects as well as income and price effects in other areas to the extent dependable on the level of using of the products delivered by the sectors covered by the EU ETS. It concerns first of all energy consuming areas and a sector of households. All the effects have a negative impact on the level of GNP. If the changes in the technological structure or the sector economy provided incentives to increase employment, it would a bit weaken the

¹⁹ Production of cold rolled products (27.32), production of flat glass and glass products (26.12), production of glass fibres (26.12), production of ceramic tiles (26.30) and production of construction ceramic products (26.40).

impediment of the GNP dynamics. The analysis of such effects requires detailed calculations for the national energy system and the economy in the branch and macro scales.

The power of the above effects depends on the following factors:

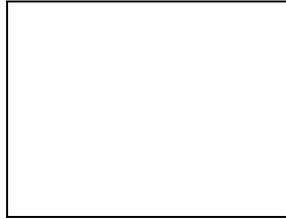
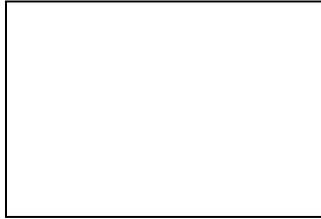
- The level of reduction of greenhouse gas emissions expressed as a difference between the limit quantities of emissions (a pool of emission allowances to be allocated within the Community) and a number of a potential emission of greenhouse gases resulting from the previous economic growth and a generated demand for energy. It means that the higher is the number of areas covered by the ETS and the economic growth, the higher will be the required reduction of emissions, and as a consequence, the higher demand for emission allowances and their prices;
- The share of free allocations to installations in the division of a pool of allowances, i.e. the higher is the share of allocated emission allowances, the lower will be the demand for the purchase of emission allowances and their prices.

A scheme including amendments to the EU ETS Directive analysed from this point of view is presented in Chart 7.1.

Allocation to an EU Member State (Block B) as well as allocation and free allocation to installations (Block C) are subject to annual correction with a line index of 1.74 per cent. However, this is done pararely and on the basis of initial data.

Chart 7.1. A scheme of direct impact of amendments to the EU ETS Directive on installations covered by the ETS ETS

A. ALLOCATION TO THE EU	ALLOCATION TO AN EU MEMBER STATE for auctioning	C. ALLOCATION TO INSTALLATIONS (allocation* free allocation)
<p>Division at the level of the EU</p> <p>Line reduction of a sum of allocations by 1.74 per cent yearly as of 2013;</p> <p>5 per cent reserve for new operators excluded from the division.</p>	<p>Division at the level of the EU</p> <ul style="list-style-type: none"> - 88 per cent in accordance with historic emissions; - 10 per cent in accordance with GNP per capita; - 2 per cent in accordance with previous reductions. 	<p>1. Division at the level of the EU</p> <ul style="list-style-type: none"> - free allocation -80 per cent in 2013, up to 30 per cent in 2020 in accordance with ex-ante product benchmarks for 10 per cent most efficient installations in the EU ETS; - 100 per cent free allocations in 'sensitive' sectgors; - no free allocations to CCS, transport and GC storage installations;



2. Division at the level of an EU Member State

- Electricity – no free allocations, conditional derogations for industrial producers (70 per cent in 2013 to 0 per cent in 2020)

CHANGES IN THE RANGE OF THE EU ETS (shifting of the ETS - non-ETS)

- Sectors (activities) – new: non-ferrous metals, mineral industry, chemical industry, CCS installations, transport and storage of GC, air transport; decrease in the range: ceramic production
- New greenhouse gases (in the production process of aluminium, chemical industry, CCS installations, transport and storage of GC);
- Reduction of an aggregation principle (> 3 MW);
- Increased thresholds of temporary shut-downs (> 35 MW and 25 Gg of CO₂/a)

The impact on installations covered by the ETS is double as it has two channels, one of which is common for all the installations and the other is individualized in accordance with sectors and subsectors:

- An increase in prices for emission allowances (in brief: a price for CO₂),
- An increase in the quantity of emissions which is not matched by free allocations of allowances and requires the purchase of allowances on the market.

While differentiating by sectors of the relation of $\frac{\text{free allocation}}{\text{emission}}$,

the final effect is the differentiation of a single cost of greenhouse gas emissions by sectors.

Changes in the emission costs are influenced by various factors (Table 7.4).

Table 7.4. Factors generating costs of greenhouse gas emissions for an installation

Variable	Level	Factors influencing the variable
Emission of CO ₂ from an installation	Installation	<ul style="list-style-type: none"> • Technological parameters, permanent in the time-horizon up to 2020; • Economic situation (volume of production);
Allocation/emission	Sector/subsector	<ul style="list-style-type: none"> • Rules for allocation (benchmarks) in sectors, variables (getting lower and lower) year by year;
Free allocation/allocation	Sector/subsector	<ul style="list-style-type: none"> • Rules for allocation (exclusions, derogations, carbon leakage); • Variables (getting lower and lower) year by year;

Price for CO ₂	The EU	<ul style="list-style-type: none"> • Supply of allowances (a pool of allowances for the EU); • Demand for allowances (economy); • Complementary – calculations of CER and ERU.
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The cost of emissions for an installation can be expressed by the following formula (5) which, after the expansion, will allow to better reflect the dependence on the results of model calculations and factors characterizing the technical parameters of the installation as well as energy and climate policy indices:

$$\text{Cost of emission} = (\text{emission} - \text{allocation} * \text{share of free allocations}) * \text{price for CO}_2 \quad (5)$$

Where the share of free allocations is expressed by the relation of $\frac{\text{free allocation}}{\text{emission}}$.

In the formula (5):

- the size of allocation gets lower by 1.74 per cent yearly (the same in all the sectors),
- the share of free allocations gets lower differently every year in each sector; for the majority of sectors the value will decrease from 80 per cent in 2013 to 30 per cent in 2020.

7.3.2. Direct impact on changes in budget revenues from the auctioning of allowances and their use in the economy

Another direct result of changes in the EU ETS Directive is an increase in budget revenues from the auctioning of allowances.

Total revenues from the auctioning of allowances can be expressed by the following formula:

$$PA_{UE} * \text{price for CO}_2 = (PI_{UE} - PBI_{UE}) * \text{price for CO}_2 \quad (1)$$

where

PA_{UE} is the total quantity of Community-wide allowances to be auctioned by the EU Member States

PBI_{UE} is the total of free-of-charge allowances to installations within the Community which will be allocated to installations in all the EU Member States

The budget revenues from auctioning are directly proportional to the costs of CO₂ emissions incurred by installations, and the interdependence is correlated:

- A higher deficit of emission allowances within the Community will lead to an increase in the prices for CO₂ and revenues from the auctioning of allowances; the level of prices for CO₂ is generated within the whole Community and adopted for analyses in accordance with the criteria set by the European Commission;
- A decreasing level of the allocation of emission allowances to installations covered by the NAP and a lower share of free allocations will mean higher costs for enterprises which will increase the budget revenues.

A possible impact consisting in an increase of budget expenditures (or the equivalent reduction of revenues from taxes) will include, among others, the following:

- co-financing of an energetic effectiveness improvement (lowering of greenhouse gas emission costs);
- increasing of consumption (compensating an increase in energy costs for households);
- covering of rising administration costs related to the auctioning system service.

7.3.3. Secondary impact of changes on the economy

Indirect impact on the economy is analysed in two planes:

- Macroeconomic – reflecting of an impact of changes in energy costs on the economy and in an increase of capital or making production factors cheaper (budget expenditures or tax reductions) in a macroeconomic model of general balance CGE-PL,
- Microeconomic – an analysis of effects on households.

The above changes will include secondary effects such as changes in budget revenues due to changes in the dynamics and structure of the economy.

The direct and indirect effects of the analysed legal act are changes in the level and structure of the economy which influence other important social and economic processes in the country such as:

- Emissions and their consequences for the natural environment;
- Changes in the labour market;
- Changes for the situation of regions of Poland.

7.3.4. Long-term technical and economic conditions of the development of energy production sources

The most important factors influencing the construction pace of new sources of energy production and thus the future structure of power are the following:

- a) level of demand for electricity and power;
- b) prices for fuels as well as costs and conditions of supplies;
- c) available generating technologies and their technical and economic descriptions;
- d) technical and resource restrictions (e.g. restrictions connected with the condition of the electric, energetic and gas networks, restrictions on the availability of fuels, renewable energy resources etc.);
- e) existing sources of energy production, their age and fuel structures, technical and economic descriptions as well as a projected pace of their closing down.

7.4. Limits of emission allowances allocations and level of prices for CO₂ in the EU ETS in the period of 2013-2020

A general limit of emission allowances in the EU ETS

The compared variants concerning the legal act in question differ both as to the establishing rules of a general pool of emission allowances within the Community and the amount of allocation to Poland as well as the role played by it in the ETS. As shown before, the volume of general pool of emission allowances in the Community plays the role of an emission limit and influences the pricing of allowances on the EU market.

Table 7.5 includes the adopted quantities of emission allowances for the whole Community in the years 2013-2020 estimated for the two variants:

- **The ETS-Continuation scenario** – it has been adopted that the general pool of emission allowances will decrease by the same pace as in the calculating period of 2008-2012 in comparison with the emissions verified in the period of 2005-2007 in all the EU Member States (an annual reduction by 0.37 per cent/a),²⁰
- **The ETS-Auctioning scenario** – in accordance with Articles 9, 9a and 10 of the EU ETS Directive (a line reduction by 1.74 per cent/a).

²⁰ If we adopted a difference between the 2008-2012 allocations and the 2005-2007 allocations, we would experience not a decrease but an increase in the total pool of emission allowances which seems to be contradictory to an assumed purpose of the continued functioning of the ETS compared to the global non-fulfillment of the reduction objectives included in the Kyoto Protocol (without inclusion of the flexible instruments).

Table 7.5. Estimated general pool of allowances for the whole Community in the years 2013-2020 if Directive 2003/87/WE is continued and in accordance with Directive 2009/29/WE^{1/}
[million tonnes of CO₂]

Variant	2013	2014	2015	2016	2017	2018	2019	2020
ETS-Continuation	2 029	2 021	2 014	2 006	1 999	1 991	1 984	1 977
ETS-Auctioning	2 050	2 014	1 979	1 945	1 911	1 878	1 845	1 813

1/ for the range of the ETS in accordance with the EU ETS Directive, without deducting a 5-per cent reserve for new operators.

Source: own calculations on the basis of the data concerning:

- the ETS-Continuation variant - http://ec.europa.eu/environment/climat/emission/citl_en.htm, file [2005-2007 CITL compiled compliance data.xls](#) and NAPs for EU Member States for the period of 2008-2012,
- the ETS-Auctioning variant – own calculations on the basis of the *Impact Assessment*,²¹ Conclusion of the EU Council²² and presentation of the results by the European Commission of 11 March 2008 in Warsaw

Prices for CO₂ emission allowances in the EU ETS up to 2020

As for each type of market goods, the prices for emission allowances will shape in accordance with changes in the demand-supply relation on a given market. The relations will be different in different variants which will depend on the solutions under the ETS. In the EU ETS the price for CO₂ emissions is shaped on a global market, i.e. on the EU market. The main factor influencing the market is, in the case of a demand, an obligation to calculate emissions with the possessed emission allowances, and in the case of a supply – a total pool of emission allowances divided into EU Member States. In the ETS-Auctioning scenario the pool is decreased by line every year in accordance with the benchmark specified in Article 9 of the EU ETS Directive, and in the ETS-Continuation scenario, in the way presented in Table 7.6.

Table 7.6. A scheme of the demand-supply relation on the CO₂ market as well as the impact of CO₂ prices in accordance with the analysed variants

Variant	Demand	Supply	Demand-Supply Relation
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²¹ *Annex to the Impact Assessment (Document accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020)*, SEC(2008)85 vol. II .

²² Note of the European Council 17215: Energy and Climate Change. Elements of the Final Compromise. General Secretariat of the Council to the Delegation. 12 December 2008.

ETS–Continuation	CO ₂ emission prognosis	Reduction of a pool of allowances in the years 2013-2020 by 0.37%/a	Decrease in the supply at the time of an increase of the demand (emission) = a non zero price for CO ₂
ETS–Auctioning	CO ₂ emission prognosis	Reduction of a pool of allowances in the years 2013-2020 by 1.74%/a	Even more serious decrease in the supply at the time of the same increase in the demand – a higher price for CO ₂

Various emission allowances prices have been adopted for the needs of this analysis for each variant in accordance with changes in the demand-supply relation on the CO₂ market. Subject to the European Commission assessments, the price for emission allowances in the EU ETS system in 2020, after the implementation of the amendments to the EU ETS Directive will amount to EUR 30-39 per tonne which will depend on the scope of possible using by the ETS participants of Clear Development Mechanism (CDM) credits (gained as a result of the implementation of CDM projects) to cover their CO₂ emissions. The estimates concern CO₂ prices after the implementation of the amendments to the EU ETS Directive.

Table 7.7. Price for CO₂ in 2020 at various variants of the achievement of the Climate Package objectives in accordance with the European Commission's estimates

Specification	'Cost efficient' variant	RES allowances trade		
		NO	YES	YES
		Using of JI/CDM mechanisms		
		NO	NO	YES
Price for CO ₂ in the EU ETS	39	47	43	30

Source: *Annex to the Impact Assessment (Document accompanying the Package of Implementation Measures for the EU's Objectives on Climate Change and Renewable Energy for 2020)*, SEC(2008)85 vol. II, Table 36 (on the basis of calculations following the Primes/Gains models)

The analysis has accepted growing prices for allowances in subsequent years because the development of the economy generates an increase in the demand for allowances, and the pool of allowances is reduced. The authors of the analysis have adopted as initial prices the estimates of the European Commission's estimates under *the Impact Assessment for the Climate Package SEC(2008)85* and have assumed that the variant compliant with Directive 2009/29/EC covers RES allowances trade, and the use of the CDM mechanism for the calculation of CO₂ emissions will lower the price for CO₂. For 2020 the following prices for CO₂ have been assumed:

- ETS-Continuation scenario: € 20 /t CO_{2eq}

- ETS-Auctioning scenario: € 40 /t CO_{2eq}

7.5. Dual prices for CO₂ – valorization of avoided costs of CO₂ emissions up to 2020

Dual prices for CO₂ in accordance with the British proposal

Dual prices for CO₂ as a measure of avoided costs express an estimated value of external effects of CO₂ emissions so they make it possible to estimate benefits from an additional reduction of emissions caused by the implementation of the amendments to the EU ETS Directive.

In accordance with the recommendations of the British Ministry of Energy and Climate Change²³, these values should be used for the assessment of emission reduction in the non-ETS sectors. Emission allowances prices are recommended for the assessment of the greenhouse gas reduction achieved in the ETS system (one should presume the benefits are national revenues from the sale of allowances to foreign ETS participants). Such benefits can appear if the emission level from the national area of the ETS will be lower than the quantity of allowances allocated to that country. The situation did not occur in the assessments made for Poland.

In the British IA report on the whole climate policy²⁴, to value the national reductions social costs assessments were used resulting from an excessive concentration of greenhouse gases in the atmosphere included in the Stern Review²⁵ as the BAU-SCC²⁶ variant which reflects the lack of reduction actions, and as a consequence, significant climate changes as well as the 450ppm-SCC variant which due to certain resolute actions (or irrespective of them) in 2050 the concentration of greenhouse gases will not exceed 450 ppm. The values for the BAU-SCC variant are not included in the IA Report. In accordance with the Stern Review, they are three times as big²⁷ as the 450ppm-SCC variant estimates.

While assessing the benefits related to the reduction of greenhouse gases, the British authors used in the higher assessment variant an algorithm which can be justified only in the assessment concerning the whole world and also on condition that a number of assumptions are fulfilled. Used for the assessment of the benefits resulting from the climate policy in a

²³ Greenhouse Gas Policy Evaluation and Appraisal in Government Departments. (IAG) December 2008

²⁴ http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/carbon_budgets/carbon_budgets.aspx

²⁵ http://www.hm-treasury.gov.uk/sternreview_index.htm

²⁶ Social Cost of Carbon means social costs of greenhouse gases emissions

²⁷ STERN REVIEW: The Economics of Climate Change Part III: The Economics of Stabilisation (Page 304)

given country, the algorithm makes the assessment become very distant from the concrete reduction results. The algorithm is a difference between the value of the whole national emission without reduction actions estimated with the BAU-SCC values and the value of the national emission after the introduction of the national reduction policy estimated with the 450ppm-SCC values with the successful achievement of the reduction world-wide²⁸.

Dual prices for CO₂ for Poland up to 2020

While assessing the impact of the legal act for Poland, as it comes both to costs and benefits, the real economic and ecological situation of the country should be taken into consideration, therefore the assessment of avoided costs should be based on the assessment of possible external effects of CO₂ emissions in our region of Europe. Also it should be considered if the results can occur in the time-horizon up to 2020.

Attempts to valorize the costs of external results can be a certain background, a sort of dual values, for the analyses of the costs related to the prevention (easing) of the greenhouse effect growing in the atmosphere and estimates of the costs of adaptation. The results of previous studies in this area for Poland show there are no justified needs to predict any unfavourable external effects of climate change in our region of Europe, particularly over a short, i.e. a 10-year-long time-horizon.

For the assessment of external results of climate change the most important are adopted emission scenarios. All the analyses presented in the literature are based, in practice, on SRES scenarios developed under the IPCC work. The majority of analyses are based on the A2 scenario. The work shows that both the A2 and the highest A1F1 scenario include a number of little realistic assumptions influencing an increase in projected emissions, in particular of a very high economic boom over a long-time period all over the world or a very high increase in the number of population all over the world.

There is high uncertainty as to the prognoses of climate change, particularly at the regional level resulting both from insufficient knowledge about the physical nature of the analysed phenomena and various tools used for the modelling of the climate (including a big difference between the results of simulations made with the use of various models). At the same time a general concurrence of long-term tendencies of projected changes is found in various centres provided that this can be in part a result of the same set of methodological and scenario assumptions adopted.

²⁸ While assessing the benefits in accordance with this method, also the country where GHG emissions grew as a result of the climate policy implementation gives considerable benefits. Their value depends almost completely on the level of national GHG emissions in accordance with the BAU scenario (the higher is the emission the bigger is the benefit) and on the difference between the higher and lower assessment of social costs of neglecting the reduction actions all over the world.

An increased frequency of occurrence of extreme weather phenomena such as floods and droughts, which is important in the case of the external assumptions about the global warming and prognosticated at the global level, has not been confirmed sufficiently so far in the area of the correlation with climate change at the regional level, including research carried out on the territory of Poland.

The prognoses of climate change on the territory of Poland show there is a number of threats such as periods of hot weather, intensive rains, floods and landslides, droughts during the vegetation period, strong winds, lack of snow, development of pathogens connected to the warming, an increase in the sea level but also some beneficial change such as a higher temperature of water, a longer vegetation period in the agriculture, less cases of morbidity and mortality in the winter period, savings to furnace fuel, more beneficial conditions for tourism, etc.

The area of external consequences which has been examined the best are effects in the sectors directly connected with the ecosphere (agriculture, forestry, fishery). The threats can be caused by extreme phenomena but so far no correlation with climate change has been proved and no quantitative estimates of their consequences have been formulated. Other effects taken into account concern the energy and tourism sectors as well as changes in the status of human health. A summary of climate change related effects can be beneficial for Poland (there are also unclear effects concerning the intensity and stability over a period of time specified in the brackets):

Table 7.8.

Climate change	Effect	Comment
Agriculture	+	Favourable effect can be strengthened by adaptation activities
Forestry	(+)	As specified above Effect can be weaker at the maximum warming scenario
Fishery	-	Little possibility of adaptation
Infrastructure, transport, construction	-	Incentive to modernize infrastructure
Energy sector	+	Favourable in our region of Europe, particularly with preferences for RES
Health	(-)	Changes unfavourable per saldo but probably weaker than those forecast at present

Additionally, one should pay attention to the fact the adaptation to climate change can start some new economic chance, including the creation of new jobs and new markets for innovative products and services such as for example new markets for construction technologies, materials and products resistant to climate change.

On the basis of previous assessments of possible occurrence in Poland of unfavourable effects of external CO₂ emissions and possibilities of favourable effects of climate change in our geographical region as well as high uncertainty of a possibility of occurrence of such effects in a long-time period, a two-variant modification of dual prices for CO₂ has been adopted used in the assessment of the amendments to the EU ETS Directive for Great Britain:

1. a zero dual price – such value of the CO₂ dual price parameter results from the assessment that the unfavourable consequences balance the favourable ones or that external effects will not probably occur up to 2020;
2. a dual price adopted for the United Kingdom x 0.25 – such value of the CO₂ dual price parameter results from the least favourable assessment that as a result of climate changes, Poland will face more unfavourable external effects than favourable and beneficial ones, nevertheless, the scale of impact of such effects will be poor up to 2020.

While assessing the benefits from the reduction of greenhouse gases for Poland, an algorithm was used linking the calculated value with the volume of reduced greenhouse gases used in the lower variant of the assessment by British authors. It is a volume of reduced emissions of greenhouse gases in the country multiplied by their concrete values.

7.6. Using of budget revenues from the auctioning of CO₂ emission allowances

In accordance with Article 10(3) of the EU ETS Directive (amended by Directive 2009/29/EC), EU Member States shall determine the way of using budget revenues from the auctioning of emission allowances. At least 50 per cent of revenues from the auctioning of allowances referred to in Article 10(2) of the Directive, including all the revenues from the auctioning of allowances referred to in Article 10(2) b and c²⁹ should be spent on the following one or more purposes:

- a) reduction of greenhouse gas emissions, including a contribution to the Global Fund for the Energy Efficiency and Renewable Energy and a contribution to the Adaptation Fund, adaptation to the consequences of climate change and financing of research and development work in the area of reducing emissions and adaptation to climate change as well as financing of demonstrative projects;

²⁹ 10 per cent of allocation divided under the GNP fund and 2 per cent of allocation divided under the earlier emissions reduction fund.

- b) development of energy from renewable sources to fulfil the Community's commitments, including the provision of a 20-per cent share of RES energy and an increase in energy efficiency by 20 per cent up to 2020 as well as the development of other technologies that enable to move to a safe and sustainable low-emission management;
- c) activities preventing the deforestation and strengthening the afforestation in developing countries which have ratified an international agreement on climate change to transfer technologies and to ease the adaptation to the consequences of climate change;
- d) sequestration of CO₂ by forests within the Community;
- e) ecologically safe capture and underground storage of CO₂ coming from, in particular, hard coal electric power stations (including third countries);
- f) incentives to change transport into low-emission transport and public transport;
- g) financing of research and development work in the area of energy efficiency and clear technologies in the EU ETS sectors;
- h) measures to increase the energy efficiency and thermal modernization of buildings or to supply financial support in order to take into account social aspects in the case of households with lower and medium incomes;
- i) covering of administrative expenditures connected with the management of Community system.

It is not clear if the specified directions of using revenues from auctioning are obligatory. One can presume the provisions have such an intention, including an obligation to notify the European Commission about the auctioning of allocations for the purpose of spending the revenues on each of the above purposes which should be included in reports submitted to the EC subject to Decision 280/2004/EC.

An obligation is also unclear to spend 100 per cent of revenues from the auctioning of allowances allocated to the EU Member State under the allocation from the GNP fund and from the earlier emissions reduction fund (Article 10(2) b and c of the Directive)³⁰. How to check the spending of the above 100 per cent of the revenues on the specified purposes if one does not know which auction of allowances matches which allocation. The auction

³⁰ See Article 9a (2) of the Directive: "At least 50 % of the revenues generated from the auctioning of allowances referred to in paragraph 2, including all revenues from the auctioning referred to in paragraph 2, points (b) and (c) /the author's own underlining/, or the equivalent in financial value of these revenues, should be used for"

equals to the allocation to a given EU Member State (from the so called base fund, GNP fund and the earlier emissions reduction fund) minus the distribution of free allowances which is not connected with any specific part of an allocation to an EU Member State from the above funds. Taking into account certain unclearness of the interpretation, one can presume the obligation is to spend rather 56 per cent of the revenues ($0,88*50\% + 0,10*100\% + 0,02*100\%$) on the specified purposes than 50 per cent of them.

7.7. Impact on households

Expenditures on energy and other living costs are different in various types of households. The highest expenditures are made by the households of old-age and disabled pensioners as well as entrepreneurs. Relatively low expenditures on electricity in the households of workers show a growing potential of energy consumption in those groups of people (Table 7.9).

Table 7.9. Average monthly expenditures of households on energy and costs of living in 2007 by the type of household

	Unit	Total	Labour workerers	Non-labour workers	Farmers	Entrepreneurs	Old-age and disabled pensioners
Expenditures per person in a household							
Average monthly expenditures	PLN/person/month	810,0	609,2	1 060,8	615,0	1 093,8	848,3
Including: energy carriers	PLN/person/month	84,6	63,7	88,7	59,1	91,0	116,2
Including: electricity	PLN/person/month	28,8	23,7	29,9	22,4	35,2	34,9
Share in expenditures (total =100%)							
Including: energy carriers	%	10,4	10,5	8,4	9,6	8,3	13,7
Including: electricity	%	3,6	3,9	2,8	3,6	3,2	4,1

Source: own calculations on the basis of the Central Bureau of Statistics' data (Yearly Statistical Bulletins of the Central Bureau of Statistics, Budgets of Households)

Share of expenditures in the total expenditures on energy is the highest in the households with lower than average incomes, i.e. those of old-age and disabled pensioners, farmers and labour workers. It accounts for 11-14 per cent of the total expenditures. The expenditures of a bit richer households of entrepreneurs and non-labour workers account for 8-10 per cent of the total expenditures on energy.

The calculations of an impact of changes caused by the implementation of the amendments to the EU ETS Directive have been made with the following assumptions:

A threshold of the growth of expenditures (increase due to an economic growth)

= an increase in GNP per capita * a flexibility index of a disposable income to an increase in GNP per capita.

The following partial assumptions have been taken into account:

- A relation of the expenditures of households to the disposable income does not change and accounts for 90 per cent of the income (89-91 per cent in 2005 and 2006);
- Due to a possibility of using a part of additional budget revenues from auctioning to support the incomes of poorer households to limit the energy poverty problem it has been assumed that the disposable income flexibility ratio in relation to an increase in GNP per capita will increase by 0.5 percentage point in comparison with the highest level observed in the years 1995-2008 (See: Chart 7.2)

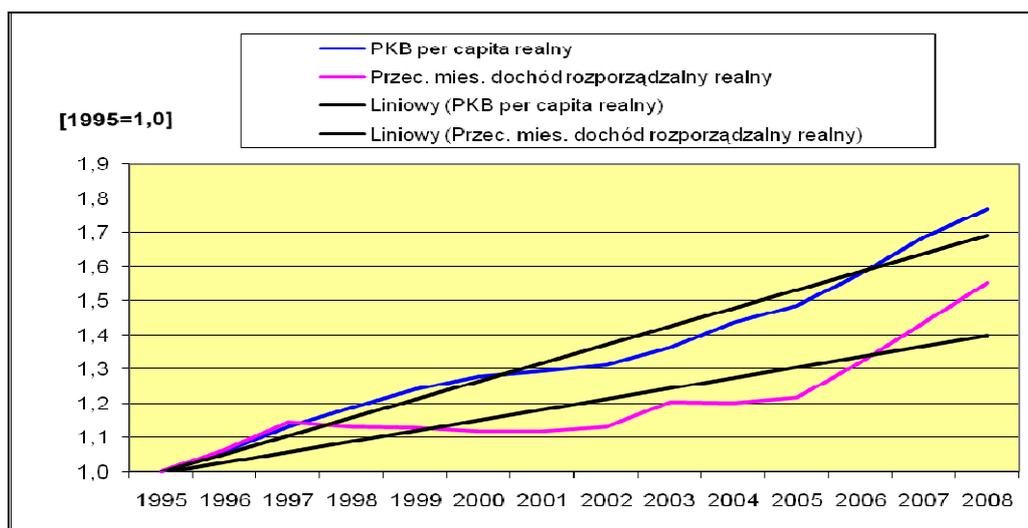


Chart 7.2. Relations between an increase in GNP per capita and an increase in a disposable income per capita in the years 1995-2008 (fixed prices)

An increase in energy expenditures:

= an increase in the demand (consumption) * an increase in the unit price for energy

The following partial assumptions have been taken into account:

- A dynamics of prices in relation to household energy users depends on a dynamics of marginal costs of electricity for nN of households (as a result of an EFOM-PL model);
- As in the above – in relation to the prices for network heat;
- The excise duty for electricity will not change;

- The prices for gas and furnace fuel will change in accordance with a forecast dynamics of import prices of relative fuels to Poland.

In accordance with the partial macro prognoses and energy needs prognoses:

It is assumed that there will be an increase in electricity consumption in Polish households

- Polish households use 3-time less electricity than average households in the EU 15 Member States. Analysing the world trends in this area, including the existing differences in the number of modern household electric appliances, one should expect a major increase in the energy consumption level in Polish households;
- An increase in electricity consumption in Polish households has to result in an increase in expenditures for electricity.

A substantial growth of households' incomes per capita is prognosticated:

- In the macroeconomic scenario there is a perspective of a faster increase in GNP per capita in Poland than an average one in the EU 27 Member States; this will be a reason for an increase in a relation of GNP per capita in Poland to average GNP per capita in the EU 27 Member States from about 50 per cent in 2005 to about 75 per cent in 2020;
- Incomes of households will increase by about 0.82 of the GNP growing rate per capita in real conditions;
- As a consequence, incomes of households per capita will grow on average by 3.3 – 3.4 per cent yearly in accordance with the scenario, i.e. by nearly 1 per cent point faster than in the period of 1995-2007.

An increase in household expenditures on energy in the projected period results from an increase in the level of consumption and an increase in prices/unit costs of energy. The dynamics of incomes and energy consumption results from a macro scenario and a final demand prognosis. The dynamics of prices/unit costs is based on marginal costs. In the case of initial fuels a projected increase in import prices has been assumed as a representative one. In the ETS-Continuation and ETS-Auctioning variants:

- A GNP dynamics and income per capita will get lower;
- A growth of energy consumption will decrease (a price and income effect);
- Prices based on national marginal costs of production will grow quickly.

The data are presented below.

Table 7.10. Values of parameters used for the estimation of shares of energy expenditures and costs of living in the total expenditures of households in the years 2005-2020

Reasons for households' incomes	Increase in GNP per capita (yearly pace of increase)	Relation of households' incomes to	Increase in households' incomes (yearly pace of increase)
---------------------------------	--	------------------------------------	---

growth per capita	ETS-Continuation	ETS-Auctioning	GNP per capita ^{1/}	ETS-Continuation	ETS-Auctioning
	4.12%	4.04%		0.82	3.36%
Reasons for households' energy expenditures growth per capita	Increase in expenditures due to an increase in consumption (yearly pace of increase)		Type of index	Increase in expenditures due to an increase in prices (yearly pace of increase)	
	ETS-Continuation	ETS-Auctioning		ETS-Continuation	ETS-Auctioning
	%a			%a	
- electricity	2.9%	2.8%	Marginal costs	2.8%	3.4%
- natural gas	2.1%	2.1%	Import prices	3.3%	
- furnace fuel (hard coal, liquid fuels, gas)	0.8%	0.8%	Import prices ^{2/}	2.2%	
- heating	1.2%	1.2%	Marginal costs	2.1%	3.2%

1/ In the years 1995-2008 the flexibility of an increase in households' disposable incomes to the dynamics of GNP amounted to 0.77. A flexibility index higher by 5.5 percentage point has been adopted assuming that poor households will be supported with budget revenues from auctioning.

2/ Hard coal, crude oil and natural gas price indices balanced with their use for heating purposes in accordance with Energysys' own forecast.

Source: Own studies

One of the most important measures of civil progress in the living standard of population is a growing electrification of households. In this area the implementation of the ETS-Continuation and the ETS-Auctioning scenarios will cause, among others, a decrease in electricity consumption to 2.9 per cent annually (the ETS-Continuation scenario) and to 2.8 per cent annually (the ETS-Auctioning scenario). Simultaneously it will cause a considerable increase in electricity prices to 2.8 per cent and 3.4 per cent annually in the ETS-Continuation and the ETS-Auctioning scenarios respectively.

7.8. Impact on the situation and development of regions

Certain projected changes have been estimated in the GNP dynamics and number of employees assuming that the changes will be proportional to:

- projected relations of change in the GNP dynamics in the years 2005-2020 for the compared variants of ETS-Auctioning/ETS-Continuation;
- the territorial spread of GNP and the structure of the labour market in the basic year.

Table 7.11. Change in GNP level in 2020 in various branches of the economy for the compared variants

Branches of the economy	Decrease in GNP in 2020 in the variants of
	ETS-Auctioning/ETS-Continuation
Industry	
Extracting industry	-1,7%
Food industry	-0,3%
Light industry	-0,3%

Branches of the economy	Decrease in GNP in 2020 in the variants of
	ETS-Auctioning/ETS-Continuation
Papermaking industry	-3,7%
Chemical industry	-2,3%
Mineral industry	-3,1%
Metallurgical industry	-3,3%
Machine industry	-1,1%
Coal industry	-1,1%
Fuel industry	0,2% ¹²
Energy industry	-1,4%
Other branches of industry	1,0%
Other sectors of the economy	
Agriculture	-0,3%
Construction	-1,7%
Transport	0,2%
Commercial services	-1,9%
Public services	1,4%

A decrease in the production capacity of coking plants by 3.7 per cent and a stabilization of crude oil processing in comparison to the ETS-Continuation

The territorial spread of GNP and the number of employees by sections of the Polish Classification of Activities has been prepared on the basis of the regional statistical data of the Central Bureau of Statistics.³¹ The division inside industrial branches has been estimated proportionally to the structure of CO₂ emissions in accordance with KASHUE in the period of 2005-2007.

³¹ See: The Regional Data Bank of the Central Bureau of Statistics, website: http://www.stat.gov.pl/bdr_n/app/strona.indeks

Table 7.12. Structure of GNP in regions by divisions and sections of the Polish Classification of Activities (PKD) in 2006

Region and voivodeship	Industry ^{1/}												Agriculture (A+B)	Construction (F)	Transport, Trade (G+H+I)	Commercial services (J+K)	Public services (L+M+N+O+Q)
	Extracting	Food	Light	Paper making	Chemical	Mineral	Metal lurgical	Machine	Coke	Energy	Refinery	Other branches of industry					
Central Region		14	6	2	1	9	1	27		33	82	49	28	24	30	36	25
- Łódzkie Voivodeship		3	6		0	8				20		49	9	6	6	6	6
- Mazowieckie Voivodeship		11		2	0	1	1	27		13	82		19	18	24	31	19
Southern Region		5	20	13	22	11	95	30	27	27	0,1		8	22	20	19	19
- Małopolskie Voivodeship		1		1	20	4	46	12		5	0,1		5	8	7	7	8
- Śląskie Voivodeship		4	20	12	1	7	50	19	27	22			3	14	12	12	11
Eastern Region		29	16		31	46	2	11		6	1	37	19	13	12	10	15
- Lubelskie Voivodeship		11			30	11				0,4			6	4	4	3	5
- Podkarpackie Voivodeship		6	11		2	2	0,4	3		1	1	20	3	4	4	3	5
- Podlaskie Voivodeship		7	3			0,2		4		1		16	6	2	2	2	3
- Świętokrzyskie Voivodeship		3	2			33	1	4		3			4	3	3	2	3
North-western Region	26	19	39	18	14	3	2	11		14		14	22	17	16	14	15
- Lubuskie Voivodeship			8	15		1				1			2	2	2	2	2
- Wielkopolskie Voivodeship	26	16	23	3		2	1	11		10		14	16	10	9	8	8
- Zachodniopomorskie Voivodeship		3	8		14	0,1	1			4			4	5	4	4	5
South-western Region	24	14	5	10	11	21	1	6	73	15			7	10	9	9	10
- Dolnośląskie Voivodeship	24	7		3	1	2	1	6	5	10			4	8	7	8	8
- Opolskie Voivodeship		7	5	8	11	20			68	5			3	2	2	2	2
Northern Region	50	19	14	57	21	9	0	9		4	17		16	14	13	12	14
- Kujawsko-Pomorskie Voivodeship		11		22	15	9	0	9		2			7	5	5	4	5
- Pomorskie Voivodeship	50	3	14	35		0,2				2	17		4	6	6	6	6
- Warmińsko-Mazurskie Voivodeship		4		6	0,2					0,2			5	3	3	2	3
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

1/ estimated on the basis of CO₂ emissions structure as reported in the EU ETSSource: own studies on the basis of KASHUE reports and the Regional Data Base of the Central Bureau of Statistics, website: http://www.stat.gov.pl/bdr_n/app/strona.indeks

Table 7.13. Structure of the number of employees in regions by divisions and sections of the Polish Classification of Activities (PKD) in 2006

Region and voivodeship	Industry ^{1/}												Agriculture (A+B)	Construction (F)	Transport, Trade (G+H+I)	Commercial services (J+K)	Public services (L+M+N+O+Q)
	Extracting	Food	Light	Paper making	Chemical	Mineral	Metal lurgical	Ma chine	Coke	Energy	Refine ry	Other branches of industry					
Central Region		14	6	2	1	9	1	27		33	82	49	24	23	25	32	25
- Łódzkie Voivodeship		3	6		0	8				20		49	9	6	7	6	6
- Mazowieckie Voivodeship		11		2	0	1	1	27		13	82		15	17	18	26	19
Southern Region		5	20	13	22	11	95	30	27	27	0,1		12	23	21	20	21
- Małopolskie Voivodeship		1		1	20	4	46	12		5	0,1		9	9	8	8	8
- Śląskie Voivodeship		4	20	12	1	7	50	19	27	22			3	14	13	13	12
Eastern Region		29	16		31	46	2	11		6	1	37	34	13	14	10	14
- Lubelskie Voivodeship		11			30	11				0,4			13	4	4	3	5
- Podkarpackie Voivodeship		6	11		2	2	0,4	3		1	1	20	7	4	4	3	4
- Podlaskie Voivodeship		7	3			0,2		4		1		16	6	2	2	2	3
- Świętokrzyskie Voivodeship		3	2			33	1	4		3			7	3	3	2	3
North-western Region	26	19	39	18	14	3	2	11		14		14	13	17	17	15	16
- Lubuskie Voivodeship			8	15		1				1			1	2	3	2	2
- Wielkopolskie Voivodeship	26	16	23	3		2	1	11		10		14	10	10	10	9	9
- Zachodniopomorskie Voivodeship		3	8		14	0,1	1			4			2	4	5	4	4
South-western Region	24	14	5	10	11	21	1	6	73	15			6	10	10	10	10
- Dolnośląskie Voivodeship	24	7		3	1	2	1	6	5	10			3	8	8	8	8
- Opolskie Voivodeship		7	5	8	11	20			68	5			2	3	2	2	2
Northern Region	50	19	14	57	21	9	0	9		4	17		12	14	14	13	14
- Kujawsko-Pomorskie Voivodeship		11		22	15	9	0	9		2			5	5	5	4	5
- Pomorskie Voivodeship	50	3	14	35		0,2				2	17		3	6	6	6	6
- Warmińsko-Mazurskie Voivodeship		4		6	0,2					0,2			3	3	3	2	3
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

1/ estimated on the basis of CO₂ emissions structure as reported in the EU ETS

Source: own studies on the basis of KASHUE reports and the Regional Data Base of the Central Bureau of Statistics, website: http://www.stat.gov.pl/bdr_n/app/strona.inde

