Mendel University in Brno
Faculty of Business and Economics

Emissions Allowances Trading System and Carbon Tax in the Visegrád Group Countries

Bachelor thesis

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Abstract

NÁPLAVOVÁ, A. Emissions Allowances Trading System and Carbon Tax in the Visegrád Group Countries. Bachelor thesis. Brno: Mendel University, 2015.

This bachelor thesis focuses on the current European Trading System with emission allowances, which does not work. Its non-functionality is shown on historical background and mainly on economic sectors of Visegrád Group Countries; Power engineering, Transport, Manufacturing industry and Households. Not only that the emissions in these sectors do not fall, neither the price of emission allowance is not on expected average. Moreover, its situation in the following month will not be different. The only solution is to introduce the Carbon tax.

Keywords

EU ETS, emission allowances, Carbon tax, Visegrád Group Countries, Power engineering, Transport, Manufacturing industry, Households, price

Abstrakt

NÁPLAVOVÁ, A. Systém obchodování s emisními povolenkami a karbonovou daní ve státech Visegrádské skupiny. Bakalářská práce. Brno: Mendelova univerzita, 2015.

Tato bakalářská práce se zaměřuje na současný Evropský systém obchodování s emisními povolenkami (EU ETS), který nefunguje. Jeho nefunkčnost je prokázána nejen na historických záznamech, ale především na čtyřech ekonomických odvětvích u států Visegrádské skupiny; energetice, dopravě, výrobním průmyslu a domácnostech. Nejen, že tedy emise v těchto odvětvích neklesají, ale navíc cena emisní povolenky je stále hluboko pod očekávaným průměrem, který se nezmění ani v následujícím měsíci. Východisko je jednoznačné, zavést karbonovou daň.

Klíčová slova

EU ETS, emisní povolenky, karbonová daň, státy Visegrádské skupiny, energetika, výrobní průmysl, domácnosti, cena

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1 Introduction

Global warming is officially considered as the biggest issue in the history of our civilization.

Last a few years is the issue about climate change mentioned everywhere around us – on radios, in televisions, newspapers and of course also on the Internet. All of them “feed” us by many catastrophic scenarios about what could have happened due to the current climate change (droughts, floods, heat waves, etc.), which was caused by anthropogenic factors, like burning of fossil fuels over the past 150 years.

Anyway, politicians themselves support these predictions and climate change deemed important. For example, Tony Blair (then as Prime Minister of England) even considered the climate change for "the most important question of all." Furthermore, Arnold Schwarzenegger once said that for his state (California) should become the Global warming a priority. (LOMBORG, 2008)

The whole idea about the global reduction of emissions was negotiated on the United Nations Conference on Environmental and Development (UNCED), in Rio de Janeiro in 1992, where the United Nations (UN) convened the leaders of 118 countries, with the aim “to meet the challenge of global warming, pollution, biodiversity and the inter-related social problems of poverty, health and population”. (PHDRE, 2011)

This was followed by several years of negotiations that culminated in 1997, when on the basis the UNFCCC (United Nations Framework Convention on Climate

Change) was signed legally binding Kyoto Protocol, which came into force eight years later after rather difficult ratification process.

All these steps had just one reason – to mitigate increasing emissions of greenhouse gases, CO_2 in particular, which have an average lifetime in the atmosphere from fifty to two hundred years and based on computer based models cause the greenhouse effect. Thus, the strategic aim is to stabilize global average temperature rise at 2°C above the pre-industrial level by reduction of anthropogenic emissions of GHG.

The European Union had developed the own trading system (EU ETS), which was designed by (in its time successful) American system "Cap-and-Trade", due to its success in the US. The system was (without any quality analysis) declared as a major tool to reduce emissions of greenhouse gases at minimal cost.

What is shared by all EU member states (in this process) is a single trading "currency" called emission allowances (EUAs). They can be used only once and allow the issuer to release one ton of CO_2.

This work will examine in more detail how it looks within the states of Visegrád Group Countries, after the introduction of the EU ETS, and in subsequent three trading phases.

In the end, it will be explored whether a carbon tax will not be a better solution how to reduce GHGs.

2 Objectives and Methodology

2.1 Objectives

The aim of the thesis is according to an analysis of the Emissions Allowances Trading System among the Visegrád Group countries (the Czech Republic, Slovakia Republic, Poland and Hungary) to assess the possible introduction of a carbon tax as an additional tool for reducing of emissions.

2.2 Methodology

Gathered data, for the purpose of the thesis, are collected from different sources. In the theoretical part are demonstrated theoretical perspectives of experts. The main sources are articles from professional online publications and books, reports from the European Union and also the Internet sources.

In the practical part are used online tables and data from Eurostat and statistical program Gretl.

From structural point of view, this thesis has two parts, theoretical part followed by practical part, accompanied by the Carbon tax proposal.

The first, theoretical, part focuses on what preceded to the system EU ETS. In short history is summarized the American "Cap-and-Trade" model and then gradual development of the EU ETS with its scientific body (IPCC) and two main treaties (UNFCCC and Kyoto Protocol). Since 2005 are deeply copied three phases, the First (Pilot) phase, the Second (first Kyoto) phase and the currently last Phase III. In all phases is observed the price development.

Due to importance of carbon intensity is necessary to mention the Kaya Identity; strategy recognized by Professor Yoichi Kaya, who as the first demonstrated four macro-scale policy levers in pursuit of emissions reductions.

The last chapter is dedicated to environmental taxes. They describe the current situation in the European Union.

In the practical part are analyzed online data from Eurostat. On the results in tables, which are divided into four categories (Power engineering, Transport, Manufacturing industry and Households.), is demonstrated mainly the situation of GHG development in Visegrád Group Countries.

To support results from Eurostat and prove the malfunction of the EU ETS, is created prediction of the price for emission allowance. Data are taken from The German Emissions Trading Authority (DEHSt), which includes installations or aircrafts that are subject to EU emissions trading.

For the purpose of thesis were chosen weekly data since January 2013 to February 2015. At the beginning of the year 2013, EU introduced a new system of purchasing emission allowances – auctioning. In previous years 2005 until 2012 were most of the allowances issued for free. So, only those who did not have enough and

needed some *extra allowances* came to the market and had to buy them for the given prices.

Thus, the prediction of the price is made for another *new* month (four weeks). However, firstly is needed to differentiate the time series data and use the Box-Jenkins methodology (BJ). "This methodology is commonly used to analyze univariate stochastic time series." (ADAMEC, 2014, P. 78)

After that is made correlogram, which is used for identifying the most suitable delay for creating an ARMA model (p, q). The model is created in the statistical program Gretl that "combines autoregression process of *p*-th order and process of moving averages of *q*-th order." (ADAMEC, 2014, P. 81) The results are optimal values AR (4, 5) and MA (4, 5, 6).

Finally, is made a prediction in Gretl under the conditions defined in ARMA model. Due to the reasons, noted above, the prediction is (by own choice) created for the next one month; four weeks.

At the end of the practical part, is theoretically described the potential introduction of the Carbon tax. The possible effectiveness is demonstrated on the Swedish example, graph (provided by Swedish government) is showing drop of GHG emissions in Sweden and on the contrary growth of GDP in last more than 20 years.

To sum it up in this bachelor thesis are used following methods:

Analysis – basic and the most widely used method which explores the more complex facts and decomposed them on simpler ones (Visegrád Group Countries)

Description – method description and clarification of information about the examined problems (Theoretical background)

Comparison – method of comparing studied phenomenon (Cap-and-Trade)

Statistical methods – method describing relationships between phenomenon under review (Prediction of the price)

Synthesis – builds on the results of analysis, connects its findings and deduces conclusions and recommendations (It does not work)

3 Theoretical background

The first conference on the environment took place in Stockholm in 1972. The main topic was about how to inspire and guide the people of the world in the preservation and enhancement of the human environment. The outcome was the **Declaration of the United Nations Conference on the Human Environment** – first-ever legal instrument to improve the environment. (UNEP, 1972)

During the eighties acquiring scientific results on transparency and receive progressively more recognition. Climate change has thus become the world's number one environmental problem. (NEMEŠOVÁ & PRETEL, 1998)

Anyhow, in the case of protection the environment the *watershed moment* occurred in Rio de Janeiro in 1992.

On these bases were by UN developed two intergovernmental panels IPCC and UNFCCC. Both paid by UN and have just "external influence" on EU ETS.

3.1 IPCC

The Intergovernmental Panel on Climate Change is the leading international; scientific body for evaluation of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). (KALVOVÁ & MOLDAN, 1996) It exists since 1988 and the idea is to bring together scientists in the world (currently from 195 countries) to investigate the science of climate change and to provide authoritative conclusions for governments and the public. From the beginning it was designed to support advocacy of urgent action. (HELM, 2012)

It is also an intergovernmental body – governments participate on the plenary Sessions, where the main decisions are taken about the IPCC work. (IPCC, 2015)

There are three groups of people – the scientists who follow the climate change up then scientists who examine the potential consequences of climate change and the last group are scientists preparing recommendations for politicians.

The main scope of the IPCC work is to inform, which means to issue reports every 4-5 years. The latest report is called "*The Fifth Assessment Report: Climate Change 2013 (AR5)".* (The reports should be understood as a common result of cooperation of the entire IPCC panel.)

RNDr. Ladislav Metelka (Focal Point IPCC for the Czech Republic till the April 2014) in an interview for "ekolist.cz" (2011) explained what each part of the report deals with:

"The first part deals with the fact how the climate changed in the past, what influences the evolution of the climate and how the climate could evolve in the future.

The second part deals with the impacts, of climate change, on a variety of the economy sectors, if the script from the first part took place. It also tries to explain the vulnerability of the climate system, ecosystems or economic systems.

The third part deals with the so-called Mitigations, which are measures to reduce greenhouse gas emissions. The Mitigations are meant to prevent climate change and prevention of potential adverse consequences of climate change." (STEJSKAL, 2011)

A significant basis of the IPCC work is the M.E. Mann & all work on proxy data and reconstruction of the global average temperature in the recent six centuries. In the research there were evaluated data about the temperatures in the northern hemisphere for the period 1400 – 1980. The graph looks like a "hockey stick". There is shown how the temperature raised steeply up during the 20th century. The authors of the chart argue that the curve shows how in this period there is a significant increase concentration of CO2 in the atmosphere.

Mann´ s hockey stick became to be one of the key arguments supporting the hypothesis about the impact of the anthropogenic greenhouse gases on global warming although it has numerous, quite fundamental deficiencies and systemic flaws.

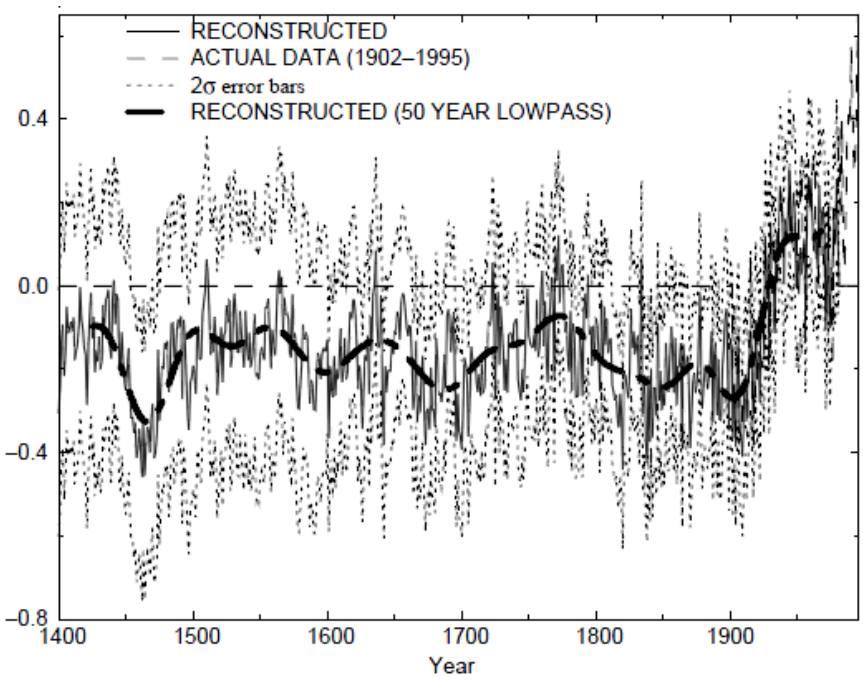

Figure. 1 Mann´s hockey stick
Source: (MANN, 2014)

3.2 UNFCCC

United **Nations Framework Convention on Climate Change** is an international environmental treaty that was agreed in Rio de Janeiro in 1992 and came into force in 1994.

This agreement has been signed by 194 countries showing that there is a problem and that action is required to mitigate climate change. However, the treaty itself is not legally binding – the aim is to stabilise GHG concentration in the atmosphere level, but it does not set any mandatory limits for individual countries.[1] (WMO WEBTEAM, 2014)

The Convention includes four kinds of countries.

Annex I is represented by the industrialized countries that were member of OECD in 1992. Thus, the Visegrád group countries are also included. They must limit their emissions, while *Non-Annex I* countries have a variety of non-binding commitments and also ability to participate in CDM. (NORDHAUS, 2009) The group formed by mostly developing countries recognized by the convention as especially vulnerable to the adverse impacts of climate change, e.g. because of their low-lying coastal areas.

Annex II consists of the OECD members of Annex I, but without the countries with economies in transition. These Parties are required to provide financial resources to developing countries. Into this group belong countries as New Zealand, Canada, EU, USA or Japan, etc.

LDCs are the least 49 developed countries which have limited ability to respond to climate change and adapt to its adverse effects. (UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, 2011)

At joint meetings is each member state represented by various ministries, but there is always named one *contact person* called National Focal Point (NFP)[2] and another key case is that the decisions made by UNFCCC do not have any influence on EU ETS.

3.3 Kyoto Protocol

The Kyoto protocol is an international treaty, which was approved, in Kyoto, in December 1997 and entered into force in February 2005 after ratification by Russia that met the ratification threshold limit of 50% of global emissions. It is based on the "Cap-and-Trade" framework. (ZBOŘIL) It follows and extends the UNFCCC, which was adopted at the 1992 meeting known as the Earth Summit, in Rio de Janeiro. Contrary to the UNFCCC´s Convention, the Kyoto Protocol is legally binding.

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[1] The convention was complemented in 1997 and is known as a "Kyoto Protocol".

[2] In the case of the Czech Republic the current NFP is Ing. Pavel Zámyslický, PhD.

The Protocol places a heavier burden on developed nations, because they are principally responsible for the current high levels of GHG emissions in the atmosphere.

The more specific rules (known as "Marrakesh Accords") for the implementation of the Protocol were adopted at COP 7 in Marrakesh, Morocco, in 2001. Its first commitment period started in 2008 and ended in 2012. (UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, 2013)

For this first commitment period (2008 – 2012) were determined the limits (for 37 industrialized countries and the European Community) to reduce GHG emissions on average 5.2 % in the comparison with 1990 levels.

However, during the same time period had to all the member states of the EU before 2004 collectively reduce their greenhouse-gas emissions by 8 %. [3]

To successfully get these stated targets, the Protocol introduced three additional mechanisms – International Emissions Trading (IET)[4], Joint Implementation (JI)[5], and the Clean Development Mechanism (CDM). Through these mechanisms is offered the chance for developing countries to move over to new technologies.

Before the second commitment period was adopted the "Doha Amendment to the Kyoto Protocol", in Qatar, in December 2012 known as Kyoto II. There was defined a new eight-year commitment period (2013-2020) and also the limits for reducing GHG emissions by at least 18% below 1990 levels.

The protocol has been signed, but not ratified by all 192 Parties [6]and represents an important step forward in the effort to tackle climate change as it includes binding, quantified objectives for reducing and limiting the production of six greenhouse gases emissions: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

On the other hand, developing countries (including China and India) were not committed to reduce emissions, because they had contributed a relatively small share of the current century-plus build-up of CO_2. (HENSON, 2011)

After all, China is already approximately four times bigger emitter than it was in 1990 and also the demand for coal increased about more than 90% between 2000 and 2010. China is, by all means, the largest GHG emitter in the world.

Nowadays, in the world there exist roughly 2300 coal-fired power stations and more than 620 of them are right in China and on the second place behind China is, of course, India. These two countries together add up three coal-fired power stations per week. Their growth is mainly energy- and carbon- intensive

[3] Targets were also accepted by Australia, Canada, Japan, the USA, Russia, Ukraine etc.

[4] IET – countries that have emission units to spare are allowed to sell them to countries who are over their targets

[5] JI- countries who are under the Kyoto Protocol can transfer or acquire emission reduction units and due to them meet their emission reduction target

[6] The US never ratified the Protocol.

fuelled by burning coal – considered the dirtiest of all energy sources. China´s share of world´s coal-bum is now close to 50%. (HELM, 2012)

Tab. 1 Obligatory targets for each party from Kyoto protocol to reduce GHG emissions during the first Kyoto
Source: (UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, 2010)

Country	Target (1990-2008/2012)
EU-15, Bulgaria, **Czech Republic,** Estonia, Latvia, Lichtenstein, Lithuania, Monaco, Romania, **Slovakia,** Slovenia, Switzerland	**- 8%**
US	- 7%
Canada, Japan, **Hungary, Poland**	**- 6%**
Croatia	- 5%
New Zealand, Russian Federation, Ukraine	0
Norway	+ 1 %
Australia	+ 8%
Iceland	+ 10%

3.4 Cap-And-Trade

Concept how to make the system of trading with emission allowances ETS was developed according to the US framework "Cap-and-Trade" which was created as an optimization tool for reducing the incidence of acid rain in 1980s, but in economic theory this vision had appeared roughly 20 years earlier.

"During that times in the US the power plants were sending up vast clouds of sulphur dioxide, which was falling back to earth in the form of acid rain, damaging lakes, forests and buildings across eastern Canada and the United States. The squabble about how to fix this problem had dragged on for years." (CONNIFF, 2009) Finally, emissions trading became a law as a part of the Clean Air Act of 1990. It was administrated by the US EPA, whereby the program is responsible for annual SO_2 emissions reductions of 50% since 1980.

"The system was successful in the US, because of complying every one of the three main preconditions.

- *The first one was that sulphur dioxide is a pollutant.*
- *Secondly, the system works in a homogeneous economic environment where the emission mitigation costs are very similar (in the US energy sector).*
- *And finally, there were technical and organizational means to reduce emissions readily available (desulfurization was, is and will be a common technology)."*(ZBOŘIL)

A huge disadvantage of the approach is that it has never been tested in the international context, and it has been unable to attain anything close to universal participation. (NORDHAUS, 2009)

3.5 EU ETS

In early days of building EU, the economic issues were much more important than the environmental ones. This was changed in 1970´s after the conference of United Nations in Stockholm (1972). The same year Paris Summit of the Heads of States and Governments took place. The outcome was that for improving quality of life, the attention should be paid to the environment. Nonetheless, the turning-point for the environment was done by entry of the Single European Act in 1987 added into the Treaty Establishing European Community. (EU, 2013)

In 2000 was adopted by the EU Council the (unsuccessful) Lisbon Strategy where the environmental issues were defined in one of the three pillars. The Strategy was eventually replaced (MEZŘICKÝ, 2005) by new strategy, Europe 2020 having the strong environmental dimension as well.

The EU has been the most active economic block in terms of GHG emissions mitigation and pursuing a new climate deal after 2020. On these bases, was recognized commitment from the Kyoto Protocol by the Council Decision 2002/358/EC and 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 was then adopted.

This led to the formation of the European Emissions Trading Scheme (EU ETS) and currently the reduction targets formed as a part of the *Europe 2020 strategy*.[7]

EU-ETS is the world´s largest and oldest trading instrument for reducing GHG emissions plagued from the very outset by numerous and extensive problems.

Actually, the scheme was commenced three years before the Kyoto protocol and is important because 33 of 37 Kyoto-regulated developed countries (*from the first commitment period 2008-2012 – "Annex B countries"*) are in Europe. The others (Canada, Australia, New Zealand and Japan) do not share any common borders with other regulated countries.

At the beginning The European Union has decided to use emissions trading scheme (on a framework of "cap-and-trade"[8] program) together with other market-oriented mechanisms (JI, CDM) permitted under the Protocol, to help it achieve compliance at least cost. (PARKER, 2011)

The EU ETS uses *emission offsets*. The offsets (or credits) allows to emitting firms purchase them from companies from other parts of world. The only condition is that foreign companies will reduce their own CO_2 emissions. So, afterwards offset-purchasing company can emit (domestically) more emissions.

The weakness of this system is that measuring and monitoring the exact amount of GHG reduced by foreign company is almost impossible. (COOPER, 2010)

[7] Europe 2020 replaced "infamous" Lisbon Strategy.

[8] The "cap" represents a statutory limit on the amount of certain chemicals that can be released economy annually

The implementation took place in two phases and the allocation plans for emission allowances were approved (for both phases).

The EU ETS includes more than 12,000 power stations and manufacturing plants from these industrial sectors: iron and steel; cement, glass and ceramics; pulp and paper; electric power generation; and refineries and these all is made in the 28 EU member states as well as in Iceland, Liechtenstein and Norway.

"Participation in the EU ETS is mandatory for companies operating in these sectors, but in some sectors only plants above a certain size are included. Governments can exclude certain small installations from the system if fiscal or other measures are in place that will cut their emissions by an equivalent amount.

Aviation operators flying within and between most of these countries are also covered." (EU COMMISSION, 2013, p. 3)

Despite the nations, industries and individual companies cooperate under the EU ETS together with the aim to collectively reduce emissions, there is also a competition among them to receive a bigger "piece of cake" – so, receive as many free emissions allowances as possible and have an advantage over their competitors. That was a reason why in NAPs most of the EU member states favoured their most revenue-generating industries with more allowances. (COOPER, 2010)

3.5.1 The Clean Development Mechanism (CDM)

It could be defined as a world´s largest carbon offsetting scheme. "Companies involved in the EU ETS are the largest buyers of carbon credits generated by the CDM." (REYES, 2014) Because the price is just roughly half a Euro per ton, it makes "European pollution" very cheap.

Thus, Countries which do not participate in the cap-and-trade system actually extend participation through the clean development mechanism (CDM). However, according to a World Bank staff report, CDM has been a major source of accounting emissions reductions; so, most of the emissions reductions in EU-ETS have come from CDM. (CDM allows to developed country "implement an emission-reduction project in developing countries, where the cost of reducing emissions may be cheaper than at home. Such projects can earn saleable Certified Emission Reduction (CER) credits (= one tonne of CO_2) which can be counted towards meeting Kyoto targets." (CITY OF LONDON, 2012, p.2)

In numbers CDM has produced 280 million tons of offsets of CO_2 for the EU (whereas emissions reductions for the first budget period are only 130 million tons of CO_2). It should be mentioned that there is still no way of verifying that the projects in fact reduced emissions in the host countries. (NORDHAUS, 2009)

The other aspect of CDM is that Asia is the largest supplier of CERs (followed by Latin America), e.g. "in 2008, China accounted for 84% of the transactions in the primary CDM market, followed by India and Brazil with 4% and 3% market share." (STERNER & CORIA, 2012, p. 364)

3.5.2 Phase I (2005-2007)

The first trading period also called as "the **Initial Phase**" or "**pilot phase**" was used for "learning by doing" started in order to help the EU meet its targets under the Kyoto Protocol (8% reduction in greenhouse gas emissions from 1990 levels). During these years in the trading process were covered only CO_2, and included only power plans with capacity greater than 20MW and other industrial facilities (= 42% of emissions).

"Permits were allocated to energy-intensive firms, especially in the power-generating sector, but also including oil refining and seven energy-intensive manufacturing sectors." (COOPER, 2010)

The Phase I was designed as a trial period and was mainly taken as a preparation for the Phase two.

The EU´s strategy was to reduce their emissions 6.5 % below 2005 level.

"Allocation of allowances in Phase I and II was determined by individual countries under National Allocation Plans (NAPs)[9], included the "Business as Usual" criterion, historic emissions, projected sector growth or a combination of these." (VAN ZEBEN, 2014)

Auctioning was allowed only to 5% from the whole quantity of emission allowances. It was used only by Germany, Hungary, Ireland and Lithuania.

Tab. 2 Auctioning in the Phase I.
Source: (HAITA, 2013)

Country	Percent auctioned or sold	Total EUAs distributed	Auctioned or sold EUAs
Germany	4.35%	93,114,184	4,381,000
Hungary	2.65%	92,813,805	23,745,00
Ireland	2.06%	58,927,569	1,213,000
Lithuania	1.58%	34,946,402	552,000

Although this phase was mandatory, nearly 100% of emission allowances were allocated free through grandfathering. However, some Member States (for example Germany, Denmark and Finland) used benchmarks for allocation to new entrants, and others (for example Sweden, Netherland, Italy) for installations in general and fixed energy efficiency rates for energy production installations. (EGENHOFER, FUJIWARA, AHMAN, & ZETTERBERG, 2006)

"Offsets favouring an emitting source from emissions savings reached in projects outside the EU were allowed." (AUER, 2012)

[9] NAP - served for setting out the total quality of allowances for every MS (GOV.UK, 2014)

On one hand, the EU ETS was successfully established as the world´ s biggest carbon market.

Unfortunately, EU this first phase was widely regarded as a failure due to an over location of emission allowances. The reason was attributed to the lack of availability of good data during the development of NAPs. (HOOD, 2010)

In the end, there was a slump in the price of carbon.

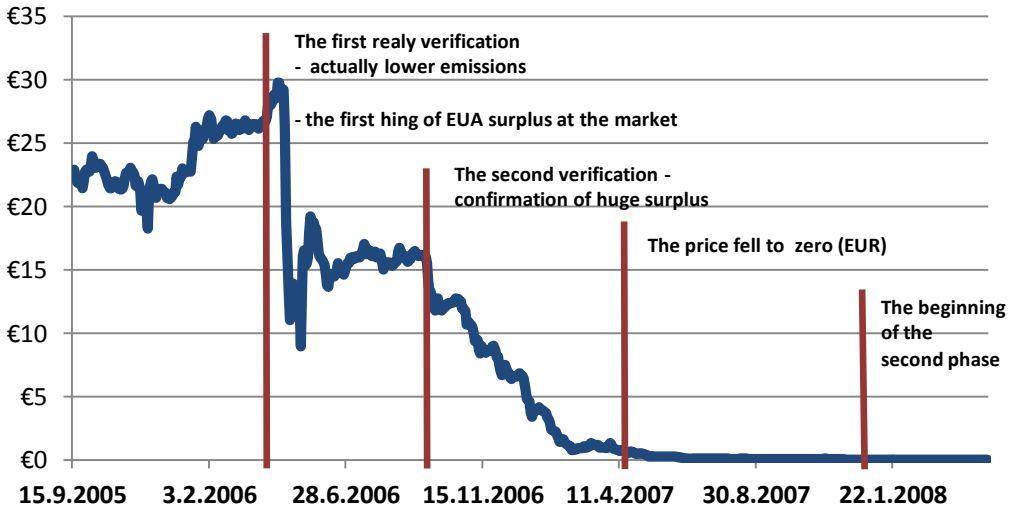


Figure. 2 Price of emission allowances during the Phase I
Source:(VIRTUSE ENERGY, S.R.O., 2014)

The first period of this allowance trading scheme (2005-2007) ended with a price of 0.01 Euro for one ton of CO2 because the allowance turned out to be too high: firms respected them very easily and therefore did not need to buy emission allowances of GHG. (SIA PARTNERS, 2008)

The trading price began at around 7 Euros per metric ton of carbon dioxide in early 2005. The peak was in 2006 – 30 Euros and then collapsed to zero in 2007. (COOPER, 2010)

3.5.3 Phase II (2008-2012)

This phase is corresponding with the **first Kyoto Commitment Period**.
The EU ETS was joined by Iceland, Norway, Liechtenstein, Bulgaria and Romania[10] on 1st January 2008.

For the second phase and fulfilling the Kyoto aims the EU adopted a strategic program (*European Climate Change Programme*) and based, its verification of the second round of NAPs, on data revealed from Phase I. Finally, the number of allowances for period 2008-2012 was reduced by 6.5% below actual 2005 emissions.

[10] new EU MSs from 2007

The European ´s new member states (except Slovenia and Slovakia) did not agree with Commission´s decision to achieve fewer permits than their required and challenged the Commission´ s revision in the European Court. (Poland and Estonia won in 2009.) (COOPER, 2010)

However, due to the Financial Crises, which started in late 2008, the industrial production fell down and the demand for emission allowances decreased. Other factors were high import of international credits and the facts that industrial sites in general received more allowances than were their total emissions. Thus, it together caused that at the start of the Phase III, there was a surplus of almost 2 billion allowances.

Nevertheless, the price of allowances did not collapse, in contrast to the previous phase, because allowances were not able to be banked for use in future trading periods. (HOOD, 2010)

Because of the growing surplus (since 2009), the Commission proposed to postpone ("back-load") the auctioning of 900 million allowances from the early years of the next phase (Phase 3) to the end of the trading period (2020).

"Back-loading" was done by the European Commission in a hope of artificially boosting the carbon price.

"The proportion of general allowances given to away for free fell slightly on at least 90%. The penalty for non-compliance was increased to €100 per tonne. Several Member States held auctions during phase two." (EUROPEAN COMMISSION, 2013)

The first EU MS which held an auction in phase II was the UK. It auctioned 10% of allowances besides to the EU average 3%. (GOV.UK, 2013) "However, during the years 2010 to 2012 a total of approximately 130 million EUA were sold in 269 individual auctions. This amounts to a total value of over 1.5 billion Euros and an average revenue of 11.64 Euros per EUA." (DEHST, 2014)

Tab. 3 Average annual quantity to be auctioned
Source: (EUROPEAN COMMISSION, 2010)

Member State	Average annual volumes to be auctioned
Germany	40 million
UK	17 million
Netherlands	3.2 million
Hungary	2.7 million
The Czech Republic	2 million
Ireland	557,065
Austria	400,000

Yet nearly at the end of the period (1.1.2012) was covered into the EU ETS the aviation sector, whose operators got 85% of allowances for free. (EUROPEAN COMMISSION, 2013)

All in all, until the end of the year 2012 the total GHG emissions were already about 18.2% below 1990 level and 21.6 % below the Kyoto base year's level.

The considerable merit on it has the economic crisis contributed to less than half of the reduction noticed during the 2008-2012 period, while EU´s GDP grew by 45% between years 1990 and 2012. (EUROPEAN COMMISSION, 2014)

Due to improvements in switching to cleaner fuels (such as natural gas and also a strong uptake of renewable), energy supply emissions showed a 16 % decline since their 1990 levels. "The share of renewable in gross final energy consumptions in the EU reached 14.1 % in 2012.". (EUROPEAN COMMISSION, 2014, p. 32) Energy-related emissions in industry experienced a decline of over 38 % since 1990.

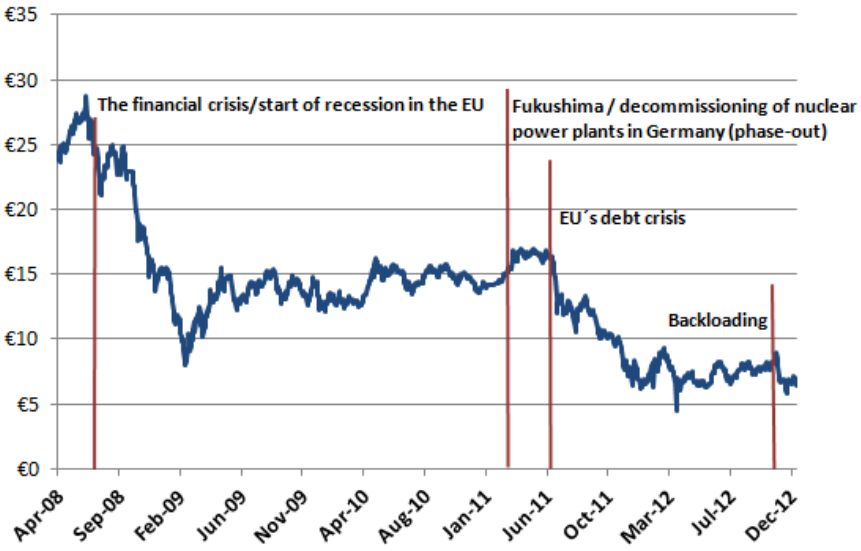


Figure. 3 Price of emission allowances during the Phase II
Source:(VIRTUSE ENERGY, S.R.O., 2013)

3.5.4 Phase III (2013-2020)

The actual; third commitment period is taken as a period which brings lots of changes and then of course as a second Kyoto Commitment Period. [11]

The biggest change for this trading period is the way of allocation the allowances. The main method (from 2013) is auctioning.12 Up to now, most of the allowances were given by governments for free (manufacturing industry still receives a part of the allowances for free[13], from 80% to 30% in 2020 and the rest is auctioned).

The power generators must buy all their allowances. It is because the previous experience shows that despite they received allowances for free, the notional cost

[11] 1.1. 2013 Croatia joined EU-ETS and six months later the EU.

[12] For auctioning were set up two platforms – the European Energy Exchange (EEX) and ICE Futures Europe (ICE). (EUROPEAN COMMISSION, 2010)

[13] Based on benchmarking.

was passed to customers. Anyhow, there are eight MS (among others Czech Republic, Hungary and Poland), who will receive limited numbers of allowances for free until 2019, but the condition is that in the same value (of the free allowances) they will invest into modernizing their power sector. (EU COMMISSION, 2013)

So, auctioned are 88% of allowances another 10% is for the least wealthy EU MSs and the last 2 % means "Kyoto bonus" for nine MS [14] who had reduced GHG emissions by at least 20% of levels in their Kyoto Protocol period.

In two previous phases, the trading system was set up on NAPs, nevertheless; it has been changed for median emission's calculation taken from 2008-2012. This new EU-wide cap replaced the national emission caps and should linearly decrease emission's levels by an annual rate of 1.74% to reach 21% below 2005 levels in 2020 and 30% reduction in comparison with the 1990 levels.

"In October 2012, the Commission opened a debate on a series of possible "structural reforms" to the ETS, ranging from higher greenhouse gas targets and limits on international offset credits, through to "bringing more sectors into the EU ETS", although there is no clear legislative path to implementing these measures." (REYES, 2014, p. 5)

[14] Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia

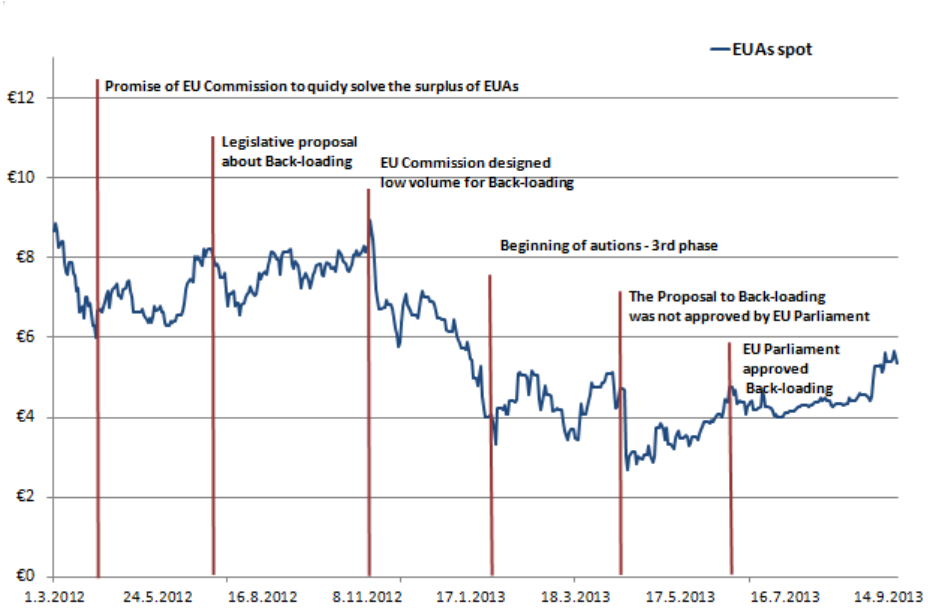


Figure. 4 Price of emission allowances during the Phase III
Source: (VIRTUSE ENERGY, S.R.O., 2014)

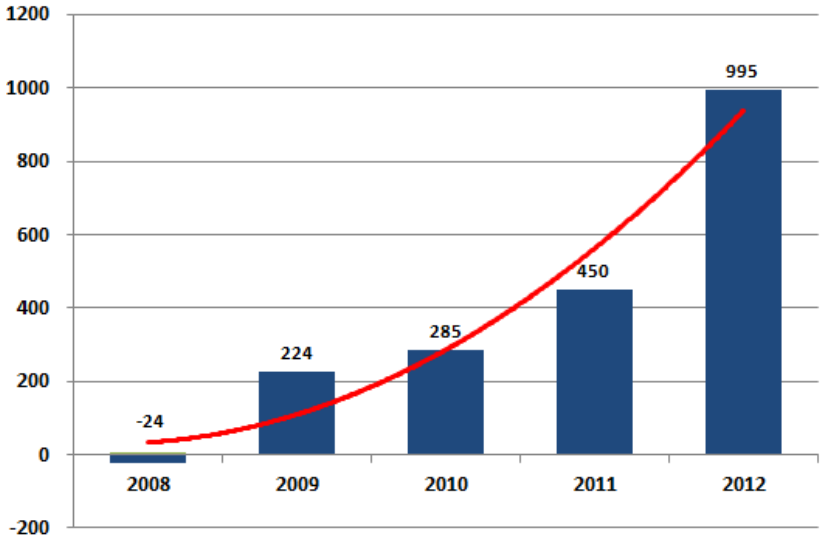


Figure. 5 The annual cumulative growth of surplus EUAs, the numbers are in Mt
Source: (VIRTUSE ENERGY, S.R.O., 2014)

3.6 Kaya Identity

The Kaya Identity is equation determining the level of human impact on climate. It "shows that there are four – and four only – macro-scale policy levers in pursuit of emissions reductions. These are respectively, population, wealth, energy intensity (meaning units of energy per unit of GDP) and carbon intensity (meaning the amount of carbon produced per unit of energy). Each of these factors is amendable to the action of a particular lever and each lever prescribes a particular approach to policy.

In the case of population, the lever is population management. In the case of wealth, the lever is to reduce the size of the economy. In the case of energy intensity, the lever is to increase energy efficiency. And for carbon intensity, a switch to energy sources that generate fewer emissions is the primary lever.

The relationship between the four factors in the Kaya Indetity can be expressed mathematically as follows:

$$\text{Carbon emissions} = C = P \times \frac{GDP}{P} \times \frac{TE}{GDP} \times \frac{C}{TE}$$

(TE = total energy)." (PRINS, ET AL., 2010)

The most important finding of the Kaya Identity is that the final result can be ultimately affected by radical improvement of the carbon intensity throughout the economies from the individual states up to the global community. Thus, major efforts must be focused on new, more efficient technologies even developing real breakthrough ones as it is stressed in the very recent analysis of the IEA. *Energy Technology Perspectives 2015 (ETP 2015)* shows that despite a few recent success stories, clean-energy progress is falling well short of the levels needed to limit the global increase in temperatures to no more than 2°C. That leaves the development and deployment of new, ground-breaking energy technologies as the key to mobilising climate action, and it urges policymakers to step up efforts to support them. (ZBOŘIL)

3.7 Environmental taxes

The current EU Environmental taxes are based on Directive 2003/96/EC.
"At European level, statistics on environmental taxes use as a basis the legislation in the area of environmental accounts and in the area of national accounts.

Regulation (EU) No 691/2011 of the European Parliament and of the Council of 6th July 2011 on European environmental economic accounts provides a framework for the development of various types of environmental accounts (also re-

ferred to as modules). Environmental taxes by economic activity are one of the three modules currently included in the Regulation and are defined as

A tax whose tax base is a physical unit (or a proxy of a physical unit) of something that has a proven, specific negative impact on the environment, and which is identified is ESA as a tax." (EUROSTAT, 2015)

The tax bases are organized in four categories – energy (including fuel for transport), transport (excluding fuel for transport), pollution and resources.

Energy taxes involve taxes on energy production and taxes on energy products used for both transport (petrol, diesel) and stationary purposes. The energy products for transport purposes mean petrol and diesel and for stationary purposes are fuel oils, natural gas, coal and electricity. In this tax are also included taxes on biofuels and on other form of energy from renewable sources.

The most important "item" covered in energy taxes in tax on carbon dioxide (CO_2).

Another category is represented by **transport taxes** which mainly include taxes related to the ownership and use of motor vehicles, as well as taxes on transport equipment (e.g. planes, ships or railway stocks) and transport services (e.g. duties on charter or scheduled flights).

Pollution taxes focus on measured emissions to air and water, management of solid waste and noise. There is an exception – CO_2 taxes are under energy taxes.

The last taxes are the **resource taxes** including taxes linked to the extraction or to the use of natural resources. It means water, forests, wild flora and fauna.

Finally, should be mentioned that Value Added Taxes, Land taxes, taxes that should be treated a rents on sub-oil assets, alcohol, tobacco and similar consumption taxes, and taxes on income and on labour are excluded from environmental tax statistics.

In the world or even in the EU there have already existed countries which have the successful carbon tax.

The first example is **Sweden**. The tax was enacted in 1991 and the aim is to reduce CO_2 emissions and to spur innovation of industry. Its focus is on oil, coal, natural gas, bottled gas and petrol, but it is not applied to fuels used for electricity generation. The industries are also advantaged, because they are required to pay only 50 per cent of tax. The results are astonishing – there is a heavy expansion of the use of biomass for heating and industry and furthermore, by 2008 they decreased their emissions by more than 40 per cent in comparison with 1980s. (CARBON TAX CENTER, 2015) The public "secret" is that Swedish electric power generation is from perhaps 90 per cent carbon free, due to the increased use of renewable energy source, though they use hydroelectric power plans, power plans and until then the biomass reasonably.

The proportion of carbon tax on gross domestic product is about 0.8%

Another state that could be mentioned is the Canadian province **British Columbia** where the tax was enacted in 1st July 2008 and the focus is on coal, oil and natural gas where the basic prise was USD 10 per tonne of CO_2. The price was annually growing and since 2012 the price has been USD 30 per tonne of CO_2.

Despite the population has been higher about 4.5% since 2008, the combustion fell is about 5% and the revenues have been more than billion USDs. Between the years 2008 and 2014 British Columbia registered a 16 per cent decrease of emissions. The money goes back through tax cuts, credits and direct payments. (HANDLEY, 2015)

The last example will be the European member state **Ireland** where the tax started to be "active" in 2010. The aim of the tax was (and still is) different than in previous two examples - it should help to reduce Irish staggering deficit. The tax payer is everyone who caused the environment damage in Ireland. Thus, the tax is on most of the fossil fuels used by homes, offices, vehicles and farms. Households´ trash is, for example, weighed at the curb, and residents are billed for anything that is not being recycled. There is also a new purchase tax on new cars and yearly registration fees that rise steeply in proportion to the vehicle´s emissions. However, the results are great. Only the revenues from tax in 2012 were around 400 million Euros which means that till 2022 the Irish 10-year deficit could be reduced by 50%. (ROSENTHAL, 2012)

The first EU "experiment" to establish a tax for those, who were not included in the system EU ETS, failed.

The carbon tax revenues should be preferentially earmarked for research and development of the modern energy technologies and also for the foreseen adaptation measures. The idea gains rather increasing support as the flat global tax be the most equitable measure for the global agreement. (ZBOŘIL)

4 Visegrád Group Countries

After 1990 (not only) in the Visegrád Group Countries collapsed the real socialism, which among others caused the disintegration of the market. This resulted in dramatic drop of industrial production and even worst closing some facilities down. These structural changes and aspects had resulted in dramatic reduction of emissions and easier achieving of the Kyoto commitment actually before they were set up.

On the other side, the Czech Republic and Poland are still two of the largest producers of GHG per capita in Europe. (For example in 2011the Czech Republic emitted 10.73 tons CO2 per capita, while Poland reported 7.79 tcp and Luxembourg 20.10 tcp just to see the scope.) The reason is caused by two factors – both countries, CZ and PL, have high-energy intensive industry and also have elderly coal plants.

Visegrád group countries joined the EU on 1st May 2004 that is why they have been automatically participating in the EU ETS from its beginning.

4.1 Allocated allowances

In the first trading period (2005-2007) all the Visegrád group countries got more of free emission allowances than they really needed.

A good example could be the Czech Republic, whose NAPI was based on emission's data from 2004, when it reached only 90 million tons, but there was roughly 8 percent ("bonus") increase and government finally gave away (in the comparison with the rest of EU MSs) the second biggest amount of free emission allowances per capita. (KOTECKÝ & SUTLOVIČOVÁ, 2006)

Of course, most of them received the energy industry (around 63.4 million) – particularly ČEZ a.s. roughly 36.8 million. (MINISTERSTVO VNITRA ČR, 2005)

However, similar situation came in every EU MS except for UK and France.

The graphs (below) show the Kyoto (second) trading period in terms of allocation and verified emissions. The verified emissions mirror perfectly the economic downturn starting 2008. For example in Hungary there was a drop between 2008 and 2009 and then stagnation, similar, but milder was the situation in the Czech Republic. Poland and Slovakia are better off since they had not experienced a drop that would be too dramatic.

By "allocated" is meant the number of allowances that was allowed to the Visegrád group countries (for free) and on the other side "verified" are the real emissions which were launched to the air.

From the specific emissions follow that nothing really happens. In all four Visegrád group countries the emissions and generally the situation around emission allowances is more or less the same.

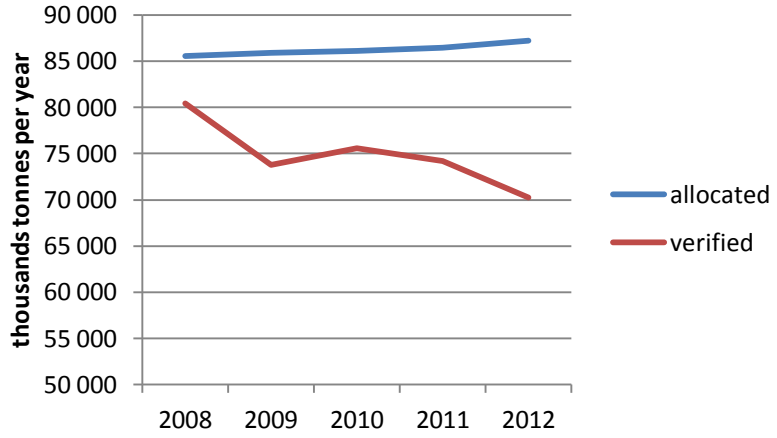


Figure. 6 The Czech Republic – allocated and verified (2008-2012) Source: (EUROPEAN COMMISSION, 2012)

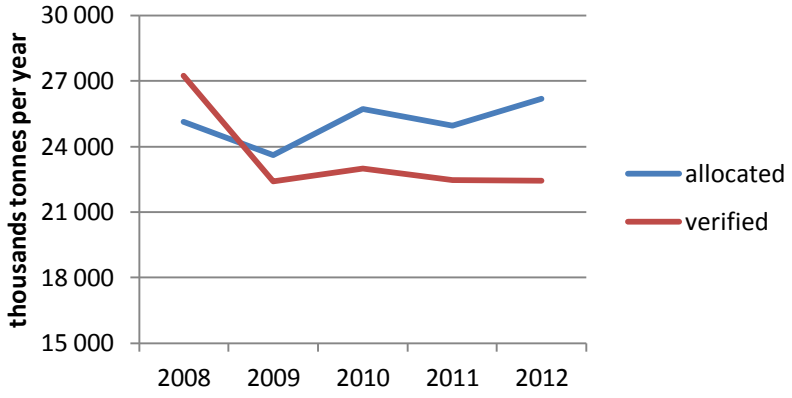


Figure. 7 Hungary – allocated and verified allowances (2008-2012) Source: (EUROPEAN COMMISSION, 2012)

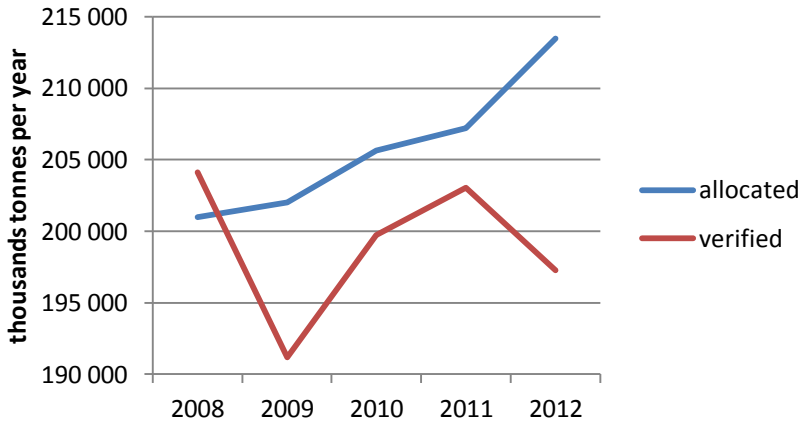


Figure. 8 Poland – allocated and verified allowances (2008-2012) Source: (EUROPEAN COMMISSION, 2012)

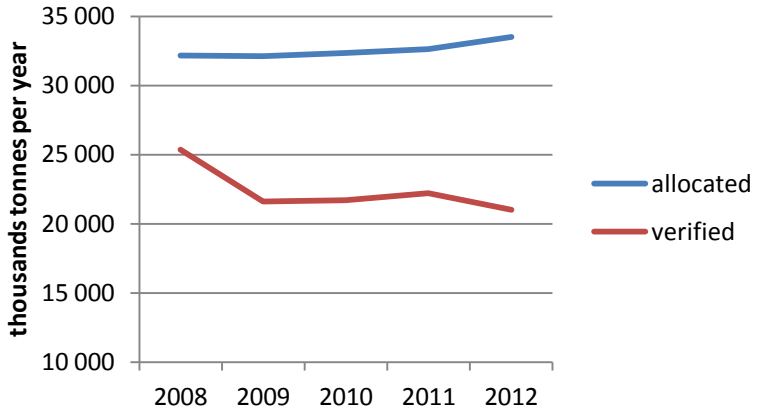


Figure. 9 Slovakia – allocated and verified allowances (2008-2012) Source: (EUROPEAN COMMISSION, 2012)

4.2 Power engineering

The EU ETS system is mainly focus on carbon reduction and the associated coal-fired power plants.

"Although coal-fired plants account for just 40 per cent of world energy production, they are responsible for more than 70 per cent of energy-sector emissions." (GUTMANN, ET AL., 2014)

Coal is a synonym for the dirtiest fossil fuel and for Industrial Revolution as well. It is publicly known that coal is worse than oil, and much worse than gas, but despite this fact, the global demand for coal is awesome (only between 2000 – 2010 it grew by over 70 per cent).

Trends in use of coal are different – in OECD countries, coal consumption is stable over the last decade; in the EU was even 14 percent drop. In contrast, in non-OECD countries the demand for coal has increased about by 94 per cent over the same decade.

Using a coal in the EU instead of more climate friendly gas is understandable – the price of coal is still cheaper than gas which must be mostly exported to the EU. So, many from the total 350 coal-fired plants are running at nearly full capacity and the opposite situation is with the gas power plants, which are becoming unprofitable. (GUTMANN, ET AL., 2014)

Among the main producers of coal and lignite in the EU are two of Visegrád group countries – Poland (80.9 %) and the Czech Republic (63 %). The table below shows decreasing primary production of coal and lignite in Visegrád group countries from 2005 to 2012, in million tonnes of oil equivalent.

Tab. 4 Primary production of coal and lignite (2005-2012) in million tonnes of oil equivalent (EUROSTAT POCKETBOOKS, 2014, P. 60)

	2005	2006	2007	2008	2009	2010	2011	2012
CZ	23.5	23.8	23.8	22.7	20.8	20.7	20.9	20.1
HU	1.7	1.7	1.7	1.6	1.5	1.5	1.6	1.6
PL	68.4	67.1	61.9	60.5	56.1	55.0	55.3	57.5
SK	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.5

Decrease in primary production was also recorded in petroleum products and natural gas production.

Primary production of renewable energies, on the other hand, is expanding no matter of the consequences on the security of supply (just the consumption doubled since 1990).

Renewable energies mean biomass, hydropower, wind power and liquid biofuels.

The target of the EU till 2020 is to have a 20% share of energy consumption from renewable resources. In 2012 the share was 14.1%.

Tab. 5 Primary production of renewable energy (2005-2012) in million oil equivalent Source (EUROSTAT POCKETBOOKS, 2014, P. 64)

	2005	2006	2007	2008	2009	2010	2011	2012
CZ	2.0	2.2	2.4	2.4	2.6	2.9	3.0	3.2
HU	1.2	1.2	1.3	1.6	1.9	1.9	1.9	2.0
PL	4.5	4.8	4.9	5.4	6.0	6.9	7.4	8.5
SK	0.9	0.9	1.0	1.0	1.2	1.4	1.4	1.4

Although, between the years 2011 and 2012 the primary production of energy went down by 1%, it resulted in higher imports of primary energy and also energy products. Solid fuels, crude oil and natural gas were imported to the EU mainly by Russia and Norway (natural gas).

The petroleum products were nearly all imported (93% of them) and similar situation was with natural gas (66%). It means that EU energy dependence on imported products is still roughly 50% (2005-2012).

In the graph below is demonstrated that energy dependency of Poland and the Czech Republic is lower than the general EU-28 average, because they are exporting countries. Their dependency rates in 2012 were -6.9% and -13%. (EUROSTAT, 2014)

Tab. 6 Energy dependence - all products 2005-2012-in %
Source:(EUROSTAT POCKETBOOKS, 2014, P. 72)

	2005	2006	2007	2008	2009	2010	2011	2012
EU-28	52.2	53.6	52.9	54.7	53.7	52.7	53.9	53.4
CZ	28.0	27.8	25.1	27.9	27.1	25.5	27.7	25.2
HU	63.1	62.7	61.2	63.2	58.5	58.1	51.8	52.3
PL	17.2	19.5	25.4	30.3	31.5	31.2	33.4	30.7
SK	66.3	63.8	68.2	64.3	66.3	62.9	64.1	60.0

The final energy consumption during 2005-2012 was mostly decreasing. However, since 1994 it was slowly growing to its peak in 2006 and then due to the financial and economic crisis decreased by 7.3% till 2012. The exception is Poland, where it has grown from original 58.3 million tonnes (of oil equivalent) to 63.6 million tonnes in 2012.

Tab. 7 Final energy consumption (1990-2012) in million tonnes of oil equivalent Source:(EUROSTAT POCKETBOOKS, 2014, P. 81)

	1990	2005	2006	2007	2008	2009	2010	2011	2012
EU-28	1080.2	1189.3	1190.2	1170.5	1174.7	1108	1160	1107.2	1103.4
CZ	32.5	26	26.4	25.9	25.6	24.4	25.4	24.5	24.1
HU	19.9	18.2	18.0	16.9	17.0	16.4	16.6	16.2	14.7
PL	59.9	58.3	60.9	61.8	62.2.	61.2	66.3	63.9	63.6
SK	15.2	11.6	11.4	11.2	11.5	10.6	11.5	10.8	10.3

Tab. 8 Greenhouse gas emissions from energy industry (1 000 tonnes of CO2 equivalent)
Source:(EUROSTAT, 2015, TSDCC210)

	1990	2005	2006	2007	2008	2009	2010	2011	2012
CZ	57937	61123	60572	64191	59019	56152	58855	58393	57413
HU	20548	19743	20262	21257	20291	17159	17856	17166	16533
PL	235819	178088	183336	180045	173747	166285	172853	174858	169603
SK	19637	12499	11967	11285	11310	10199	9866	10025	9478

It is also important to focus on the carbon intensity of the energy production in the V4 countries. The figures show development in kg CO_2 per MWh:

	2007	2008	2009	2010	2011	% Change
CZ	636	621	588	589	591	92,9
HU	368	351	313	317	317	86,1
PL	820	815	799	781	780	95,1
SK	221	208	210	197	200	90,5

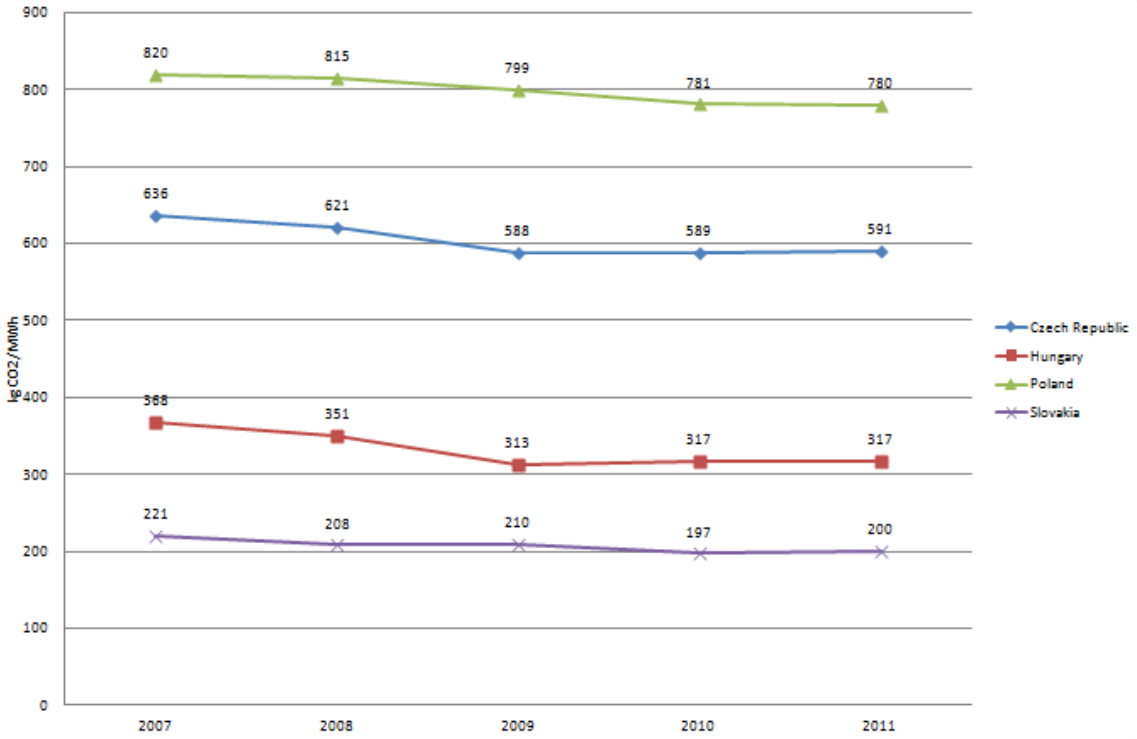


Figure. 10 Carbon intensity by V4 countries - electricity generated: kg CO2/MWh
Source: (IEA, 2015)

The diagram shows that in terms of decarbonisation of power sectors no dramatic development can be seen.

4.3 Transport

After energy is transport the second biggest greenhouse gas emitting sector being responsible for perhaps one quarter of EU emissions.

While GHG emissions from other EU sectors fell down about 15%, between 1990 and 2007, in contrast emissions from transport increased over the same period about 36%.

"This increase has happened despite improved vehicle efficiency because the amount of personal and freight transport has increased. Since 2008 greenhouse gas emissions from transport have started to decrease." (EUROPEAN COMMISSION, 2010)

In most of the countries more than 50% cars are petrol-driven. "The contribution of alternative fuels was significant in Poland (16%) and Italy (7%). In the six-year period (2006-2012), all EU MSs recorded increased numbers of diesel-driven passenger cars. In Poland, Ireland, and Sweden the increase was almost threefold." (EUROSTAT, 2014)

Tab. 9 Greenhouse gas emissions from transport (1 000 tonnes of CO2 equivalent) Source:(EUROSTAT, 2015, TSDCC210)

	1990	2005	2006	2007	2008	2009	2010	2011	2012
CZ	7756	17951	18280	19237	19076	18510	17434	17263	16909
HU	8520	11883	12719	13092	12987	12889	11726	11394	10849
PL	20575	35058	38829	42897	44844	45262	47676	48244	46825
SK	5022	6265	5858	6518	6713	6173	6652	6396	6574

"Transport is the only source of emissions in the EU which experienced an increase over the period. Similar to the general trend, the emissions from transport underwent a slight dip in 2009, due to the effects of the economic crisis, yet they were still about 2 % above their 2000 levels." (EUROSTAT, 2012, p.12)

Tab. 10 Motorisation rate of lorries and road tractors 2007-2012 (=number of lorries and road tractors/1000 inhabitants) Source:(EUROSTAT POCKETBOOKS, 2014, P. 129)

	2007	2008	2009	2010	2011	2012
CZ	54.1	58.7	57.7	57.2	57	57.5
HU	47.4	45.4	46.5	46.4	46.6	47
PL	66.1	71.1	73.3	78.1	81.3	82.5
SK	43.7	49.9	53.6	55	56.3	57.4

Tab. 11 Motorisation rate of passenger cars 2006-2012 (number of passenger cars/1000 inhabitants) Source:(EUROSTAT POCKETBOOKS, 2014, P. 126)

	2006	2007	2008	2009	2010	2011	2012
CZ	401	414	424	424	429	436	448
HU	319	325	305	301	299	299	301
PL	351	383	422	432	447	470	486
SK	248	267	287	295	310	324	337

Transport is besides GHG emissions responsible also for dust, air pollution or noise.

From the households point of view transport represents spending about 10-15% of their consumption. It is roughly the same spending as on food or housing.

Generally, there is an increase of road share by 4% since 2000 to a current 77% of the total, but the opposite situation (decrease of 3%) happened at the same time in railway transport. (EUROSTAT, 2012)

Tab. 12 Final energy consumption by transport 2005-2012 (million tonnes of oil equivalent) Source:(EUROSTAT POCKETBOOKS, 2014, P. 85)

	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
CZ	2.8	4.4	6.1	6.3	6.7	6.7	6.5	6.2	6.2	6.0
HU	2.7	3.3	4.3	4.6	4.7	4.8	4.7	4.3	4.2	4.0
PL	8.3	9.9	12.5	13.9	15.3	16.3	16.6	17.6	17.8	17.3
SK	1.4	1.5	2.4	2.3	2.5	2.7	2.4	2.6	2.6	2.3

Tab. 13 Final consumption of petroleum products (in ktoe)
Source: (EUROPEAN COMMISSION, STATISTICAL POCKETBOOK, 2014)

	1995	2000	2005	2010	2011	2012
CZ	2601	4070	5866	5724	5661	5538
HU	2609	3220	4208	4070	3954	3718
PL	7891	9459	11911	16217	16371	15942
SK	1294	1372	1731	2093	2056	1997

4.4 Manufacturing industry

Manufacturing industry received 80% of its emission allowances for free also in 2013 (in a differentiated manner based on the rules for prevention of carbon leakage) and every year this percentage is decreasing annually to 30% in 2020. The rest allowances are (the same as in power generation) auctioned.

Industry represents 20% of EU´s employment in 230,000 enterprises. (EUROPEAN COMMISSION, 2011)

Tab. 14 Final energy consumption by industry
Source: (EUROPEAN COMMISSION, STATISTICAL POCKETBOOK, 2014)

	1995	2000	2005	2010	2011	2012
CZ	12.5	10.1	9.7	8.6	8.5	8.1
HU	3.8	3.5	3.4	2.9	2.8	2.6
PL	23.0	19.0	16.6	15.3	15.0	14.9
SK	4.7	4.5	4.7	4.4	4.3	4.3

As is shown in the table below, this industry recognized a sharp decrease in GHG emissions from the year 1990. The real reason is not thanks to new technology, unfortunately, it has been made by reduction of production.

In actual fact, some branches of industry (the steel industry, most notably) the greenhouse gasses are released as a result of physical-chemical processes. In most cases, such emissions have already been reduced to the lowest levels technically possible.

Tab. 15 Greenhouse gas emissions from Manufacturing Industries and Construction (1 000 tonnes of CO2 equivalent) Source:(EUROSTAT POCKETBOOKS, 2014)

	1990	2005	2006	2007	2008	2009	2010	2011	2012
CZ	46754	23311	22700	20184	20302	19455	18836	18834	16603
HU	16409	5886	5766	5750	5583	4363	4623	4565	3986
PL	42518	35439	35408	37417	33194	29617	31286	31755	30902
SK	16839	9444	10148	9128	9022	8578	8419	8980	7225

The modernisation of technologies caused in early beginnings of the system that the emissions went down. All in all, in following ten years more than 0.5% annual reduction of emissions is hardly possible without further, undesirable, reduction of production. The energy intensive industries, at least in the Czech Republic, about the situation is virtually the same throughout the EU have reached nearly their technology minimums of emissions, based on implementation of the Best Available Techniques. Further tightening the GHG emissions limits as foreseen by the new assumptions related to the 2030 targets would inevitably lead to final departure of these industries from the EU as whole as well as from the V4 countries. (ZBOŘIL)

4.5 Households

Households are not the direct emitters (in terms of the EU regulation), but they are "the secondary ones". They consume electricity, gas, fuels and other products including the carbon.

The emissions of this category are not monitored, for example the emissions from the heat go on the "account" of heating plants.

Tab. 16 Final energy consumption by households (1995-2012)
Source:(EUROPEAN COMMISSION, STATISTICAL POCKETBOOK, 2014)

	1995	2000	2005	2010	2011	2012
CZ	6.4	6.1	6.3	6.6	5.9	6.0
HU	6.3	5.6	6.5	5.7	5.5	5.1
PL	22.7	17.2	18.3	21.1	19.0	19.6
SK	2.0	2.6	2.5	2.3	2.1	2.1

Tab. 17 CO2 per capita (kg CO2/cap)
Source:(EUROPEAN COMMISSION, STATISTICAL POCKETBOOK, 2014)

	1995	2000	2005	2010	2011	2012
CZ	12,534	12,338	12,427	11,232	11,056	10,678
HU	5,989	5,753	6,02	5,235	5,069	4,694
PL	9,463	8,376	8,394	8,615	8,556	8,381
SK	8,33	7,606	7,795	6,919	6,922	6,536

5 Prediction of the price

At the beginning of the system, in 2005, the EU Commission expected that the price for emission allowance will be around 20 or better around 30 Euros. However, they probably did not "count" with the economic fluctuations, which are the most important *influencers* on the price of emission allowances.

Mainly due to them the trading market with emission allowances is not working since the First Phase, on whose end the price was equal to zero. Analogical situation almost supervened in the Second Phase, so, because of this the EU Commission decided to introduce a new system for the Phase III, auctioning.

Although, the price in last a few months goes slowly up, the prediction clearly shows that the future price position will not exceed the 8 Euro limit.

Firstly was made the first difference from data, see in the picture below, where is shown the 95 per cent interval where the prediction will be.

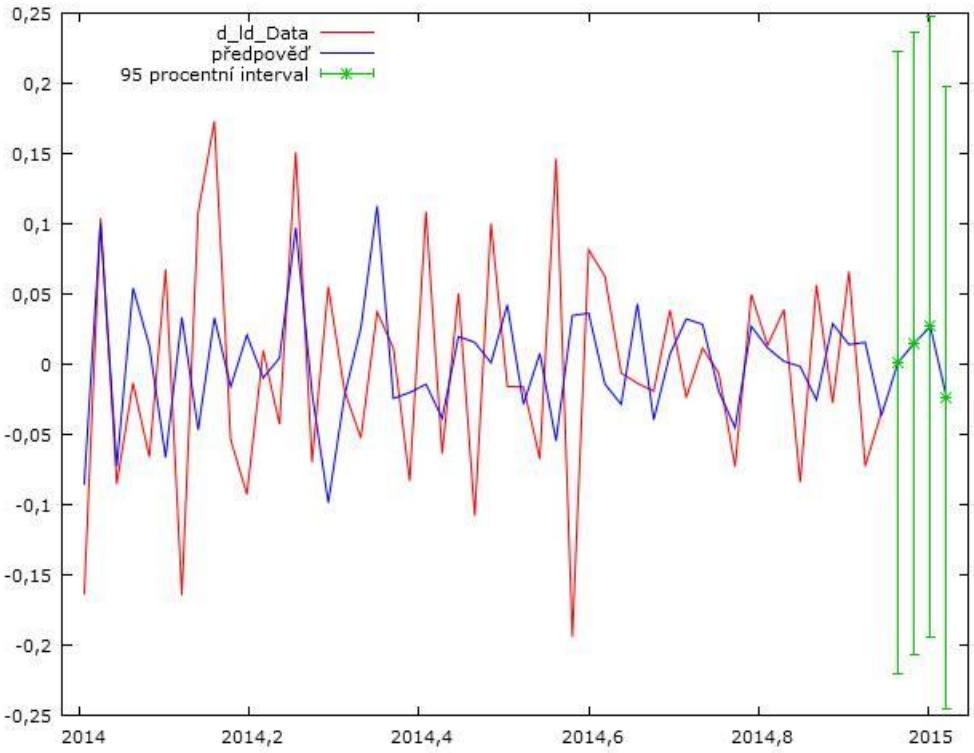
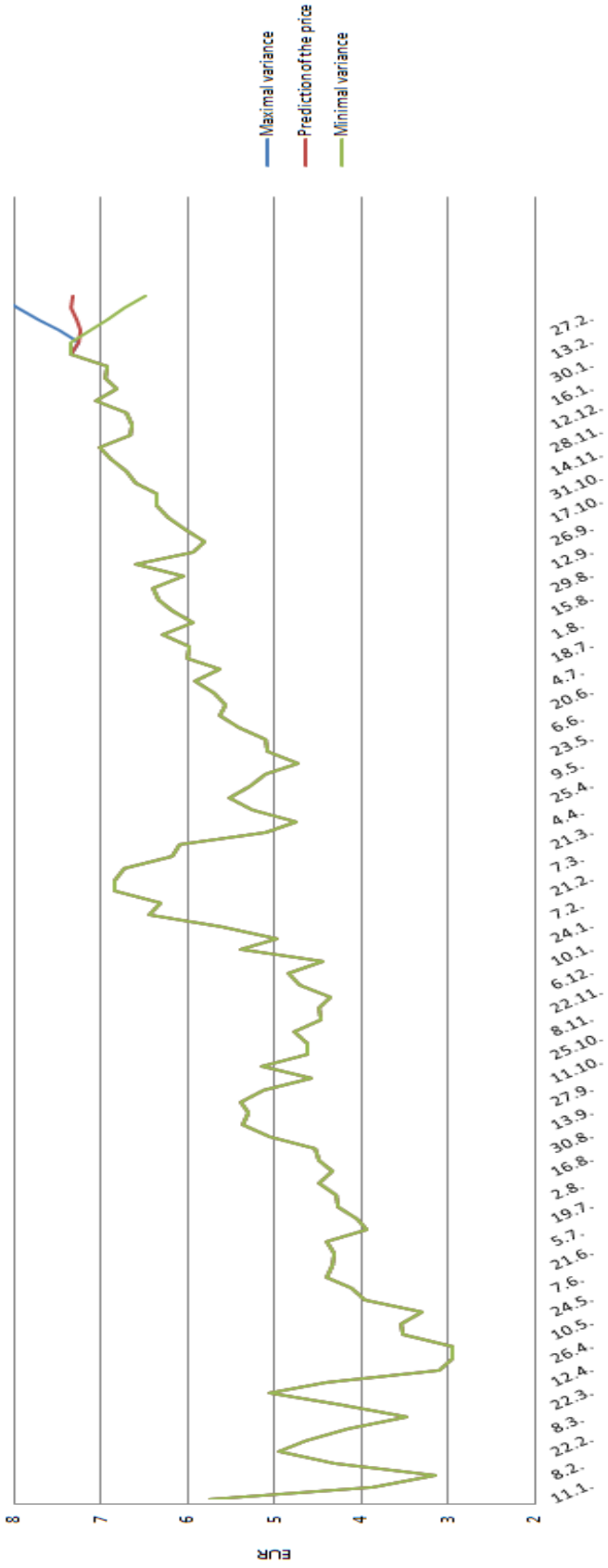


Figure. 11 The first difference of the data made in Gretl,

In the Appendix are data regarding time series and also the results from ARMA model. Finally, was made the prediction of real data in Microsoft Excel

Figure. 12 Prediction of the price for another 4 months Source of data: (DEHST, 2014)



6 It does not work

As the collected data and their analyses show, the EU ETS works as an autonomous system, delivering no significant (and promised) reductions of the GHG emissions. In addition, it is being on a sort of "permanent resuscitation".

Reasons, why the EU ETS is a failed policy, are more than a few.

First, the model for creating the EU-ETS was the US "Acid Rain program". The primary difference between these two systems is the American one was focused on a massive switch from high sulphur to cheap and in that time (1980s) available low sulphur coal and did not allow any outside offsets.

On the other side, "a cap and trade program for climate change focuses on keeping the price of fossil fuel energy low. Even a cap-and-trade program that did not include offsets or facilities without accurate monitoring will only have an indirect impact on the relative price of foil fuel and clean energy." (WILLIAMS&ZABEL, 2009, P.8)

In spite of this, the Acid Rain programme was sold as a model for the system of greenhouse gas emissions trading and above the system has been adopted in a very short period of time with no possibility to be tested in the international context. There was in particular a strong political will to met EU´s obligations under the Kyoto Protocol, but implementation is far from complete and in many points of view the system is still only a construction site with many critical elements of setting. (EGENHOFER C. , FUJIWARA, AHMAN, & ZETTERBERG, 2006)

Secondly, all along there was a massive over-allocation of emission allowances which has resulted in no motivation to decrease the emissions and on the other hand, negatively motivated countries to cheaply purchase emissions allowances from elsewhere, but it has been already noted in the theoretical part of this work.

Another distinguishing aspect is lobbying that since the early beginning has played an important role. Thanks to lobbying are allowances allocated according to competitiveness rather than environmental concerns.

In the EU "there are an estimated 15,000 to 30,000 lobbyists attempting to influence the Brussels institutions, the vast majority of whom represent business rather than citizens´ interests." (REYES, 2014, p. 19)

For example well-known is German government lobbying on behalf of its luxury car-maker etc.

The system is also too costly (there is rotating at least amount of 100 billion Euros) and inefficient, because of the high levels of non-participation.

Moreover, "there have been nearly twenty years of efforts to influence emissions directly by – paradoxically – indirect methods. Principally, these methods are "top down" regulation of the end uses of energy. They have been highly ambitious, including the attempted and flawed manufacture of a market for carbon; but they have failed to reduce emissions or, more importantly, accelerate the rate of decarbonisation of economies." On the other hand, it should be done oppositely – aim to "achieve real reductions in emissions indirectly by – not so paradoxically –

direct methods. This strategy is aimed with intensity and focus on the supply side at the primary production of energy." (PRINS, et al., 2010)

Finally, it should be mentioned that if we replace the fossil fuels for the "carbon neutral" biomass. "The potential risk in the case of using biomass is the loss of some renewable materials (especially wood) for the forest based processing industries. The support given needs, therefore, to be carefully chosen to avoid such loss. With wind energy, the risk lies in its instability and having a large share of energy coming from wind power could jeopardise the reliable supply of electricity in the networks; capacity therefore needs to be backed up by stable sources." (COMMITTEE, 2006, p. 10)

The physical truth is (according to the Massachusetts Environmental Energy Alliance) that emissions from biomass are roughly on average 50 per cent higher than those of coal which is a sort of bitter irony.

The fall of emissions can be caused only by reduction of production. On the contrary, industrial sectors received allocations with assumed full capacity production, thus, it may this way, large subsidies. This resulted in a surplus which they sell for profit. The power sector even passed on the free allowances as costs to customers in the Phase I, nothing like that happened in case of energy intensive industries; their prices are surely just market-driven ones. It is necessary to say that such allowance revenues were no close of loses the energy intensive industries just reported in the critical period of time (60% capacity utilization in steel industry, etc.).

7 The Carbon Tax

One of the alternatives how to react the current deadlock; not working EU ETS as a tool for emission reductions at the least cost, is to introduce revenue-neutral, carbon-based tax or levy. (JÍLKOVÁ, 2003)

Carbon tax is an indirect tax, which could be defined as "a form of pollution tax used to cut greenhouse emissions and promote cleaner energy. It is meant to target carbon dioxide emissions from burning fossil fuels." (A QUICK LOOK AT SWEDEN´S CARBON TAX, 2013)

On the other hand, the tax should not be a plain substitute for EU-ETS, its purpose would be just to get badly needed money for Research and Development and adaptation measures.

It means that energy intensive industries (like steel, lime, chemicals, cement or paper mill industry) who are not under the current and foreseeable technical standards able to further reduce the emissions in other way than to decrease the production should not be killed by further tightening the emission caps. In other words, mature technologies are in place and only new, breakthrough technologies that do not exist yet would meet EC expectations in terms of targets 2030. (ZBOŘIL)

The tax was a subject of negotiations many times in the past, but the Commissioners could never agree on it. Create a neutral and equal tax in all sectors and countries of the EU and perhaps globally, is not easy, at least because it means stepping out-of-the-box.

In spite of this, the tax rate should be (according to a Swedish model) lower for industry than for households. Otherwise it could hinder the competitiveness of European enterprises at the international markets. The potential "final" tax collector should be something like the World Bank and money collected to be used for energy Research and Development or invest in energy security of supply and energy efficiency.

Actually the global community does not know how to finance the Climate Fund already established (assuming 100 billion USD per year).

The advantage of this tool is that it would create a fixed price for carbon and so also support business environment in the EU. Moreover, every country uses taxes and already has an administrative tax system, tax collectors, and needs revenues. Another "benefit" of carbon tax is, in comparison with current EU-ETS, the price of tax would not vary so widely from year to year, or even day to day. Also, "the tax approach provides less opportunity for corruption and financial finagling than do quantitative limits, because the tax approach creates no artificial scarcities to encourage rent-seeking behaviour." (NORDHAUS, 2009, P. 6)

The dark side of the tax is a fact that it will not lead the European or even world economy toward a particular climate target as for example CO2 concentration limit or global temperature limit would be restrained of course. (NORDHAUS, 2009) In view of people, the raising price of energy generally affects they are poorer (the poorest would be hit the hardest), but unfortunately, it does not mean

that higher price imposed on the people would truly save the energy or perhaps money.

For this reason, the tax should be combined with another "instrument" - the Energy union. The EU Energy union "means making energy more secure, affordable and sustainable. It will allow a free flow of energy across borders and a secure supply in every EU country, for every citizen." (EUROPEAN COMMISSION, 2014)

Anyway, it is still just in a phase of negotiations and preparations, admittedly it could be probably one of the last chances for the EU to survive after 2020. One thing is almost undoubted – the current format (Cap-and-Trade) as was the Kyoto Protocol is not plausible any further if there is a chance to conclude Paris deal in December 2015.

The potential efficiency of the carbon tax could be demonstrated on the Swedish example, where is the tax efficiency more than successful. This graph (below) clearly shows, how the reduction of CO2 emissions[15] fell about 20% down and conversely was observed 59 percentage of economic growth.

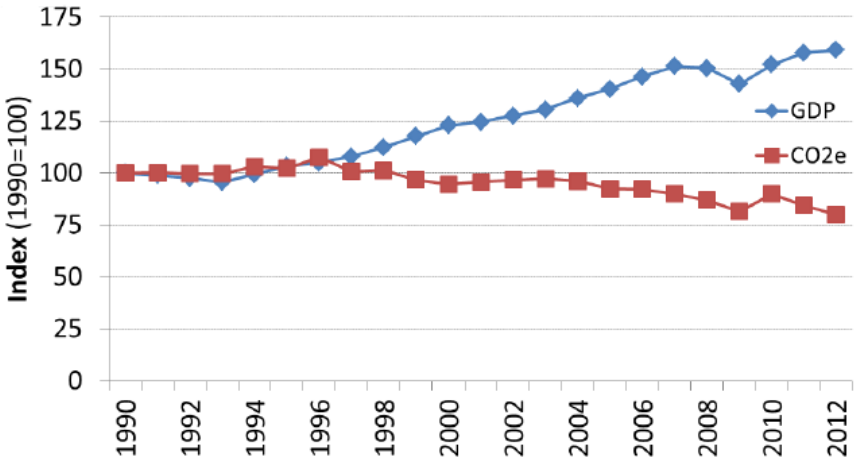


Figure. 13 Real GDP growth and CO2e emissions in Sweden 1990-2012 (ÅKERFELDT, 2014)

[15] CO_2 = approx. 80% of total CO_2e emissions

8 Discussion

Since the absolute level of emissions is a rather than straightforward indicator the international community focuses (very easily and short sighted) on the absolute figures. Unfortunately this indicator does not tell us anything about structural changes that are badly needed in the energy sector as well as in the manufacturing energy intensive industries. Carbon intensity shown like physical weight of GHG per unit of output (MWh tonnes) expresses much more closely the decarbonisation efforts of individual operations and even the industrial sectors eliminating fluctations of temperatures throughout the year changes of a business cycle, etc.

It has been ten years since the official start-up of the EU ETS and our current path is leading us nowhere., showing no particular structural changes in electricity generation pattern. Low cost measures (especially in the power sector) had been employed in the beginning like organizing operation order of the power plants alongside the minimal carbon intensity of the power plants, but no serious decarbonisation measures have been employed so far. We should also keep in mind that the RES operators are very often outside of the power sector establishment, thus deployment of the RES (PV wind) could be seen in the national scale also best as change of carbon intensity. The EU ETS does not take the carbon intensity into account.

We might reduce the emissions, but it is has been achieved by reduction of production and not, unfortunately, by structural, more carbon-efficient measures.

The situations very similar in all the V4 countries since the industries operate in very similar economic environment and the detailed statistics reporting the CZ industrial situation could be easily to considered applicable V4, even the EU wide ones (see in Appendix).

As many analysts throughout the political spectrum agree, the EU ETS has no potential of a forward looking instrument, boosting research and development and it is even incapable to raise financial resources for such an endeavour. The effort to provide funding for pilot CCS projects has not brought any tangible results and parties initially interested in such projects have, all of them, withdrew from their interests in these technologies.

Since the EU ETS has not ever been analysed for its efficacy to deliver emission reduction directly, the key problematic factor is declared “over-allocation”. These basic presumptions wrong since there are not readily available technologies for the economy wide decarbonisation.

In the V4 countries, Poland is obviously in the most precarious situations. The remaining three countries have at least some nuclear generating capacities while Poland and its industries rely most on their indigenous hard coal. No doubt, it is in their vital interest to set up the decarbonisation efforts on something much more reliable and conducive than the EU ETS with all its problems and risks of administrative incursions in the system.

According to many specialists, EU ETS was the world´s first serious cap and trade regime for GHG, but also one of Europe´ s biggest mistakes since World War II. Even the whole idea has been mainly supported by European green parties, now they admit the system is failed policy, as well.

Thus, from my point of view, if the EU does not want to lose its ultimately competitiveness, energy or reputation, it should start working on some plausible alternative. I think that the best solution would be to introduce the carbon tax and, as was mentioned above, ideally in combination with European Energy Union, which should come in power towards the year end 2015.

In the world there has been already existing examples of countries which have started with carbon tax and now it is profitable for them, among others nine European states. Probably the most well-known is Swedish example how it should definitely look like in the rest of the Europe. However, they also pose that if we want to decrease the GHG emissions and stop the rising temperature, we will have to pay something for it – and it will not be a little.

So, the added focus should not be taken just on energy and manufacturing sector, but on increasing transport (and its GHG emissions) as well. Generally, the transport sector is under-going something like “modernization”, the aim ought to be safety and fuel-efficiency (consumption up from 3 to 3.5 litres per hundred kilometres). Electric vehicles and hydrogen cells still remain the challenges for much more distant future.

Another goal of EU´s attention could be concentrated on households as a sector which will pay a carbon tax in the price of petrol, diesel, gas or electricity etc.

Finally, I would like to impart, that the wide effort how to prevent runoff the climate change, cannot be made only by the EU itself. The World should be united in these efforts, which means the biggest world´s issuers (China, India and USA) should be add up to joint efforts, otherwise it is just wasting of time and money.

In coming years, it is expected that the EU will be forced to act - about what happens have many experts different opinions, but might we will not have to wait so long, because one of the opinions is that the United Nations Clime Change Conference in Paris (December 2015) decides.

9 Conclusion

The aim of this thesis was to show on four Visegrád group countries, that the European emission trading system does not work delivering emission reductions as expected and also to suggest another alternative, which could replace the EU ETS partially at least.

At the beginning, United Nations came with a commendable idea to protect the environment in the global scale.

On the basis of the Earth Summit in Rio de Janeiro (1992) there was agreed and finally ratified the Kyoto Protocol defining obligatory targets for each party to reduce GHG emissions during the years 2008 and 2012.

The European Union got committed to meet these targets, so three years, before the "Kyoto period" started, there was commenced a new trading system EU ETS, complying the Cap-and-Trade Kyoto framework. The US (sulphur oxides) emission trading system within their Clean Air Act was the blueprint for the EU ETS.

The first, three-year long, Phase I did not turn out well. The EU MSs, based on individual NAPs, received more free emission allowances than they actually needed. Thus, due to a good lobbying was ensured the worst issuers got so many free emission allowances that they did not have to buy any "extra" ones. The end of the first phase was, from price point of view, catastrophic. One emission allowance was just for 0.01 Euro. Anyway, the EU itself declared this end is not so catastrophic, because it was only "learning" phase.

The second EU Phase, but the first Kyoto Phase, came with a new rule – countries got less free emission allowances (roughly 6.5 % in comparison with 2005). Unfortunately, in late 2008 the global financial and economic crisis hit the EU with a serious decline of the industrial production and, inherently, it lead to large surplus of allowances (roughly 2 billion) within the EU ETS. In spite of this, the price, did not drop to zero. The Commission (EC) suggested so called "backloading" and 900 million allowances were taken from the market.

The end of the Phase II meant also the end of the 7-year period where the operators had a right of getting almost all allowances for free provided they would meet the emissions limit (cap).

It is expected from the third Phase, which started in January 2013, that it would bring eventually success. How it would turn out will be known in 2020, but one thing for sure – auctioning, introduced in 2013, is no miracle. Economic fluctuations and European decisions still influence the price and whole EU ETS so strongly that it provides only little signal for investors looking further ahead and evaluating new low-carbon technologies, which are by the way still missing in many industries. Under such circumstances, the EU ETS can be hardly considered a market instrument.

The potential EU ETS achievement does not support the results in tables from Eurostat data in which clearly demonstrate that amount of used coal in EU is even higher than in 2005.

A good example could be the graph of carbon intensity (p. 39) that shows the situation is more or less the same as roughly ten years ago, so there is no dramatic change, not to mention the EU´s targets in this respect.

In the case of price, the original "wish" to sell one emission allowance for at least 20 Euros is far away and how the prediction of the price shows, the situation will not be better.

It is understandable that the operators would want rather actual trading with emission allowances than the Carbon tax. Reasons are simple, within this system they still have potential hope that due to a good lobbying they get minimally a part of allowances for free, in the case of taxes is something like that really impossible. On the other hand, the tax could help to fix the carbon price and it could be withal an equivalent to the price which is important for many decarbonisation efforts. Unfortunately, set the price will be another; difficult task.

However, there are still more benefits of the tax than its possible disadvantages. One of the benefits is definitely the fact that thanks to the tax could be the price of carbon fixed and also the price for emission allowances would not be different day-to-day. Furthermore, the administrative system for collecting taxes is already existed in all EU MSs. On the other side, the tax alone would not lead the European economy toward a particular climate targets and as was discussed above, the best would be combination with Energy Union.

Finally, it should be mentioned that global environmental problems pose a new challenge to international cooperation. Its scope and action goes across the traditional boundaries of national interests and national responsibilities and it exceeds the period of politicians not only in individual institutions, but especially in parliaments and governments. (MEZŘICKÝ, 1996) Many politicians and leaders on the EU scene have changed since 2005. Many of them wring their hands in the global media and claim they will take an action, but most of them have achieved almost nothing and what is even worse many of them have in the EU ETS projects their own capital, which they lose if the tax would be introduced.

Thus, if politicians would "leave alive" the current system or create a new agreement, it may not be just an administrative exercise. The aims and instruments adopted must of course reflect all three pillars of sustainability: planet, people and economics. Disregarding anyone of them would lead towards poverty worsening the environment and no hope especially for the younger generation. It is a serious challenge not only for developing world, but also for economic blocks of developed countries.

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Appendix

A List of Abbreviations

UNCED	United Nations Conference on Environmental and Development
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
EU	European Union
EU ETS	European union Emission Trading System
US	United States
EUA	Emission Allowance
GHG	Greenhouse gas emission
IPCC	Intergovernmental Panel on Climate Change
WMO	World Meteorological Organization
OECD	Organisation for Economic Co-operation and Development
NFP	National Focal Point
IET	International Emissions trading
JI	Joint implementation
CDM	Clean Development Mechanism
CO_2	Carbon dioxide
CH_4	Methane
HFCs	Hydrofluorocarbons
N_2O	Nitrous oxide
PFCs	Perfluorocarbons
SF_6	Sulphur hexafluoride
SO_2	Sulphur dioxide
EED	European Emission Drive
NAP	National Allocation Plan
CER	Certified Emission Reduction
MS	Member State
UK	United Kingdom
EUR	Euro
GDP	Gross Domestic Product
CZ	the Czech Republic
HU	Hungary
PL	Poland
SK	Slovakia Republic

B Data connected with prediction of the price

Model 2: ARMA, by used observations 1951-2050 (T = 100)
The dependent variable: d_Data

	Coefficient	*Standard deviation*	*From*	*p-value*	
const	-0,00371588	0,119445	-0,0311	0,97518	
phi_4	0,528016	0,0796074	6,6328	<0,00001	***
phi_5	0,414044	0,0691559	5,9871	<0,00001	***
theta_4	-0,75227	0,0799035	-9,4147	<0,00001	***
theta_5	-0,209595	0,0514566	-4,0732	0,00005	***
theta_6	0,220872	0,0738074	2,9926	0,00277	***

The mean value of dependent variable	0,011800	Standard dev. of dependent variables	0,451174
The mean value of in.	0,011471	Standard dev. innovation	0,399246
Logarithm credibility	-52,98806	AIC	119,9761
Schwarz criterion	138,2123	HQC	127,3566

		Real	*Inaginal*	*Absolute value*	*Frequency*
AR					
	Kořen 1	1,0135	0,0000	1,0135	0,0000
	Kořen 2	0,1701	1,0636	1,0771	0,2248
	Kořen 3	0,1701	-1,0636	1,0771	-0,2248
	Kořen 4	-1,3145	0,5711	1,4332	0,4348
	Kořen 5	-1,3145	-0,5711	1,4332	-0,4348
MA					
	Kořen 1	1,0858	0,0000	1,0858	0,0000
	Kořen 2	0,0474	0,9989	1,0000	0,2425
	Kořen 3	0,0474	-0,9989	1,0000	-0,2425
	Kořen 4	-1,2858	0,3588	1,3349	0,4567
	Kořen 5	-1,2858	-0,3588	1,3349	-0,4567
	Kořen 6	2,3399	0,0000	2,3399	0,0000

For the 95% confidence interval of (0,025) = 1, 96

Observation	d_ld_Data	prediction	Standard error	95% interval
2014-12-19	undefined	0,00100719	0,113014	(-0,220495, 0,222510)
2014-12-26	undefined	0,0148866	0,113014	(-0,206616, 0,236389)
2015-01-02	undefined	0,0268671	0,113014	(-0,194636, 0,248370)
2015-01-09	undefined	-0,0237815	0,113014	(-0,245284, 0,197721)

C V4

Carbon intensity in the CZ manufacturing industries and in the V4 electricity generation.

The following tables and diagrams show absolute GHG emissions and production volumes and resulted carbon intensity which shows key driving factor affection the decarbonisation process. Data sources: industrial statistics (manufacturing volumes) and EC verified emissions from the EU wide statistics relevant for the EU ETS individual operations.

Tab. 18 Cement Industry, CZ

Year	Unit	2008	2009	2010	2011	2012	2013
Cement Manufacturing	kt/yr	4710	3637	3345	3831	3434	3211
Verified CO2 Emissions	kt/yr	3015	2335	2205	2533	2298	2143
Specific Emissions	t/t	0,640	0,642	0,659	0,661	0,669	0,667

Tab. 19 Lime Industry, CZ

Year	Unit	2008	2009	2010	2011	2012	2013
Lime manufacture emissions	kt/year	1042	877	939	978	868	897
Lime Manufacture	kt/year	1012	853	915	943	830	849
Specific emissions	t/t	1,030	1,028	1,026	1,037	1,046	1,057

Tab. 20 Steel Industry, CZ

Steel Industry	unit	2008	2009	2010	2011	2012	2013
Emissions GHG	ktonnes	9773	7534	7870	8236	8167	8373
Crude steel	ktonnes	6387	4594	5180	5583	5072	5152
Specific emissions	tonne/t.	1,53	1,64	1,52	1,48	1,61	1,63

Tab. 21 Electricity – ČEZ

Electricity ČEZ	Unit	2008	2009	2010	2011	2012	2013
Emissions GHG	ktonnes	31279	30477	30727	30195	26278	26278
Generation (gross)	GWh	67595	65344	68433	69209	68832	66709
Carbon Intensity	t/MWh	0,46	0,47	0,45	0,44	0,38	0,39