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The European Union Emissions Trading Scheme Failure Analysis and Assessment of Market Stability Reserve Solution

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Major Energy Natural Resources and the Environment

Abstract

The European Union Emissions Trading System (EU ETS) is presented to be the cornerstone of European Union climate policy to reduce greenhouse gas emissions. Implemented in 2008, it is the first, and still the biggest international trading system for GHG emissions.

European Union set a goal of reaching 20% reduction of GHG in 2020 compared with 1990 level. This target has already been achieved in 2014. Tantalizingly, this could mean that EU ETS works perfectly and has been very efficient in reducing GHG emissions.

The main goal of EU ETS was to reduce emissions by sending right price signal to induce implementation of low carbon technology. Fuel-switching carbon price, which is the price that makes stakeholders indifferent between burning gas or coal is calculated to be slightly above 30 EUR per tCO2.Yet, the average price of EU allowance under EU ETS oscillated at around 5 EUR per tCO2 for the most of the EU ETS period.

The objective of this Master thesis is to answer why the price has been so low and why this is a problem. The thesis describes all the main factors contributing to the price failure. It takes into account over-allocation in original caps, oversupply of UN offset credits, economic downturn, rising gas prices and other legislative loopholes. Finally, it concludes the EU ETS has failed so far to send right price signal to promote fuel switching. The thesis proves EU ETS did not contribute to the early achievement of EU target in 2014 of reducing 20% GHG emissions from 1990 level.

Moreover, the planned reforms with Market Stability Reserve (MSR) Solution in the foreground are presented and assessed. The thesis will try to answer the key question if MSR is going to improve the EU ETS scheme and if yes, to which extent.

Acknowledgements

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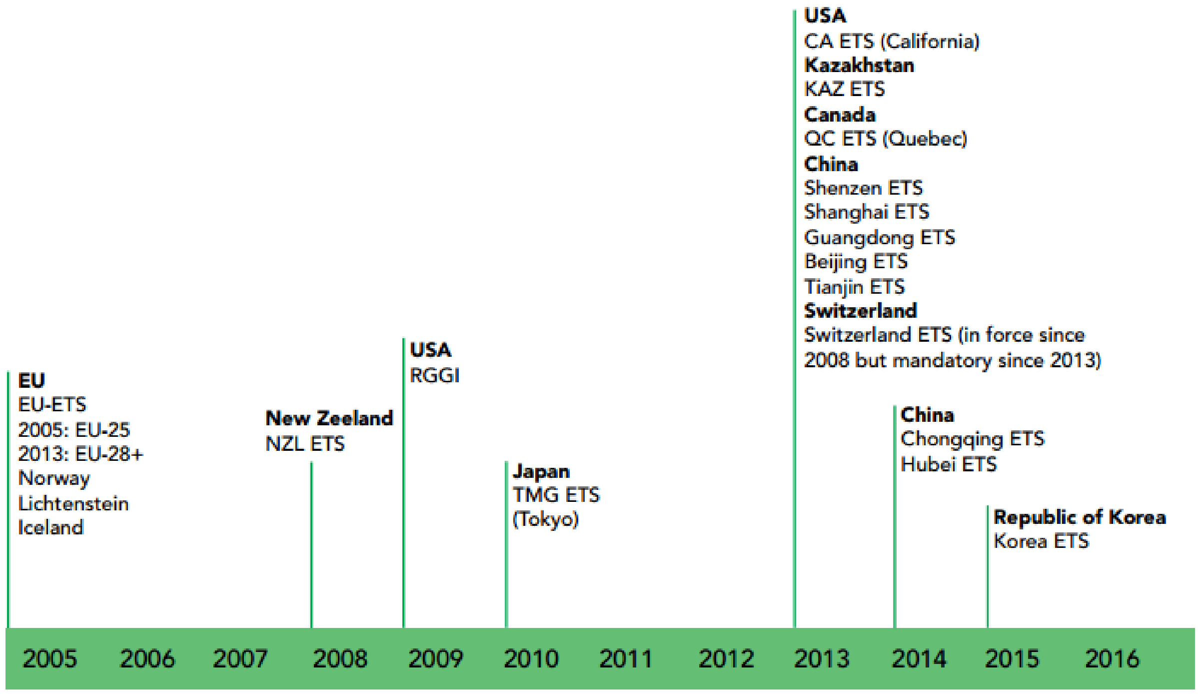
1 Introduction

Nowadays the majority of scientists agree that the mankind's industrial activity is responsible for higher greenhouse gas emissions which results in global warming. This climate change may lead to natural disasters if it continues. To counteract the negative changes, United Nation adopted so called Kyoto Protocol on 11th December 1997. The Kyoto Protocol extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that obligates State Parties to cut GHG emissions to "a level that would prevent dangerous anthropogenic interference with the climate system" (Art. 2). The global consensus is that temperature should not rise over 2 degrees Celsius above the preindustrial levels. The Kyoto Protocol set legally binding emission reduction targets or caps. The treaty came into force on 16th February 2005 and each Member State should comply to what it has committed. The first commitment period under Kyoto Protocol was scheduled for 2008-2012 and covered 37 industrialized countries. In order to meet the Kyoto commitments European Commission needed to propose policy instruments, In 2000 it suggested a green paper on "Greenhouse gas emissions trading within the European Union" where the first scheme EU ETS was presented. After many discussions the EU ETS Directive was adopted in 2003 and EU ETS was implemented in 2005. It covers 28 EU countries and also three EEA-EFTA countries, i.e. Norway, Liechtenstein and Iceland. It captures around 50% EU's GHG emissions in more than 11.000 installations in power plants and manufacturing industry.

In December 2015 the global community gathered in COP21 conference and committed to new climate change policy called Paris Agreement. The global consensus is that world needs to mitigate their emissions so much that it must not exceed 2 Celsius degrees from the pre-industrial level. Parties agreed, however, to do their utmost to mitigate emissions so that global temperature does not exceed 1,5 degrees from pre-industrial level. This is much more ambitious target that was agreed in Copenhagen in 2000. 185 countries have submitted their INDCs which is Intended Nationally Determined Contributions which say about countries' targets in period 2020-2030. They cover around 95% of total world GHG missions. (ICAP, 2016) Now that the international commitment and the global framework is already in place, the focus needs to be shifted to the national levels. Each country has to decide what works best for them in order to reach the targets. Conference in Paris advocated for carbon markets and cap and trade systems.

EU ETS is the first and so far the biggest international trade and cap scheme for GHG emissions in the world. Beside European Union legislated ETSs exist in Switzerland, New Zealand, Australia, South Korea, and Kazakhstan at national level. Some subnational schemes are legislated in the US, Canada, and Japan. (Talberg, 2016) A great improvement is also observed in the Chinese market. After China has succcessufully launched local pilot schemes in 2013 and 2014 now it plans to introduce their national carbon market in 2017 and thus, become the largest ETS in the world. The overview of the ETS schemes in shown in Figure 1.

Figure : Emissions trading around the world



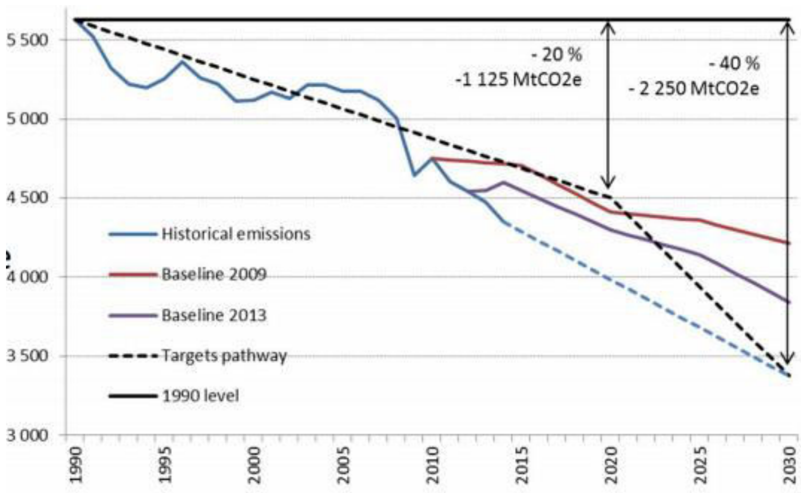
Source: Haug et al. 2014

1.1 EU Targets

European Union has committed to so called 20-20-20 goals until 2020. EU target is to reduce GHG emissions by 20% in comparison with GHG emissions level in 1990. It wants to achieve 20% of total energy consumption from renewable energy and 20% higher energy efficiency than in 1990. For 2030 EU set more ambitious goals, which are: 40% lower GHG emissions than in 1990, 27% renewable energy of total energy production and 27% increase in energy efficiency. Its long term goal is to reduce emissions to 80-95% compared to year 1990. (EC, 2016) This is required by commitments made by developed countries during COP21 in Paris in 2015.

Interestingly, European Union has already overachieved its target for 2020 in 2014 with -23% of GHG compared with 1990 level. It means Europe is very likely to largely over-deliver on its target in 2020. Sandbag economists forecast that emissions will probably fall by over 30% compared with 1990. As optimistic as it may sound the current Europe 2020 and proposed 2030 targets are not enough to meet the Paris Commitment temperature goal in 2050 of well below 2 Celsius degrees with an aspirational goal of 1.5 degrees. To achieve this goal Europe would have to apply much stricter targets.

Figure: EU GHG emissions and EU targets until 2030

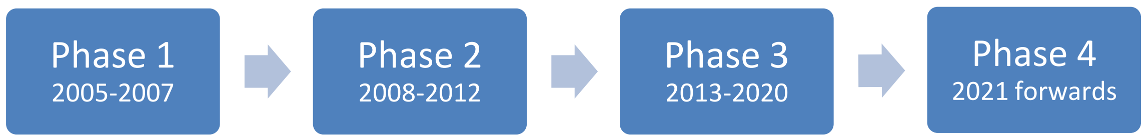


Source: I4CE - Institute for Climate Economics, 2015

1.2 EU ETS Development

After 2003 when the EU ETS Directive was adopted Europe began its preparations for EU ETS introduction in 2005. The EU ETS has been divided into 4 phases. The below figure depicts the phases EU ETS consists of together with the timeframe. Each phase will be shortly described.

Figure: Phases in EU ETS



Source: own

Phase 1

The first phase was meant to be a pilot phase and lasted 3 years, from 2005 to 2007. Its aim was to get prepared for the Phase 2 and establish the ETS infrastructure, reporting and verification of emissions. Almost 100% of all allowances were distributed for free. For the first two phases allowances caps were determined by every member state in their national allocation plans (NAPs). The first phase cap was set based on estimations as there were no reliable and clear emissions data. Ex post analysis showed that allocation caps exceeded demand significantly and at the end of Phase 1 the allocation price fell to 0. However, the allowances from phase 1 could not be banked to phase 2 (no carry forward possibility). Phase 1 served as the verified data for emissions and set reliable Phase 1 was to test the carbon price formation in the market. (EC, 2016) Thanks to Linking Directive businesses could use UN credits from CDM Mechanism to comply with EU ETS.

Phase 2

The second phase lasted 5 years from 2008 to 2012 and it corresponded to the first commitment period in Kyoto Protocol. 3 countries from EEA-EFTA joined the scheme. These were Iceland, Liechtenstein and Norway. The scope was slightly widened too. It covered not only CO2 emissions but also nitrous oxide. Moreover, some member states used auctioning instead free allocation. In the second phase business could also use offset credits from JI Mechanism. Linking Directive from 2004 enabled EU ETS businesses to use offset credits from the UN which made European Union the global largest source of demand for CERs and ERUs international offset credits. In 2012 aviation sector was added to EU ETS (EC, 2016)

Phase 3

Currently EU ETS is in the third phase that will last until 2020. This covers the second commitment period under Kyoto Protocol. In this period European Union has committed to the first target under Kyoto Protocol and EU ETS is key to reaching the target.

Phase 4

The EU trading scheme has no end date is will continue also after 2020.

1.3 Cost of various types of electricity

It is challenging to compare different types of energy technologies because each of them uses different fuels, has different plant life and works under different physical principles. In such cases, investors, researchers and governments rely on method called levelized cost of energy (LCOE). LCOE allows to compare different energy sources on a unit cost basis over the lifetime of specific energy technology. (Narbel, Hansen, Lien, Energy Technologies and Economics, 2014)

There are three components of LCOE formula: capital costs, operation and maintenance costs and fuel costs.

LCOE method says that amount of spending is equal to the total return.

$$\sum_{t=0}^{T} \frac{\bar{p} \cdot E_t}{1 + r_t} - \sum_{t=0}^{T} \frac{I_t + M_t + F_t}{(1+r)^t} = 0$$

Based on the above equation we get the formula for average electricity production costs:

$$\bar{p} = \frac{\sum_{t=0}^{T} \frac{[I_t + M_t + F_t]}{(1+r)^t}}{\sum_{t=0}^{T} \frac{[E_t]}{(1+r)^t}}$$

I_t= Capital expenditure in the year t

M_t= Operating and maintenance costs in the year t

F_t= Fuel price expenditures in the year t

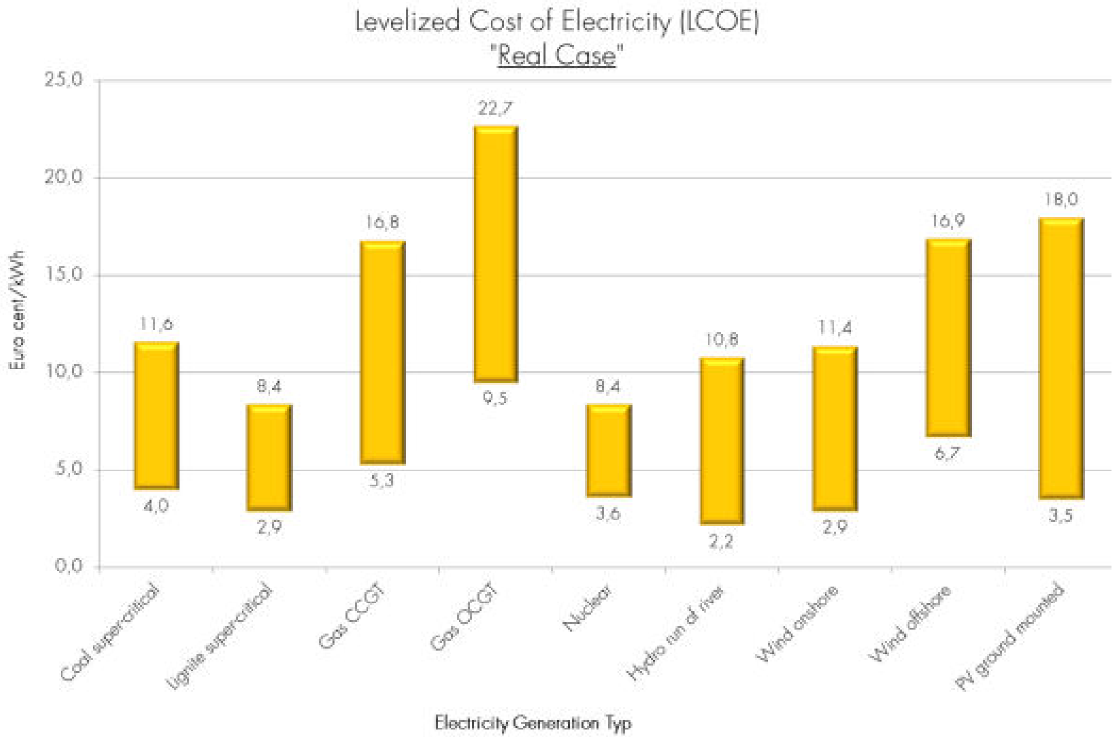
E_t= Net electricity production in the year t

r= Discount rate

$\bar{p}$= Average electricity production costs

The next graph illustrates the comparison between different energy sources based on LCOE calculation.

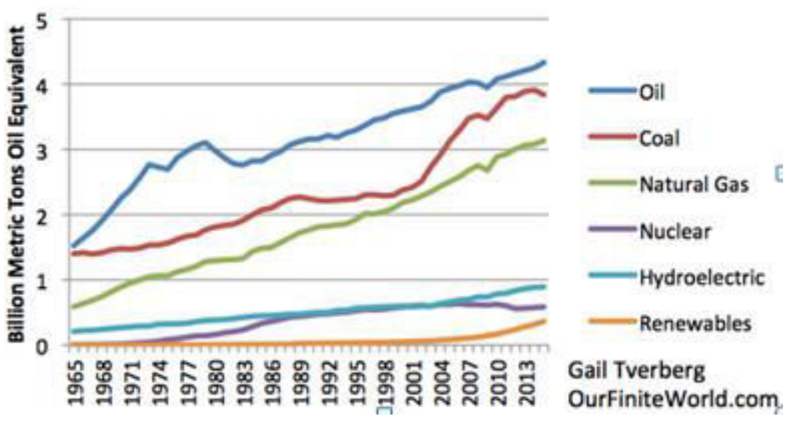
Figure: LCOE for different energy sources



Source: VGB Powertech, Levelized cost of electricity, LCOE 2015

From the above graph, it can be deduced that electricity production is definitely among the cheapest. Only large hydropower plants and near-surface geothermal may be competitive in some specific settings. Because of the low LCOE of coal plants and high availability of coal, coal is still second most consumed energy source. Unfortunately, burning coal causes the most GHG emissions from all energy sources.

Figure: World Energy Consumption by Fuel



Source: ourfiniteworld.com, retrieved 01.12.2016

1.4 Theoretical Background

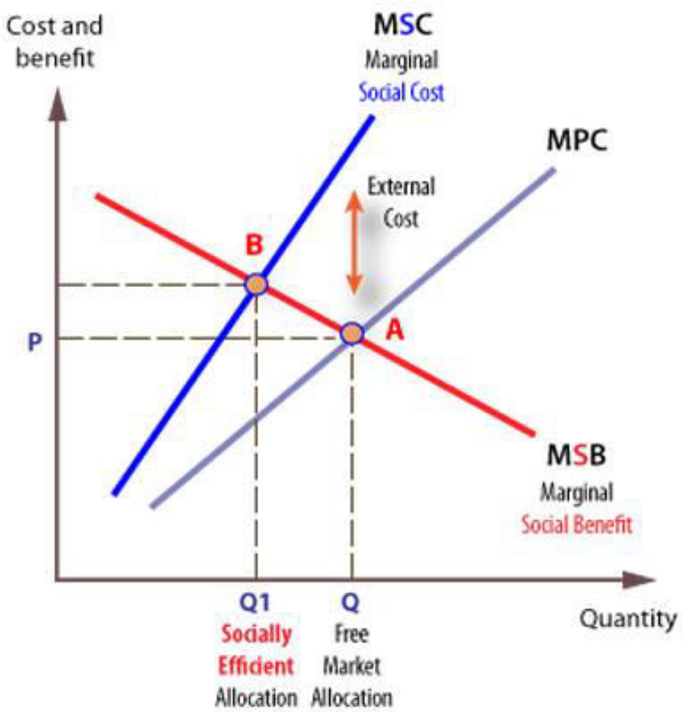
LCOE is used to estimate the direct cost of energy. However, there are still indirect, "invisible" costs. To understand the full cost of energy production we have to take externalities into consideration. When coal is burnt to release the heat, GHG emissions are discharged into the atmosphere. These include: carbon dioxide, small particulate matter and mono-nitrogen oxides (NO and NO2). CO2 contributes to global warming, which can have fatal results in the future. NO and NO2 impact current population by causing acid rains and smog. Finally, small particulate matters impact human health and may lead to premature death (Narbel, Hansen, Lien, Energy Technologies and Economics, 2014). That is why, it is very important to take externalities into account. This chapter concentrates on theoretical background of negative externalities.

<u>Negative Externalities</u>

GHG emissions are negative externality. In economics theory, negative externalities are costs suffered by the third party, which stem from economic transaction made between two parties: producer and consumer. By a third party we may understand all the stakeholders, society or any individual or organisation. It means that they are indirectly affected by this economic transaction.

The notion of divergence between social and private cost and benefit has been already described in the book "Economics of welfare" by English economist Pigou. According to him, social costs are reductions in human wellbeing whereas social benefits are increases in human wellbeing. Marginal private cost (MPC) is the marginal production cost for producer and marginal private benefit is the direct benefit for consumer (MPC) of producing additional good. Below, it is shown how the negative externalities arise.

Figure: Representation of negative externality

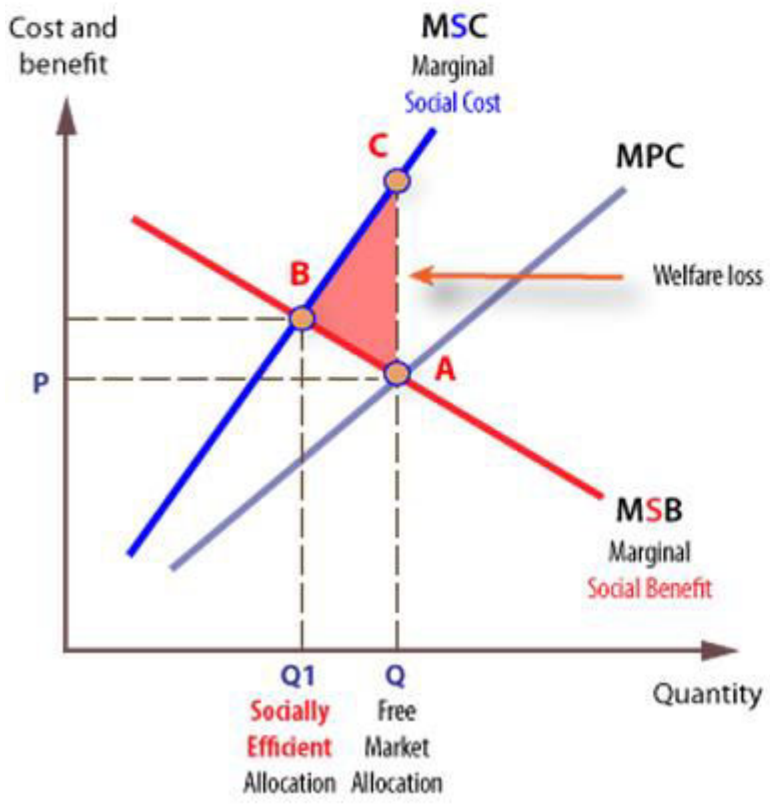


Source: economicsonline.co.uk, 2016

In free market, marginal private cost curve (MPC) and marginal social benefit curve (MSB) intersect in point A producing quantity Q at price P. However, if we take into account marginal social cost (MSC), which includes also negative externality (in our case it is pollution) then the efficient allocation point looks different. MSB curve and MSC curve intersect in B, which results in lower production (Q1) and higher price.

In the free market, where marginal social cost is higher than marginal social benefit we talk about the market failure. The red triangle (ABC) in the below graph represents net welfare loss.

Figure: Representation of negative externality

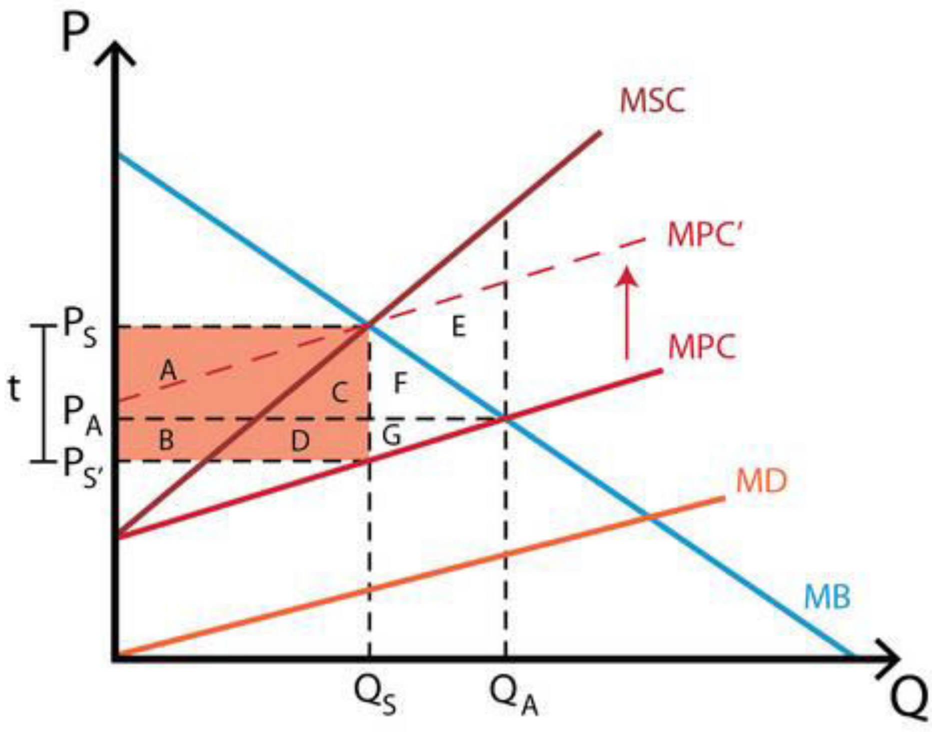


Source: economicsonline.co.uk, 2016

Because of the above described deadweight loss there is a need to intervene and correct this market failure. There are some market based mechanisms that aim at manipulating the market forces in order to reduce deadweight loss (in our case GHG emissions).

Pigoue argued in his book "Economics of welfare" that introduction of tax on pollution is the way to achieving efficiency.

Figure: Pigouvian tax



Source: policonomics.com, 2016

The horizontal axis represents quantity of production (Q) by the power plant and P the price/cost. Without any intervention power plant will produce at the point where marginal private cost (MPC) intersects with marginal benefit (MB). Then, the plant produces at level Qa at the price Pa. Pigou argued government has to introduce such a tax that MPC curve shifts upward by the MD (marginal damage, cost of negative externality). Then, the plant would produce at the so called social optimum point: the intersection of new MPC (marginal private cost plus marginal social cost) and marginal benefit (MB) . The quantity produce would decrease to Qs and price would rise to Ps.

The Pigouvian tax was widely acknowledged in economics for 40 years until Nobel Prize-winner Ronald Coase published his famous book “The Problem of Social Cost” in 1960. He stated that both Pigou’s analysis and proposed policy are clearly wrong, and this for three different reasons. Coase argued that negative externalities do not have to cause inefficient result. And even if it was inefficient, tax proposed by Pigou would not lead to optimal efficient point. Thirdly, he showed it is all about transaction cost theory and not externality theory.

In his book, the British economist explains that government does not have to intervene into the market. Problem of externalities would be solved by establishing property rights. If government could clearly assign the property rights, the private market would do the rest. As long as one party has the property rights, it does not matter which party has them. This situation would, anyway, lead to bargaining process, in which the externalities are taken into consideration. This is known as the Coase Theorem.

To sum up, property rights should be clearly established to take into account the externalities. if the property rights cannot be established, as for example for sees or air, society has two choices: 1) either it learns to live with the externalities or 2)government has to find a way to price the externality.

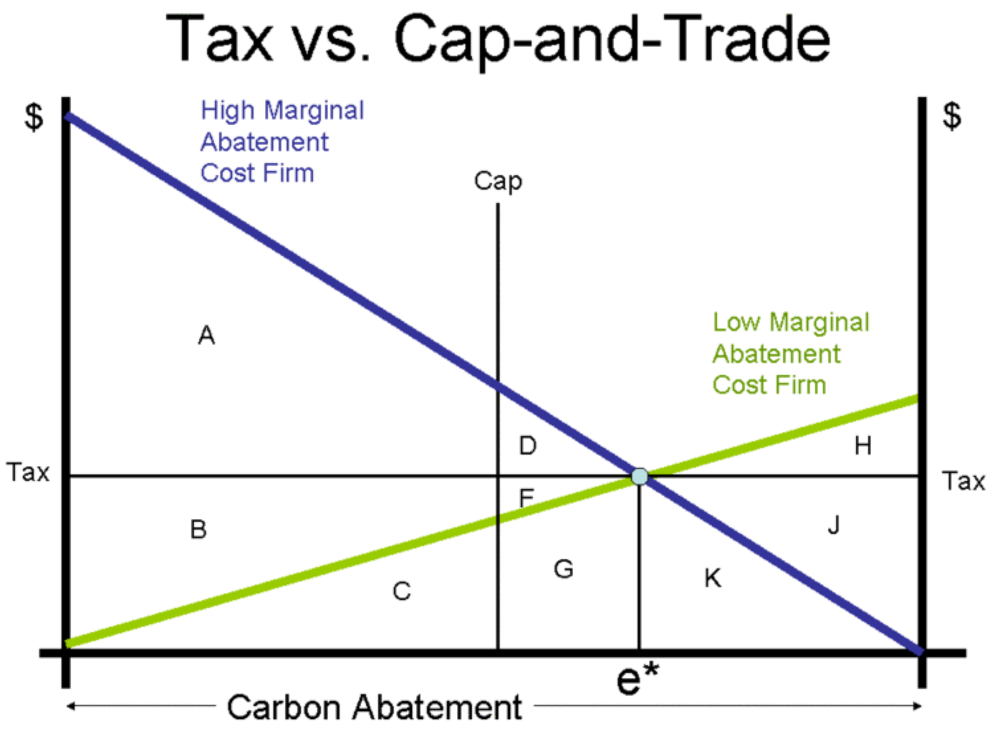
Market-forced vs. command-and-control regulations

There are two main ways of how to price the externality(in the thesis GHG emissions): either by market-based policies or by command-and-control policies. Command-and control policies require companies to take specific actions to cut or eliminate their pollution. It can be done for example by installing specific filter or using specific technology. Such regulations have been widely criticized by economists since they are inflexible. Firstly, they do not consider the fact that different firms have different compliance options and different associated costs. Secondly, they do not give incentive for polluters to innovate and invest in newer, better technology to further reduce abatement costs. (C2ES, 2015)

On the other hand, market-based regulations do not require the polluters to take a specific action. They provide the incentive to reduce or even eliminate emissions, giving the plants a free hand of how they want to do this. In this case every company can decide on its own what solution is the best for them based on the firm's specifications. Market-based regulations include two types of policies: price and quantity policies. Setting a cap is an example of quantity policy. Making cap tradable turns it to market-based and as it also impacts the price. Another example of price policy might be setting a carbon tax.

The basics of environmental economics show us that the firms would not have any incentive to abate without market regulations. To achieve efficient abatement level marginal abatement cost (MAC) curve should intersect with marginal benefit (MB) curve. This point is represented by e* on the graph.

Figure 1: Tax vs Cap-and-Trade



Source: Haab and Whitehead, 2016

Carbon Tax

When the government sets the carbon tax on the point where market's marginal abatement costs are equal, the company with low marginal abatement cost (green curve company) will have incentive to abate until MAC is cheaper than tax (C+G), if it wants to produce more it would prefer to pay the tax than pay more expensive abatement cost (H). When it comes to high marginal abatement cost firm (blue curve company) it will abate also up to intersection point (so only K). After that it would prefer to pay the cheaper tax (D+A). The abatement cost for both polluters is minimized (C+G+K) and government receives revenue B+C+F+G+J+K

Cap and Trade

We can achieve the same abatement cost also in the case of cap and trade scheme. In the most basic model, the permits are distributed fairly (equally) to the market participants and the maximum carbon supply level (cap) is set, represented as a vertical line on the graph. Each issued permit allows the company to emit one unit of GHG. As we can see from the graph, the low abatement cost firm will have abatement cost C and the high abatement cost company D+G+F+K. If the high MAC company recognizes its MAC is higher than low MAC firm, it can offer a trade. In reality, the green MAC curve turns into permit supply curve, and the blue MAC curve turns into permit demand curve. Trading would cut back on the total abatement costs of D+F and exactly as in the carbon tax scenario, the abatement cost for both polluters is minimized (C+G+K)

Differences: carbon tax vs. cap and trade scheme

Tax and tradable quotas work in the similar way using market forces to minimize the total abatement. Actually, in theory, under specific conditions such as perfect information on production, production costs and energy costs for all branches of industries, these both policies lead to the same optimal abatement level.

The same increased efficiency with the minimized abatement cost leads to the same optimal abatement level (e*). Although the results in the face of negative carbon externality solution may seem the same, there are still significant differences among tax and cap and trade policy.

First and foremost the distribution of wealth is different. Firms will always prefer cap since then they incur smaller cost, especially when first allowances are distributed to companies for free. With carbon tax scenario the government receives revenues for every unit of carbon emitted (Haab and Whitehead, 2016)

Secondly, it poses a clear choice between price certainty and environmental certainty; in cap and trade system a cap determines the maximum supply of permits that cannot be exceeded, thus creating environmental certainty. However, the price of permits is subject to market forces and cannot be predetermined. The contrary situation can be observed in carbon tax system. Price for carbon tax is known and predetermined whereas the overall of emitted pollution is uncertain. This means the reduction of GHG is dependant from market forces.

Thirdly, impact of economic situation on both systems are different. Permit price reacts very quickly to economic changes. During an economic downturn, the allowance price will drop and when the economy is doing good – the price will rise. We have self-adjusting mechanism driven by market forces. Under the tax, though, whatever happens in the economy the price will remain stable and will not change until the government decides to adjust the price according to new economy conditions. Government actions do not respond that quickly as the self-adjusting mechanism of cap and trade.

Furthermore, flexibility for companies is different for respective systems. Under the carbon tax, firms need to plan each year how much they produce, calculate how much they can abate and how much tax they need to pay. Under cap-and-trade system, firms remain much more flexible as the options such as banking, borrowing, and longer compliance periods are available. This allows companies more flexibility on planning the compliance over extended period of time.

1.5 Why trading system has been chosen?

Tax system is a tempting option as it provides additional revenues to the government. It also guarantees price certainty. Although tax system seems to be simple in the theory, the practice shows it is much more difficult to implement. Many special provisions have to be done in order to avoid negative influence on specific regions. Moreover, introducing tax unanimity for all 31 EU countries would is so far impossible as states consider taxes to be an issue of national sovereignty. In this case, the right solution was to introduces well-functioning cap-and trade system,: EU ETS.

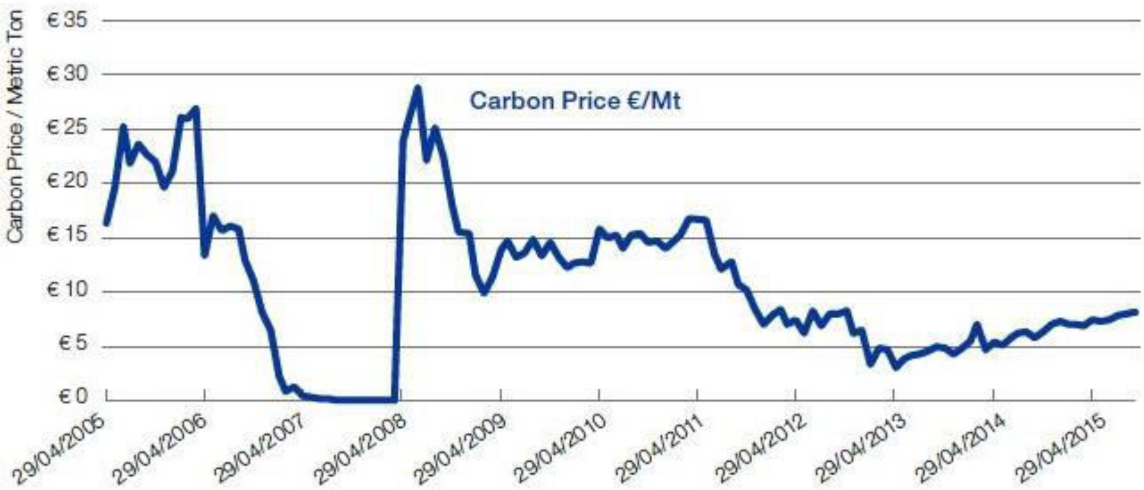
2 Analysis of Failure

Coal driven technologies, because of the low LCOE, are still widely used in the economy. However, to counteract the environmental risks of burning coal, EU ETS was introduced in order to take into account the price of negative externalities. To remind, the main goal of EU ETS was to reduce emissions by sending appropriate price signals into the economy. In the below chapter the price analysis of EUA (EU Allowances) is carried out in order to answer the main question: Has EU ETS succeeded in sending the right price signal pushing Europe to change the fuel?

2.1 Carbon Price Analysis

The below figure depicts the price development of EUAs in the decade overview from 2005 to 2015.

Figure: EU ETS Carbon price in EUR per metric tone



Source: Bloomberg

As the first phase was launched the beginning price of EUAs hovered around 7 Eur. As the credits could not be banked and used in phase 2 from 2008, the price of allowances was dependant on the current market demand so economic growth, relative energy prices and weather conditions as well as marginal abatement costs. (Convery et al., 2008). The next graph depicts very well how EUA spot prices and EUA future prices diverged in between the transition from first to second phase of EU ETS scheme.

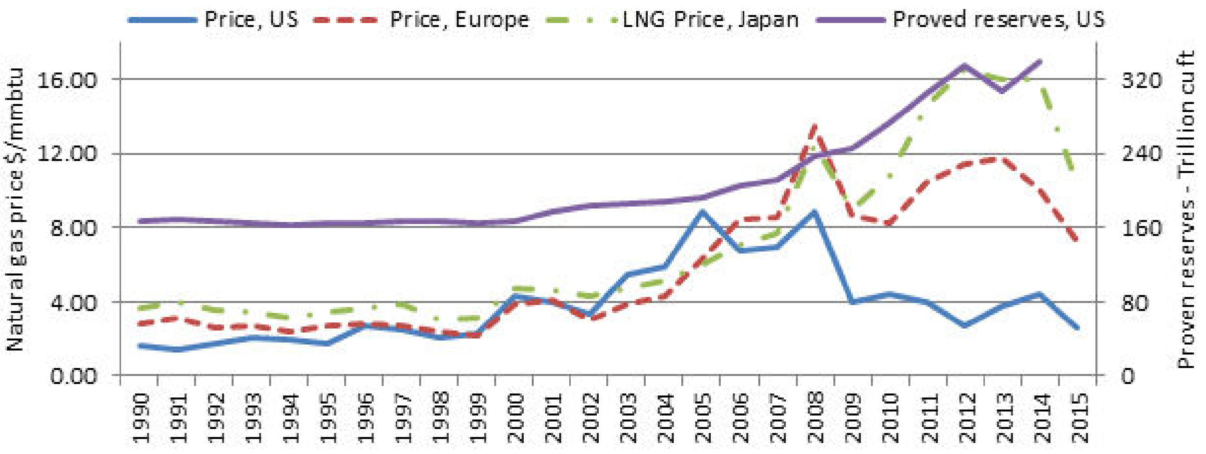
Figure: EUA price chart in 2005-2009

Source: Committee on Climate Change, Meeting Carbon Budgets

Since 2005 the price rose gradually and hit the historical maximum at almost 33 Eur in April 2006. This price increase was induced by the economic growth and the rising gas prices. After that, however, prices of EUAs were quickly dropping as the over allocation of permits was noticed and second phase was coming. As the allowances could not be banked into the second phase, EUA from phase 1 were losing value, reaching 0 EUR/tonne CO2 in 2007.

The below figure shows how the gas prices in Europe behaved in the period up to 2015.

Figure: Natural gas prices in the US, Europe and Japan



Source: World Bank, Commodity Markets Data, 2016

We can see that European gas prices rose continuously until 2008 crisis. These high gas prices led European economy to switch to coal, which is much cheaper. That is why the correlation between EUA and European gas price is observed. The EUA prices were rising until 2006, reaching its historical maximum in April 2006. The costlier the gas the worthier gets allowance for carbon too. Based on this conclusion the EUA should have risen steadily until 2008 as the gas price did. However, just few days after the maximum price of around 30 Eur in April 2006 the EUA collapsed by over 50%. This happened due to official statements that some EU countries have done: the Dutch, Czech and French government proclaimed that their emissions are much below the initial allocations (Ellerman & Buchner, 2008). After these events the price stabilised at around 15 Eur for few months. As seen on the graph starting from September 2006 the EUA price started to plunge as it became obvious that there is huge overallocation, phase 2 is getting closer, weather and other factors did not increase extra demand for carbon credits. (Ellerman & Buchner, 2008). Moreover, credits from first phase were not bankable. This means they could not be carried forward into phase 2. As the result, the price of EUAs fell to 0 Eur.

As the phase 2 began in 2008, the prices jumped again to around 20 Eur and in mid-2008 it even surpassed the 2006 maximum price. However, shortly after this point the global recession came and production fell drastically. Thus, the EUA price was decreasing and fell under 10 Eur in the end of 2008. The price slowly rebound to around 15 Eur in mid-2009 and this price hovered until mid-2011 when a new cyclical economic downturn decreased the prices again. After then the EUA price oscillates at around 5 Eur which is much too low value to motivate the industries for abatement. For today, 30th of May the price amounts to 6.10 Eur and analysts do not predict sudden upwards changes.

Predictability of prices is of prior importance for cap-and-trade to work. If the companies do not know the approximate price for which they could sell they have no inventive to invest in the clean air technology. For them it pays of more to wait, avoid investments and changes. This of course undermines the basic idea behind cap-and-trade.

The prices of allowances have been much too low to induce companies to invest in carbon-cleaner production. It is estimated that the allowance price should amount to around 30 Eur per tCO2 to shift economy from carbon based to gas-based. As seen in the below graph, unfortunately, the price has oscillated at around 5 Eur per tCO2 for the most of the EU ETS period. They were much too low to meet the main expectations of EU ETS.

The main goal of the EU ETS was to set such a price of GHG to induce economy switching to other sources of energy. As the above has shown, EU ETS has so far failed to deliver this goal. As the consequence of the price failure of EU allowances, we can talk about the whole EU ETS failure

2.2 Problems of EU ETS

In this chapter the thesis will examine the most important problems of EU ETS which could have contributed to the price failure, and thus EU ETS failure as a whole.

Inefficiency at reducing emissions

First of all it is quite hard to measure how much emissions have been reduced thanks to EU ES as it is almost impossible to assess hypothetical emissions that would have been abated without the cap. From quite narrow literature on the subject we can find out that “emission savings are in the range 40–80 MtCO2 per year, about 2–4% of total capped emissions” (WIREs Climate Change, 2014). The above facts apply, however, only to the pre-crisis period so it captures period between 2005 and 2008. Because the economy slowed down significantly after 2008 assessment of how much emissions attributable to EU ETS have been reduced is extremely hard. It can be noted that 2-4% of total capped emissions is very low, far from the EU ETS targets. After 2008, the actual reductions were even smaller.

Volatile prices

For every cap-and-trade to work, predictability of prices is of upper importance. As the above allowance price analysis shows, prices have been extremely volatile, discouraging investors to plan abatement. When the prices continued to fall down, plants did not have any incentive to abate.

Problematic grandfathering

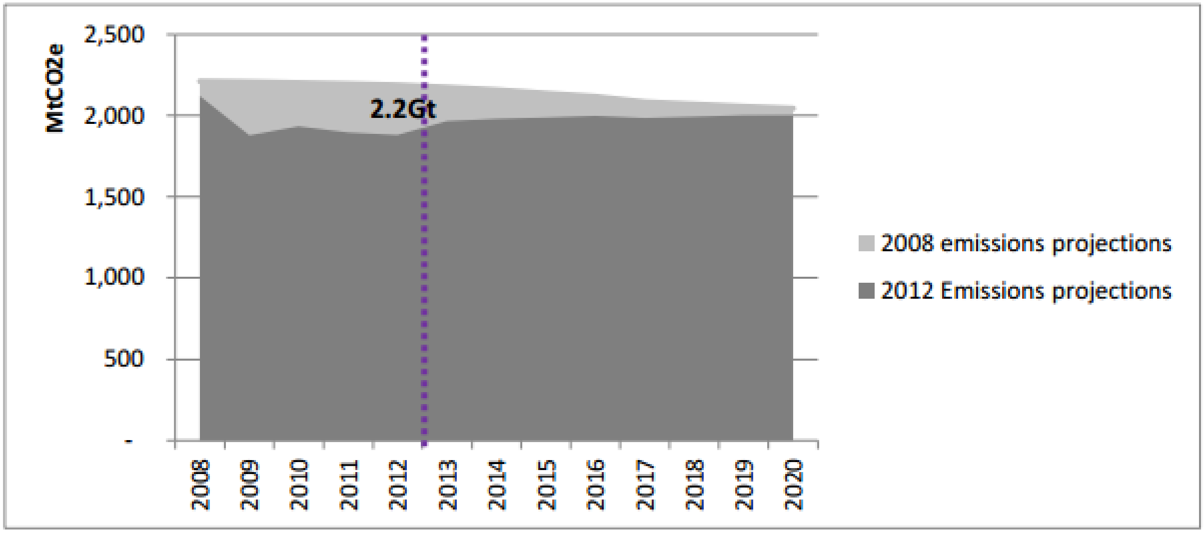
In the first and second phase permits were distributed based on the “grandfathering rule”, which means number of allocations were given for free based on historical emissions of particular firms. Member states had the right to allocate on their own to their industries within the NAP (National Allocation Plan) according to some European rules. Grandfathering was chosen as it offered companies status quo in the beginning and made them agree for the new system in the first place (Zetterberg,2012) In theory, as Coase argued in his analysis of social cost both methods - grandfathering and auctioning should lead to efficiency. However, reality proves differently. As Fischer points out grandfathering subsidizes polluters. Companies that emit a lot have no incentive to reduce emissions because they know that in future they will get lower number of allowances. Grandfathering inhibits also the innovation in less polluting technology (Fisher, 1996). Another criticism of grandfathering regards ethics. The ethical dilemma arises because actually polluter is paid for abating instead paying for emissions. (Goldemberg, 1996) Thirdly, it seems to be unfair that much polluting companies (with no environmentally friendly technology) were rewarded with more permits than emission-effective firms that have already invested in cleaner technology. This puts the latter firms in unfavourable situation and makes little incentive for both to invest further in better technology.

Oversupply of allowances

The economic recession slowed down the production, thus companies needed much less amount of allowances. As the basic economics says, the lower demand results in bigger supply, which in turn makes the price lower.

Because of the 2008 crisis and other unexpected events and policies, Europe found itself in a completely different scenario that the one that was expected when planning caps for Phase III . In 2008, analysis predicted that in the period 2008-2020 there would be 2.2 billion tonnes more emissions than they predicted just before Phase 3 (2012) This made the EU caps obsolete and EU ETS completely inefficient because of huge oversupply of allowances (see figure below)

Figure: Expected emissions set in 2008 vs. projections in 2012



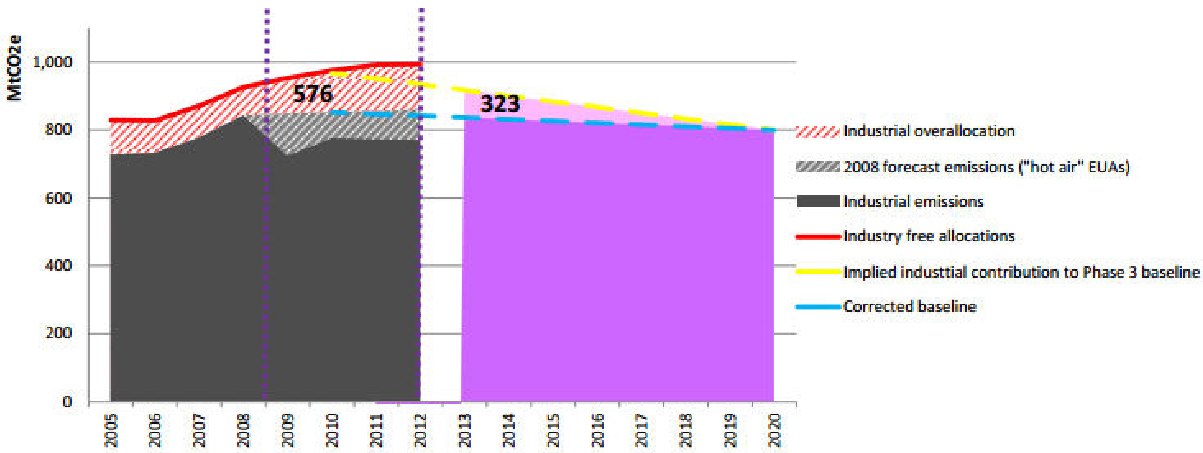
Source: *Losing the Lead*, Sandbag, p.5

Over-allocation in original caps

.Additionally, experts from the Sandbag environmental NGO argue that even the initial scarcity of allowances given in Phase 2 was fake. They calculated that around 900 million allowances had been allocated too generously as state governments wanted to support their national industries and allocated them with surplus allowances. (Sandbag, 2012) This resulted in inadequate level of cap for Phase 2 and because cap for Phase 2 served as a baseline for setting a cap for future – also for Phase 3. Furthermore, this created unfairness among EU states and contributed to big cash transfers from countries which allocated responsibly towards countries that were profligate (for example from the UK to Germany or France) (Helmer, 2008)

The below figure made by Sandbag economists shows how overallocation in original cap affected Phase 3 indirectly. 576 million allowances were given in surplus in Phase 2, leading to higher Phase 3 baseline, thus over-allocating companies with 323 extra allowances in Phase 3. When shadowed grey field (wrong emissions forecasts, caused mainly by the 2008 crisis) is added to the calculations we end up with huge oversupply of allowances in the market. According to Sandbag NGO, 3.1 Gt allowances are in surplus in 2008-2020 ETS cap. To be specific, there is around 2.2 Gt of oversupply of allowances and 900 Mt of overallocation. (Sandbag, 2012)

Figure: Phase 2 overallocation and its effects on Phase 3



Source: Sandbag, Losing the Lead, 2012

Unfair distribution

As described above some companies have had the advantage of getting overalloaction. As in Phase 1 and 2 the allowances were distributed for free but companies which had oversupply of them could sell them, they could earn a lot of “oversupply profits”. Unfortunately these profits had not been earned thanks to abatement and innovative technology but the distributors’ generosity and the economic downturn.

Next to overallocation profits some companies got a chance for lucrative windfall profits. Some industrial sectors have been treated much more favourable and these got called carbon fat cat companies.

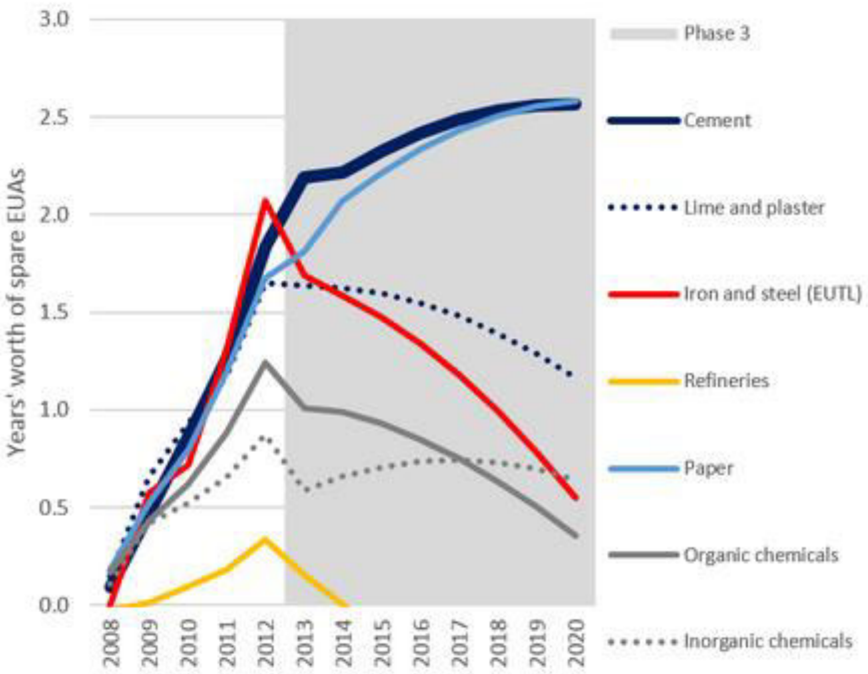
When introducing EU ETS there was a big opposition from heavy industries that are carbon intensive in a direct or indirect way (through higher electricity prices). They argued that carbon price will increase drastically the production costs of European firms thus resulting in loss of international competitiveness and carbon leakage. Carbon leakage is the situation of relocating production from Europe to “carbon havens” – countries with milder or no environmental policies. This leads to loss of profits in EU, job losses and of course no environmental benefits. In many cases, instead of lower emissions in EU this may cause higher emissions in other parts of the world. (Branger, 2014)

European Commission granted 100% free allocation in all the phases of EU ETS to companies that stand at risk of carbon leakage. These are as many as 146 sectors out of 256 with cement, aluminium, paper, ceramics, steel, oil refining in the lead and constitute 77% of all EU industrial emissions (!) (Ellerman, 2010)

Allowances that are given for free are actually subsidies. Governments abstain from the revenue they could receive from auctioning and decide to give for free pricey support. When companies get over-subsidized for the pollution they emit, economists talk about so called windfall profits. Investopedia defines them as “huge profits that occur unexpectedly due to fortuitous circumstances“.

Below the figure displays cumulative overallocation surpluses for industrial sectors that benefit most from the EU ETS.

Figure: Overallocation surpluses and fat cat sectors



Source: Sandbag, 2016

Until 2013 it was the steel industry that enjoyed most windfall profits. After some reforms in phase 3 it is the cement industry that has been the winner in the carbon fat cat competition. Such overallocation in the cement industry (and also some other heavy industry sectors) that get 100% free allocation due to protection against carbon leakage risk bring about not only huge unfair profits for some industries but foster also ignorance to environmental policies and GHG abatement. The carbon fattest cat, as the cement industry has been recently nicknamed, got so many surplus allowances only in the period 2008-2014 that it could cover 2.2 years of extra GHG emissions without purchasing any single permit. (Sandbag, 2016)

CE Delft consultancy calculated that heavy industries earned more than 24 billion Euro as windfall profit in the time period 2008-2014.(Delft, 2016) Companies earned these profits in three ways. Firstly, when the firms get too many allowances than they actually need and they sell the surplus for profit in the market (oversupply profit). This part constituted for 8.1 billion Euro. Secondly, when the companies buy and surrender much cheaper offset credits and sell their free allocated allowances (0.6

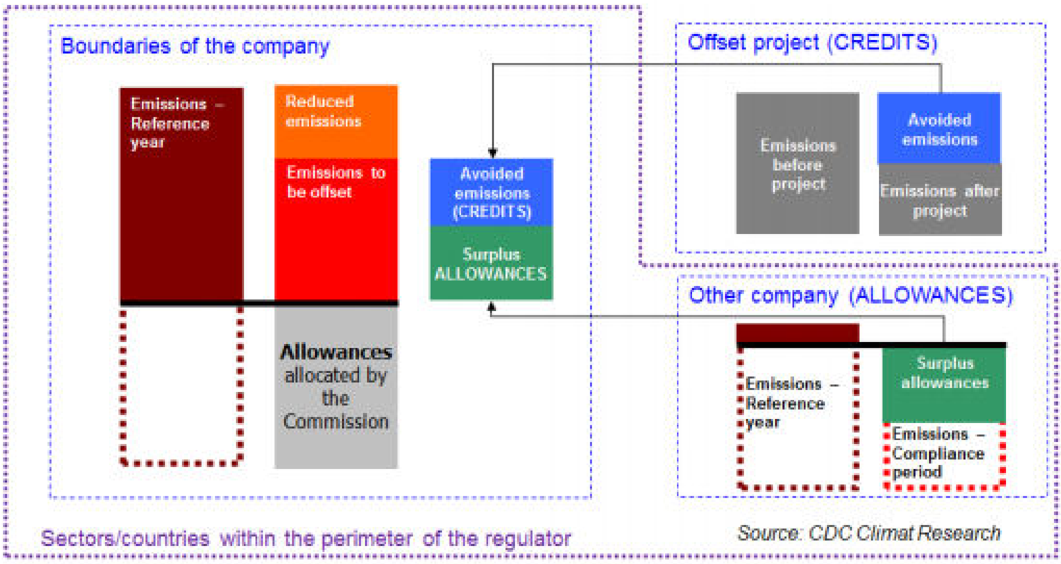
billion Euro). Thirdly, when companies pass cost of the allowances to customers, although they received them for free (15.3 billion Euro)

Passing through the cost onto the customers has been especially predominant in the electricity companies and it arose hot debates and arguments in recent years that the electricity users need to pay for allowances firms get for free. Indeed, the point is valid that the distributional effects are unfair. It is nether the overall society nor the government that benefits from the overallocations but the electricity companies that are private to a great extent.

However, it has been logical that companies would act that way. Allowances carry opportunity cost. It means, if companies would not pass the cost to consumers they could sell them for profit in the market. Furthermore, rising the electricity prices give incentive for every consumer individually to cut back on their bills and simply save electricity which is an efficient way of reducing GHG emissions.

All of the above methods of earning profit is ethically questionable as polluter should pay for emitting pollution instead of getting paid for little or no effort in emissions abatement.

Figure: Compliance possibilities for EU ETS installations.



Source: Stephan (2014), p.4

Oversupply of UN offset credits

The enormous oversupply of allowances on the market was worsened even more by the oversupply of offset credits.

Offset credits are GHG emission reduction credits that one party can buy from another party which produces less GHG to compensate (offset) their own emissions. The nature of GHG emissions is that they move around the globe so reduction of them is of primary importance whereas location of their reduction is secondary. Thus, it is rational from the economics perspective that firstly these emissions should be cut which are the cheapest to reduce. (Sandbag, 2012)

In second phase of EU ETS (2008-20012) more than one billion offset credits were surrendered, which amounts to 10% of the whole cap. (Stephan et al., 2014) To be exact, 675 million CERs and 383 million ERUs were surrendered. Most of the credits were CERs (Certified Emission Reductions) which come from CDM (Clean Development Mechanism) CDM is an example of Flexible Mechanism which was defined in the Article 12 of the Kyoto Protocol (IPCC, 2007) Projects in developing countries can earn saleable CER credits which can be then sold to Annex B countries to meet the Kyoto commitments. CERs usually come from the emerging economies like Brazil, China or India.

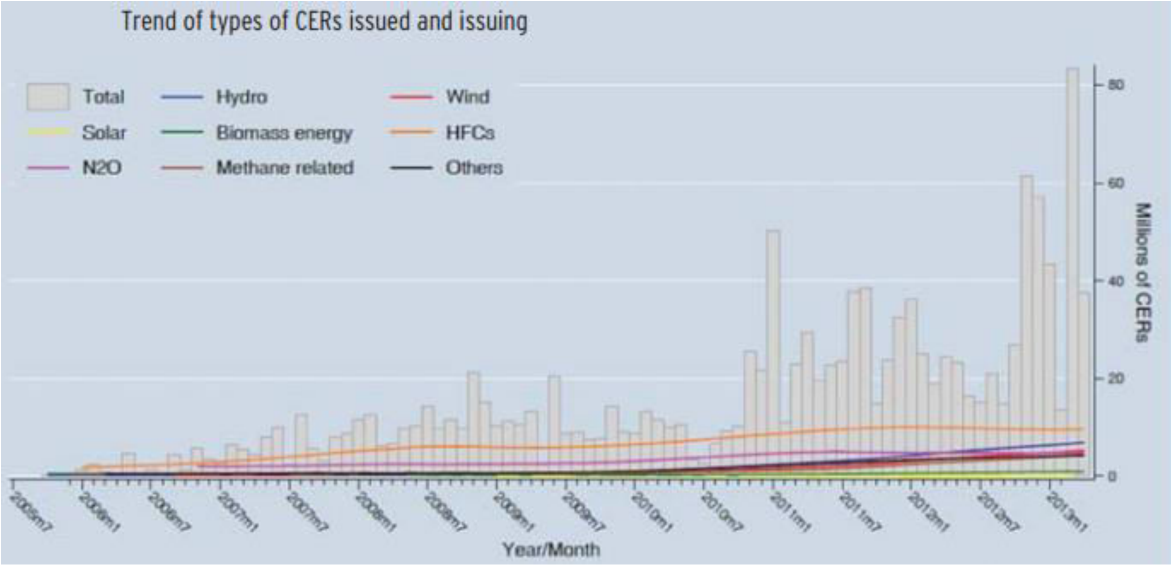
ERUs are Emission Reduction Units generated by the Joint Implementation (JI) mechanism. These credits come from industrialized countries (mostly the ones in transition). ERUs are sold for the GHG emissions reductions from European Union which are not covered under EU ETS programme or from outside EU, e.g. from Russia and Ukraine. Both Flexible Mechanisms work the same with the main difference that ERUs do not increase overall cap set by the Kyoto Protocol whereas CERs increase the total cap. In Phase 2 these were the national governments that decided in NAPs of how much percentage of international offset credits their industries are allowed to use. Again, the states were afraid of high and out of control carbon price and in order to help and support their industries the offset credits allowance was inflated. The European Commission has allowed for total 1.6 billion tonnes of offset credits in Phase 2 and 3 . Companies under EU ETS can use these credits as supplementary in order to comply with EU ETS commitments. As NGO Sandbag discovers not only companies that needed extra credits to comply took use of the possibility. Even the companies with the allowance surplus bought as many offset credits as their offset limit allowed. This is because the offset credits are cheaper than the allowances and the allowances can be carried forward to next years and phases. That is why companies bank their allowances for the future and surrender cheap international offset credits.

Perverse incentives of CDM

The most important feature of international offset credits should be “additionality”. It means that every such project should be additional to the standard business as usual. It ought to be greener than it normally would have been. Unfortunately, most of the projects did not fulfil this requirement as verification of projects is very hard which led to many cases of fraud. These projects did not reflect the introductions of “real” emission cuts, that means cuts that would have not been made if there had been no CDM.

The most scandalous example refers to HFC-23 destruction projects. HFC-23 is a by-product in the HCFC-22 production. HCFC-22 is the refrigerant GHG used mainly in refrigeration, air-conditioning, foams and aerosols. This gas is extremely potent, estimated to be 14.800 times more climate damaging than CO2 (EIA, 2013). Given the fact that the gas is so dangerous and it is very easy and cheap to eliminate it with the use thermal oxidation or plasma pyrolysis, HFC-23 destructions projects quickly got the focus of CDM. As shown in the below figure HFCs projects constituted the majority of all CERs generated projects. As of 2013, 39% of all CERs were generated from HFCs projects, mainly in China and India.

Figure: Types of CERs generating projects



Source: UNFCCC & UNEP Risoe, 2013

HFC can be destroyed for only 0,17 Eur per tonne of CO2-equivalent whereas HFC-23 CERs were sold to the EU ETS market for around 12-15 Eur. It is around 70-90 times more than it takes to eliminate the gas. (EIA, 2013) In the consequence, producers of the gas had the perverse incentive to generate more "artificial" HFC-23 projects as they could earn more from its destruction than from product manufacturing. Because this was so lucrative such projects mushroomed and there was no official control over it. Some documentation reveals that as for 2013 HFC-23 manufacturers' profits amounted to around 4.7 billion Eur when the real abatement costs is valued to be around 100 mln Eur. (EIA, 2013) The loudest scandal regarded GFL company which was the biggest HCFC producer in India. In the official financial statement for 2012 year, the company declared the revenues from CERs at around 134 mil Eur whereas the revenues that came from refrigerant sales totalled to around 11mil Eur. This means that the huge proportion of revenues was made as windfall profits. They accounted for 93.4% of all declared revenues whereas refrigerant sales to 6.6% (!) (EIA, 2013)

As the oversupply of HFC-23 projects decreased the efficiency of EU ETS scheme and contributed to further EUA price decline, European Commission decided in late

2011 to ban HFC-23 projects in the EU ETS scheme starting from phase 3. (EC, 2016)

Analysis of CERs prices

Figure: EUAs prices vs. offset credits prices

Source: Lang, 2013

In the beginning of EU ETS offset credits were very popular and this is because the CERs were cheaper than EUAs and offered the same value as allowances. That is why companies tried to buy and surrender as much CERs they could for EU ETS compliance.

As from the graph we can see strong correlation between EUAs and offset credits. The latter were always around 2-5 Eur cheaper and followed the price formation of EUAs. They had the peak in the beginning of EU ETS when CER prices reached over 20 Eur in mid 2008. When the economics crisis of 2008 hit, the prices fell to around 7 Eur in the first quarter of 2009 and got closer to EUA prices. After these turbulences the price for offset credits stabilised until October 2011 and oscillated between 10 and 15 Eur for around 2 years.

At the end of phase 2 of EU ETS it became obvious that there is large oversupply of both allowances and offset credits. Prices of offset credits started to plunge and decouple from EUAs. For phase 3 European Commission introduced important restrictions in the usage of offset credits for compliance which decreased further the demand for them. Since May 2013 CERs generated by HFC-23 and N2O projects were banned. Moreover credits only from least developed countries and the countries that have signed bilateral agreements were accepted. The EU ETS market was saturated with international credits even before these changes but after May 2013 offset credits got almost totally worthless, valued at little over 0 Eur.

Generally "Hot Air"

Hot air is understood as carbon credits that instead to reduce GHG emissions they increase them. This includes cases already discussed above. In this category fall all carbon permits that do not carry real emission reduction value. These are:

- Surplus of EU allowances
- Surplus of AAUs – assigned amount units (emission units under Kyoto Protocol)
- Credits or reductions counted twice (e.g. double counted recycled CERs)
- Non-additional CERs and ERUs, i.e. emission reductions that would have occurred anyway
- Land use credits which are used to offset permanent GHG with solutions that store carbon only temporarily (forests)

Although ETS was from the beginning subject to many concerns, other approaches did not offer better solution. The most discussed alternative - carbon tax, was deemed unrealistic because taxation demands unanimity in jurisdiction across all EU countries. It implies also conflict with member state's autonomy over taxation. (Ellerman et al. 2010) Moreover, Europe has already faced one carbon taxation failure in the past. In the early 1990s Europe tried to implement carbon and energy tax for the whole community. As expected, it faced hard opposition from some industries and several member states. (Ellerman et al. 2010) Carbon tax can be indeed quite successful but so far only at national level. Norway, Sweden or Germany are examples of European countries that combine EU ETS with their national carbon taxation. While it works perfectly in one region, combining it with other regions is difficult and so far unrealistic. For these reasons European Union decided to choose EU ETS over carbon tax in reply to Kyoto Protocol arrangements.

Susceptible to fraud

The immaturity of the carbon market and the intangible facet of EUAs make EU ETS especially susceptible to fraud in comparison with other markets. Such fraud occur always as big scandals and damage further the reputation of the scheme. The most popular fraud refer to recycling of CERs, turnover of non-additional offset credits and VAT fraud. (Branger, 2014)

CERs recycling

CERs credits get recycled in the moment when the surrendered credits to the government are not retired but entered again into the market. At that time there was no regulations that banned selling used credits to the international market under Kyoto Protocol. The scandal broke when these used CERs entered again back to the EU ETS market. It occurred in 2010 when Hungarian government got surrendered offset credits from polluters who rendered them to meet their caps. The government did not retire them but totally legally sold these used 800.000 CERs to a Hong-Kong based trading house that was supposed to sell them to Japan. Many companies bought them, some of the credits were delivered to Bluenext – Paris based European environmental trading exchange. Investors bought them and unconsciously tried to use them on the European market again. (Corporatewatch, 2010)

The above procedure was performed not only by Hungarian government. UN revealed that 10 other countries failed to retire and sold 62 million surrendered credits. Among them there were countries such as Poland, Czech Republic, Germany, Spain and the Netherlands. (Corporatewatch, 2010)

The complicated and intangible nature of CERs together with selling, re-selling, packing and repacking the credits show how easy it is to create lack of transparency and path a way to corruption.

After the loud fraud in 2010 the European Commission blocked the surrendered credits in "withdrawal accounts". Yet Interpol warns against probable other fraud. (Branger, 2014)

Turnover of non-additional offset credits

Additionality requirement says that the GHG emissions should be lower after introduction of a CDM project than they would be in the most realistic alternative scenario without implementation of CDM. Wara and Victor (2008) argues that theoretically it is impossible to decide if credits are issued for activities that would have occurred anyway or not. Moreover, it is more than difficult to assess the emissions level that would occur if the CDM project had not been used. This is why the projects were prone to fraud from the very beginning.

Wara and Victor (2008) seriously question whether the majority of projects registered through the CDM program are contributing to real reductions in emissions that would not have otherwise occurred. They calculated that around 40% of all CDM projects that were registered under EU ETS scheme until July 2007 would have been performed anyway even in the absence of the CDM (Bauhr, 2009).

The additionality problem was addressed as from Phase 3 and thanks to the changes the problem has been limited.

Carousel VAT fraud

VAT fraud mushroomed and came into light in 2010. The kind of fraud that became widespread in EU ETS market were so called carousel fraud or missing trader intra-community value-added tax (VAT). They were based on claiming VAT refunds from international carbon trades. Firstly, companies would buy tax free allowances from the markets abroad and then sell them with tax in the domestic market. Thereafter, companies would disappear without paying VAT to government. This resulted in huge tax fraud profits which were actually very difficult to trace. The problem of this issue lied in the fact that there were many various registries which made carbon trading transactions. Because of that, it was difficult to investigate which allowances are authentic which not. (Climate and Capitalism, 2011)

After 2010 scandals new EU ETS regulations entered into force which limited the carousel fraud. However, still the registries are lax and inconsistent across European member states. The problem begins when the unverified allowances enter the registries because then it's hardly possible to check their authenticity. Unfortunately, until 2010 countries performed such checks extremely rarely. For example Danish government did not carry out any single check in the period 2008 -2010. Then in 2010 it occurred that Danish registry is full of fraudulent firms and fake names. In the same year over 90% of all account holders in the registry in Denmark had to be deleted. (Climate and Capitalism, 2011)

Overlap with other EU states policies

Some EU member states, having noticed that EU ETS is not effective discuss and introduce their national based environmental policies. The low EUA price and all above mentioned concerns induce countries to implement more restrictive policies to achieve their own more ambitious emissions mitigation targets.

However, European Council of Academies of Applied Sciences, Technologies and Engineering argues that such measures increase the inefficiency of EU ETS. They also contribute to even lower demand for allowances and further decrease the EUA price. Such domestic policies are likely to strengthen the European market asymmetries in marginal abatement costs in EU states. (EuroCase, 2013)

Last but not least, it is worth mentioning that member states have conflicting interests. It is a paradox that countries like Poland, Spain and Germany take part in EU ETS and at the same time subsidize their national coal sectors under an EU state provision until 2018.

2.3 Impact Analysis of Other EU Environmental Policies on EUA Prices

It has been said that EU ETS is the cornerstone of European climate policy. The question has been raised if it should be one and only environmental policy or other complementary policies should be introduced.

Advocates of implementing other polices argue that EU ETS scheme does not tackle all the environmental market failures, that is why we need other specific regulations to support the climate sustainability from all angles.

Other experts, however, stand by the opinion that any other policy such as deploying renewables or supporting energy efficiency programmes directly harms the EU ETS. They argue that any other additional policy does not reduce the total emissions in EU ETS sectors because the EU ETS cap is already set. It is inflexibly fixed by EU legislation. It is sometimes referred as "waterbed effect". It means that emission reductions in one place cause emission increase by the same amount in another place, because the cap is already fixed. The mechanism is similar as in waterbed. If we squeeze one spot of the waterbed, the same volume of water will bulge out in another spot of waterbed. For example, German utility RWE stated in their paper *Proposals of Federal Ministry for Economic Affairs and Energy endanger the future survival of lignite* from 2015 that closing a German lignite plant "*would not lead to a CO2 reduction in absolute terms. the certification volume in the ETS would remain unchanged and as a result emissions would simply be shifted abroad"*

Moreover, well-known argument of Jevon's paradox is often cited in debates about additional actions in EU environmental policies. Economist William Stanley Jevons argued in his book *The Coal Question: an Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of our Coal-mines* that technological efficiency gains instead of decreasing the consumption it actually increases the overall coal consumption. Energy efficiency technology instead of bringing environment advantages rebounds and backfires. Savings from energy efficiency are offset to increased production of energy. It is easy to exemplify with private consumption. If we decide to install new energy efficient bulbs instead of old incandescent ones, we most probably install more bulbs to lighten our home. If not, we will use the savings from lighting the home to buy other appliances that consume energy. Similarly, fuel efficient policies for American cars were implemented in 1975, however, the it did not result in decline of car usage. On the contrary, United States have around fifty million more registered cars than licenced drivers right now.

From the above, it might be concluded that the only way of reducing energy consumption (and emissions) is by making energy more expensive or reducing its use directly.

Another aspect of implementing additional policies to the EU climate legislations is the price formation. When, for example, more renewables are used then demand for coal, and thus, for allowances decreases. In theory ,lower EUA demand should lead to even lower prices.

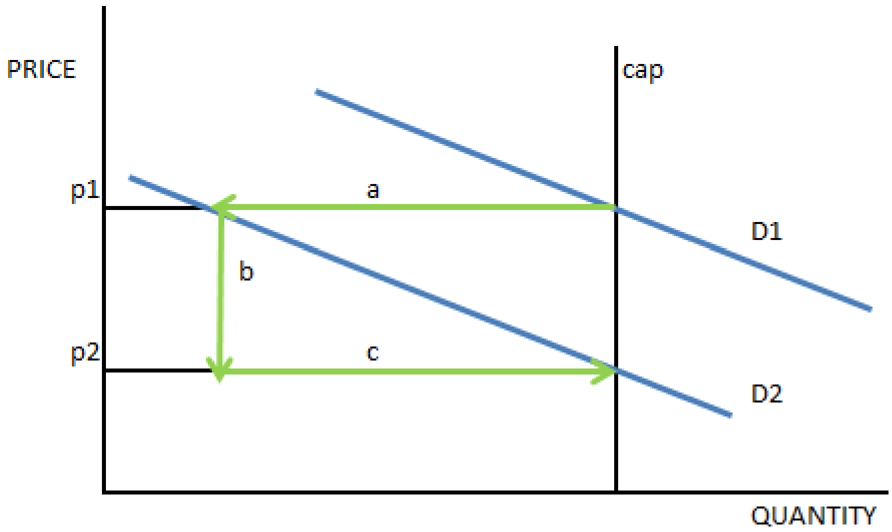
This chapter will try to answer the question if the additional actions such as deploying renewables or introducing energy efficiency programmes impacted EUA price which contributed to inefficiency of the whole EU ETS scheme.

Analysis of waterbed effect

Let's hypothesize there is only one environmental policy in the market- EU ETS, demand for allowances is represented by D1 on the graph. Supply of allowances if perfectly inelastic, fixed by EU legislation. This supply is the cap for allowances represented by vertical line "cap". In this base scenario price of allowance is set at p1.

Let's now analyse situation when EU decides to implement additional strategies for limiting emissions. Coal power stations get closed, renewables get subsidies and thus get wider deployed or member states implement additional national carbon pricing. In this situation demand for allowances will drop. New demand in the graph is D2 and price decreases to p2. Because allowances are cheaper now, additional demand for them appears and shifts again to the quantity set by the cap (c)

Figure: Illustration of waterbed effect



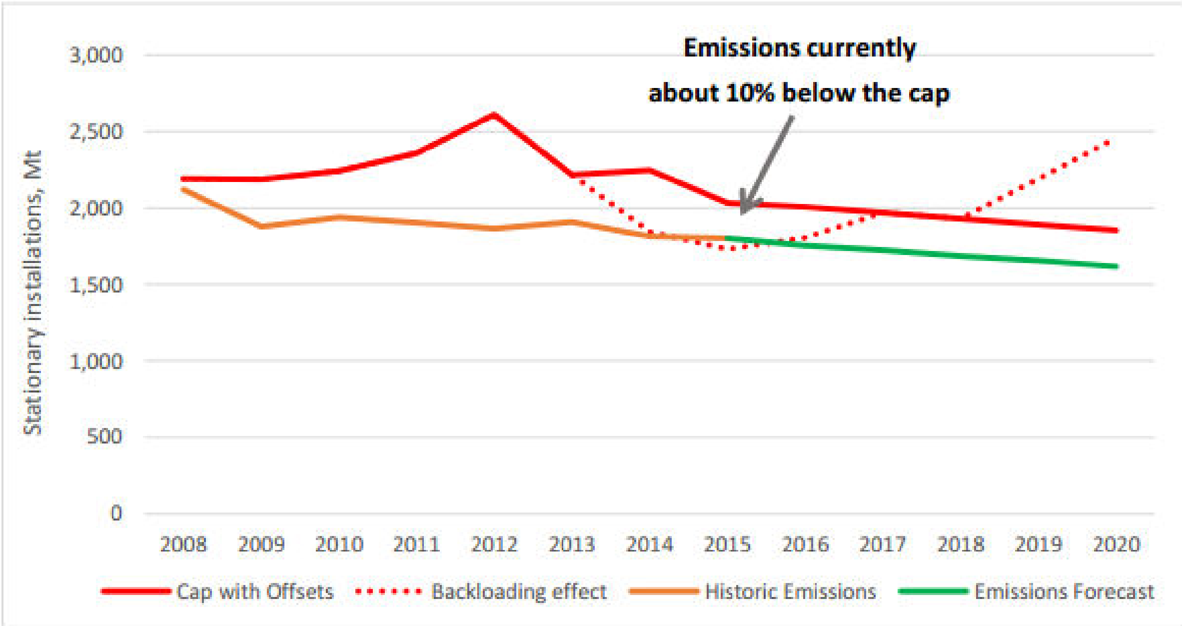
Source: own

Concluded on the above, additional policies in the environmental legislation bring disadvantages because in total, there is the same amount of emission, but they are sold for the lower price (price difference b in the graph). Low price of allowances, as already stated earlier in this thesis, is the direct cause of EU ETS inefficiency. Low price of emission does not give any incentive to switch to other energy efficient solutions.

Before the final conclusion will be stated that EUA price got so low because of waterbed effect, the above simple graph has to be verified against reality. As described in previous sector of this thesis, there has been large oversupply of allowances in the market, already from phase 1 of EU ETS scheme. It has been caused by, among others, generous grandfathering and generous allocation in NAPs, economic recession and oversupply of offset credits.

The below figure, made by Sandbag analysts, proves the current market surplus. Emissions have been much below the cap for the whole time of EU ETS. The market gains both annual and cumulative surplus. The average annual surplus has been 223 MtCO2 in the period 2008-2015 and Sandbag forecasts predict that future surplus would be reduced very little, down to 180-190 Mt (Sandbag, 2016)

Figure: Emissions and Cap in 2008-2020

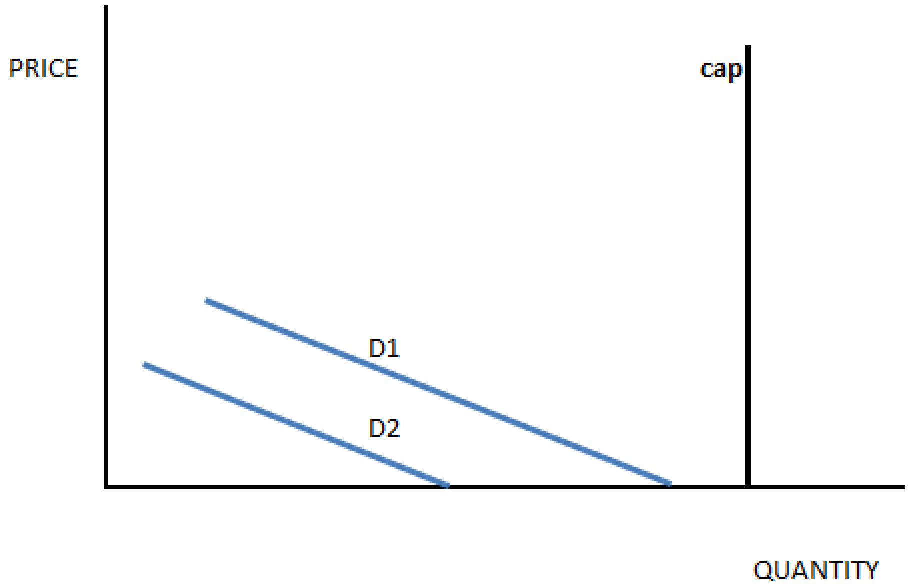


Source: Sandbag, *Puncturing the waterbed myth*, 2016

Had it not been for the possibility of banking of allowances into next phases, the price would most probably hit 0. Moreover, the introduction of MSR in 2019 supports the current price because it is expected that allowances get scarce in the future.

This means that the cap is set very far away from the demand on the market. The below graph depicts how it looks in reality. Additional policies shift the demand curve from D1 to D2 but still have no impact on the EUA price because demand is anyway set much below the supply curve.

Figure: Illustration of impact of additional policies with oversupply of allowances



Source: own

Thus, this means that there is also no extra demand for allowances to offset the emission reduction achieved form additional environmental policies. Consequently, additional policies are extremely beneficial because not only they do not influence the price of EUA but also manage to retain fully all emission reductions. (Sandbag, 2016)

To sum up, it might be proved that all additional actions coming from the European Union such as subsidies to renewables, Energy Efficiency Directive or NER300 had no adverse effect on the EUA price and thus did not contribute to the so far failure of EU ETS scheme. The same can be said about all additional actions on the national level form EU member states. Closure of coal plants in Netherlands, introduction of UK carbon price floor or feed-in tariffs for wind and solar energy offered by many countries are definitely not the cause for EU ETS inefficiency

3 Assessment of Reforms

In this chapter the assessment of already implemented reforms will be discussed. Furthermore, the proposals of reforms that are going to be implemented as from Phase 4 will be presented and analysed.

European Commission started debating about the necessity to reform EU ETS already in pilot Phase 1. With the lapse of time and gained knowledge by learning-by-doing European Union discusses and tries to increase the efficiency of EU ETS and address the problems listed in chapter 2. The question that is posed in the thesis is: Do the reforms work, will they work and if so, to which extent?

3.1 EU ETS Amendments in Phase 3

Decreased cap and number of free allowances

In the first two phases the vast majority of allowances were distributed for free. As we know from chapter 2, it was a big issue that contributed to the inefficiency of EU ETS. European Commission addressed this problem in Phase 3 by introducing auctioning. As from 2013 there were no free allocations to power companies. There were few exceptions among Eastern and Southern EU countries, they were allowed 70% free allocations in 2013 but this free allowances will decrease annually and reach 0% in 2020. (EC, 2016)

Non-power sector got 80% of free allocations in 2013 and this will also gradually decrease to 30% in 2020. Only sectors that are classified to the high risk of carbon leakage have been allowed 100% free allowances for the whole Phase 3.

Moreover, to address the problem of over-allocation on the market, European Commission introduced one single cap over whole EU ETS system instead of national caps in every member state. The most important feature of the EU-wide cap is the fact that the cap is by 11% smaller than it was in Phase 2 and additionally the cap gets smaller every year by a linear reduction factor of 1.74% (EC, 2016). This is very good news as it gives the companies the certainty and kind of predictability about the prices, which enhances investments in the clean air technology.

Thanks to above reforms the allowances that companies will be able to use in 2020 is 21% lower than in was in 2005. However, this is still not enough to achieve the targets EU committed to, i.e. lower emissions by 40% by 2030 compared to preindustrial levels (base year 1990). Experts calculated that the cap would have to be further lowered to 2.2% - 2.4% from Phase 4. (EC, 2016) To meet the commitments of targets in 2050 emissions from the EU ETS sectors would have to decrease even further, by 90% compared with 1990. (EC, 2016) In this case 1,74% linear reduction factor seems not to be enough.

Offset credits limitation rules

To address the countless problems of UN offset credits, new rules entered into force in 2013 that limit the use of UN credits. Firstly, overallocation of offset credits has been counteracted by the lower maximum import limits. They amounted to around 13.4% in Phase 2 and were limited to around 6% in phase 2 and 3 combined. (EC, 2016)

Furthermore, offset credits are not allowed to be used directly as EU ETS compliance, but at first they have to be exchanged for EU allowances. (EEA, 2015)

To fight against fraud and non-additionality aspect of CERs, HFC-23, N20 and also Large Hydro credits are not allowed anymore at all. Because so many fake projects mushroomed in order only to win windfall profits, since 2013 only projects that were registered before 31.12.2012 are allowed to sell offset credits. The exception here are least developed countries that can sell credits from project that were registered also since 2013. Last but not least, credits that were generated in phase 2 could not be banked longer than until March 2015. (EC, 2016)

Backloading

One more big attempt to counteract the market oversupply was based on the so called backloading. Backloading is the short-term method of decreasing supply of EUAs. European Commission withheld 400 mln allowances in 2014, then 300 mln in 2015 and 200 mln in 2016. These allownaces are supposed to be returned into the market later at the end of phase 3. 300 mln allowances will be reinjected in 2019 and further 600 mln in 2020. (Camco, 2016)

3.2 Future reform - Market Stability Reserve System

The market stability reserve solution is somewhat similar to back-loading however, it provides much more stability by flexibility. Whereas back-loading is a short-term solution, MSR offers long-term method of providing market stability and smaller volatility.

The first legislative proposal of MSR was put forward in January 2014, accepted by European Parliament in 2015 with some changes. (Cail, 2015) The European Commission plans to introduce the solution even before the Phase 4. MSR is planned to be established in 2018 and come into operation in January 2019. (EC, 2016)

MSR solution is based on the withdrawing extra allowances when there is oversupply in the market, store them in the reserve and reinject the allowances when there is shortage of them. This would guarantee stable and higher EUA prices that would cause higher efficiency of EU ETS. (EC, 2016)

To support higher prices on the market European Commission has taken a decision to delay the re-injection of back-loaded allowances from 2014-2016 and spread them later when the stability system will be in force. This means that 900 mln back-loaded allowances will enter the reserve instead of being auctioned in 2019-2020. (EC, 2016)

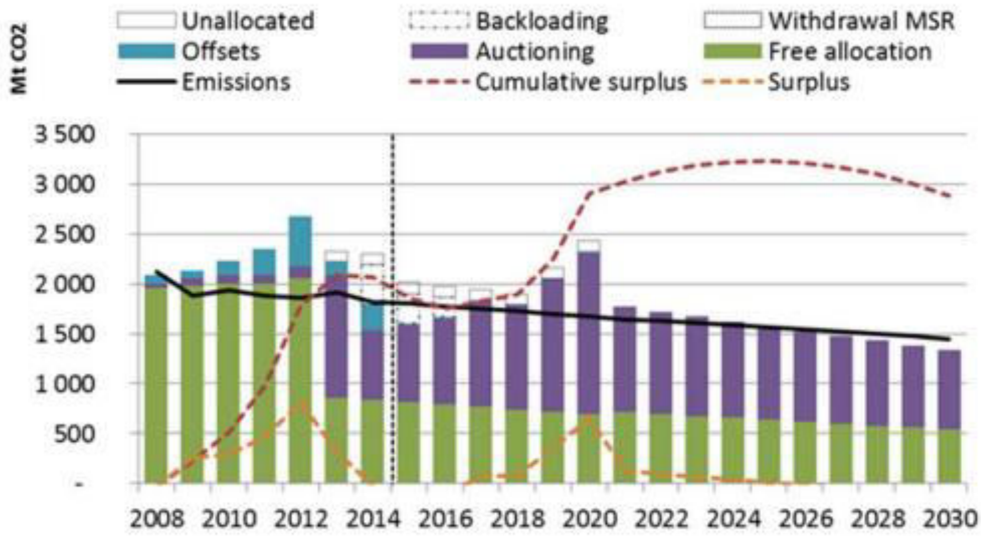
Apart from back-loaded allowances the unallocated allowances will also be put in the reserve. The exact number of unallocated allowances will be given in 2020 but experts assess that about 550-700 mln allowances might be unallocated by the end of Phase 3. (EC, 2016)

As European Commission argues, the MSR role is to address not only the current oversupply of allowances in the market but also offer long-term solution of resilience to unpredictable market shocks, thus providing demand-supply balance.

3.3 Analysis of impact of MSR

Analysts from Institute for Climate Economics estimated that without MSR introduction, the allowances surplus would drastically increase since the beginning of Phase 4 as it was in the beginning of Phase 3. As seen in the below figure the surplus could most probably exceed 3 Gt CO2

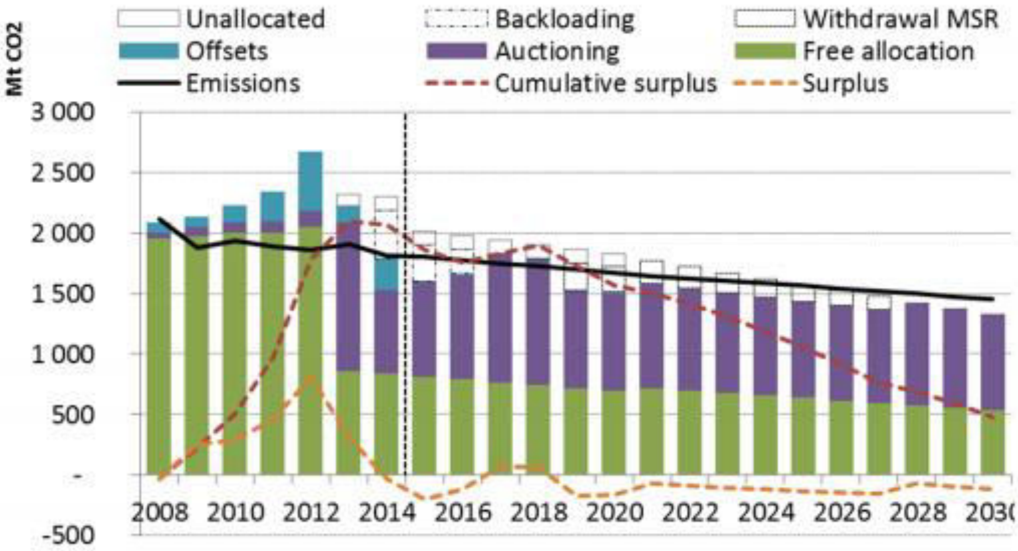
Figure: Allowances surplus without MSR



Source: Institute for Climate Economics, 2015

However, with the implementation of MSR the surplus could be limited by as much as 1 Gt CO2. As depicted in the next figure, estimations show that MSR is able to keep the surplus below 2 Gt CO2 in 2020 and decrease later down to 500 Mt CO2 by 2030.

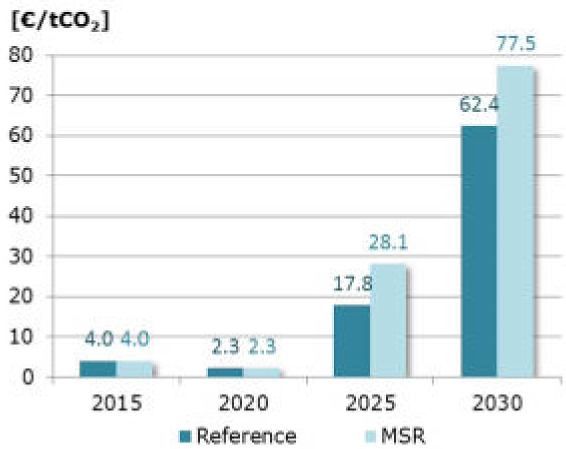
Figure: Allowances surplus with MSR



Source: Institute for Climate Economics, 2015

Based on these estimations, MSR seems to be excellent tool to introduce allowance scarcity in the market, thus creating stable, higher and predictable prices. Confidence about more rigorous future climate policies, predictability and low volatility of prices are the key for companies to consider investing in better, cleaner technology.

Figure: Comparison of EUA prices with MSR and without



Source: POLES Enterdata model, 2015

Enterdata analysts used the POLES model to assess also the price of EUA with and without the MSR (see above figure). In both cases EUA is supposed to rise, however, the implementation of MSR will speed up the process and the price increase will be much sharper, reaching around 28.1 Eur per tCO2 by 2025 and 77.5 Eur per tCO2 by 2030. Without the MSR the prices would amount to 28.1 and 62.4 Eur per tCO2 respectively. Scenario wit MSR offers allowance price which is over 24% higher than the scenario without MSR.

Finally, it is argued that MSR will induce additional emissions reduction (due to allowance scarcity in the market and higher prices). It is estimated that thanks to MSR total additional abatement costs in EU ETS would amount to around 1.7 bn Eur. (Cail, 2015) Enterdata shows that around two third of extra abatement costs could be achieved by the power sector because it has high flexibility in the emissions reduction potential due to the fact that power sector has relatively low reduction costs (39Eur for tCO2 avoided). Other sectors that would lessen their emissions to a great extent is mineral sector and industrial sector.

Figure: Additional cumulative abatement costs in the period 2015- 2030 thanks to MSR implementation,

Sector	Δ abatement costs [€m] (cumulative 2015-2030)	Share of total [%]	Average cost per tCO_2 avoided [€/tCO_2]
Industry	**403**	**23.6%**	**46**
Chemicals	48	2.8%	41
Manufacturing	30	1.7%	38
Mineral Production	178	10.4%	46
Steel	76	4.5%	71
Upstream and Refining	71	4.2%	38
Power	**1,129**	**66.0%**	**39**
Buildings	**22**	**1.3%**	**16**
Residential	15	0.8%	30
Services	7	0.4%	8
Air Transport	**153**	**8.9%**	**43**
Domestic	22	1.3%	43
International	131	7.7%	44
Agriculture	**4**	**0.2%**	**28**
Total EU ETS	**1,711**	**100%**	**40**

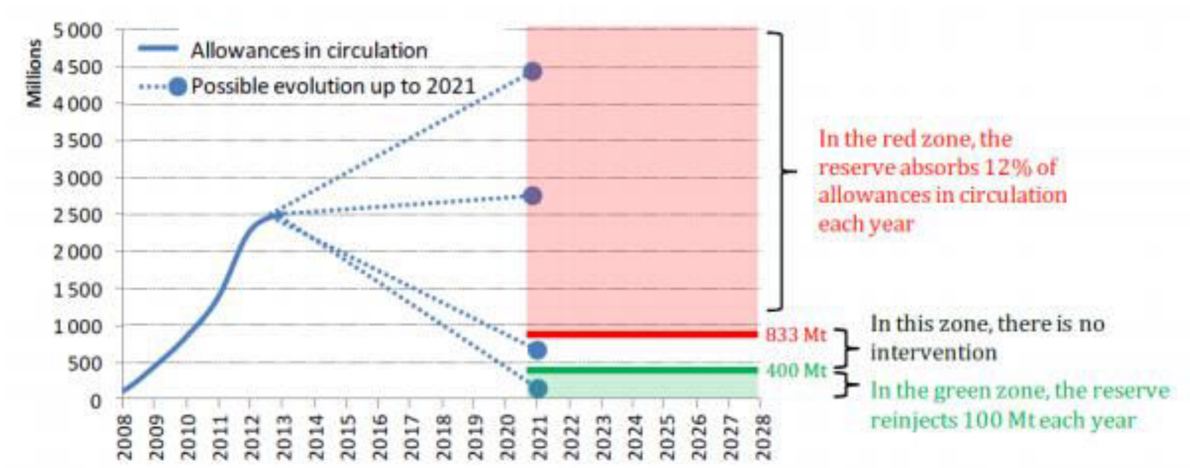
Source: POLES Enterdata mode, 2015

3.4 MSR Criticisms

Although MSR can be praised for all the reasons numbered in the previous sector, it is unfortunately not without drawbacks. This chapter will focus on analysing the MSR criticism published by environmental economists.

Economists criticize MSR because the system is incapable of recognizing surplus coming from abatement results or surplus coming from market exogenous shocks. Such automatic withdrawal of surplus may cause price volatility and discourage companies which invest in technology. As the below figure depicts the triggering mechanism is very automatic, "robot-like". There are strict rules when and how much of the triggering or withdrawal should be performed depending on the number of allowances in circulation. That is why some kind of "human intervention" should be added to avoid unreasonable withdrawal of surplus every single time. (Cail, 2015)

Figure: The functioning of MSR triggering mechanism



Source: Trotignon et al, 2014

Additionally, it is uncertain if the basic idea of MSR, i.e. the short-term based withdrawal of allowances will raise the price of EUAs, is justified. It is unknown how the market participants will react to MSR and how the price will evolve. And this is because MSR does not withdraw the over-allocations from the market forever, it only changes the timing of auctioning. In this way, the MSR is similar to back-loading, however, for a longer term. When the reserves will grow, the number of allowances in the market will decrease in the short run but they will eventually come back later.

According to basics of environmental economics principles such a market adjustment that is cap neutral should have small or even no influence on the EUA price because of the inter-temporal price smoothing of EUAs(Knopf, 2014). MSR might bring about some changes if the scarcity of allowances will be so great that companies will face substantial allowance shortage and would be incapable of complying to EU ETS without buying additional permits from auctioning. However, the chances stand, that the rebound effect would appear when the allowances are reinjected to the market later on. Knopf argues that the EU allowance price rise is very questionable because MSR does not change expectations of market participants about sufficient long-term number of allowances.

It should be noticed that if MSR would be able to contribute to certain price rise if it was reformed in the way MSR is no longer cap-neutral, for example when allowances expire due to reserves exceeding maximum level or when the allowances stored in the reserve expire due to retirement.

Finally, MSR does not address all the issues of EU ETS. It is purely a quantity-based mechanism. It does not guarantee a stable price. This is why some experts suggest rather setting a price collar, which would limit volatility of allowances between set price floor and price ceiling. MSR does not solve the problems of international offset credits, susceptibility to fraud and other loopholes.

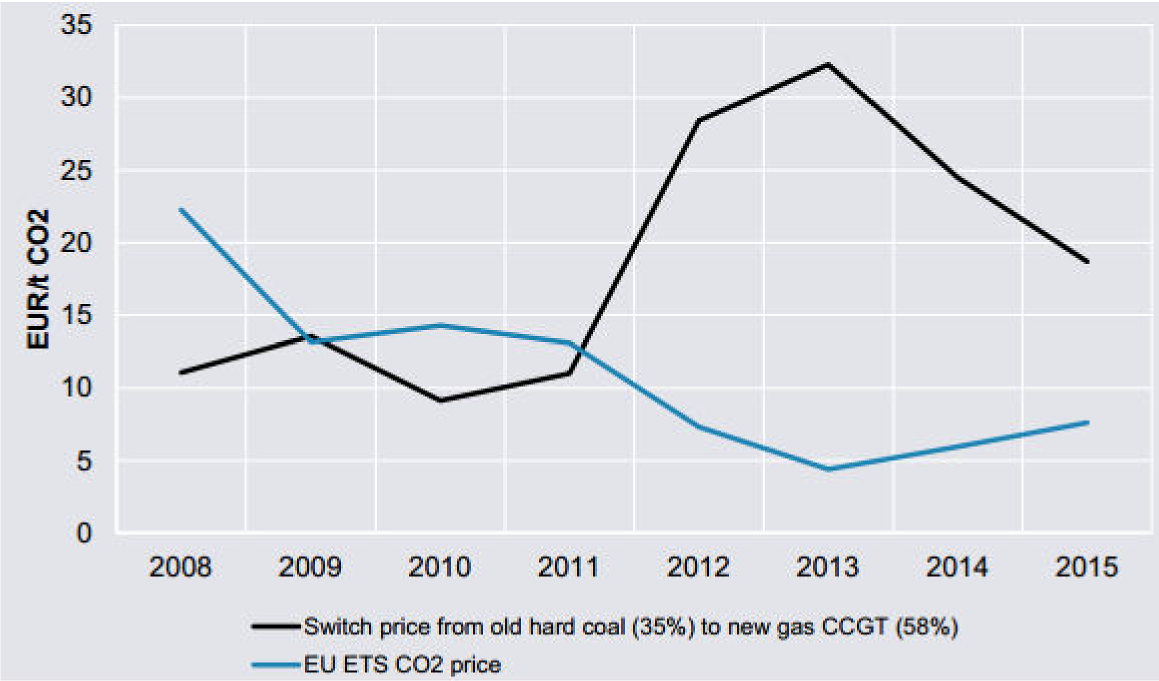
4 Conclusions

Because of the fast changing environment and global warming, the international community needed to take some legislative steps to counteract the effects of global warming. European Union has implemented the EU ETS scheme in order to make sure a price is put on carbon. In theory, putting a price on carbon is essential and very reasonable for climate policy. It can directly address the issue of market failure of pollution emissions. Carbon price indicates the level at which abatement costs and investment in cleaner technology is more cost-effective than buying and surrendering the allowances. EU-ETS was aimed to be a game changer. The EU ETS directive from 2003 proclaims that the scheme is implemented to "promote reductions of greenhouse gas emissions in a cost-effective and economically efficient way". However, the timeframe is not given in this Directive.

The main goal of the EU ETS was to set such a price of GHG to induce economy switching to other sources of energy. As this thesis shows, EU ETS has so far failed to deliver this goal.

The prices of allowances have been much too low to induce companies to invest in carbon-cleaner production. It is estimated that the allowance price should amount to around 30 Eur per tCO2 to shift economy from carbon based to gas-based. As seen in the below graph, unfortunately, the price has oscillated at around 5 Eur per tCO2 for the most of the EU ETS period. They were much too low to meet the main expectations of EU ETS.

Figure: Comparison of coal to gas switching price and EU ETS CO2 price



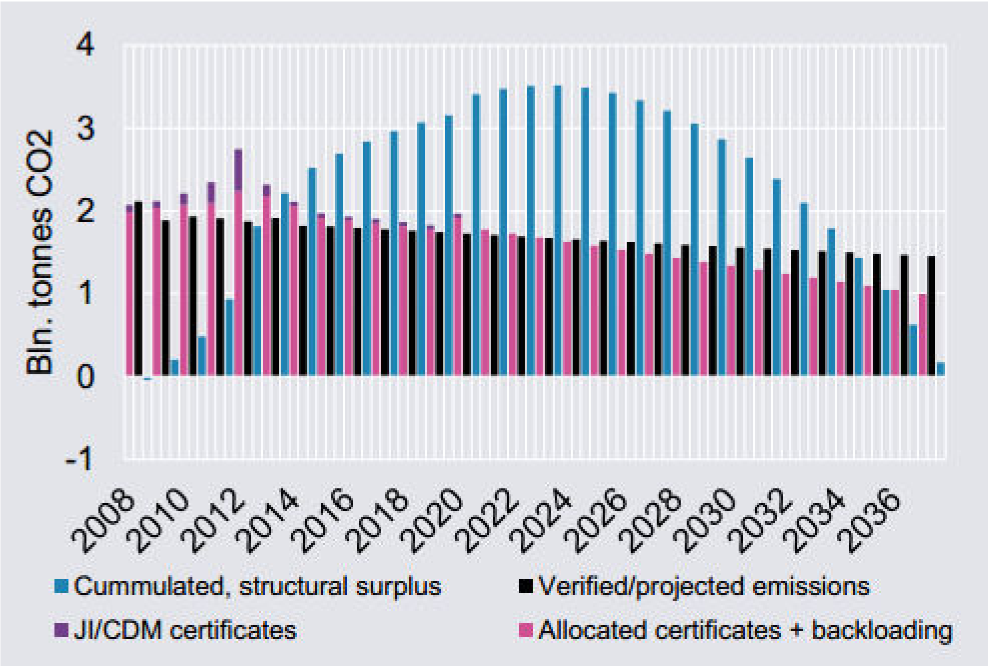
Source: Agora Energiewende (2016)

This price failure happened because EU ETS has faced a big number of problems. Firstly, the originally allocated allowances were oversupplied because of generous National Allocation Plans because states wanted to give advantage to their countries. Then when the crisis came in 2008, the situation got even worse with the decreasing production and increasing oversupply of allowances.

Moreover, EU ETS has delivered perverse incentives with the limitless possibility of using CERs and ERUs for the EU ETS compliance in the first place. There have been many fraud connected with the additionality clause of offset credits, also with offset credits recycling. These all aspects contributed to the increasing oversupply of allowances on the market, and thus price failure.

Even worse, as shown below, this enormous oversupply of allowances will keep CO2 prices well below the demanded 30 EUR/t for at least next 15 years or so.

Figure: Cumulated allowance surplus in the EU Emissions Trading System



Source: Agora Energiewende (2016)

EU ETS has been accused also of unfair windfall profits for many industries, with fat cat cement sector in the foreground. The ethical issue that polluter earns with its pollution instead of paying for emissions is still in place.

The operation cost is bigger than the EU ETS results. According to UBS Investment Research, the EU ETS cost $287 billion through to 2011 and had an “almost zero impact” on the volume of overall emissions in the European Union. Analysts believe the money could have resulted in more than a 40% reduction in emissions if it had been used in a targeted way, for instance to upgrade power plants. (Breaking our Carbon Budget, Energysmack, 2012)

The EU ETS is severely criticised as it has many loopholes and shortcomings. Yes, it has failed so far. However, if there had not been EU ETS, there would have been no other big policy. Tax, indeed, would be more effective but tax unanimity among 31 countries is impossible as states consider taxes to be an issue of national sovereignty. In this case, the only solution was to make an attempt to rescue ETS by implementing reforms.

Based on the above, the EU ETS has to be reformed as soon as possible. The eligible solution for the problems is to be implemented as Market Stability Reserve in 2019. It was originally planned that EU ETS will enter into force starting from Phase 4 in 2021 but the market situation is bad enough that one should speed up the reform implementation. MSR is the pure quantity-based mechanism that indirectly affects the price of allowances. It is actually an extended version of back-loading introduced in Phase 3. MSR withholds the allowances when the supply is too big, puts them into a reserve, and injects them back into the market when the supply is too small. In theory, MSR works in the way that it provides scarcity, and thus stability, of allowances on the market in the short term and creates resilience to unpredictable market shocks.

However, MSR is also susceptible to many drawbacks. Firstly, it does not differentiate between oversupply stemming from over-allocation from oversupply coming from emissions abatement. Secondly, it creates the market scarcity only in the short-run as the allowances are still there waiting to be reinjected into the market. Thus, it is actually questionable if the MSR can affect the price. Last but not least, MSR Solution does not address all the problems EU ETS has been struggling with.

Whereas MSR is likely to work in case of another economic crisis, when the production drops and permits oversupply the market, it is useless in face of issues like: too big inflow of international offset credits, overlapping policies among the member states, low credibility of EU commitment leading to distorted market participants expectations.

Based on the above, MSR System will absolutely not solve all the problems of the European cap-and trade scheme. Instead, a much wider comprehensive reform of EU ETS is needed. MSR should be combined with other measures such as setting a price collar, expanding EU ETS to other carbon intensive sectors – transport and heat in the first place. Moreover, wider coordination on the international arena is needed to avoid carbon leakage. If EU ETS was linked to other cap-and-trade regions or new countries joined the EU ETS, the issue of carbon leakage risk would be much smaller. Additionally, other complementary policies have to come into force in order to stimulate innovation and R&D in the market. ETS and MSR alone would hardly help here.

To sum up, reaching the target of keeping global warming under 2 Celsius degrees, or as agreed during COP21 even trying to keep it under 1,5 Celsius degrees is, to put it straightforwardly, very hard and overly optimistic. Global warming has already exceeded 1 Celsius degree and emission reductions that are necessary to meet the goal are enormous. If the target of 2 Celsius degrees is to be met, net GHG emissions would have to drop to 0 by 2050, and if we take more optimistic scenario of 1,5 Celsius degrees – by 2030. It would mean that in few years already humankind would not possess any coal or gas power stations without carbon capture and store technology, nor any cars, ships or planes powered by fossil fuels. However, nowadays still new coal power plants are built that are supposed to operate for decades and oil and gas companies spend millions of Euros for searching for new resources. Although the arrangements done in environmental summits and recently in Paris at COP21 have stated about the ambitious targets, EU ETS does not deliver any major improvements in technology, and countries have not presented any eligible proposals of meeting the targets. In conclusion, the good intention of politicians is unfortunately not sufficient to bring about environmental changes.

EU ETS needs definitely many more strict reforms to start being efficient and get closer to the targets. The MSR here alone will not help. Finally, for environmental policies to make sense, cooperation and coordination among all countries in the world is necessary.

5 Sources

Climate Change mitigation, A Carbon Tax or an Emissions Trading Scheme? An analysis of the Norwegian perspective, available at: http://brage.bibsys.no/xmlui/bitstream/handle/11250/170046/Medina_2013.pdf?sequence=1 retrieved 15.02.2016

The European Union Emissions Trading System Why has it developed into an inefficient mechanism to lower greenhouse gases? available at: http://brage.bibsys.no/xmlui/bitstream/handle/11250/243143/664447_FULLTEXT01.pdf?sequence=1 retrieved 15.02.2016

Emissions for Sale: The Ethics of Emissions Trading available at: http://www.diva-portal.org/smash/get/diva2:19281/FULLTEXT01.pdf retrieved 17.04.2016

The European Union Emissions Trading Scheme: should we throw the flagship out with the bathwater? available at: http://www.cepn-paris13.fr/epog/wp-content/uploads/2015/09/Branger_Lecuyer_Quirion_WIRES-CC_2014_ETS.pdf retrieved 7.05.2016

Glimpses of Phase 4 of the EU ETS - The 2030 Climate and Energy Policy framework, available at: http://www.reedsmith.com/Glimpses-of-Phase-4-of-the-EU-ETS---The-2030-Climate-and-Energy-Policy-framework-11-07-2014/ retrieved 7.05.2016

EU Emissions Trading System: failing at the third attempt, available at: http://www.carbontradewatch.org/downloads/publications/ETS_briefing_april2011.pdf retrieved 7.05.2016

Assessing design options for a market stability reserve in the EU ETS, available at: http://www.ecofys.com/files/files/ecofys-2015-assessing-design-options-for-market-stability-reserve-euets.pdf retrieved 10.04.2016

Haab and Whitehead, ECON 101: Carbon Tax vs. Cap-and-Trade http://www.env-econ.net/carbon_tax_vs_capandtrade.html retrieved 01.03.2016

Haug, C., Frerk, M.L, Kachi, A., Serre, C. and Wilkening, K. (2014). Emissions Trading Worldwide. International Carbon Action Partnership

(ICAP) Status Report 2014. Available at: https://icapcarbonaction.com/component/attach/?task=download&id=152 (2016-02-10) retrieved 10.03.2016

Kyoto Protocol to the United Nations Framework Convention on Climate Change". UN Treaty Database. Available at: https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-a&chapter=27&lang=en , retrieved 01.02.2016

Delbeke (2006), EU Environmental Law: The EU Greenhouse Gas Emissions Trading Scheme,

Claeys & Casteels, MARKET MECHANISMS: UNDERSTANDING THE OPTIONS ,Center for Clmate and Energy Solutions (C2ES) ,April 2015 availale at: http://www.c2es.org/publications/market-mechanisms-understanding-options retrieved 15.02.2016

Stephan N, Bellassen V, Alberola E. Utilisation Des Crédits Kyoto Par Les Industriels Européens: D'un Marché Efficace À L'éclatement D'une Bulle (in French). Etude Climat. CDC Climat Recherche; 2014.

N. Stephan, Valentin Bellassen, E. Alberola. Use of Kyoto credits by European industrial installations: from an efficient market to a burst bubble. [Research Report] auto-saisine. 2014

R. Elsworth, B. Worthington, D. Morris Help or Hindrance? Offsetting in the EU ETS, Sandbag, November 2012, available at: https://sandbag.org.uk/site_media/pdfs/reports/Help_or_Hindrance_Offsetting_2012_3.pdf retrived 28.02.2016

Morris, D. Losing the lead?, Sandbag, available at: http://www.sandbag.org.uk/site_media/pdfs/reports/Losing_the_lead_modified_3.8.2012.pdf retrived 28.02.2016

R. Helmer, ETS all hot air?, 2008 available at: https://rogerhelmermep.wordpress.com/2008/08/07/ets-all-hot-air/ retrived 01.06.2016

Goldemberg, J. et al. (1996). "Introduction: scope of the assessment.". In J.P. Bruce; et al. In: Climate Change 1995: Economic and Social Dimensions of Climate Change. IPCC website.doi:10.2277/0521568544. ISBN 978-0-521-56854-8.

Fisher, B.S.; et al. (1996). "An Economic Assessment of Policy Instruments for Combating Climate Change". In J.P. Bruce; et al. Climate Change 1995: Economic and Social Dimensions of Climate Change IPCC website. doi:10.2277/0521568544. ISBN 978-0-521-56854-8.

Wråke, M., Burtraw, D., Löfgren, Å. and Zetterberg, L. (2012). What we have learnt from the European Union's Emissions Trading System. Ambio, 2012 February; 41(suppl.1), pages 12-22.

Zetterberg, L. (2012). Linking the Emission Trading Systems in the European Union and California: FORES study 2012:6. FORES, Bellmansg 10, SE-11820 Stockholm, Sweden. www.fores.se.

Zetterberg, L. (2014). Benchmarking in the European Union Emissions Trading System: Abatement Incentives. Energy Economics 43, pages 218-224.

Branger F, Quirion P. Climate policy and the 'carbon haven' effect. WIRES Clim Change 2014, 5:53–71. doi:10.1002/wcc.245.

Ellerman D, Convery F, de Perthuis C. Pricing Carbon: The European Union Emissions Trading Scheme, Cambridge, 2010

Anita Talberg, Science, Technology, Environment and Resources Section
Kai Swoboda, Economics Section Emissions trading schemes around the world June 2013

ICAP. (2016). Emissions Trading Worldwide: Status Report 2016. Berlin: ICAP. https://icapcarbonaction.com/images/StatusReport2016/ICAP_Status_Report_2016_Online.pdf

Offset Credit 'Recycling' Causing Waves in Carbon Markets, 09/04/2010 https://corporatewatch.org/news/2010/apr/08/offset-credit-recycling-causing-waves-carbon-markets, retrieved 30.04.2016

Environmental Investigation Agency, Two billion tonne climate bomb: How to defuse the HFC-23 Problem, June 2013, available at: https://eia-international.org/wp-content/uploads/EIA_HFC-23_report_0613_Final1.pdf retrieved 30.04.2016

Climate and Capitalism, 2013 http://climateandcapitalism.com/2011/05/05/fraud-and-scams-in-europes-emissions-trading-system/ retrieved 06.06.2016

Bauhr, M., 2009, Corruption in the Carbon Market? International Organisations, Transparency and the Clash of Values, QoG Working Paper Series 2009:15, Quality of Government Institute, University of Gothenburg.

Wara, M., and D. Victor, 2008, A Realistic Policy on International Carbon Offsets, Working Paper #74,

Program on Energy and Sustainable Development, Stanford University Camco, Clean Energy, available at: http://www.camcocleanenergy.com/emissions-trading/the-3-big-changes-of-phase-3 retrieved 01.06.2016

Sylvain Cail , The Market Stability Reserve: Assessing Reform Needs and Possible Impacts on the EU ETS, Enerdata, 2015, available at: http://www.kic-innoenergy.com/wp-content/uploads/2016/03/HET12_-_Market_Stability_Reserve_-_Final.pdf retrieved 10.03.2016

Trotignon, Gonand, de Perthuis, 2014, EU ETS reform in the Climate-Energy Package 2030:First lessons from the ZEPHYR model (Policy brief No. 2014-01)

Jevons, W.S., 1865/1965. The Coal Question: an Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of our Coal-mines. 3rd edition 1905, Ed. A.W. Flux. Augustus M. Kelley, New York.

RWE Proposals of Federal Ministry for Economic Affairs and Energy endanger the future survival of lignite, Essen, 2015

Negative externalities, http://www.economicsonline.co.uk/Market_failures/Externalities.html, retrieved 25.11.2016

VGB Powertech, Levelized cost of electricity, LCOE 2015

Matthias Buck, Christian Redl, 2016 The Power Market Pentagon, A Pragmatic Power Market Design for Europe's Energy Transition, https://www.agora-energiewende.de/fileadmin/Projekte/2016/Power-Market-Pentagon/Buck_Redl_Presentation_PENTAGON-Paper_28042016.pdf , retrieved 01.12.2016

Sandbag, *Puncturing the waterbed myth*, October 2016, available at: https://sandbag.org.uk/site_media/pdfs/reports/Waterbed_report_A.pdf

Breaking our Carbon Budget, Energysmack, 2013, https://energysmack.wordpress.com/, retrieved 01.09.2016