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EU Emissions Trading: The Need for Cap Adjustment in Response to External Shocks and Unexpected Developments?

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EU Emissions Trading: The Need for Cap Adjustment in Response to External Shocks and Unexpected Developments?

by

Jochen Diekmann
DIW Berlin (Germany)

On behalf of the German Federal Environment Agency

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Wörlitzer Platz 1
06844 Dessau-Roßlau
Germany
Phone: +49-340-2103-0
Fax: +49-340-2103 2285
Email: info@umweltbundesamt.de
Internet: http://www.umweltbundesamt.de
http://fuer-mensch-und-umwelt.de/

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1 Introduction

The effectiveness of an emissions trading system in terms of reducing greenhouse gas emissions is mainly due to the magnitude of the specified emission cap. Assuming sufficient control, a quantitative emission target defined in such a way is *quasi* automatically achieved by the limited allocation of emission allowances. In functioning markets, this coincides with a somewhat higher allowance price as a scarcity signal for emissions. The cap setting in emissions trading is therefore a central political control mechanism. In order to evaluate the effectiveness of the European Emissions Trading System (EU ETS), the system boundaries in terms of geography, sectors and time and the rules for internationally flexible mechanisms and banking should be observed. EU ETS is a partial system that has so far covered about half of the emissions. For a given total emissions target, the cap setting will determine the ex-ante allocation of emissions to the ETS and non-ETS sectors. Under dynamic aspects, it is also important that the allowance price driven by the cap may also trigger incentives for long-term investments and thus influence future options of emissions reduction.

It is a feature of emissions trading that the cap is set ex ante, i.e. prior to the actual phase of emissions trading. Such cap determination must ultimately be based on uncertain expectations about related developments during the trading period. These include *inter alia* the overall economic development, the development of energy prices and the impact of policies aimed at supporting renewable energy and energy efficiency. Unexpected developments may then possibly cause considerably fewer allowances to be required and the allowance price will drop sharply. In this respect, the contribution of the ETS to long-term emission reduction may be reduced dramatically.

In October 2010, a total of 2.039 billion of emission allowances (EUAs) was set for 2013, which decreases by 1.74 % per year for the following years. The underlying basic parameters of the targets (to reduce overall emissions 2020/1990 by 20% and in the ETS sectors 2020/2005 by 21%) however, stem from 2008, and are out of date also in the opinion of the European Commission, especially taking into account economic development since then, meaning that more ambitious targets might be pursued. On top of that, expected surplus allowances for the second trading period will be transferred to the third trading period and

will continue to put pressure on the allowance price. Given that the length of the trading period was extended to eight years, the options to update the parameters for the emissions trading system have decreased.

Against this background, there are various proposals to subsequently align the requirements for the ETS sectors under certain conditions in order to increase the short-term and long-term effectiveness of emissions trading. In the political discussion, various parties specifically require a significant amount of emission allowances to be temporarily set aside (e.g. by *backloading* in the auctions) or permanently set aside thus supporting the allowance price and providing stronger incentives for emissions reduction. These adjustments might, however, affect ETS's credibility, lead to uncertainty in the market and necessitate difficult political renegotiations.

In scientific and political debates, minimum and maximum allowance prices are proposed as an alternative or supplement to such adjustments. Depending on the configuration, such price limits may lead to similar effects in subsequent volume adjustments. The main motive for such hybrid systems is to stabilise the allowance market by restricting price fluctuations. However, depending on the circumstances, this may also cause a permanent change in the emission budget.

In this paper the advantages and disadvantages of the various adaptation options will be discussed from an economic perspective. Firstly, the criteria for identifying a need for potentially legitimate adaptation should be investigated. Furthermore, the issue of appropriate timely intervention points prior to or within the trading period will be discussed. In what periods and scenarios are adjustments to the cap worthwhile from an economic perspective? To what extent could minimum prices or price ranges make sense? What role could a strategic reserve play? By addressing these issues, it will be fundamentally discussed as to how the emissions trading scheme could be further developed and strengthened by greater flexibility.

After a brief characterisation of emissions trading in theory and practice in Chapter 2, Chapter 3 will identify potential external shocks and unexpected developments which may impair the functioning of an emissions trading scheme. The current problems of cap setting for the third trading period of the EU ETS will be described in Chapter 4. Against this

background, cap adjustments will be discussed in Chapter 5, minimum and maximum prices in Chapter 6 and strategic reserves in emissions trading in Chapter 7. The conclusions are summarised in Chapter 8.

2 Emissions Trading in Theory and Practice

An emissions trading scheme such as the EU ETS consists of three elements: capping of emissions (cap), distribution of emission allowances (allocation) and actual trading in emission allowances (trade). Emissions trading can theoretically be an ideal approach to reducing emissions if a suitable upper limit is specified, emission allowances are allocated without distortion and trade provides the necessary flexibility so that marginal costs of emission reduction can be compensated for at regional and sectoral levels and between individual polluters, so that the total abatement costs are minimised (Kemfert, Diekmann 2009).

From an environmental and economic perspective, an emissions trading scheme with the proper configuration is at the same time an efficient and cost-effective means of emission reduction. The effectiveness is theoretically directly achieved by setting an upper limit of emissions and ensuring compliance by a monitoring system. In addition, the system's cost efficiency is theoretically achieved by free trade in emission allowances, so that emissions are ultimately avoided where it is the most cost-efficient.

However, effectiveness and cost-efficiency of the European emissions trading system are in reality difficult to assess for several reasons:

- Due to the recognition of the use of credits from project mechanisms (*Clean Development Mechanism, Joint Implementation*) it is an open system in which emissions (taking into account approved credits) are higher than the total volume of allowances issued. Here, the global effectiveness also depends on the quality of the projects abroad (in particular, the additionality of emission reductions achieved in this way).
- As long as there are no comparable efforts for climate protection in many other regions, a shift of emissions into non-ETS regions (*carbon leakage*) may occur which limits EU ETS's overall efficiency.

- EU ETS alone cannot ensure existing national emission targets are also met.
- EU ETS is a partial system covering about half of total emissions. It cannot automatically guarantee both effectiveness and cost efficiency of the entire emission reduction, including the non-ETS sectors.
- The allowance price generates a scarcity signal with emissions trading as an incentive to reduce emissions in the trading period. However, it is unclear to what extent investments into innovative technologies are encouraged which is the pre-requisite of dynamic efficiency.
- In addition to emissions trading, other energy and environmental policy instruments also influence emissions in the ETS sectors. Because of the interactions with the support of renewable energy and energy efficiency in particular, there is the problem of accountability of effects on the one hand, and the need for coordination among the instruments on the other.

Moreover, international negotiations on climate change have stalled, so the European climate strategy which is increasingly perceived as unilateral is critically viewed and ambitious reduction targets are politically controversial. In this context, cost burdens and possible dangers to competition are often emphasised, while Europe's contribution to the reduction of global emissions is considered low.

In addition, in recent years the reputation of the existing emissions trading scheme as a market instrument for climate protection has been hurt by scandals such as VAT fraud (Carousel fraud with allowances), allowance theft (phishing) and multiple use of emission credits (CERs).

Currently, European Emissions Trading is suffering an unexpectedly sharp drop in prices, which raises doubts about its effectiveness. Although emissions in the ETS sectors have been effectively limited, the contribution to further emissions reductions is probably lower at low prices. Above all, it is feared that emissions trading provides only minor impetus for sustainable emission reductions. This also includes the risk that emissions trading loses its role as the central climate protection instrument and that instead other, possibly less effective methods gain prominence.

3 External Shocks and Unexpected Developments in Emissions Trading

The basic design of the emissions trading scheme is that of a quantity-based instrument to achieve quantitative targets. Unlike pricing instruments such as taxes, pricing of emissions is not immediate, but a result of government volume requirements and market processes which are influenced by numerous other factors. With regard to the specification of total volumes and the rules for the participants, it is basically an ex-ante system, while prices are only determined ex post during emissions trading and are hardly predictable.

Due to the significance of dynamism and uncertainty a static and deterministic view of emissions trading would fall short. This is especially true when the trading period is relatively long and has a multi-year ramp up. When the requirements are specified (*ex ante*), expectations about relevant developments in the trading period are highly uncertain . Therefore, serious external shocks and unexpected developments may occur later (ex post), which lead to unexpected and undesirable results on allowance markets and reactions from emitters or investors.

Potential shocks and unexpected developments include all factors which affect allowance pricing via demand, supply or market structure.

The demand for allowances is uncertain in the ex-ante analysis. It can vary greatly over the trading period and generally move to unexpected levels. Among the demand determinants subject to uncertainties are:

- Changes in the framework
    - macroeconomic developments (economy, growth, interest rate and pricing levels)
    - demographic trends (including migration)
    - technological developments and structural changes
    - trends in energy prices
    - weather
- Insufficiently anticipated impact of policies
    - for the expansion of renewable energy
    - to increase energy efficiency

Changes in these determinants alter the short- and long-term marginal costs of emission reduction and thus the relationship between allowance demand and allowance price. For a given cap they therefore cause short-term fluctuations and long-term changes in the level of allowance prices.

In addition to these demand determinants, allowance prices are influenced by other supply side factors and the market structure. These include:

- Supply side and market flexibilities
    - Use of project-related credits
    - Banking and borrowing
    - Interaction between spot and futures markets
    - Speculation
    - Influence of market power
- Actual and expected policy requirements
    - Changes in overall emission targets
    - Changes in the requirements for the non-ETS sector
    - ETS rule changes, including auction planning

All these factors influence the results on allowance markets and can cause temporary or permanent shocks or unexpected developments. However such changes need not necessarily cause problems and negatively impact the functionality of the emissions trading scheme, but may in some cases even be desirable. The appraisal depends not least on what the short-and longer-term objectives of the emissions trading scheme are.

Therefore, market-related fluctuations in allowance demand in the emissions trading system do not by themselves represent a volume problem in the short term because the volume of emissions in the ETS is ultimately limited by the cap. If the cap corresponds to the emissions target, the quantitative target is reached as the upper limit. Though the contribution of the ETS towards further lowering emissions in a period can of course change greatly. In a very weak economy with high energy prices, this contribution may be temporarily very low or even zero. This can also happen if energy generation from renewable sources subsidized by other measures or energy efficiency increases are unexpectedly high.

The ETS tends to stabilize the development of the emission volume. Nonetheless, the marginal abatement costs can vary greatly from period to period and thereby increase the cumulative total costs over time. To reduce this effect, banking and limited borrowing[1] of emission allowances are permitted. Thus, the temporal flexibility of the volumes is increased (and price volatility reduced). Since greenhouse gas emissions have a cumulative impact on the climate, it is not harmful if emissions targets are not met or exceeded in individual years.

Sustained volume problems can however occur in the emissions trading scheme, if the overall goal of reducing emissions has to be revised or if the targets for the ETS sector are no longer consistent with the efforts in the non-ETS sector. In addition, many volume problems can be caused if other policy instruments are more effective in reducing emissions than was expected when the cap was set. In these cases it should be considered to what extent an adjustment of the targets for the ETS sector is required.

Of particular importance are the effects of shocks and unexpected developments on allowance prices and pricing expectations:

- Very high prices lead to strong pressure on consumer prices, particularly for electricity.
- Very high prices may weaken the competitiveness of European industry.
- Sharp price fluctuations cause uncertainty, particularly for the planning of long-term investments.
- Sharp price fluctuations can limit the dynamic efficiency of the ETS to the extent that they contribute to fluctuations in marginal abatement costs.
- Low prices and price expectations create little incentive for fundamental innovation.
- Very low prices indicate low effectiveness of the ETS in terms of its performance to further reduce emissions.
- Low prices lower auction proceeds for the state. If price volatility is high, the ability to plan the use of revenue is severely restricted.[2]

[1] The option for borrowing between individual years results from the fact that the allowances for the current year are issued in February and surrendering for the previous year does not occur until April.

[2] The revenues for the "Energy and Climate Fund" for 2012, were established in June 2011 on the basis of an allowance price of 17 euros. In March 2012, this forecast was reduced by of 56% to 7.5 euros (BMF2012).

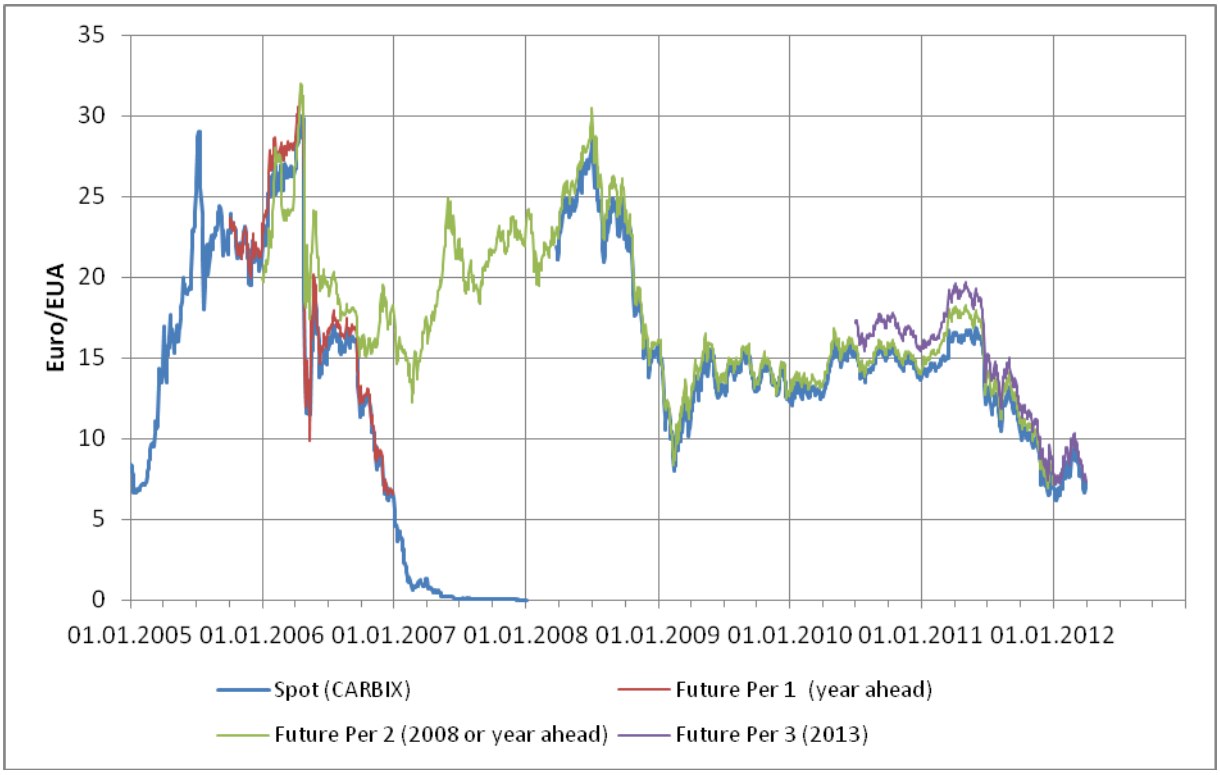
As a quantity-based instrument, an emissions trading scheme can lead to sharp price fluctuations. External shocks and unexpected developments can in principle lead to very high or very low allowance prices and also cause severe price fluctuations. While price flexibility in emissions trading is in principle a prerequisite for the efficiency of the system, extreme price developments can be economically and enviro-economically harmful.[3] If such phenomena persist over a longer period of time, they are not only economically but also politically problematic because they can endanger the overall credibility of climate protection policy.

4 Current Cap Setting Issues for the Third Trading Period

The experiences with the European Emissions Trading System so far are reflected in the development of allowance prices (Figure 1). In the first phase from 2005-2007, the price had initially risen sharply from less than 10 euros and ranged between 20 and 30 euros. After the initial data on actual (verified) 2005 emissions were published in the spring of 2006, the price on the spot market went down by 50% and rapidly declined to near zero by early 2007. Apparently the supply of emission allowances was too high in the first period, so that the market, which had been based on uncertain expectation for a long time, collapsed completely. Because it was not possible to bank into the second trading period, the allowances became worthless at the end and some were deleted unused.

[3] From an economic perspective, one reason is that there are no perfect markets of the future, which could theoretically provide an intertemporal optimisation.

Figure 1
Allowance prices 2005 to March 2012 (Euro/EUA)



Source: EEX.

Since the end of 2006 however, the prices for the first and second period diverged greatly. The prices for the second trading period even doubled by mid-2008, back to around 30 euros. A key driver was that the European Commission had put a lot of pressure on the government to reduce caps in the National Allocation Plans, to thus drastically reduce the total available quantity of emission allowances.

Mainly as a result of the international economic crisis, prices collapsed again in mid-2008 until early 2009, temporarily sliding to below 10 euros. But after a period of relatively stable prices in the range of 13 to 17 euros from mid-2009 to mid-2011, there was another decline in prices - not just the price of the second, but also the prices for the third trading period starting in 2013.

Because of the banking option there is a very close relationship between the prices of the two trading periods, so that that the upper limits set for both periods at that time, and the expectations for current and future shortages, were reflected in the prices. Recent price increases in early 2012 were in part driven by the expectation that the supply of allowances

would be limited by policy decisions. But by now this effect is minor. In early April 2012, the price fell to 6 euros.

So overall, the market shows considerable fluctuation in carbon prices over the past few years and is currently at an extremely low level, which hardly sends any signals for a current reduction of emissions. In this context, expectations for the future development of carbon prices are also highly uncertain and are an obstacle for investments in low-carbon technologies.

The current problems in European emissions trading is not solely a result of the overall economic development, but results from a variety of the price determinants noted in Chapter 3. Apart from the economic downturn which by now has been more or less offset in Europe by economic growth, there are serious uncertainties about future economic development, the development of energy prices, the development of international climate policy, the concrete medium-term emission targets in Europe and the effects of past and future measures for promoting renewable energy and energy efficiency.

Currently the interactions of the allowance supply for the second and the third trading period are also of significance because they will hit a common market due to the option to bank allowances into the third trading period. Additional auctions for the second period concur with early auctions for the third period. In addition to that, the cap development in the third period is dependent on the caps for the second period so that the overhang is transferred to upper limits in the following period.

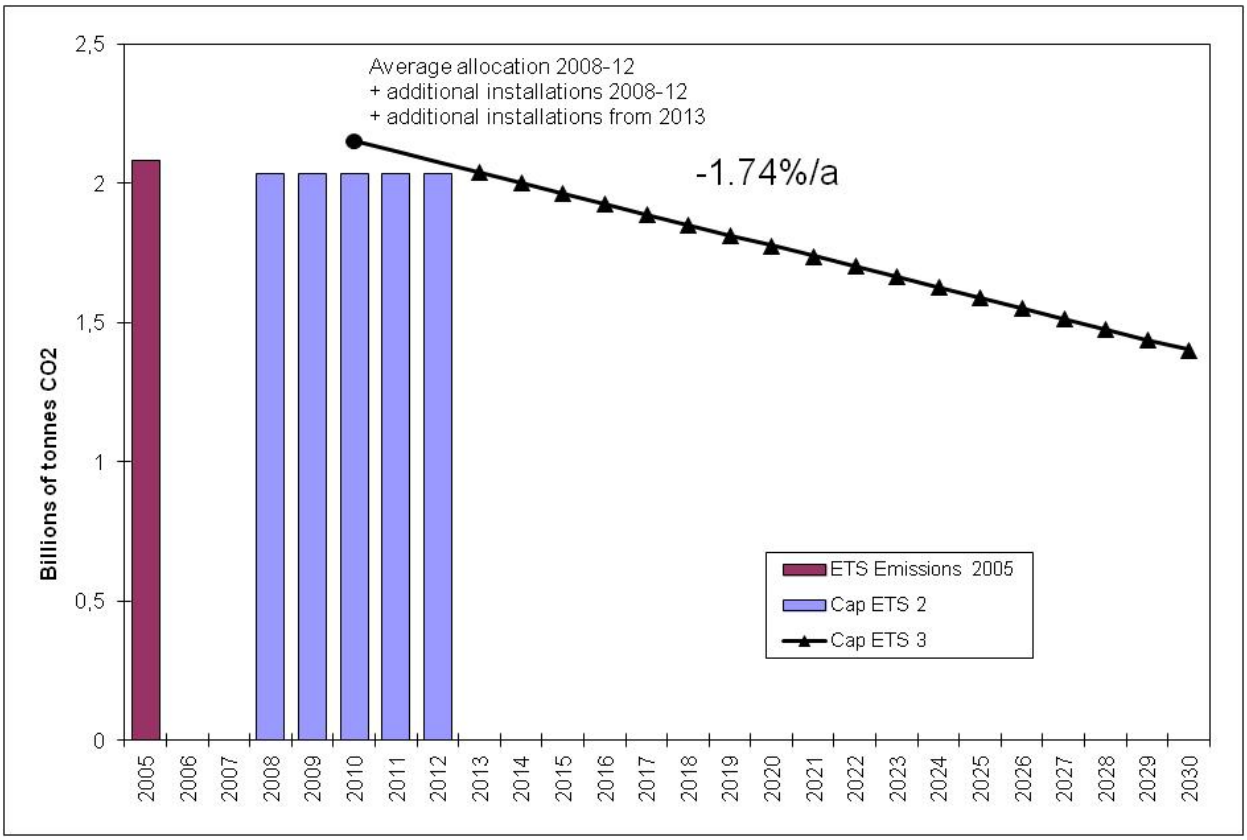
Cap setting for the third period is based on the existing policy objective to reduce total emissions in Europe by 20% by 2020 compared to 1990 levels. For this, emissions in the ETS sector are supposed to be reduced by 21% from 2005 to 2020.

Table 1
Allowance volume (cap) for the third trading period

	2010	Reduction 2010-2013	2013
	Million EUAs	Million EUAs	Million EUAs
Average allocation for 2008-12	2037.2	106.3	1930.9
For additional installations in 2008-2012	1.4	0.1	1.3
For additional installations from 2013 on	112.8	5.9	106.9
Total allowance volume	2151.5	112.3	2039.2
Reduction of 1.74% per year	37.4		

Sources: COM 2010/634/EU, 22.10.2010, Calculations by DIW Berlin.

Figure 2
Dynamic EU ETS cap from 2013



Sources: COM 2010/634/EU, 22.10.2010, calculations by DIW Berlin.

Pursuant to the amendment of the ETS Directive of 2009, the volume of over 2 billion allowances calculated for the year 2013 is based on the average allocation in the second period, adjusted for additional installations included in emissions trading. The cap is reduced by 1.74% per year (based on 2,151.5 million EUAs) or 37.4 million EUAs (Table 1, Figure 2).

With more ambitious emission targets for 2020, allowance volume would have to be significantly reduced. For this purpose the initial allowance amount could be reduced, and/or the annual reduction factor increased.

The total available quantity of allowances in the third trading period is increased by allowances which have been transferred from the second period. In the previously established path for the emissions cap, relatively low allowance prices are to be expected in the medium term. The future pricing development also depends primarily on the overall

economic development, energy prices and the effects of the measures to promote renewable energy and energy efficiency.

5 Cap Adjustments

5.1 Ex-ante and Ex-post Adjustments

As an emissions trading system is essentially an ex-ante system, it is important to consider the temporal dimension of the adjustments (Table 1). The characterisation 'ex-ante' refers to all regulations established before the start of the trading period. This includes decisions in the cap-setting phase (National Allocation Plans 2004 and 2006, EU-Cap-Setting 2008/2010) and corrective adjustments before or at the start of the trading period (e.g.2012 for the period from 2013).

In the cap-setting phase the emissions trading targets must be matched to the overall emission target and the effort in the non-ETS sectors. The effects of other policies that impact emissions in the ETS sector must also be taken into account. Corrective adjustment decisions before the start of a trading period are an option particularly when the lead time is relatively long and if it appears during that time that the data framework used for capping has changed significantly compared to original expectations.

Adjustments after the start of the trading period (ex-post) are an exception in the emissions trading scheme. It is therefore useful to distinguish between one-time and repeated adjustments. In the second case, the cap level could be checked and adjusted regularly. A rules-based cap adjustment according to predefined criteria is also conceivable. Ongoing ad-hoc changes to the cap would however be difficult to reconcile with the principles of an emissions trading system.

Overview 1
Temporal dimension of cap adjustments

Ex-ante

- Adjustment or coordination during emission budget planning
- Corrective adjustment before the start of the trading period

Ex-post

- One-time
- Repeatedly
    - periodic review of the cap
    - rule-based adjustment of the cap
    - ad-hoc changes

Depending on what shape they take, subsequent cap adjustments are more or less problematic, since they may adversely affect the reliability of the emission trading scheme. There is a risk of a significantly increased market uncertainty when the rules of the game are changed after the fact. In order to protect the concepts of legitimate expectations and legal certainty, the possibility of subsequent adjustments must be made transparent before the start of the trading period.

Cap adjustments are subject to stringent legal and policy requirements. The basis for calculating the cap-path for the period starting in 2013 is set out in the ETS Directive. Major adjustments are therefore only possible via a change in the Directive, which typically requires a protracted political settlement process. This in turn may entail difficult political renegotiations.

If the cap is subsequently reduced, it must also be decided to what extent the allocation of emission allowances has to be changed, particularly with regard to the ratio of free allocation and auctioning. If the free allocation has to remain the same for the sake of international competitiveness or for legal and administrative reasons, the auction amount must be reduced accordingly.

A cap reduction results in a reduction of emissions in the ETS sector and an increased allowance price. If allowance demand is price-inelastic (elasticity less than 1), the price rises faster than emissions are reduced, which means that increased auction revenues can be expected as a result. On the other hand, a cap reduction increases the total cost of emission

reduction in the trading period. Due to increased opportunity costs this also applies to emitters with free allocations.

Subsequent cap adjustments must be specifically justified in each case. The following is a more detailed look at the adjustment of caps to emission targets, the macroeconomic data framework and other policy measures. Interventions via minimum pricing and in the form of strategic reserves, some of which may work similar to cap adjustments, are discussed in the following chapters.

5.2 Cap Adjustment to More Ambitious Emission Targets

In March 2007, the European Council adopted a reduction target of 30% on the condition that other countries also commit to ambitious climate change mitigation targets. The EU could also pursue higher emission reduction targets regardless of international agreements.[4] If more ambitious emission targets are to be pursued in the trading period, the cap in the emissions trading scheme must also be adjusted.

Article 28 of the Emissions Trading Directive provides that, in the event of an international climate agreement which specifies mandatory reductions of greenhouse gas emissions of more than 20% compared to 1990 by 2020 for the EU, the Commission has to submit a report within three months and, where appropriate, make a proposal for amending the Directive. For the non-ETS sectors, Article 8 of the Decision on the effort of Member States to reduce their greenhouse gas emissions (Decision 406/2009/EC) also established that the Commission has to submit a report and, if necessary, proposes an amendment. An international agreement of this sort is currently not yet in sight.

In the long term, the greenhouse gas emissions in Europe are to be further reduced by a significant factor. By 2050, a reduction target of 80 to 95% has been adopted. Internal European emissions (not including international carbon markets) would have to be reduced by at least 80% compared to 1990 levels. Pursuant to the Roadmap 2050 proposed by the Commission in March 2011 emissions shall be reduced by 40% by 2030 and by 60% by 2040.

[4] The Federal Government (2012) agrees to "an increase in the EU climate target to 30 percent ... based on the national target of 40 percent, if no further emission reductions are required of Germany and all EU Member States make a fair contribution."

A policy decision to that effect would be an important signal towards longer-term climate change policy and might serve to prop up pricing on the carbon market price[5].

In the context of such long-term goals the 20% target for 2020 is not ambitious enough[6]. In May 2010 the Commission presented a report on options for more ambitious targets (COM (2010) 265 final, 26.05.2010) and in February 2012 published a report (according to the prevailing assumptions at the time) on the expected impact on the individual Member States (SWD (2012) 5 final, 01.02.2012). The emission reduction target to be achieved by 2020 compared to 1990 is 14% in the baseline scenario. In the reference scenario - in accordance with the previous target - it is 20%, and in the "Reduction Commitment" scenario it is 30%, but this includes an increased use of credits from projects in other countries. In the 30% scenario, emissions would decrease by 25% in the EU.

The reduction target for the ETS sector in 2020 compared to 2005 increases from 21 to 34% in this scenario. In this range, emissions in Europe would then decrease by 26% instead of 19%. For this purpose the Commission proposes to "set aside" emission allowances designated for auctioning. The auction amount for the third trading period 2013-2020 is supposed to be reduced by 15% in total or 1.4 billion EUAs (COM (2010) 265). According to the calculations of the Commission, auction revenue expected for 2020 would increase by 7.3 billion euros to 28.5 billion euros because of the higher allowance price. Out of this increase, 5.4 billion euros go to low-income countries and 1.9 billion euros to high-income countries (Table 2, last two lines).

[5] Due to high discount rates especially from speculative market participants, the effect on prices is however, limited, see Neuhoff et al 2012.

[6] Also see UBA (2012).

Table 2
Impact of a more ambitious target on auction revenue

Auctioning revenue (excluding aviation) in 2020			
	20% GHG reduction target		Example 30% Reduction Commitment scenario
	distribution of allowances for auctioning based on:		
(€ million, 2008 prices)	2005 share in ETS emissions	The share as proposed in the Package	A reduction only in Member States of the higher income group
EU	21203	21203	28524
AT	328	289	325
BE	545	527	592
BGc	381	571	1045
CY	53	56	64
CZ	822	959	1755
DK	297	262	296
EE	130	186	340
FI	392	345	387
FR	1315	1162	1324
DE	4706	4148	4653
EL	699	717	803
HU	256	308	563
IE	224	198	224
IT	2222	1997	2241
LV	28	55	101
LT	64	111	204
LU	28	27	33
MT	20	21	39
NL	802	709	806
PL	2012	2558	4682
PT	359	365	669
RO	675	1023	1873
SK	245	314	575
SI	86	91	166
ES	1815	1801	2029
SE	194	188	213
UK	2504	2214	2521
Higher income group	16125	14640	16511
Lower income group	5078	6563	12012

Source: Analysis of options beyond 20% GHG emission reductions: Member State results. COMMISSION STAFF WORKING PAPER SWD (2012) 5 final Brussels 01.02.2012. (Calculations based on Primes)

Emission reduction efforts in the non-ETS sector would also need to be increased. In the Commission's 30% scenario, the reduction target for the non-ETS sectors in 2020 compared to 2005 increases from 10 to 16%.

In their analyses the Commission has also taken into account the impact of the economic crisis so that by 2020, relatively few additional costs emerge in the 30% scenario compared to the 20% scenario. The Commission also points out that the emission reduction effects of developing renewable energies and energy efficiency improvements will be greater than expected in 2008. But in the end, the main reason for the adjustments discussed is an ultimately more ambitious reduction target for 2020, which will be a policy decision.

The Commission calls the auction amount reduction discussed for the third trading period a "set aside". But ultimately, this is about a substantial reduction of the ETS cap. It would be desirable that at least the political decisions about this are made prior to the start of the trading period to allow emitters and other market participants to adjust to any changes early.

An adjustment to a more ambitious target would even still be possible within the trading period. The more it is delayed, the more abruptly the Cap-path would have to be lowered.

5.3 Cap Adjustment for Macroeconomic Developments

The question of whether the emissions trading cap should be adjusted ex-post to economic development is controversial.

On the one hand the argument goes that the ETS should not stifle economic upturns with an absolute volume restriction, but should rather employ a flexible cap to allow for adequate room for economic growth.[7] A fixed emission target would not have to be achieved in each period anyway, as the GHG emissions are cumulative. The Scientific Advisory Council to the Federal Ministry of Economics (2008) had therefore called for a maximum price for allowances. Article 29a of the ETS Directive also provides for certain measures for situations in which allowance prices have risen sharply. Conversely, a minimum price could be introduced in order to avoid a price decline during downturns.

On the other hand it is argued that a specific cap could even have an economically stabilising effect: during an economic upturn "overheating" due to high allowance prices could be

[7] In the initial discussion of the National Allocation Plan, businesses argued that the cap should be systematically increased by a bonus for economic upturns . However, such a cap would generally lead to an over-allocation and make emissions trading largely ineffective.

counteracted, and in an economic downturn, low allowance prices would mean cost reductions and thus contribute to economic recovery.

Cyclical allowance price fluctuations are generally desirable with a quantity-based instrument since the allowance price will signal scarcity. Additionally, the European ETS provides certain temporal flexibilities because of banking and borrowing. Furthermore, allowance price fluctuations could possibly be limited with minimum and maximum prices. Such price limits, however, are primarily temporary measures to stabilise prices and not for subsequent cap adjustment in the sense of a re-adjustment of the quantitative limitations. Advantages and disadvantages of price limits are discussed in Chapter 6.

While normal economic cycles generally should not be a motive for subsequent cap adjustments, in cases of extreme macroeconomic developments it needs to be examined to what extent a correction in the ETS may be required. The global economic crisis of 2008/09 led to drastic declines in production in many areas. In the short term, this had a strong influence on allowance prices. At the same time the overall level of allowance demand was significantly reduced in the second trading period which due to banking will continue to have an effect in the third trading period. Moreover, the crisis has also reduced expected emissions in the third trading period.

In this context, applying the logic of emissions trading as a quantity-based instrument, the hypothetical question might be asked how the caps would have been set if the economic crisis had been correctly anticipated in the extent to which it actually occurred. Since the National Allocation Plans of the second trading period, similar to the first period, initially tended towards over-allocation anyway, the Commission could have been more insistent on cap reductions. However, in that case, these further reductions of the ETS budget must not be allowed to lead to a corresponding increase in the non-ETS sector, whose emissions also depend more or less on the economic situation. But then the question would have been asked, whether the overall emissions target should not be reduced - below the commitment level under the Kyoto Protocol.

Also with respect to cap adjustments for the third trading period as a result of the economic crisis of 2008/09, volume corrections in the ETS sector should be discussed in the context of the overall emission targets. As long as the medium-term emission reduction targets are to

be reduced in view of the longer-term trend anyway, the surplus of emission allowances which exists as a result of the economic crisis, serves a convenient opportunity to more easily implement ambitious emission targets with a single cap adjustment.[8]

For the case of another severe economic crisis during the third trading period, a rule-based cap adjustment could be considered as a precautionary measure. However, emissions budget planning which merely follows actual emission development would not only face significant implementation problems, but may also affect the reliability and transparency of the ETS. It is therefore important to establish criteria that would be observed in the case of any cap adjustment to the overall economic development. The following may be useful criteria:

- Ex-post adjustments to the cap are an exception in the ETS. For regular economic cycles no cap adjustment to the overall economic development is recommended.
- Ex-post adjustments to the cap can however be considered if economic development is significantly disrupted by severe crises which impair economic growth for a long time, significantly reducing allowance demand.
- The development in individual Member States is not the crucial criterion for any cap adjustment, but rather the economic development in Europe as a whole.
- Whether a severe economic crisis is at hand, should be examined by the European Commission annually.
- When economic development indicators fall below a certain threshold, the Commission will assess if there is a serious problem with the overall economic development within three months and asses the need for a cap adjustment.
- An assessment should be performed when the gross domestic product (GDP) compared to the previous year or the year before that declined by 2% in real terms. (By comparison, in 2009 the GDP in the EU declined by 4.4% compared to the previous year).
- When determining the level of the cap adjustment, the expected overall economic development in the trading period compared to scenarios that were the basis for the impact assessment must also be taken into account.
- When examining and calculating the cap adjustment, the impact on achieving long-term objectives needs to be taken into account, considering developments in the non-ETS sector.
- If an adjustment to the cap due to a severe economic crisis is indicated, it must also be examined whether and to what extent the emission reduction expectations from renewable energy and energy efficiency expansion efforts have been exceeded, and

[8] If the goal of the intervention is largely a sufficient ETS scarcity signal also for longer-term investment and innovation decisions in times of crisis, then adjustments may also be oriented to market prices. Various forms of minimum pricing are discussed in Chapter 6.

how these reduction contributions are expected to further develop in the trading period.

5.4 Adjusting the Cap due to the Effects of other Policy Measures

The emissions trading scheme is a key element of European climate protection policy. However, it cannot replace other policies that also contribute to reduced emissions:

- The impact of emissions trading is limited to certain sectors and gases and therefore only covers about half of the greenhouse gas emissions in Europe. For the sectors not covered, equivalent measures are necessary.
- The effects of emissions trading are primarily – at least based on previously observed effects - incentives for short-and medium-term emission reductions, while these hardly produce sufficient impetus for fundamental innovation and long-term structural changes, so that dynamic efficiency is not automatically guaranteed.
- Because of market failures and specific barriers, emission allowance prices alone are not a sufficient stimulus for emission reduction investments.
- In addition to the reduction of CO_2 emissions, which is one objective of emissions trading, other instruments are used concurrently to achieve additional energy and environmental policy objectives, such as a reduction in other greenhouse gas emissions and air pollutants, as well as other aspects such as sufficient energy supply and technological development.
- There are economic and political constraints that prevent the establishment of sufficiently ambitious emission caps.

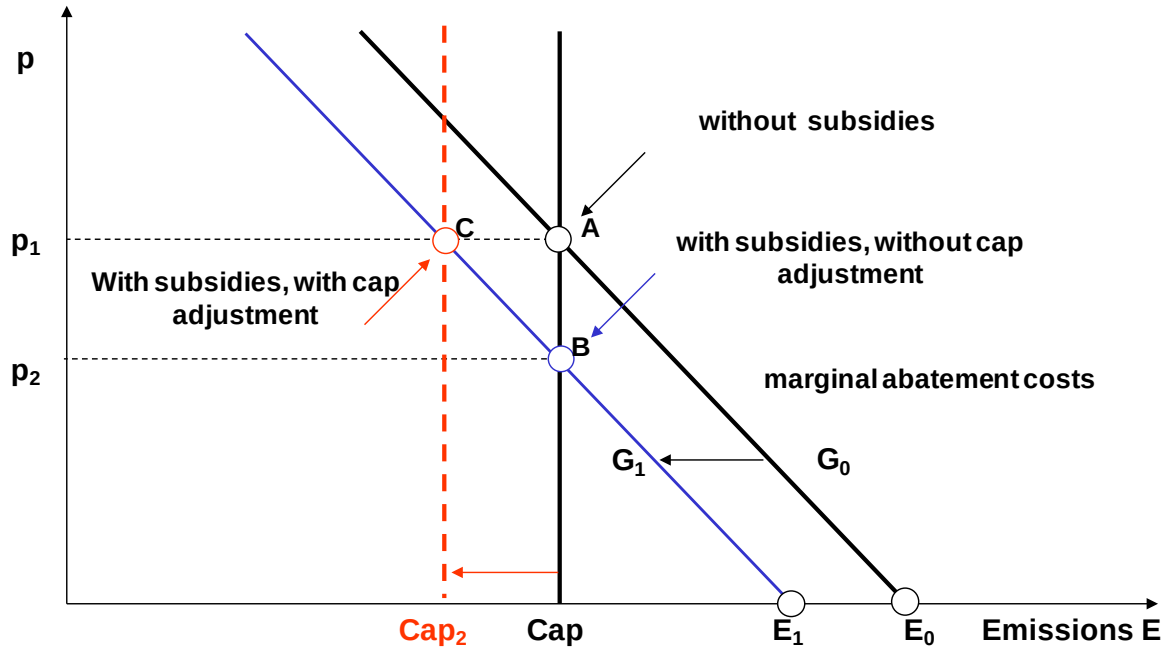
Therefore, a mix of policy measures is needed which specifically includes the promotion of renewable energy and energy efficiency.[9] However, when simultaneously implementing several instruments, their respective interactions must be considered. Of particular importance in this respect are the interactions between supporting power generation from renewable energy sources in the Member States and the European emissions trading scheme, as well as the expected effects of the Directive on energy efficiency.

Subsidised power generation from renewable energy replaces power generation from fossil fuels and thereby reduces the demand for emission allowances which is a result of marginal

[9] See Kemfert, Diekmann (2009, 2012), Diekmann (2009, 2010), Fischedick, Samadi (2010), Matthes (2010), Holm-Müller, Weber (2010), Hansjürgens (2012). However, many other economists such as the Scientific Advisory Council to the Federal Ministry of Economics (2004, 2008, 2012) particularly oppose subsidising renewable energy sources with the German Renewable Energy Act (EEG) in conjunction with an emissions trading scheme.

abatement costs.[10] With an unchanged supply of allowances (cap), a reduced demand for emission allowances can lead to a price reduction, and a shift of emissions to other emitters in the emissions trading sector (Figure 3). In that case, subsidising power generation from renewables would have a pricing effect on the carbon market, but not trigger a volume effect. The interplay of the instruments would be disrupted in this case.[11]

Figure 3
Cap adjustment using the example of subsidies to power generation from renewables



When implementing a combination of policy instruments, their design must take into account their interactions. This particularly applies to establishing the cap in the ETS. When the emission reduction caused by renewables subsidies is fully taken into account when setting the cap (cap reduction), an allowance price reduction and a shift of emissions within the ETS can be avoided (C instead of B in the figure). In that case, the reduction of emissions through subsidised development of renewable energy is not "absorbed" by emissions trading.

[10] For analysis on the interplay between emissions trading and other policy instruments see Sorrel, Sijm (2003), del Río González (2007), Diekmann, Horn (2008).

[11] In an open emissions trading system in which as a result of flexible mechanisms such as the Clean Development Mechanism (CDM), it is possible to offset credits, the supply of allowances is (to some extent) flexible and depends on the price of emission allowances. In this case, additional power generated from renewables leads to an additional reduction of emissions in Europe. At unchanged cap levels this reduction in Europe would however then face increased emissions outside of Europe (Diekmann, Horn 2008).

A lack of coordination between emissions trading and subsidies to renewables may arise particularly when emission reductions from renewables is not correctly anticipated when establishing the cap. This also applies to the interplay of emissions trading with policies to improve energy efficiency, particularly in the power generation sector.

When setting the cap for the first two trading periods on the basis of the National Allocation Plans (NAP I and NAP II) created in 2004 and 2006, the EU Commission had required the Member States in its NAP Guidance to take into account the effects of other policies such as renewables subsidies. However, taken as a whole, the caps for the first period were too high, and the caps for the second trading period were significantly reduced only at the insistence of the Commission. For the third trading period, the coordination of different goals and instruments was supposed to be ensured by the fact that the 2008/2009 policy requirements were adopted as a single package.

The contribution of other instruments to reduce emissions must be estimated in advance, or anticipated at the time of cap-setting for that period. While the contribution of renewable energy in the base period is easily ascertained and can be taken into account in volume planning, the future contribution must be estimated for now. Differences between the impacts calculated for other measures when setting the cap and their actual effect may have different causes:

- insufficient conceptual consideration of other instruments when setting the cap,
- changes in the goals for the development of renewables after the cap was set, or
- differences between the actual development of renewable energy and its expansion targets by the end of the trading period.

The EU-wide ETS cap was set taking into account the 20% target for renewables. The consistency of these elements was examined in the Assessment Report of the EU package (EC 2008). The risk of adverse interplay effects has thereby been significantly reduced compared to the first two trading periods.

An accurate ex-ante coordination between the instruments can however not be guaranteed. For instance, at the time the target was set, it was not yet known to what extent the Member States wanted to increase the share of renewable energy. In Germany, the goal for

expanding renewable energy was increased several times, and as of late, the actual share of renewable energy in power generation was well above the target set.

If the cap level is revised before the start of the trading period to reflect more ambitious emission targets, the ex-ante coordination with the expected contribution of renewable energy to reduce emissions could also be reviewed. Increased power generation from renewable energies can serve to reduce total emissions. However, at the same time, the efficient allocation of emissions budgets to the ETS and non-ETS sector is changed.

The scope for further measures for reducing adverse interplay effects during the trading period is limited. In principle, consideration could also be given to ex-post cap adjustments to the actual development of renewable energies. An ongoing cap adjustment depending on the pace of expansion of power generation from renewable energies, however, would conflict with the ex-ante principle of emissions trading. More conceivable would be a mid-term review and possible adjustment of the ETS requirements, e.g. after four years - though the political risks associated with renegotiation should not be underestimated (Kemfert, Diekmann 2012).

A subsequent cap adjustment within the trading period would be particularly appropriate when the policy instruments for the promotion of electricity from renewable energy sources and the reduction of power consumption contribute to reducing greenhouse gas emissions to a drastically higher degree than initially expected. However, such adjustments should be made according to predefined criteria. Eligible criteria for cap adjustments to effects of other policy measures are for example:

- Policy measures for the development of renewable energy sources and to increase energy efficiency reduce emissions in the ETS sectors, especially in the power sector. These effects were generally included in the planning and analysis of the requirements for the third trading period and thus require no ex-post adjustments to the cap.
- Ex-post adjustments to the cap on the other hand come into consideration if the contribution to reducing emissions through renewable energy and efficiency improvements it is considerably higher than initially expected. Additional emission reductions may have the effect of significantly reducing allowance demand, thereby reducing the allowance price considerably.
- The development in individual Member States is not the criterion for any cap adjustment, rather it is the economic development in Europe as a whole. In that context, the sum total of the emission reductions which result from the promotion of

renewable energy and energy efficiency as compared to the originally anticipated impact must be examined.

- In 2015 the European Commission is to examine to what extent renewable energy and energy efficiency improvements have contributed to the original expectations for reducing emissions in the ETS sector.
- If the impact of the measures taken in this area exceeds a certain threshold, the Commission will assess to what extent the effectiveness of the emissions trading system is disrupted within three months and may determine the need to adjust the cap.
- Whether it may be necessary to adjust the cap should be determined if additional emission reductions, compared to the expectations based on the impact assessment, exceed 50 million tonnes of CO_2 per year.
- In determining the level of the cap adjustment, the expected course of the development of renewable energies and energy efficiency in the trading period, compared to scenarios that were based on the impact assessment, must be taken into account.
- When examining and calculating the cap adjustment, the impact on achieving long-term objectives must be considered, taking into account the overall economic development and the development of emissions in non-ETS sector.

6 Minimum and Maximum Prices

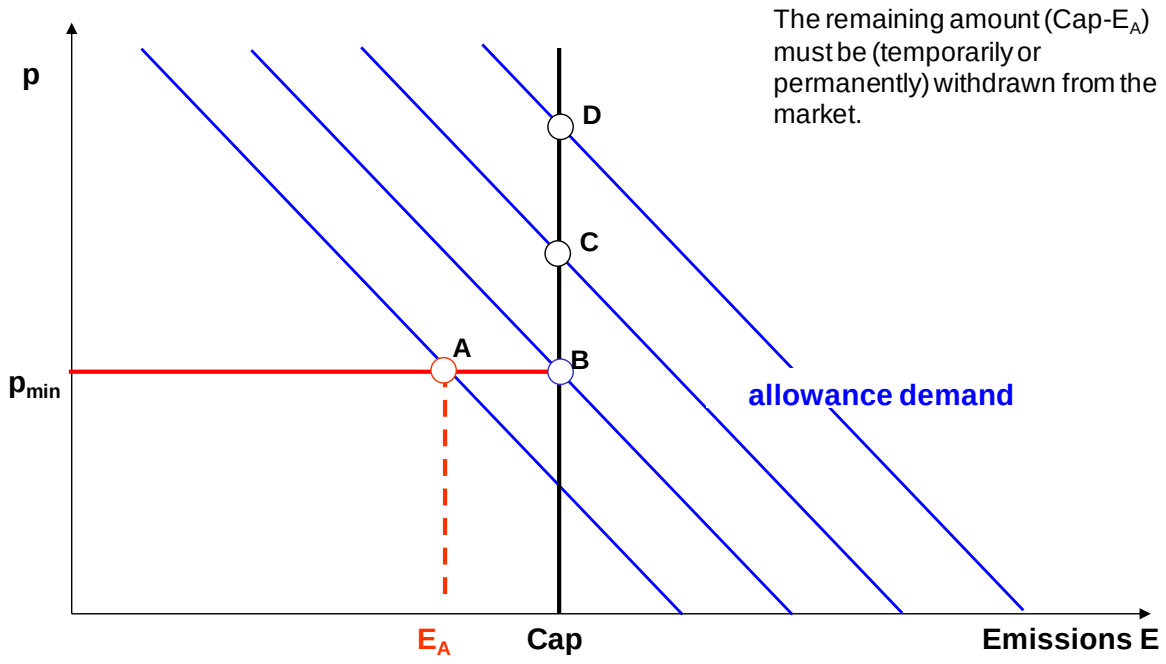
6.1 Theoretical Foundations

From an economic perspective, establishing minimum or maximum prices for goods and factor markets is often viewed critically, as this may cause market imbalances in which supply and demand are at different levels, at a given price. This leads to excess supply or demand, either of which must be rationed. With both minimum and maximum prices, the overall welfare of the market participants (sum of buyer and producer surplus) is less than in a market with constant full price flexibility. The setting of minimum or maximum prices must therefore be justified by existing market imperfections or external factors.

Though these principles generally apply to price limits in an emissions trading scheme, it should be noted however, that a carbon market is an artificial market created by policy in which the total supply is set as a target by the state (or community of states). If minimum and maximum rates are set in such a system, it must also be established how market imbalances can be avoided or compensated.

By introducing price limits in emissions trading, the volume control is more or less complemented by price control (like an emissions tax). This produces a hybrid system, which acts as a volume or pricing instrument depending on market conditions. Like the volume limits of the ETS, the price limits represent politically created targets.

Figure 4
Emissions trading with a minimum price (price floor)



A minimum price (Figure 4) is to prevent the allowance price from dropping too low or even falling to zero at low demand. As long as the allowance price is higher than the minimum price, the minimum price will not remain in effect, and emissions are as high as the cap set (D, C, B). At low allowance demand however, the allowance price should be as high as the minimum price (A). In this situation, depending on allowance demand, emissions (E_A) lower than the set cap will result. The marginal abatement costs are then as high as the minimum price. The total cost of emission reduction is higher than in a system without a minimum price. The amount of associated additional costs is indicated as the area under the allowance

demand curve passing through point A from Cap to E_A (the integral of the marginal abatement costs).[12]

The remaining amount of emission allowances (Cap - E_A) must be withdrawn from the market. In this situation, the quantitative target is exceeded.

If – as in the third trading period of the EU ETS – allowance auctions dominate, a minimum price in emissions trading can be largely implemented through a minimum price (reserve price) in primary auctions: Only bids at the minimum price and higher are accepted. This could be more easily implemented and monitored than direct price controls for the secondary market. Another implementation alternative is price supporting market interventions that are based on a minimum price. As soon as the price drops to the minimum price, a central institution (*"Carbon Bank"*)[13] would have to buy up and set aside emission allowances.

As another option, the literature also discusses a minimum price for CO_2 emissions via a tax on emissions. However, this is unrealistic at the EU level. Aside from that, the allowance price would not increase because of that, but rather the sum of allowance price and tax, while the allowance price would even drop.

A *maximum price* (Figure 5) is to prevent the allowance price from rising too high at high allowance demand.[14] As long as the allowance price is lower than the maximum price, the maximum price is not in effect, and emissions are as high as the cap (A, B, C). At higher allowance demand, the allowance price should however, be as high as the specified maximum price (D). Depending on allowance demand, this results in emissions (E_D), which are higher than the cap. The marginal abatement costs are then as high as the maximum price. The total cost of emission reduction is lower than in a system without a maximum price. Thus the amount of avoided costs is indicated as the area under the demand curve passing through D from Cap to E_D (integral of the marginal abatement costs).

[12] Barth (2012) describes these additional costs as a "welfare loss" because the reduction of emissions below the cap is not beneficial.

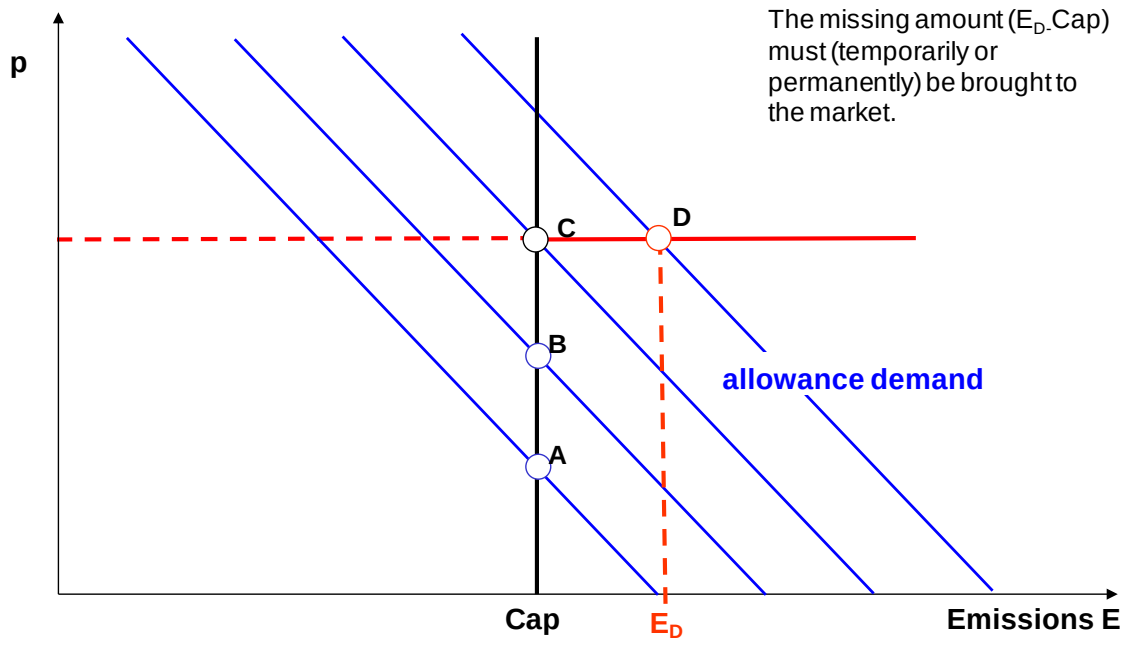
[13] The designation Carbon Bank frequently used in the political debate and the comparison with the ECB are problematic because they are inaccurate in some respects, see also Chapter 7.

[14] See McKibbin, Wilcoxen (1997), Pizer (2002). See also Advisory Board at the BMWi (2008)

The missing amount of emission allowances (E_D - Cap) must additionally be brought to the market. The volume target cannot be achieved in this situation.[15]

A maximum price may be implemented inasmuch as the amount auctioned in the primary auction is increased so that the clearing price is not higher than the maximum price. Another option is to implement price-reducing market interventions based on a maximum price. Once the price rises to the maximum price, a central institution (*Carbon Bank*) should offer additional emission allowances.

Figure 5
Emissions trading with a maximum price (price ceiling)



If both a minimum and a maximum price have been specified, a *price corridor* for the allowance price emerges (Figure 6)[16]. The allowance price can then move between the minimum and maximum price as the cap stipulates. If the price limits are effective, residual amounts must be withdrawn from and missing amounts must be brought back to the market. Such a price corridor reduces price uncertainty in emissions trading and limits price fluctuations to a pre-specified range. Thus the marginal abatement costs become also stabilised.

[15] The target can only achieved (in a dynamic sense) if sufficient reserve is available.

[16] Cf. Philibert (2009), Burtraw, Palmer, Kahn (2010), Fell et al. (2010).

Figure 6
Emissions trading with minimum and maximum prices (price collar)

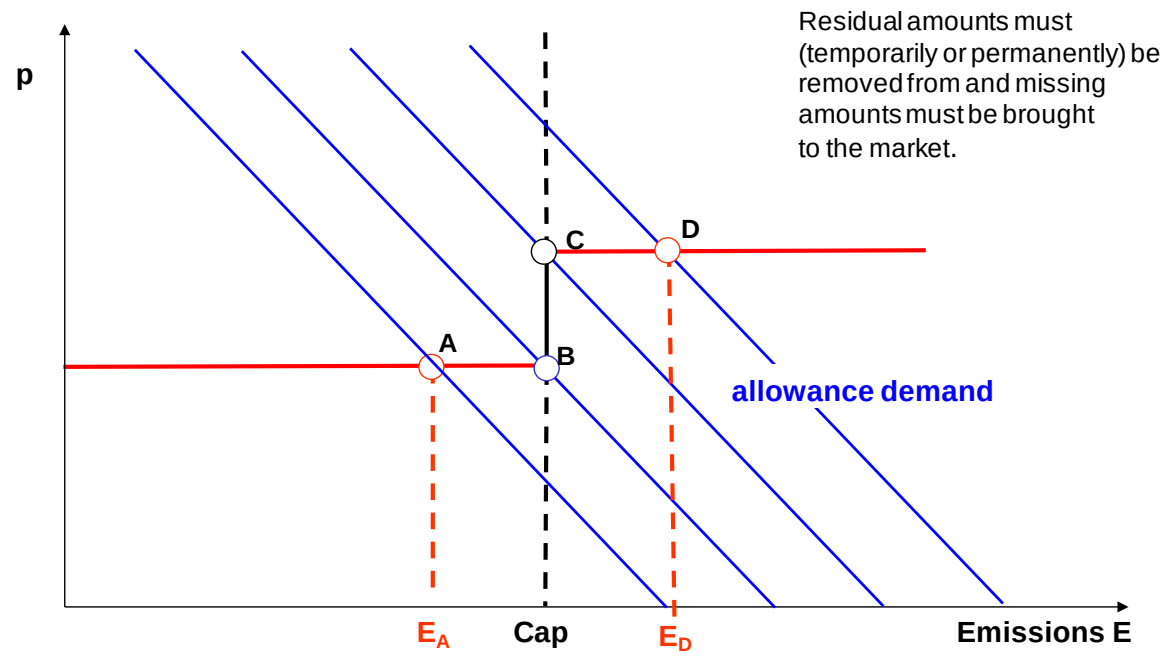
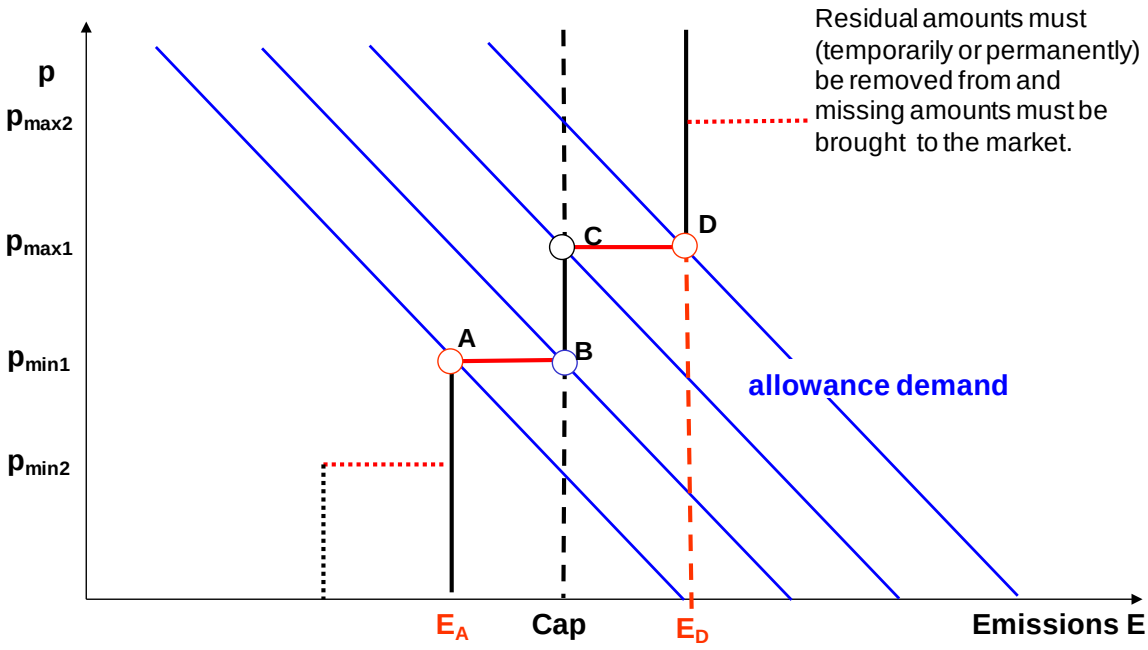


Figure 7
Emissions trading with modified minimum/maximum prices



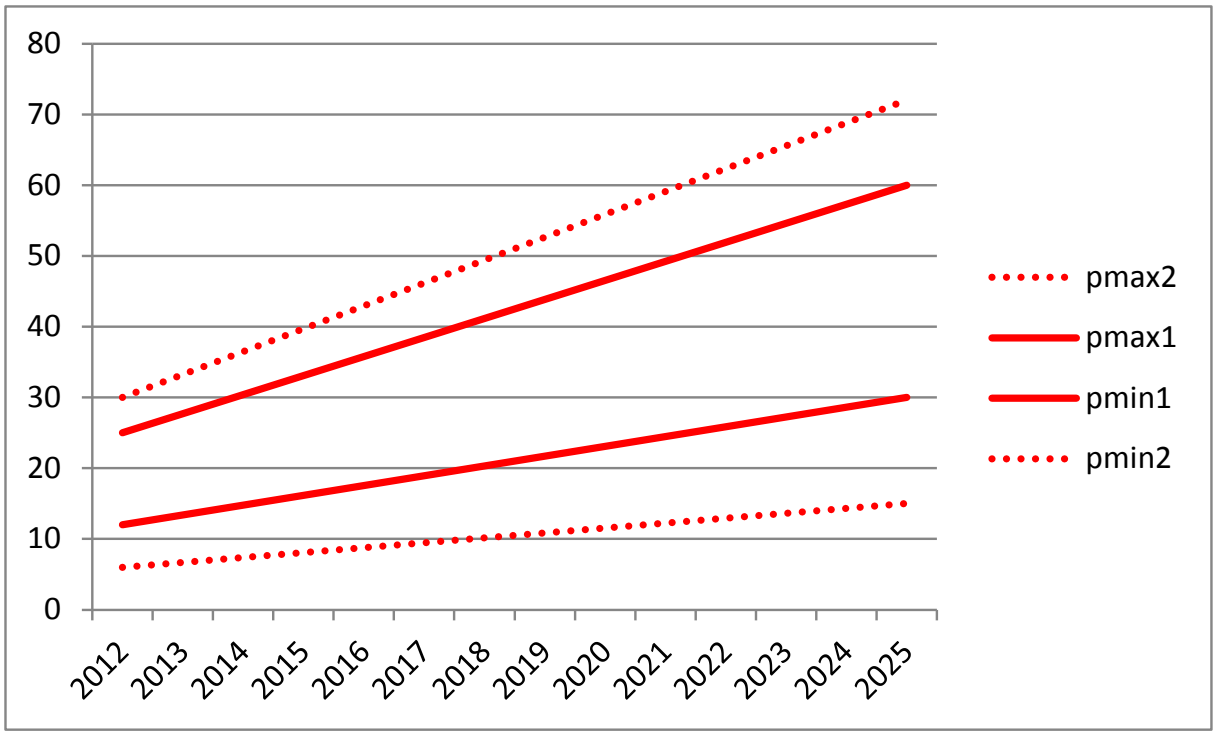
More complex systems with modified minimum and/or maximum prices that only apply to specific amounts of the overall allowance budget are also possible (Figure 7). Multiple

minimum or maximum prices may also be envisaged. The continuation of such modifications leads to hybrid systems of volume and price controls which can also be interpreted as systems of graded emission taxes.

If price limits are to be set for a longer trading period, it is reasonable to dynamically stipulate them as a path (Figure 8). Binding them to a price index may also establish an adjustment to the (actual) inflation.

However, if minimum and maximum prices have been set, the carbon market can only exert its pricing function when the price corridor is not too narrow. Conversely, very wide limits upwards and downwards are only efficient in exceptional cases.

Figure 8
Dynamic price limits (fictitious example)



6.2 Price Limits in EU ETS

No set price limits have been envisaged in the European Emissions Trading System so far. However, there are two different intervention regulations that focus on the price level:

- a provision for excessive price increases (Article 29a ETS Directive) and

- a provision for too low allowance prices in primary auctions (Article 7 (6) EU Auctioning Regulation)

Pursuant to Article 29a of the ETS Directive, the Commission shall immediately convene a meeting of the Climate Change Committee "... if the allowance price equals more than three times the average allowance price in the previous two years on the European carbon market for more than six consecutive months". If this price trend is not due to changing market conditions, it can be made possible for Member States to bring forward auctions or to auction up to 25% of the reserve to new market participants.

Under Article 7 (6) Auctioning Regulation, an auction will be cancelled if the auction clearing price "was significantly lower than the price of just before and during the opening of the bidding window on the secondary market." In this case, the non-auctioned volume must be distributed evenly among the following auction dates pursuant to Article 7(8).

In both cases, price fluctuations may ultimately be countered by bringing forward or postponing auctions in the event of market disturbances. The terms of such interventions, however, are very tight and, in practice, are likely to play only a minor role.

The two provisions mentioned can be interpreted as relative maximum or minimum prices, which should contribute to the smoothing of sharp volatility. However; absolute price limits in the ETS such as minimum prices in auctions have mostly met rejection by electricity producers and industrial companies[17].

In particular, given the current trend of allowance prices i.e. they are much lower than previously expected, the question arises as to whether it would make sense to introduce minimum prices in the ETS.[18]

[17] Cf. European Commission (2010): Impact Assessment on Auctioning Regulation. SEC (2010), p. 41.

[18] Sandbag (2011), Grubb, Neuhoff (2011), UK House of Commons, Energy and Climate Change Committee (2012), Grubb (2012), vote *inter alia* for minimum prices in the EU ETS cf. also Holm-Müller, Weber (2010).

Overview 2
Configuration features of minimum prices

- Motives
  - Avoiding excessive price volatility
  - Avoiding too low a price level (on average)
- Function
  - Temporary withholding of EUAs (temporal stabilisation)
  - Strategic withholding of EUAs (strategic stabilisation)
  - Permanent withholding of EUAs (cap reduction)
- Modification by volume limitation
  - Unlimited residual volumes
  - Limited residual volumes (and possibly multi-level price limits)
- Implementation forms
  - Primary auction (minimum price on sub-markets)
  - Secondary market (minimum price or price-controlled intervention)
  - Combination of ETS with taxes (fixed or variable taxes)
- Type of limits
  - Absolute limits (in euros/EUA)
  - Relative limits (between sub-markets or dates)
- Dynamics
  - Static price limits (nominal/real)
  - Dynamic price limits
- Combinations
  - Without price caps
  - With price caps (corridor)
- Territorial application
  - National
  - EU-wide

A variety of configuration features for minimum prices should be considered in the debate of possible future minimum prices in the EU ETS (Overview).

The configuration of price limits largely depends on the objectives to be achieved by them. The main motive for minimum prices may, on the one hand, be to avoid strong short- and medium-term price fluctuations on the carbon market in order to reduce uncertainty for emitters and other market participants. On the other hand, a generally higher average price

level can be aimed at by a minimum price which enhances the scarcity signal, especially for longer-term investments.

A temporary withholding of allowances comes into consideration for a temporary stabilisation of allowance prices. However, if the amounts withdrawn are automatically brought back to the market after a pre-specified period of time, no sustained price stabilisation can be guaranteed. Such an approach is rather more suited to balancing short-term price fluctuations.

To achieve a medium-term stabilisation, residual allowances could flow into a strategic reserve which, under later market conditions with a high allowance demand, could possibly be partially or completely dissolved again (for example, in conjunction with maximum prices) (see Chapter 7). Price uncertainty is first reduced by the minimum price. However, under certain circumstances, uncertainty about the size and future course of the overall available amount of allowances may increase, which may lead to higher uncertainty in price expectations.

However, if allowances not sought after at the minimum price are permanently withheld or are deleted, this corresponds to a reduction of the overall cap for the trading period. Such a minimum price regulation would thus permanently affect the price level of allowances.

As a modification of a minimum price regulation, the relevant residual amounts may be limited or multistage minimum prices introduced. If the residual amounts are limited, the price may be less than the minimum price if allowance demand is very low. In the event of multistage minimum prices, the intensity of intervention may be staggered depending on the market situation. A combination of different uses of residual amounts (time-related, strategic, permanent withholding) is conceivable. Such modifications, however, would increase the complexity of the (hybrid) system of quantity control with price limits.

It would be difficult to implement minimum prices directly on the secondary market. Pre-specified minimum bid prices offer an option in the third trading period to implement minimum prices on the carbon market chiefly in primary auctions. Though this does not directly exclude lower prices in the secondary market, such a minimum price (on a sub-market) has an indirect impact on the overall market due to the great importance of auctioning in the third trading period. Alternatively, price-supporting market interventions

may also come into consideration if relevant powers are delegated to an institution (*Carbon Bank*) (see Chapter 7). In this case, price limits for interventions should be made *ex-ante* transparent. An implementation of minimum prices via a tax is however, out of the question at the EU level (see also Section 6.3).

Minimum prices considered here are absolute price limits which should be specified in advance in euros per EUA. The extent of price limits must ultimately be a matter for political decision. As far as investments in low-carbon technologies are concerned, minimum prices that would set sufficient incentives may be conceivable – similar to tax rates of an optimal emission tax[19]. In order to let emissions trading have sufficient leverage in pricing, it may be appropriate to set the minimum price lower and thus assign it a security function rather than a direct control capability. For reasons of political acceptance, a lower minimum price would also be more appropriate. From today's perspective, a minimum price of at least five to ten euros should come into consideration. Since the emissions cap in the third trading period decreases from year to year, a real rising path should be specified for the minimum price.[20]

A minimum price could be combined with a maximum price in the European Emissions Trading Scheme. The maximum price would have to be significantly higher than the minimum price and should rise during the trading period (see Figure 8). A combination of minimum and maximum prices could be particularly useful if residual amounts of emission allowances occurring at minimum prices are not cancelled but flow into a strategic reserve. To prevent the trading period cap from being exceeded, the maximum price regulation can be restricted to the magnitude of the then existing strategic reserve. As a precaution against a potential maximum price situation, it would be useful to form an initial reserve from the outset within the overall cap. This would require the quantities scheduled for immediate auction to be reduced accordingly.

Regarding the geographical scope, all measures in connection with minimum or maximum prices should apply to the entire area covered by the European Emissions Trading Scheme. National price limits, however, are less useful and can harm the ETS (see Section 6.3).

[19] The Scientific Advisory Council to the Federal Ministry of Economics and Technology (BMWi, 2012) suggests a minimum price equal to the tax with regard to a uniform international emission tax for the European emissions trade.

[20] Grubb (2012) suggests a minimum price rising from 15 to 22 euros from 2020 to 2013.

All in all, the introduction of price limits in the European Emissions Trading Scheme would fundamentally change its mode of operation. This would require a change to the Emissions Trading Directive and the Auctioning Regulation and thus political agreement concerning specific benchmarks.

Limits can only partly correct distorted scarcity conditions in the emissions trading system. They are not an adequate means as such for adapting to changing emission targets or the effects of other policy measures and cannot fully replace such adjustments. Past experience with the emissions trading system has shown that shocks and unexpected developments such as the severe international economic crisis in 2008/09 may lead to significant price movements which challenge the functionality of the system. The introduction of minimum prices – also in conjunction with maximum prices – may contribute to avoiding price extremes and enhancing the reliability of the emissions trading system. This would also improve incentives for investments in low-carbon technologies.

6.3 National Price Limits

In conjunction with the European climate policy, the individual Member States pursue their own national goals and employ additional instruments. The interaction of national actions in particular with the European emissions trading must be taken into account.

In the UK field of power generation, additional incentives for investment in low-carbon technologies should be created by supporting and perpetuating a national carbon price (*carbon price floor*). For this purpose, a minimum price per ton CO_2 of £16 has been specified as of April 2013 and is expected to increase to £30 by 2020 in real terms (which corresponds to 19.2 and 36 euros at 2009 prices). This minimum price should be achieved by a tax (*climate change levy, CCL*) calculated from the carbon content of energy sources and the expected allowance price. For April 2013, a (*carbon price support rate*) difference of £4.94 /t CO_2 and €5.93 /t CO_2, respectively, has been calculated (DECC 2011; UK HM Revenue & Customs, HM Treasury, 2011, A97).

However, the price difference from today's perspective is likely to be much higher so that the intended national carbon price would not be achieved.

Even if the allowance price could be predicted correctly, the purpose of such a measure, i.e. aiming at a higher domestic carbon price than in the European allowance market, is doubtful[21]. Domestic power producers would bear more of a burden than in other Member States and must therefore decrease their emissions more so that the total demand for allowances in Europe will tend to decrease. Emissions in the entire European ETS sector, however, will not diminish. As a result, the allowance price will not increase, instead they will tend to be further reduced.

Such a national measure is therefore not suited to stabilising the European carbon price. It has no role model for a functioning Emissions Trading System either: if all Member States would impose a tax equal to the difference between a target minimum price and the allowance price, the tax may in balance be as high as the minimum price and the allowance price may sink to zero.

7 Strategic Reserve

To strengthen and increase the flexibility of the European Emissions Trading Scheme, a strategic reserve could be introduced to help create short-term scarcity in the allowance supply and stabilise allowance prices. Such a reserve is not yet envisaged in the EU ETS. The Emissions Trading Directive is strictly based on the principles of an ex-ante quantity-based system that basically precludes subsequent interventions in cap setting, allocation and trading rules. This applies in particular for auctioning in primary auctions whose "procedure (should) be predictable, in particular as regards the timing and sequencing of auctions and the estimated volumes of allowances to be available" (Article 10). From 2013, Member States must auction all allowances which are not allocated free of charge. Consequently, they have (except for "measures in the event of excessive price fluctuations" according to Article 29a, which relate solely to excessive price increases) no way to influence the bid amount of allowances. As at the previous auctions, a fundamental goal is to avoid disturbing the secondary market – and thus the carbon market as a whole – as far as possible.

[21] While Wood, Jotzo (2011) see benefits in such a system, it is fundamentally criticised by the UK House of Commons, Energy and Climate Change Committee (2012) with reference to an intra-EU leakage.

The building of a strategic reserve, at least implicitly, plays an important role in the current political debate. It is assumed that withholding allowances that are provided for the auctions (*set aside*) is legally and politically easier and faster to enforce than further amendments to the Directive which might be accompanied with complex political re-negotiations. But if allowances are withheld and this is not declared as a cap adjustment, a strategic reserve is inevitable. The conditions under which the allowances come back to the market later or be cancelled must then be pre-specified.

In July 2012, the European Commission proposed to reduce the auction volume planned for 2013 to 2015 by 400, 900 or 1,200 million allowances, but to increase the auction volume by the end of the trading period (2018 to 2020 or 2020) (*backloading*). For this purpose, the Commission has put forward proposals for the amendment of the Emissions Trading Directive and the Auctioning Regulation (European Commission, 2012 a, b, c, d).

As the discussion in Chapter 6 has shown, a strategic reserve associated with price limits such as minimum prices in primary auctions – perhaps in conjunction with maximum price regulations – may also be important.

If a number of adjustments to strengthen and increase the flexibility of the EU ETS should be made at the same time, as is demanded from several sides[22], it makes sense to embed them in an overarching concept of a strategic reserve. In addition to a short-term one-off reduction of auction volumes and difference volumes due to price limits, other adjustments such as repeated reduction of auction volumes at a later date or potential mechanisms for market intervention according to specified rules are also conceivable.

The supply of allowances for a strategic reserve may thus come from the following sources:

- one-off withholding of emission allowances intended for auctions (*set aside*),
- residual amounts which emerge when minimum prices are effective,
- possibly repeated withholding of emission allowances,
- additional removal of emission allowances by market interventions.

The following may be considered for the use of allowances from the strategic reserve:

- deletion of allowances,

[22] Cf. Sandbag (2011), Grubb, Neuhoff (2011), UK House of Commons, Energy and Climate Change Committee (2012), Grubb (2012).

- carry-over in the subsequent trading period,
- return at potential price ceilings,
- potential return by market interventions.

The building and management of such a strategic reserve should be embedded in the ETS Directive. If the available emission allowances are significantly reduced in one step compared to the previous cap setting, greater clarity should be created as to whether and to what extent another withholding of emission allowances may possibly occur at a later date, or if this is to be excluded. The conditions under which any serious changes to the ETS Directive should be expected should be politically announced well in advance.

A particularly high degree of transparency and predictability on possible rules for running market interventions would be necessary. For this purpose, founding an independent institution ("*Carbon Bank*") has been considered, the idea being that the European Central Bank would be a role model that could flexibly influence the allowance market in such a way that no amendment of the ETS Directive would be required[23]. The general task of such a body would be to stabilise the allowance market in the event of unforeseen developments and to ensure an appropriate allowance price. In functional terms, that such a body can infiltrate the emissions trading system by arbitrary or speculative ad-hoc interventions would have to be ruled out. Rather, it should be precisely specified under what conditions certain interventions may be possible.

Since the objective ultimately is the stable development of the allowance price, *ex-ante* specified absolute and maybe additional relative price rules would be most likely suitable. However, if the powers of the institution are limited in this sense, there is then no fundamental difference from a system with fixed minimum and maximum prices.

The institution would be more of an executive agency that centrally manages a part of the emission allowances or a supervisory committee that monitors compliance with the rules. Even with a reduced function of the institution, complex institutional regulations would be needed to establish such an institution and provide the ability to meet the onus at the EU level and achieve credibility among market participants. To what extent is it possible to

[23] Cf. e.g. UK House of Commons, Energy and Climate Change Committee (2012).

speed up policy making to improve the EU ETS or replace it in a particular case, is not easy to foresee since the Member States' national interests may be affected.

Legal aspects

Regardless of establishing a new institution, the legal aspects of the implementation of a strategic reserve must be studied more closely. This applies *inter alia* to the issues as to which legal basis must be adjusted, how precisely should *"set aside"* be separated from cap adjustments and how could minimum prices or other interventions be implemented. In this respect, the views are currently seemingly still far apart.

On 25 July 2012, the European Commission proposed a "technical" change to the EU ETS Directive "by which it should be made clear that, because of exceptional circumstances, the auctioning timetable can be adjusted within a trading period by changing the relevant regulation by the Commission to ensure the proper functioning of the carbon market" (European Commission, 2012 d). However, the criterion of "exceptional circumstances" is not further specified. The Commission also presented a draft for a future revision of the Auctioning Regulation which regulates *backloading*. In 2012, the Commission will present an initial report on the functioning of the carbon market in the EU to be used as a basis for debating the structural measures required in the EU ETS.

In its committees, the EU Parliament has debated adjustments of the ETS, firstly, in relation to more ambitious emission targets and secondly, in connection with the draft energy efficiency directive, but has ultimately left decisions about measures and implementation open. In a legal commentary, ClientEarth (2011) regarded it possible that the Commission may decide on a reduction of the cap for 2013 and thus may lower the cap path bound to it. Sandbag (2011) proposed that the Commission should withhold at least 1.7 billion EUAs for the third trading period and initiate a revision of the ETS Directive by 2015, so that the allowances withheld can then be cancelled. In Grubb's (2012) opinion, the economic crisis represents a *vis major*. Over a *set aside* (1.4 billion EUAs), in his view, may be decided in a comitology procedure. This applies similarly for the introduction of a minimum price at primary auctions. The report of the UK Energy and Climate Change Committee (2012) however emphasises that transparent rules, objective assessments and clear mechanisms are required in this context for deletion or return.

Legal aspects cannot be discussed in this paper in detail. However, the hope of many authors that effective short-term changes in the ETS can be achieved by a minimum amount of legal effort is viewed with scepticism. The adjustments considered represent major amendments to the EU ETS which can only be performed with a high degree of political decision-making and require clear legal regulations. From an economic perspective it is particularly important that market participants can put the necessary confidence in the functioning and stability of the carbon market.

8 Conclusion

The European Emissions Trading Scheme (EU ETS) is basically a quantity-based instrument aimed at achieving volume targets which must be ex-ante set as the upper limit, i.e. before the actual phase of emissions trading. The price established in trade should reflect the scarcity of emission allowances. Shocks and unexpected developments, however, can result in the allowance price fluctuating greatly and only fulfilling its steering function with limitations. Currently, CO_2 prices are extremely low and give little incentive to reduce emissions and invest in low-carbon technologies. Such a development can shake the trust in the European climate policy's central instrument. Low CO_2 prices result in low auction revenues whose prime aim is to finance climate protection measures.

Different approaches are pursued in the climate policy debate to strengthen emissions trading and add flexibility. This includes a binding formulation of long-term reduction targets, a more ambitious reduction target of the EU for 2020, a reduction of the cap for the ETS sector, withholding allowances intended for auction (*set aside* or *backloading*), minimum prices at auctions, mechanisms for more flexible adjustments of the ETS requirements and limitations on the recognition of credits from project activities in other countries.

This paper deals with cap adjustments, minimum prices or price corridors and a strategic reserve. This mainly involves a temporary or permanent scarcity of the allowance volume to support the allowance price and provide stronger incentives for climate protection.

Subsequent cap adjustments should be made in an emissions trading system only in exceptional cases. They may impair the reliability of the ETS, lead to market uncertainty and may bring along difficult political re-negotiations. For reasons of trust protection and legal certainty, possibilities of any adjustments should be made transparent before the start of the trading period. Cap adjustments may be considered in the event of changes in policy objectives, of special macroeconomic developments and to harmonise with the effects of policy measures to promote renewable energy and energy efficiency.

If the political *goal of reducing overall emissions* is enhanced for 2020 (from 20% to 30% compared to 1990), a cap adjustment is inevitable. It was intended from the outset to amend the ETS Directive – and change the decision on the effort in the non-ETS sector – in the event of a target change in connection with international negotiations. This should also apply in the case of unilateral target enhancement. However, The European Commission published a 30 % scenario in May 2010 which counts on an increased use of credits from projects in other countries so that emissions in the EU would decrease by 25 %. In this scenario, the reduction target for the ETS sector increased from 21 to 34% by 2020 compared to 2005. For this purpose, the Commission has proposed a *set aside* of 1.4 billion allowances intended for auction. The Commission's analysis predicts that, in the case of a permanent removal of this amount from the market, auction revenues expected for 2020 would increase by 7.3 billion euros due to the higher allowance price. It would be desirable that at least the relevant political decisions should be taken prior to the start of the trading period to allow emitters and other market participants to adjust to any changes in time.

The issue of whether the emissions trading cap should subsequently be adapted to *economic developments* is controversial. Fluctuations of allowance prices in a quantity-based instrument are generally desirable since the allowance price signals the current scarcity. In addition, the European ETS provides certain flexibilities time-wise through banking and borrowing. The 2008/09 global economic crisis however, has led to drastic reductions in many production areas and thus in allowance demand, and this will have an effect due to allowance banking, even in the third trading period. As it is, the medium-term emission reduction targets are to be reduced in view of the longer-term trend. In the meantime, the surplus emission allowances resulting from the economic crisis provide a straightforward opportunity to implement more ambitious emission targets by adjusting the single cap. In

the case of another severe economic crisis during the third trading period, a precautionary rule-bound cap adjustment may be considered. However, such cap adjustments may affect the reliability and transparency of ETS under certain circumstances. Therefore, clear criteria should be agreed upon from the outset which should be adhered to if the cap were adjusted to the overall economic development. This in particular includes the restrictions placed on a scenario where economic development is seriously disrupted by a severe crisis, economic growth is permanently impaired and the demand for allowances is significantly reduced.

The interaction between emissions trading and *other policy instruments* which promote renewable energy and enhance energy efficiency must be considered as early as (*ex-ante*) cap setting. When the emission reduction caused by other measures is fully considered in cap setting, can a reduction in the allowance price be caused anyway and can carbon leakage within the ETS be avoided. Coordination between the instruments may in particular be lacking if emission reduction by renewable energy and energy efficiency improvements have not been correctly anticipated in cap setting. Current *ex-post* cap adjustments to the actual development however, were in conflict with the *ex-ante* principle of emissions trading. After a possible adjustment before or at the beginning of the trading period, a mid-term review of the ETS requirements e.g. in three or four years – would be more conceivable. A subsequent cap-adjustment within the trading period would be particularly appropriate if policy instruments for the promotion of electricity generation from renewable energy sources and the reduction of power consumption contributed considerably more to reducing greenhouse gas emissions than initially expected.

Flexibility in ETS within the trading period may also be increased by introducing absolute *minimum prices or price corridors* which, depending on the configuration, result in similar effects as subsequent volume adjustments. However, they cannot specifically replace a cap adjustment to more ambitious emission targets. The main motive for such hybrid systems is the stabilisation of the allowance market by restricting price fluctuations. In order to temporarily stabilise allowance prices using a minimum price, a temporary withholding of allowances may be considered. However, if the withheld volumes are automatically placed back on the market after a pre-specified period of time, sustainable price stabilisation cannot be guaranteed. For a medium-term stabilisation, any remaining allowances may flow into a strategic reserve that may, in combination with maximum prices, partially or

completely be resolved in future market situations when allowance demand is high. However, if emission allowances not wanted at the minimum price are permanently withheld or cancelled, this corresponds to a reduction of the overall cap for the trading period. Such a minimum price regulation may thus permanently affect the price level of allowances. First of all, pre-specified minimum bid prices in primary auctions may be one option to implement minimum prices on the carbon market during the third trading period. From today's perspective, a minimum price initially set at minimum of five to ten euros may be considered, which should rise in real terms year on year in the third trading period. A possible maximum price should be considerably higher than the minimum price and also should increase in real terms year on year. To prevent the trading period cap from being exceeded, a maximum price regulation may be limited to an existing reserve. All measures associated with minimum and maximum prices should apply to the entire area of the European emissions trading scheme. National price limits, however, make little sense and may harm the ETS.

The introduction of a *strategic reserve* may help to quickly reduce the supply of allowances and stabilise the allowance prices. Withholding allowances which are intended for auctions (set aside) in a strategic reserve would be legally and politically easier, and faster to enforce, than further amendments to the Directive which might be associated with more complex political re-negotiation. The conditions under which the allowances later come back onto the market or are cancelled should be specified in advance. It may also be helpful to include residual volumes in a strategic reserve associated with a minimum price or price corridor and release them later.

Possible rules for an independent institution to intervene in the market would require a particularly high degree of transparency and predictability. Since the ultimate objective would be a stable development of the allowance price, pricing rules specified *ex-ante* should be considered at the outset. Then there would be no fundamental difference to a system with specified minimum and maximum prices. Complex institutional regulations in connection with the introduction of an independent institution should be avoided if possible.

Table 3 compares the medium-term adaptation options in the European emissions trading system based on evaluation criteria. Due to the different motives and modes, these options should essentially not be considered as alternatives, but they may complement each other depending on the particular political feasibility.

From an economic perspective a cap adjustment to more ambitious goals is inevitable once a political agreement has been reached. A cap adjustment to the economic development may be appropriate in the exceptional case of a serious crisis. Whether a cap adjustment due to the effects of emission reduction as a result of political measures to promote renewable energy and energy efficiency becomes necessary during the trading period should be reviewed after three or four years. The withholding of auction volumes (set aside) may contribute to short-term stabilisation and may serve as a precursor to cap adjustments, but the options to do this – similar to cap adjustments – should be specifically justified and made transparent early on.

Table 3
Medium-term adjustment options in the EU ETS

	Cap adjustment to more ambitious targets	**Cap adjustment due to economic development**	**Cap adjustment due to effects of political measures**	**Set aside**	**Reserve management**	**Minimum price**
Criteria for adjustment need	Change of targets, e.g. 30 % instead of 20 % by 2020	Extreme macroeconomic shocks	Severe non-anticipated effects	Targets, shocks, political measures	Avoiding extreme prices and fluctuations	Avoiding extreme prices and fluctuations
Adjustment frequency	One-off	One-off, may be repeated	One-off	One-off, may be repeated	One-off introduction	One-off introduction
Adjustment period	Immediately after goal adjustment	In case of crisis	After review in 2015/16	Depending on configuration	Ongoing	Ongoing
Function/ configuration	Permanent reduction of allowances	Permanent reduction of allowances	Permanent reduction of allowances	At least a temporary reduction in the volumes auctioned	Reserve building and reduction by independent institution ("Carbon Bank")	Increasing minimum price in primary auctions (optional with maximum price)
Aagreement on targets	Immediately, also non-ETS sectors	May be necessary	May be necessary	Conditional	Open	Moderate
Short-term efficiency	High	Partly	Partly	Conditional	Conditional	Conditional
Long-term efficiency	High	Partly	Partly	Conditional	Conditional	Conditional
Certainty for market participants	Comparatively high	Limited	Medium high	Moderate	Very moderate	High
Auction revenue	Increasing	Increasing	Increasing	Conditional	Open	Conditionally increasing
Legal/administrative implementation	Change in Directive, application also to freely allocated amounts?	Change in Directive, application also to freely allocated amounts?	Change in Directive, application also to freely allocated amounts?	Change in Directive, Auctioning Ordinance	Complex regulations of competences necessary	Change in Directive, Auctioning Ordinance
Political feasibility	Open, different views on goals, also depends on international process	Questionable, also depends on goal discussion	Unclear	Relatively good (suggested by Commission)	Questionable	Unclear (not supported currently by Commission)
Economic evaluation	Change of goal necessary, adjustment will be inevitable	Adjustment to be limited to exceptional cases	Adjustment may be necessary	As a precursor to a cap adjustment may be useful	Problematic; complex institutional arrangements to be avoided	Useful as support measure, also depends on other adjustments

Active reserve management during the trading period by a new institution (*Carbon Bank*) would however, be problematic with regard to the credibility and effectiveness of the ETS and is therefore viewed sceptically. Given the recent price developments which differ greatly from previous expectations, *ex-ante* rules for specifying minimum prices as a support activity may be useful. A final evaluation of price controlling items in the ETS depends largely on what adjustment provisions for the volume control are politically feasible.

Cap-adjustments may strengthen the European emissions trading system and make it flexible. The introduction of minimum prices may be conceivable. Major changes to the ETS however, can only be made with a broad political consent and require clear legal regulations. From an economic perspective it is particularly important that market participants can put the necessary confidence in the functioning and stability of the carbon market.

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