CHAPTER

2

THE EU ETS AND THE MARKET STABILITY RESERVE

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KEY MESSAGES

• ***Structural changes in the adopted MSR legislative text -*** The legislative proposal for the Market Stability Reserve (MSR), disclosed in January 2014, was approved by the EU Parliament on 7th July 2015 with some substantial changes from its initial version. The revised parameters detail: a start date in 2019; the reintroduction of 900 million backloaded allowances and unallocated allowances in Phase III in the MSR; provisions for monitoring the MSR which includes two reviews in Phase IV, and a reduced time lag of the mechanism. The decision was adopted by the EU Council on 18th September.

• ***MSR impacts on the EUA surplus -*** According to the Institute for Climate Economics, verified CO_2 emissions will remain below the CO_2 emission cap until mid-Phase IV. Without the implementation of the MSR, the estimated surplus could increase to 3 $GtCO_2e$ by 2020. With the implementation of the MSR from 2019 and the return of backloaded allowances to the reserve, the EUA surplus could be limited to 2 $GtCO_2e$ in 2020 and decrease gradually from 2021 to 2030 until reaching 500 $MtCO_2e$. This means that the MSR would not begin re-injecting EUAs into the ETS market before 2030 because the surplus would still be higher than 400 $MtCO_2e$ in 2030. As such, the MSR will likely help to restore the short term scarcity needed during Phase IV of the EU ETS, enabling market participants to take into consideration the long term stringency of climate policies. It will also help increase its resilience to external shocks. However, given the wide range of uncertainties, an appropriate governance of the MSR will be essential to ensure its efficiency by recalibrating its parameters in order to avoid important deviations from an efficient decarbonization pathway.

• ***MSR impacts on EUA prices -*** According to the POLES model's results, the introduction of the MSR from 2019 will lead to an increase in the CO_2 price by roughly $€_{2010}$15/tCO_2 (compared to the Reference scenario) by 2030. Additional abatement costs amount to $€_{2010}$ 1.7 billion from 2015-2030 are supported at about 66% by the power sector with an important emissions reduction potential associated with relatively low average reduction costs ($€_{2010}$ 39/tCO_2 avoided).

• ***Experiences beyond Europe -*** California, RGGI and the Beijing pilot ETS in China have implemented flexible mechanisms to stabilize the price of carbon in their program. While these mechanisms may differ from the approach taken by the EU ETS, they equally help to manage the supply of allowances, while maintaining an incentive to decarbonise.

1. This chapter on the Market Stability Reserve (MSR) is based on I4CE & Enerdata expertise and analysis developed in the COPEC research program organised on 6th November 2014 and results from academic research. We thank Raphael TROTIGNON (Climate Change Economics Chair), Marie-Eugenia SANIN (University of Evry) and Anne CRETI (University Paris-Dauphine) and Godefroy GROSJEAN (Potsdam Institute for Climate Impact Research (PIK) for their very comprehensive analysis and insight on this issue.

This chapter begins with an introduction to the design of the Market Stability Reserve proposal adopted on 7th July 2015 to be implemented in the EU ETS from 2019 onwards. Section 2 provides an analysis of the consequences of introducing the MSR and its potential impacts on the EU ETS supply-demand balance, with specific reference to the level of EUA surplus expected in 2030. Section 3 uses POLES modelling results to demonstrate the potential impacts of the MSR on the EUA price, investment and effort sharing among EU ETS sectors leading to 2030. Lastly, section 4 provides an overview of three other emissions trading schemes in the world which have implemented provisions to help stabilize the price of carbon in their programs.

1. IMPLEMENTING THE MARKET STABILITY RESERVE: FROM A "ONE-SHOT" INTERVENTION BEFORE 2020 TO "ROBOTIC" ADJUSTMENTS LEADING TO 2030

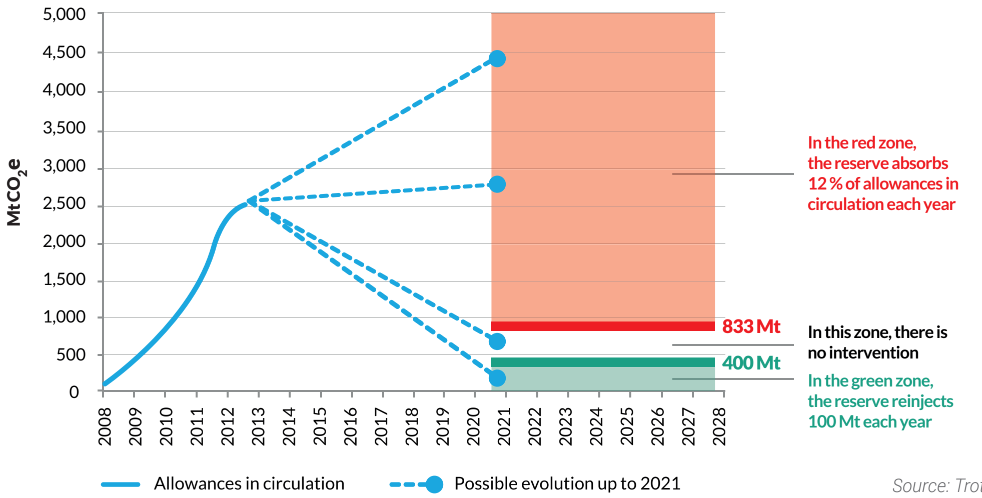
After over two years of discussions, the EU Commission disclosed on 22nd January 2014 a legislative proposal for a Market Stability Reserve (MSR),[2] in its communication titled "A policy framework for climate and energy in the period from 2020 to 2030".[3] This measure was planned to be implemented from the next compliance period (2021-2030) onwards, in an effort to reduce the growing allowance surplus of allowances since 2008 and improve the ETS's resilience to external shocks. The MSR operations are based on predefined rules that leave no discretion to either the EU Commission or Member States as the supply of allowances to be auctioned will be automatically adjusted.

Choosing a quantity-based instrument to address EU ETS weaknesses before the EU ETS directive is revised for Phase IV

Intervention of the MSR is premised on the cumulative EUA surplus representing the total number of allowances held by market participants that are not used to cover actual emissions. From 2018, the EU Commission will calculate the surplus which equals all allowances (auctioned and freely allocated), plus all Kyoto credits minus the total covered verified emissions from 2008. Two quantity thresholds and a price threshold are defined. The lower quantity threshold is set so that when allowances in circulation fall below the limit, the Commission commits to reintroduce more allowances. The upper threshold is set so that allowances in circulation above the limit would lead to allowances being removed. The price threshold is an "emergency" trigger that is activated if there is an extremely volatile rise in prices. More specifically, the EU Commission has committed to:

- Removing 12% of the total allowances in circulation and place it in the MSR if the **cumulative surplus is greater than 833 Mt.**
- Adding 100 Mt worth of allowances to the auctioning volume by removing them from the MSR if the total amount of the **cumulative surplus is less than 400 Mt.**

Figure 1 - Demonstration of MSR operations based on the EU commission's proposal.



Source: Trotignon et al. 2014.

2. EU Commission (EC), *A policy framework for climate and energy in period from 2020 to 2030*, 2014.
3. EC, *Proposal for a Decision concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EU*. 2014.

Backloading: A temporary measure to tackle surplus allowances with limited effect on EUA prices[4]

In July 2012, the European Commission introduced a proposal to reduce the supply of allowances between 2013 and 2015 to tackle the current EU ETS surplus. This proposal, termed "backloading", involved setting-aside 900 million allowances early in Phase III and reintroducing these allowances back into the market at the end of Phase III (thereby maintaining the level of the cap for that phase).
The European Parliament finally approved the measure in December 2013, and in February 2014, the EC amended its auctioning regulation (EU) No. 1031/2010 to reschedule the auction volume from 2013-2020. As a result the volume of auctioned allowances is reduced by 400 million in 2014, by 300 million in 2015 and by 200 million in 2016.

In theory, assuming rational actors that optimize dynamically without any informational constraints, the backloading measure is expected to have little, if any, effect on the carbon price due to the fact that backloading creates a temporary and artificial scarcity of which participants are aware. As a result, participants can sell allowances safely with the knowledge that the extra allowances will be reintroduced later in the scheme and can be bought back at the same price. However, the European Commission (2014) finds this outcome unlikely in a market with a limited time horizon.

It expects the price to rise in the short-term because the surplus holders will require a price premium to sell allowances. It also expects the price to fall at the end of Phase III when allowances are reintroduced to absorb the extra supply.

Table 1 - Comparison of Market Stability Reserve provisions in the proposed and adopted legislative text.

	MSR legislative proposal - Initial text (January 2014)[5]	MSR legislative proposal - Adopted text (July 2015)[6]
Date established/ Date of implemented	1st January 2021	(Art 1.) 2018 / 1st January 2019
Reintroduction of 900 million backloaded allowances in Phase III auctioning volumes	Yes	No. (Art 1.1.a) … shall not be added to the volumes to be auctioned in 2019 and 2020 but shall instead be placed in the reserve.
Return of unallocated allowances in Phase III	-	(Art 1.1.b) … shall be placed in the reserve in 2020
Monitoring and review	(Art. 3) By 31st December 2026, the Commission shall on the basis of an analysis of the orderly functioning of the European carbon market, review the Market Stability Reserve and submit a proposal, where appropriate, to the European Parliament and to the Council.	(Art. 3) The EC will monitor the functioning of the MSR and publish a report that should consider relevant competitiveness effects, in particular in the industrial sector, including GDP, employment and investment indicators. Within three years of the start of the operation of the reserve and at five year intervals thereafter, the Commission shall review the Market Stability Reserve and submit a proposal whether appropriate.
Responsiveness of the mechanism	Changes to the auction volumes take place two years after the emissions have occurred. Thus, the cumulative surplus calculated in year n is in fact that of year n-2.	Each year, a number of allowances equal to 12% of the total number of allowances in circulation, as set out in the most recent publication under paragraph 2, shall be deducted from the volume of allowances to be auctioned by the Member States under Article 10(2) of Directive 2003/87/EC and shall be placed in the reserve **over a period of 12 months beginning in September of that year.**

Source: I4CE – Institute for Climate Economics, based on EU legislative texts 2014, 2015

4. EC, *Commission Regulation (EU) No 176/2014 of 25 February 2014 amending Regulation (EU) No 1031/2010 in particular to determine the volumes of greenhouse gas emission allowances to be auctioned in 2013-20.*
5. EU Council & Parliament, *Concerning the establishment and operation of a Market Stability Reserve for the Union greenhouse gas emission trading scheme and amending directive 2003/87/EC* , 2014.
6. EU Council & Parliament, *Concerning the establishment and operation of a Market Stability Reserve for the Union greenhouse gas emission trading scheme and amending directive 2003/87/EC , ANNEX 2014.*

- Adding 100 Mt worth of **allowances if the allowance price is higher than three times its average value over the previous two years.** This threshold is only valid when the price is increasing; there is no provision to remove allowances on the basis of a volatile drop in prices.

The legislative proposal submitted for the MSR gave rise to an intensive debate among Member States in 2014 and 2015. Three main issues were discussed: the commencement date for the MSR, the introduction of backloaded allowances into the MSR and various design parameters such as thresholds. After two trilogue meetings in March and May 2015, the legislative proposal of the MSR was approved by the European Parliament on 7th July 2015 with some substantial changes from the initial version, as presented in Table 1. The decision was adopted by the EU Council on 18th September 2015.

Additional MSR provisions in the proposal of the revised EU ETS directive for the post-2020 period

The proposal of the revised EU ETS directive disclosed in July 2015 specifies two complementary provisions for the MSR. Firstly, 250 million unallocated allowances from the MSR shall be set aside for new entrants.

Secondly, the Innovation Fund will be infused with 50 million unused allowances from Phase III that would otherwise have been placed in the MSR in 2020, in addition to 400 million free allowances coming from the free allocation budget.

2. ASSESSING THE MSR'S ABILITY TO ADJUST EU ETS SUPPLY

As specified by the European Commission,[7] the "reserve" should be operational from 2019 to address the increasing surplus, to build the EU ETSs resilience to supply-demand imbalances and to enhance synergy with other climate and energy policies.[8] The role of the MSR is to help adjust the scheme to create an orderly and largely predictable market. While taking stock of EU ETS shortcomings, this section provides an assessment on how effectively the MSR can deliver on expectations.

Factors leading to low and volatile EU carbon prices: structural rigidity, lack of EU ETS credibility and the myopia of market participants

EU ETS rigidity gives rise to large imbalances

The EU ETS is a regulatory market. On the one hand, the demand of allowances is fluctuating according to cyclical and more structural patterns. On the other hand, the supply of allowances is inelastic, as it was set years back, in line with economic and technological development forecasts of the time. The lack of flexibility in the EU ETS was designed intentionally to ensure regulatory stability, and environmental effectiveness. However, in other markets, supply fluctuates in order to adjust to the level of demand and allow price discovery.

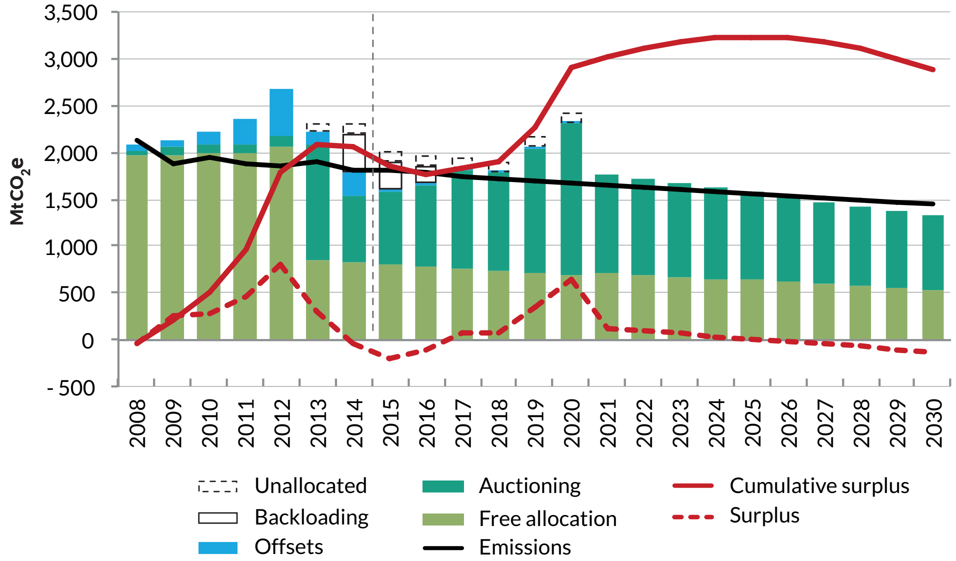
Verified emissions by installations covered by the ETS decreased by 15% (19% with constant scope) between 2008 and 2014, or by 2.7% per year on average which was a much faster rate than the cap is set to decline in Phase III (1.74% per year). Combined with a large inflow of international credits amounting to 1,400 million in 2014, the slump in demand for allowances has led to a growing surplus, estimated to be 2.1 billion in 2014, as described in Chapter 1. This surplus is expected to be carried over to the end of Phase III, and is fuelling expectations of low scarcity (Trotignon, 2014). The emissions cap in Phase III compared to the Business As Usual emissions trajectory, is no longer perceived as stringent.

According to Institute for Climate Economics' projections, verified CO_2 emissions are likely to remain below the emission cap until mid-Phase IV.[9] As shown in Figure 2, returning backloaded allowances to the market without implementing the MSR would increase the surplus to 3 $GtCO_2$ in the 2020 to 2030 period.

However, EU allowances surplus should not be perceived as an issue per se, as it could be the result of abatement efforts and banking behaviors[10] corresponding to optimal strategies undertaken by market participants (Bosetti, 2008). With the prospect of an increasingly stringent cap as of mid-Phase IV, market participants should retain their banked allowances, and prices should increase to reflect long term scarcity. This is not the case in the EU ETS: prices are depressed

7. EC, *Adopted MSR legislative proposal*, 2015.
8. EC, *Proposal for a directive amending directive 2003/87/EC*, 2015. pg. 25.
9. Assuming a 1.4% annual growth of industrial output, 0.6% growth of power generation, and renewable generation progressively entering the market to reach the 2020 objective.
10. Long term banking of market participants anticipating the position of market is not used, even if theoretically this option exists in the system.

Figure 2 - Allowance surplus without MSR: increasing to 3.25 Gt CO_2 before 2030.



Source: I4CE – Institute for Climate Economics, based on data from EC, EU TL, 2015.

despite the fact that the market is expected to be tight within ten years. This is generally explined by two reasons. Banking of allowances may not be used enough because of the lack of credibility of the scheme driving market participants to heavily discount allowances in the long run. Another contributing factor could be the shortsightedness of market participants, and their excessive focus on the short-term, preventing them from adopting long-term cost minimizing strategies.

Lack of long-term political credibility in the EU ETS

By deciding a 2030 ETS emissions reduction target with a long term objective for 2050 binding, uncertainty regarding climate policy and the EU ETS has been significantly reduced. However, the credibility of climate commitments may be undermined by the lack of time-consistency of climate policies. As highlighted in Chapter 1, the multiple (and sometimes conflicting) objectives of energy and climate policies (affordability, security of supply) evolve overtime, and governments may embrace different priorities at different points. This may be further reinforced by the uncertainties surrounding global cooperation in the fight against climate change. In practice, evolving policies adjusting the supply of allowances have somewhat undermined the overall credibility of the EU ETS. For instance, the inflow of more than 1.5 billion international credits in Phase III highlighted that the cap in the future may not be as legally binding in nature as suggested, and that there may be possibilities to negotiate more lenient objectives. Given that capital intensive low-carbon investments are largely irreversible and their profitability deeply relies on climate policies, lack of time-consistency can have a significant impact on investment decisions.

As a response to a wide array of uncertainties relating to the state of the EU ETS in the future, participants may disregard long-term anticipated scarcity, leading to the carbon price being driven largely by the short-term surplus. Based on an extended database (2012 to the end of 2013), Koch (2014) attempts to quantify the impacts on price formation of three commonly cited demand-side fundamentals: Economic Sentiment Indicator, renewable energy production, and offsets. He finds that these market fundamentals explain only 10% of EUA price changes. Among these, the Economic Sentiment Indicator is still statistically significant, whereas renewable energy sources production seem to have an impact of secondary importance. It is then suggested that political decisions are alternative drivers of carbon price formation.

Market participants short sightedness

It has been highlighted that covered installations have a limited planning time horizon linked to their operational production cycles. Neuhoff (2013) exposes the case of the power sector, emitting half of the EU ETS cap. Utilities are used to selling power in forward markets within a three year timeframe. This means that they start to sell a part of the planned production three years in advance, and they gradually close their open positions until the time of production. While selling power, they buy underlying commodities, including EUAs in the forward market to secure a margin – so called "clean spread". This procedure is defined by precise risk mandate strategies. EUA forward contracts are provided by financial operators, that trade off the cost of capital as they buy EUA allowances in the spot market and sell it on forward markets with low discount rates (risk neutral "cash and carry" strategy). However, when the need to hedge is satisfied, speculative market participants intervene and adopt open positions, applying much higher discount rates, 10% or 15% against 5% for utilities hedging (Neuhoff, 2013). As such, given an expected price signal in the long term, EUA spot prices undergo downward pressure due to high discount rates. For example, according to the EU's 2014 Impact Assessment, EU carbon prices in 2030 are expected to reach €40/tCO_2. Consequently, with a 12.5% discount rate, EUA prices in 2015 would be only of €7/tCO_2 compared to €20/tCO_2 assuming unlimited banking at low discount rates of 5% (I4CE – Institute for Climate Economics, 2015).

There is no scarcity in the EU ETS market, in the short-term nor is it anticipated in the medium term. For different reasons identified, market participants are unable to take into consideration the long term scarcity that should be conveyed by the emissions cap by 2030. Consequently, EUA prices have been depressed since 2011.

Low carbon prices increase the long term cost of European decarbonisation

Low prices in an ETS should not be considered as inherently negative: the emissions cap secures the EU ETS reduction target and therefore, low prices may imply that the schemes objectives can be achieved at a lower cost than expected. If the objective of the EU ETS is to simply lower the cost of compliance within a given trading period, no reform would be required. However, climate policies focus on forging the most cost effective – long-term – pathway to a low carbon economy as expressed in the EU 2050 Energy Roadmap. EU carbon pricing is assigned a wider role beyond short-term optimizations to reduce the CO_2 emissions of existing capital stock. It should provide a clear and credible long term signal that can lead investors to progressively "green" their capital stock, and drive the necessary development of low carbon technologies.

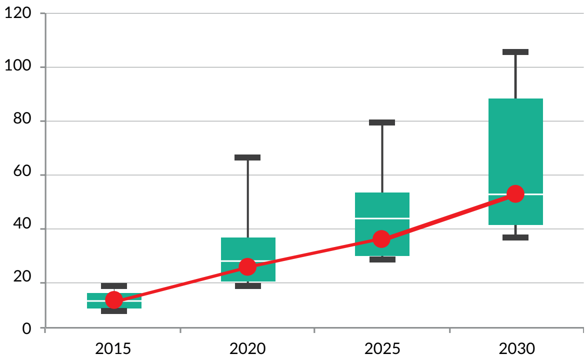
From this perspective, low EUA prices are likely to prevent the carbon price from playing its dynamic efficiency role, and will be detrimental to the cost effectiveness of the scheme. Three issues are highlighted:

- With low carbon prices, early cost abatement opportunities may be disregarded by market participants, which will raise their cost of compliance in the long run;
- Low prices delay investments in low technologies development, meaning that fewer options may be available to combat climate change in the future, and at high cost;
- Low carbon prices are likely to give rise to investments in high carbon technologies referred to as carbon lock-in. Later on, the rise of carbon prices is likely to devaluate high carbon assets before the end of their economic lifetime, steering an inefficient allocation of capital.

To address these three issues that increase the long-term cost of the European decarbonisation effort, the carbon price must follow an efficient pathway that can induce sufficient technological developments and provide a credible framework for the investment of low carbon technologies. Figure 3 provides a wide array of efficient carbon price pathways observed in economic literature (Knopf *et al,* 2013) which could drive the transformation towards a low carbon economy at the least cost in order to achieve the -80% GHG emission reduction target by 2050.

These carbon price trajectories are subject to a large degree of uncertainty in terms of technological and economic development. However, it appears clear that current EUA prices are far below the recommended levels and are likely to encourage a deviation from an optimal abatement pathway.

Figure 3 - Examples of efficient carbon prices from different energy-economy models.



Euro Case, 2014, based on Knopf et al. 2013.

This is all the more true when EU ETS prices are compared to the level of the social cost of carbon recommended in the French Quinet report (2009), from €32 in 2010 to €100 in 2030.

This situation warrants intervention in EU ETS design to help restore adequate scarcity in the short-term and drive more efficient abatement decisions. The question then remains, to what extent can the MSR play this role?

The MSR should restore the short-term scarcity and reinforce the resilience of the EU ETS

In view of the need to intervene in the EU ETS and improve its dynamic efficiency, a wide debate took place in 2012 on the type of instruments that could be implemented. Many economists have advocated for price based stabilization mechanisms like price corridors (Taschini, 2014; Euro-Case 2014) due to the fact that they are simpler, more transparent, less easy to manipulate, and would be more likely to reduce regulatory uncertainty than a quantity based mechanism. Others, building on the existing monetary policy literature, have advocated for a higher degree of delegation to overcome, time inconsistency issues more efficiently (Helm 2003, Grosjean 2014).

There has been a wide support among stake-holders for a mechanism based on quantities to adjust supply. The European Commission have emphasized that a price based mechanism goes against the intrinsic nature of a market and would hinder price discovery. Moreover, a price corridor would require, on a preliminary basis, difficult political negotiations to define a price target. Eventually, the MSR became the preferred option, as it is non-discretionary and cap neutral. This leads to the question on whether or not the MSR will be able to correct the identified failures.

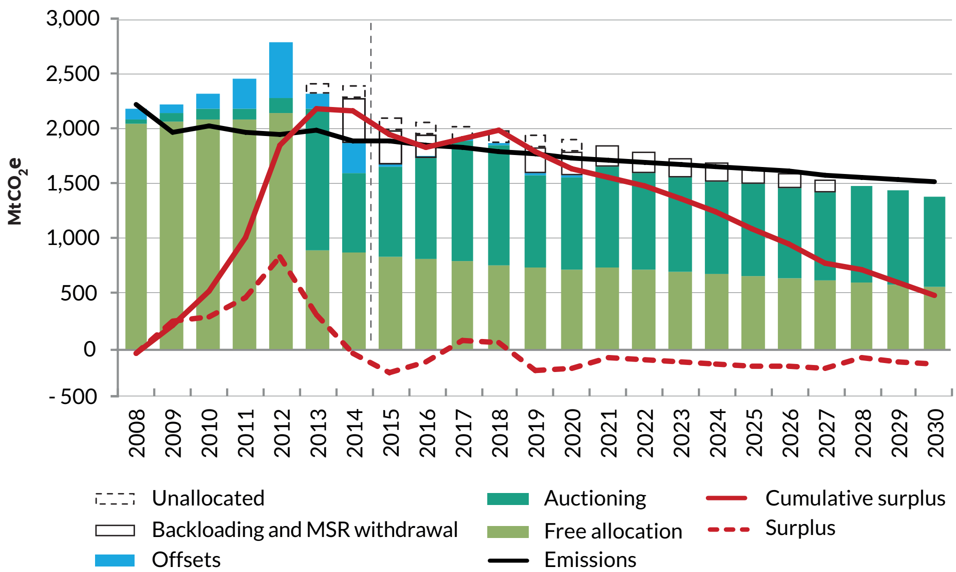
Overcoming the short sightedness of market participants

The MSR will provide some flexibility in the supply of allowances and will mechanically increase short-term scarcity and prices. If the short sightedness of market participants is thought to be the key element, the MSR will force market participants to take into consideration long-term scarcity. This will drive early and consistent investment decisions and help get closer to an efficient abatement pathway.

As outlined in Figure 4, implementing the MSR in 2019 and the return of backloaded allowances in the reserve, would limit the EUA surplus to 2 $GtCO_2$ in 2020 (relative to 3 $GtCO_2$ without the MSR), and will continue to gradually decrease it from 2021 to 2030 until it reaches 500 $MtCO_2$. As such, the MSR will likely restore the needed short term scarcity during Phase IV of the EU ETS.

Climate Strategies (2015) have used a set of models to test the ability of the MSR to increase the cost-effectiveness of the EU ETS using three criteria: the inter-temporal efficiency, price credibility and robustness.

Figure 4 - Impact of the MSR on the allowance surplus in EU ETS Phase IV.



Source: I4CE – Institute for Climate Economics, based on data from EC, EU TL, 2015.

They demonstrate that with the MSR, abatement trajectories of market participants are closer to an efficient pathway, reducing efficiency losses from market failures by two thirds. They also demonstrate that market participants bank allowances more efficiently, and that the EU ETS is more responsive to and robust against exogenous shocks.

According to Institute for Climate Economics modelling results, the MSR will help to increase the EU ETS's resilience to potential future shocks. To demonstrate this, a shock in demand was simulated with a drop in annual growth from 1.4% to -3% from 2024 to 2026. This was followed by a slow recovery with 0% growth from 2027 to 2029, coupled with a major breakthrough in storage technologies that would enable a higher pace of deployment for intermittent renewables.[11]

As shown in Figures 5 and 6, EUA surplus in the EU ETS is not significantly affected by these large exogenous shocks. At the end of Phase IV, the EUA surplus settles at 1,300 $MtCO_2e$, relative to 3,800 $MtCO_2e$ without the MSR, which seems to be a reasonable surplus size for a well-functioning market.

Figure 5 - Impact of a large decrease in demand on the EU ETS surplus with the MSR.

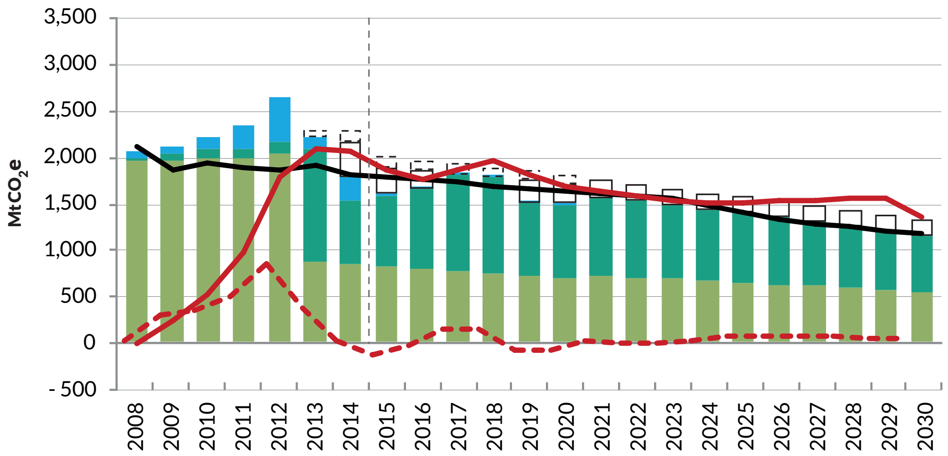
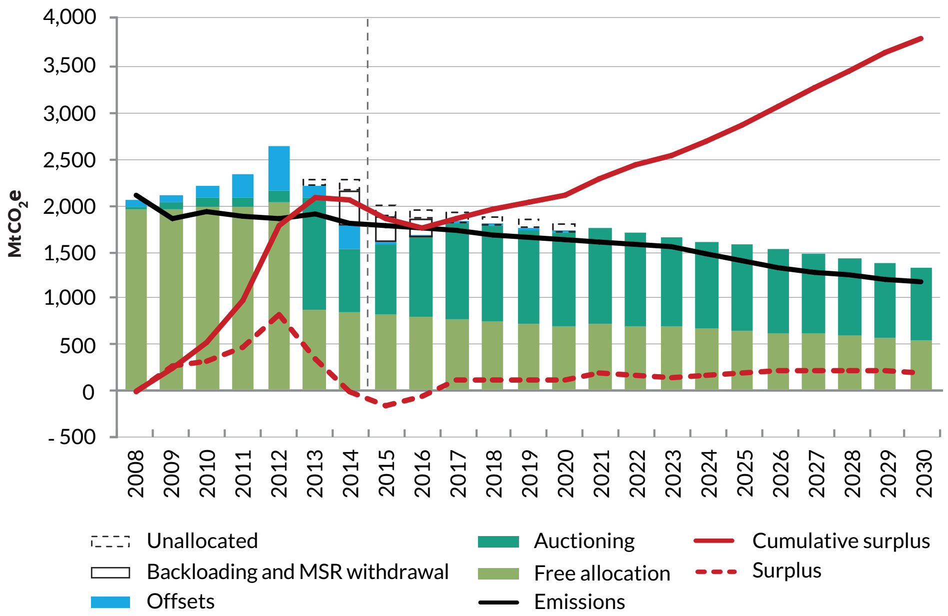


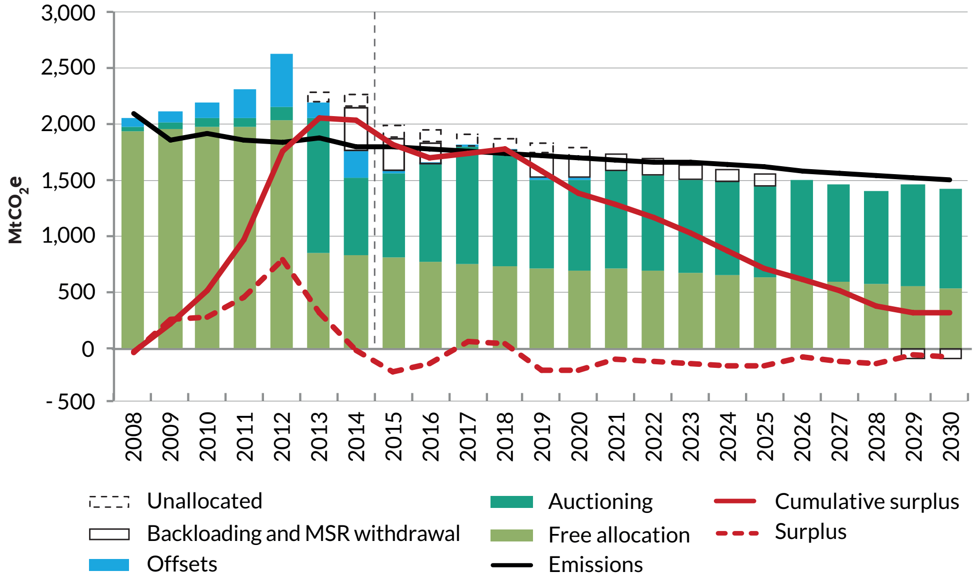
Figure 6 - Impact of large decrease in demand on the EU ETS surplus without the MSR.



Source: I4CE – Institute for Climate Economics, based on data from EC, EU TL, 2015.

11. 45% share in electricity generation compared to 35% in the impact assessment 2030 framework, on top of 11% of hydro generation.

Figure 7 - Impact of a large increase in demand on the EU ETS surplus with the MSR.



Source: I4CE – Institute for Climate Economics, based on data from EC, EU TL, 2015.

Conversely, a 2% annual growth rate leading to 2030 would significantly increase the demand for EUAs and the surplus would reach the lower thresholds of 400 million by 2028. With the reinjection of 100 million allowances in 2029 and 2039, the surplus stabilizes to 320 million allowances in the end of Phase IV as outlined in Figure 7.

As a result, the MSR deeply reinforces the robustness of the EU ETS, which ensures better price consistency, and provides a more credible framework for investment in low carbon technology development and deployment. Attention is however required regarding the injection rate that may be too low in case of positive economic shock.

Ensuring MSR efficiency through proper governance

The MSR is likely to enhance the dynamic efficiency of the EU ETS, and is a positive step towards achieving emission reductions at the least cost in the long run. However, dynamic modelling results underline the difficulties in forecasting the impact of the MSR on banking behaviors of operators and EUA prices. Inadequate parameters are likely to spur volatility and can have detrimental consequences on the low-carbon investment framework.

Trotignon (2014) highlighted that, if thresholds are not set properly, there is a high risk of instability. Carbon prices could increase significantly over short timeframes, leading to high levels of abatement that could be followed by a sudden drop in price.

- If the upper threshold of the surplus corridor is below hedging needs, this may entail additional banking behaviors that will lead to a growing surplus and prompt increasing withdrawal of allowances by the MSR.
- Increasing withdrawals may send further scarcity signals to market participants and drive them to increase abatement beyond what would be efficient. Such a chain reaction would likely give rise to great volatility.

In order to insulate the scheme from this risk, a thorough understanding of hedging needs and the design of parameters accordingly are of paramount importance. With the ongoing transformation of the power sector, epitomized not only by an increasing share of renewable energy, but also by the emergence of new business models for utilities, hedging needs are likely to evolve significantly. Only appropriate governance can adapt the MSR to these changing circumstances in a timely fashion.

Moreover, a major default of the mechanism lies in its inability to discriminate between different types of surplus. A "good" surplus, stemming from abatement efforts and a "bad" surplus stemming from exogenous shocks should not be dealt with the same way. As demonstrated in Chapter 1, surplus spurred by complementary policies should be withdrawn from the supply of allowances. As a first best, this adjustment should be done in the ex-ante assessment and embedded in the emissions cap. In this case, the complementary policy would not give rise to additional surplus.

For policies undertaken after the cap has been defined, intervention of the MSR would be warranted to eliminate the corresponding surplus. This also holds true when complementary policies over achieve their objectives.

Beyond complementary policies, a surplus of allowances arising from macroeconomic cycles could be viewed as a countercyclical effect but could however be harmful for the cost-effectiveness of the trading scheme. Indeed, it would have a downward impact on prices whereas the need to stimulate low carbon investments and innovation still exist. In case of technological breakthrough and massive low carbon investments entailing large abatements, a structural surplus would mean that long term commitments can be achieved at a lower cost than expected and this should be revealed by the carbon price. Therefore, it should not systematically be removed from the supply, as this could trigger the 'chain reaction' mentioned earlier.

Therefore, it is necessary to establish a regulatory and institutional framework in order to recalibrate the MSR. Given the wide range of uncertainties, some degree of "human" intervention will be essential to carry out a thorough analysis of the surplus and its impact on behaviors and banking.

A periodical review, based on the annual report of the carbon market functioning, should determine whether the surplus in the market provides sufficient liquidity, and whether it undermines the perception of long term scarcity by market participants. If the surplus is thought to be harmful for the least cost achievement of long term goals, a review of the parameters should be undertaken to tackle the surplus. A clear procedure should be established to ensure predictability, outlining which parameter can be updated and at what time (for instance, in 2021, and every five years thereafter). However, the governance should allow for sufficient reactivity to avoid important deviations of the carbon price from the efficient pathway. If very large changes in the fundamentals are witnessed, a process for a quick update should be necessary.

Conclusion - The MSR is a welcome mechanism to restore short-term scarcity but may need to be recalibrated to guarantee the long-term cost-effectiveness of the EU ETS

The MSR is a highly welcome provision for the EU ETS as it is expected to gradually absorb the current surplus and provide flexibility to face exogenous shocks. This will clearly help overcome market imperfections linked to the shortsightedness of market participants and their limited ability to bank allowances at social discount rates. Therefore, it will help drive the price trajectories closer to more efficient ones.

At the same time, the surplus is not necessarily a good indicator of the health of the EU ETS, and the major drawback of the mechanism lies in its inability to discriminate between surplus stemming from abatement efforts and surplus stemming from exogenous shocks. A "robot-like" withdrawal of surplus is likely to spur volatility and can have detrimental consequences on the low-carbon investment framework. Some degree of "human intervention" will be essential to recalibrate the MSR in a timely fashion and to safeguard the dynamic efficiency. Some stakeholders have called for a committee of experts to assess the state of the EU ETS before formulating recommendations to adapt the design of the MSR accordingly.

If one considers that the lack of credibility in long term climate commitments is the core issue, more than myopia of market participants, a price corridor would be more efficient to stabilize expectations and reduce price uncertainties. Going forward, (Helm, 2003; Grosjean, 2014), show that some degree of delegation to an independent authority could have positive effects on the stability of the market by adjusting the supply of allowances according to long term price expectations in line with the decarbonisation target.

3. INTRODUCING THE MSR IN THE EU ETS BY 2030: RESULTS BASED ON THE POLES MODEL

The ex-ante impact analysis of the MSR is performed using the POLES model, with which it is possible to use as an input the level of surplus to be used in the ETS over the simulation period leading up to 2030. The impact of the MSR on the level of surplus is first estimated in the context of a brief literature review. Further, two comparative scenarios (with and without the MSR) are calculated and analyzed.

Literature review

As an input of the modelling exercise, the level of surplus and its evolution over time can be considered under various framework conditions. Most of the analyzes performed on the potential impact of the MSR on allowances surplus include:

- EC, 2014: the Impact Assessment of the European Commission, January 2014;
- UK, 2014: UK position on the MSR, October 2014;
- Ecologic Institute Berlin, 2014: the Next EU Climate and Energy Package, August 2014;
- Ecofys, 2014: assessing the EU 2030 Climate and Energy targets, March 2014.

These sources provide a broad and diverse array of approaches to the methodology referred to for the quantification of the surplus, going from a brief government's position to more detailed analysis reports. These studies, which differ in their treatment of backloaded allowances leading up to 2020, rely further on the assumption of the introduction of the MSR from 2021 onwards. The present analysis provides an assessment of the surplus evolution accounting for the MSR introduced as of 2019. Figure 8 summarizes the results of the studies mentioned in terms of surplus' projections up to 2028-2030 if available. This Figure compares these projections with the reference scenario of the European Commission, leading up, in 2028, to a surplus reduction ranging between 1,625 $MtCO_2$ (Ecologic Institute Berlin), and 1,860 $MtCO_2$ (Impact Assessment of the European Commission, MSR option 2c). The projections provided by Institute for Climate Economics, which are consistent with (Ecologic Institute Berlin, 2014) in the long run and account for an introduction of the MSR in 2019, are considered for the present scenario analysis.

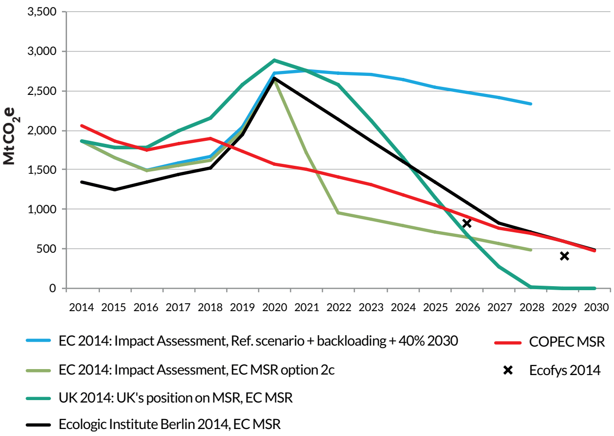
Scenario definition

Based on the literature review described above, two scenarios are defined, both following the same evolution of surplus until 2018 (I4CE – Institute for Climate Economics, 2015):

- **COPEC Reference:** in the reference scenario, the level of surplus from 2019 corresponds to the EC, 2014 reference case;
- **COPEC MSR:** in this scenario, the MSR is introduced from 2019, leading up to a level of surplus of 475 $MtCO_2$ in 2030 (I4CE – Institute for Climate Economics, 2015, see previous section).

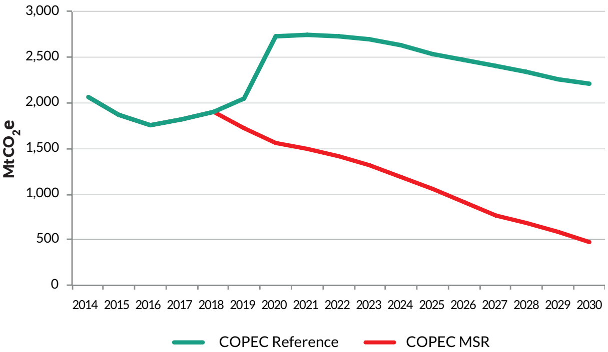
The evolution of the surplus, illustrated in Figure 9, is used as an input for the POLES-Enerdata model, in the way that it impacts the reduction cap of the EU-ETS sector until 2030 and therefore the carbon price incentive needed to reach this yearly level of emissions reduction.[12]

Figure 8 - Impact of the MSR on the evolution of the allowance surplus: literature review.



Source: EC 2014, UK 2014, Ecologic Institute Berlin 2014, Ecofys 2014, I4CE – Institute for Climate Economics, 2015.

Figure 9 - Scenario definition for the impact of the MSR on the evolution of the allowance surplus.



Source: I4CE – Institute for Climate Economics, 2015.

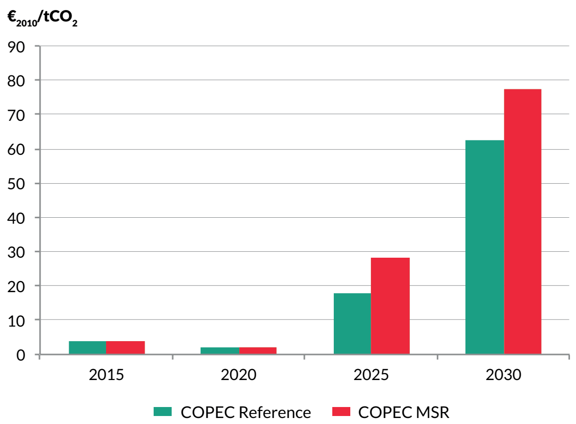
12. The modelling approach does not consider free allocation to inductrial sectors exposed to carbon leakage in Phase IV.

Results

As seen in Figure 10, the introduction of the MSR from 2019 leads to an increase in the CO_2 price due to a reduced number of surplus allowances. The difference in CO_2 price observed between both scenarios increases progressively to reach €$_{2010}$15/tCO_2 in 2030. For comparison purposes, this impact has been analyzed in a wide range of further studies. Among others, Ferdinand(2014) calculates a price increase of about €$_{2010}$11/tCO_2 (from €$_{2010}$28/tCO_2 to €$_{2010}$39/tCO_2) by 2028, whereas Trotignon(2014) estimates it could reach approximately €$_{2010}$26/tCO_2 (from €$_{2010}$40/tCO_2 to €$_{2010}$66/tCO_2),[13] compared to a €$_{2010}$13.2/tCO_2 increase in the present analysis for the same year.

The methodology applied allows for analysis of the economic impacts that the introduction of the MSR from 2019 could have in different EU ETS sectors.[14] Table 2 provides an overview of the additional abatement costs that can potentially accumulate from 2015-2030, resulting in the ETS individual sectors from the MSR. Approximately two thirds of additional abatement costs are supported by the power sector. This sector is one of the most flexible and has significant emissions reduction potential derived from relatively low average reduction costs (€$_{2010}$39/tCO_2 avoided). To a lesser extent industry, and in particular the mineral products sector, also plays a significant role in the additional reduction effort needed.

Figure 10 - Impact of the MSR on CO_2 price in the EU ETS.



Source: Enerdata, POLES and Carbon Market Tool models, 2015.

For the EU ETS as a whole, total additional abatement costs amount to €$_{2010}$1.7 billion cumulated over the period 2015-2030.[15]

Apart from abatement costs due to emission reductions, the EU ETS will see, with the introduction of the MSR, an additional cumulated investment reaching €$_{2010}$ 21 billion from 2015-2030. The power sector is estimated to support about 66% of this investment in new production capacities, whereas 34% would be invested in final demand sectors such as industry and households. As a consequence of the introduction of the MSR from 2019, the end user price of electricity is increased by approximately 2% in 2030 compared to the case without MSR.

Table 2 - Impact of the MSR on 2015-2030 cumulative abatement costs in the ETS.

Sector	Δ abat. costs cum. 2015-2030 [€$_{2010}$mio]	2015-2030 % of total	Average cost/tCO_2 avoided [€$_{2010}$/tCO_2]
Industry	**403.4**	**23.6%**	**46.1**
Chemicals	47.8	2.8%	40.9
Manufacturing	29.7	1.7%	38.3
Mineral Products	178.3	10.4%	46
Steel	76.4	4.5%	71.2
Upstream and Refining	71.1	4.2%	38.4
Power	**1,129**	**66.0%**	**38.6**
Buildings	**21.4**	**1.3%**	**15.9**
Residential	14.5	0.8%	30.4
Services	6.9	0.4%	8
Air Transport	**152.8**	**8.9%**	**43.4**
Domestic	21.8	1.3%	42.8
International	130.9	7.7%	43.5
Agriculture	**4.2**	**0.2%**	**28**
Total ETS	**1,710.8**	**100%**	**39.8**

Source: Enerdata, POLES and Carbon Market Tool models, 2015.

13. Both Ferdinand, 2014 and Trotignon, 2014 results are based on the introduction of the MSR from of 2021.
14. The analysis carried out in the following of this section has been performed by a model coupling between the long-term energy system model POLES and the Carbon Market Tool, dedicated software for the analysis of carbon markets worldwide. Please see the Annex for more information about Carbon Market Tool.
15. These results would probably be amplified in the reality by considering possible free allocations for industrial sectors subject to carbon leakage over Phase IV of the ETS, provision which is accounted for in the modeling work.

Table 3 - Impact of the MSR on additional permit trading ($MtCO_2$) in the ETS.

Sector / Δ $MtCO_2$ imports	2025	2030
Industry	**4.1**	**16.1**
Chemicals	0.0	1.4
Manufacturing	0.4	1.5
Mineral Products	1.1	8.9
Steel	0.9	-1.1
Upstream and Refining	1.6	5.4
Power	**-4.0**	**-18.3**
Buildings	**0.2**	**1.8**
Residential	0.2	1.1
Services	0.1	0.6
Air Transport	**-0.6**	**-1.0**
Domestic	0.1	0.3
International	-0.7	-1.3
Agriculture	**0.2**	**0.7**

Source: Enerdata, POLES and Carbon Market Tool models, 2015.

Table 3 provides detailed information on sectorial burden sharing within the ETS. The introduction of the MSR is basically supported by the power sector, which achieves additional domestic reductions that allow it to sell approximately 18 $MtCO_2$ to the market. To a lesser extent, the aviation sectors' international bunkers offer flexibility to increase their emission reduction efforts and become a net permit exporter in comparison to the case without MSR. On the demand side of the ETS market, the industry sector increases it sourcing on the market by about 16 $MtCO_2$. Two sectors in particular, namely mineral products and upstream and refining are responsible for this trend.

4. ETS DESIGN BEYOND EUROPE: STABILISING CARBON PRICES AND COMPLIANCE COSTS

It can be useful to refer to the experiences of other emissions trading schemes when assessing flexibility provisions. To guarantee a certain level for the price of carbon a price floor, a price ceiling or an allowances reserve can be implemented. Many programs such as those implemented in North America, and China have implemented at least some flexible mechanisms to help stabilise the price of carbon in their respective programs, thereby managing supply, market uncertainty while maintaining an incentive to decarbonise. The table below provides a brief overview of how other emissions schemes use flexibility mechanisms to counteract the effects of market uncertainties.

Table 4 - Flexibility mechanisms in Emissions Trading Schemes implemented beyond Europe.

Scheme		California	RGGI	Beijing Pilot
Banking		Allowed but subject to holding limits (quantity is based on a multiple of the entities annual allowance budget).	Unlimited, banked allowances will factor into future state emissions budgets.	Allowed, but banked allowances cannot be carried forward beyond the pilot period.
Borrowing		Allowed for two situations: 1. From future periods for compliance in the current period, but only to satisfy an excess emissions obligation. 2. If the quota was purchased from the APCR to contain the price.	Not permitted.	Not permitted.
Offsets		Up to 8% of total compliance obligation. Includes early action offsets international sector based offsets and ARB offset credits.	Up to 3.3% of compliance obligation. Domestic offsets within RGGI jurisdiction only (landfill methane capture, SF6 in the power sector, forest sequestration and afforestation, avoidance of CO_2 from natural gas and oil, avoided methane from agriculture).	5% of annual compliance obligation can be met using CCERs or other certified projects. 50% of offsets generated have to be located in Beijing.
Price Floor		\$12.10 (2015) the price increases annually by 5% plus the rate of inflation.	\$2.05 (2015), the minimum price increases by 2.5% annually.	None.
Reserve	**Cost Containment Reserve (price based)**	Allowance Price Containment Reserve: collects a portion of allowances each year to release them if certain predetermined trigger price is reached.	Cost Containment Reserve: Contains fixed quantity of allowances above the cap that are held in a reserve. In 2015 the reserve will contain 10 million allowances.	Government sets aside 5% of total annual allowances. When the average price of allowances are above 150 Yuan or below 20 Yuan (over ten consecutive trading days), the government will purchase surplus allowances from the market.
	Allowance Reserve (quantity based)	None.	None.	None.

Source: I4CE – Institute for Climate Economics, 2015 based on national ETS legislation.

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