Innovation Brief

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Managing Carbon Market Uncertainties

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Summary

Since the launch of the EU Emission Trading System (ETS) in 2005, the emerging carbon market price has been very sensitive to recent global economic changes creating uncertainties. Market players are facing tremendous challenges to manage those uncertainties. This brief addresses the problems created and the challenges for market players to find ways of stabilising prices. Mott MacDonald can assist players to reduce price risks and maximise opportunities for profit using tested techniques from other commodities to be innovatively applied to the carbon market.

The problem

The carbon market is a relatively new market. However, the market price for carbon credits has already experienced high fluctuations. Market players, buyers and sellers, have to contend with instability in prices. For instance, the carbon credit price for CERs (Certified Emission Reductions) was quite low at around 10€/t in March 2009 compared to 24€/t in July 2008. The expected future EUA (EU Allowances) price is also uncertain. As shown in *Table 1* during the last quarter of 2008 there was a continuous decrease in the predicted EUA price for December 2013.

Table 1: Predicted EUA price for December 2013

Prediction Date	Predicted EUA price
22nd Sept. 2008	€ 30.68
13th Oct. 2008	€ 26.51
28th Nov. 2008	€ 20.71
15th Dec. 2008	€ 20.39

Source: Reuters

This uncertainty can deter market players, as they fear their potential revenues from this market may diminish forcing them to withdraw. This will also have a negative effect, creating more uncertainty in the carbon market price, potentially entering into a downward spiral.

At the same time due to current cuts in European industrial production as a result of the global financial crisis, greenhouse gas emissions will be lower than expected, leading to an overspill of credits and acceleration in potential decrease of credit prices. As long as the economic situation does not show any signs of recovery, prices could continue to slide in the near future. The current financial crisis demonstrates how suddenly the economy can weaken and influence market prices, increasing the wariness and unwillingness of sellers and buyers when it comes to taking risks.

Buyers in the carbon market are usually brokers or companies that are carefully buying the credits for their own use. Both of them are cautious in buying credits, as a decreasing market price will reduce future revenues. It is also true that the originator of the credits or a broker will be reluctant to sell credits, as an increasing market price will reduce their potential future revenues. Thus, it is important for the carbon buyers to minimize credit price risk and to find a way to stabilize the price over the years.

Graph 1: Historical Carbon Market Price in Euro/tCo_2

Source: PointCarbon – 25 March 2009

Graph 1 depicts the development of the CER over the counter price between July 2007 and March 2009. In February 2009, the carbon price once again started to increase. However, it is uncertain whether this improvement will continue.

The Challenge

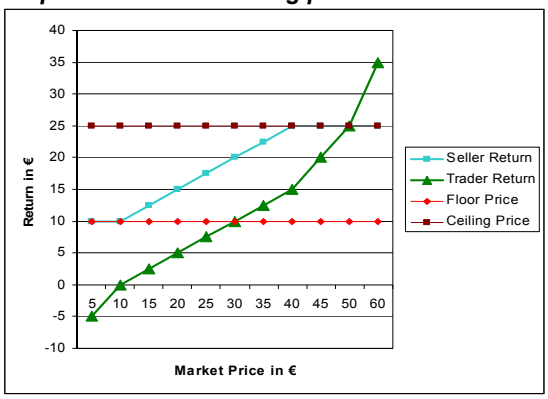
The uncertain CER market faces major challenges: How can the market price for carbon credits and their revenues be stabilised? How can a fair balance of the market risk between buyers and sellers be determined?

The Innovation: Selection of opportunities and defining an innovative commercial strategy based on other commodities

A solution to this dilemma is to define agreed prices which assure sellers higher carbon credit prices in the future and buyers lower prices. This innovative commercial strategy has already been successfully applied to negotiations of Power Purchase Agreements (PPA) and Fuel Purchase Agreements (FPA) and can be transferred to the carbon market. The idea is that market players agree on a floor price and a ceiling price, between which they share the risk of an arbitrage of loss or gain. Arbitrage allows for profitable exploitation of price differences of identical or similar financial instruments, on different markets or in different forms.

Graph 2 depicts an assumed floor price of €10 and an assumed ceiling price of €25, agreed by market players.

Graph 2: Floor and Ceiling price



Source: Mott MacDonald's Carbon Team

If the market price is between the agreed boundary prices, market players share the revenue of a price above the floor price. In this case the buyer will pay the floor price plus the median market value to the seller. The median market value here is defined as 50% of the difference between the market price and the floor price.

For example: Assuming a market price of €15 and a 'Delivered Quantity' of z, the formula would be: Seller Return (y) = z * (€10 + (€15-€10)*50%) = z * €12.50.

Thus in this case, with the market price between floor price and ceiling price, the seller wins 50 percent of the arbitrage value, which it would otherwise have lost to the buyer. In case that the market price is below the floor price, the seller simply receives the floor price. If the floor price added to the median market value is higher than the ceiling price, then the buyer has to pay the ceiling price and gets the arbitrage between ceiling and market price, whereas the seller loses it.

The buyer's return is smaller than the seller's return, as the seller tends to carry more risks such as technical, volume and price risks of delivery of carbon credits. The only risk for the buyer is to find other buyers.

Table 2 illustrates the returns to the seller and buyer assuming a floor price of €10 and ceiling price of €25.

Table 2: Example

Market Price	Seller's Return	Buyer's Return
€ 5	€ 10	-€ 5
€ 10	€ 10	€ 0
€ 15	€ 13	€ 3
€ 20	€ 15	€ 5
€ 25	€ 18	€ 8
€ 30	€ 20	€ 10
€ 35	€ 23	€ 13
€ 40	€ 25	€ 15
€ 45	€ 25	€ 20
€ 50	€ 25	€ 25
€ 55	€ 25	€ 30

Source: Mott MacDonald's Carbon Team

To ensure optimum conditions, the buyer and investor negotiate the floor and ceiling prices. During negotiations the buyer will try to keep floor and ceiling prices as low as possible whereas the seller will try to keep both prices higher.

To negotiate fair agreements for the floor and ceiling price trading partners must have knowledge about

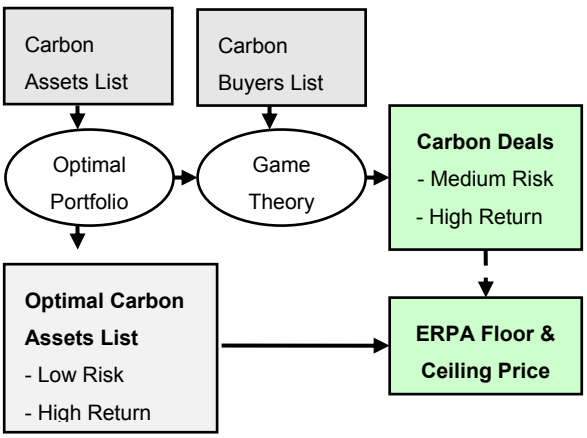
the carbon market and its development. Furthermore, they will need some knowledge of the financial market and the technology involved in the project under consideration. This necessitates specific experience and familiarity in this area, access to information and time available for researching.

Suggested way forward and the role of Mott MacDonald

As the defining of fair floor and ceiling prices is not easy and will take time, there is a clear role for experienced companies with knowledge about carbon trading, the carbon market and financial markets. Mott MacDonald could offer this extra service to customers. Mott MacDonald is already supporting their customers with the procedure of receiving credits and communicating between clients and brokers in the carbon market community. The position as an independent communicator is to define fair and realistic floor and ceiling prices for agreement between market players. Through years of experiences Mott MacDonald has the knowledge and information to define fair floor and ceiling prices.

Our company has already developed a system for minimizing the carbon price risk. We have created an innovative methodology for a utility with several carbon assets as a financing tool in carbon markets.

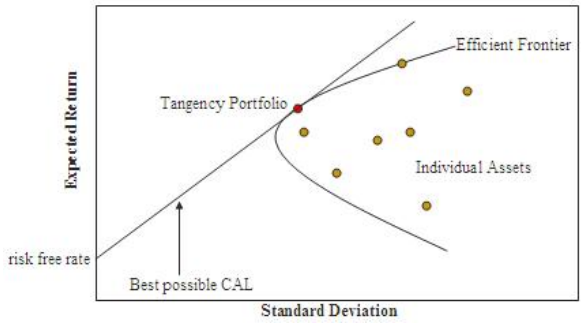
Diagram 1: Minimizing the carbon price risk



Source: Mott MacDonald's Carbon Team

The level of risk with regards to carbon assets (delivery of carbon credits and regulatory bodies) can be different depending on the project. Assets with a higher risk often have a higher return (revenue from carbon credits minus costs), while assets with a lower risk generally have a lower return. A portfolio of projects can increase the return and decrease the risk. The aim is to find the "tangency portfolio"— the portfolio with the highest Sharpe ratio. This is the combination of projects that together can amass the highest possible return with lowest risk. *Graph 3*l would be the point where the Efficient Frontier Curve meets the Capital Allocation Line (CAL.). The Efficient Frontier Curve is a curve on which an optimal portfolio is based. Beyond it is impossible and between the curves it is not efficient. The Capital Allocation Line is the line of expected return plotted against risk that connects all portfolios that can be formed using a risky asset and a risk-less asset.

Graph 3: Tangency Portfolio



Source: Wikipedia

From all possible carbon assets of the client, Mott MacDonald can analyse the portfolio with the best combination of assets to obtain the best possible balance of low risk and high return. Projects of the optimal carbon assets list should be developed by the client. The client will be in a position to sell the carbon credits over an ERPA (Emission Reduction Purchase Agreement) with floor & ceiling prices to be defined by Mott MacDonald.

The other carbon assets with higher risks should be developed partly by third parties. The idea is to find carbon buyers that invest in those projects to lower the development risk and therefore discount the carbon credit price quotation of those particular opportunities. Using Game Theory, Mott MacDonald can define the best opportunity for the client regarding the amount of risk reduction and carbon price quotation. The starting point for using Game Theory is to construct a pay-off matrix which shows the outcomes (profits/losses) for a given combination of strategy and events. The strategies are under the

control by the client, while the events represent different market outcomes (which will be in this case the actions of the carbon buyers). *Table 3* presents an example of a pay-off matrix:

Table 3: Game Theory

	Event 1	Event 2	Event 3	Event 4
Strategy1	23	14	-5	2
Strategy2	15	12	19	-25
Strategy3	3	3	-1	21

Source: Mott MacDonald's Carbon Team

In Game Theory all pay-off cells are treated as having equal probability. Game Theory examines which strategy yields the highest results on different events. The selection criteria reflect the client's risk preference. Three different selection criteria exist:

- Maxi-Max strategy that has maximum possible pay-off,
- Maxi-Min strategy that maximises the worst outcome, and
- Mini-Max-regret strategy that minimises the maximum regret that the client can experience.

The chosen strategy will include carbon deals with a medium risk and the highest possible return for this risk. Though the strategic choice is a carbon credit price already agreed with the credit buyer, the agreement could include a floor and ceiling price.

To define the floor and ceiling prices for carbon credits of the optimal carbon assets list Mott MacDonald would use Game Theory as well. This time based on six different price combinations of floor and ceiling prices used as strategies and possible carbon market developments that result in different credit prices as events. Mott MacDonald could use the following five market scenarios.

- Business as Usual (BAU): this would include oil and gas prices falling slowly from today's highs; steady demand growth; albeit decelerating; no carbon constraints rules in EU; and, gradually increasing carbon prices in the EU.→ Slightly increasing credit price compared to today.
- Higher crude oil prices, as in BAU but with higher oil product and gas prices, plus higher carbon prices, all of which will feed through to higher wholesale power prices in EU. → Increasing credit prices compared to today.
- Lower crude oil prices, as in BAU but with lower oil product and gas prices, plus lower carbon prices, all of which will feed through to lower wholesale power prices in EU. → Lower carbon prices than today.
- Capacity crunch, in which generation margins in Europe become very tight as a result of delayed investment and strong growth in demand.
- Carbon constrained, in which demand growth is substantially slowed. → Carbon price stable.

The outcome of the matrix could then be ranked with the selection criteria (Maxi-Max, Maxi-Min and Mini-Max-regret), with options favouring the client ("seller") and with options favouring the carbon buyer, in order to find the fairest strategy and fairest floor and ceiling prices.

Our invitation

The Renewable and Low Carbon Team of Mott MacDonald assists companies, organizations and governments in the development of profitable emission reduction projects, including the whole regulatory process, not only for EU Allowances (EUA), but also for Certified Emission Reductions (CER) and Voluntary Emission Reductions (VER) as well. We also advise key carbon market players in the profitable trading of their carbon credits.

We invite you to contact us to explore the opportunity to work together in developing carbon credit trading with lower risks and higher returns.

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