

# CO<sub>2</sub> Emissions – A New Asset Class for Institutional Investors

**“I can certainly see carbon becoming the biggest of any derivatives product in the next four to five years. And that would of course mean overtaking T-Bills (Treasury) and any other contract that is out there right now” Bart Chilton, Commissioner, CFTC, Financial Times, March 10, 2008.**

## Introduction

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CO<sub>2</sub> emissions trading is an important and efficient instrument to limit greenhouse gas emissions. The European Union Emission Trading Scheme (EU ETS) was launched in January 2005 as part of the Kyoto Protocol on climate change. In 2007<sup>1</sup>, it has grown rapidly to a trading volume of 1.6 billion tonnes of CO<sub>2</sub> (approximate market value of EUR 28 billion), with one tonne of CO<sub>2</sub> representing one EUA. One EU Emission Allowance (EUA) is the smallest trading unit within the EU ETS, being sold to installations which have to cap on their emissions.

The ETS is regarded as the world-wide reference system for a standardized emissions trading system in an overall global emissions market<sup>2</sup> of 2.7 billion tonnes of CO<sub>2</sub>. Trading volume and trading frequency within the EU ETS is expected to further increase significantly with the beginning of the second trading period in 2008. All member states of the European Union can auction up to ten percent of their carbon allowance credits for the second phase of the EU ETS “cap-and-trade” scheme which runs from 2008 to 2012. Within such a scheme polluters buy credits to offset emissions beyond the caps established by EU regulators and institutions that do not require all their allotted credits can trade that is sell them. Recently the U.K. announced that is to hold its first auction of EUAs in September 2008.

Next to EUAs, Certified Emission Reductions (CERs), which are tradable instruments generated from Clean Development Mechanism (CDM) projects, are currently emerging as the international currency in the global carbon market. After reaching a trading volume of 350 million tonnes of CO<sub>2</sub> in 2007<sup>3</sup> in the secondary market, estimates are that the market will reach 2.6 billion tonnes of CO<sub>2</sub> by 2012<sup>4</sup>, and will be worth EUR 41 billion.

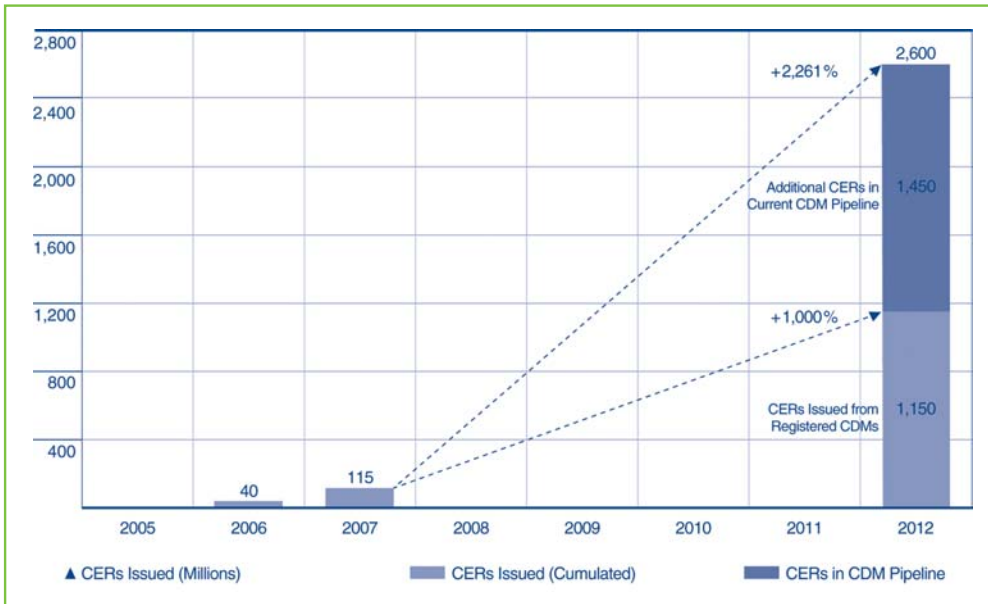
<sup>1</sup> Point Carbon, “Carbon Market Monitor January 2008: A review of 2007”.

<sup>2</sup> New Carbon Finance, “North America and Global Carbon Market – June 2007”.

<sup>3</sup> Point Carbon, “CDM & JI Monitor”.

<sup>4</sup> UNFCCC (United Nations Framework Convention on Climate Change) 2008 CDM Statistics.

Diagram 1: Projected Growth of the CERs Market



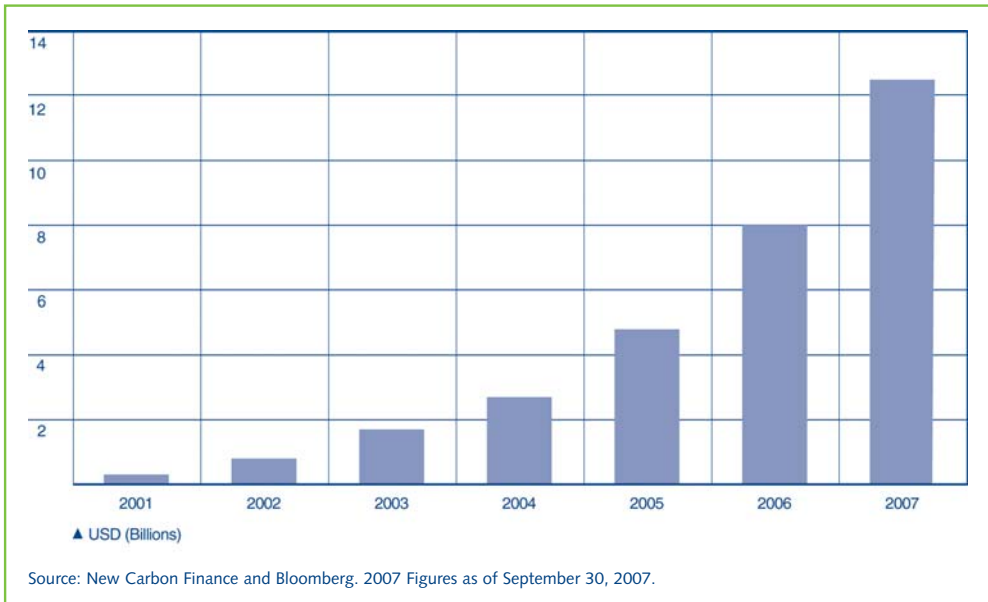
The U.K. is the leading investor in CDM projects with 41.5 percent of projects. In January 2008, a total of 907 CDM projects were registered at the UNFCCC, another 1,893 CDM projects are currently in the pipeline. More than 50 percent of the 907 CDM projects registered were located in India and China; India accounting for the largest share with 33.5 percent. Brazil currently accounts for 12.7 percent of the worldwide registered CDM activity. However, in terms of value of CDM projects, China is far ahead of all other countries.

### Current Market Development

A sign of the growing maturity and importance of the CO<sub>2</sub> emissions market as a new asset class is the growing number of indexes covering this specific market. In April 2008, Merrill Lynch and Société Générale launched emissions indexes on EUAs and CERs, the MLCX Global CO<sub>2</sub> Emissions Index and the SGI-orbeo Carbon Credit Index; already, Barclays Capital (the Barclays Capital Global Carbon Index) and UBS (the UBS World CO<sub>2</sub> Emissions Index) have launched emissions indexes. Such indexes will provide the base for the construction of structured products on emissions markets.

As emissions trading has increased equally the number of carbon funds emerged, set up for the financing of CO<sub>2</sub> emission projects in developing countries and the generation of large amounts of CERs – in 2006 Climate Change Capital raised more than EUR 800 million for a new carbon investment fund with Dutch pension funds, ABP and PGGM providing more than two thirds of the investment. A unit of the Man Group raised USD 382 million for a fund specializing in greenhouse gas (GHG) projects at Chinese coal plants, the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB) jointly manage the Multilateral Carbon Credit Fund, the Nordic Carbon Fund saw investment by Finland's Ilmarinen Mutual Pension Insurance Company and recently Merzbach Group launched a Carbon Hedge Fund in carbon asset projects whose aim is to attract USD 100 million in investment, to name just a few. Diagram 2 outlines the enormous growth in investment in carbon funds.

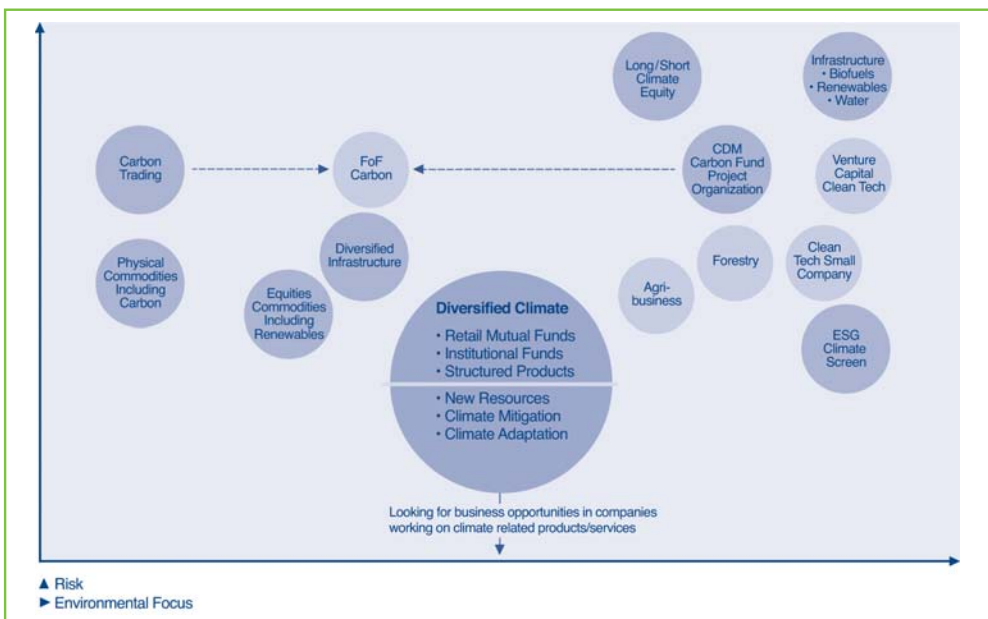
**Diagram 2: Cumulative Investment in Carbon Funds**



Also, there exists a plethora of investment funds related to the investment in companies and industries involved in the mitigation of and adaptation to climate change – F&C Global Climate Opportunities Fund, Schroder Global Climate Change UK Unit Trust, Schroder ISF Global Climate Change Equity Luxembourg SICAV Fund, Cowen Asset Management Climate Change Fund and Henderson Global Investors' Global Care Growth Fund, for example, Deutsche Asset Management had over EUR 6 billion in climate change investment strategies by the end of September 2007.

Mark Fulton, climate change strategist at Deutsche Asset Management in New York, in "Investing in Climate Change: An Asset Management Perspective" aptly outlines the linkage between the various climate change investment vehicles and the role of CO<sub>2</sub> trading:

**Diagram 3: Climate Change Investment Strategies**



## EEX/Eurex CO<sub>2</sub> Emissions Trading Products

Since December 2007, EEX and Eurex have been cooperating in emissions trading. The alliance combines EEX's energy market membership and connectivity to the European power trading community with Eurex's financial market membership and global distribution network. The following CO<sub>2</sub> derivatives are available:

**Table: EEX/Eurex CO<sub>2</sub> Products**

Product	Eurex Product ID	Introduction
EUA Futures	F2PE	December 5, 2007
CER Futures	FCER	March 26, 2008
Options on EUA Futures	O2PE	April 14, 2008

In addition to electronically trading the EEX/Eurex products in the central order book, market participants also have the possibility of entering bilaterally agreed OTC transactions into the Eurex<sup>®</sup> system. Registered OTC trades are then automatically cleared as regular exchange transactions. The OTC Block Trade facility is fully electronic, therefore causing a significant reduction in operational cost and risks. Eurex and EEX imposed no size restrictions on block trades in CO<sub>2</sub> products (please visit the appendix for more in depth information).

## EUAs and CERs – No Correlation to Traditional Asset Classes of Government Bonds and Equities

The attraction to fund managers and hedge funds in EUAs and CERs as an asset class lies in their non-correlation to the traditional investment asset classes of bonds and equities. For the period of November 1, 2007 to March 18, 2008 an econometric analysis was made to examine the relationship between the (daily) change in EUAs and CERs (for December 2008 settlement) and the (daily) change versus the following financial instruments:

- Three-Month EURIBOR rate
- Dow Jones EURO STOXX 50® Index
- DAX®
- DBR 4.5% 2013 (Euro-Bobl Future deliverable bond)
- DBR 3.75% 2017 (Euro-Bund Future deliverable bond)
- DBR 4.25% 2039 (Euro-Buxl® Future deliverable bond)

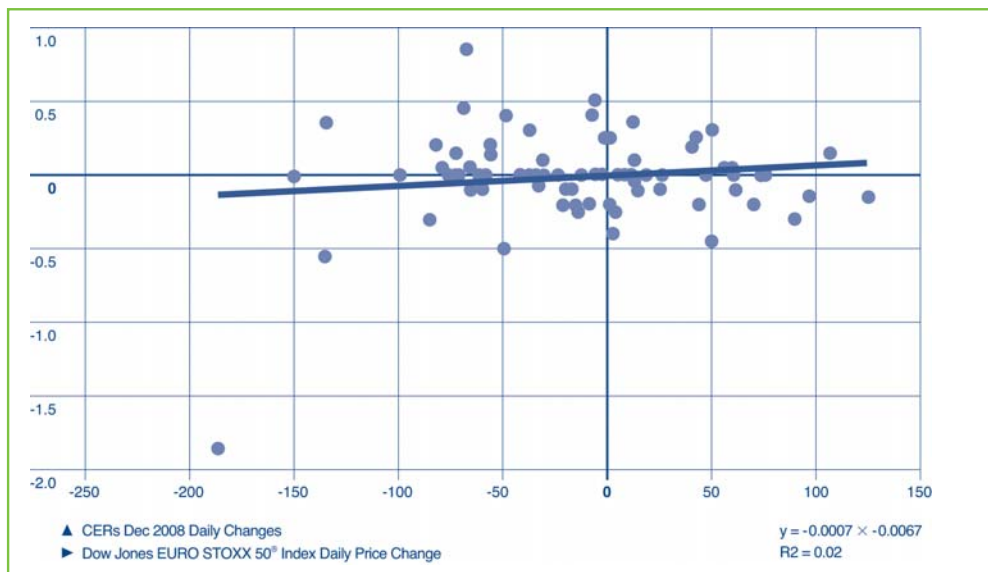
**Table: Results of Econometric Analysis November 1, 2007 to March 18, 2008**

Daily Change	Daily Change						
	Three-Month EURIBOR	Dow Jones EURO STOXX 50®	Dow Jones EURO STOXX 50®	DAX®	DBR 4.5% 2013	DBR 3.75% 2017	DBR 4.25% 2039
<b>EUAs Dec 08</b>	0.03*	0.05*	0.05*	0.07*	0.01*	0.01*	0.03*
<b>CERs Dec 08</b>	0.09*	0.02*	0.02*	0.05*	0.01*	0.03*	0.08*

\* Value of R2, 'goodness of fit' statistic between the two variables. A close statistical relationship between two variables has a R2 higher than 0.7, low values of 0.01/0.9 show very little/no correlation.

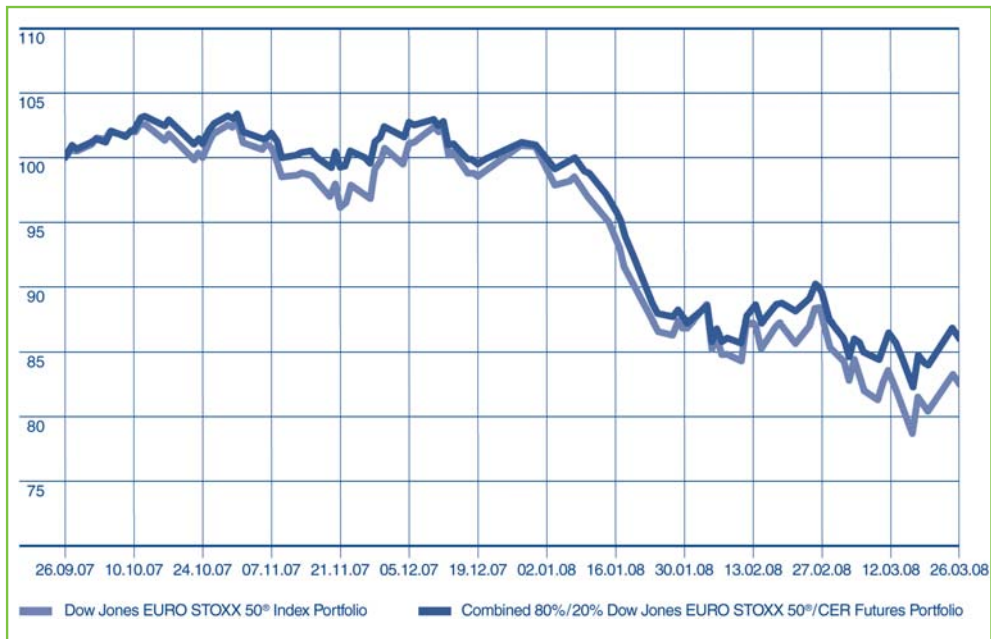
The results of the analysis clearly show that there is little correlation between the traditional asset classes of European government bonds and European equities to that of EUAs and CERs. The value of the R2 "goodness of fit" statistic in all the analyses carried out between the (daily) change in EUAs and CERs and the traditional asset classes of bonds and equities shows that no significant correlation exists between these asset classes. This is underlined by looking at a scatter diagram (Diagram 4) of one of the two variables under analysis; the (daily) change in CERs compared to the (daily) change in the Dow Jones EURO STOXX 50® Index:

**Diagram 4: Correlation Between CERs & Dow Jones EURO STOXX 50® Index**



The benefit of incorporating a non-correlated asset like CO<sub>2</sub> emissions into a traditional asset class of bonds or equities can be simply shown by analyzing the returns of an equity portfolio represented by the Dow Jones EURO STOXX 50® Index and comparing the returns of a combined equity/CO<sub>2</sub> emissions portfolio in a, for example, 80:20 ratio (rebalanced weekly).

**Diagram 5: CO<sub>2</sub> Emissions – Benefits of Incorporating a Non-Correlated Asset Class**



The returns comparison (Diagram 5) clearly shows the benefits of incorporating CO<sub>2</sub> as a non-correlated asset to an equity portfolio with the combined 80 percent/20 percent Dow Jones EURO STOXX 50® Index/CER portfolio outperforming the portfolio fully invested in the Dow Jones EURO STOXX 50® Index. In “Do Carbon Permits Constitute a Respectable Asset Class?” Hervé-Mignucci and Keppler analyzed the CO<sub>2</sub> emissions market to other markets in terms of:

- Sophistication of carbon exchanges,
- Volatility,
- Information efficiency,
- Liquidity,
- Transaction costs,
- Arbitrage opportunities,
- Asset pricing<sup>5</sup>

and – based on this criteria – concluded that the emissions market was a proper asset class.

Also, like the relationship that exists in cash financial markets and their corresponding financial derivatives, Uhrig-Homburg and Wagner in “Futures Price Dynamics of CO<sub>2</sub> Emission Certificates – An Empirical Analysis”, found that futures lead the price discovery process of CO<sub>2</sub> emission certificates.

<sup>5</sup> There have been a number of studies on carbon asset pricing, Benz and Trück (2008), Daskalakis, Psychoyios and Markellos (2007), Seifert, Uhrig-Homburg and Wagner (2006) and Uhrig-Homburg and Wagner (2007).

## Product Applications

EEX/Eurex CO<sub>2</sub> derivatives offer investors numerous trading opportunities to pursue their investment strategies. The following section outlines various product applications to meet individual requirements of traditional and alternative money managers.

### CO<sub>2</sub> Derivatives & Portfolio Overlay – Increasing the Flexibility of Fund Management

The introduction of CO<sub>2</sub> derivatives to Eurex's existing suite of European benchmark exchange-traded derivative products increases the fund manager's possibilities in assisting changes in portfolio asset allocation efficiently and quickly whilst leaving the existing portfolio intact<sup>6</sup>. For example, a European pension fund manager decides to switch 10 percent of his EUR 100 million European equity holdings into a CO<sub>2</sub> emissions exposure. The European pension fund equity holding has a 1.23 beta to the Dow Jones EURO STOXX 50<sup>®</sup> Index Future. The steps in a portfolio overlay strategy to switch parts of an investment in European equities to CO<sub>2</sub> emissions are as follows:

1. Calculate the appropriate number of Eurex Dow Jones EURO STOXX 50<sup>®</sup> Index contracts to be sold to reduce European equity holdings by 10 percent:

$$\frac{\text{Value of equity holding}}{\text{Future} \times \text{beta} \times 10\%} = \frac{\text{Value of Dow Jones EURO STOXX 50}^{\circledR} \text{ Index}}{\text{EUR 36,740}^7 \times 1.23 \times 0.10} \sim 335 \text{ futures contracts}$$

2. Calculate the ratio of each of the futures contracts' risk positions based on historical price volatility:

$$\frac{\text{Dow Jones EURO STOXX 50}^{\circledR} \text{ Index Future}}{3,674 \text{ (index price)} \times 29.435\% \text{ (30-day historical price volatility)}} = 1,081 = \text{EUR 10,810}$$

$$\frac{\text{EEX/Eurex EUA Future}}{22.46 \text{ (futures price)} \times 25.66\% \text{ (30-day historical price volatility)}} = 5.76 = \text{EUR 5,760}$$

Based on each of the contracts' risk positions, the ratio of Dow Jones EURO STOXX 50<sup>®</sup> Index Futures to EUA Futures is 1 Dow Jones EURO STOXX 50<sup>®</sup> Index Future: 1.8 EUA Futures. Therefore, the pension fund manager would need to buy 603 EEX/Eurex EUA Futures against selling 335 Dow Jones EURO STOXX 50<sup>®</sup> Index Futures to synthetically switch 10 percent of the pension funds' European equity holdings to CO<sub>2</sub><sup>8</sup>. When the fund manager wants to switch out of CO<sub>2</sub> products and return to being fully invested in European equities he unwinds the short Dow Jones EURO STOXX 50<sup>®</sup> Index/long EUA Futures position. Diagram 6 graphically outlines the portfolio overlay strategy<sup>9</sup>:

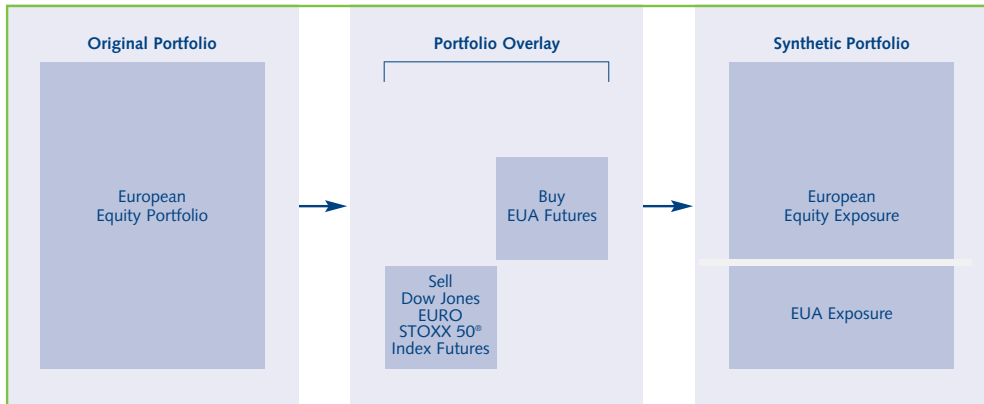
<sup>6</sup> See B.Baldwin, "Derivatives: Increasing the efficiency of Fund Management", Pensions World, December, 2004 for application of exchange-traded derivatives in fund management.

<sup>7</sup> With an index price of 3,674 the value of the Dow Jones EURO STOXX 50<sup>®</sup> Index Future is index price multiplier of EUR 10.

<sup>8</sup> Under this method changes in historical price volatility of the contracts would result in a change in the ratio and the number of contracts in the overlay

<sup>9</sup> The Eurex OTC Block Trade facility ("BTF") enables the initiation of such cross asset class portfolio overlay strategies in Eurex futures and options products off-exchange, whilst maintaining the benefits of having a position in exchange-traded derivative products, cleared by the Eurex Clearing House. See [www.eurexchange.com](http://www.eurexchange.com) and [www.eurexclearing.com](http://www.eurexclearing.com) for more details.

**Diagram 6: Portfolio Overlay – Synthetically Switching Asset Class**



### **EEX/Eurex CO<sub>2</sub> Derivatives – Generating Alpha**

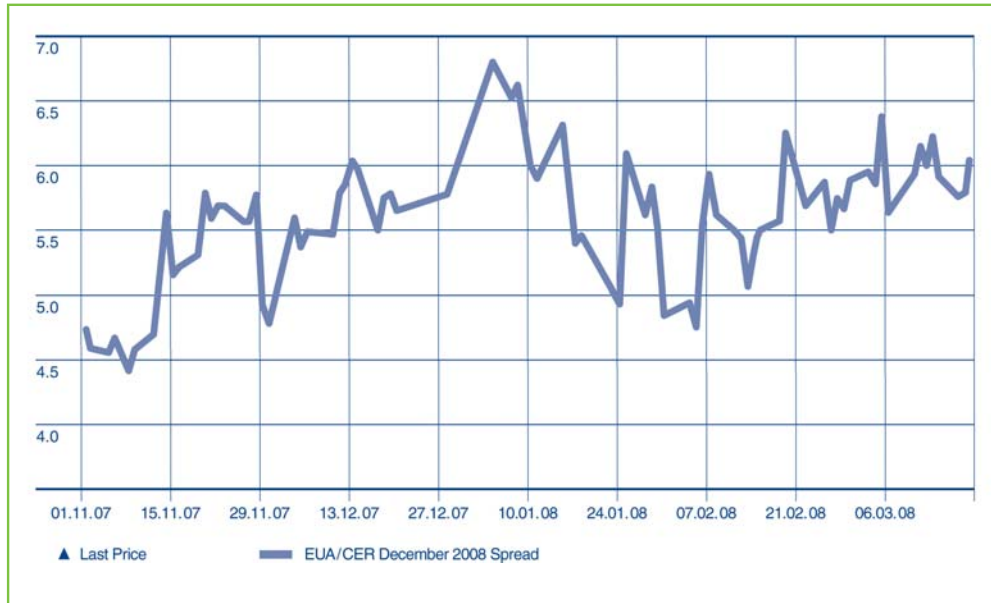
There are already OTC derivative structures – EUA/CER spread options and EUA/CER swaps – to trade the spread between EUAs and CERs. With the introduction of EEX/Eurex CER Futures, initiating EUA/CER spread positions becomes much cheaper, particularly with EEX/Eurex offering cross margining between the two contracts and the benefit of substantially reduced counterparty risk compared to its OTC equivalents, with the transaction cleared through a centralized Clearing House.

Factors affecting the EUA/CER spread:

- EU ETS Policy – Supply of allowances, introduction of new industries into the scheme and EUA auctions will affect EUA prices
- Linking Directive – EU ETS participants can purchase CERs to meet its obligations, however, until the ITL and CITL are connected EUAs and CERs cannot be interchangeably used under the EU ETS system.
- Governments and corporates outside the EU for example Japanese Voluntary Emission Trading Scheme will buy CERs to meet emissions targets.
- Supply of CERs governed by the number of CDM projects and their approval (or rejection) by the UN will affect CER prices.
- Substitution Effect – High gas prices will increase the use of coal and drive up carbon prices.
- Economic Growth – Strong economic growth will push up carbon prices; and likewise
- Weather – very cold (i.e. heating) or very hot weather (i.e. air conditioning) will boost EUA and CER prices and vice versa.

The diagram below illustrates the development of the EUA/CER spread for the futures expiring in December 2008 for the period November 2007 until March 2008.

**Diagram 7: EUA/CER Spread**



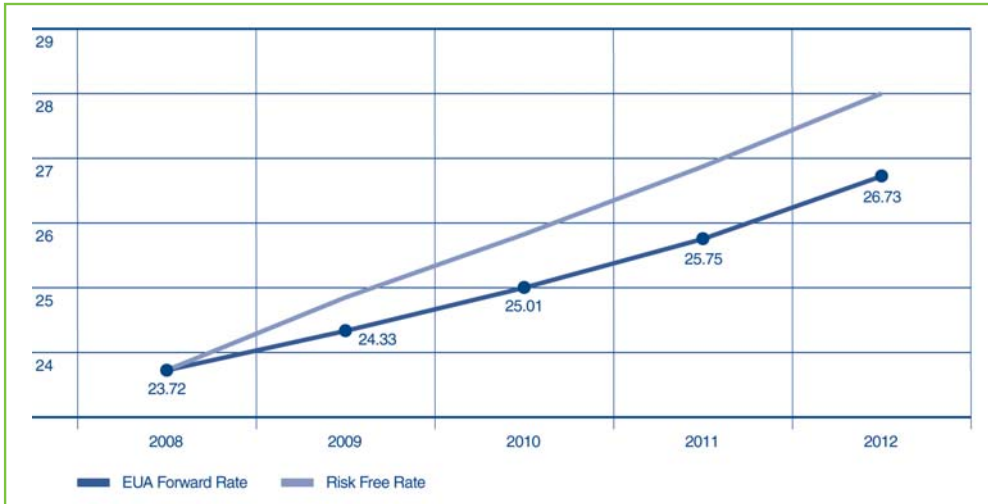
Exchange-traded CO<sub>2</sub> derivatives, by offering prices with maturities of up to five years, aid the forward pricing of CO<sub>2</sub> structured products and offer institutions an ability to “forwardfix” their future purchase or sale price in EUAs and CERs. Moreover, it generates further opportunity to generate alpha by trading EUA and CER calendar spreads – with substantially reduced counterparty risk through a centralized Clearing House. Equally, it can offer arbitrage<sup>10</sup> opportunities. For example, assume the following:

1. December 2008 EEX/Eurex EUA Future is EUR 23.72
2. December 2008 to December 2012 risk free rate is 4.4036
3. December 2012 EEX/Eurex EUA Future is EUR 26.73

This gives an implied December EEX/Eurex EUA 2012 Futures price – based on cost of carry – of EUR 28.18 that is  $EUR 23.72 \times (1.044036)^4$ . Based on a flat yield curve of 4.4036 percent, a forward curve of EUA Futures can be calculated and compared to actual EEX/Eurex EUA Futures (see Diagram 8). In such a situation, an institution can sell EUAs for December 2008 delivery, invest the proceeds to buy allowances for future delivery a price less than the original sale price less the interest earned. Selling December EUA at EUR 23.72 investing over a four year period at 4.4036 percent equates to a profit of EUR 1.45 per EUA.

<sup>10</sup> Allocation of coming year EUA allowances (February 28 of each year) occurs before previous year compliance (on April 30 of following year) in effect allows borrowing.

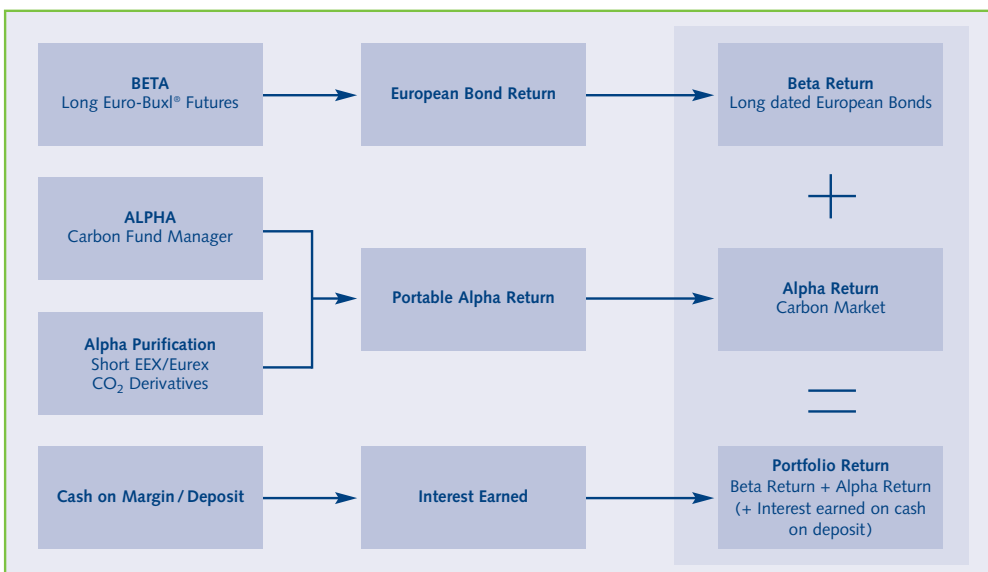
Diagram 8: EUA Futures and Risk Free Rate



### CO<sub>2</sub> Derivatives and Portable Alpha Investing – The Next Development

As the CO<sub>2</sub> derivatives market grows and matures then unquestionably portable alpha investing<sup>11</sup> will emerge amongst CO<sub>2</sub> investment products. Exchange-traded CO<sub>2</sub> derivatives will allow the separation of alpha and beta returns in the carbon market permitting institutional investors to “port” the alpha return of a carbon investment vehicle to a benchmark beta investment. For example, in a portable alpha investment portfolio a European pension fund manager matches the funds liabilities to its assets by buying long dated Eurex Euro-Buxl® Futures (his beta investment). He feels that a carbon fund manager can give him a diversified, uncorrelated return to his beta investment. However, the pension fund manager does not want to have exposure to the carbon market that is not the beta return/exposure but just the alpha return. The fund manager uses EEX/Eurex CO<sub>2</sub> derivatives to separate the beta return and the alpha return of the CO<sub>2</sub> fund. Diagram 9 shows how Eurex derivative products are used in a portable alpha investment portfolio:

Diagram 9: Portable Alpha Investment Using CO<sub>2</sub> Derivatives



<sup>11</sup> See B. Baldwin, Using Exchange Traded Derivatives in Portable Alpha Investing, Pensions World, December 2005.

## Conclusion

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With the U.S. and Japan to introduce emissions trading systems in the near future it is conceivable that CO<sub>2</sub> trading will reach levels to surpass that of trading in global commodities – the U.S. Climate Security Act could potentially create a cap-and-trade market three times the size of the EU. CO<sub>2</sub> as an asset class has great attraction for institutional investors because of its non-correlation to the traditional asset classes of government bonds and equities with the outlook for CO<sub>2</sub> prices very positive with phase three of the EU ETS creating a tighter cap. Recently, the influential London Accord in a recent report said that institutional investors should be putting money into CO<sub>2</sub> markets. EEX/Eurex CO<sub>2</sub> derivatives give existing carbon market participants and institutional investors cheap access to carbon market “beta” and the opportunity to generate alpha with the added attraction of substantially reduced counterparty risk and the added flexibility of transacting off-exchange whilst reaping the benefits of the Eurex Clearing House with the Eurex OTC Block Trade facility.<sup>12</sup>

<sup>12</sup> See Appendix 1 “Clearing of CO<sub>2</sub> OTC Trades”.

## References and Suggested Further Reading

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See Eurex website for further information on EEX/Eurex CO<sub>2</sub> derivatives:

[http://www.eurexchange.com/trading/products/CO<sub>2</sub>\\_en.html](http://www.eurexchange.com/trading/products/CO2_en.html)

"Introduction to the Emissions Market", Barclays Capital.

"Emissions Trading to soar, says regulator", Financial Times, 10 March 2008.

"Do Carbon Permits Constitute a Respectable Asset Class?" Efficiency, Liquidity and Volatility in comparison with other Financial Markets". M. Hervé-Mignucci & J. H. Keppler, Université Paris-Dauphine, June 2007.

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"Climate change investing is the cool option for forward-thinking trustees", A. Ellis, Pensions Week, March 2008.

"Cashing in on Pollution" S. Baker-Said, "Pumping Green" E. Robinson, "CO<sub>2</sub> Wildcatters" L. Kassenaar, Bloomberg Markets magazine, December 2007.

"Modelling CO<sub>2</sub> Emission Allowance Prices and Derivatives: Evidence from the European Trading Scheme" G. Daskalakis, D. Psychoyios and R. N. Markellos, Athens University, October 2007.

"An Econometric Analysis of Emission Trading Allowances" M. S. Paoletta and L. Taschini, University of Zurich, November 2006.

"Modelling the Price Dynamics of CO<sub>2</sub> Emission Allowances" E. A. Benz, University of Bonn and S. Trück, Macquarie University, February 2008.

"Derivative Instruments in the EU Emissions Trading Scheme – An Early Market Perspective" M. Uhrig-Homburg and M. W. Wagner, University of Karlsruhe, November 2007.

"Futures Price Dynamics of CO<sub>2</sub> Emission Certificates – An Empirical Analysis", M. Uhrig-Homburg and M.W. Wagner, University of Karlsruhe, August, 2007.

"Derivatives: a tool for efficient fund management", B. Baldwin, Pensions Week, December 2004.

"In the footprints of giants", H. Wheelan, IPA, Second Quarter, 2008.

"Carbon 2008. Post 2012 is now", Point Carbon, March 2008.

"Trading Carbon", Point Carbon, April 2008.

"The Upside to Climate Change", J. Blinch, Global Pensions, April 2008.

Data Source: Bloomberg.

## Appendix 1: Clearing of CO<sub>2</sub> OTC Trades

The EEX and Eurex emissions trading cooperation, launched in December 2007, combines EEX's energy market membership and connectivity to the European power trading community with Eurex's financial market membership and global distribution network.

### CO<sub>2</sub> Derivatives – Product Offering

Product	Product ID	Introduction
EUA Futures	F2PE	December 5, 2007
CER Futures	FCER	March 26, 2008
Options on EUA Futures	O2PE	April 14, 2008

### Opportunities in Clearing Over-the-Counter CO<sub>2</sub> Trading

Trades in EEX/Eurex cooperation products can be cleared by both Eurex Clearing AG (ECAG) and European Commodity Clearing AG (ECC). Physical settlement is carried out by ECC, a specialized Clearing House experienced in the physical delivery of commodities.

The Eurex block trading functionality provides all participants with the possibility to enter bilaterally agreed OTC transactions into the Eurex<sup>®</sup> system and have them cleared and settled in a standardized way. With this facility you can benefit from the choice of OTC trading while maintaining the advantages of standardized clearing and settlement. The minimum number of contracts for OTC Block Trades is one contract. The benefits of the OTC Block Trade Facility are diverse:

- **Integrated OTC Trading Functionality**

The Block Trade Facility is available via the Eurex front-end trading application. When entered into the system, OTC trades are automatically cleared as regular EEX transactions which allows you to reduce operational costs and risks significantly. There are no size restrictions on block trades in the EEX/Eurex cooperation products.

- **Elimination of Counterparty Risk**

The Clearing House is the central counterparty to all emissions transactions executed on the Eurex<sup>®</sup> system. The Clearing House limits counterparty risk to a single contractual partner. The inherent benefits for the users of a Clearing House are:

- Decreased cost of capital
- Improved collateral management
- Lower operational costs

- **Competitive Margins Including Cross Margining**

The level of margin is competitive and calculated to cover any contractual risks but to also achieve an optimal degree of security with a minimum amount of collateral. The Clearing House also offers cross margining for CO<sub>2</sub> derivatives such as EUA Futures and CER Futures, independent of whether the trades are executed on-exchange or entered via the Block Trade Facility.

- **Straight-Through Processing**

The Block Trade Facility is fully electronic which gives customers the benefit of straight-through processing (STP). You will benefit from unmatched efficiency throughout the process chain from entering OTC trades to clearing and settlement.

- **Anonymity**

OTC transactions entered on the Eurex<sup>®</sup> system and cleared are anonymous to the rest of the market.

## OTC Block Trade Entry Window

## Pricing Model

We offer an attractive price model for trading and clearing of our cooperation products.

## Fee Overview for CO<sub>2</sub> Derivatives

Trading Fee	EUR 2 per contract
OTC Trade Registration Fee	EUR 2 per contract
Clearing Fee	EUR 1 per contract
Physical Delivery Fee	-

## Fee Rebates

EEX and Eurex offer the following trading fee rebates in 2008:

### EUA Futures

- 50 percent reduction for order book and OTC transactions until the end of 2008
- 75 percent reduction for OTC transactions for legacy trades during the second quarter of 2008

### CER Futures

- No fees for order book and OTC transactions until the end of 2008

### EUA Options

- 50 percent reduction for order book and OTC transactions until the end of 2008

## Fee Rebates for Market Makers

If Market Makers meet their performance criteria, they receive full refund of their trading fees.

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