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December 18, 2007

Clean Energy

Emissions Trading: Trends and Opportunities

Emissions trading is a key political tool for reducing emissions, and an effective tool for achieving specific targets on greenhouse gas reductions. While other measures may offer successful short-term controls, the magnitude of the challenge to reduce developed world emissions by over 50% long-term means that any legislation must minimise the cost to the overall economy, and mobilise private capital on a massive scale. There is sufficient government and private sector support to make emissions trading the most likely route for global emissions controls.

Markets are showing signs of development but are still at an early stage. We have analysed the emergence of other markets historically, and view emissions trading as less mature than the current infrastructure would suggest. We expect perhaps another decade of an informal and heterogeneous market for emissions-related products before significant liquidity and uniformity are established. Signs of an active cash market for emissions products are emerging, and we view this as a long-term trend.

We provide a toolbox to analyse the long-term market opportunity. Longer-term, we believe the market for carbon credits will come to resemble other commodity derivatives markets, and be traded through formal exchanges and broker networks. We use the scenarios provided by the London Accord to provide a quantitative analysis of traded carbon markets. We also examine emerging business models in the sector and assess their scope for development.

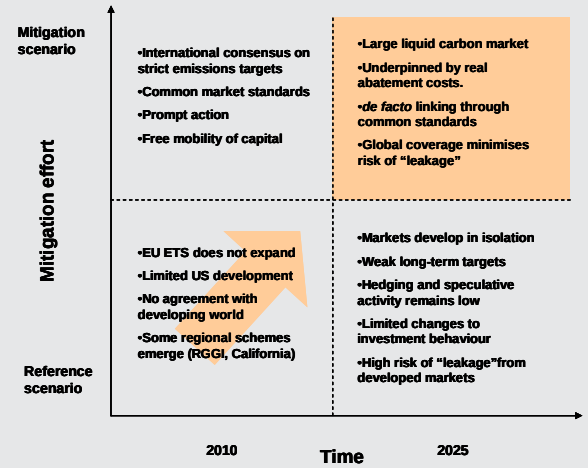
Political milestones on the road to a solution. There are many barriers to implementation of a successful climate change strategy. We analyse current and expected policy developments in key markets, and assess their potential effectiveness. Our economics research team has also published a recent report on the country-specific impacts and opportunities created by climate change, *The Economics of Climate Change.*

This report has been written by Morgan Stanley in conjunction with 'The London Accord'

The London Accord CO_2

Exhibit 1

Scenarios for carbon market development



Source: Morgan Stanley Research

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Executive Summary

Primary objectives

- In this report we set out to analyse the function and scope of global emissions trading markets.
- We outline the theories behind cap and trade, and why it is a preferred policy tool for reducing global CO2 emissions.
- We focus on the development of the European Emissions trading scheme, outlining the development of the market to date and the major players.
- We introduce our proprietary quantitative model, setting out the scope for emissions trading markets globally.
- We outline business models that have evolved to date, and discuss major opportunities for the future.

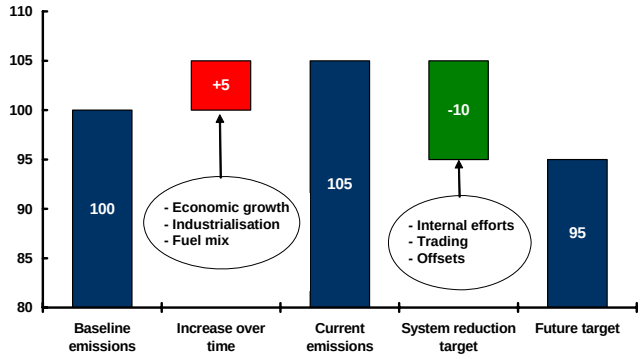
Background to cap and trade

Cap and trade markets are enabling structures for carbon abatement. We use this report to address the opportunities for investors that could arise from traded markets in CO_2 allowances, or "cap and trade" schemes. We analyse the scope for such schemes as an enabling tool for emissions reduction technologies, and address the role that such schemes could play in achieving the overall levels of emissions reductions viewed as necessary by governments and scientists.

Schemes create a fixed "pool" of emissions permits within a closed system. The function of a cap and trade scheme is to create a market price for the right to emit greenhouse gases, at a level reflecting the long-term cost of reducing emissions to a sustainable level. Policymakers set caps in line with long-term emissions targets, which are then translated into targets for individual participating firms. Participants are in theory free to reduce emissions by a range of methods, or to buy permits from other market players.

Exhibit 2

Cap and trade delivers a specific emissions target

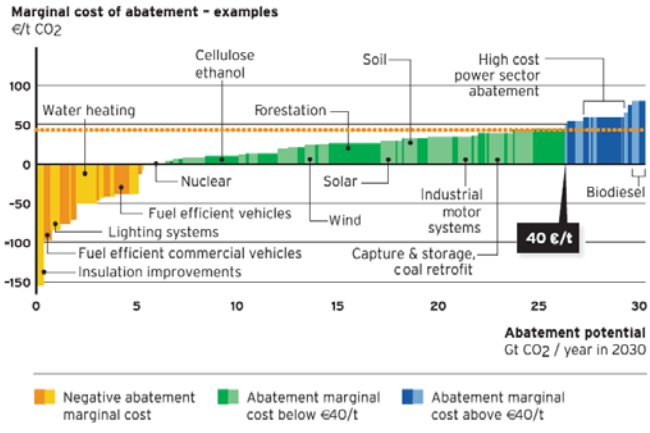


Source: Morgan Stanley Research

Quantity first, price second. In contrast to other policy tools designed to reduce emissions (taxation, technology subsidies), cap and trade schemes begin by fixing a targeted quantity of emission reductions, traded in units of standard quantity and quality and allow the market to determine the clearing price for permits based on the range of technology options available to all participants. Rational market theory suggests that individual participants will aim to meet their targets by the cheapest means possible, whether this is through internal abatement or buying permits in the market. The total system cost (and overall economic effect) should therefore be the lowest possible for a given quantity of emissions reductions.

Exhibit 3

Cap and trade enables a range of abatement options

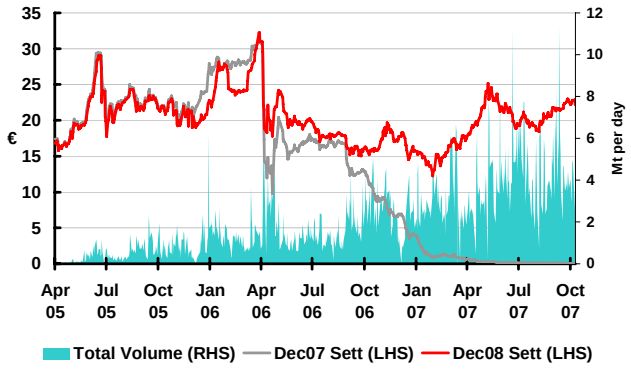


Source: Vattenfall

European market development

Cap and trade will be key to achieving European emissions targets. The EU Emissions Trading Scheme (ETS) covers 11,500 large emitters, and is a key part of European aims to reduce greenhouse gas emissions by 20% by 2020, or 30% if other nations follow suit. The scheme targets a net reduction in annual greenhouse gas emissions of 8% in Phase II, which runs from 2008-12. Emissions permits under the ETS are freely tradable, prices for Phase II have stabilized in the €15-25 per tonne range and trading volumes are growing. Negotiations are underway for Phase III of the scheme, which should create a larger programme running to 2020.

Exhibit 4
ETS prices stable in Phase II and volumes growing



Source: European Climate Exchange, Morgan Stanley Research

Market infrastructure has developed ahead of a mature trading market. Regulation on emissions means a substantial infrastructure has developed, including standardized contracts, registries providing proof of ownership, technology for monitoring emissions accurately and businesses providing exchange, brokering and clearing services. To date, the majority of these businesses have remained much smaller than similar businesses in other sectors, though growth is rapid.

Long-term market requires the development of a "need" to trade carbon, rather than just an opportunity. The challenge for policymakers and scheme designers is to create "real" demand for a commodity that has previously been used for free. Historically, the emergence of new markets has been characterised by an early phase of less formal, *ad hoc* cash markets, followed by more formal trading structures. The early signs of such a market have emerged recently.

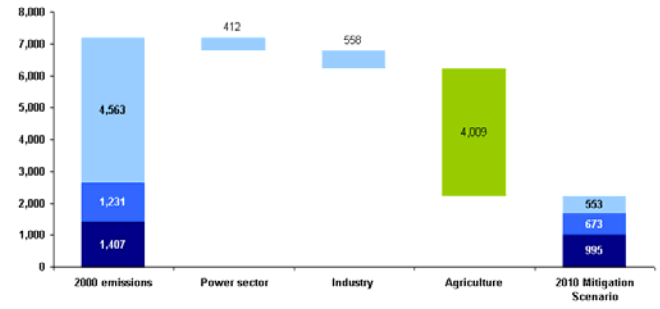
Offsets: the key to long-term market development

Carbon offsets are a bridge to a formal market. Participants in an emissions trading scheme can offset their obligation by financing emissions reductions in other markets. Offsets created under the auspices of the Kyoto Protocol and subjected to approval at UN level are a key feature of the European ETS, and will fulfill a substantial part of companies' obligations to reduce emissions in the 2008-12 phase of the scheme.

Offsets could create a common currency between emissions markets. Provided there is agreement on standards, offsets could be a means of encouraging earlier liquidity in informal emissions markets. Such markets are already emerging in the US, which accounts for 60% of volumes in Voluntary Emissions Reduction (VER) markets, several years ahead of expected federal emissions trading.

Offset schemes also broaden the scope of emissions trading schemes. Schemes encourage emissions reductions in sectors where the small scale of individual players or the expense of routine measurement means these would not usually take place. One example is non-CO_2 abatement in the agricultural sector, which represents a significant abatement opportunity (see Exhibit 5), but is difficult to legislate for as a sector within an emissions trading scheme.

Exhibit 5
Non-CO_2 abatement opportunities globally



Source: US Environmental Protection Agency, Morgan Stanley Research

Several specialist businesses have grown up in this market. The most well known of these (EcoSecurities, Trading Emissions) cater for the market in Kyoto credits under the Clean Development Mechanism (CDM). This is the formal offset scheme also used by members of the EU ETS to offset their obligations. There is also a substantial market for offset credits developing in the US ahead of regional (and potentially federal) trading schemes, though standards and project types are less uniform.

The emerging carbon economy

Broadly speaking we see two types of market evolving. These can be broadly classified as a 'formal' and 'informal' market for carbon trading. While these definitions will doubtless be imperfect, we classify market players whose business depends on specific standards and structures of a regulated market to the "formal" market, and other players whose involvement is more flexible to the "informal" market.

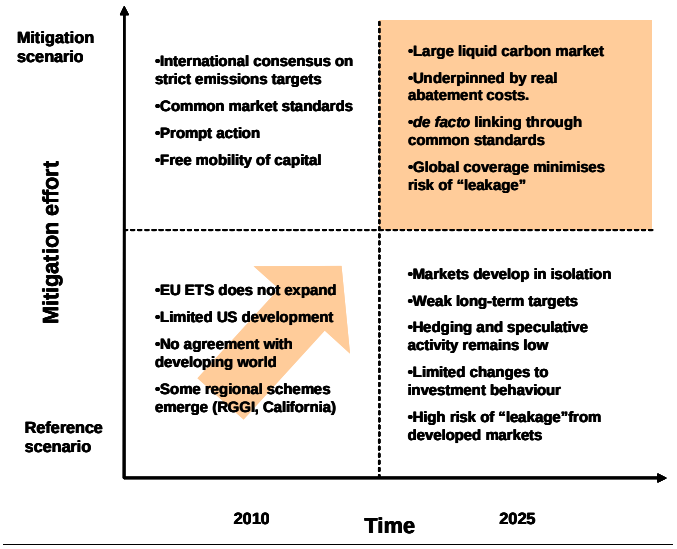
The market will have to walk before it can run. Most markets we have examined have developed in a piecemeal, *ad hoc* fashion, only developing formal structures and standards at a later stage of evolution, once a real need for hedging and risk pricing is established. While the regulated nature of the carbon market means that the development of a market infrastructure has been front-end loaded, we believe there will need to be substantial development of 'natural' supply and demand in an informal market before this is fully used.

We draw several conclusions from this thesis:

- **Opportunities will take time to develop.** Regulation has created a market, but real opportunities will take time to emerge as affected businesses undergo a period of readjustment to life in a carbon-constrained world.
- **Market will remain fragmented.** The early stages of carbon markets will be regional and disparate in scope. Businesses such as offset providers will likely continue to operate on a relatively small scale.
- **Larger opportunities are still open to competition.** Some players have dominated the early market in carbon trading, such as Climate Exchange in the European exchange-traded market. Nonetheless, there are still major opportunities to invest in both formal and informal markets.
- **Current actions will determine long-term market development.** We use the scenarios provided by the London Accord to sketch two alternative trajectories for the development of global carbon markets, as outlined in Exhibit 6 below.

Exhibit 6

Qualitative scenario analysis



Source: Morgan Stanley Research

Exhibit 7

Players in the formal (blue) and informal (orange) carbon market

	Project origination / implementation	Verification / certification	Commercialisation	Consulting	Exchanges
Global	EcoSecurities	IETA	EcoSecurities	ICF Consulting	
Global	MGM International		Large investment banks	Trucost	
Global	AgCert		Trading Emissions	PWC	
Global	Camco International		Climate Change Capital	E&Y	
Global	Econergy			Clifford Chance	
Global	Sustainable Forestry			KPMG	
Europe	Carbon Neutral Company	Det Norske Veritas	TFS		European Climate Ex.
Europe		TuV	Spectron		Nordpool
Europe		SGS	Natsource		EEX
Europe					Powernext
USA		Chicago Climate Ex.	Terrapass	Trexler Associates	Chicago Climate Ex.
USA		Green-e			

Source: Company data, Morgan Stanley Research

Global potential for emissions trading

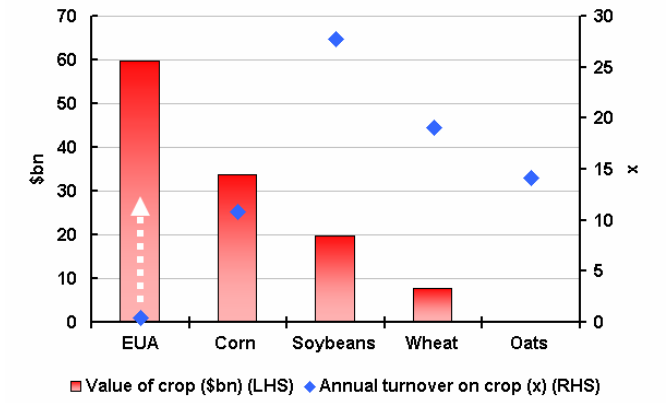
Formal carbon markets contain substantial room for growth. We would expect to see substantial growth in traded volumes of emissions allowances and related instruments (futures, options, structured contracts) on the emergence of a broader and deeper legislative framework for emissions trading. The physical market for carbon at current prices is substantially larger than some other established commodities markets, but only trades a fraction of annual issuance or "crop". Exhaustive data on the Chicago Board of Trade (CBOT) suggests that derivatives contracts in agricultural markets typically trade many times their physical baseline value.

We present our proprietary model for long-term traded volumes. Central to this report is a quantitative model outlining the scope for development of formally traded emissions markets, assuming these display similar characteristics to other financial products and derivative markets over time. The trend we see over the long-term is summarised in Exhibit 8 below. We examine the development of several markets over history, and draw parallels with the development of the market for agricultural derivatives in the US. We also examine the US market for SO_2 trading, though we conclude that its relatively small scale makes it unsuitable for in-depth analysis.

We provide four scenarios for the development of global carbon markets, comprising short- and near-term estimates for the Reference and Mitigation Scenarios outlined by the London Accord. Under a scenario of strong policy action, we believe global carbon markets could be worth US$27 billion by 2010, US$4.6 trillion by 2025.

Exhibit 8

EU carbon has the baseline value but low liquidity



Source: Chicago Board of Trade (CBOT), USDA, Morgan Stanley Research
EUA price of €20 assumed, other commodity data is 2006

Market variables

There are several key factors that will determine the extent to which this market emerges:

- **Breadth of coverage** – the larger the scheme, the greater the traded volumes are likely to be. Broader coverage for an ETS also extends the range of abatement options and costs – i.e. broader-based liquidity in the physical commodity.
- **Depth of cuts** – steeper targets increase 'natural' demand for the physical commodity and the number of scheme participants who need to trade. This in turn stimulates more speculative liquidity based on anticipated market demand.
- **Regulatory stability** – crucial for market stability, as participants will only invest resources in emissions markets where the market framework induces confidence. More to the point, stable regulation is more likely to provide stable and transparent pricing, which will drive long-term investment in emissions reduction technology.
- **Long-term visibility** – significant emission reductions typically involve investment in assets with long-term payback profiles. Participants need to be confident in the long-term prospects of a market to make these investments.

This paper forms part of a series published under the auspices of the London Accord. The series examines a variety of subjects in environmental markets. Exhibit 9 below outlines key areas of overlap with other London Accord papers.

Exhibit 9

Overlap with other London Accord papers

Research paper	Overlap
Biofuels	Potentially significant impact if cap and trade covers transport sector. Relatively expensive medium term.
Adaptation	Limited overlap.
Renewables	Major contribution to emissions targets and benefit directly from transparent carbon pricing. Significant contributor to offset markets.
Efficiency	Potential major contribution to emissions reductions. Most efficiency measures have a negative abatement cost, so no direct benefit from carbon pricing.
Carbon Capture & Sequestration	Long-term contribution to emissions reductions. Depends on high long-term carbon price to be economic
Solar	Some potential, though short-term expense means direct subsidies are most likely medium term.
Carbon Intensity	Potential indication of demand for allowances by sector.

Source: Morgan Stanley Research

Scenario analysis: forecasting market volumes

Methodology to forecast carbon market volumes:

We have built a simple, modular, proprietary model to estimate long-term growth in emissions trading. We base our analysis on energy-related emissions projections from the World Energy Outlook 2006.

Our estimates for the tradable market are based on comparative analysis of other derivatives, including metals, financial instruments and agricultural derivatives. We view agricultural derivatives as the most similar in terms of characteristics of the underlying physical asset, and base our estimates for market metrics on these.

Step 1 – **Define the sector coverage.** We assume that the current sector coverage in Europe remains unchanged until 2025 (majority of emissions in power generation and industrial sectors), and we assume a similar sector coverage for the US, with the addition of the transport sector. Discussions on the inclusion of the transport sector in EU ETS post-2012 could lead us to revisit this view.

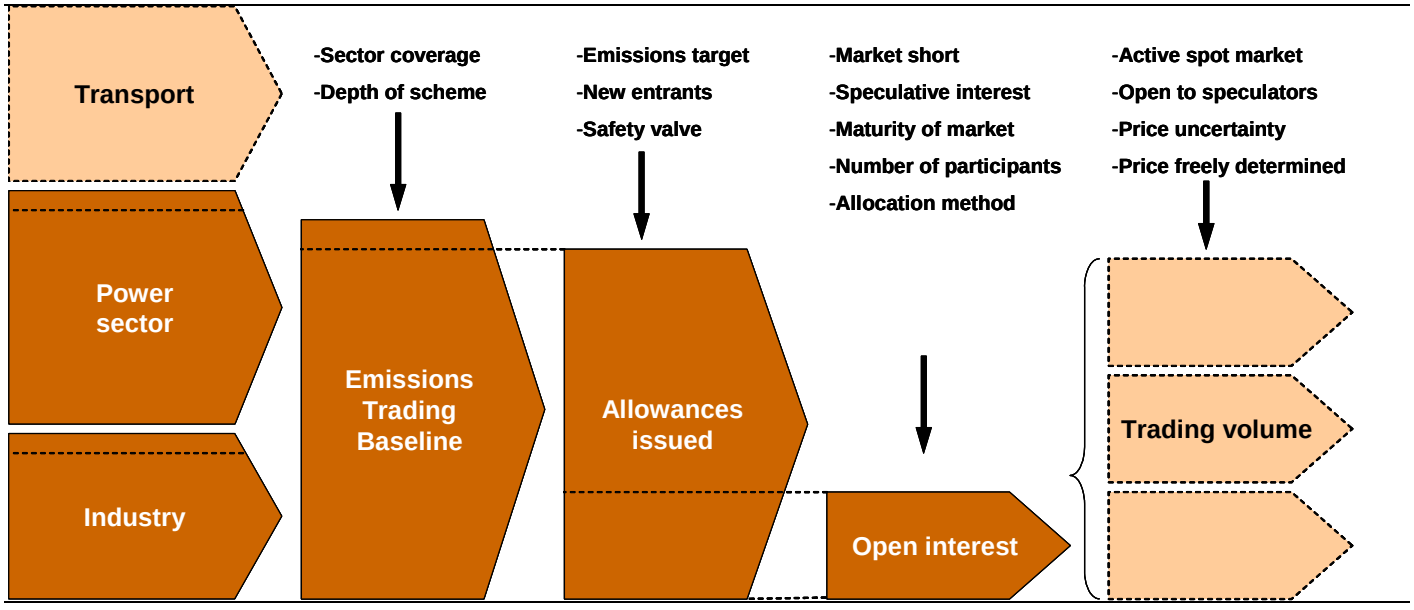
Step 2 – **Forecast open interest.** We start from average open interest in the US corn, soybeans and wheat markets based on CBOT data. The level of cuts targeted by government will also have a significant effect on open interest, as the extent of the short position will be roughly equivalent to the 'natural' position of the market. We also add our best estimates for broker-driven volumes to forecast the volumes that originate OTC but are cleared on exchange.

Step 3 – **Forecast daily turnover on open interest.** We model average daily volumes as a percentage of open interest, based on long-term convergence between carbon and other commodities.

Step 4 – **Add options & CER volumes.** Futures on carbon offsets could develop, and could in time be the bridge for linking between regional schemes. Other potential avenues for market development include revenues for options and futures on CER offsets, based on historical data on the same agricultural commodities.

Exhibit 10

Illustration of our market volume methodology, with key volume drivers at each stage

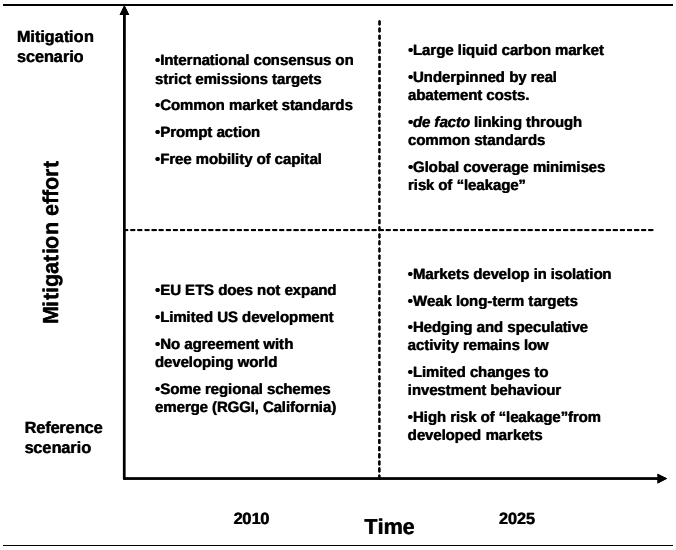


Source: Morgan Stanley Research

Four main scenarios

We outline the likely development of emissions markets in four scenarios, representing the medium- (2010) and long-term (2025) prospects for emissions markets (see Exhibit 11), based on the methodology outlined above.

Exhibit 11
Only stringent legislation will create a viable market

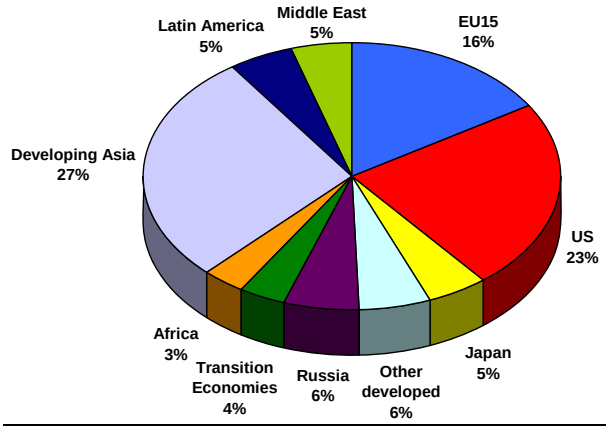


Source: Morgan Stanley Research

Developed world leads, but Asia holds the key. Europe and the US are most likely to achieve meaningful reductions in emissions, given their large industrial bases and lower growth prospects than the developing world (see Exhibit 13).

Developing Asia is the largest long-term swing factor, as rapid industrialisation will lead to substantial emissions growth unless a "cleaner" path for development is chosen.

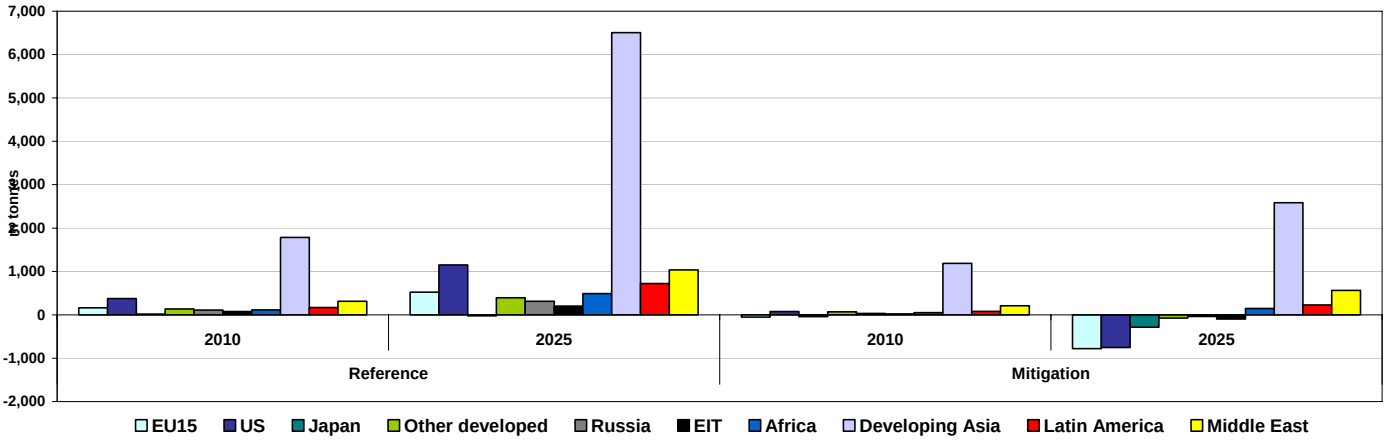
Exhibit 12
2005 global energy-related CO_2 emissions: 26.3Gt



Source: UNFCCC, Morgan Stanley Research

Long-term patterns will be established in the next few years. Exhibit 13 shows some of the qualitative features likely to emerge in our scenarios. The mitigation scenario represented requires significant progress even in the short-term if targets are to be met. This suggests a 13% reduction in energy-related CO2 emissions by 2010 as an intermediate stage towards long-term targets, which is more ambitious than any policy measures announced to date. Our long-term market estimates may therefore be viewed as a "bull case" for market development.

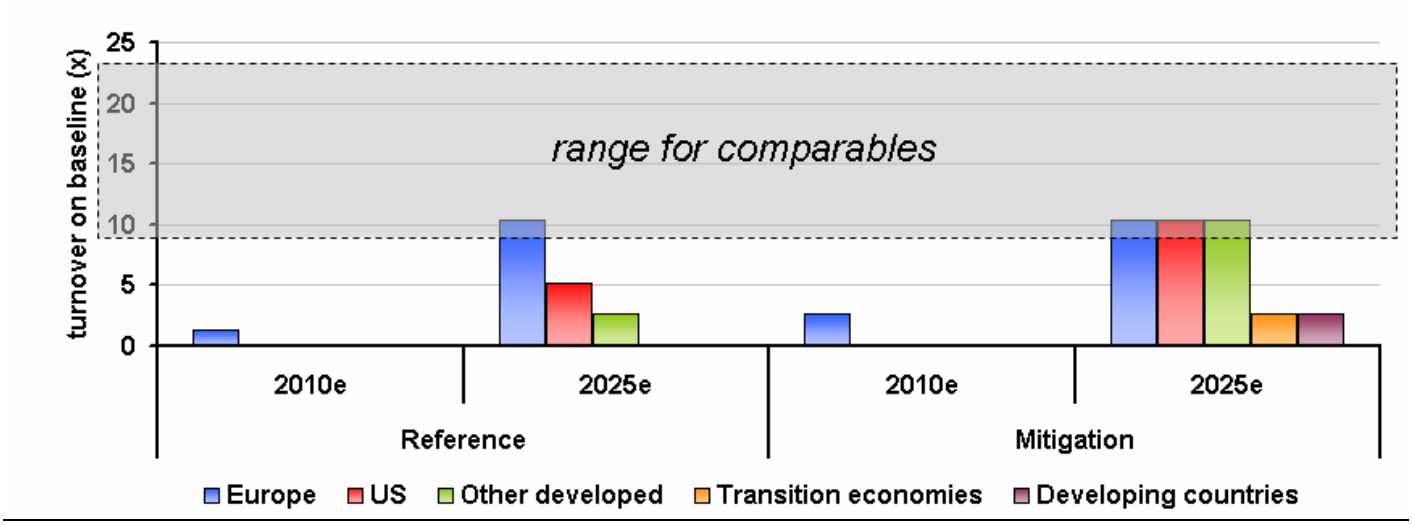
Exhibit 13
Emissions under the reference and mitigation scenarios



Source: UNFCCC, Morgan Stanley Research

Exhibit 14

Our long-term estimates for carbon put trading activity at the lower end of the range for comparables



Source: Morgan Stanley Research estimates

Exhibit 15

Qualitative factors – structure of markets will have a big influence on liquidity

Auctioning	✓	Requires installations to bid competitively for allowances, rather than giving them away. Proceeds can be redistributed towards mitigating some of the economic effects of a stringent climate policy.		
Banking	✓	Allows participants to "save" emissions reductions achieved in one compliance period for use in future phases. Banking in US SO_2 trading was the key to managing price volatility in the early years.		
Recognition for early action	✓	Rewarding participants for emissions reductions achieved ahead of legislation can spread the cost of reducing emissions over a longer period. This encourages early development of baseline and monitoring procedures.		
Linking	✓	Making allowances fungible with other markets can give access to a broader and potentially cheaper pool of abatement options. Increases market liquidity and cost-effectiveness without sacrificing environmental benefits.		
Borrowing	×	Participants can borrow credits from future years for compliance today. Limits price volatility but may undermine targets.		
Price cap	×	Seriously undermines attempts to meet specific emissions targets by allowing participants to "buy out" their obligation.		
Intensity-based targets	×	Replace an absolute emissions target with carbon-intensity measures. Makes it difficult to establish clear policy goals and undermines market transparency.		

Source: Company data, Morgan Stanley Research

Market Estimates: Europe Leads the Way – US Is the Long-term Play

Global carbon markets could be worth $27bn by 2010, $4.6 trillion by 2025 in our mitigation scenario. The US is the major variable, constituting around 57% of our total market estimate due to broader sector coverage, high-energy intensity of the economy and the likelihood in our view that a federal cap and trade scheme will encourage financial speculation. Europe makes up c. 18% of the total market value based on the current development trajectory, with RoW making up 25%.

Europe gives an indication of how markets may develop. Our analysis of the European market suggests it has the foundations of a viable market. Steeper cuts targeted for 2020 and beyond will start to create material demand in the market, and produce the kind of changes in investment behaviour that will give visibility on long-term carbon prices. Over time we expect price support measures such as the cap on CERs to fade out as the offset industry reaches maturity and other markets begin to absorb some of the supply.

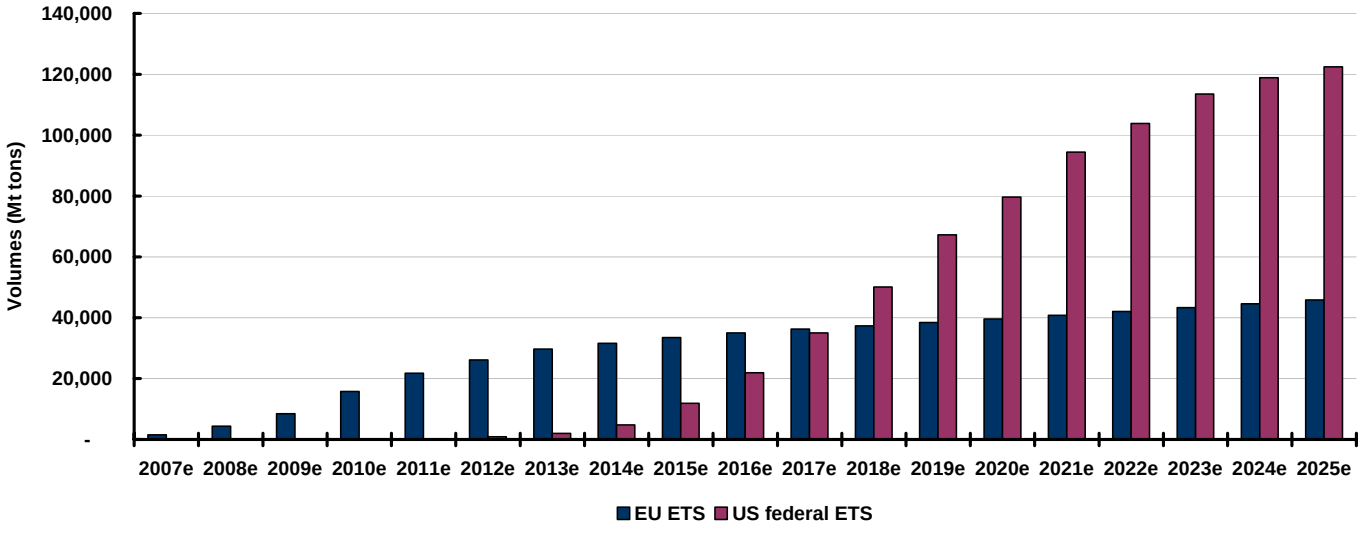
The most liquid markets will trade several years out. Open interest in EU ETS is focused on the current year and one year forward, reflecting the trading patterns of compliance buyers. Our estimates factor in full long-term liquidity in these two years for Europe and the US, with a lesser level in the next forward year. Longer-term requirements are likely to be brokered in our view, particularly where they involve an element of project offsets.

US comes on-line later, but develops faster. We have assumed that an emissions trading scheme at US federal level is implemented in 2012-13, but reaches normal market levels of liquidity by 2025. Having a forerunner in the EU ETS, along with current growth in the voluntary market and familiarity with the issues surrounding emissions trading, should mean growth is relatively rapid.

We only outline two scenarios. Both of these are based on cap and trade being adopted by major markets to some extent. The unprecedented nature of the commodity will likely mean the market develops in ways that we do not currently anticipate. Moreover, we recognise cap and trade is only one of a suite of policy tools, and used in isolation is not likely to achieve the sorts of policy goals currently being set by governments. The highly regulated nature of schemes already announced makes this point amply.

Exhibit 16

Annual volumes traded or cleared on exchange under our mitigation scenario



Source: Morgan Stanley Research estimates

Reference scenario

The Reference Scenario as outlined by the London Accord includes many of the emissions reduction measures already announced in the developed world. Nonetheless, the projections outlined here would be insufficient to reduce emissions to a level that scientific opinion suggests would be sustainable. Rampant emissions growth in the developing world and softer measures in developed countries both contribute to an increase in total global CO_2 emissions of around 43% by 2025 under this scenario.

Market opportunities related to emissions reductions may still emerge, though they are likely to remain fragmented and relatively small scale. At government level some of the likely features of this scenario include

- **Weaker targets** – intensity-based measures or targets rather than mandatory caps.
- **Price controls** – some schemes aim to provide visibility on prices by introducing caps. Such measures seriously undermine mandatory emissions targets, in our view.
- **Limited linking** – by limiting the movement of capital internationally, some proposed schemes remove one of the chief benefits of cap and trade, i.e. that emissions reductions be made in areas of low cost.

Based on the above indications, it is unlikely that regulation under the Reference Scenario would create an environment in which large-scale investments in emissions reductions could be effectively carried out.

In terms of technology development, only those areas that are currently close to competitive would likely remain long-term growth markets, with wind the prime candidate. Carbon capture and storage, solar PV and other technologies all require higher carbon pricing and much greater visibility on long-term pricing to make a material contribution, in our view.

Exhibit 17

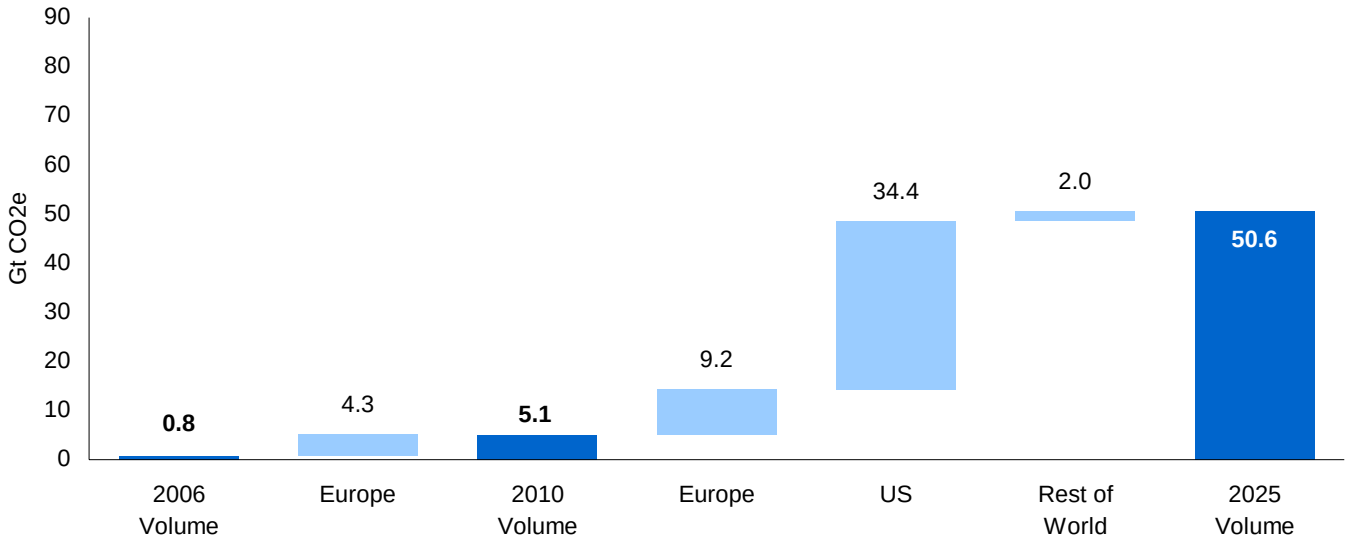
Key metrics for Reference Scenario

mn tonnes	2007	2010	2025)
Global emissions	26,280	29,524	37,596
Covered by ETS	2,002	1,999	9,966
% of total	8	7	27
Open interest	153	195	1,947
% of baseline	8	10	20
Daily volumes	6	19	195
% of open interest	4	10	10
Annual volumes	1,566	5,062	50,622
Turnover on baseline (x)	0.8	2.5	5.1

Source: World Energy Outlook 2006, Morgan Stanley Research estimates (for volumes)

Exhibit 18

Volume sensitivity in reference scenario



Source: Morgan Stanley Research estimates

Mitigation scenario

Mitigation scenario implies a 26% reduction in emissions from the Business as Usual case. This would roughly mean stabilisation of emissions globally at today's levels, suggesting dramatic cuts in the developed world (c. 50% by 2050), with more modest growth from the developing world than under the Reference Scenario.

Achieving the Mitigation Case is challenging but not impossible. Significant capital has been dedicated by emissions mitigation both by the financial sector and by corporates. Internationally, China and Russia are developing the infrastructure for emissions trading through participation in CDM and JI projects. There are still political barriers to overcome, both domestically in countries that have yet to adopt formal targets for emissions and on the international movement of capital for emissions projects.

What are the milestones for this scenario?

- **Tough international legislation** – specific and ambitious targets will need to be set by many nations not currently bound by legislation on emissions. The US has shown signs of taken a lead, but China and India will have to follow.
- **Extension of existing schemes** – negotiations are already underway for EU emissions trading to be extended to 2020, with a soft commitment further out. This would provide industry with sufficient visibility to begin serious investment in clean technology.
- **Firm timetable** – December's summit in Bali for a successor to the Kyoto Protocol is a key milestone.
- **International arbitration.** Bilateral deals are unlikely to provide a genuine solution. The eventual deal on climate change will have to be brokered, most likely by the UN.

The above criteria could dramatically increase scope for investment. The informal market for carbon currently developing would likely see much greater activity as a result of visibility on specific legislative timetables and targets. We would look for the emergence of an active informal market as a precursor to the formal market that we model here.

Exhibit 19

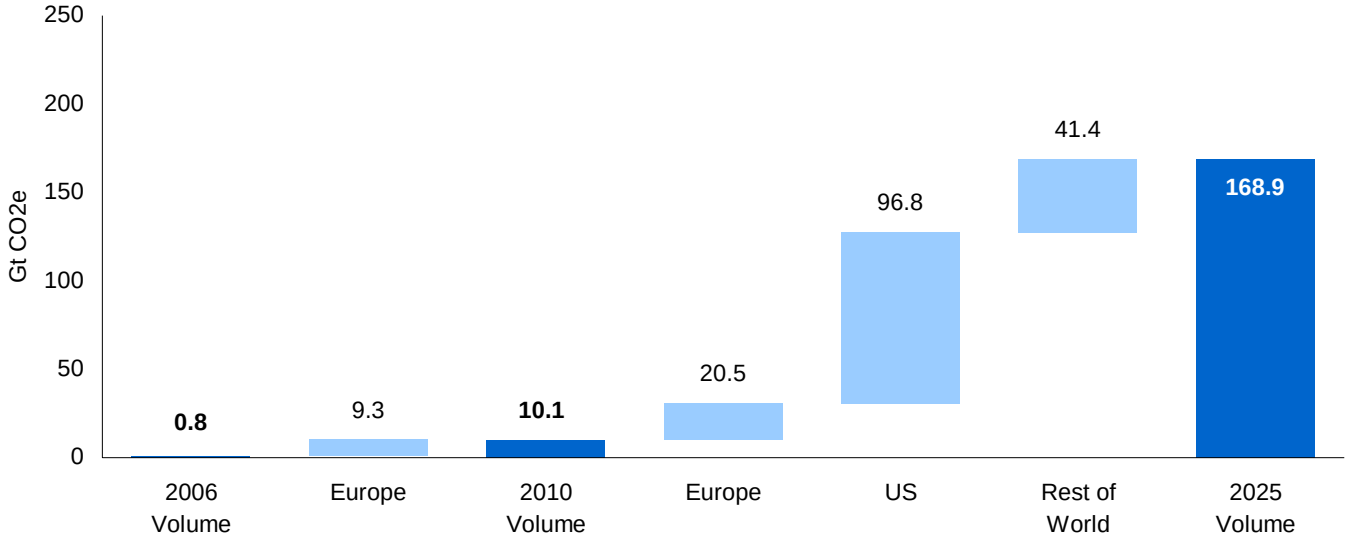
Key metrics for mitigation scenario

mn tonnes	2007	2010	2025
Global emissions	26,280	27,913	27,777
Covered by ETS	2,002	1,884	11,939
% of total	8	7	27
Open interest	153	390	3,248
% of baseline	8	21	27
Daily volumes	6	39	650
% of open interest	4	10	20
Annual volumes	1,566	10,138	168,885
Turnover on baseline (x)	0.8	5.4	14.1

Source: World Energy Outlook, Morgan Stanley Research estimates (for volumes)

Exhibit 20

Volume sensitivity in mitigation scenario



Source: Morgan Stanley Research estimates

Exhibit 21

2025 reference scenario

mn tonnes	EU15	US	Japan	Other developed	Russia	Transition Countries	Africa	Dev'ping Asia	Latin America	Middle East	Total
Gross emissions											
Energy	1,653	2,974	381	657	920	463	580	7,311	540	865	16,345
Industrial processes	864	896	325	409	267	295	181	3,457	437	585	7,716
Transport	1,271	2,351	293	492	229	162	364	1,777	719	494	8,151
Agricultural	55	40	11	12	18	19	3	71	33	18	281
Residential and other	912	951	217	284	371	272	190	1,294	275	335	5,102
Total	**4,756**	**7,212**	**1,228**	**1,855**	**1,805**	**1,211**	**1,319**	**13,910**	**2,004**	**2,297**	**37,596**
ETS coverage											
Energy (%)	*87*	*85*	*85*	*85*	*50*	*50*	*0*	*0*	*0*	*0*	
Industrial processes (%)	*88*	*85*	*85*	*85*	*50*	*50*	*0*	*0*	*0*	*0*	
Transport (%)	*0*	*85*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Agricultural (%)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Residential and other (%)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Total (%)	***46***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	
ETS baseline											
Energy	1,438	2,528	324	559	460	231	0	0	0	0	5,540
Industrial processes	760	762	276	348	133	148	0	0	0	0	2,427
Transport	0	1,998	0	0	0	0	0	0	0	0	1,998
Agricultural	0	0	0	0	0	0	0	0	0	0	0
Residential and other	0	0	0	0	0	0	0	0	0	0	0
Total	**2,199**	**5,288**	**600**	**906**	**594**	**379**	**0**	**0**	**0**	**0**	**9,966**
Open interest as % of crop in next three years											
Year 0 (%)	*10*	*10*	*5*	*5*	*0*	*0*	*0*	*0*	*0*	*0*	
Year 1 (%)	*10*	*10*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Year 2 (%)	*5*	*5*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Open interest											
Energy	360	632	16	28	0	0	0	0	0	0	1,036
Industrial processes	190	190	14	17	0	0	0	0	0	0	412
Transport	0	500	0	0	0	0	0	0	0	0	500
Agricultural	0	0	0	0	0	0	0	0	0	0	0
Residential and other	0	0	0	0	0	0	0	0	0	0	0
Total	**550**	**1,322**	**30**	**45**	**0**	**0**	**0**	**0**	**0**	**0**	**1,947**
Volumes											
% turnover on open interest	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	
Daily volume	55	132	3	5	0	0	0	0	0	0	195
Annual volume	**14,291**	**34,372**	**780**	**1,178**	**0**	**0**	**0**	**0**	**0**	**0**	**50,622**

Source: UNFCCC, IEA World Energy Outlook 2006, Morgan Stanley Research estimates (for ETS metrics)

Exhibit 22

2025 mitigation scenario

mn tonnes	EU15	US	Japan	Other developed	Russia	Transition Countries	Africa	Dev'ping Asia	Latin America	Middle East	Total
Gross emissions											
Energy	830	1,682	229	337	694	286	363	4,749	326	546	10,041
Industrial processes	742	773	271	351	222	234	153	2,631	372	511	6,259
Transport	1,016	1,927	254	421	184	133	280	1,431	523	442	6,611
Agricultural	49	37	10	11	16	17	3	61	30	16	250
Residential and other	817	887	202	267	339	244	177	1,119	256	309	4,616
Total	**3,454**	**5,305**	**965**	**1,386**	**1,455**	**914**	**976**	**9,991**	**1,507**	**1,824**	**27,777**
ETS coverage											
Energy (%)	*87*	*85*	*85*	*85*	*70*	*70*	*50*	*50*	*50*	*50*	*63*
Industrial processes (%)	*88*	*85*	*85*	*85*	*70*	*70*	*50*	*50*	*50*	*50*	*64*
Transport (%)	*0*	*85*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*25*
Agricultural (%)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Residential and other (%)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total (%)	***40***	***70***	***44***	***42***	***44***	***40***	***26***	***37***	***23***	***29***	***43***
ETS baseline											
Energy	722	1,430	195	286	486	200	181	2,375	163	273	6,310
Industrial processes	653	657	230	298	156	163	76	1,316	186	256	3,991
Transport	0	1,638	0	0	0	0	0	0	0	0	1,638
Agricultural	0	0	0	0	0	0	0	0	0	0	0
Residential and other	0	0	0	0	0	0	0	0	0	0	0
Total	**1,375**	**3,724**	**424**	**585**	**641**	**364**	**258**	**3,690**	**349**	**529**	**11,939**
Open interest as of crop in next three years											
Year 0 (%)	*20*	*20*	*20*	*20*	*5*	*5*	*5*	*5*	*5*	*5*	
Year 1 (%)	*20*	*20*	*20*	*20*	*0*	*0*	*0*	*0*	*0*	*0*	
Year 2 (%)	*10*	*10*	*10*	*10*	*0*	*0*	*0*	*0*	*0*	*0*	
Open interest											
Energy	361	715	97	143	24	10	9	119	8	14	1,500
Industrial processes	327	328	115	149	8	8	4	66	9	13	929
Transport	0	819	0	0	0	0	0	0	0	0	819
Agricultural	0	0	0	0	0	0	0	0	0	0	0
Residential and other	0	0	0	0	0	0	0	0	0	0	0
Total	**688**	**1,862**	**212**	**292**	**32**	**18**	**13**	**185**	**17**	**26**	**3,248**
Volume											
Turnover on open interest (%)	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	
Daily volume	118	372	42	58	6	4	3	37	3	5	650
Annual volume	**30,665**	**96,827**	**11,037**	**15,198**	**1,667**	**945**	**670**	**9,594**	**907**	**1,375**	**168,885**

Source: UNFCCC, IEA World Energy Outlook 2006, Morgan Stanley Research estimates (for ETS metrics)

Exchange volumes: lessons from other commodity markets

Key points

Large market opportunity – with a market value of $60bn in the EU alone, carbon has many of the characteristics that may lead to the emergence of a formally-traded market.

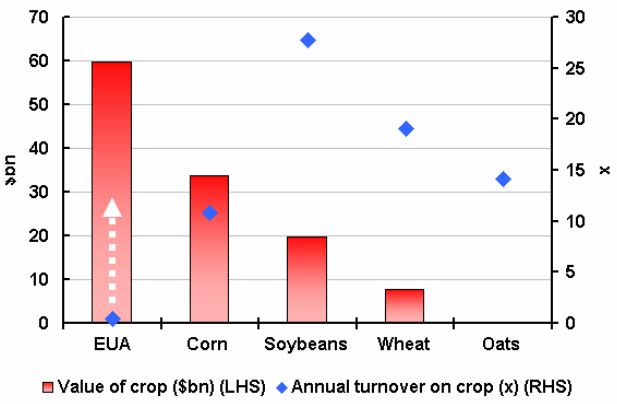
Low value of traded market – a lack of "natural" demand in the early stages of this market means volumes to date have run at a fraction of other commodity markets.

Market structure holds the key – steeper cuts, new allocation methods and increasing familiarity have the scope to create a traded market of similar size to other commodities.

Value of traded carbon markets will grow substantially. Our analysis shows that carbon is a larger market than several other established commodity markets, measured purely on the value of the underlying physical asset. One of the factors that has prevented liquidity emerging more fully to date is that the value of this asset is not transparent, and frequently volatile. Tighter regulation and a more mature market over time should increase transparency and encourage market activity.

Exhibit 23

Carbon should be traded as other commodities



Source: CBOT, Morgan Stanley Research

Carbon remains thinly traded relative to other markets. Despite the $60bn baseline value of European carbon, trading activity has been very thin compared to other commodity groups (see Exhibit 23). Trading volumes in commodity derivatives tend to reach multiples of the physical baseline.

We expect liquidity to converge with other markets. There is sufficient momentum behind global policy initiatives to underpin our assumption that demand for carbon permits will be internalised by market participants, and "real" demand will emerge. How long this takes depends on how quickly legislation is implemented to create a meaningful short market in emissions allowances. The market is unlikely to reach full maturity until some time after the end of Phase II of EU ETS.

Agricultural markets are the best comparison. We have analysed a number of derivatives markets taking into account liquidity profile, major influences on price and the physical characteristics of the underlying asset. We view agricultural commodities as a close comparison due to the strong seasonality of supply, short-dated liquidity curve and the overlap of price influences (see Exhibit 24).

Derivatives will play a significant part in future carbon markets. Allowances in cap and trade schemes only need to be submitted at (or shortly after) year-end. The most liquid instruments in emissions markets to date have therefore been year-end futures contracts. The establishment of a liquid futures market will contribute to the efficient pricing of carbon, improved information flow and the transfer of risk between market players.

Liquidity is the simplest and most transparent measure of a market's success. The more liquid a market, the more accurate pricing information will be, and the easier it becomes for market players to transfer risk or realize the market price for an asset. Silber (1981) analyses the number of years a contract trades, and sets the liquidity bar at an annual volume of 10,000 contracts. Black (1986) uses the Wall Street Journal's criterion for listing a futures contract – open interest in excess of 5,000 contracts and daily volume in excess of 1,000 contracts. We assess liquidity by comparing open interest and daily volumes with other commodity derivatives.

Carbon has many of the characteristics that would encourage the development of a derivatives market. Most trading in the early stages of the formal market in Europe has been in year-end futures contracts for the delivery of emissions permits. Compliance obligations are only assessed at year-end and participant firms only need to submit allowances at that time. Exhibit 24 gives an indication of the conditions that have historically led to the establishment of such a market, and of the experiences of developing markets in the EU and the US.

Several factors have prevented liquidity emerging more fully to date.

- × **Brand new market** – many market participants (particularly in the industrial sector) lack trading expertise, and carbon allowances are an unfamiliar asset class even for those that have such expertise.
- × **Demand not yet 'natural'** – other derivatives markets are based on established demand patterns in informal cash markets. Carbon constraint is not yet 'real' enough for businesses for it to be viewed as necessary to do business.
- × **Market shock** – the market shock in Phase I allowances during 2Q06 damaged confidence among participants, and though more players have come to the table since, turnover on physical issuance remains quite low.
- × **First phase overallocation** – many participants have not needed to trade actively in Phase 1 due to excess allocation of allowances.

There are a number of steps legislators could take that would allow future markets to develop more fully.

- ✓ **Structural visibility** – long-term certainty on demand (not necessarily on pricing) is essential to encourage potential capital providers and speculators in the market.
- ✓ **Steeper cuts** – already envisaged for Phase 2 of EU ETS, these will create greater 'natural' demand in the market, and a larger number of abatement opportunities.
- ✓ **Auctioning** – competitive bidding for allowances would see higher volumes come to market, in our view, and allow the involvement of financial players at an earlier stage.
- ✓ **Broader coverage** – including additional sectors in the EU ETS (such as aviation from 2010) would increase the baseline and therefore traded volumes.

Exhibit 24

Carbon markets could have most of the characteristics of a liquid market – depending on legislation…

	Comment	EU experience	US experience
Price uncertainty	*Industry players need to hedge prices.*	Restrictions are not yet tight enough that participants have a real need to hedge exposure. Variable abatement costs will lead to natural positions in the market over time.	Proposed price caps could undermine need to hedge. Effect of borrowing on market liquidity is uncertain.
Correlations between related products	*Carbon price should be driven by marginal cost of abatement.*	Weak relationships to date, though some convergence between CERs and EUAs.	Unclear whether US carbon will be fungible with other instruments.
Industry fragmentation	*Only in fragmented industries is there a requirement to hedge prices at stages of the value chain.*	No demand imbalance during Phase I of EU ETS, so little trade between market players. Natural supply/demand imbalance will arise over time, as some industries have much greater scope for abatement than others.	Upstream coverage of proposed federal scheme may mean carbon costs are passed downstream.
Large value of transactions	*Large markets attract a greater number and value of counterparties.*	$60bn baseline value is larger than all US agricultural crops.	Total baseline 5.2 billion tonnes or $140bn at $27 (€20) per tonne, including transport sector.
Price freely determined	*Trading and speculation emerges where pure market forces drive prices*	Offset caps and uncertain regulations have prevented free price formation. This will improve as the market develops and restrictions tighten.	Safety valve would undermine free determination of market price.

Source: Morgan Stanley Research

Wider market development could lead to explosive growth. While the nature of the commodity is new, trading technology and greater familiarity with exotic instruments mean a liquid carbon market could develop much more rapidly than we have seen in other areas. We use the December 2008 EUA future as out benchmark for analysis.

Exhibit 25

Dec-08 EUA futures contract is the most liquid …

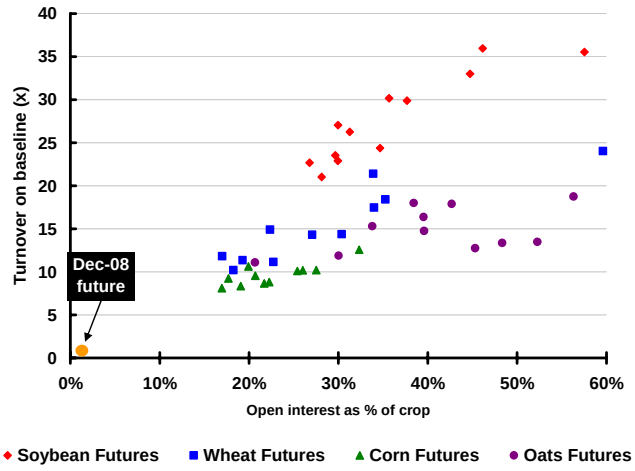
000 tonnes	Open interest	% of baseline	September volume	ADV*	% of open interest
Dec-07	49,996	2.3%	3,497	159	0.3%
Dec-08	62,483	3.1%	68,572	3,117	5.0%
Dec-09	25,001	1.3%	3,481	158	0.6%
Dec-10	9,152	0.5%	3,740	170	1.9%
Dec-11	4,475	0.2%	2,892	131	2.9%
Dec-12	9,403	0.5%	6,133	279	3.0%
Totals	**160,510**		**88,315**	**4,014**	

Source: European Climate Exchange, Morgan Stanley Research

Market development relies on demand for carbon getting "real". Other commodities (oil, metal, corn, wheat) are key to economic activity, and have a demand profile, based on the ongoing need for the physical commodity. This is what drives participants in the value chain to hedge price risk and is the basis for a derivatives market. Carbon allowances at present represent a regulatory requirement for scheme participants, and where active trading of these has emerged, it has been largely speculative.

Exhibit 26

… but even that is a long way behind other markets



Source: Chicago Board of Trade, Morgan Stanley Research

Our central case is for carbon to converge with other markets by 2025. Exhibit 28 plots our estimates for carbon market development alongside other commodities (each point is one year's crop and trading activity). We analyse open interest (total outstanding positions in the market) as a percentage of the physical crop, and daily turnover of the open interest in order to strike long-term volume estimates.

Exhibit 27

Agricultural commodities are the closest in terms of liquidity and physical characteristics

	Carbon	Agricultural products	Metals	Financial futures
Physical market	Utilities, Industrials	Farmers, Food producers	Industrials	None
Volumes related to physical market	Yes	Yes	Yes	No
Price drivers	- Power generation - Weather - Fuel mix and prices - Annual allocation - Legislation	- Weather - Planted acres - Crop yields - Reserve levels	- Industrial activity - Mining output - Speculative activity	- Speculative activity - Market volatility - Risk appetite
Daily volume as % of open interest	2-9%	15-25%	20-70%	25-50%
Volume growth 1H07 (%)	+95	+41	+41	+27

Source: CBOT, European Climate Exchange, Morgan Stanley Research

Long-term commitments suggest a real market is likely to emerge. The European target of a 20% reduction by 2020 will create a more stable demand profile if it translates into tougher targets in the EU ETS. Draft federal bills in the US envisage a c.50% cut by 2050, meaning a much larger section of the economy will have a significant requirement for carbon.

Broader-based demand will open up the market for investors. The current relatively modest targets for EU ETS mean that most of the target for emissions reductions will likely be met by fuel-switching and other operational factors, rather than investment in infrastructure. This is a mixed outcome.

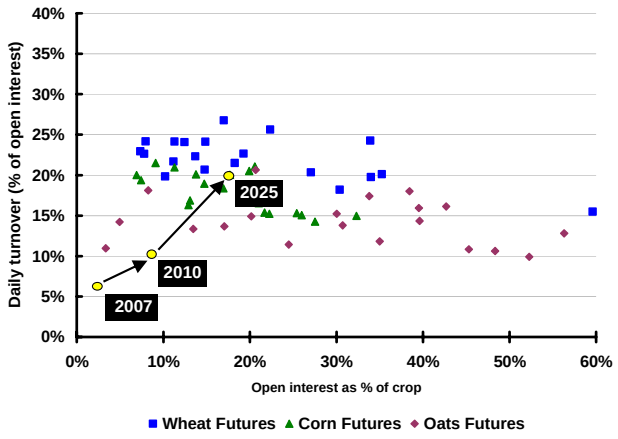
- **Relatively low cost of compliance** – current EUA prices of around €20 per tonne represent a relatively low cost compared to other means of reducing emissions, and given to fuel-switching within phases.

- **Potentially volatile abatement cost** – the cost of fuel switching depends on potentially volatile coal and gas prices, rather than usually more stable investment costs in abatement technology. The price signal for those that may actually use the market to finance infrastructure investment is diluted.

US and Europe are the most likely markets for active trading. Emissions from developing Asian countries including China and India will be much larger long term, though we do not anticipate these markets to be so open for the establishment of emissions trading exchanges, even if they do adopt mandatory emissions targets. Climate Exchange has established a joint venture with the Mumbai Stock Exchange, though it is likely to be some years before the potential of the venture is clear.

Exhibit 28

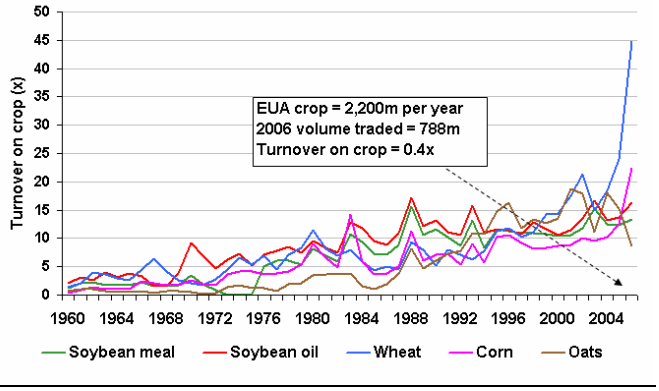
We expect carbon to converge with other markets



Source: Chicago Board of Trade (CBOT), Morgan Stanley Research

Exhibit 29

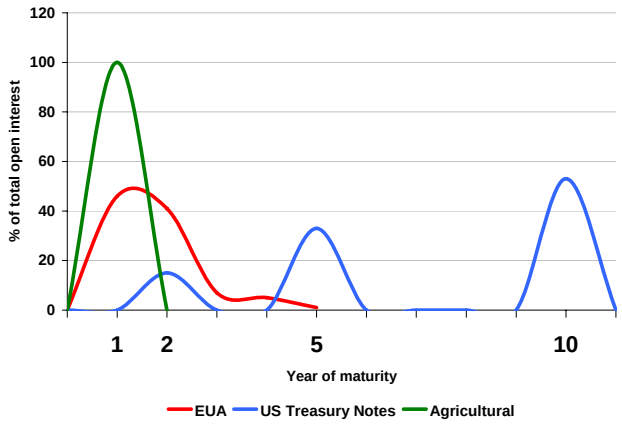
Other commodity markets have taken time to grow



Source: Chicago Board of Trade (CBOT), Morgan Stanley research

Exhibit 30

Liquidity profiles in various commodity groups



Source: Company data, Morgan Stanley Research

Offsets: the Key to Market Confidence and Liquidity

Key points

Cheaper emissions reductions – offset schemes have already delivered low-cost emission reductions and are a key mechanism for delivering long-term environmental goals.

Common currency being developed – current UN standards provide a template for the market, though competing standards are developing. These must give confidence that reductions are real, additional and permanent.

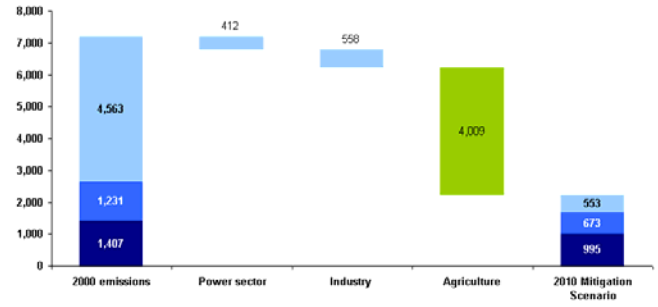
Opportunity will remain fragmented – specialist expertise and local market presence needed will likely mean this continues to be a sector for niche businesses.

Offset schemes are a key mechanism for achieving low cost abatement. Long-term cuts of 50% or more in emissions from power and industrial sectors would be very expensive without significant progress on reducing technology costs, or cuts in production. Offsets are created when an entity not covered by an emissions trading scheme reduces emissions in a manner that is verifiable and quantifiable according to certain standards, and sells the resulting credit into an emissions trading scheme.

Kyoto will drive the majority of demand for offset credits. The theory behind international agreement on emissions trading through the CDM is that one tonne of carbon removed from the atmosphere is of equal benefit whether it is removed in China, Russia or the UK. Offset schemes function at international level in a similar fashion to regional emissions trading schemes, in that they allow emissions reductions to take place in whatever location offers the lowest cost option.

Most offsets will likely come from sectors not covered by Emissions Trading Schemes. The agriculture sector in particularly contains significant scope for emissions abatement, particularly in the areas of non CO_2 gases, though it is unlikely to be covered by an emissions trading scheme due to the administrative effort and cost involved in extending a scheme to a large number of small facilities. Exhibit 31 gives the US Environmental Protection Agency's estimates for abatement opportunities of non-CO_2 greenhouse gases (methane, sulphur hexafluoride, N_2O, HFCs etc.) at a cost of less than $30 per tonne (€21 per tonne).

Exhibit 31
Non-CO2 abatement potential by sector



Source: US Environmental Protection Agency, Morgan Stanley Research

Long term, offsets could become indistinguishable from internal abatement. International trade will become much better established if our Mitigation Scenario is reached, and the distinction between offsets and domestic credits is likely to become blurred. This scenario requires much more progress on integration of trading and registry infrastructure than we have seen to date. More to the point it requires an element of political will. Early discussions on use of offsets under a US cap and trade scheme envisage one that relies primarily on credits generated by domestic projects. These are unlikely to be as cost-effective in reducing emissions, though go some way towards easing political concerns that offset mechanisms represent a significant transfer of wealth to international economic competitors.

Opportunities likely to remain fragmented. Our positive view on the outlook for emissions trading schemes means that most of the larger abatement opportunities in industrial and power generation sectors are likely to be undertaken by larger entities under the auspices of such schemes. Specific investment opportunities in pure play offset providers are therefore likely to remain limited in terms of size. Nonetheless there is an opportunity for players with specialist skills able to capitalize on the fragmented nature of the industry by building networks of local contracts, spotting the potential in new markets early and profiting from the sometimes healthy development premium on offset projects.

Compliance offset markets

The primary market for offset credits is that created by the Kyoto protocol and the main instruments are Certified Emissions Reductions (CERs) for non Annex 1 countries and Emissions Reduction Units (ERUs) for Annex 1 countries. The difference is that the latter type does have an independent obligation to reduce emissions under the terms of the protocol.

Exhibit 32

Summary of project-based carbon markets by volume ($MtCO_2e$) and value (US$mn)

	2005 Volume	2005 Value	2006 Volume	2006 Value
Primary CDM	341	2417	450	4813
Secondary CDM	10	221	25	444
JI	11	68	16	141
Other compliance	20	187	17	79

Source: Company data, Morgan Stanley Research

Significant government purchasing of offset credits has already been undertaken, with European countries the major buyers (see Exhibit 33). Most of this data is derived from National Allocation Plans (NAPs) specifying how countries intend to comply with their obligations under the Kyoto Burden Sharing Agreement struck at EU level, and also cover the allocation process for Phase II of EU ETS from 2008-12.

Exhibit 33

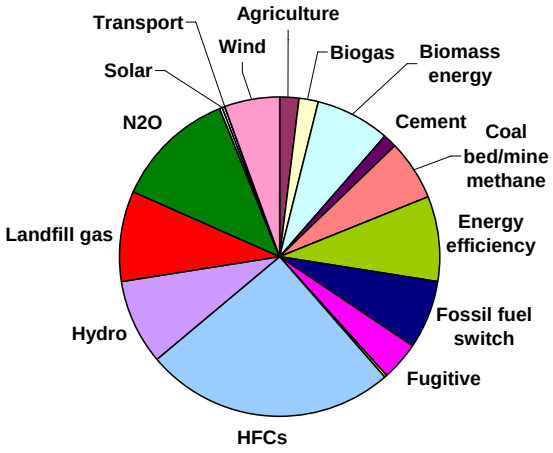
CER/ERU purchasing intention of EU states

Country	Annual purchases	Total 2008-12
Spain	31,830	159,150
Netherlands	20,000	100,000
Italy	19,000	95,000
Austria	9,000	45,000
Norway	9,000	45,000
Sweden	7,400	37,000
Belgium	7,040	35,200
Denmark	4,200	21,000
Ireland	3,600	18,000
Portugal	3,300	16,500
Finland	2,400	12,000
Germany	1,800	9,000
Total	**118,570**	**592,850**

Source: EU National Allocation Plans, Point Carbon, Morgan Stanley Research

Exhibit 34

Total CDM offsets in the pipeline at 2bn tonnes



Source: United Nations Environment Programme (UNEP) Risoe centre

Other offset markets

The voluntary market for project offsets is developing rapidly, with a recent industry survey suggesting that around 75Mt of voluntary offsets will change hands in 2007, compared with 20Mt in 2006. Around 60% of this market has been in the US to date, and constitutes a mixture of genuine voluntary buying and so-called "pre-compliance" business, where companies look to become familiar with carbon markets ahead of likely regulation. Some voluntary standards place less emphasis on auditing specific emissions reductions, with a focus on sustainability.

The long-term status of these markets is unclear. The most successful standards in the voluntary market have been those offering audit ability on a par with UN schemes (though they claim less bureaucracy). Markets have typically been highly price sensitive, with mid-range pricing of VER transactions at around $7-9 per tonne (€5-6 per tonne). It is this feature that leads us to question whether the voluntary market can make a meaningful contribution to carbon price discovery, without a specific requirement on its participants to sign up to specific targets. The possible exception to this is CCX, a voluntary offset market that asks its participants to commit to legally binding targets.

Nonetheless, we continue to see scope for voluntary offsets in retail and related markets, provided some of the reputational issues surrounding standards and project reliability can be addressed. We see three key criteria for promoting market confidence:

- ✓ **Additionality** – credits must represent a reduction in emissions over and above what would have happened, had the incentive of potential carbon revenues not existed.
- ✓ **Permanence** – sellers must be able to demonstrate that emission reductions will be lasting, particularly in the case of forestry and carbon capture and storage projects.
- ✓ **Uniqueness** – avoidance of double-counting. The development of registries is crucial to this.

Exhibit 35

Offset standards vary in terms of coverage, priorities, endorsement and registry infrastructure

	Launched	Endorsed by	Credits registered	Sectors	Priorities	Registry
CDM Gold Standard	May-06	UN, WWF, Greenpeace and 41 other NGOs	350,000	RE, EE	Sustainable development, additionality	Gold Standard database
CCX	Jan-07	CCX members	15,000,000	RE, EE, CH, TR, MM, AG, AF, WA, SO, AD	Regulatory simplicity	CCX
VCS	Feb-07	IETA, The Climate Group, World Economic Forum	1,860,000	RE, EE, CH, TR, MM, AG, AF, WA	Similar to CDM	Bank of New York
VOS	Jun-07	Morgan Stanley, ABN Amro, Citigroup, Barclays Capital, Deutsche Bank and Credit Suisse	NA	RE, EE, CH, TR, MM, AG, AF, WA	Similar to CDM	na.
VER+	Jun-07	TuV	383,932	RE, EE, CH, TR, MM, AG, AF, WA	Similar to CDM	TuV's own BlueRegistry
Community Climate Biodiversity (CCBA)	2007	CARE, Nature Conservancy, Rainforest Alliance, others	45,695	AF, AD	Sustainable development, additionality	CCBA database

Source: Company data, Morgan Stanley Research
Key: RE-Renewable Energy, EE=Energy Efficiency, CH=Chemical Processes, TR=Transport, MM=Metals & Mining, AG=Agriculture, AF=Afforestation & Reforestation, WA=Waste, SO=Soil, AD=Avoided Deforestation

The Big Picture: Background to Cap and Trade

Key points

Clear need for emissions targets – scientific consensus and long-term economic concerns have put restricting greenhouse gas (GHG) emissions high on the political agenda.

Cap and trade is key – emissions trading schemes are the only policy mechanism capable of delivering specific emissions goals at an acceptable total cost.

Political support crucial – cap and trade is not a 'silver bullet' and needs rigorous implementation and ongoing political support to achieve its aims.

Why emissions legislation?

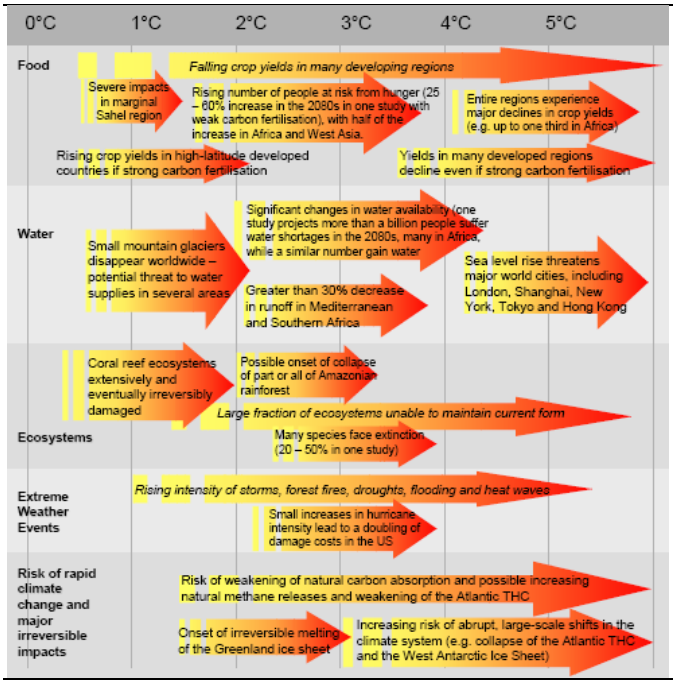
Human activity is at least partly responsible for climate change. The most recent conclusions of the Intergovernmental Panel on Climate Change (IPCC), state it is "likely" that human activity has contributed to a warming climate, and "very likely" that this trend will continue if no action is taken. Potential economic and environmental consequences are severe (see Exhibit 36).

Governments are taking action. The G8 stated in June 2007 that the group of nations would "contribute our fair share" to a reduction in global emissions of 50% by 2050. Several nations (including the U.S.) have yet to commit to specific targets, but political momentum is building. The G8 declaration represented significant progress towards a coordinated political response to environmental concerns.

Commitments made under the Kyoto Protocol are likely to be extended. The treaty concluded in 1995 targets a 6% cut in developed nations' emissions during the 2008-12 commitment period. Europe and Japan among developed nations have already committed to much steeper targets beyond 2012, and the United Nations Framework Convention for Climate Change hopes to set out a roadmap for a successor to Kyoto during the conference in Bali in December 2007.

Exhibit 36

Rising temperatures increase economic risk

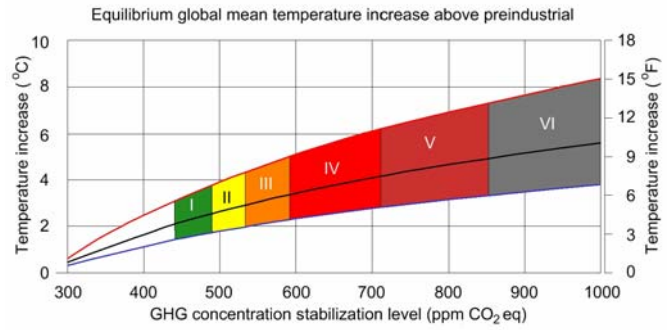


Source: Stern Report

Mitigating the effects of climate change is a long-term challenge. Climate models suggest global emissions will need to peak close to the 2004 levels of 26.1 gigatonnes between 2020-40 and decline until the end of the century to stabilize CO_2 concentrations so that the average global temperature rise does not exceed 2°C. This will require many developed countries (responsible for most growth in CO_2 emissions) to cut emissions by 60-80% long term in order to offset increasing emissions from the developing world. Current atmospheric concentrations are in the region of 380ppm.

Exhibit 37

Target 450-550ppm to limit temperature rises



IPCC Fourth Assessment Report, Working Group I

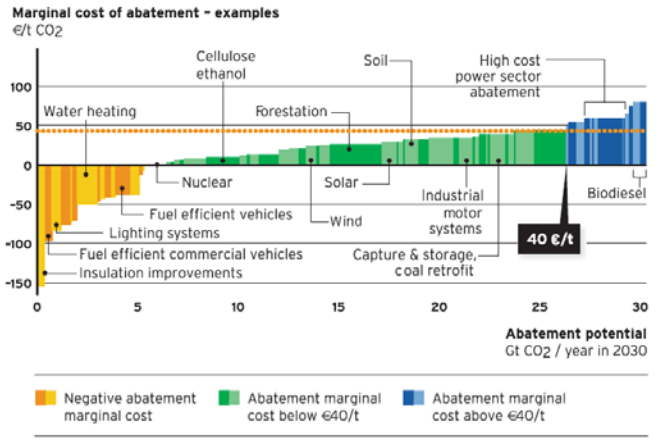
Why cap-and-trade?

Greenhouse gas emissions will become a scarce resource. The steep long-term reductions needed to meet the above targets will create meaningful scarcity in the resource of permissible emissions. They will require changes in operational and investment decisions in many parts of the economy. Appropriate allocation of this resource between market participants and sectors of the economy is a major challenge, particularly if economic growth is to be maintained.

Cap and trade is an effective means of allocating the resource. The size of the long-term cuts targeted means emissions reductions must come from all sectors. Exhibit 38 shows Swedish utility Vattenfall's estimates for the range of emissions reductions likely to be made at various costs. Cap and trade is a means of setting an absolute emissions target, and allowing the free determination of a market price to drive investment in those areas where it is most cost-effective.

Exhibit 38

Emissions targets need all sectors to pull together



Source: Vattenfall

How does it work?

Cap and trade schemes set a total level of allowable emissions in covered sectors, and issue an allocation of the total to each participant. Those participants with too few allowances for their level of emissions can buy allowances from those with too many. In this way investments are most likely be made in those sectors with the cheapest opportunities to reduce emissions, with excess permits then sold to sectors where the cost of reducing emissions, and therefore willingness to pay for permits, is higher. The equilibrium price in a competitive market should be determined by the marginal cost of abatement.

Exhibit 39

Cap and trade schemes need infrastructure

Standard unit	✓	Market confidence depends on a legal definition of uniform size, grade and quantity.
Evidence of ownership	✓	Registry is required to provide proof of legal title, prevent double-counting and act as proof of compliance.
Means of transfer	✓	Trading infrastructure is needed to transfer title. Most be low-cost and watertight to encourage liquidity.
Monitoring infrastructure	✓	Participants have to report emissions in a timely and accurate fashion to maintain scheme integrity.

Source: Company data, Morgan Stanley Research

The necessity of a market

Cap and trade schemes are the most reliable means of achieving a specific target in terms of emissions reductions across a diverse range of market participants.

Specific target … – regulators can set an emissions target according to policy goals and leave the market to determine where emissions reductions are made.

… creates demand – by setting targets for individual participants, such schemes create real market demand for allowances.

Firms incentivised to act – market demand creates an opportunity for those able to reduce their emissions at lower cost to sell permits to those with higher costs.

Low-cost solution – By incentivising the low-cost reductions with a potential to profit, overall targets should theoretically be achieved at the lowest total cost.

Cap and trade is a single tool, not a complete solution. The economic basis for emissions trading is sound but, as the Vattenfall chart shows, behaviour is not always economically rational – even measures that would save money as well as reduce emissions have not been undertaken (yellow section in Exhibit 38). We do believe emissions trading offers distinct advantages in terms of cost and effectiveness compared to two other types of policy measure.

Taxation – gives visibility on long-term costs to industry, but gives no assurance that absolute emissions targets will be met. The point is often made for taxation that revenues can be used for investment in cleaner technology, though there is no guarantee that this would be the case, and industry has typically innovated more successfully than government in areas of new technology.

Command and control – gives scope to set an absolute target and tailor legislation by sector. Good for controlling behaviour at individual level, though it has the potential to be highly bureaucratic.

Emissions reductions must be made at lowest cost. Even under the IEA's Beyond Alternative Policy Scenario, fossil fuels account for the majority of global primary energy demand by 2025. Reducing emissions from fossil sources is therefore a major undertaking requiring significant technology innovation, given 60-80% reductions targeted in developed markets.

Exhibit 40

Cap and trade schemes have several advantages, but a number of challenges for regulators

	Advantages of cap and trade	Challenges for regulators
"Cap and trade sets a specific target for emissions reductions."	✓ Quantifies target reduction and sets a time period for doing so EU has specified a goal of a 50% reduction by 2050, in line with scientific advice. ✓ GHGs can be measured accurately in most cases, so compliance is a binary issue.	× Difficult to align absolute emissions targets with aims for industrial development. × Lobbying can lead to less stringent targets. The pilot phase (2005-07) of EU ETS saw successful industry lobbying for soft targets while market transparency was low.
"Broad sector coverage under a single policy mechanism"	✓ Single scheme can include a range of sectors and abatement opportunities. ✓ Schemes usually cover power sector and heavy industry, which account for 53% of emissions among developed nations. If transport is included, this rises to over 80%.	× Varying economic and competitive drivers between sectors may mean some players are more exposed to emissions restrictions than others. × Determining the 'right to emit' and consequent allocation method can be politically fraught.
"Gives flexibility to extend targets and include further sectors	✓ Firms' ability to buy allowances in the market means important industrial functions can continue despite emissions constraint. ✓ Emissions targets and coverage of scheme can be increased over time.	× Use of "offsets" to buy in allowances from outside schemes has met some resistance, though it makes economic sense. × The broader coverage becomes, the more complex the rulebook. Provisions for "protected" industries can distort the market.
"Represents the lowest theoretical cost of achieving a given target."	✓ Rational participants will undertake emissions reduction projects where it makes most economic sense, and sell allowances beyond their needs to the market. ✓ In an efficient market equilibrium prices should reflect the marginal cost of abatement.	× The cheapest option for reducing emissions may not be the most politically attractive. × Chemical processes (HFC, N_2O destruction) and nuclear power present some of the cheapest abatement options, but offer little in the way of other environmental benefits.
"Mobilizes private capital to address a public issue"	✓ Private companies historically have a better track record of innovation than publicly funded schemes. A stable carbon price gives visibility on the economic return that can be made. ✓ Industry represents a larger and deeper capital base from which to draw than public schemes.	× Regulatory uncertainty in the early stages means industry is likely to require a high return on capital to justify investment. × Potentially volatile carbon prices in the early stages of schemes can undermine market confidence.
"Clear scheme rules should simplify monitoring and compliance"	✓ Responsibility and cost of monitoring passed on to industrial participants. ✓ Other cap and trade schemes (US SO_2 trading) have a very good compliance record.	× Requires upfront investment to establish monitoring protocols. × Schemes must have reliable historical emissions data to be effective. US SO_2 scheme was based on factual emissions data, and was effective from the start.

Source: Morgan Stanley Research

Market Developments to Date

Key points

Europe is the main market – the EU Emissions Trading Scheme started in 2005 and approximately tripled in traded value to $24bn in 2006. With only 8% of global emissions covered there is substantial scope for further growth.

Market is developing – open interest and speculative trading continue to grow in the European market. Reaching comparable levels to other markets would require a step change in market activity, in our view.

Other markets are following – the proposal of two competing cap and trade bills in the US Senate indicates a sea change, and has the potential to spark much greater integration of environmental policy worldwide.

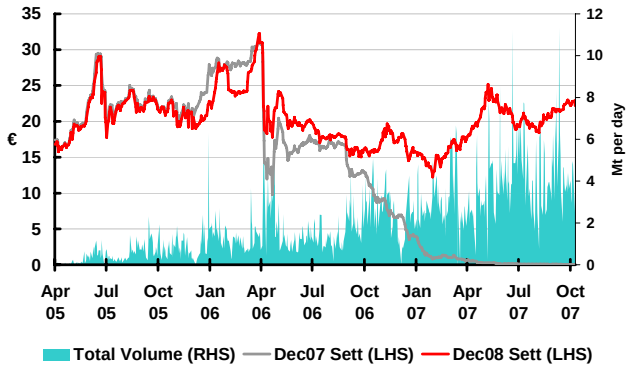
EU ETS

EU ETS is the largest and most liquid scheme. EU ETS covers a total baseline of 2.2 billion tCO_2e across 11,500 installations in the power generation and industrial sectors. The scheme targets an 8% average reduction over 2008-12 compared to 1990 levels. Plans to extend the scheme beyond 2012 are in progress, and the EU has established a target reduction of 20% by 2020. There are also plans to cover additional sectors. Aviation will be covered from 2010.

Prices have been volatile during Phase I. CO_2 prices reached a high of €32 per tonne in April 2006 before verified emissions data for 2005 revealed a surplus of allowances in the market. Phase I allowances hit €15 and have continued to fall, while tighter allocations for Phase II have led to a recovery in prices to around the €20 mark.

Volumes have growth resiliently despite volatility. Volumes rose to around 800 million tonnes in 2006 or 36% of the baseline. The lull in volumes was only temporary, with a strong recovery in 4Q06. The market continues to grow strongly with average volumes of 5.4 million tonnes per day in July 2007 compared with 3.0 million tonnes per day for 2006.

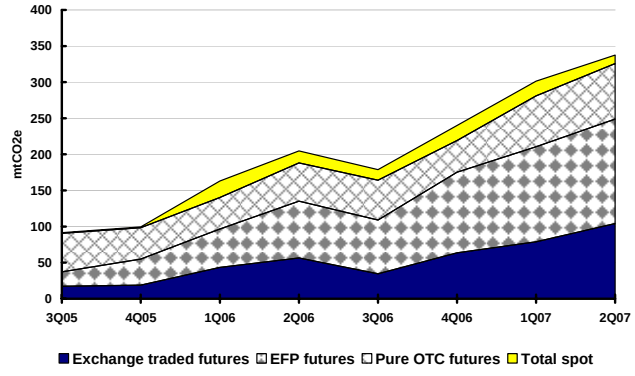
Exhibit 41
Volumes and prices in Phase I/II of EU ETS



Source: European Climate Exchange

Futures trading dominates the market. Participants in EU ETS only need to submit allowances at the year-end for compliance, and in the short term we do not expect spot volumes to make a significant contribution. Exhibit 42 shows the larger part of volumes are in so-called Exchange For Physical ("EFP") contracts dealt through brokers but cleared on exchange. We expect the bulk of volume growth to come through exchange-traded contracts traded by financial players. EFP will continue as a service for industrial participants, but we do not expect volume growth here to be as strong.

Exhibit 42
EFP volumes are 50% of the European market



Source: ECX, Nordpool, EEX, Powernext, Morgan Stanley Research

Phase II is likely to create meaningful scarcity. Our analysis of Phase II National Allocation Plans (NAPs) leads us to estimate a total gap of 109 million tonnes per year or 6% of total allocations that will need to be reduced by internal means. The European Commissions (EC) has decided on 21 NAPs accounting for c.95% of total EUAs in Phase II. Minor adjustments may yet occur as some countries (Germany, Spain and Italy) are still finalising details on auctioning and allocations.

Exhibit 43

Arriving at the Phase II Emissions Gap

	mn tonnes p.a.
2005 emissions	2,122.2
Average Phase II allowances	2,080.9
Difference between 2005 emissions and Phase II	**41.3**
Add to difference:	
Additional installations from increase in scope[1]	84.6
New entrants	109.3
Norway[2]	7.0
	200.9
Total EUA shortfall	**242.2**
% of 2005 emissions	11.4
Allowable Kyoto mechanism credits	**278.2**
Available Kyoto mechanism credits	133.6
Lesser of allowable and available	**133.6**
Estimated ETS emissions gap	**108.6**
% of 2005 emissions	5.1

Notes:

1) EC's refinement of scope means additional installations are to be included in Phase II but these will not have allocations from the new entrant reserve.

2) This figure represents the gap between Norway's 2005 emissions and expected Phase II allocation.

Source: Morgan Stanley Research estimates based on EC data

We expect trading activity to grow significantly during Phase II. Daily volumes on the Dec-08 contract are currently 6-8% of open interest, while there is minimal activity in the Dec-07 vintage due to the Phase I surplus. In 2008 we expect two vintages (Dec-08 and Dec-09) to be actively traded, which should boost volumes. Increasing visibility on legislation post-2012 should also attract a greater number of participants to the market, whether for hedging or speculative purposes.

We may not get a fully underpinned market until Phase III. The level of emission cuts envisaged during Phase II of EU ETS will likely be achieved through fuel-switching and other operational factors. There is unlikely to be serious investment in carbon reduction technologies until legislators give longer-term visibility on emissions restrictions.

In effect this means that carbon prices during Phase II will be determined largely by the relative prices of coal-fired and gas-fired generation (so called dark- and spark-spreads). This will be more volatile than the cost of longer-term investments to reduce emissions, such as clean coal or other technologies.

Liquidity may be slow to emerge until visibility improves. While volatility generally encourages liquidity and speculation in financial markets, regulatory uncertainty during Phase II may prevent full liquidity emerging, at least until the market gains confidence in the structure of Phase III. In practice, this is only likely to occur when new legislation is passed.

Exhibit 44

Dec-07 is 40% of open interest but minimal volume

000 tonnes	Total volume	Exchange traded	EFP	Open interest
Jul-07	0	0	0	0
Dec-07	3,009	1,399	1,615	45,948
Mar-08	0	0	0	20
Dec-08	87,019	35,691	51,328	52,562
Dec-09	17,232	2,756	14,476	24,173
Dec-10	4,560	641	3,919	7,362
Dec-11	2,356	197	2,159	2,634
Dec-12	5,087	423	4,664	5,415
Total	**119,263**	**41,107**	**78,161**	**138,114**
Average daily volume	**5,421**	**1,869**	**3,553**	

Source: Company data, Morgan Stanley Research

There are several possible reasons for low levels of liquidity:

- **EU ETS is a brand new market in an unfamiliar commodity.** Previous contract launches in derivatives markets have generally been in commodities for which demand was already established and well understood.

- **Overallocation has prevented a spot market emerging.** An active cash market is normally a prerequisite for the development of a liquid and stable derivatives platform. Exhibit 44 shows such a market has failed to emerge during Phase I.

- **Some players are unfamiliar with trading structures.** Industrial participants have withheld long positions from the market in Phase I, using them only for compliance at the end of monitoring periods. This means around 37% of the total baseline has not reached the market in any traded form.

- **Structural uncertainty.** While price uncertainty is a key feature of a viable futures market, low visibility on allocation levels during Phase 2 and eligibility of offsets created fundamental uncertainty on market structure for potential liquidity providers until recently.

Other cap-and-trade markets

Several other regional cap and trade schemes are in the process of being established, including two in the US (RGGI in the Northeastern States, and California). In most cases these are not as demanding as targets under Kyoto or the longer-term targets adopted by the EU. The schemes are diverse in terms of structure, targets and timeframe.

Exhibit 45

Regional schemes show little consistency

	RGGI	Canada	Australia	California
Start date	2009		2010	2012
End date	2014	2010	NA	2020
Future phases	2.5% pa	2% pa	NA	80% by 2050
Coverage	PG	LE	PG	PG, IN
Baseline ($mtCO^2e$)	120	275	195	334
% of total emissions	NA	44	37	76
Base year	2005	2006	NA	1990
Target vs base year (%)	0	18	NA	0
Price cap	No	No	Likely	No
Offsets allowed	If price >$10	Yes	Yes	Yes
Offset cap (%)	No	10	Possible	No
Offset standard	CERs	Unspecified	TBC	CERs
Linking	Yes	Yes	Yes	Yes

Source: Morgan Stanley Research

Key :PG = Power Generators; LE = Large Emitters; IN = Industry

Mandatory US federal scheme is likely by 2012-13. The US withdrew from the Kyoto Protocol in 2001 despite being instrumental in drawing it up. Several pieces of legislation are currently in progress to create an Emissions Trading Scheme at US federal level, and there is the possibility that a new President from 2009 may look to re-engage with the Kyoto process. The establishment of emissions trading in the US would not only create a significant market opportunity, it could be instrumental in determining the extent to which emissions restrictions are adopted by other countries, particularly China and India.

Two leading bipartisan bills have emerged from the Senate process. These represent quite different scenarios for the US market, in our view, with the Lieberman-Warner proposal most likely to succeed. Though still in draft form, this bill resembles the European market closely, seems to have won early support from both sides, is most environmentally credible and would be most effective at creating a liquid, tradable market.

The $12 price cap imposed by the Bingaman-Specter draft bill would undermine the market, in our view. Both bills are summarised in Exhibit 46.

Exhibit 46

Summary of two draft US bills

	Bingaman-Specter	Lieberman-Warner
Target	2006 emissions by 2020; 1990 emissions by 2030	2005 emissions by 2012, 70% cut by 2050
Structure of cap	Bill sets "annual targets" for reductions	Hard long-term cap with year-to-year flexibility.
Cost provisions	$12 buy-out named "Technology Accelerator Payments"	"Cost containment provisions" allow borrowing from future periods.
Coverage	Upstream: refineries, natural gas plants, fossil fuel importers, coal-fired power stations	75% coverage of US emissions, all sectors except agriculture.
Allocations	Free allocation initially, gradual auctioning after 5 years	80% auctioning initially and rising.
Offsets	Not discussed	15% limit on offsets

Source: Morgan Stanley Research

There are several unknowns in the development of the US market. While we believe there is sufficient grassroots and government support for federal legislation of some kind to be passed, this does not guarantee a liquid market. Borrowing of allowances between years is a likely feature (as in Europe) and the effect on liquidity is difficult to assess (multi-year demand is inherently more difficult to predict). Auctioning, we believe, will be positive for liquidity over the long term, but we have very little visibility on what effect this will have on prices and trading activity during the early stages of the market.

The effect of upstream coverage on liquidity is uncertain. Part of a federal US scheme is likely to cover oil importers and refiners as an indirect means of regulating the transport sector. Abatement options upstream are fewer, and there is greater asymmetry of information between producers and the market as a whole. Costs could fairly easily be passed downstream and regulation in this case may in fact function in a similar fashion to a tax, rather than encourage trading liquidity in the market.

Appendix 1: State of the Industry

Business models in the sector are at an early stage of development. Several advisory businesses have established an early presence in the market to help bring projects to market. These have not typically provided capital to the market, however, and the business has been quite fragmented.

The industry has attracted funding from a number of sources. Several companies have raised equity from public markets, and investment banks are getting more involved in buying up offset projects and portfolios of credits. We expect momentum to pick up further as asset quality becomes easier to assess.

Exchanges are at an early stage but with much potential. Previous emissions markets (US sulfur trading, EPA gasoline lead-content scheme) have not been liquid enough to justify dedicated exchanges. The potential size of the end market for carbon allowances has led several European exchanges to establish a presence here, as well as one dedicated player.

Whether this investment pays off depends on the emergence of a more fully-fledged financial market. There are several factors that will be crucial to determining this**:**

- Certainty on long-term demand for emissions allowances, which depends on a legislative framework to restrict industrial carbon dioxide emissions for the long term.
- The development of a viable cash market in the underlying commodity, which will allow for a deeper market for financial speculators.
- Strong enough legal and regulatory framework to give confidence in the enforceability of contracts and the quality of the underlying asset.
- Common (or at least similar) standards between markets to minimize confusion as to the traded contract.
- Sufficient market infrastructure and a global registry for allowances in order to establish and record ownership.

Most of these requirements relate to the market's ability to "internalize the externality". Most of the current trade in emissions is based on short-term compliance requirements, rather than the recognition of a long-term shift to a carbon-constrained environment. Some businesses have begun to build an optional presence in a post-Kyoto market, but this remains far from market consensus.

Legislation will need to give visibility on the long-term market. Regulation in the sector to date has focused on maintaining standards, sending a market signal on price and satisfying domestic environmental lobbyists. Long-term regulations will need to give sufficient visibility on demand to stimulate the investment required to reduce emissions.

Exhibit 47
Industry remains fragmented

	Project origination / implementation	Verification / certification	Commercialisation	Consulting	Exchanges
Global	EcoSecurities	IETA	EcoSecurities	ICF Consulting	
Global	MGM International		Large investment banks	Trucost	
Global	AgCert		Trading Emissions	PWC	
Global	Camco International		Climate Change Capital	E&Y	
Global	Econergy			Clifford Chance	
Global	Sustainable Forestry			KPMG	
Europe	Carbon Neutral Company	Det Norske Veritas	TFS		European Climate Ex.
Europe		TuV	Spectron		Nordpool
Europe		SGS	Natsource		EEX
Europe					Powernext
USA		Chicago Climate Ex.	Terrapass	Trexler Associates	Chicago Climate Ex.
USA		Green-e			

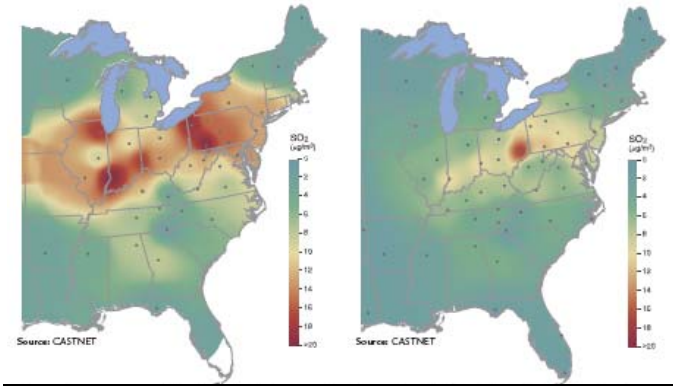
Source: Morgan Stanley Research

Appendix 2: Lessons from SO_2 Trading

US sulphur-dioxide trading was the template for cap and trade schemes. The first phase of the program began in 1995 and affected 263 units at 110 mostly coal-burning electric power plants in eastern and Midwestern states. Restrictions were tightened in 2000 with an annual cap of 9.5m tons (compared to 1980 emissions of 17.3 million tons). The scheme affects existing power generating units greater than 25 megawatts and all new units.

Environmentally, the programme has been a success. Visibility on long-term targets and a rapid tightening in 2000 led many to beat targets in the early stages to bank allowances for the later phase. Penalties at $3,000 per ton were also highly stringent, with no buy-out option and a requirement to make good the shortfall. The result was a rapid fall in the level of atmospheric SO_2 concentrations (see Exhibit 48).

Exhibit 48
US SO_2 concentrations 1989-91 and 2003-05



Source: Environmental Protection Agency (EPA)

The market is too small to attract significant interest. Total issuance of 9.5 million tonnes means the market is less than one tenth the size of EU carbon, even assuming prices of $500 per ton (see Exhibit 49).

Exhibit 49
SO_2 permits forward price curve

Delivery date	Price	Delivery date	Price
2007	$560.00	2011	$280.00
2008	$559.16	2012	$268.80
2009	$555.63	2013	$257.60
2010	$285.60	2014	$246.40

Source: Company data, Morgan Stanley Research

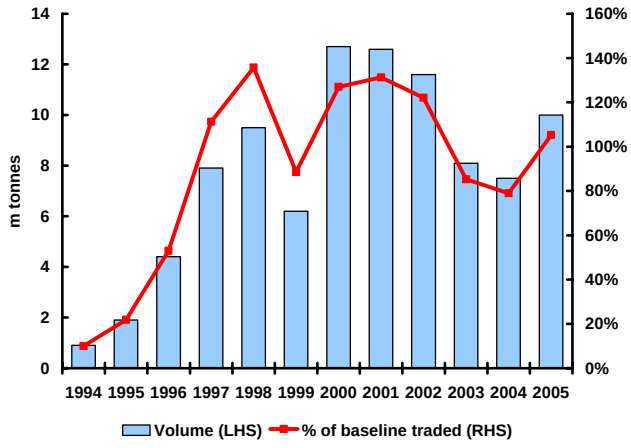
SO_2 trading has not become a fully-fledged market. Annual volumes to 2005 have not reached more than double the physical crop, despite tough targets, freely determined market price and use of auctioning as an allocation method. We attribute the lack of speculative interest in the market to several factors.

Small market – the relatively low baseline means few potential speculators have dedicated the trading resource to this market.

Scheme structure – the sharp drop in issued permits to 50% of the previous level post-2000 meant installations had to focus on internal abatement. Overcompliance in the early years of the scheme therefore meant there was little incentive to trade.

Fewer participants – 263 installations compared with 11,500 in the EU ETS. Participants in SO_2 trading are also more homogeneous, meaning similar abatement options are available to each. This effectively means there is less natural flow from one sector of the trading scheme to another.

Exhibit 50
SO_2 OTC volumes and % of baseline traded



Source: EPA 2005 Acid Rain Progress Report, Morgan Stanley Research

The scheme also achieved broad coverage with accurate data. These are key lessons for the EU ETS, in our view, as they ensured the environmental integrity of the scheme, both by avoiding "leakage" and by giving regulators sufficient information to set appropriate targets for the scheme.

Appendix 3: the Importance of Speculation in Markets

The establishment of a derivatives exchange can fulfill several primary goals in developing an efficient market:

- ✓ Improve the allocation of resources
- ✓ Maintain efficient and visible pricing
- ✓ Improve information flows on market
- ✓ Transfer risk between market participants
- ✓ Reduce transaction costs

Who trades futures markets?

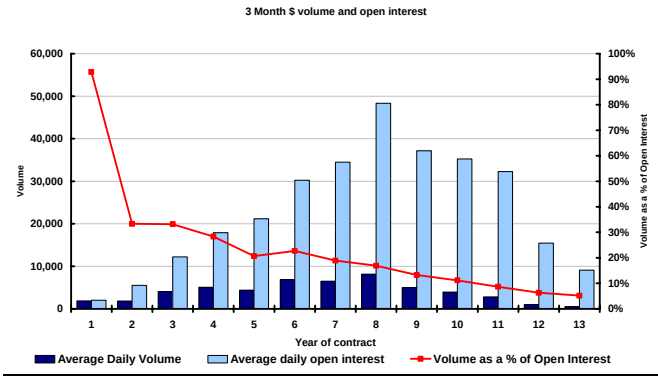
1. **Hedgers**: Market participants involved with the production or sale of the underlying physical commodity. Use futures contracts to lock in present expected prices for future production.

2. **Liquidity providers:** Financial players bringing capital to the market by writing derivatives contracts for hedging participants. These players establish the price of liquidity and risk appetite.

3. **Speculators:** Financial players with a view on prices, whether of the underlying physical asset or risk within the market. Typically sophisticated investors with expertise in the market and will usually use highly leveraged investments such as futures and options.

Exhibit 51

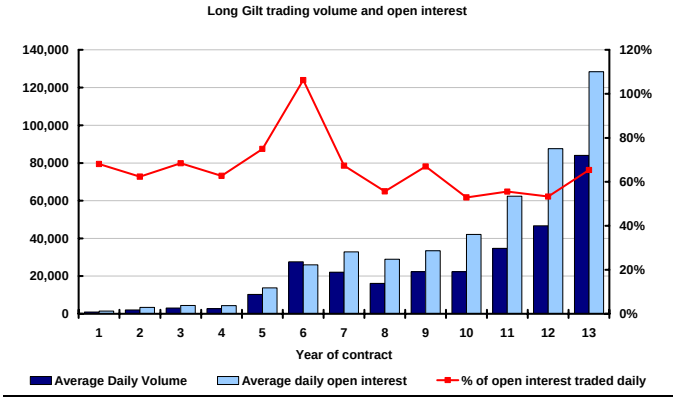
Turnover on open interest is a key metric …



Source: LIFFE, Morgan Stanley Research

Exhibit 52

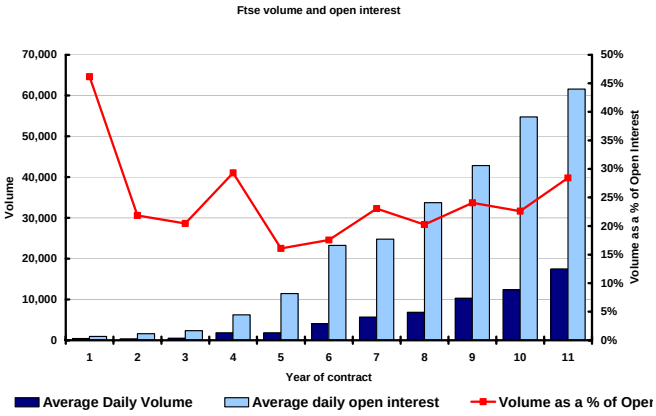
… which is stable in successful contracts



Source: LIFFE, Morgan Stanley Research

Exhibit 53

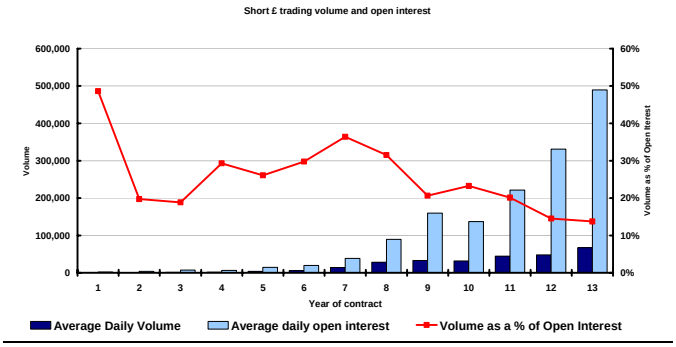
Volumes are driven by rising open interest …



Source: LIFFE, Morgan Stanley Research

Exhibit 54

… as speculative activity increases



Source: LIFFE, Morgan Stanley Research

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(as of October 31, 2007)

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Overweight/Buy	**958**	**42%**	**313**	**44%**	**33%**
Equal-weight/Hold	**989**	**43%**	**312**	**44%**	**32%**
Underweight/Sell	**328**	**14%**	**85**	**12%**	**26%**
Total	**2,275**		**710**		

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Industry Coverage:Clean Energy

Company (Ticker)	Rating (as of)	Price (11/07/2007)
Luciano Diana		
Biopetrol Industries (B2I.DE)	O (07/27/2006)	€4.92
Ceres Power (CWR.L)	O-V (10/30/2006)	319p
Climate Exchange (CLIE.L)	E-V (10/10/2005)	1,146p
Clipper Wind Power (CWPR.L)	O-V (04/24/2007)	670p
CropEnergies AG (CE2G.DE)	U-V (03/01/2007)	€5.37
D1 Oils (DOO.L)	E-V (07/27/2006)	163p
EOP Biodiesel (E2BG.DE)	E (07/27/2007)	€4.84
Ecosecurities (ECO.L)	E (05/25/2006)	169p
Gamesa (GAM.MC)	O (07/09/2007)	€36.3
Solaria Energia y Medioambiente (SLRS.MC)	E-V (08/02/2007)	€22.7
Verbio AG (VBKG.DE)	E-V (03/01/2007)	€3.19
Vestas Wind Systems (VWS.CO)	E-V (07/09/2007)	DKr533
Allen D Wells, CFA		
GTL Resources (GTL.L)	O-V (09/03/2007)	107p

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