

# Combating Climate Change - Opportunities and Risks



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## Climate Change fully on the agenda

Climate change is on political and corporate agendas globally. The risks and effects are well documented; if no action is taken to stabilise greenhouse gases (GHG's), a 2°C temperature gain globally could occur as soon as 2035 (Stern). In 2007 newsflow momentum will continue from the UN IPCC, Kyoto updates and political measures. Broader media coverage will also keep the topic current.

## Business benefits of addressing outweigh costs

Our view is that going forward the predominant policy stance in developed regions will be towards curbing GHG emissions to combat global warming. Even with disagreement over the causes, (i.e. anthropogenic or natural cycle) and the consequent climatic effects, the uncertainty is such that to ignore the issue is not an option. Thus all industries and sectors will ultimately be impacted by the drive to reduce emissions in our opinion. In developed regions where governments are not taking a pro-active stance, investors and corporates are also changing attitudes and behaviour. Corporates are identifying the wider benefits of adopting a proactive environmental stance; namely higher operational efficiencies prior to legislative changes, opportunities to help shape government policy, lower risk from supply chain and workforce disruption, and demand drivers from a 'climate aware' consumer. In effect, the benefits of addressing environmental externalities are beginning to outweigh the costs, with intangible benefits a key driver.

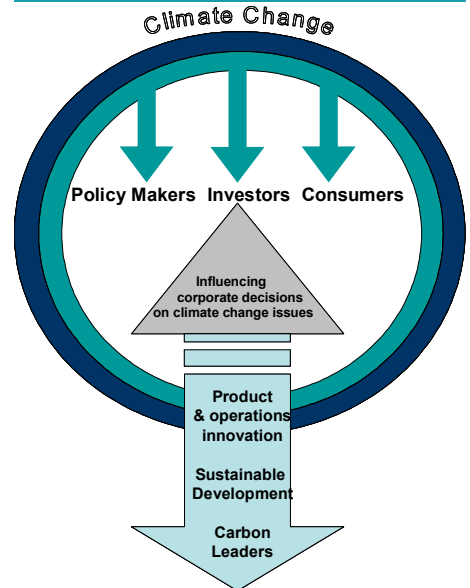
## Global, not just local, legislation drivers

The corporate challenge of climate change issues is not constrained to local operations. Curbing carbon emissions is high on the political agenda for most countries, and the likely outcome is legislative drivers. On pages 6 to 20, we note regional emission forecasts and industry composition of gases to establish potentially higher risk sectors on a broad scale. We also look at the regional and global policies for curbing emissions including the Kyoto Protocol and EU ETS.

## Investor demand for carbon disclosure

280 investors with \$41trn AUM have grouped together to request carbon emission information from 2400 companies globally; the Carbon Disclosure Project (CDP). As carbon reporting becomes the norm, investors can use comparative measures, such as Revenues/CO2 as risk indicators, which is discussed on page 20.

Chart 1: Variety of forces driving corporate action against climate change



Source: Merrill Lynch SRI Research

**This report is an extract of a report of the same name published on 16<sup>th</sup> April 2007.**

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## Climate Change - fully on the agenda

‘Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level’. IPCC, Climate Change 2007: The Physical Science Basis, February 2007

The climate change debate is gaining more prominence on the global political agenda. While the Stern Review on the Economics of Climate Change propelled the issue to the forefront of UK politics towards the end of 2006, media, business, policy, and dedicated think tanks like the UN Intergovernmental Panel on Climate Change (IPCC) are raising awareness to the next level on a global scale. Even in the US, a region slow to address climate change, there is a push towards action.

The geographical risks and effects of climate change have been widely documented. From an economic perspective, the Stern Review (2006) estimated that ‘if we don’t act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. In contrast, the costs of action – reducing GHG emissions to avoid the worst impacts of climate change – can be limited to around 1% of global GDP each year<sup>1</sup>. In temperature terms, a 2°C gain is expected if no action is taken. Since GHG’s are a function of population and economic growth, they are unlikely to be stabilised without intervention. At these levels the following impacts are expected.

- Potential 20-30% decrease in water availability in some regions (e.g. South Africa and Mediterranean)
- Sharp declines in crop yield in tropical regions
- 40 – 60 million more people exposed to malaria in Africa
- Up to 10 million more people affected by coastal flooding each year
- 15 – 40% of species facing extinction
- Potential for irreversible Greenland ice sheet melting, accelerating sea level rise and committing the world to an eventual 7m sea level rise

For investors, the cause of warming is not important, pre-empting the likely mitigation action is

There is continued debate among the scientific community on whether the causes of temperature fluctuation and severe weather activities of recent years are anthropogenic or natural cycle. The cause in our view is not important to investors. What is important however is to establish the likely ‘carbon<sup>2</sup>’ position of governments globally, pre-empt possible measures to combat climate change, and identify the stock risk and opportunity.

We believe policy makers will take an emission reduction approach

The foundation of our thought process is the belief that policy makers will impose measures to reduce emissions, and that a shift has occurred whereby business will be rewarded from adopting a proactive stance. This will come in the form of lower cost pressures from changing regulation on a global scale, demand drivers from a climate aware consumer and opportunities for innovation in new markets.

Newsflow catalysts in 2007

2007 is also set to be a year that emphasizes the ramifications of ignoring the warming problem, with the conclusions from the UN Intergovernmental Panel on Climate Change’s (IPCC) Fourth Assessment reports to be published throughout the year. The first, Climate Change 2007: The Physical Science Basis, (February 2007) documents the scientific evidence of anthropogenic contribution to climate change. The second, Climate Change Impacts, Adaptation and Vulnerability notes that “although many early impacts of climate change can be

<sup>1</sup> The Economics of Climate Change, The Stern Review, Nicholas Stern, Cambridge University Press 2006

<sup>2</sup> For ease in this note we use the term ‘carbon’ to denote the 6 gases regulated by Kyoto which are generally measured in tonnes of CO<sub>2</sub> equivalent. GHG’s refers to all greenhouse gases. The Kyoto Protocol is discussed in Appendix 1.

effectively addressed through adaptation, the options for successful adaptation diminish and the associated costs increase with increasing climate change". The third report, 'Mitigation of climate change', will be published in May.

Thus far, many studies have focussed on sectors and stocks that are the most impacted by legislation currently in place, such as the Kyoto protocol and EU ETS. However, globally, a mindset shift among business leaders is occurring. Ultimately, if the belief among policy makers is that carbon emissions are to blame for climate change, then to reduce them to levels consistent with forecasts of stabilisation, steps will have to be taken across all countries, industries and sectors. Business leaders in all sectors are considering their carbon footprint, and this along with other environmental considerations lead to a competitive advantage in our view. A demonstration of proactive environmental awareness and responsibility demonstrates a high quality business model and a greater likelihood of sustained earnings growth should financial penalties based on new legislation occur.

Proving that a company is higher quality, (and justifies an associated valuation premium) because of its environmental credentials is tough, since growth in revenues and earnings is a result of many factors irrespective of the environment. Going forward however, we believe that companies will find it more difficult to hide behind bad environmental habits as governments impose legislative changes, investors become more involved in engagement, consumers demand more transparency on the supply chain, and that investors will value these financial and reputational risks accordingly.

Investors are already acting to obtain greater disclosure of environmental factors and risks. The Global Framework for Climate Risk Disclosure was published in October 2006, as a statement of investor expectations for climate change related risks and opportunities. These would be reported through existing mandatory financial reports, the carbon disclosure project, (an investor led request for carbon information from companies across sectors globally) and the global reporting initiative. Eventually carbon emission and other environmental indicator reporting will be de rigueur in our view. This is unlikely to occur in the short term however.

As quantifying and publicising emissions data becomes the norm investors will be able to calculate valuation measures, such as Revenues/CO<sub>2</sub> or EBITDA/CO<sub>2</sub>, for comparative purposes. Similarly to other valuation techniques there will be flaws with comparison across the market due to varying carbon intensities in sectors, but a carbon ratio would be a risk profile indicator. A low Rev/CO<sub>2</sub>e ratio would indicate the company would find it more difficult to cope with legislative cost changes from carbon penalties.

Corporates are already beginning to adopt a pro-active stance towards combating climate change. While many are already implementing 'ISO 14001', an international standard environmental management system, which requires setting and recording environmental targets and achievements, others are making more public claims of their commitments, with quantified, tough to achieve targets.

These leaders have recognised the benefits of achieving early adoption status, namely the opportunity to shape policy and thus reduce regulatory cost risk, and ultimately achieve increased cost savings from improved efficiencies. In addition, pro-active consumer facing industries could see market share gains as media coverage prompts changing habits in consumers (although this is unlikely to happen short term) towards more environmentally friendly products. Industrials however, also have opportunities to win business by taking a proactive approach as a greater focus is given to supply chain ethics.

Thus far focus on Kyoto impacted industries, now business leaders across all sectors are taking note

Now higher risks for companies from hiding behind bad environmental practices

Investors also want more disclosure on climate change risk and opportunity; Global Framework for Climate Risk Disclosure

Broadly available data enables carbon valuation comparisons - a low Rev/CO<sub>2</sub> ratio would indicate a higher risk profile with respect to possible carbon penalties

The leadership of a few will provoke a response among the many, legislation will enforce the laggards

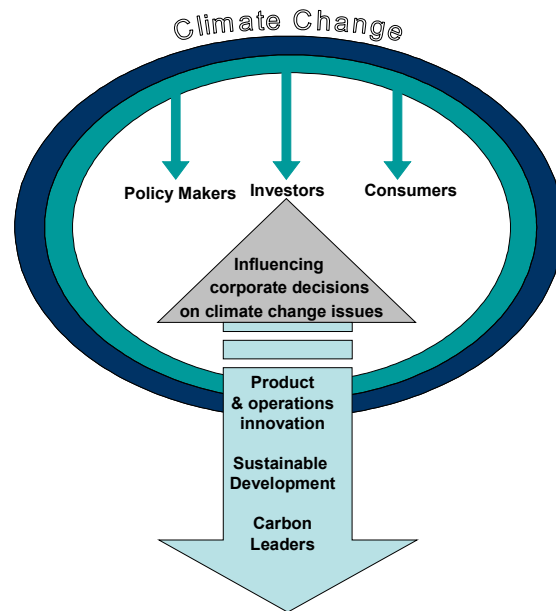
Early adopters could help shape regulation

Many benefits from a proactive environmental strategy

In our view companies that are taking a proactive approach towards an environmental strategy (not purely climate related) will have higher operational efficiencies, a lower risk of supply chain and workforce disruption, a better risk management strategy, possible innovation benefits from identifying new market and/or product opportunity and a sustainable growth strategy. Curbing carbon emissions is high on the political agenda for most countries, and the likely outcome is legislative drivers. We don't expect legislation to be a particularly high risk to companies in 2007 but we believe the benefits of developing a proactive stance to environmental matters now outweigh the costs.

Policy makers, investors and consumers are pushing corporates to tackle climate change, but business leaders are also adopting first mover advantage

**Chart 2: Variety of forces driving corporate action against climate change**



Source: Merrill Lynch SRI Research

Emission growth forecasts and breakdown illustrate the countries and sectors that could be exposed to stringent legislative changes

This note firstly highlights the forecasts for carbon emissions in major regions, in order to identify which countries could be subject to the most stringent legislative drivers. We show the industry composition of emissions, including a breakdown of sectors emitting the higher global warming potential gases to establish potentially higher risk sectors on a broad scale.

Regional policies highlight risks and opportunities for companies

Secondly, we look at the regional and global policies in place for tackling climate change, including the Kyoto Protocol and the mechanism of the EU Emissions Trading Scheme (EU – ETS) to establish risks and opportunities for companies. In addition we look at how investors are collaborating to gain more information on the risks and opportunities for individual companies.

Finally we identify the environmental credentials of companies on the ML Europe 1 stock ideas list from page 23. Most companies are detailed and quantitative in the approach, with Whitbread and Barclays having particularly good disclosure. We also provide a Rev/CO2 comparative indicator.

## Global problem, impacting global business

Overseas drivers to legislation change gaining in importance

The challenge of running a profitable business within an environmentally friendly framework is not restricted to optimal efficiency in the local region. For overseas operations, new legislative drivers could come in to force which give rise to cost pressures. These effects can be mitigated by optimal processes, but also by forward knowledge of potentially higher risks geographically. A look at global carbon emission projections shows which regions are currently the highest emitters, and consequently those that may come under early pressure to impose more stringent legislative changes.

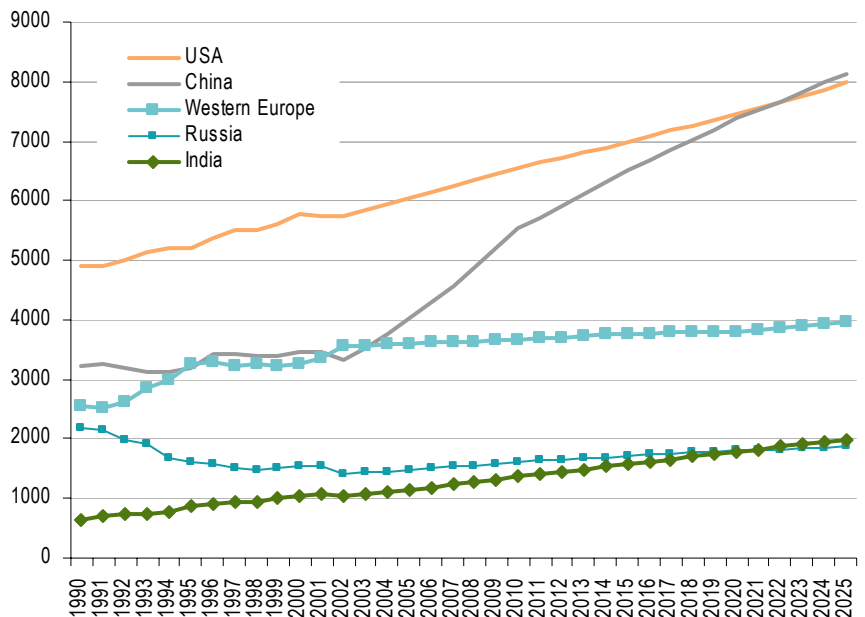
Economic and population growth drive carbon emissions

Carbon emissions are a function of GDP and population growth. Thus it is possible to calculate the likely growth profile of emissions on a regional basis. The World Resource Institute computes this data and chart 4 below shows historical emissions from 1990 – 2003 (the most recent actual date from the WRI) and forecasts to 2025 for the main regions, on the WRI base case scenario.

China and India will post the fastest growth in emissions, but the US retains the position of highest absolute levels until 2022

From 2003 – 2025 the greatest growth in emissions is expected to come from China, at 130%, and India at 88%. The US, however, retains its status as highest absolute level emitter until 2022 on these forecasts. However, Energy Information Administration (EIA) data (Official Energy statistics from the US government) suggests that China could overtake the US by 2009. Chart 3 shows that by 2025 on the WRI forecasts, Chinese and US emissions will be double that of Western Europe. Discrepancies in forecasts come from varying the assumptions on population and economic growth as well as assumptions on likely mitigation policies. Although chart 3 shows that there is room for improvement in all regions, this data would suggest attempts to roll out legislative enforcement will be quicker and with greater impact in the USA and China. Mitigation measures are being rolled out globally however.

**Chart 3: Carbon Emissions for major regions 1990 – 2025 (MtCO2)**



Source: World Resource Institute, CAIT Database, base case scenario

## Global reduction measures in progress

### 20 Years of tackling harmful substances

Global initiatives to tackle atmospheric substances since 1987

Global initiatives have been in place for tackling substances harmful to the environment for the last 20 years. In 1987 the Montreal Protocol was adopted on substances that deplete the ozone layer, which introduced the notion of a historical base year for reduction targets. Indeed the protocol was successful, with chlorofluorocarbons (CFC's), the main gases targeted, now essentially banned in the developed world.

UN FCCC: information sharing mechanism on GHG emissions and policies

Subsequently, a wider focus on tackling climate change was implemented in March 1994 with the launch of the UN Framework Convention on Climate Change (UN FCCC). At the time 189 countries ratified the convention, which was designed for governments to share information on GHGs, national policies and best practices and was the precursor to the Kyoto Protocol<sup>3</sup>. In 1997 the Kyoto Protocol extended the principles of the FCCC by implementing legally binding targets on GHG emissions for countries in Annex B of the Kyoto Protocol. These countries are listed in table 1 below, with their quantified emission limitation or reduction commitment as a percentage of the base year, usually 1990.

Kyoto commitment countries

**Table 1: Annex B Countries and emission reduction commitment (in relation to base year\*)**

Austria	-8%	France	-8%	Lithuania*	-8%	Slovakia*	-8%
Belgium	-8%	Germany	-8%	Luxembourg	-8%	Slovenia*	-8%
Bulgaria*	-8%	Greece	-8%	Monaco	-8%	Spain	-8%
Canada	-6%	Hungary*	-6%	Netherlands	0	Sweden	-8%
Croatia*	-5%	Iceland	+10%	New Zealand	+1%	Switzerland	-8%
Czech Republic*	-8%	Ireland	-8%	Norway	-6%	Ukraine*	0
Denmark	-8%	Italy	-8%	Poland*	-8%	UK	-8%
Estonia*	-8%	Japan	-6%	Portugal	-8%		
EEC	-8%	Latvia*	-8%	Romania*	0		
Finland	-8%	Leichtenstein	-8%	Russian Federation*	-8%		

Source: UN FCCC \*Base year is flexible in the case of countries with economies in transition, Bulgaria and Poland is 1988, Hungary is the average of 1985-1987, Romania is 1989 and Slovenia is 1986.

**Table 2: GHG's regulated by Kyoto**

Gas	Symbol	GWP 100 Years	2000 MT
Carbon Dioxide	CO2	1	24,098
Methane	CH4	21	5,855
Nitrous Oxide	N2O	310	3,349
Hydrofluorocarbons	HFC's	140-11700	91
Perfluorocarbons	PFC's	6,500-9,200	265
Sulphur Hexafluoride	SF6	23,900	53

Source: WRI, Climate Analysis Indicators Tool (CAIT) Database

The 6 main GHG's are included in the Kyoto reduction targets, and are measured in terms of carbon dioxide equivalent (CO2e). CO2e provides a universal standard of measurement against which the impacts of releasing different GHG's in the atmosphere can be evaluated, since each gas has a different global warming potential (GWP). GWP's and absolute emission levels for 2000 are shown in table 2 and shows that every tonne of Sulphur Hexafluoride (SF6) has a warming potential of 23,900 times that of one tonne of carbon dioxide (CO2), but that absolute SF6 emissions in tonnes are low.

The emission reduction targets in Table 1 above are for the first commitment period 2008 – 2012, but countries are expected to have made significant progress towards this through 2005-2007. To achieve the reduction targets each country must primarily put in place its own measures, but can also use the flexible mechanisms within the protocol to obtain credits. These are summarised in the table overleaf. Although phase II of Kyoto is legally binding, the framework enables national governments flexibility to employ a strategy relevant for the structure of the domestic economy.

<sup>3</sup> The Kyoto Protocol framework and its flexible mechanisms are discussed in detail in Appendix 1.

**Table 3: Summary of Kyoto Carbon Credit Flexible Mechanisms**

	<b>Clean Development Mechanism (CDM)</b>	<b>Joint Implementation (JI)</b>	<b>Emissions Trading</b>
Carbon allowance credits issued	Certified Emission Reductions (CER's)	Emission Reduction Units (ERU's)	No countries eligible*
Location of project	Developing countries	Industrialised countries	NA
Credit Usage	Phase I and II	Phase II	

Source: UN FCCC, \*Regional schemes may be established under Kyoto, such as the EU ETS

Conclusions: long history of reduction measures, unlikely to see U-turns

**Conclusions - Global measures already in place too advanced for reversal**

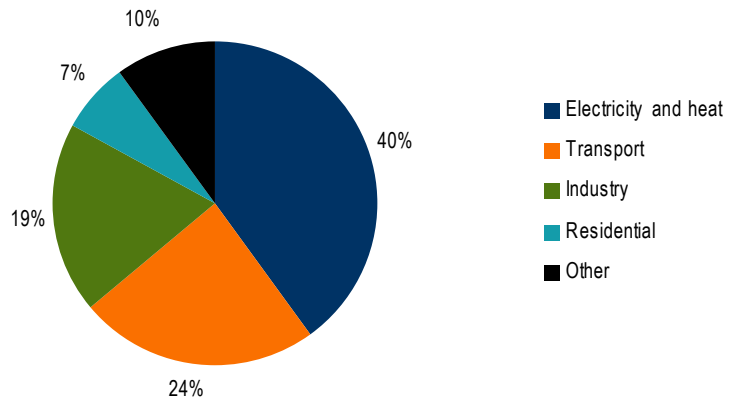
The Kyoto framework, while not flawless, is operational as a mechanism to measure and reduce GHG's. So far the signatories are acting to meet targets. While it is disappointing that not all countries are signatories to the Protocol, we believe that the mechanism is strong enough to result in national policy implementation to reduce GHG's. Although there is currently uncertainty over what will happen to Kyoto post 2012, we believe that the European public commitment to reductions to 2020 will help maintain momentum and provide a continuation of Kyoto.

All industries consume power thus cost risks if energy inefficient

**All industries, not just utilities impacted by climate change issues**

It is well known that globally power generation industries emit the most CO2, namely 40% in 2004 as shown in Chart 4. However, all industries are involved in the consumption of power, and thus all sectors will be impacted by any changes in legislation targeted at the energy sectors, likely through a cost impact if emissions are capped and costs passed on from the providers.

**Chart 4: Breakdown of world CO2e emissions by sector**



Source: WRI, Climate Analysis Indicators Tool (CAIT) Database

Risks of more stringent legislation appears higher for higher GWP gases

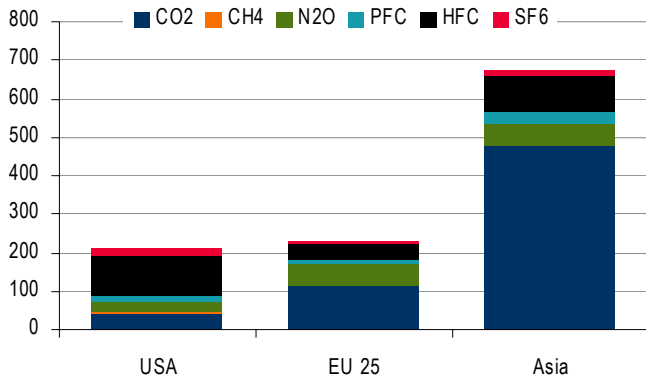
**Higher GWP gases are present in wide ranging industries**

Although CO2 is by far the largest volume gas in absolute tonnes emitted globally (Mt 24,098 compared with Mt 410 for PFC's, HFC's and SF6 combined in 2004) the higher GWP gases in table 2 could be subject to more stringent and higher penalty legislation. Table 2 above shows the different intensities of warming potential, with HFC's PFC's and SF6 the highest. At first glance this implies that policy measures for reduction would target these gases first.

Used in industrial processes:  
Refrigeration, Air conditioning, Medical  
Device Inhalers, Insulation

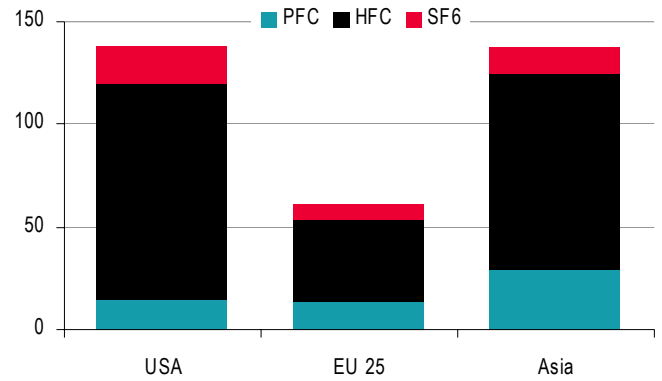
The higher GWP gases are generally emitted during industrial processes (note only methane and nitrous oxide are emitted from waste or agriculture) and chart 5 below shows the absolute emissions from HFC's, PFC's and SF6 in the USA, Asia and EU 25 in 2000 (Most recent data from the World Resource Institute).

**Chart 5: Gases from industrial processes, 2000, Mt**



Source: WRI, CAIT Database

**Chart 6: Higher GWP gases from industrial processes, 2000, Mt**



Source: CAIT Database

But these are often a more environmentally friendly alternative

These gases are by products of commonly used applications like refrigerators, air conditioning, medical inhalers and insulation. The chart shows that that the absolute emissions from these gases are low compared to the CO2 emitted in industrial processes (Chart 5). Chart 6 shows that the absolute levels are much higher in the USA and Asia than in Europe. However, these gases are often used as the most environmentally friendly alternative to increased energy consumption. For example, HFC's were developed for use instead of CFC's (regulated by the Montreal Protocol) in medical device inhalers (MDI) and the transition from CFC's to HFC's in healthcare will reduce the global warming impact of MDI emissions by at least 75% from 2000 to 2010<sup>4</sup>.

Refrigeration used in many industries

Refrigeration is a requirement for many industries, including food, technology, transport, healthcare, and for domestic use, and is a large source of high GWP emissions. However, the thermal insulation from using high-efficiency HFC blown foams reduces the overall energy consumption of refrigeration equipment, offsetting what would be a higher level of carbon emissions.

High GWP gases could be more heavily targeted, but unlikely in short term

We believe that legislative emission reduction efforts will remain primarily focused on high carbon dioxide industries rather than the higher GWP gas related sectors. However, there is a low probability that higher taxes could be imposed on activities that emit HFC's, PFC's, and SF6, i.e. refrigeration, air conditioning, insulation and some medical inhalers. We believe this is unlikely as yet given other environmental benefits of using these gases where necessary, however, over the medium to long term new regulation could have cost impacts.

<sup>4</sup> www.fluorocarbons.org

Conclusions: Highest impact sectors will remain the most regulated, but now all companies need a view on their emissions

### Conclusions - reduction effort to remain on CO<sub>2</sub>, but all sectors exposed

Although it is clear that the highest emission sector globally, power generation, will continue to be the most heavily regulated and impacted by any changes in legislation, in our view all companies now have to be aware of their emissions in order to minimise risk from potential regulatory cost increases. As yet we do not think the highest GWP sectors are at greater risk from more stringent legislation, because of the environmental justification for them.

## What policy measures are countries adopting?

### Europe - leader in implementing environmental legislation

Europe - Climate change centre stage

In Europe climate change has reached the centre of political debate. Germany used its position of EU presidency to push the topic hard. Indeed, at the EU summit in March chancellor Angela Merkel reached an agreement to reduce emissions by 20% by 2020 compared with 1990 levels, effectively extending on Kyoto targets. If other regions also joined, this target would be increased to 30%. This is to be reached through increasing use of renewable energy and emissions mitigation. The European wide target is legally binding, but member state targets will be set under a flexible national plan system, which also compliments the Kyoto framework. Under Kyoto, the EU is expected to reduce emissions by 8% of the 1990 base. Individual country targets for Kyoto are given in table 1 on page 6.

European Climate Change Task force in place since 2000

Since 2000, Europe has had a climate change programme in place, which has sought to provide measures for CO<sub>2</sub> reductions. It is now on the second phase (ECCP II) which was launched in October 2005. Working groups discuss and prepare the development of the EU's climate policy. Currently there are working groups for aviation, CO<sub>2</sub> and cars, carbon capture and storage, adaptation and the EU Emissions Trading Scheme (EU ETS) review. There are ongoing updates for the working groups, but a study launched in June 2006 focussing on sectoral emission reduction potentials is expected to deliver results in June 2008.

EU ETS: Cap and trade system for emissions

The 2003 European Trading Scheme Directive set the wheels in motion for the February 2005 launch of the EU Emissions Trading Scheme, a cap and trade system for carbon for 25 EU member states. Carbon allowances are given to specific operational units where activities are carried out that could have an effect on emissions and pollution – installations. Installation operators are both obvious candidates like offshore oil and power generators, but also organisations like hospitals, universities, dairies and other food producers. These all have annual CO<sub>2</sub> allocations to be adhered to.

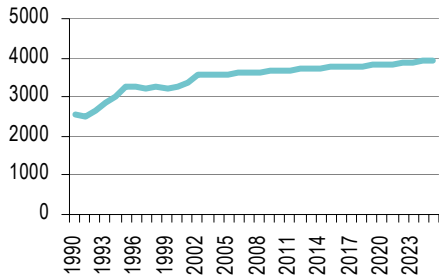
The owner of the installation is not necessarily a European company, for example Toyota, Sony, and ExxonMobil all have regulated installations in the UK, and must meet those requirements either through reduction efforts or by buying or selling credits in the market. The mechanism of allocating allowances to installations is discussed in Appendix 2, but it is worth noting that any company can buy or sell credits in the EU-ETS, not just those regulated by an emissions cap.

Early legislative directives a feature in the EU

**EU - Long history of environmental directives**

Prior to Kyoto, the EU had already introduced Directives<sup>5</sup> on an ongoing basis targeting environmental issues. There are Directives focusing on sub-sectors like fuel or waste, tackling, soil, noise and water pollution, recycling and the disposal of waste oils.

**Chart 7: European Emissions MTCO2**

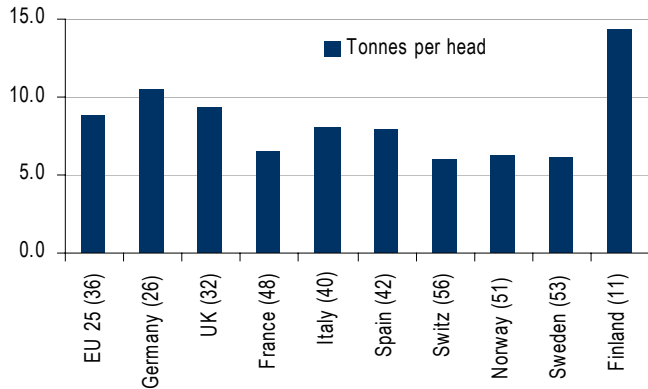


Source: World Resource Institute

Early implementation of legislation appears to have stabilised absolute levels of emissions from 1993 to 1999 (chart 6), and the world resource institute sees Western European emissions rising 10.9% from 2003 until 2025. A 10.9% rise is low compared to the US, which is expected to see rises of 36.5%.

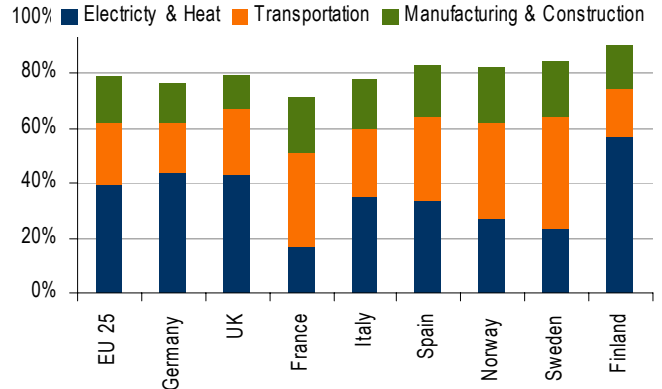
In terms of tonnes per head, a popular metric because of the ability to look at countries relative to each other, European regions are reasonably low in a global context, with the EU as a whole ranking 36<sup>th</sup> globally. Finland is the least carbon efficient per population in Europe, and at 11<sup>th</sup> is highly ranked on the global scale, with almost 80% of its carbon emissions coming from electricity and heat and transport. (Chart 8).

**Chart 8: Selected countries tonnes per head**



Source: WRI, Global ranking in brackets

**Chart 9: Selected countries - source of emissions**



Source: WRI

Chart 8 shows that for most of the largest Euro zone countries (Germany, France, Italy, Spain), electricity and heat, and transport comprises at least 60% of emissions. France is the exception, with a low electricity and heat emissions level, curtailed by the amount of nuclear energy utilised in France. In the US, electricity and transport represents 77% of emissions. It is likely that fuel directives in the EU have stabilised transport emissions which has not occurred in the US.

Conclusion: Severe legislation changes unlikely, large companies used to environmental reporting

**Conclusions - EU companies proactive on environmental KPI's, low risk**

Most European companies are proactive about reporting their environmental achievements, either by reporting according to ISO 14001, or by noting environmental kpi's in separate reports. In our view sudden severe legislation changes are unlikely in the EU, and most large companies are already at ease with environmental reporting and managing risk.

<sup>5</sup> Council Directive 1972 on emissions of pollutants from diesel engines; Council Directives June 1989 on the prevention of air pollution from new and existing municipal waste-incineration plants for example

## UK - Climate policy high on the agenda

Part of Kyoto, but also domestic high targets

The UK has had a long track record of taking the environment and climate change seriously, and is a Kyoto signatory. According to DEFRA<sup>6</sup> the UK is currently on track to reduce carbon by 15-18% lower than 1990 levels by 2010. The DEFRA report and 'The Economics of Climate Change; The Stern Review' (Nicholas Stern, 2006) put climate change towards the front of the political agenda in 2006.

UK: Climate Change and Sustainability Act 2006

The Climate change and Sustainability Act gained royal assent in July 2006. The purpose of the act is to enhance the UK contribution to combating climate change. The act stipulates that an annual report on the steps the government has taken to reduce carbon emissions, and the level, Increase or decrease, of emissions in the UK has to be produced.

Annual recording of GHG's levels; microgeneration targets

In addition, the chancellor has to include the fiscal measures appropriate to assist with microgeneration and energy efficiency. Microgeneration is the generation of zero or low-carbon heat and power by individuals, small business and communities to meet their own needs. There will be national and local targets for microgeneration, and an annual report will state the implementation strategies and achievements. In addition, a scheme facilitating the sale of electricity produced by domestic microgeneration will be enabled by July 2007.

In the March 2007 budget there were several measures specifically geared towards tackling carbon levels. Interestingly, the government is encouraging the participation of private enterprise by launching a competition to develop the UK's first full-scale demonstration of carbon capture and storage. The result of this will be announced in 2008.

Carbon neutral homes good idea in theory, no incentive for housebuilders however

The Chancellor also targeted homes as a means to address the microgeneration task. From October 2007 new zero-carbon homes costing up to £500,000 will pay no stamp duty, with zero carbon homes costing in excess of £500,000 receiving a reduction in their stamp duty bill of £15,000. This represents a significant saving for home buyers as currently, stamp duty on houses from £250,000 to £499,999 is 3%, and above £500,000 it is 4%. However, ML housebuilding analyst Mark Hake thinks that there is little incentive for housebuilders to build carbon neutral homes as yet.

Funding and assistance for energy efficiency in households

The chancellor laid down an intention that by the end of the next decade all householders will have been offered help to introduce energy efficient measures with the aim that, where practicably possible, all homes will have achieved their cost-effective energy efficiency potential. There is also a Low Carbon Buildings Programme fund of over £18m to help meet demand from households for microgeneration technologies.

Behavioural changes aimed for

The chancellor acknowledged that government intervention was required to solve the market failure arising from environmental externalities, and noted a commitment towards encouraging behavioural change towards the use of energy, waste and water. The government have attempted to confront this with the stamp duty changes and high taxes on landfill waste. The rate of landfill tax will increase by £8 per tonne per year from April 2008 until at least 2010-11. While these measures are a step in the right direction, they rely heavily on the incumbent to change behaviour, without guidance to address the issues. I.e. the seller of the

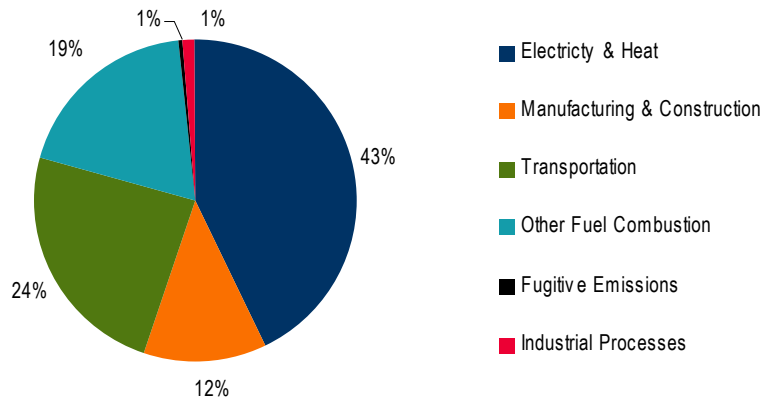
<sup>6</sup> Department for Environment, Food and Rural Affairs, 'Climate Change The UK Programme 2006', March 2006

house has to implement the change to achieve a carbon neutral home, but the buyer gains the benefit of a reduced tax bill. Although over time a carbon neutral home could receive a price premium such that the buyer benefits from the carbon neutral status but the seller benefits from a higher price this is unlikely to occur in the short term, and there is thus little incentive for the seller to suffer the initial cost outlay. Nevertheless, the moves are a step in the right direction to mainstream carbon reduction efforts.

The chart below shows the sector breakdown of UK emissions, demonstrating that power generation is the main cause and as a percentage is at the upper end of weight in a European context. In the UK the higher GWP (HFC, PFC, SF6) gas industrial process sector is particularly low at just 1%. Thus the UK would be better positioned than other regions should high penalties be implemented for emitting high GWP gases. We do not believe that his legislation would be introduced in the near term however.

Manufacturing and construction lower source of emissions than in UK than in other EU countries

**Chart 10: Sector breakdown of UK emissions – 2003**



Source: WRI Note: Note: Fugitive emissions are the unintended gas leaks from the processing, transmission, and/or transportation of fossil fuels, CFCs from refrigeration leaks, SF6 from electrical power distributor, etc

Carbon Disclosure Project (CDP)<sup>7</sup> is promoting the reporting of carbon

The government bias is to push for behavioural changes across business and households rather than taking a hardline regulatory stance. Business leaders are already adopting a proactive stance. In some cases a tangible objective is given, including dates for achieving carbon neutrality. We would argue that business leaders in the UK are recognising the first mover competitive advantage of embracing environmental measures. UK corporates are also familiar with detailed investor requests for carbon data. For example the Carbon Disclosure Project (CDP) surveyed the FTSE 350 for carbon data. The Carbon Disclosure Project is discussed in detail on page 20.

Conclusion: Still opportunity for business to shape policy in the UK

**Conclusions - regulatory risk low, but opportunities to shape policy**

Opportunity exists for business’ to shape future policy and regulation, including refining DEFRA’s guideline on the KPI’s for international reporting, and the adoption of industry standards. Installations are already regulated under the EU ETS system and other business’ are looking at their environmental efficiencies. In addition the ‘Carbon Trust’ has been set up to help business reduce emissions. We believe that the risk of stringent legislative changes in the UK is low, but believe there is a first mover opportunity for corporates in the UK.

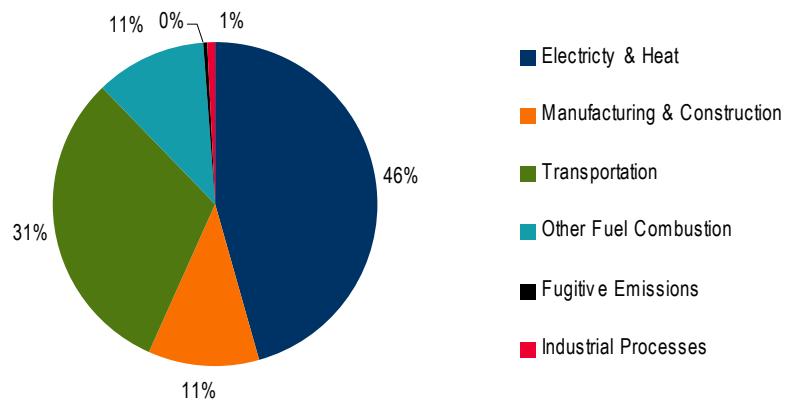
<sup>7</sup> <http://www.cdproject.net/>

US - opted out of Kyoto; the bad example is hard to overcome

## US - gaining momentum, but global laggards

The US has been slow to get off the ground in terms of specifically tackling climate change. Despite the creation of the Environmental Protection Agency (EPA) in 1970, designed to set national standards for a variety of environmental programs, the US opted out of Kyoto. This in itself presents a global hurdle to carbon mitigation. As shown in chart 3 on page 6, the US emits the largest amount of carbon today in absolute terms (US is ranked 6<sup>th</sup> globally on a per head basis at 19.9 tonnes). Opting out of the Kyoto framework sets a poor example to other regions, especially developing countries where raising the standard of living from faster economic growth is largely dependent on fossil fuel consumption. Chart 11 below shows the breakdown of the source of emissions in the US.

**Chart 11: Breakdown of emissions source in the US – 2003**



Source: WRI

The US autos team look at climate change and the autos industry in 'Alternatives for the clean car evolution'

John Murphy  
+1 212 449 7045

The US has a larger proportion of carbon emissions coming from transportation than most other regions, at 31% versus an EU 25 level at 23%. Indeed, auto emissions are a contentious issue in the US. At the beginning of April the supreme court ruled that the EPA has the power to regulate GHG's emissions from cars and trucks. The ruling was that CO2 falls under the legal definition of pollutants that the federal government has authority to regulate.

The ML US autos team look at the pressures on the autos industry from energy security and climate change in the note 'Energy Security & Climate Change – Alternatives for the clean car evolution', (6 November 2006).

Pressure groups emerging of business and environmental organisations - taking a lead in shaping national policy

Pressure groups are emerging to push the Federal Government into action. USCAP, the United States Climate Action Partnership is a group of business and environmental organisations calling for national legislation for the reduction of GHG emissions. Its recommendations are along the same lines as other policies internationally, (legislation needs to be implemented for cap and trade, policies for deployment of zero and low emitting technologies etc) but the fact that business is driving the effort is important to note, and demonstrates a belief that the benefits of proactive action outweigh the costs of legislative measures.

California the most high profile 'action' state

In the US, the most high profile action has been the Assembly Bill 32 in California, which pledges that the state's GHG emissions be reduced to 1990 levels by 2020, to be achieved by implementing a state wide cap on levels starting in 2012. Other states (for example in the North East) are also following this lead. Under the Californian proposals there would be mandatory reporting rules for significant sources of GHG's, and implementation plans formulated by 2009.

**EPA has Clean Air and Global Climate Change as long term strategic goal**

The EPA states that Clean Air and Global Climate Changes is one of its long-term strategic goals<sup>8</sup>, and the agency strives to implement the Clean Air Act Amendments of 1990 and other environmental laws. Within the framework, the agency has six strategic goals; healthier outdoor air, healthier indoor air, to protect the ozone layer, radiation, reduce greenhouse gas intensity, and to enhance science and research. Most of the objectives have 2010 deadlines, but are voluntary schemes and driven by grant funding.

**Targets in place**

The US EPA has stated targets for The Clean Air and global Climate Change goal for 2006-2011. These include absolute reduction targets by 2012 from 2002 levels, in buildings, transport and industry. However, there is a lack of clarity on how these are to be achieved other than through partnership efforts. The EPA has, however, made significant traction with its Energy Star Program.

**Energy Star can boost sales - food equipment manufacturers**

**Energy Star Initiative - driving product replacement cycles**

Energy Star is a joint program between EPA and the US Department of energy. The initiative was introduced by the EPA in 1992 as a voluntary labelling system to promote energy-efficient products in order to reduce GHG emissions, and now covers major appliances, office equipment, electronics, new homes and commercial and industrial buildings.

**Earlier replacement cycle driven by energy efficiency**

The system can benefit business, as it creates an earlier replacement demand cycle because of efficiency gains. In addition, in some cases customers are given the extra incentive of rebates. In the restaurant industry, for example, where food sales contribute c4-5% to GDP, energy intensive high GWP equipment such as cookers, refrigeration units and hobs are in use for long periods of time. Product manufacturers have launched new product ranges with the energy star in mind, and customers can gain rebates from \$75 up to \$2000. The food equipment industry was worth approximately \$8.2bn<sup>9</sup> in North America in 2006 so market share gains from increased energy efficiency products are worth pursuing. Companies which operate in this industry that have products under the Energy Star scheme are shown in the table below. ML rates UK pure play Enodis a Buy.

**Table 4: Food equipment manufacturers with exposure to the US market**

ML Ticker	Company	Listing	Market Cap USDm	Rating	QRQ	Analyst	Telephone
UTX	United Technologies Corp*	United States	64,467	1 - Buy	B-1-7	Ronald J. Epstein	+1 212 449 4585
ITW	Illinois Tool Works	United States	28,963	2 - Neutral	A-2-7	John G. Inch	+1 212 449 2341
IR	Ingersoll-Rand	United States	13,811	2 - Neutral	B-2-7	Andrew Obin	+1 212 449 4425
DOV	Dover Corp	United States	9,852	1 - Buy	B-1-7	John G. Inch	+1 212 449 2341
RTLLF	Rational AG	Germany	2,344	2 - Neutral	B-2-7	Christian Deckart	+44 20 7996 3414
ENODF	Enodis Plc	United Kingdom	1,608	1 - Buy	B-1-7	Jo Reedman	+44 20 7996 3840
AGAPF	Aga Foodservice	United Kingdom	996	1 - Buy	B-1-7	Jo Reedman	+44 20 7996 3840

Source: Merrill Lynch \*UTC also has alternative products that are under the Energy Star scheme. Based on Prices as at 12 April 2007.

**Product improvements beneficial to energy efficiency in other regions**

The development of these products should also benefit the energy efficiency programs of other regions, as franchises move overseas but use the same suppliers. For example Enodis in the UK also sells its equipment into Chinese and other Asia Pacific markets, thus transferring its energy efficient models. The Chinese food sales market is expected to maintain double digit growth to the end of the decade<sup>10</sup> for example, and 56% of sales in 2006 are estimated to be

<sup>8</sup> US EPA Performance and Accountability Report 2006, November 2006

<sup>9</sup> Enodis Annual Report 2006

<sup>10</sup> Tecnomia Asia

replacement<sup>11</sup>, hence continued sales growth opportunity in those markets, and a competitive advantage versus lower efficiency product ranges.

Conclusion: potential legislative drivers in the US

### Conclusions - potential cost risks from legislative changes

The US is likely to see the greatest changes to its regulatory framework on carbon emissions in our view. However, the legislative changes are likely to be drawn out and driven by pockets of initiative in individual states rather than a federal effort, because of resistance from industry. The Supreme Court ruling is important because it opens the possibility for regulation and would likely also impact European companies that have production capabilities in the US.

State Environment Protection Administration in place

### China - Objectives set; realisation difficult

China has a reasonably good track record on paper of acknowledging environmental damage, with the State Environment Protection Administration (SEPA) in place. Sepa have been providing annual reports on the state of the environment since 2001, with statistic updates since 1999, with other, more case specific pollution reports in place since 1997. Indeed, Premier Wen Jiabao took a tough stance during his recent speech on the 11<sup>th</sup> five year plan, noting the failure of some local governments and companies to comply with laws and standards on energy saving and environmental protection.

Environmental Impact Assessment Law - but enforcement an issue

One area publicised as failing is the Environmental Impact Assessment (EIA) Law, which went into effect in 2003. The law decreed that all construction projects must pass the EIA prior to commencement. While some projects have been delayed or suspended from not meeting the guidelines (including power plants), the penalty for not complying is, in our view, too lenient. If a construction project is built without consent, it must simply undergo a make-up environmental assessment, which, if not completed in the designated time the developer is fined. However, the possible fine is capped at \$25,000, which is often little in comparison to the size of the overall project, and thus developers adopt this approach. SEPA is the regulator and supervisor on all angles of the environment, including nuclear power, natural resource utilisation. It also handles pollution accidents and ecological damage.

New high targets, uncertainty over how to achieve

In China, the 11<sup>th</sup> five year plan 2006-2010 addresses environmental issues. In addition, the renewable energy Law entered into effect on 1 January 2006, which states that the installation capacity of renewable energy generation is targeted to reach 30% of total generation capacity by 2020. China's national plan is to quadruple the 2000 GDP level by 2020, and she aims to reduce the amount of energy required to produce one unit of GDP by 20% by 2010. The progress will be reported annually.

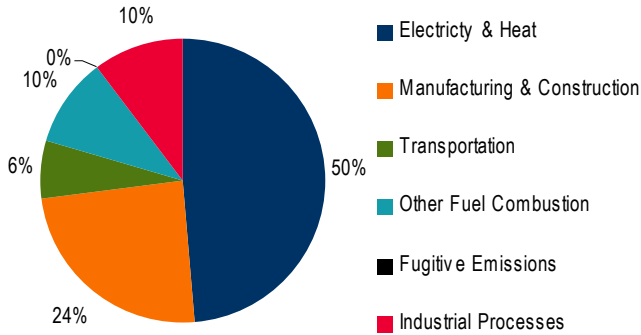
Manufacturing and construction emissions understandably higher in China than US and Europe

Chart 8 below shows China's current energy emissions breakdown by sector, and shows that almost 50% come from electricity and heat, which is a higher percentage than for European developed regions, but is in line with the US. The main difference in developing regions is, understandably given the fast GDP growth rates in China, the proportion of emissions from manufacturing construction, which is currently 25% in China compared to 11% in the US and 16% in the EU 25. The WRI base case expects emissions to grow by 130% from 2003 – 2025 which would take emission levels to over MT 8,000, and to levels higher than the project US levels. Chart 12 shows the sector split as it would be in 2025 according to US sector weights today, which would result in the absolute

<sup>11</sup> Botany Hill Management

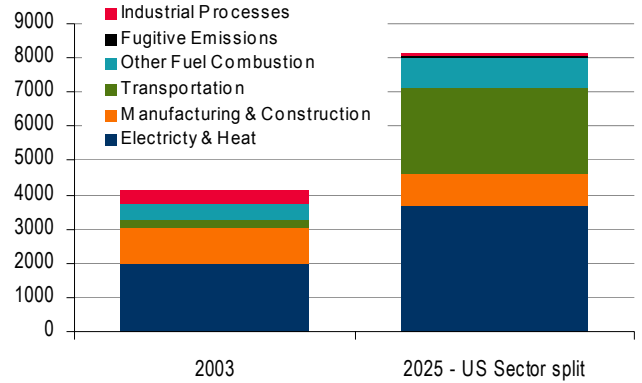
level of emissions coming from industrial processes shrinking from today. To reach a US style emissions composition, emissions from transportation would increase strongly.

Chart 12: Split of Emissions by sector - 2003



Source: WRI

Chart 13: Sector split in 2025 according to current US weights

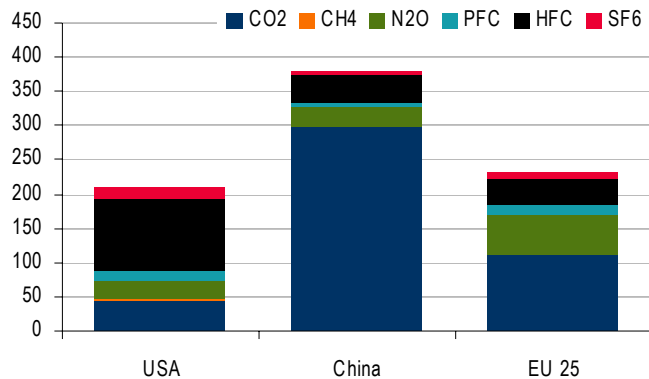


Source: WRI, ML Research

Industrial processes and agriculture higher proportion of emissions than for US or Europe

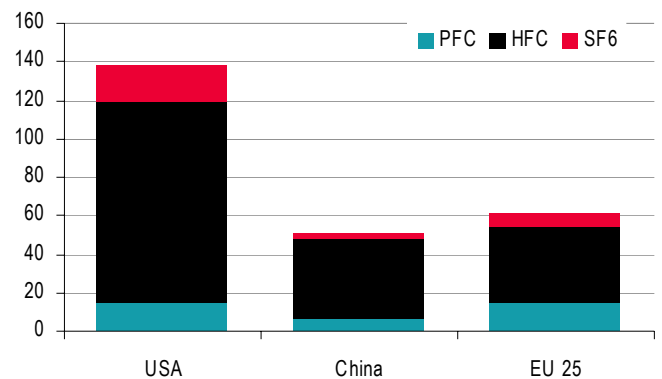
The other main differences currently between China, the US and Europe are in industrial processes and agriculture. Chart 14 shows that the emissions from industrial processes in China are almost double that in the USA and Europe. This is to be expected from the rate of economic growth in China and can be expected to continue, given China's targets for GDP growth to 2010. However, Western companies are involved in much of this growth, and are likely high emitters thus stringent legislative changes would likely impact Western corporates. Industrial processes include the refrigeration, air conditioning areas etc that are high in high GWP gases. Chart 15 shows that the emissions from high GWP gas are lower in China than for the US and Europe. However we have shown (page 9) that HFC's, PFC's and SF6 products are used in processes to increase efficiency. It is likely that going forward the Chinese balance will move towards a higher level of high GWP gases in industrial processes, but that the US levels will decline.

Chart 14: Gases emitted from industrial processes in 2000



Source: WRI

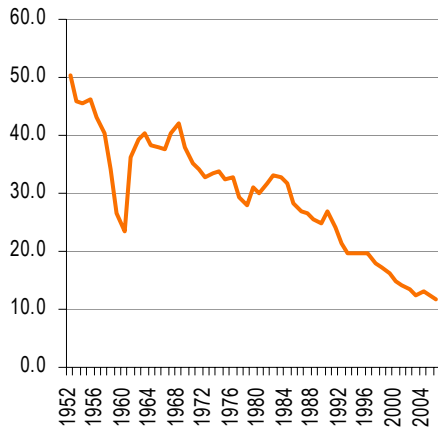
Chart 15: Gases emitted from high GWP in industrial process in 2000



Source: WRI

Agriculture is a large, albeit declining (chart 16) proportion of GDP contribution. Methane (CH4) and Nitrous Oxide (N2O) are by products of agriculture and thus it is unsurprising that the Chinese emissions of these two gases were much higher than for the US or EU 25 in 2000.

**Chart 16: Agriculture contribution to GDP**

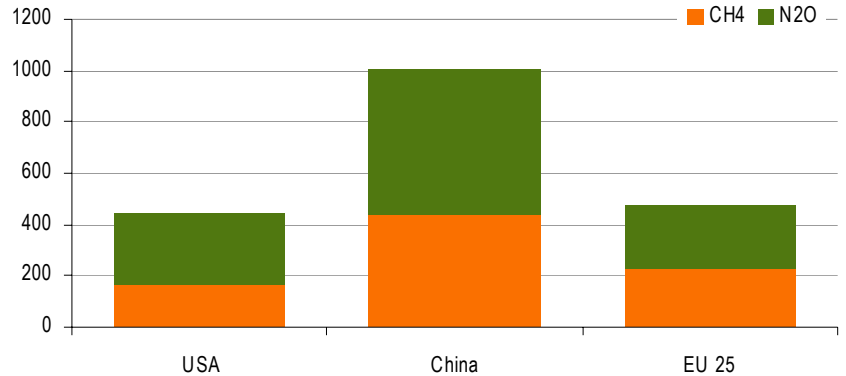


Source: Merrill Lynch Research

9 projects with verified emission reductions have been allocated CER's in China

Renewable efforts up and running but small in the broader context

**Chart 17: Gases emitted from agriculture in USA, China and EU 25**



Source: WRI

**China - A Kyoto clean development mechanism beneficiary**

The CDM framework of Kyoto has prompted investment in Chinese renewable power. Under the CDM a key proponent is that additionality is achieved, that is more carbon is reduced that would have been the case without the project. Emissions are verified before certified emission reductions (CER's) are awarded. This provides entities with installations regulated by Kyoto an opportunity to meet caps if they cannot meet them on reduction efforts alone, by either investing in the initial project to gain the CER's or to buy CER's on the EU ETS.

So far, 9 projects in China have received the certified emission reduction status required for the issuance of 'Certified Emission Reductions' (CER's). 6 of these are in the renewable wind power space, 1 if for waste and the last in industrial processes, specifically addressing HFC's. In addition just over 600 other projects are in the CDM process (see Appendix 1, page 25).

Small steps have therefore been made towards powering China's growth from renewable sources. So far renewable energy represents 1.9% of total energy generation. In addition 382 of the CDM projects are for renewable energy, which is expected to generate 48m CER's (each CER is the equivalent to 1 Tonne CO2e). This is a small dent in the MtCO24497 that China emitted in 2003 (WRI), but are significant nevertheless in that these projects are unlikely to have occurred without the Kyoto mechanism. The table below show the solar companies that ML cover.

**Table 5: ML Coverage of Solar stocks**

ML Ticker	Company	Mkt Cap US\$	Price	Rating	Analyst	Phone
MOEIF	Motech Industrie	1,931	NT\$420	1 - Buy	Ian Tu	+866 2 2376 3714
XROEF	Renesola Ltd	779	486p	1 - Buy	Tien-Yu Sieh	+852 2536 3025
STP	Suntech Power-A	4,076	US\$ 36	1 - Buy	Tien-Yu Sieh	+852 2536 3025
TSL	Trina Solar Ltd	590	US\$ 54.9	1 - Buy	Tien-Yu Sieh	+852 2536 3025

Source: ML Global Research, iQ Toolkit, Prices close 12<sup>th</sup> April

Rapid GDP growth means high expected emissions growth for China; optimally Western companies will aid abatement efforts to a significant degree

US and China highest emission countries, but risks of large cost penalties from legislative change unlikely in the near term

Many countries have some drivers in place for tackling carbon

### Conclusions - effort for environmental protection in place

The proportions of emissions in China are as one would expect from an economy that is undergoing rapid growth – namely a higher proportion in manufacturing and construction and industrial processes. Total carbon emissions are expected to grow by 130% to 2025, which is the fastest growth of a region globally. Measures are in place for environmental protection but are not strictly imposed as yet, there is a risk that this could change with higher quality checks and risk of legislative measures to impose financial penalty, however, we think this is unlikely in the near term. Optimally, Western companies will bring environmental awareness and energy efficiency by using modern applications.

### Conclusions

Globally, the US and China dominate in terms of absolute emissions levels, which could leave companies operating in those regions vulnerable to more stringent (and likely higher cost) measures to tackle emissions. However, in the US a policy at the Federal level is unlikely to occur in the near term, and businesses themselves are tacking an active stance. In the US we believe the risks of cost increases through legislative changes should be low in the near term. In China, there are measures in place as part of the eleventh five year plan, which will unlikely to be changed, so high impact legislative risk is likely to be low.

The majority of countries signed up the UNFCCC in 1994, and most regions have some drivers in place for tackling emissions or increasing renewable energy usage. However, there are differences in the quality of the reporting mechanisms, with Europe the most advanced through the EU ETS framework.

The EU has been a driving force in setting reduction targets that extend beyond the scope of Kyoto, which is positive. However, little focus has been given to how these will be achieved. In addition, the plans could be too relaxed.

In our view the risk of severe financial penalty from carbon emissions for corporates is a medium to long term risk. Legislation is likely to get tougher and impact more sectors, and we believe a pro-active stance towards monitoring and tackling emissions is a prudent strategy, but in the near term the risk is low.

## Globally, investors forcing the issue Carbon Disclosure Project: single request for emissions data

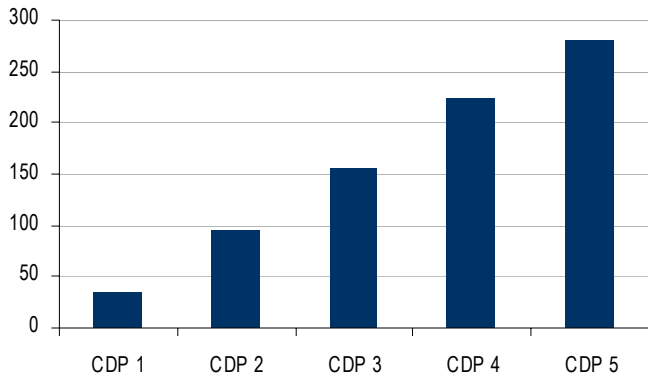
### Merrill Lynch sponsors of CDP 5

The Carbon Disclosure Project (CDP) is a collaboration of institutional investors to efficiently gain access to information on corporate GHG emissions on a global scale. Investors collectively sign a single request for data which is sent to companies for completion. The aims of the project are to inform investors of the risks and opportunities presented by climate change and to inform company management of the serious concerns of their shareholders regarding the impact of these issues on company value.

CDP 5: 280 investors, \$41trn AUM request carbon emissions information request from 2400 companies

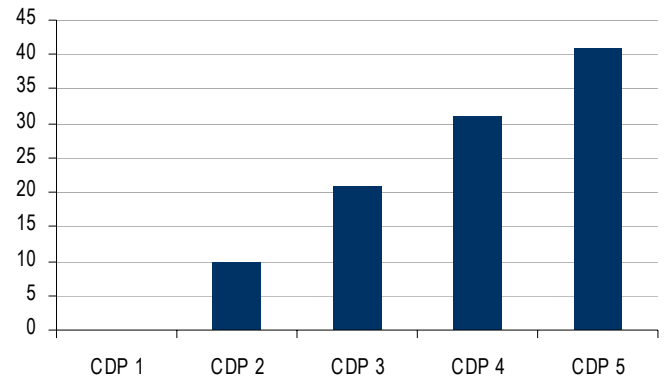
So far four CDP's have been completed. The first questionnaire was sent out in May 2002 to the FT 500 largest companies, backed by 35 investors. The request for data for CDP 5, which was issued in February 2007, was backed by 280 institutional investors, with assets under management of \$41trn. The charts below show the evolution of the project in terms of numbers of investor signatories and their total assets under management. The results of the requests for information are freely available at <http://www.cdproject.net/responses>.

Chart 18: Number of Institutional Investor Signatories



Source: Client Disclosure Project

Chart 19: Assets under management \$ trillion



Source: Client Disclosure Project

CDP 5 questionnaires sent to 2400 companies - more detailed for higher impact sectors

The questionnaire for CDP 5 was sent to over 2400 companies on the 1st February 2007. It is split into two sections, one for all companies to answer and a second with more detailed emission related questions for companies in higher emitting sectors. The questions are more structured, and hence straightforward than previously and although all companies are requested to detail emissions according to scope 1 and 2 of the Greenhouse Gas Protocol (GHG Protocol), the more detailed emissions management (reduction, trading, intensity, costs etc), and climate change governance questions are requested only from the higher impact sectors.

Greenhouse Gas Protocol: A corporate accounting and reporting standard  
Scope 1: Direct GHG emissions  
Scope 2: Electricity indirect GHG emissions

The GHG Protocol is an international accounting tool for government and business leaders to understand, quantify and manage GHG emissions. The initiative is a partnership between the World Resources Institute and the World Business Council for Sustainable Development and provides the framework for inventory and emissions reporting.

Scope 1 emissions are those that occur directly from sources that are owned or controlled by the company. (E.g. emissions from combustion in owned or controlled boilers, furnaces or vehicles). Scope 2 accounts for emissions from the generation of purchased electricity consumed by the company, scope 2 emissions physically occur at the facility where electricity is generated.

#### CDP 5 results in September 2007

The results of CDP 5 will be launched in September 2007. The CDP is a global initiative, but data can be presented by both country and sector. For the UK last year, a CDP report was published for the FTSE 350. Responses for the FTSE 100 were high with 83% responses and 55% providing quantified emissions data. In the FTSE 250 only 36% of companies responded, but many were receiving it for the first time.

Interestingly, a key finding from the UK company responses was that companies in more carbon intensive industries are not more likely to report than companies from less intensive sectors. However, high intensity sectors are more likely to provide quantitative emissions data.

CDP: High quality freely available resource for checking company attitudes to carbon reporting

The carbon disclosure project has made huge progress in raising awareness of climate change related issues among both investors and corporates, and has become a high quality resource for checking companies' attitudes to emissions. (The website details all the companies that have been questioned, and notes if they declined to participate). With the media coverage that has already been attached to climate change this year and newsflow catalysts set to continue, CDP 5 should achieve a much higher response rate.

Broadly available data will enable carbon valuation comparisons - a low rev/co2 would indicate a higher risk profile with respect to possible carbon penalties

As quantifying and publicising emissions data becomes the norm for companies investors will be able to calculate comparative valuation measures, such as Revenues/CO<sub>2</sub>e or EBITDA/CO<sub>2</sub>e. This will be a major step forward in quantifying the emissions effect for comparative purposes. Similarly to other valuation techniques there will be flaws with comparison across the market as some sectors are naturally more carbon intensive. However, a carbon ratio provides an additional tool for analysis. A low Revenue/CO<sub>2</sub>e ratio would indicate that a company would find it more difficult to cope with legislative cost changes from carbon penalties. This demonstrates the company carbon risk profile.

Carbon reporting to become the norm, driven by investors rather than accounting regulation

#### Conclusions - high level of investor interest in carbon

The CDP demonstrates the interest of investors in accounting for carbon. Having grown out of a core of dedicated SRI investors, the initiative is now broader and covers a large group of institutional investors. In our view carbon reporting will become the norm, but this is unlikely to be in the short term, due to lack of resource and reporting mechanisms in place. Investor initiative is likely to push this through more quickly than government regulatory or accountancy standard changes.

Quantitative carbon reporting by companies will provide an indicator of risk profile, since a company with a low Rev/CO<sub>2</sub> ratio would find it more difficult to cope with a financial impact from legislative changes (e.g. a cost penalty from emissions).

Kyoto has legally binding targets and came into force in 2005

Phase II of Kyoto starts in 2008

## Appendix 1: The Kyoto Protocol

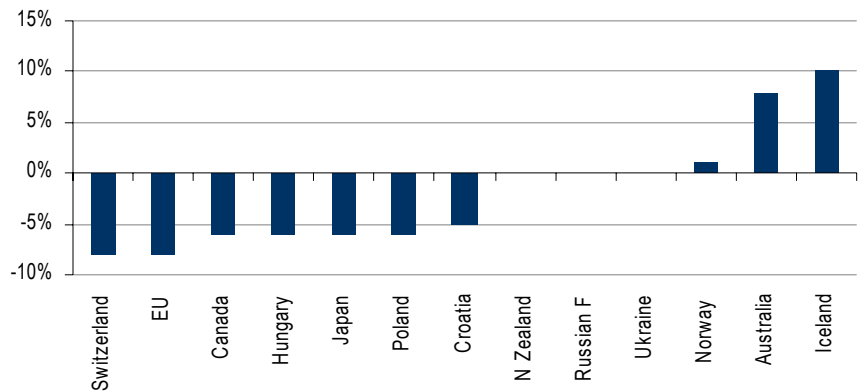
The end of 2007 is the end of the first phase of Kyoto. The Protocol was an extension of the UN Framework Convention on Climate Change (UNFCCC), an international treaty designed to consider what could be done to reduce global warming. The UNFCCC was adopted in 1992 at the Rio Earth Summit and entered into force in March 1995.

The aim of Kyoto is for participating countries to take a more committed approach to reducing GHG emissions by meeting reduction targets. It was adopted in December 1997, but the legally binding measures came into force on 16<sup>th</sup> February 2005.

Not all parties that signed up to the UNFCCC have also ratified Protocol, and only those that have are subject to the commitments. Initially 84 countries signed the Protocol noting that they intended to ratify, but uncertainty over the operation and rules meant that not all ratified.

The emissions targets of the countries included in Annex B to the Protocol are charted below and most targets are based on measurement from 1990 as the base year, with the reductions to be achieved in the 2008-2012 period. In aggregate the individual targets add up to a total cut in GHG emissions of at least 5% from 1990 levels in the commitment period 2008-2012. The EU targets are redistributed around individual countries.

Chart 20: Emissions targets of Annex B countries



Source: UN FCCC

Table 6: GHG's covered by Kyoto

Gas	Symbol	GWP 20 Years
Carbon Dioxide	CO2	1
Methane	CH4	56
Nitrous Oxide	N2O	280
Hydrofluorocarbons	HFC's	460-9100
Perfluorocarbons	PFC's	4,400-6,200
Sulphur Hexafluoride	SF6	16,300

Source: UN FCCC

### 6 gases covered by the protocol

Emission reduction targets for each country cover the six main greenhouse gases, and are measured as tonnes of carbon dioxide equivalent (TCO2e). This provides a standardised measurement as each gas has a different global warming potential. The GWP describes a gases effect on climate change relative to a similar amount of carbon dioxide. Table 5 shows the GWP's over a 20 year time frame. This shows that in 20 years time, one tonne of methane will have an effect on global warming that is 56 times greater than one tonne of carbon dioxide.

The higher GWP gases (HFC's, PFC's, SF6) are by products of commonly used applications like refrigerators, air conditioning, medical inhalers and insulation. CH4 and N2O are emitted during agricultural and waste processes.

## Flexible Mechanisms under Kyoto

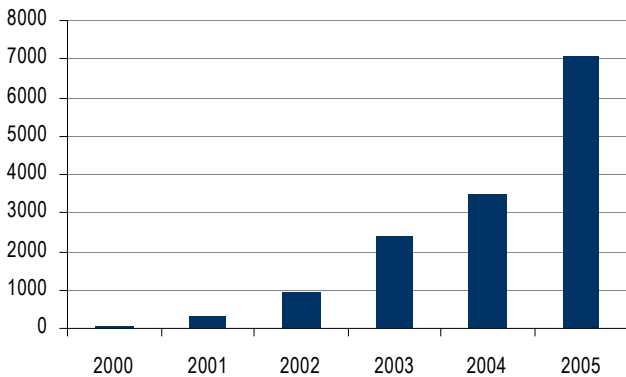
An entity may not be able to meet its carbon allowance simply by implementing abatement efforts. Kyoto offers three flexible mechanisms to help facilitate targets.

CER's issued to entities that invest in emission reduction projects in developing countries

### Clean Development Mechanism (CDM)

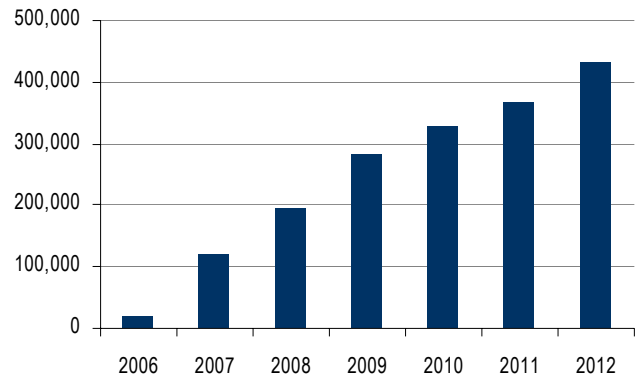
This is a mechanism whereby entities in Annex I countries finance a project in a developing country, and receive Certified Emission Reductions (CER's) on proof of additionality. (That the project reduced emissions by more than would have been the case had the project not taken place). Projects can include renewable energy plants, waste reduction or improved agricultural techniques, reduced use of refrigerant, or any proposal that can demonstrate it will reduce emissions by more than alternative processes. CER's can be traded in Phase I and II of Kyoto. Entities can buy or sell CER's on the EU ETS. CER's have already been issued for early projects, which are shown in chart 22. Chart 23 shows the expected CER's to be issued for 2006 to 2012. 1 CER is equivalent to 1 tonne carbon dioxide equivalent.

Chart 21: CER's that have been issued from 2000 – 2005



Source: Point Carbon

Chart 22: CER's to be issued from 2006 - 2012



Source: Point Carbon

The process of CDM project application is long and involves detailed proposals and independent validation of the emission reductions proposals and outcomes. Table 7 below details the process.

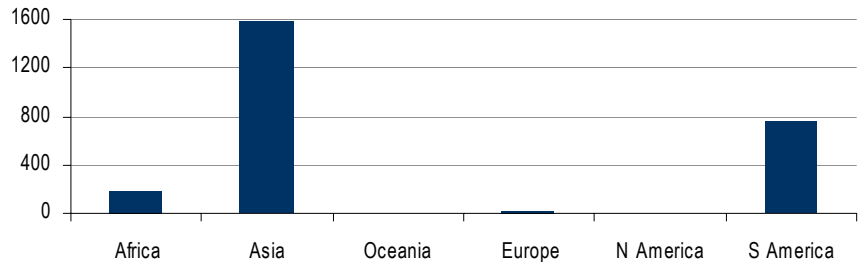
Table 7: CDM Project Cycle

	Applicant Procedure	Comments
1	<b>Project Design Document (PDD)</b> <i>Developer sends proposal to Designated National Authorities for approval</i> <i>Validation by Designated Operational Entities</i>	Detailed plan Host country agencies that have to develop projects eg Ministry of Environment Independent validation of projects
2	<b>Project registered with CDM Executive Board</b> <i>Implement project</i> <i>Monitor reductions and Verification by DOE</i>	Oversea all procedures - elected by COP Verification of additionality
3	<b>Issuance of Credits (CER) by CDM EB</b> <i>After emissions are reduced credits are received, then they can be sold</i>	

Source: ML SRI Research, Point Carbon

There are currently c2540 CDM projects that are at PDD level and above according to the point carbon database. These are shown in chart 24 below by region. In Oceania there are two projects in Fiji and Papua New Guinea. In Europe there are 15 projects outstanding in Cyprus, Albania, Moldova and Hungary.

**Chart 23: Outstanding CDM projects by region**



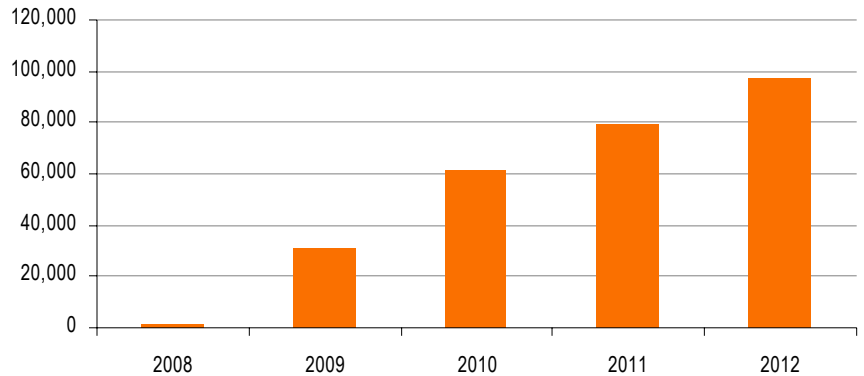
Source: Point Carbon

ERU's issued to entities that invest in emission reduction in industrialised countries

**Joint Implementation (JI)**

Joint Implementation is a similar mechanism to CDM, with the main difference that it is for entities in developed countries to finance projects in other developed countries (e.g. Russia). Emission Reduction Units (ERU's) are issued, and can be traded in 2008-2012. Similarly to the CDM, proof of additionality must be given, and 1 ERU is the equivalent of the reduction of 1 tonne carbon dioxide equivalent. Chart 25 shows the expected issuance of ERU's from 2008 – 2012.

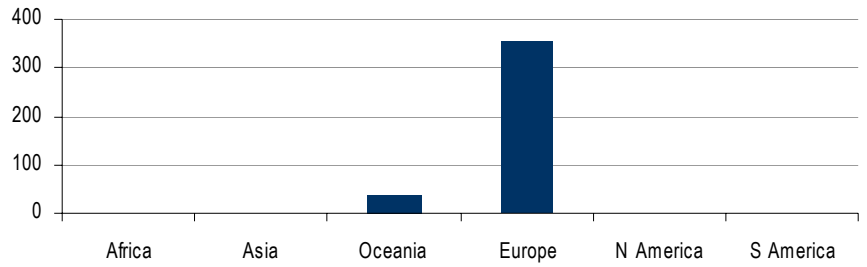
**Chart 24: ERU's expected to be issued**



Source: Point Carbon

For JI most projects are in Russia and the Ukraine, and in Oceania the proposed projects are in New Zealand, which is shown in chart 26 below. The project cycle is also broadly similar for JI.

**Chart 25: Joint Implementation Projects outstanding**



Source: Point Carbon

**International Emissions Trading (IET).**

Currently countries must meet criteria to be eligible for IET under the Kyoto protocol, but the EU set up the EU ETS as a mechanism to trade allowances as well as CER's (2005 – 2012) and ERU's (2008 – 2012).

## Appendix 2: EU Emissions Trading Scheme

### How does the EU ETS work?

Cap and trade system, with NAPs set by EC

The framework of the EU ETS is a cap and trade scheme, whereby member states are set a national allocation plan (NAP) by the EC, and then individual countries allocate the allowances as they see fit – enabling each country to allocate allowances on a basis that fits the economy and domestic environmental policy.

### National Allocation Plans for 2008-2012

Under the NAP process, each member state submits a proposal of the emissions cap which forms the basis of its binding agreement. The EC reviews and revises the plan and is responsible for the final decision on the cap. Currently allocations are in progress for 2008-2012, the period for Kyoto compliance.

Table 5 below shows the status for each country and reveals some important data. Firstly, it shows the allocation caps for Phase 1, and the verified emission data for 2005. The numbers in bold denote regions where the verified data was less than the cap, which indicates that phase 1 caps were too lenient. This led to a collapse in the price of carbon as shown in chart 27.

Chart 26: Phase I and II Carbon Prices



Source: ML Commodities Research

Table 8: Emissions Allocations in EU

	Phase I Cap	Verified Emissions 2005	Proposed Cap 08-12	Cap allowed 08-12	Additional emissions	Credit Limit (%)	Status of proposal
Austria	33	33.4	32.8	30.7	0.35	20	Approved
Belgium	62.08	<b>55.4</b>	63.33	58.5	5	10	Approved
Bulgaria			67.1			12	Draft
Czech Republic	97.6	<b>82.5</b>	101.9	86.8		10	Approved
Denmark	33.5	<b>26.5</b>	24.5			26	Submitted
Estonia	19	<b>12.6</b>	22.6			13.5	Submitted
Finland	45.5	<b>33.1</b>	39.6			11.2	Submitted
France	156.5	<b>131.3</b>	132.8	132.8	5.1	10	Approved
Germany	499	<b>474</b>	482	453.1	11	20	Approved
Greece	74.4	<b>71.3</b>	75.5	69.1		9	Approved
Hungary	31.3	<b>25.9</b>	30.8			10	Submitted
Ireland	22.3	22.4	22.6	21.2		22	Approved
Italy	232.5	<b>223.1</b>	209			14	Submitted
Latvia	4.6	<b>2.9</b>	7.7	3.3		5	Approved
Lithuania	12.3	<b>6.6</b>	16.6	8.8	0.05	9	Approved
Luxembourg	3.4	<b>2.6</b>	3.95	2.7		10	Approved
Malta	2.9	<b>1.98</b>	2.96	2.1			Approved
Netherlands	95.3	<b>80.35</b>	90.4	85.8	4	10	Approved
Norway	6.8	<b>5.7</b>				38.2	
Poland	239.1	<b>203.1</b>	284.6	208.5	6.3	10	Approved
Portugal	38.2	<b>36.4</b>	37.9			10	Submitted
Romania			97.6			10	Submitted
Slovakia	30.5	<b>25.2</b>	41.3	30.9	1.7	7	Approved
Slovenia	8.8	<b>8.7</b>	8.3	8.3		15.8	Approved
Spain	174.4	182.9	152.7	152.3	6.7	20	Approved
Sweden	22.9	<b>19.3</b>	25.2	22.8	2	10	Approved
UK	245.3	<b>242.4</b>	246.2	246.2	9.5	8	Approved

Source: <http://www.europa.eu/>

A closer look at the countries that have already has their emissions approved also reveals and interesting situation. Although for many countries the approved cap is much lower than the proposal, levels are above the verified emissions data for 2005. It shows that for the most part, allowances have been reduced from the initial applications, but that allowances are higher than the verified emissions of 2005.

The member state then sets an allocation for installations. An installation is a stationary technical unit where activities are carried out that could have an effect on emissions and pollution. Each entity therefore has a CO2 account and will incur a penalty if, at the end of April each year it does not surrender sufficient allowances to cover its emissions for the previous year.

In the introductory period of trading (2005-2007) member states could auction up to 5% of allowances. This enables allocation to new installations that come on stream through the year, or for other installations to 'top-up' allowances at the start of the period. In the 2008-2012 period, up to 10% of allowances will be auctioned.

Throughout the year to balance the TCO2e account an entity may

- Buy allowances at auction
- Buy allowances in the market
- Sell allowances in the market

If an entity ends the year short carbon allowances a financial penalty per tonne is incurred, and the additional emission reduction required is rolled over

At the end of each year an installation can be neutral, long or short carbon allowances. If it is long, verified emissions are less than allowances, and position is carried over into the next year (i.e. no obligation to sell surplus allowance). If it is short verified emissions exceed allowances and so it incurs a financial penalty AND must carry over the excess emission status into the next period, thus ensuring compliance of the physical reduction target, by a double financial penalty from non compliance (mandatory penalty and purchase of allowance). In the introductory period the penalty for excess emissions is €40 TCO2e, in the second Phase, when Kyoto compliance kicks in the penalty jumps to €100 TCO2e.

The EU ETS also uses aspects of the flexible mechanism under Kyoto, by the facilitation of trading CER's. (The certified emission reductions generated by clean development mechanisms under the protocol). This is in place for the 2005-2007 period, and from 2008 CER's and ERU's (Emission Reduction Units generated from joint implementation projects) will both be traded on EU-ETS in the 2008-2012 period. A summary of EU ETS is detailed in table 3 below.

**Table 9: Summary of the EU ETS**

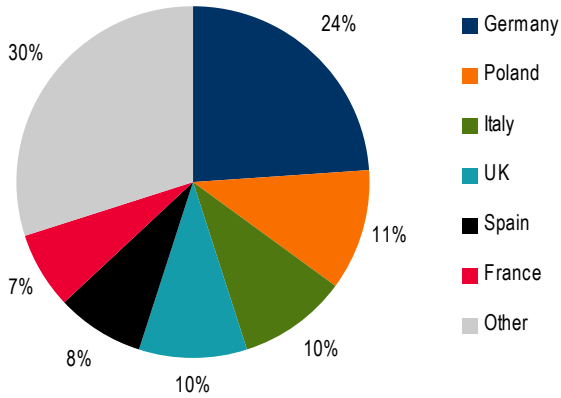
	<b>Introductory Period 2005 - 2007</b>	<b>Kyoto Compliance period 2008 - 2012</b>
Allocation	95%	90%
Auctioning	Up to 5%	Up to 10%
Penalty	€40 tonne CO2	€100 tonne CO2
CDM / JI	CDM	CDM + JI

Source: Point Carbon, SRI Research

### Distribution of Allowances

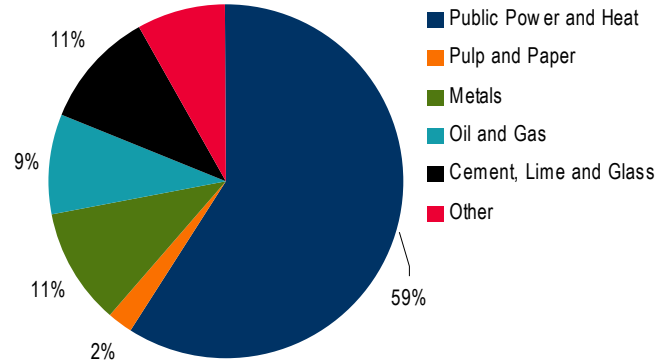
The raison d'être of the system is ultimately to reduce GHG emissions to tackle the legally binding targets of Kyoto. Hence the most efficient method of targeting reduction is to tackle the highest emitting sectors and countries.

Chart 27: Country Distribution of Allowances (€6bn)



Source: Point Carbon

Chart 28: Sector Distribution of Allowances



Source: Point Carbon

Chart 15 shows that Germany currently holds the greatest number of allowances per region. This makes sense given it emits MT865CO<sub>2</sub> in 2003 according to the world resource institute and is ranked seventh globally. In terms of sectors, unsurprisingly public power and heat are the key drivers.

Point Carbon estimates that the companies emitting over 10MtCO<sub>2</sub>e represent just 2% of companies and hold 40% of allowances. Between 1Mt and 10Mt there are 8% of companies holding 50% of allowances. 90% of companies are emitting less than 1Mt and represent 20% of the allowances.

## Appendix 3: Glossary<sup>12</sup>

### Annex I Countries

Annex I countries are parties that signed the UN Framework Convention on Climate change in May 1992, and are listed in Annex I of the convention. The objective of the convention is to stabilize GHG's, but the responsibilities of the signatories are towards voluntary national policies, and emissions reporting.

**Table 10: Annex I Countries**

Australia	Finland	Lithuania*	Slovenia*
Austria	France	Luxembourg	Spain
Belarus*	Germany	Monaco	Sweden
Belgium	Greece	Netherlands	Switzerland
Bulgaria*	Hungary*	New Zealand	Turkey
Canada	Iceland	Norway	Ukraine*
Croatia*	Ireland	Poland*	UK
Czech Republic*	Italy	Portugal	USA
Denmark	Japan	Romania*	
Estonia*	Latvia*	Russian Federation*	
EEC	Leichtenstein	Slovakia*	

Source: UN FCCC \*Countries undergoing process of transition to market economy at that time

### Annex B Countries

Annex B countries are the countries that ratified the Kyoto Protocol, thereby committing to legally binding emissions reduction obligations in the commitment period of 2008-2012. Annex B countries are those listed in table 4 above, except Australia, Belarus, Turkey and USA.

### Anthropogenic

Greenhouse gas emissions that are produced as the result of human activities.

### Carbon Dioxide (CO<sub>2</sub>)

A colourless odourless gas which is a normal part of ambient air. CO<sub>2</sub> is a product of fossil fuel combustion. CO<sub>2</sub> is a greenhouse gas that traps terrestrial (i.e. infrared) radiation and contributes to the potential for global warming.

### Carbon dioxide equivalent

A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as 'million metric tons of carbon dioxide equivalents (MTCO<sub>2</sub>e)'. The carbon dioxide equivalent for a gas is derived by multiplying the tonnes of the gas by the associated GWP.

### Carbon intensity

The relative amount of carbon emitted per unit of energy or fuels consumed.

### Carbon sequestration

The uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store the carbon.

### Cogeneration

Production of two useful forms of energy such as high-temperature heat and electricity from the same process. For example, while boiling water to generate electricity, the leftover steam can be sold for industrial processes or space heating.

### Conference of the Parties (COP)

The supreme body of the United Nations Framework Convention on Climate Change (UNFCCC). It comprises more than 170 nations that have ratified the Convention. The COP's role is to promote and review the implementation of the Convention. It will periodically review existing commitments in light of the Convention's objective, new scientific findings, and the effectiveness of national climate change programs.

<sup>12</sup> Source: Natsource, Point Carbon, WRI

Enhanced greenhouse effect	The concept that the natural greenhouse effect has been enhanced by anthropogenic emissions of greenhouse gases. Increased concentrations of carbon dioxide, methane, and nitrous oxide.
Fugitive emissions	Unintended gas leaks from the processing, transmission, and/or transportation of fossil fuels, CFCs from refrigeration leaks, SF6 from electrical power distributor, etc
Global Warming Potential (GWP)	The index used to translate the level of emissions of various gases into a common measure in order to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emissions of one kilogram of a greenhouse gas to that from emission of one kilogram of carbon dioxide over a period of time (usually 100 years). The chart below shows the original GWPs (assigned in 1990) and the most recent GWPs (assigned in 1996) for the most important greenhouse gases.
Greenhouse Gas	Any gas that absorbs infra-red radiation in the atmosphere. Greenhouse gases include water vapour, carbon dioxide (CO <sub>2</sub> ), methane (CH <sub>4</sub> ), nitrous oxide (N <sub>2</sub> O), halogenated fluorocarbons (HCFCs), ozone (O <sub>3</sub> ), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).
Hydrofluorocarbons (HFCs)	Compounds containing only hydrogen, fluorine, and carbon atoms. They were introduced as alternatives to ozone depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are also used in manufacturing. They are powerful greenhouse gases with global warming potentials ranging from 140 (HFC-152a) to 11,700 (HFC-23).
Nitrous Oxide (N <sub>2</sub> O)	A powerful greenhouse gas with a global warming potential most recently evaluated at 310. Major sources of nitrous oxide include soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.
Perfluorocarbons (PFCs)	A group of human-made chemicals composed of carbon and fluorine only. These chemicals (predominantly CF <sub>4</sub> and C <sub>2</sub> F <sub>6</sub> ) were introduced as alternatives, along with hydrofluorocarbons, to the ozone depleting substances. In addition, PFCs are emitted as by-products of industrial processes and are also used in manufacturing.
Sulfur hexafluoride (SF <sub>6</sub> )	A very powerful greenhouse gas used primarily in electrical transmission and distribution systems and as a dielectric in electronics.
Water vapour	The most abundant greenhouse gas; it is the water present in the atmosphere in gaseous form. Water vapour is an important part of the natural greenhouse effect. In addition to its role as a natural greenhouse gas, water vapour plays an important role in regulating the temperature of the planet because clouds form when excess water vapour in the atmosphere condenses to form ice and water droplets and precipitation.

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