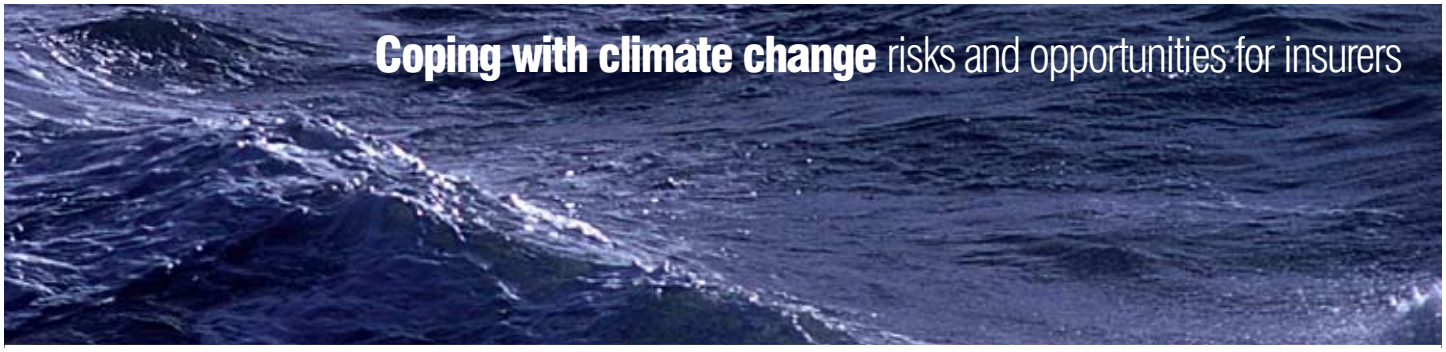


Chapter 17
Carbon markets

17.1 Introduction

The creation of the carbon markets has been one of the main policies implemented to tackle climate change. It is arguably the most effective policy strategy to incorporate business, governments and communities in the effort to curb greenhouse gas (GHG) emissions.

The chapter will introduce the carbon emission trading markets and consider why a market based system is the most effective policy option. It will also look at key existing regulatory frameworks including the Kyoto Protocol, the European and the UK Emission Trading Scheme as well as other initiatives around the world. We will also outline the challenges and opportunities for the insurance and financial services industry.

17.2 Preferred policy response

Fossil fuel consumption and other energy-intensive human activities have dramatically increased the amount of carbon dioxide and other greenhouse gasses (GHGs) in the earth's atmosphere. Scientists agree that surface air temperature and sea levels are rising. According to the U.S. National Academy of Sciences, "human-induced warming and associated sea level rises are expected to continue through the 21st century." This was confirmed by the Fourth Assessment Report of the IPCC in 2007. Because even small changes in the climate can have potentially catastrophic ecological, social, and economic impacts, policy makers around the world have sought ways to reduce GHG emissions.

There have been many economic theories and policy options proposed to deal with pollution and the environment including the work of Ronald Coase and Arthur C. Pigou. It was Coase who first established the general principle of externalities and defined these externalities as the actions of one party affecting another party. These externalities may be pecuniary, when they are actually transferred by a price mechanism, or non-pecuniary. Historically pollution has been seen as non-pecuniary; no one was made to pay for polluting and the problem remained. This developed when governments established pollution regulation and more specifically property rights (the phrase 'property rights' relates to the use of a resource). By assigning property rights, polluter and sufferer are then able to bargain over the level of externality. For instance if people are given the right to clean air, then the polluters must be charged for the costs they inflict, or the negative externality. Conversely a polluter may be sold the right to pollute. In this instance the general population who wish to enjoy the amenity service of clean air will have to organise to pay companies (polluters) not to pollute. The aim of pollution regulation may therefore be considered as establishing ways of reaching the socially optimal level of pollution.

Pigou proposed a tax as a suitable means of equating private and social cost. These taxes became known as Pigovian Taxes or pollution charges. In reality these taxes are difficult to develop efficiently and enforce effectively not least because it is nearly impossible for Governments to know what level of tax would deliver any kind of optimal pollution level. Furthermore taxes are generally unpopular and where abatement costs differ, always inequitable.

One of the policy responses for reducing GHGs is a capital market innovation known as emissions trading. Based on successful efforts to reduce acid-rain pollutants in the USA through trading in sulphur dioxide permits, emissions trading restricts the total amount of pollutants that can be released into the atmosphere. Under the Kyoto Protocol (see section 17.4), a national government can issue shares of its agreed limit in the form of tradable certificates that provide evidence of compliance with targets. Energy, power, and other companies can decide for themselves whether to reduce their GHG emissions or purchase these certificates from another entity with surplus permits. Such permits become available when a business has exceeded its target for emissions reductions.

By introducing a trading approach, emissions trading allows for "price discovery" of the cheapest abatement opportunity (see table 1). If every company were simply forced to reduce its GHG emissions by a specified amount, but not allowed to trade, the differing marginal abatement costs per ton would be inequitable. Companies that are generally more energy/carbon efficient would find it more expensive than an inefficient company to reduce further their emissions. Moreover, the total cost of abatement would be higher. In the example, Company A is able to reduce its emissions by expenditure of $1,000, which is equivalent to $100 per unit reduced. However, Company B is in the situation that it can reduce emissions more cheaply, for just $50 per unit. It makes economic sense to allow Company A to "over-reduce", and sell its surplus emissions reductions to Company B. From the environmental stance, it does not matter where the reductions are achieved, because emissions rapidly mingle through the entire atmosphere.

Table 1: The benefit of emissions trading: an example

Emissions Trading: The Lowest-Cost Method of Reducing GHGs

Without Trading	With Trading
Companies A and B each reduce emissions by 10 units	Company B reduces by 20 units; Company A buys rights to 10 units for $75 per unit
Reductions cost Company A $100 per unit, or $1,000	Reductions cost Company B $1,000 - $750 $250
Reductions cost Company B $50 per unit, or $500	Company A costs: $750
Total Costs = $1,500	**Total Costs = $1,000**

Because emissions trading produces the least-cost solution to climate change, businesses support it over a carbon tax or other policy response. Another advantage of emissions trading is its ability to create incentives for developing innovative abatement technology as the market-determined price of carbon rises. With a tax, the price per ton is set, and the only incentive is to adjust production levels, which generally benefits neither business nor society. With some exceptions, the global community of nongovernmental organisations accepts emissions trading as the favoured policy option because it delivers measurable environmental benefits. Of course some criticism has been levelled at the limited impact that the current Kyoto targets are likely to have and the overall reductions achieved in the first phase of the EU ETS (see Figure 1 in 17.3). This criticism misses the point, however, that the great success of these first initiatives has been the development of the market framework and institutions that will allow for greater emissions reductions in the future.

Additionally there are a number of other important advantages to a system of marketable permits including the following:

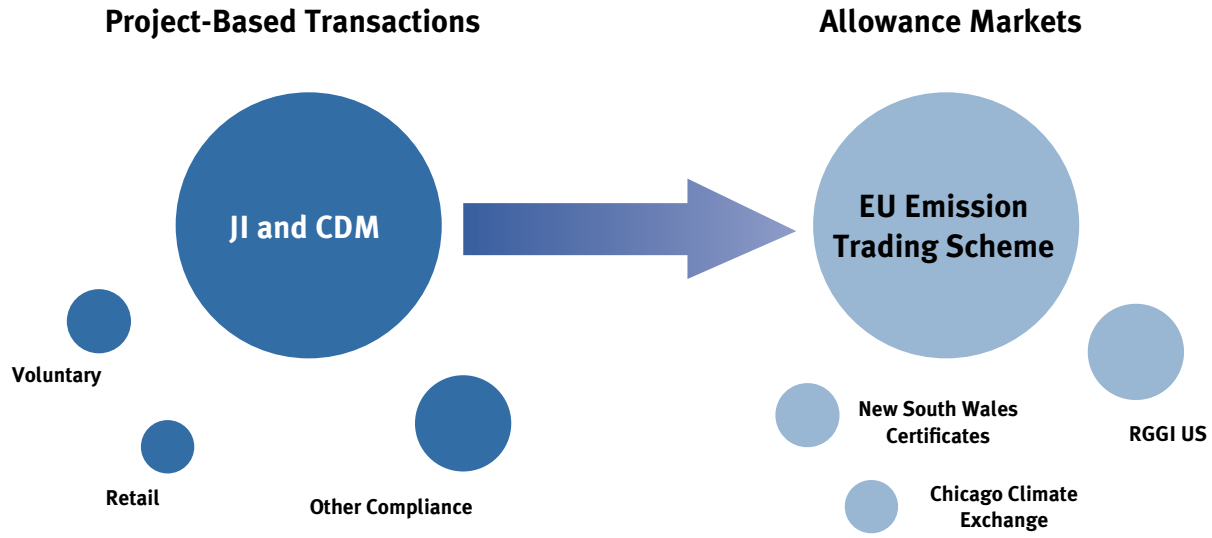
- New entrants to the market can easily be absorbed by increasing the permit price or increase supply of permits.
- Non-polluters who are concerned to lower the overall level of pollution are able to participate. This would reflect the intensity of preference for pollution reduction as revealed by a willingness to pay.
- Unlike taxes, inflation will not erode the real value of permits since the market responds to supply and demand.
- Any tax should reflect the damage done. However, there are many polluters and pollution receptors with different assimilative capabilities. Similarly there may be aggregate levels of damage larger than the sum of damage from a single pollution source. Any tax system that reflects the above would almost certainly be unworkable.

It can therefore be seen why a system of tradable permits is an effective method to reduce emissions. This is reflected in the fact that one of the three flexible mechanisms proposed under the Kyoto Protocol is emissions trading. It should be noted, however, that other policy options, typically tax and direct legislative emission restrictions, can offer attractive alternatives depending on the policy target, and are widely used at national and regional level. Furthermore, without a comprehensive policy strategy for energy and the environment more widely, any market based solution will be severely limited in its ability to generate longer term structural changes.

17.3 Markets

There are already a number of different markets in existence each of which have their own rules and modes of operation. The current structure of the carbon market as illustrated below, but ultimately as we see these markets grow and develop over time, they are likely to merge and join up as the policy develops and fungibility between them increases, i.e. the ability to exchange credits and permits between different regimes and markets.

Figure 1: Markets



Projects-based markets are also known as 'baseline and credit' markets. In this instance a baseline for business as usual activity is typically established and credits are awarded/granted for improving on this baseline, i.e. emitting less. Allowance markets typically follow a 'Cap and Trade' system where specific limits are imposed and permits issued to participants who either reduce their emissions to a level to equal the number of permits issued or additional permits are purchased from other scheme participants with a surplus.

17.4 The Kyoto protocol

The main legal framework underpinning the carbon market is the Kyoto Protocol. In 1997, 159 governments signed the Protocol establishing global and national targets for average reductions of 5.2 per cent of the industrialised world's 1990 level of emissions. National targets range from +10% (for Australia) to -8% (for the EU). Despite the opposition of the U.S. government, which considers the treaty's targets unrealistic and economically harmful, the Kyoto Protocol came into force in February 2005, when the Russian Federation joined more than 90 other countries in ratifying the agreement.

All nations agree that climate change poses significant global risks. On the other hand, reducing GHG emissions will have a cost. Now the Kyoto Protocol is in effect, national governments will allocate their emissions obligations among carbon-intensive domestic industries, which will, in turn, pass these costs to consumers. Many companies in Europe anticipate spending $10million or more to comply with the treaty. The Protocol considers three flexible mechanisms to reduce emissions; international emissions trading (IET), the clean development mechanism (CDM) and joint implementation (JI). These mechanisms enable Parties to access cost-effective opportunities to reduce emissions or to remove carbon from the atmosphere in other countries. IET is between governments whilst CDM and JI are targeted towards private sector market participants. While the cost of limiting emissions varies considerably across regions, the benefit for the atmosphere is the same, wherever the action is taken.

The Kyoto Protocol's emphasis on emissions trading has accelerated the development of GHG markets around the world. Today, there are over 30 international, regional, national, local, and company-internal trading schemes. The World Bank estimated the global aggregated carbon market value in 2005 at US$10bn. In 2006 a daily average volume of 1.7million tco_2e[1] were traded with a total of 1.6billion tco_2e exchanging hands. Permits and credits are traded either Over the Counter (OTC) or through a number of exchanges. OTC trades currently account for 60% of the market. The first quarter 2007 daily average on the European Climate Exchange which accounts for approximately 80% of exchange traded permits was approximately 1.78million tco_2e.

[1] tco_2e means tonnes of carbon dioxide equivalent. An amount of another greenhouse gas can be expressed as the quantity of carbon dioxide that would have the same effect.

Clean Development Mechanism (CDM) defined in Article 12 provides for Annex I Parties (typically OECD countries and Economies in Transition (EIT)) to implement project activities that reduce emissions in non-Annex I Parties, in return for certified emission reductions (CERs). The CERs generated by such project activities can be used by Annex I Parties to help meet their emissions targets under the Kyoto Protocol. Article 12 also stresses that such projects are to assist the developing country host Parties in achieving sustainable development.

The current procedures for the CDM focus on activities that reduce emissions. A CDM project might involve, for example, a rural electrification project using solar panels or the installation of energy-efficient boilers. Annex I Parties are to refrain from using CERs generated through nuclear facilities to meet their emission targets.

The basic principles of the mechanism commonly referred to as "Joint Implementation" are defined in Article 6 of the Kyoto Protocol. Under JI, an Annex I Party may implement an emission-reducing project or a project that enhances removals by sinks in the territory of another Annex I Party and count the resulting emission reduction units (ERUs) towards meeting its own Kyoto target. Projects starting as of the year 2000 may be eligible as JI projects if they meet the relevant requirements, but ERUs may only be issued for a crediting period starting after the beginning of the year 2008.

In order to comply with Kyoto targets, every country receives a number of Assigned Amount Units (AAUs) equal to their baseline year emissions less their agreed reduction target. These units are tradable allowances which they can place on the market.

17.5 UK emissions trading scheme

The world's first legislatively backed national greenhouse gas market was the U.K. Emissions Trading Scheme (ETS), which opened in April 2002 and ran until December 2006 with final reconciliation in March 2007. Under the Kyoto Protocol, the United Kingdom is committed to a 12.5 per cent reduction in greenhouse gases. As an inducement to participate in the ETS, the government provided financial incentives to firms that voluntarily adopt emissions reduction targets for greenhouse gases. The government wanted to encourage companies to develop trading expertise before 2008, Kyoto's first year of compliance. The 34 organisations that took on legally binding reduction targets had the choice of trading just CO_2 emissions or all six greenhouse gases covered by the Kyoto treaty[2]. Additionally the scheme was also open to 6000 companies with Climate Change Agreements. These negotiated agreements between business and Government set energy-related targets. Companies meeting their targets received an 80% discount from the Climate Change Levy, a tax on the business use of energy. Companies could use the scheme either to buy allowances to meet their targets, or to sell any over-achievement of these targets. The 2005 results show that the scheme has brought about emissions reductions of over 7million tco_2e since the scheme began in 2002.

17.6 European emissions trading scheme

The European Union Emissions Trading Scheme (EU ETS) is one part of the EU strategy to enable it to meet its obligations under the Kyoto Protocol. The first phase runs from 2005-2007 with the second phase running from 2008-2012 to coincide with the first Kyoto Commitment Period. Further five-year periods are expected subsequently with stated targets of at least 20% GHG reductions by 2020.

The scheme covers approximately 13,000 installations in the 25 EU member states. It has grown rapidly with an estimate by Point Carbon that 600,000 tco_2e were traded in 2003 compared to 362,000,000 tco_2e traded in 2005 with an estimated value of US$7.2bn. This is expected to grow to 1,500m tco_2e in 2007.

Certain energy-intensive sectors and activities have been included in the first phase[3]. Other sectors including the aviation, chemicals, aluminium and transport sectors, and emissions of other greenhouse gases are being considered for inclusion at a later date.

[2] In addition to carbon dioxide, the GHG gases are methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

[3] Large combustion installations, energy production, ferrous metals, minerals e.g.cement, pulp and paper.

In Table 2 below we summarise the differences between the Kyoto and EU schemes.

Table 2: Kyoto & EU ETS Compared

Kyoto	Europe
• Annex 1 and Non-Annex 1 Countries	• Europe only
• All industries	• Specified Industries only
• Country Based	• Installation Based
• All 6 GHG Gases	• CO_2 only
• Baseline Approach	• Cap and Trade
• Trading Periods 2008-12	• Trading Period 2005-07 & 2008-12
• Cannot use credits from other schemes for compliance	• Can use Kyoto CER's & ERU's for Compliance

The scheme works on a "Cap and Trade" basis with EU member governments setting an emission cap for all installations covered by the Scheme. Each installation will then be allocated allowances for the particular commitment period in question. The number of allowances allocated to each installation for any given period (the number of tradable allowances each installation will receive), will be set down in a document called the National Allocation Plan.

Member states must allocate allowances to installations each year and ensure that by 30 April each year, each installation surrenders an independently verified number of allowances equal to its total emissions during the preceding calendar year. Installations therefore had to surrender allowances for the first time by 30 April 2006 equal to their emissions during 2005.

With about 50 times the total quantity of allowances available in the US SO2 trading market it is the world's largest and most liquid emissions market. EU Environment Commissioner Margot Wallstroem calls emissions trading the "linchpin of a cost-effective climate change strategy for the European Union."

Buyers v Sellers

Currently each country and industry is making different progress towards meeting its compliance obligations or delivering emissions reductions. Figure 2 shows the Kyoto Gap for those countries with binding targets (i.e. Annex 1 countries) as per the latest national GHG inventories in terms of percentage points.

Figure 2: Kyoto target progress 2004 (%)

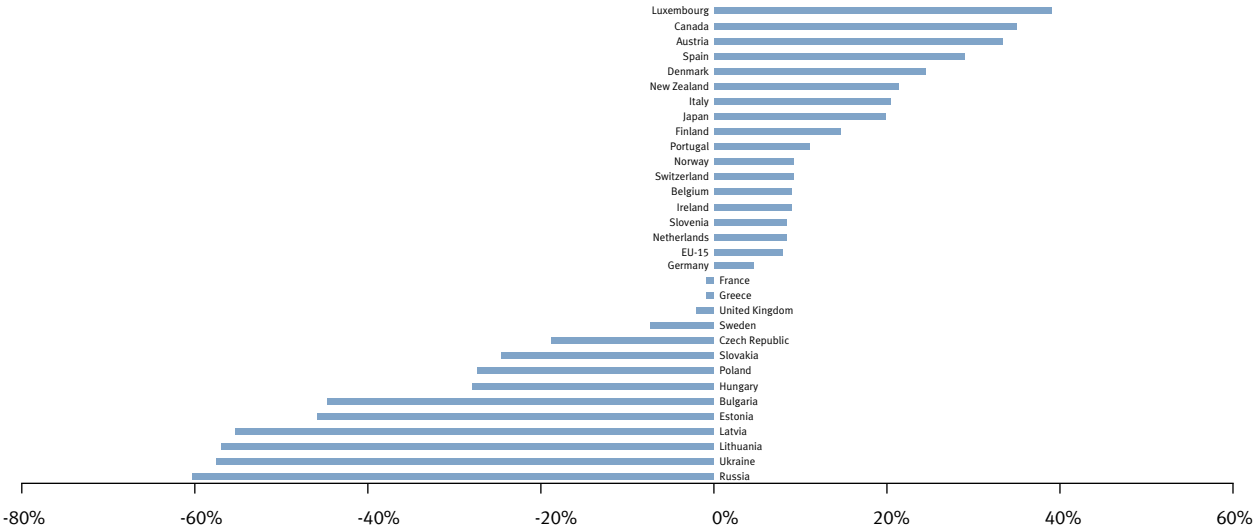
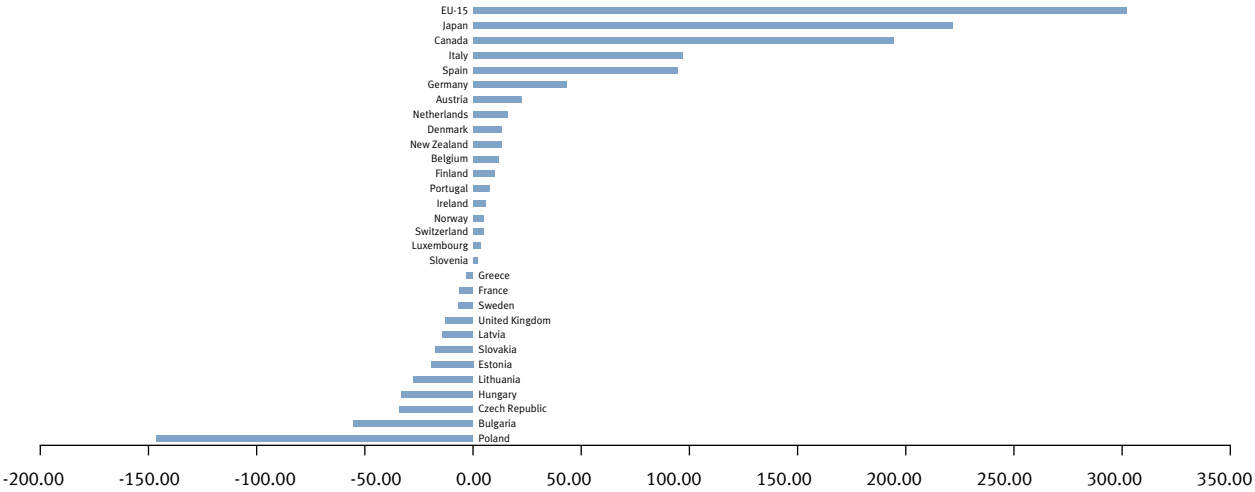


Figure 3 shows the Kyoto Gap for those countries with binding targets in terms of millions of tonnes needed to meet the targets.

Figure 3: Kyoto target progress 2004 (Mt)



It can be seen that overall the market is in a 'net short' position (i.e. there is an overall shortage). This net short position must be filled from other sources, primarily the project based mechanisms of Kyoto, being CDM and JI.

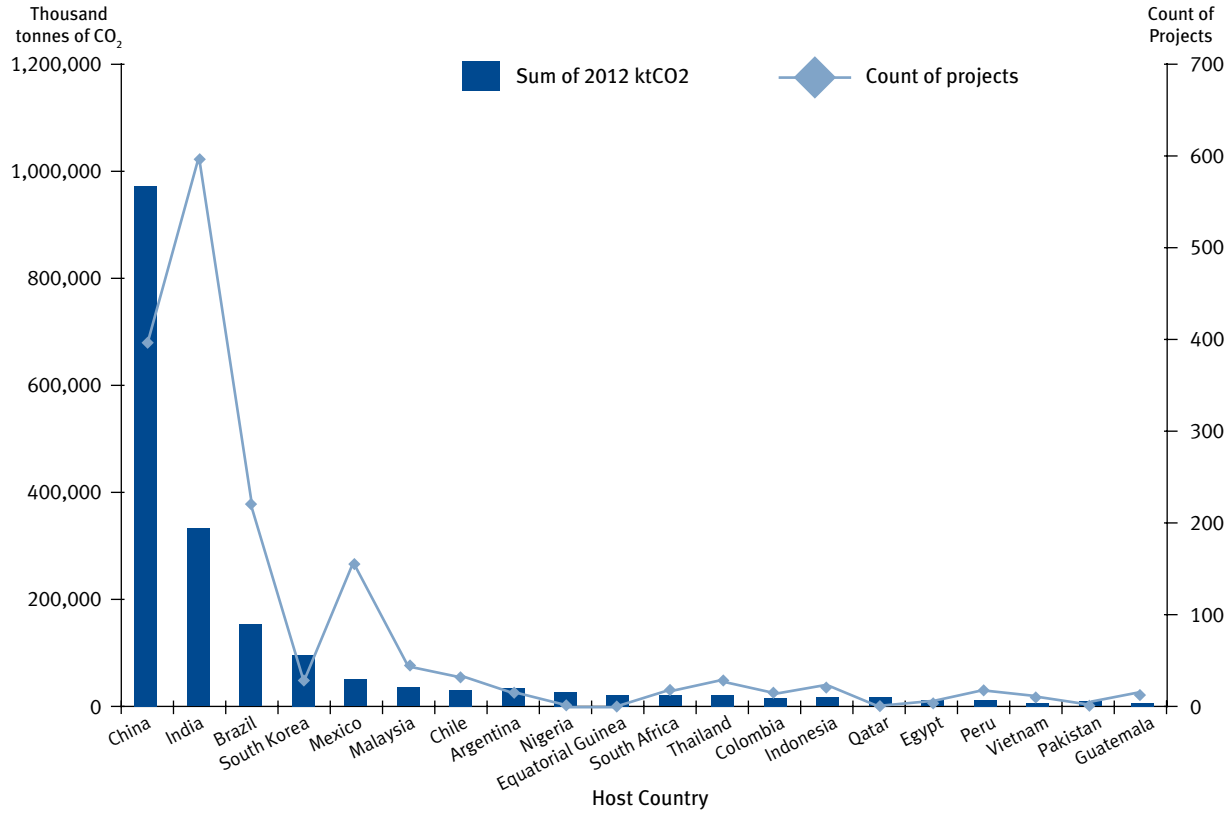
17.7 CDM and JI markets

Projects have concentrated in those countries where foreign direct investment was already flowing in large quantities. In this way, Asia accounted for 73% of contracted volumes in 2005 followed by Latin America. China delivered on the expectation to become the biggest seller accounting for 66% of the volume contracted on the 15 months to March 2006 according to World Bank data. Indian developers apparently held on to their permits on the expectation of higher prices thus they only accounted for 3% of volumes contracted. Brazil continued to lead the way in Latin America with 10% of the total volume from January 2005 to March 2006.

The project "pipeline" shows a slightly different figure with Asia accounting for 67% of the gross total. China has passed India as the number one project developer on the back of several HFC projects, three of which are registered. India accounts for 20% of credits in the pipeline and South Korea is now the fourth largest developer with 9%. Brazil continues to the fore in Latin America with 14% of the gross total in the pipeline.

Figure 4 shows the distribution of sellers in the pipeline as of April 2007 split between the count of projects by country and the number of reductions estimated to be generated by 2012.

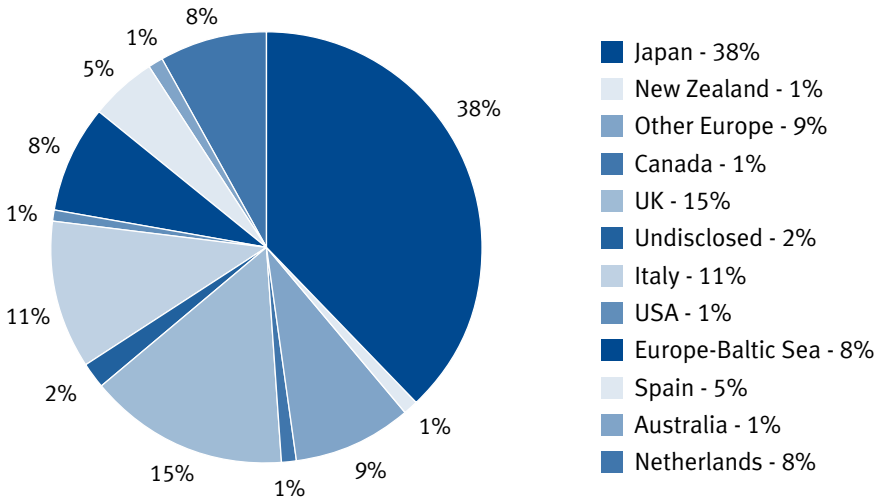
Figure 4: Kyoto projects in preparation, by country



Source: Data from UNEP Risøe Centre

On the demand side, European and Japanese buyers dominate the market. Europe accounted for 56% of the volume contracted during 2005 while Japanese buyers represented 38%. Canadian buyers have been notably absent representing only 1% of demand during the year.

Figure 5: Buyers January 2005 - March 2006



Source: State and Trends of the Carbon Market 2006, World Bank, May 2006

Figure 5 shows the distribution of buyers from January 2005 to March 2006 according to World Bank data.

In the CDM project pipeline, however, a large amount of projects are not associated with a buyer (31% as of June 2006). One explanation for this could be that some private buyers do not want to have their name disclosed on the pipeline; however, there are also several unilateral projects which are expected to come into the market as volatility decreases and prices increase.

Many European countries are placing caps on the amount of credits from developing countries that can be used for compliance under the EU ETS. There are a variety of political and market reasons for this limitation but the intention was generally to ensure direct action is taken by EU companies to reduce their own emissions rather than purely relying on actions by external countries. The latest National Allocation Plan (NAP) submitted by the UK sets a cap of 8%, France's NAP places a cap of 10% and Germany's plan considers about 60 Mt for project permits.

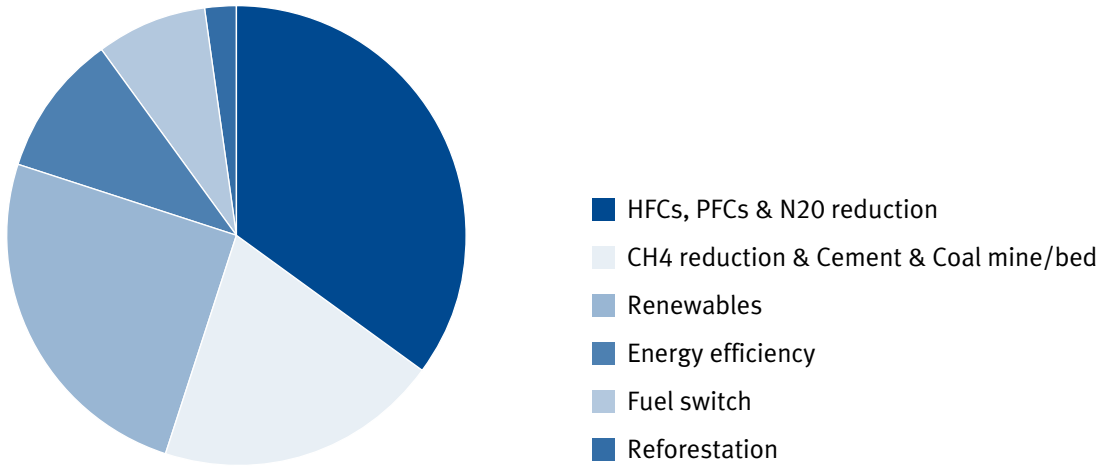
So far buyers have made agreements for over 700 Mt according to the data in the pipeline. Japanese firms have agreed to purchase almost 145 Mt, European buyers account for almost 550 Mt. Canadian buyers only account for 20 Mt during the entire Kyoto period. Private buyers have overtaken governments as expected. The World Bank estimates that over 90% of transactions recently were conducted by the private sector. Firms are expected to continue being the most active players as governments pass the burden on to the private sector.

17.8 Abating technologies

Emission reductions from projects have concentrated on the destruction of industrial gases. These represent the easier and least costly reduction projects. There are only 19 projects of this type but they account for almost half of the permits in the pipeline.

In terms of the number of projects, Biomass and Hydro represent the biggest share combining for about 40% of the projects. However, CER expected from this two sectors accounts for only 13% of the total. Figure 6 shows the distribution of CERs by project sector in the pipeline as of March 2007.

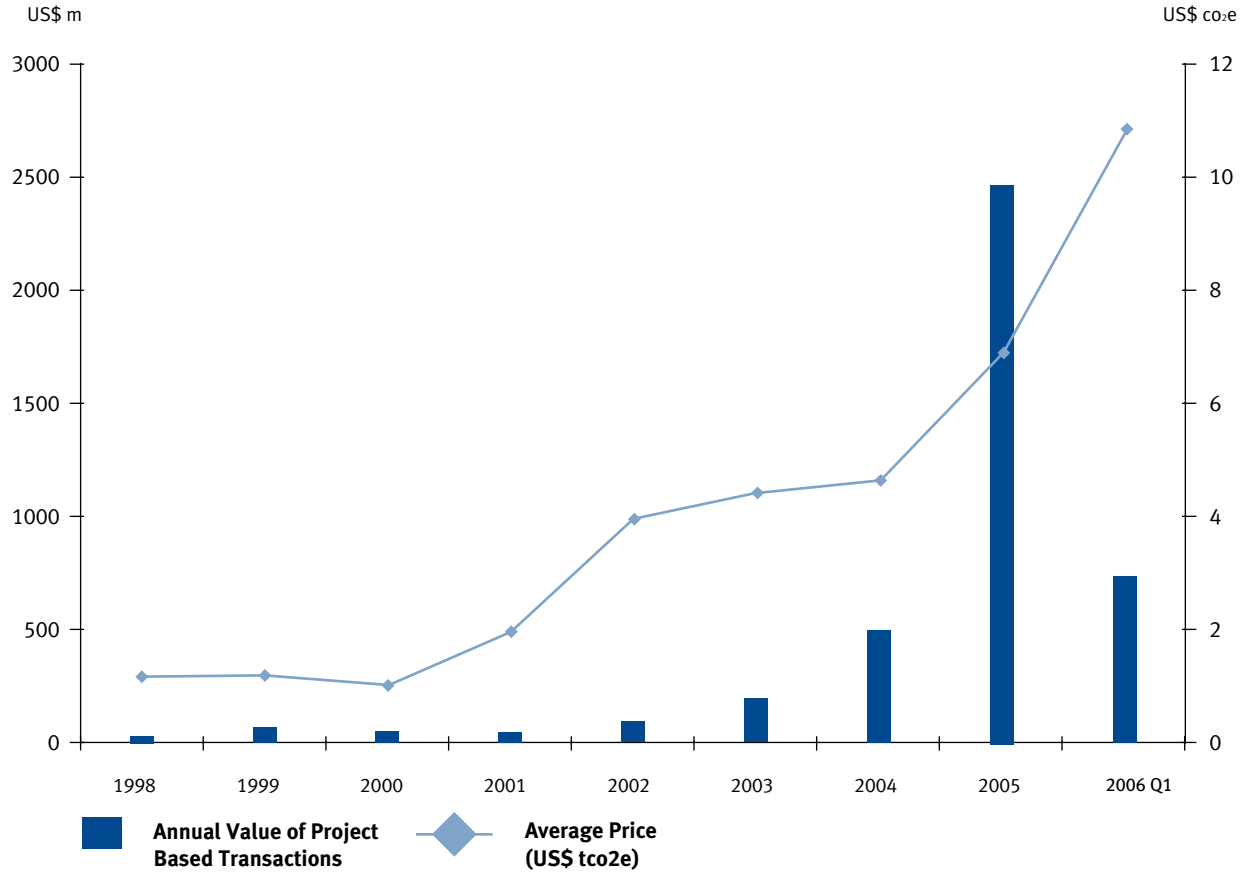
Figure 6: CER's up to 2012 by technology



Source: Data from UNEP Risøe Centre CDM pipeline

The project based market has been growing at similar rate to the overall carbon market. As certainty about the rules and procedures of project implementation have increased, so has the price achieved for project based credits.

Figure 7: Annual volumes of project based emission reductions and annual average price



Source: World Bank – State and Trends of the Carbon Market 2006

17.9 Voluntary & offset markets

In addition to the compliance markets there is a growing market for voluntary emissions reductions and offsets. In 2006 the World Bank estimated traded volumes in the voluntary sector at 6.05m tco_2e. ICF, a London based consultancy estimates this market will grow to 400m tco_2e by 2010. Whilst these markets are much smaller and more fragmented than the compliance markets they still attract a similar range of participants including brokers, project developers, registries and investment funds.

Motivation for participation in the markets ranges between individuals who see it as a practical step to help reduce their carbon foot print, to businesses that see it as an opportunity to position products and gain competitive advantage. It is certainly an important part of image-building and it can indeed provide valuable learning experience for companies who anticipate or already do operate under mandatory compliance obligations. The USA is a case in point (see later).

Criticism has been levelled at this market sector; it is generally considered better not to emit at all, rather than to emit and then offset. And whilst this is certainly true, it is simply not possible to have a zero emission world. Secondly, given the fragmented nature of the sector, concern has been raised about the quality and integrity of the reductions. In order to ensure environmental integrity there has been a call for the sector to adopt global standards such as the 'Gold Standard' which has been endorsed by 43 NGOs including WWF, Greenpeace and Voluntary Carbon Standard developed by The Climate Group, the International Emissions Trading Association and the World Economic Forum. It may, however, be more appropriate for offsets to be done through the retirement of actual permit issued under a mandatory scheme such as the EU ETS.

17.10 US markets

Despite the Bush Administration's refusal to address climate change at a federal level this is not representative of activity at state, city and corporate level. Indeed one of the largest and fastest growing markets for voluntary reductions is in the US where the Chicago Climate Exchange was established in 2003. It has over 50 members including Ford, Dupont, Amtrak & Bayer Corporation.

One of the more important schemes under development is the Regional Greenhouse Gas Initiative (RGGI). This is co-operative effort by North-eastern and Mid-Atlantic states to reduce carbon emissions through the development of a multi-state cap and trade programme with a market based emissions trading scheme. Currently, seven states including Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont are participating in the RGGI effort. Legislation was signed in April, 2006, that requires Maryland to become a full participant in the process by June 30, 2007. In addition, the District of Columbia , Massachusetts, Pennsylvania, Rhode Island, the Eastern Canadian Provinces, and New Brunswick are observers in the process.

On the other side of the US the governors of Washington, Oregon, and California approved a series of detailed recommendations to reduce global warming pollution. The action started in 2004 was a part of the West Coast Governors Global Warming Initiative, whose three states collectively rank 7th in the world in greenhouse gas emissions. The governors are concerned that global warming will have serious adverse consequences on the economy, health, and environment of the West Coast states. They believe that their States can enjoy economic benefits by importing less fossil fuel and making greater investments in clean energy technologies.

The complex mix of legislation across states adds to the cost of doing business in two or more states with different emissions regulations. A number of pending bills in Congress, including one that calls for a domestic "cap-and-trade" system, are aimed at providing greater consistency, clarity, and certainty for U.S. businesses.

Sox, nox and acid rain

In the United States, emissions trading has already played a central role in the reduction of sulphur dioxide (SO_2 or SOX) and nitrous oxides (NOX), the primary components of acid rain. Because electric power generation is responsible for about two-thirds of SO_2 emissions and one-third of NOX emissions, the Clean Air Act of 1990 required electric utilities to lower their emission of these pollutants by 8.5 million tons compared with 1980 levels. Over the first four years of the program, SO_2 emissions from the largest electric utilities were about 5 million tons below 1980 levels.

The cost of these reductions has been significantly less than anticipated. In 1989 the utility industry estimated that the cost of compliance for its companies would be $7.4 billion. A year later, the EPA estimated compliance costs of $4.6 billion. Based on actual compliance information, a 1998 report by Resources for the Future estimated the cost of SO_2 emissions reductions at less than $1 billion.

Phase II of the program in 2002 extended to over 3,200 electricity generating plants causing some 10.2m tons of SO_2 emissions. By 2010 it aims to reduce SO_2 emissions by 50% from 1980 levels.

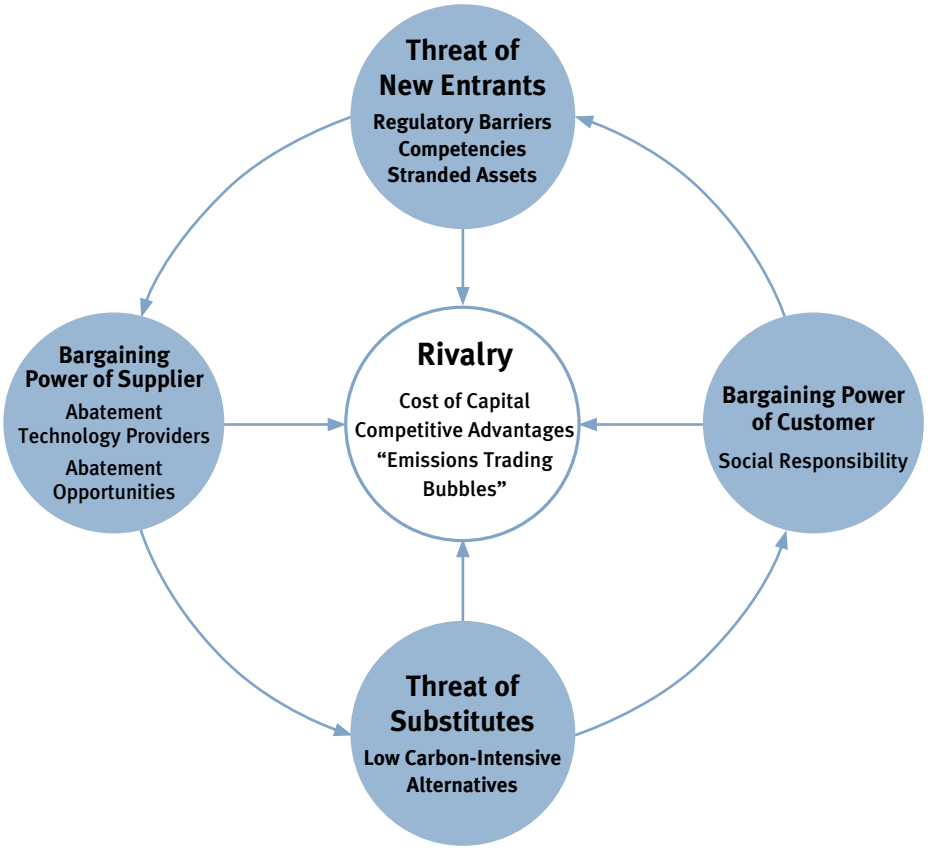
The EPA attributes the large reductions in emissions and the lower-than-anticipated costs to the decentralised, market driven approach of the Acid Rain Program. EPA administrator Christie Whitman said that the program has "achieved more air pollution reductions, more cost effectively, than all other air programs combined."

17.11 Emissions trading and risk management

New born and fragmented, the global market for trading GHG emissions is growing rapidly. GHG emissions could eventually become the world's largest commodity market—one that is deep and liquid, with secondary and derivative markets. UNEP, the United Nations Environmental Programme, estimates that the market will reach $2 trillion by 2012.

Restricting the emission of GHGs will have a profound impact on the market dynamics of carbon-intensive industries (Figure 8). On one hand, compliance regulations may be a barrier to entry for new competitors. On the other, existing businesses may find themselves with stranded assets. A coal-fired power station, for example, may no longer be economically efficient when the cost of carbon has been included. Some companies' products may be replaced altogether by low-carbon substitutes.

Figure 8: The implications of a carbon-constrained economy on market dynamics



New suppliers of abatement technology will enter the market, and increasing numbers of consumers and investors will hold companies accountable for their environmental performance. Moreover, carbon-intensive businesses will have to develop new skills and competencies—for example, in emissions monitoring and trading. The companies that are most successful at using carbon emissions trading as an additional source of revenue will be able to reduce their cost of capital and gain competitive advantage.

Emissions trading has a key role to play in the inexorable transition to a carbon-constrained world, where businesses will face new financial and operational exposures. Fundamental to developing compliance and risk management strategies will be a better understanding of a company's GHG emissions profiles and the marginal cost of emissions reductions. Because a substantial portion of emissions trading will be done on a forward market and be based on project-generated emissions reductions, there will be many credit, efficacy, hazard, price, and political risks that require risk management solutions. Of course, for the early movers and leaders in this sector there are opportunities as well as risks. Emissions reductions inevitably bring focus to other production costs. Contrary to expectations that participation in an emissions trading market will increase costs, a number of major oil companies have found that it has given them a cost advantage over their competitors because it has led to more cost-efficient processes,

17.12 Insurance, carbon trading and climate change

The insurance sector has long seen the potential exposure it has to climate change through more frequent and/or severe hurricanes and other loss events. However, it is not possible to say that a particular loss or storm was caused by climate change or not. Nor have various academic studies been able to demonstrate exactly how climate change will affect the insurance industry[4]. Nonetheless forward-thinking insurers should be looking at the opportunities created by these risks.

Ultimately all markets share risks in different ways and one part of that risk transfer puzzle is "insurable risk". Is there a role for the insurance industry in the emerging carbon markets? Brokers and insurers are looking at both traditional and new risks associated with the carbon market to offer products and solutions that will assist the carbon market work with greater efficiency and liquidity.

[4] Global Climate Change and Extreme Weather: An Exploration of Scientific Uncertainty and the Economics of Insurance – Valverde & Andrews

The trading of emissions reductions from specific projects (such as the CDM) particularly generate new risks that project developers, investors or carbon credit buyers might seek to transfer or lay off.

On the one hand, project developers are undertaking projects that will generate carbon credits, often with long lead times. These credits are a new asset, with uncertain value, and are subject to numerous regulatory and project-related risks. While the buyers of these credits are often large banks or energy companies with strong balance sheets, they are also often bought by smaller boutique operations with poorer credit ratings.

On the other hand, investors or credit buyers find themselves dealing with developing countries' projects, often using new or relatively untested emissions reduction technology, and frequently under development by small or entrepreneurial companies. They are buying carbon assets that are subject to a great deal of regulatory risk, and often over long time horizons.

Any contract to buy and sell carbon credits involves a sharing of these manifold risks between buyer and seller. This, however, is not necessarily the most efficient solution, particularly when there are parties available who either better understand a certain risk and/or who have a specific appetite for some of those risks. At the heart of each contract is 'delivery risk' – who bears the risk that credits may not be delivered as contracted. This is spelt out in the emissions reduction purchase agreement. How the risk is shared is a major determinant of the price that the developer can realise for its credits.

When the developer commits to delivering a firm volume of credits – with a requirement to compensate the buyer if no credits are delivered – the developer can command a substantially higher price for its carbon. Where that commitment is not available (when the buyer assumes much or all of the delivery risk), the developer loses a considerable amount of the value associated with the revenue stream. Equally, financiers are unlikely to lend against that carbon revenue stream where delivery risk is not laid off. Typically discounts of between 40-80% are being applied to project credits.

While this discount is attributed to 'delivery risk', in fact non-delivery is the consequence rather than the risk. It is therefore important to disaggregate what is meant by 'delivery risk'. Parhelion's research has identified and analysed more than 70 individual risks to which a project may be exposed. These can be categorised as shown in the table, with a selection of examples.

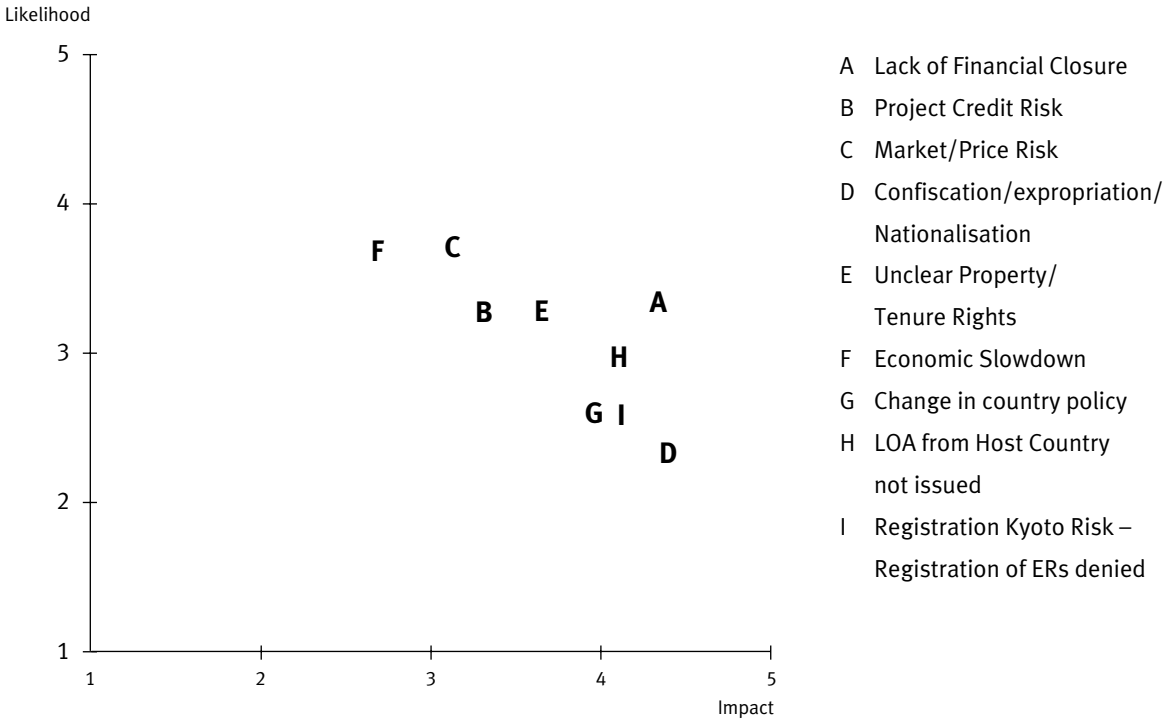
Table 3: Typical CDM Project risks

	Non-Kyoto Related	Kyoto Related
Political Risk	• Confiscation/nationalisation/ expropriation • Currency inconvertibility • War	• Change or revocation by CDM Executive Board of previous decision • Host country letter of approval revoked • Country withdrawal from Kyoto • Non-renewal of Kyoto
Operational Risk	• Epidemic	• Verifier error or omission
Performance Risk	• Technology efficacy • Resource risk, e.g. wind	• N/A
Physical Risk	• Fire, windstorm, flood or earthquake • Equipment delivery/transit risk • Terrorism	• Loss of monitoring records
Regulatory Risk	• Building permits not in place • Unclear property rights	• International Transaction Log risk • Verification risk • Validation risk • Baseline risk • Designated operational entity (DOE – the verifier) struck off
Project Risk	• Strikes, riots	• Poorly written baseline study • Incorrect baseline or monitoring methodology used
Contract Risk	• Lack of standard insurance coverage	• DOE not available
Credit Risk	• Credit default by project developer • Lack of financial closure	• Credit default by DOE
Market Risk	• Feedstock/output commodity price • Economic down-turn	• Carbon credit price risk

The most important ones are:

- Physical Risk – there are traditional physical risks involved in the construction and operation of the emission reduction projects that will need to be insured.
- Political Risks – due to the nature of the CDM and JI mechanisms many of the emission reduction projects are in third country location which are also often less developed. Furthermore, many new risks arise from the fact that the entire market is underpinned by legislation. This can often be overturned or changed leading to significant impact on investments.
- Credit Risk – the carbon market has incentivised many new projects to start up and exploit opportunities offered in this new market. Typical financing has been through Single Project Finance structures which often require credit support.
- Technology Risk – a floating carbon price is designed to incentivise technological innovation and hence there are new opportunities for technology and warranty underwriters.

Figure 9: Emission permit delivery risks, by likelihood and severity



Source: Parhelion

Parhelion has further ranked these risks according to likelihood and severity. Of the 70-plus risks that the company identified, approximately 46 are traditionally insurable. Insurable risks have certain characteristics. These are that:

- The risk must be fortuitous, that is, that the loss event must be unpredictable and free from moral hazard;
- The risk must be independent of other risks;
- The insured must have an interest in preventing losses;
- Loss events must be measurable in financial terms;
- The risk must not be against public policy or the law;
- It must be particular to the individual;
- The premium must be affordable; and
- There should be large numbers of similar risks to take advantage of the law of large numbers.

The balance of risks need to either be managed in other ways such as hedging and rigorous due diligence, or via new hybrid/ cross market solutions. The most likely products to be offered include 'delivery wraps' or 'carbon credit enhancement' structures.

Effectively, these look to monetise the future value of carbon credits generated under project based mechanisms. The discounts being applied to the forward purchase of certified emission reductions (CERs) because of the risk of non-delivery means that the carbon revenue steam is not significantly contributing to project financing. If, however, a significant proportion of these risks can be removed or transferred for a reasonable premium, then the carbon revenue can be monetised up front and be taken into the financing decision. This, in turn, will reduce the project's cost of capital and improve its internal rate of return.

So what should potential buyers of such a product consider? Detailed consideration should be given to the following aspects:

- Breadth of coverage, i.e. does it include a broad range of risk triggers, and are they well defined?
- Period/duration. Does it include plant construction and operation?
- Credit enhancement value, i.e. does the additional value the buyer gets from paying the premium lower its cost of capital significantly?
- Transaction cost, i.e. management time and broker expenses – these can be extremely high if a piecemeal solution is sought;
- The cost of the premium;
- The basis of the indemnity: cash or credits?
- The deductible/retention; and
- Who the insured/beneficiary is. Who can execute and benefit from the protection?

Unless the above can be clearly expressed then the chances are the product does not do what the buyer needs. Some innovative insurers have started to look at such structures. These include Parhelion, Swiss Re, Munich Re and AIG.

These products have been difficult to transact to date because a great deal of focus of the insurance industry has been on the consequences of climate change and trying to understand what it is going to do to loss ratios, rather than developing products and solutions for the carbon market. It has therefore been left to innovators such as Parhelion to develop detailed solutions and products. Other products are also under development including long-term option contracts, forestry related securities and Cat Bonds for catastrophic market and political risks.

Most insurers with the resources to develop such products rarely have the innovative dynamic to do so. It takes underwriting expertise, carbon market knowledge and innovative thinking to execute such solutions. Unfortunately, the insurance industry has had some more immediate issues to deal with in recent years (e.g. pension mis-selling, regulatory and compliance problems and back-to-back hurricane losses to name but a few). Innovation is also retarded by the silo mentality that exists in many large companies, and simple inertia – doing things the way they have always been done.

17.13 Recommendations

1. Underwriters and brokers should ensure they understand the carbon markets and its implications for their industrial clients in particular. It can lead to major changes in their businesses, and also affect their assets and liabilities.
2. Insurers and brokers should investigate the potential for risk transfer products in this growing market, in both the underlying project activity and in the permits themselves. There appears to be a range of possible products and services.
3. Investors should investigate the potential of the carbon market for alternative forms of asset.

Biography

Julian Richardson

CEO of Parhelion Capital and Underwriting

Parhelion is a specialist company focused on insurance and structured risk transfer products for climate change and the carbon trading markets. Julian has 16 years' experience in the reinsurance sector. He was a producing broker at Marsh focusing on oil and gas business in the Middle East and Africa and then the underwriting risk manager at GE Insurance Solutions, responsible for the Global Markets portfolio of specialty reinsurance business. He was the FSA approved person for the London legal entity. Julian has an MBA from Cranfield School of Management where his thesis was on Carbon Trading Risk. He has spoken at numerous international conferences on risk management, carbon finance and climate change insurance.