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Carbon credits and insurance

Can insurance address the current and future needs of the industries?

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Executive Summary

Greenhouse gas (GHG) emissions regulation is expanding worldwide with the implementation of new cap and trade systems and the development of existing ones.

The EU Emissions Trading Scheme (ETS) sets a cap on GHGs emitted by energy-intensive industries in the EU. Emissions beyond that cap must be compensated for either by paying penalties or by purchasing carbon credits in the form of EU Allowances or carbon "offsets" obtained from Kyoto Protocol-based *Clean Development Mechanism* (CDM) or *Joint Implementation* (JI) projects.

Until recently, companies have received more allowances than they needed. This will change with Phase 3 of the ETS (starting in 2013): fewer allowances (a majority of which will be auctioned rather than granted for free), fewer admissible types of offsets and new sectors involved. Carbon credit prices are expected to rise as a result.

Carbon-related costs are treated as production costs which companies typically retain and reflect in their business decisions. Volatility risk can be hedged through flexible price clauses in sales agreements and through financial products available from the carbon markets. Companies have therefore seldom sought to transfer any carbon risk to insurance.

Whilst increasing efforts and capital are dedicated to reducing energy costs, companies face new risks with more restricting compliance requirements.

Firstly, industries can suffer a Business Interruption loss following the failure of (or damage to) a production unit. Loss mitigation efforts may involve the temporary use of less energy efficient spare units (and the fuel they use) which may trigger the need to purchase carbon credits to make-up for the increased emissions so caused. Such additional costs are generally covered under the Increased Cost of Working section of conventional PD/BI policies.

Secondly, companies involved either as owners, developers, financiers or investors in a CDM/JI project all face the risk of non (or late) delivery of carbon offsets which can be due to a wide spectrum of risks such as climatic, technologic, political, credit, insolvency and/or regulatory.

Coverage for "non-delivery" risks can be found with several insurers however sales, if any, have been very limited to date. Insurers have also failed to attract the necessary levels of insurance capacity that such projects require. Sales are expected to improve, albeit a at a slow pace, with the economic recovery and more restrictive cap and trade rules.

Regulatory risks are a major area of uncertainty for CDM/JI stakeholders. Most insurers believe there is no meaningful data to assess them. In 2010, the UN Emissions Board postponed the delivery of more than half of the offsets generated by CDM projects worldwide. Price volatility is also a sensitive risk. It can be covered subject to a cap (as is the case in other risks involving commodities).

Current policy wordings must address the specificities of carbon credits (focusing particularly relating to loss valuation and mitigation) failing which contractual disputes will undoubtedly arise.

Key words

Business Interruption; Cap and Trade Scheme; Carbon Credit; Carbon Credit Non-Delivery Insurance; Clean Development Mechanism; Increased Cost of Working (ICW); European Union Emissions Trading Scheme (EU ETS); Greenhouse Gas Emissions (GHG emissions); Insurance; Kyoto Protocol; Regulatory risks; Volatility risk.

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Jonathan Young	Underwriter, Carbon Risks	Munich Re

Reasons for choosing carbon credit insurance as a topic

The writer handles large insurance and reinsurance claims submitted by companies from various industrial sectors *inter alia* energy, mining, onshore/offshore, space and construction. Claims are typically made for Physical Damage (PD) and subsequent Business Interruption/Loss of Turnover (BI) losses.

In the past years, the value of BI claims as compared to that of PD claims has risen significantly (roughly from one third to two thirds). A major reason for this is the severe price spikes of the various commodities which the affected productions involve (e.g. copper or coal).

A number of items may fall under the BI section of a policy. Carbon credits are one of them and although today they tend to lead to savings which insurers deduct from the claims they pay, they will result in sizeable losses when the (awaited) more restrictive ETS Phase 3 rules are implemented. The carbon credit issue will also go global as other cap and trade schemes throughout the world are established.

New risks have also emerged in connection with the so-called Kyoto Protocol "flexible mechanisms" which enable companies, (a) to generate carbon offsets (or purchase them) for compliance reasons, or (b) to trade them.

The topic is therefore of interest to claim handlers but also to underwriters and their clients when negotiating the premium, scope, terms and conditions of a policy (or a reinsurance contract in the presence of captive insurance companies) that involves carbon credits in some way or another. Reinsurers will also be keen to examine how carbon credits are treated by their cedants' underwriting policies.

New risks could mean new insurance needs if companies are willing to transfer them. Assuming these can be met, wordings must adapt to reflect the specificities of carbon credits in a way to prevent ambiguity and disputes.

Methodology

1. Research

Extensive research has been conducted with regards to the following topics:

- EU ETS regulation
- Other carbon credit schemes throughout the world
- Energy costs to industries
- Carbon credit trading
- Existing solutions in terms of transfer of carbon-related risks to the insurance and financial markets
- The concept of insurability
- The formation of carbon credit prices

2. Interviews

Because literature pertaining to carbon credit insurance is so scarce (which is not the case of carbon credit business and trading), this study relies predominantly on information provided by the practitioners of the industries concerned with one or more cap and trade schemes.

Interviews have been conducted between July 2010 and February 2011 in French or in English language with over 60 persons representing 45 institutions of the following sectors and professions:

- Energy-intensive industries
- Industries not (yet) subject to the ETS
- Insurance and Reinsurance companies
- Insurance brokers
- Law firms
- Loss adjusters and forensic experts
- Trading desks
- Carbon credit funds
- Consultants
- Administration

When first contacted, prospect interviewees were presented with a five-page document which included: (a) an abstract of the topics which this study aimed at discussing, (b) a description of the methodology which the writer intended to use for his research and, (c) a draft executive summary of the study itself. The latter was improved as progress was made in the author's research and interviews.

Interviewees were then sent a list of specific questions for discussion ahead of the meetings or conference calls.

Meetings generally lasted between 45 and 90 minutes.

Every interviewee was asked to (a) approve minutes of a meeting or conference call, (b) advise whether any of its contents should remain confidential, and (c) whether they wished not to be quoted on any particular statement made. A very limited number of interviewees have in fact requested that part or whole of the minutes be redacted or not attributable to them or to their company.

3. Feedback

For practical reasons, a large majority of the interviews involved global companies with their headquarters and/or activities in France. The writer believes that the feedback should provide a meaningful sampling of the views of those companies that have a direct or an indirect interest in the ETS.

Regrettably, no more than 1 in 3 persons contacted responded to the author's request for an interview. The response from the energy and utilities sector has been rather limited. It should be noted however those that did respond have shown a high level of interest in the proposed research and its conclusions. In most instances, the survey has been perceived by the industries as prospective but timely given that Phase 3 of the ETS starts in 2013.

Insurers that currently deliver carbon credit-related coverage have also been very open to discussing the way they elaborated such specific and new products and their views on opportunities for the insurance market in the years to come.

4. Key reports

- The Carbon Disclosure Project (CDP). Requirements from investors and shareholders have lead a vast majority of companies subject to the ETS to publish annually detailed information pertaining to their carbon emissions and the way they manage risks associated with climate change. Reports are available free of charge on www.cdpproject.net.
- State and trends of the Carbon Market 2010, World Bank (http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf)
- Key figures on Climate, 2011, CDC Climat, MEDDTL (http://www.developpement-durable.gouv.fr/IMG/pdf/Repclimat_anglais.pdf).

5. Web

A number of websites also provide very useful information and statistics. This study will on many occasions refer to figures and data posted on the following websites:

- UNFCCC (www.unfccc.int)
- European Commission - Climate Action (www.ec.europa/clima/policiesets/index_en.htm)
- UNEP (www.unep.org)
- International Energy Agency (www.iea.org)
- International missions Trading Association (www.ieta.org)
- Point Carbon (www.pointcarbon.com)
- UNEP Riso Centre (www.cdmpipeline.org)

List of acronyms and abbreviations

2003 EU Directive	EU Directive 2003/87/EC of 13 October 2003
2009 EU Directive	EU Directive 2009/29/EC of 23 April 2009
BI	Business Interruption
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CDM EB	Clean Development Mechanism Executive Board
CDP	Carbon Disclosure Project
CER	Certified Emissions reduction
CO_2	Carbon Dioxide
CO_2-e	Carbon Dioxide equivalent
DNA	Designated National Authority
EB	Executive Board
EC	European Commission
ERPA	Emissions reduction Purchase Agreement
ER	Emissions Reduction
ERU	Emissions reduction Unit
EU ETS (ETS)	European Union Emission Trading System
EU	European Union
EUA	European Union Allowance
GHGs	Greenhouse Gases
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
IEA	International Energy Agency
JI	Joint Implementation
NAP	National Allocation Plan
PD	Property Damage
Phase 1/2/3	Phases 1/2/3 of the EU ETS
PFC	Perfluorocarbon
PRI	Political Risks Insurance
REC	Renewable Energy Certificate
RGGI	Regional Greenhouse Gas Initiative
TCO_2e	Ton of Carbon Dioxide Equivalent
UN	United Nations
UNEP	United Nations Environmental Program
UNFCCC	United Nations Framework Convention on Climate Change
VER	Verified Emissions reduction

INTRODUCTION

(1) Insurance and climate change

There appears to be consensus that the insurance industry has a role to play and great opportunities to seize with climate change.

a. Global initiatives and calls from insurers' associations

On 6 September 2010, four leading insurance and climate change initiatives (ClimateWise[1], The Geneva Association[2], the Munich Climate Insurance Initiative[3] and the UNEP Finance Initiative) representing more than 100 of the world's leading insurers called for greater action to adapt the emerging countries to climate change through the use of insurance-linked products and risk management mechanisms.

This is one of many positions taken by insurers towards assisting governments and NGOs in preventing the risks associated with climatic changes and extreme weather conditions. Insurers have volunteered to provide their expertise in risk engineering and loss prevention. They are prepared to share the tools (natural climate and catastrophe database, extreme weather models, etc.) and expertise necessary to assist vulnerable countries in assessing and managing the risks of climate change[4]. They have also stressed the need for reliable regulatory and societal frameworks as well as for governments' cooperation with (re)insurers, particularly with regards to the critical need for local weather information and high-quality historical data for underwriting purposes[5].

A number of companies such as Zurich Financial Services[6] have also individually highlighted the role of insurance and public policy in managing the new risks arising out of climate change.

Insurers' involvement in climate change is generally well perceived however there has been some reaction, in particular from NGOs such as WWF, to the effect that insurers' only motivation is to generate new streams of revenue.

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[1] Climatewise was established in 2007 involving over 40 leading insurers and reinsurers which have agreed to abide by a number of principles towards the reduction of climate change.

[2] The Geneva Association is a think tank on insurance and risk management issues. In May 2008, it launched the "*Climate Change and its Economic Impact on Insurance (CC+I)"*. On 29 May 2009, 50 CEOs from global insurance and reinsurance companies signed the "Kyoto Statement" of the Geneva Association which aims at countering climate risks through cooperation and the use of sustainable practices and sharing strategies of mitigation and adaptation.

[3] The MCCI was founded in 2005 by representatives of Germanwatch, the IIASA, Munich Re, PIK, SLF, the Tyndall Centre, the World Bank and independent experts. It focuses on providing insurance solutions for developing countries by helping them manage the impacts of climate change.

[4] *"The insurance industry and climate change – Contribution to the global debate",* July 2009, http://www.genevaassociation.org/PDF/Geneva_Reports/Geneva_report%5B2%5D.pdf. Retrieved on 21 December 2010.

[5] "*Climate change challenges are opportunities for industry to learn"*, K. Ishihara, Geneva Association, Insurance Day, 23 November 2010.

[6] *"The Climate Risk Challenge – The role of insurance in pricing climate-related risks",* http://www.zurich.com/NR/rdonlyres/E2B5B53E-11DB-47AF-91E4-01ED6A2BDCA3/0/ClimateRiskChallenge.pdf. Retrieved on 9 November 2010.

b. New business opportunities

Climate change exposes companies and their businesses to new or increased property and casualty risks. In the current global economic system, this inevitably means that insurance needs will grow thus providing opportunities for new insurance markets and products[7]. This has led a number of established insurers and newcomers to insurance market to offer innovative and bespoke coverage solutions. Solar and wind power generators are one of many examples of new technologies that require specific solutions. Munich Re is recognised as a leader in the creation of renewable energy insurance. In 2010, it entered into a 25-year agreement with LDK Solar to cover the photovoltaic panels it manufactures. In March 2011, the company announced that it had agreed to insure 5-year guarantees offered by Fuhrländer, a wind-turbine manufacturer, to its customers. On the liability side, companies are increasingly exposed to regulation and pollution risks.

Insurers also play a role in climate change when they encourage their clients to "go green" through premium differentiation. In the motor insurance industry, the "*pay as you drive*" experience in the UK has proven particularly successful with low mileage drivers. A number of companies also offer discounts for fuel efficient and hybrid vehicles.

In other lines of business such as building and home insurance, insurers have actively promoted best available technology by offering lower premium rates and extended cover to companies that use renewable energies and apply resource-efficient business models[8]. Further, a policy can also provide for the rebuilding of damaged property using green material and complying with new compulsory norms and/or higher optional standards[9]. Demolition and Increased Cost of Construction (DICC) and code upgrade are a particularly big issue in the USA.

(2) Basic terminology

The following terms will be used throughout this study.

a. Carbon emissions[10]

Greenhouses Gases (GHGs) are natural gases in the earth's atmosphere which allow infrared radiation in to warm the earth's surface. Excessive concentrations of these gases due to human actions (anthropologic emissions) have resulted in preventing much of the heat brought by the sun escaping from the earth into the atmosphere. It is widely believed that this is affecting the global climate (greenhouse effect).

The Kyoto Protocol in its Annex B covers six major greenhouse gases emitted by the largest industries:

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[7] "*Advancing adaptation through climate information services"*, UNEP and Sustainable Business Institute (SBI) survey, January 2011.
[8] "*Global Change, Acts of God, Acts of Man, Acts of Nature and Systemic Risks"*, Walter R. Stahel, Geneva Association Information Newsletter, May 2010, pp.3-4.
[9] By way of an example, FM Global recently launched its "*Sustainability Select*" product which includes the two following optional additional coverage: (a) the "*Risk Improvement*" coverage by which the risk quality of a damaged location can be improved by paying for the extra cost to satisfy current recommendations in FM Global's Property Loss Prevention Data Sheets, and (b) the "*Green*" coverage by which damaged property can be upgraded through the use of green materials and practices in line with local environmental norms. See www.fmglobal.com/page.aspx?id=03010102. Retrieved on 26/01/2011.
[10] http://www.carbonoffsetguide.com.au/glossary. Retrieved on 08/08/2010.

- **Carbon dioxide** (CO_2) is by far the most commonly produced GHG. It is generated as a by-product of oil and gas production, burning fossil fuels and biomass, as well as from all animals, plants and a number of other natural sources;

- **Methane** (CH_4) is emitted from landfills, oil and natural gas operations, coal mines and agriculture (particularly livestock farming);

- **Nitrous oxide** (N_2O) is emitted from nitrogen fertilizers, burning fossil fuels and some industrial and waste management processes;

- **Hydro fluorocarbons** (HFCs) are mainly released from leakage from refrigeration equipment during operation and its end-of-life destruction. They are also used in aerosols, air conditioners and metered dose inhalers;

- **Perfluorocarbons** (PFCs) ozone-depleting CFCs used in refrigeration systems;

- **Sulphur hexafluoride** (SF_6) is a man-made chemical that can be found in electrical switchgear, magnesium smelting processes and semiconductors.

The **Global Warming Potentia**l (GWP) is the potency of GHGs, meaning their ability to trap heat in the atmosphere, through the difference in time GHGs remain in the atmosphere, and their effectiveness in absorbing outgoing infrared radiation.

Under the Kyoto Protocol, GWP is a numerical measure relative to carbon dioxide (CO_2 = 1). The GWP of the five other abovementioned gases is measured in terms of equivalency to the impact of CO_2 (CO_2-equivalent or CO_2e), as follows:

GHGs	**Contribution to man-made global warming**[11]	**GWP** (CO_2e)
Carbon dioxide (CO_2)	63%	1
Methane (CH_4)	19%	21
Nitrous oxide (N_2O)	6%	310
Hydro fluorocarbons (HFC)	12%	140-11,700
Perfluorocarbon (PFC)		5,000-10,000
Sulphur hexafluoride (SF_6)		23,900

By way of an example, N_2O has 310 times the amount of heat retaining capacity of CO_2. CO_2 however is currently responsible for almost two thirds of man-made global warming whilst other GHGs are released in relatively small quantities.

[11] http://ec.europa.eu/clima/policies/brief/causes/index_en.htm. Retrieved on 16/12/2010.

Energy efficiency is all about "using less energy to provide the same service"[12]. Its benefits to industries can be multiple: lower fuel costs and reliance on fossil fuels, increased competitiveness and good reputation.

Direct emissions (also called **Scope 1** emissions) are emissions that are issued by sources that belong to and are controlled by a company. In contrast, **indirect emissions** (also called **Scope 2** emissions) are those that relate to the production of electricity, heat or steam that is either imported or purchased. Indirect emissions can be the direct emissions of another company (e.g. a coal fired turbine emits gas or steam to produce electricity). **Scope 3** emissions are other indirect emissions either upstream (e.g. raw materials and capital equipment used for the production of Scope 2 emissions) or downstream (e.g. distribution, use or disposal of a manufactured product, etc.). Some emissions not part of the supply chain (out of stream) may also be considered as Scope 3 emissions.

Carbon capture and storage (CCS) or geo-sequestration involves the capture, transport, injection and long-term storage of GHG emissions in underground geological formations for the primary purpose of mitigating GHG emissions. CO_2 is separated from the other exhaust gases generated in the industrial combustion of fossil fuels.

b. Cap and trade schemes

Under a c**ap and trade** scheme, a central authority sets a cap on the amount of GHGs that can be emitted by specified businesses or industries. The cap is estimated by reference to an industry's emissions in a "*business as usual*" situation. That cap lowers over time so that companies are encouraged to further reduce their emissions.

Allowances are either allocated or sold to companies in the form of carbon credits which give them the right to emit a determined quantity of GHGs over a specified period ("Carbon Year", typically one year). In a sense, carbon credits can be viewed as a "license to pollute".

At the end of the Carbon Year, companies must surrender carbon credits equal in number to the CO_2 emissions they release. If they emit more than they are allowed to, they can either pay a fine or purchase surplus allowances (trade) from companies that manage to stay below their limit during the Carbon Year.

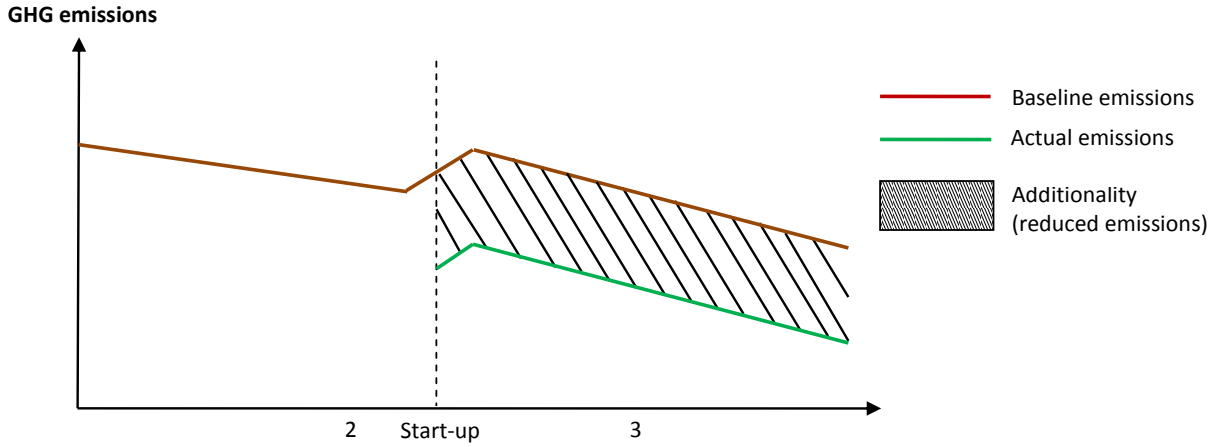
The first cap and trade system involving gas emissions was implemented in the US under the 1990 Clean Air Act applying to SO_2. Today, the EU Greenhouse Gas Emission Trading System (**ETS**) is the most advanced cap and trade system in the world. The Regional Greenhouse Gas Initiative (**RGGI**) in the USA follows and in December 2010, California adopted its own mandatory state scheme which is expected to become the second largest in the world.

A **carbon credit** (also referred to as **allowance** or **permit**) is a generic term to assign a value to the specific weight unit amount of an emission, reduction or offset of GHG emissions. One carbon credit is set to be equivalent to one ton of CO_2 or one ton of CO_2-equivalent gases.

A carbon credit generally refers to an **Assigned Amount Unit** (AAU) under the Kyoto Protocol or to a **European Union Allowance** (EUA) under the ETS however depending on the context this might also (or instead) refer to carbon offsets.

[12] http://eetd.lbl.gov/ee/ee-1.html.

Carbon offsets (or project-based credits) are credits issued in return for investments in projects that reduce GHG emissions (e.g. electricity generated by wind, solar or hydro power, ethanol produced from biological fermentation of organic material used as fuel, etc.) or that sequester carbon from the atmosphere (e.g. a forestation, etc.). Per the Kyoto Protocol, such reductions must be "additional" to emissions reductions that would otherwise be obtained in a project[13].



Offsets are the difference between business as usual and residual CO_2 emissions. One offset credit equates to an emissions reduction of one ton of CO_2. By paying for such emission reducing activities, companies can use the resulting credits to offset their own emissions, either voluntarily or within emissions trading schemes. They can also bank their offset credits.

The most common form of carbon offsets is the **Certified Emissions reductions** (CERs, generated in Clean Development Mechanism projects) and the **Emissions Reduction Units** (ERUs, generated in Joint Implementation projects) as part of the Kyoto flexible mechanisms.

(3) Scope of this study

Whether they are granted for free by governments or purchased on the spot or auction markets, carbon credits are valuable assets to companies. If a company needs more credits, it will have to incur a cost. If it has surplus, it will expect to generate revenue from their sale.

Insurers and reinsurers are involved in cap and trade because the industries they (re)insure contribute to climate change through their emissions.

This study will consider whether carbon credits may be considered an insurable interest and if so, what conditions must be met. An insurable interest is a true, valid, determinable and direct economic stake of a policyholder (or any designated beneficiary of a policy) in the continued existence or safety of an insured property (or person). The policyholder must stand to suffer a direct financial loss if an insured peril occurs[14].

[13] **Additionality** is defined in 3/CMP.1, Annex, paragraph 43 as follows for CDM projects: "*A CDM project activity is additional if anthropogenic emissions of GHGs by sources are reduced below those that would have occurred in the absence of the registered CDM project activity*".
[14] http://www.businessdictionary.com/definition/insurable-interest.html. Retrieved on 11 February 2011.

This study will focus on the ETS only although it should be recognised that the RGGI in the USA is now a well advanced operating cap and trade scheme with allowances actually already being auctioned. Notwithstanding, a number of generic insurance issues discussed will likely be of relevance to other cap and trade schemes throughout the world i.e. not specific to the ETS.

The purpose of this study is to highlight one specific topic: carbon credits and the associated risks which the energy-intensive industries that are (or will be) subject to the ETS face (or will face if and when they become subject to the ETS).

The author will seek to offer answers to the following fundamental questions:

- Which are the relevant local, national and international cap and trade schemes?
- Who are the parties involved?
- What are the implications (costs and risks) of such regulation?
- Have they been identified and how are they currently managed by companies?
- Which are the existing risk transfer solutions?
- Why is the insurance industry's response limited and how can it improve?
- Are all carbon credit-related risks insurable?

The following topics will NOT be discussed:

- Other climate change-related risks and solutions (e.g. climate derivatives, etc.)
- Carbon trading by individuals
- Carbon taxes[15].

This survey will first address the way companies that are subject to cap and trade schemes (particularly in the EU ETS) manage the risks which they raise (section 1). Solutions available from the insurance industry will then be presented (section 2). The final section will focus on those risks (regulatory and price volatility) for which limited coverage only can be currently found (section 3).

[15] Although the debate as to whether a tax system might be a more appropriate and fair system than cap and trade is still very much alive, this study will assume that the latter is the basis of all efforts being put towards fighting climate change in line with the Kyoto Protocol mechanisms which a very large majority of States have ratified.

1. MANAGING CARBON CREDIT RISKS

ABSTRACT

Legal framework

The Kyoto Protocol imposes binding reductions targets on 6 greenhouse gas emissions to its signatory countries. They are to be achieved through the implementation of a cap and trade system and so-called "flexible mechanisms" (Clean Development Mechanism and Joint Implementation) which enable parties to offset their emissions via projects that contribute to reducing emissions (or that sequestrate them) in foreign countries.

Fighting climate change is a key priority for the EU. The EU Emissions Trading Scheme was set up in 2005 based on the Kyoto Protocol principles. It is staged process which imposes increasing emissions restrictions to companies. Phase 3, which is due to start in 2013, will see major developments as the scheme will apply to more sectors and gases and as a majority of allowances will be auctioned (rather than granted).

Other cap and trade schemes are emerging across the world mainly in developed countries. Regional initiatives, particularly in North America, are also very active.

Risk management

The EU ETS applies to energy-intensive installations in the EU and their GHG emissions.

Reducing energy costs has been a main concern for industries for many years. The ETS is therefore perceived as a further incentive to switch to renewable energies and reduce emissions.

So far it has raised no major concern because, (a) allowances have been allocated at no cost and have exceeded by far actual levels of emissions, (b) the sale of surplus allowances has actually generated windfall profits and, (c) carbon market prices have remained low.

Industries see the cost of carbon regulation as an additional production cost which they now factor into their key business and strategic decisions. Carbon credits are treated as a commodity (in the same way as fuel or coal) which volatility risk can be mitigated through price index clauses in sales agreements and derivatives on the carbon markets (futures, options, swaps).

Companies that are subject to the ETS face two main types of new risks.

1. An Increased Cost Of Working scenario. An industry would have to purchase additional credits in order to compensate for increased emissions due to the switching of a failed (or damaged) production unit to a less efficient one in order to mitigate a BI loss. Such risk is currently covered by traditional PD/BI policies.

2. A risk of non-delivery of carbon credits (CERs or ERUs) expected from CDM and JI projects. Such risk may involve a large number of stakeholders (financing, contractors and clients). Partial coverage can be found via so-called "all risk" carbon credit non-delivery policies.

1.1 Legal framework

a. UN Framework Convention on Climate Change (UNFCCC)

A milestone in the decision to implement carbon cap and trade systems throughout the world is the UNFCCC Earth summit which took place in Rio in May 1992. 189 states signed up to a text which aimed at stabilizing "*greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*"[16]. To achieve this, the signatories agreed to set a non-binding cap on allowable GHG emissions and committed to establishing national programmes for reducing GHG emissions and publishing regular reports.

Three key-principles have emerged from the agreement (which came into effect in 1994):

- "common but differentiated responsibilities" (the top 20 emitters emitted 80% of total GHG emissions in 2005),
- an "equitable burden-sharing according to capacities",
- a "possible joint implementation".

The **Kyoto Protocol** to the UNFCCC was adopted on 11 December 1997 and entered into force on 16 February 2005. Its purpose was to supplement the UNFCCC in setting legally binding targets to States on six GHG emissions (see Gases). As at February 2011, there were 193 parties (including the EU) to the Protocol.

Per the terms of the agreement, Industrialized Countries (also known as the UNFCCC "Annex I countries" having ratified the Kyoto Protocol) must reduce their collective GHG emissions by an average of 5,2% below 1990 levels (when levels were particularly high) by 2012. EU countries must reduce their emissions by 8% over the same period.

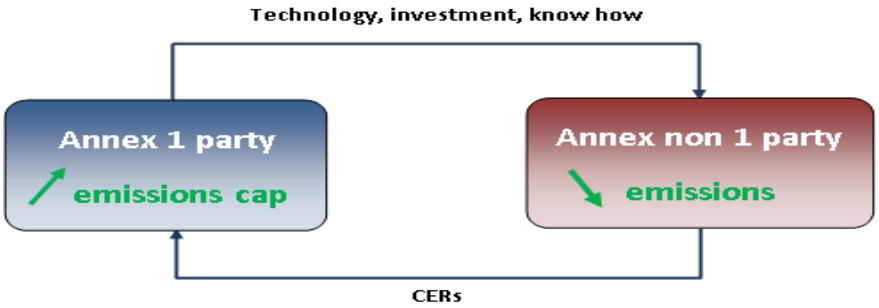
The Marrakech Accords in November 2001 established three market-based implementation "mechanisms" for States to meet such targets.

The first is the **International Emissions Trading** (art. 17 of the Kyoto Protocol), a cap and trade system which allows Annex I countries to trade carbon credits allocated to them (Assigned Amount Units - AAUs). The cap reduces over time.

The two other mechanisms, "CDMs" and "JIs", are known as "project-based mechanisms".

- **Clean Development Mechanisms** (CDM, art. 12 of the Kyoto Protocol) allow companies from an Annex I country to offset some of their GHG emissions by helping to finance the emergence of environmentally-friendly industries in Developing Countries (also known as UNFCCC "Non-Annex I" countries having ratified the Kyoto Protocol).

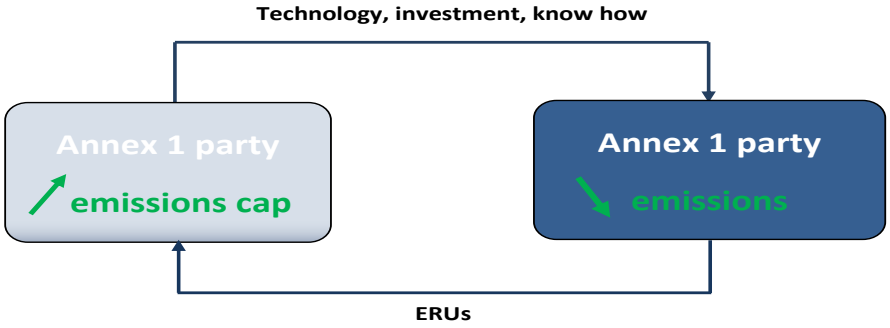
[16] Article 2, The United Nations Framework Convention on Climate Change.



Carbon offsets generated by CDM projects are called Certified Emissions Reduction (CERs) with one CER unit equating to a reduction of one metric ton of CO_2. CERs can be used, exchanged (for EUAs under the ETS) or sold in addition to allowances granted separately by Member States. Local regulation may establish specific requirements for CERs to be recognised.

CDM projects must also comply with a given non-Annex I country's priorities in terms of sustainable development. It must also be validated and registered by the UNFCCC. Once this is achieved and the project is operational, independent auditors must verify that the targeted emissions reductions are actually achieved.

- **Joint Implementation** projects (art. 6 of the Kyoto Protocol) were introduced in 2008. They allow companies from an Annex I country to be granted carbon offsets as a result of investments in other Annex I countries when they are intended to reduce the net GHG emissions in that other Annex I country.



Carbon offsets generated by JIs are called Emissions Reduction Units (ERUs). They can be used, traded or exchanged (against EUAs under the ETS). Local regulation is due to establish the requirements for ERUs to be recognised.

CDM and JI projects must result in real additional, measurable, verifiable and long-term climate change benefits (see Additionality).

The International Transaction Log (ITL), held by the UNFCCC Secretary, is a centralized database of all UN tradable credits (including CERs). It verifies that all international transactions comply with the Kyoto Protocol rules and policies.

Verified Emissions reductions or **Voluntary Emissions reduction** (VERs) are alternative ways of generating credits through emissions reduction activities when they cannot enter the scope of

CDM programs (e.g. when they are conducted in countries that are not signatories to the Kyoto Protocol). Projects mainly involve agro forestry, methane reduction and renewable energies.

The Kyoto Protocol will expire in 2012 and Member States have yet to decide on whether it will be extended or not. Policymakers failed in Copenhagen (2009) and Cancun (2010) to provide long-term visibility on any post-Kyoto international framework. This has caused many investors to postpone CDM and JI projects. COP 17 in Durban at the end of 2011 will attempt to address unresolved issues and outline the future, if any, of an international legal binding cap and trade system (or any alternative solution[17]).

b. The EU paving the way for mandatory cap and trade schemes

The Kyoto Protocol was ratified by the EU and all its Member States on 31 March 2002[18]. All accession countries that have since joined the EU have ratified the Protocol.

Under the Protocol, the EU15 committed itself to reduce its GHG emissions by 8% during the 2008-2012 period[19]. Each Member State has its individual target to meet[20].

In December 2008, the European Parliament and Council adopted the "**Climate and Energy Package for 2020**". The text, which became law in June 2009, implements the following "20-20-20" target:

- 20% of EU energy consumption to come from renewable sources
- +20% improvement in energetic efficiency within the EU
- -20% GHG emissions compared to 1990 levels (-30% in the event that a satisfactory international convention can be ratified).

Such assignments and the Kyoto Protocol have motivated the launch of the **EU Greenhouse Gas Emission Trading System** (ETS), a cornerstone in the EU's fight against climate change. This was achieved through the **EU Directive 2003/87/EC**[21] of 13 October 2003 (hereafter the "2003 EU Directive", in force on 25 October 2003 and subsequently amended).

In January 2005, the ETS started operation as the first and largest international, multi-sector company-based cap and trade system for CO_2 emissions. The system, which currently applies to companies owning over 11,500 energy-intensive installations across Europe, is one which sets a total volume (cap) of permitted emissions during a certain period. Companies subject to the regulation are allocated carbon credit allowances (EUAs) by the EU Members States' governments. At the end of each yearly reconciliation period, companies must surrender to their government an amount of allowances equivalent to their emissions during same period. Any savings which they can achieve through emissions reduction efforts can be traded on a dedicated market. Emissions

[17] It has been suggested that a bottom-up type of agreement based on countries making domestic commitments) might be a way of gaining worldwide support.
[18] The Kyoto Protocol is implemented as law in the individual EU states. Member States are required to transpose the directive into their legislation.
[19] Council Decision 2002/358/EC of 25 April 2002.
[20] Targets assigned to EU Members are not uniform: -21% for Germany (where there are still a large number of coal power stations), 0% for France (given the high proportion of electricity generated by nuclear power stations) and +15% for Spain (accounting for the post 1990 increased industrialization).
[21] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:en:PDF. Retrieved on 20 December 2010.

exceeding the cap will be fined unless companies are able to surrender admitted carbon offsets instead.

The EU Commission is the entity responsible for the allocation process and trade of carbon credits in the EU. It approves the National Allocation Plans (NAPs) which are drawn up by each Member State to set an overall cap on CO_2 emissions and the corresponding allowances. NAPs must comply with 12 criteria that are set out in Annex III to the 2003 EU Directive. A key criterion is that the proposed total quantity of emissions permitted must be in line with the Kyoto Protocol requirements. A corresponding number of EUAs is then granted per installation. Allocations are made for a sequence of several years ("Trading Period") with a view to neutralise *unusual* weather conditions (cold winters and hot summers can mean more energy is required for production thus increased pollution). Member States can issue additional allowances in cases of *force majeure* such as *extreme* weather conditions.

Each EUA represents a permit to emit one metric ton of CO_2-e or an amount of any other GHG listed in Annex II to the 2003 EU Directive with an equivalent GWP. The EU Commission adopted a proposal on 23 July 2003 which allowed[22] companies to convert carbon offsets generated by CDM and JI projects in order to meet their commitments under the ETS.

As part of their reporting obligations to their national regulators, companies must publish an Annual Emissions Report every year which discloses their actual level of GHG emissions as well as their balance (debit or credit) of carbon credits. The report must be submitted to the EU Member State entity responsible for regulating carbon emissions and verified by an Independent Accredited Verifier.

The ETS is defined by its overall cap (21% below 2005 levels by 2020 based on a linear annual reduction factor). It works in phases.

- **Phase 1** ran from 1 January 2005 to 31 December 2007. During that period, also known as the "*trial period*", emissions in the EU decreased by 2-3%[23]. The ETS covered CO_2 emissions by a limited number of industrial sectors (mainly energy, metallurgy and mining). The caps were set at national level.

  Virtually all allowances were granted at no cost (up to 5% were auctioned). Allocations were based on historical emissions at installation level. Companies could generate profit through the sale of surplus allowances to companies emitting beyond authorised limits. Any surplus in year Y had to be used or sold in year Y+1. Unless otherwise compensated by carbon offsets or credits purchased on the spot market, companies exceeding allowances would be fined EUR40 per ton of CO_2 exceeded in addition to having to purchase the equivalent shortfall for retirement the following year. Their name would also be published on a shame list on the ETS website.

  During Phase 1, companies received far more allowances than they actually needed (see Oversupply) and carbon prices were very volatile, eventually collapsing at the end of the period because credits could not be banked beyond Phase 1.

[22] Up to a certain limit (up to 10% of the Member States' total allowances under Phase 2).
[23] Source: World Bank.

- **Phase 2** started on 1 January 2008 and is due to end on 31 December 2012. It has also been named the "*commitment period*" in line with the Kyoto Protocol target (an overall 2.1 bn t/year cap for the EU during that period). Emissions fell by 11% in 2009 with the financial turmoil. The caps are also national.

  Allowances have been mostly granted at no cost (up to 10% auctioned) but the overall number of allowances available has reduced. Allocations are based on historical emissions at individual production installation level. Surplus carbon credits can be used at any moment during Phases 2 and 3 to cover possible shortfall. Companies exceeding their individual emission limit face a EUR100 fine per ton of CO_2 exceeded.

  As part of the 2008 EU Climate & Energy Package, Phase 2 saw the 2003 EU Directive amended on 23 April 2009 (hereafter the "2009 EU Directive") to improve and extend the ETS as from 2013[24].

- **Phase 3** will run from 1 January 2013 to 2020. Its rules were approved on 15 December 2010 by the EC Climate Change Committee and are due to be submitted to the EU Parliament and Council within a three month timeframe.

  Phase 3 will also see the EC granted with increased control and power on the scheme. The quantity of overall yearly allowances will be set at EU level[25] and shall decrease by a linear factor of 1,74% compared to the average yearly total quantity of allowances issued by Member States between 2008-2012[26]. All allowances will be registered at a national level under EU supervision. NAPs will be abolished in favour of a special EC authority which will decide on allocations of each individual installation. All national registries will have to be connected to the EU Community Independent Transaction Log (CITL) that records the issuance, sale, cancellation, retirement and banking of credits issued by the ETS. Preventing Fraud is a top priority for the EC.

  The Phase foresees fundamental changes in that the auctioning rather than allocation of allowances will become the rule and new sectors including aviation will join the ETS. 60% of permits will be auctioned. Auctioned permits will be time-limited and sold at costs reflecting a sector's carbon intensity and environmental impact. Costs will also account for the potential for carbon leakage[27]. 164 industrial sectors have been identified as sensitive to carbon leakage risk out of a total of 258. They will each receive 100% of their benchmarked allowances for free until the end of 2014. After 2014, the list of 164 will be revised. Auction dates have not yet been published.

  Benchmarks will be based on the average GHG performance of the 10 most CO_2 efficient EU installations for every sector, as calculated against the base year 2007-2008. The most

[24] Directive 2009/29/EC modifying Directive 2003/87/EC of 13 October 2003 - http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:EN:PDF. Retrieved on 26 December 2010.
[25] The EC decided on 22 October 2010 that there would be 2,039,152,882 allowances for 2013 (valued at circa EUR100 bn). This includes all Phase 3 sectors except aviation which level of allowances have yet to be determined.
[26] Article 9 of the 2009 EU Directive.
[27] Carbon leakage risk stems from the alleged (see Leakage) competitive disadvantage which industries would suffer against those that are not subject to the ETS restrictions. It is feared that the companies involved would have to relocate production outside the EU where they would use less efficient installations, resulting in increased emissions globally. Article 15 of the 2009 EU Directive sets out the relevant criteria for the determination of a carbon leakage situation. The complete list of sectors and sub sectors appears in the 2010/2/EU Commission Decision of 24 December 2009.

"climate friendly" installations will be granted free allowances during a transitional period. The heavy industry (including cement, steel, aluminium and chemical) will obtain a higher share of free allowances. By contrast, electricity producers, subject to some derogations, will have to buy 100% of their allowances at auction (see windfall profits).

There will be quality restrictions on the use of carbon offsets. This follows notably the UN Emissions Board's decision to postpone the delivery of CERs for certain types of CDM projects (see HFC23). Banking of permits from Phase 2 to Phase 3 will be permitted

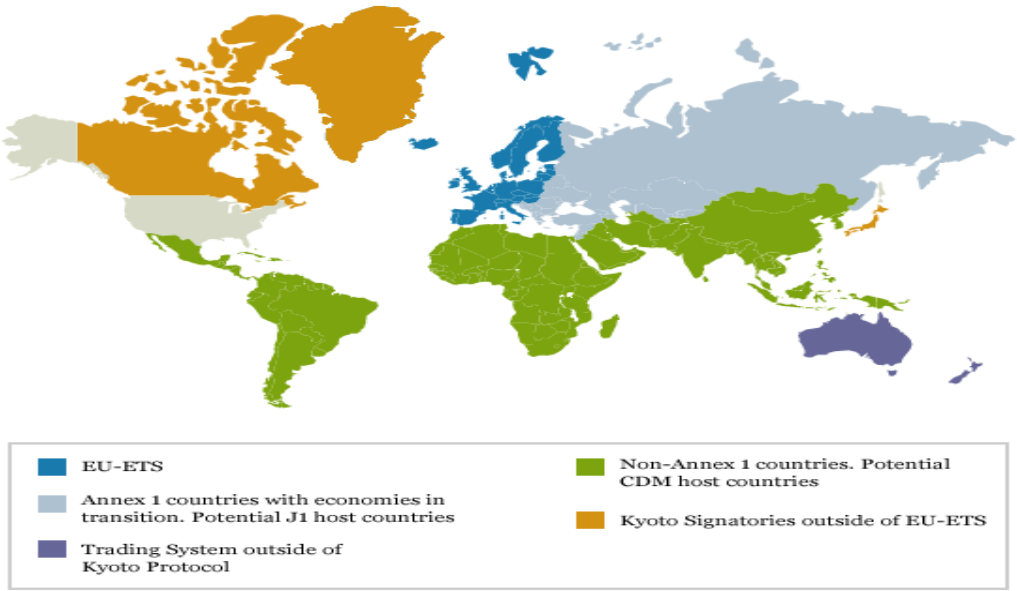
A common auction platform will be created (at a location to be determined) however Member States (who will be collecting the auctioning revenue) will have the right to opt-out and hold their own auctions subject to meeting certain criteria (such as a minimum amount of quotas being auctioned, identical access conditions to platforms, etc.) and subject to the EC's approval.

The EC has committed to continuing with its cap and trade scheme despite the limited cap and trade initiatives on other continents. It recognises its cost to EU-based companies however is convinced that efforts in terms of energy efficiency will give them a long-term comparative advantage through lower costs and enhanced security.

c. Other carbon cap and trade schemes throughout the world

Although this study will focus on the EU scheme, the obligatory and voluntary schemes that are emerging across the world at various levels (local, national and international) are mentioned because EU insurers and reinsurers will insure policyholders involved in schemes worldwide.

Several signatory States to the Kyoto Protocol are setting up or planning to set up carbon cap and trade schemes. Currently 5% of the worldwide GHG emissions are subject to such schemes. This is expected to reach 35% by 2020[28].



Source: Element Markets[29]

[28] Letter from C. Lagarde to M. Prada (President of Paris Europlace) dated 15 April 2010.

- **United States of America**

It is noteworthy that the ETS was actually preceded by the SO_2 emissions cap and trade system which was implemented in the USA as part of the Acid Rain Program (Title IV) of the 1990 Clean Air Act.

If a federal carbon cap and trade system was established in the US, it is likely that the volume of carbon credits exchanged would exceed that in the EU. Currently however, there is no such scheme.

President Obama stated on 17 November 2008: "*Cap and trade is the best way from my perspective to achieve some of those gains because what it does is it starts pricing the pollution that is being sent into the atmosphere*". His commitment to ratify the Kyoto Protocol and to set up a federal scheme to limit global warming has since met strong resistance. The November 2010 mid-term elections may well have wrecked the prospects of the Congress implementing what looked like a well advanced energy reform bill[30]:

- The **American Clean Energy and Security Act** (**Waxman-Markey** HR 2454 bill) was adopted by the House of Representatives in June 2009. It aims at reducing emissions by 17% by 2020 using a 2005 baseline (83% by 2050). Per the bill, carbon offsets would be capped at 2 bn tons per year (compared to 350Mt under the ETS), 50% of which could be imported (75% if there is insufficient domestic supply). Substantial offsets stemming from forestry, agriculture and land uses would be accepted. The law sets a \$10/ton CO_2 permit price floor and a "strategic reserve pool" would serve to stabilize prices if they exceeded 60% of the historical price.

- The **Clean Energy Jobs and American Power Act** bipartisan bill is a proposal made by senators Kerry, Liebermann and Graham in May 2010. It aims at reducing GHG emissions by 20% by 2020 based on 2005 levels (also 83% by 2050). To achieve this, it plans to set up of a cap and trade system applying to the 7,500 plants which emissions exceed 25,000t/CO_2 annually. This amounts to approximately 75% of GHG emissions in the US. The scheme should apply to producers of electricity as from 2013 (as against 2016 for the industry). Carbon offsets would also be capped at 2 bn tons per year with import offsets not to exceed 25%. The draft bill proposes an \$11/ton CO_2 permit price floor and a "strategic reserve pool" to stabilize prices if they exceed \$28/ton in 2012 and increasing for the following years. The Republicans blocked the Act in July 2010 after it had been adopted by the House of Representatives in 2009.

In Jason Reeves' view (Zelle Hofman), the most realistic prospect for US cap and trade is the Environmental Protection Agency (EPA) regulation using cap and trade following the 2 April 2007 Supreme Court determination[31]. The Court ruled that GHGs were "air pollutants" causing "air pollution" as defined under the Clean Air Act and that the EPA could therefore regulate GHG emissions. In theory, the US judiciary should balance any legislation or governance failure.

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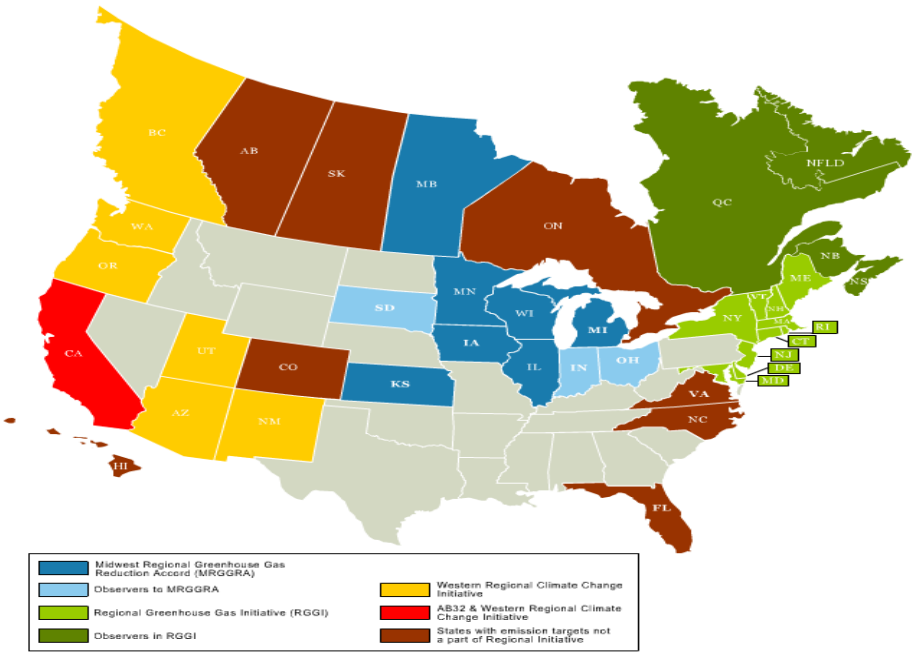
[29] http://www.elementmarkets.com/na_carbon_markets.html. Retrieved on 28 February 2011.

[30] Paradoxically, the chances of adopting a federal cap and trade scheme had never been so high: a Democrat president, a majority of Democrats at the Senate, major States taking concrete action against climate change and private companies such as Wall-Mart and Coca-Cola imposing their "White Roof" policy on their chain suppliers. The proposed reform however came at the worst possible time. Indeed, the recession hit Americans so badly that climate change could no longer be considered as a priority in the general opinion. Another important reason for the reform not passing is that the Senate (before which the Waxman-Markey bill was presented) was unwilling to take up a further sensitive debate weeks only after the highly controversial one on Health Reform had ended.

[31] *Massachusetts v EPA et al*, 549 US. 497; 127 S. Ct. 1438.

Despite the failed congressional efforts to pass a nationwide carbon cap and trade system, a number of federal states have moved forward with schemes of their own.



Source: Element Markets[32]

The **Regional Greenhouse Gas Initiative** (RGGI)[33] is the most advanced scheme in the USA. It was launched on 1 January 2009 and currently involves ten Mid-Atlantic and Eastern states. The initiative established a mandatory cap and trade CO_2 emissions program which covers 210 power plants that use fossil fuel for more than half of their annual input. It aims at reducing CO_2 emissions in two phases. Phase 1 (2009-2014) sets a cap which is aligned with historical emissions. Phase 2 (2015-2018) targets a 2,5%/year decline in emissions. The scheme provides for safety valves in order to prevent dramatic increase in prices. Companies have received more allowances than they needed in the past years, partly due to the economic recession. Well ahead of the ETS, allowances have been auctioned since September 2008. Installations that do not purchase enough credits or offsets (which are capped and limited to five categories of projects) face penalties to compensate for their emissions. Banking of allowances is permitted. Credit prices are low and do not appear to modify industrial behaviour.

In February 2007, the **Western Climate Initiative** (WCI) established a GHG emissions trading system between seven US states, four Canadian provinces and several Mexican States. It is due to commence in January 2012 and will cover the six Kyoto Protocol gases as emitted by electricity generators and large industrial companies. The WCI will be extended to other sectors in 2015.

In line with the emissions reduction targets set by the 2006 **California Global Warming Solutions Act** (AB 32), California's Air Resources Board (ARB) adopted a carbon cap and trade scheme in December 2010. The scheme is to become the second largest in the world with $1,7 bn in transactions expected in 2012 reaching 10 bn by 2016. It will apply to all major industrial companies and electric utilities as from 2012 and will later extend to distributors of transport fuels,

[32] http://www.elementmarkets.com/na_carbon_markets.html. Retrieved on 28 February 2011.

[33] *Insurers and Regional Cap and trade Programs: Regional Greenhouse Gas Initiative*, T. Cook, J. Reeves and K. Gonzalez, Zelle Hofman Voelbel & Mason LLP, 6 December 2010. http://www.zelle.com/news-publications-108.html

natural gas and other fuels. The scheme will ultimately involve 360 businesses owning 600 facilities. Allowances are expected to be allocated in July 2011; they will be bankable from one period to another. The Act includes forest carbon offsets and recognizes offset activities and credits already generated (known as "*early action*"). Offsets are projected to exceed 200 million tons through 2020. The operation phase of the scheme will start in 2012 with limited application (electricity producers and certain industries). It will then extend to gas and fuel distributors in 2015. Free allowances will be granted until 2012. Prices will then be \$10/t CO_2 reaching \$18/t in 2016. The Act does not set a maximum price.

Also due to incept in January 2012 and covering the six Kyoto Protocol gases is the **Midwestern Greenhouse Gas Reduction Accord** (Assembly Bill 32) which involves nine US states and one Canadian province. The agreement will apply widely across the industrial sectors.

The 1997 Emissions Reduction Market System trading credits, which commenced in 2000, relates to over 100 sources of pollution in the State of **Illinois.**

- **New Zealand**

As a follow-up to the Climate Change Response Act of 2002, the **New Zealand Emissions Trading Scheme** (NZ ETS) was adopted in September 2008 (amended on 25 November 2009). It is the first mandatory carbon cap and trade scheme outside of the EU. It applies to various sectors with the following dates of implementation:

- Forestry, as from 1 January 2008,
- stationary energy, industrial processes and liquid fossil fuel emissions, as from 1 July 2010,
- agriculture, as from 1 January 2015.

The law provides for various methods of allocation of permits. The price of New Zealand Emissions Units (NZUs) is capped at NZ\$25 from 1 January 2010 to 31 December 2012 with only one unit needing to be surrendered for two allocated (i.e. NZ\$12,5 per unit).

- **Australia**

The **New South Wales Greenhouse Gas Abatement Scheme** (GGAS) is a local mandatory GHG emissions trading schemes which commenced on 1 January 2003 and aims at reducing emissions associated with the production and use of electricity. Its targets have been set until 2012.

The **Carbon Pollution Reduction Scheme** (CPRS) was Australia's cap and trade scheme project until it was rejected by the Senate. A fixed price on carbon was to be introduced in July 2012 and the trading scheme would have followed three to five years later. It would have placed a cap on the amount of carbon pollution industry can emit and allowed trading of carbon credits. It concentrated on the biggest polluters during the first stages (circa 1,000 Australian companies involved).

- **Japan**

The **Japanese Voluntary Emissions Trading System** was established by the Japanese Ministry of Environment in 2005. It involved 359 companies as from December 2010. The Japanese government is considering implementing a mandatory nationwide program which could begin in

2013. Municipal markets are also emerging in cities such as Saitama and Tokyo. The latter has imposed a 7% reduction in emissions between 2011 and 2014.

- **Canada**

The proposed federal **Canadian Emissions Trading Scheme** is a baseline-and-credit system which aims at reducing GHG emissions by 20% by 2020 and by 2% annually thereafter. The scheme, which is still debated and may not go forward, is intended to complement (rather than duplicate) provincial markets. Several provinces are members of various schemes implemented in North America. Alberta, which has a large oil sands industry, has set up its own emissions intensity-based trading scheme.

- **China**

China, where coal continues to be extensively used as a combustible, became the largest carbon emitter several years ago. The country committed at the 2009 Copenhagen summit to reduce its GHG emissions by 40-45% between 2005 and 2020 (i.e. twice more emissions than today accounting for an 8% annual economic growth).

China has expressed interest and sees great business opportunities in climate change from the energy efficiency standpoint. It is the host country to a vast majority of CDM projects. CO_2 trading platforms have also been operating in Shanghai and Beijing since 2008 and a test cap and trade system was launched by the Chinese government in Tianjin in 2010.

- **Switzerland**

The Swiss cap and trade system (*Schweizer Emissionshandelssystem*) started on 1 January 2008 as a voluntary alternative to domestic CO_2-tax. It involves around 400 companies and circa 6,5% of the GHGs emitted in Switzerland.

- **South Korea**

Korea's **Framework Act on Low Carbon, Green Growth** of 13 January 2010 provides for the establishment of an emissions trading scheme which will cover up to 480 installations (possibly 600 if it is extended to buildings and the electric power sector) and 70% of the country's overall GHG emissions. The scheme is still very much under construction with a pilot planned for the 2010-2012 period. Allocation, auction and offset issues have not yet been decided.

- **Others**

Countries such as Mexico, Kazakhstan, Chile, India, Ukraine and Brazil have at some stage publicly shown some interest in implementing a carbon cap and trade scheme.

There have also been calls for cap and trade at sectorial levels. Pierre Albano (Air France) said that the International Air Transport Association (IATA) had formally asked the International Civil Aviation Organization (ICAO) to regulate CO_2 emissions and possibly set up a specific international scheme within the aviation sector. On 15 October 2010, an ICAO resolution on climate change set out a number of non-binding "aspirations" relative to fuel efficiency, a collective capping of carbon emissions from 2020 onwards and a global CO_2 standard for aircraft engines.

d. Linking the schemes together

A number of organisations have called for the various existing schemes to eventually link:

- The **Washington Declaration** of 16 February 2007 is an agreement in principle between the heads of several governments (Canada, France, Germany, Italy, Japan, Russia, United Kingdom, US, Brazil, China, India, Mexico and the Republic of South Africa) on the outline of a global cap and trade system applying to both industrialized countries and developing countries.

- The **International Carbon Action Partnership**[34] was established on 29 October 2007. Its goal is to pursue actively the development of carbon markets through the implementation of mandatory cap and trade systems with absolute caps. The ICAP consisted of 29 Member States and regional initiatives (RGGI and WCI) as of September 2009.

- In a communication dated 28 February 2009, the **EC** stated that the EU should seek to build an OECD-wide carbon market by 2015 through the linking of the ETS with comparable domestic cap and trade schemes in the USA, Australia and other developed countries. It hoped that eventually the linking would be expanded to all major emitting countries by 2020.

The ETS was actually designed in a way to allow EUAs to be identical (or "fungible") to the Kyoto Protocol AAUs. The **EU Global Linking Directive** (2004/101/EC) [35] provides for connection between the ETS and the flexible mechanisms of the Protocol which non-EU countries will adopt. This enables companies in the EU to trade credits outside the EU. Liechtenstein, Iceland and Norway have actually already joined the ETS (in 2008) and there are plans to discuss a similar agreement between the EU and Switzerland.

Linking cap and trade schemes, however, is no straight-forward process. Although the various existing and projected systems share many common features, they remain very different in their scope and organisation. Some schemes do not even comply with the Kyoto Protocol (gases involved not matching, carbon offsets not equally admitted, etc.). Quite different measurement methodologies can be also be found.

In the background, policies that guide the schemes can be far apart. For example, the USA approach tends to be driven by offsets (as opposed to abatements under the ETS) and to favour low carbon prices (as opposed to high ones in the EU intended to drive change).

Significant concessions may be necessary for states to agree to a top-down international scheme: some states such as China are openly against allowing an international body to govern climate change. A more likely evolution would appear to be that schemes inter-connect through bilateral or multilateral agreements.

[34] www.icapcarbonaction.com.
[35] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32004L0101:EN:NOT. Retrieved on 20 December 2010.

1.2 Stakeholders at risk

a. Installations currently subject to the ETS

Under its **Phase 2**, the ETS applies to energy-intensive installations across the EU27 (plus Norway, Iceland and Liechtenstein) which emissions exceed a specified threshold. 11,359 installations[36] owned by approximately 4,000 operators were subject to the regulation in 2008 with overall emissions involved representing almost half of CO_2 emissions in the EU. The operators in question and their plants are the biggest insurance clients.

An installation[37] is "*a stationary unit where one or more activities listed in Annex I are carried out and any other directly associated activities which have a technical connection with the activities carried out on that site and which would have an effect on emissions and pollution*".

An operator[38] is "*any person who operates or controls an installation or, where this is provided for in national legislation, to whom decisive economic power over the technical functioning of the installation has been delegated*".

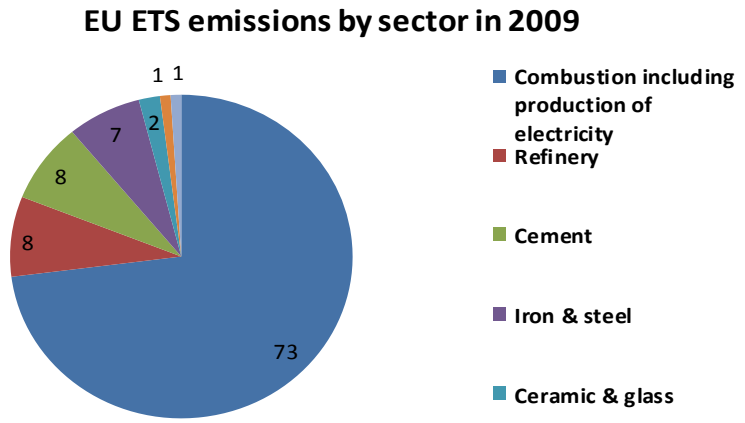
The ETS applies to the following industries subject to specific thresholds[39]:

- Combustion installations[40]
- Refining of mineral oil
- Production of coke
- Production and processing of ferrous metals
- Metal ore
- Pig iron and steel plants (>2,5 tons per hour)
- Cement (>500 tons per day)
- Lime (>50 tons per day)
- Glass fibre (>20 tons per day)
- Ceramic products (>75 tons per day)
- Pulp
- Paper and cardboard (>20 tons per day)

In 2008, the 25 largest companies subject to the ETS accounted for 50% of EU25 emissions whilst the smallest 80% of installations represented only 10%.

[36] www.ec.europa.eu/clima/policies/ets.oversight_en.htm. Retrieved on 11 February 2011.
[37] Art. 3 of the 2003 EU Directive.
[38] Art. 3 of the 2003 EU Directive.
[39] Annex I to the 2009 EU Directive.
[40] The ETS applies to units which rated thermal input exceeds 20MW (aggregated) and that burn fuel for the purpose of energy production (except in installations for the incineration of hazardous or municipal waste). Capacities of different stationary units on a same site are aggregated even in the absence of any technical connection.
Combustion installations include electricity generators, boilers, combined heat and power (CHP) technologies, gas turbines (including compressors) and the incineration of waste where the primary purpose is to produce energy. They do not include ovens, dryers, fryers and incineration where the primary purpose is to dispose of municipal or hazardous waste.

By far and large, combustion is the primary source of emissions in the EU:



Source: European Commission

The companies most exposed to the ETS appear to be those from the Utilities sector. Based on a sampling exercise, the CDP Report Europe 300[41] shows that 48% of direct emissions come from utilities electricity & gas industries, independent power producers & energy traders and multi-utilities.

Subject to strict conditions, Member States may exclude from the ETS installations which have reported less than 25,000 tons of CO_2 equivalent and, when they carry out combustion activities, have a rated thermal input below 35MW. Hospitals may also be excluded if they undertake equivalent measures[42].

b. Extension of the ETS to additional sectors

Phase 3 of the ETS will extend to additional industries as from 1 January 2013 (as listed in Annex I to the 2009 EU Directive).

- **Aviation**

Based on Directive 2008/101/EC (which came into force on 2 February 2009), all civil flights operating within, arriving into and departing from airports in Member States will be subject to the ETS as from 1 January 2012,

The emissions cap for the aviation sector during year 2012 and Phase 3 of the ETS will be based on the overall emissions of the sector for the 2004-2006 period. Allowances will be distributed among operators according to Revenue Ton-Kilometres (RTK) produced in 2010. Companies will receive free allocations representing 85% of the allowed emissions and the remaining 15% (or in fact more since actual emissions are expected to exceed allowances) will be auctioned. The market is semi-open: companies from the aviation sector will be allowed to purchase credits from ground

[41] https://www.cdproject.net/CDPResults/CDP-2010-Europe-300-Report.pdf. Retrieved on 21 December 2010.
[42] Article 27 of the 2009 EU Directive.

sector companies whilst aviation allowances cannot be used by other sectors for compliance. No revisions of the scheme will be possible until 2014.

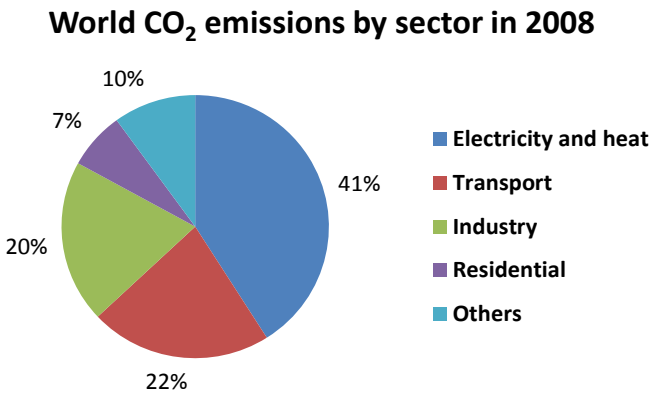
The cost of the ETS to airlines has been estimated at $55 bn for the period running from 2011 to 2022 (CDP 2010).

The lawfulness of the extension of the ETS to aviation has been challenged before the European Court of Justice (as referred to by the High Court in London) by the Air Transport Association of America (ATA) and by three US-based airlines (American, Continental and United). The companies allege that the ETS violates national sovereignty over states' airspace, the Chicago convention and several international bilateral agreements.

- **Other activities**

- Primary and secondary (>20MW) aluminium
- Production and processing of non-ferrous metals (> 20MW)
- Mineral wool insulation material
- Drying or calcination of gypsum or production of plaster boards and other gypsum products (>20MW)
- Production of carbon black
- Nitric acid
- Adipic acid
- Glyoxylic acid
- Ammonia
- Bulk organic chemicals (>100 tons per day)
- Hydrogen and synthesis gas by reforming or partial oxidation (>25 tons per day)
- Soda ash
- Sodium bicarbonate

It is noteworthy that transport and buildings are not currently covered by the ETS despite their representing the largest share of CO_2 emissions after the energy-intensive and power-generation industries.



Source: IEA, 2010[43]

Also, neither agriculture nor forestry were included in the Kyoto Protocol's scope of CDMs (which is incorporated into EU law) due to the difficulties of accurately measuring emissions from

[43] http://www.iea.org/CO2highlights/CO2highlights.pdf. Retrieved on 21 December 2010.

these sectors. The Reducing Emissions from Deforestation and Forest Degradation (REDD) is a UN scheme intended to enable countries to sell carbon credits linked to forestry preservation schemes. Projects generate carbon certificates that can be traded on the voluntary carbon market.

c. Gases covered by the ETS

The scope of gases covered by the EU scheme is in line with that of the Kyoto Protocol (Gases)[44].

The 2009 EU Directive however has extended the GHGs definition to "*other gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation*"[45]. It also allows Member States, from 2008 onwards, to apply emission allowance trading to activities and to GHGs which are not listed in Annex I of the 2009 EU Directive ("*Categories subject to which this directive applies*"[46]) subject to the EU Commission's prior approval[47].

It will be noted that nuclear energy is not on the EC's list. This follows the current perception - which is the subject of much controversy - that nuclear energy is CO_2-free and that as such it should enjoy a full exemption from the ETS.

Separately, the EC has launched a study concerning the possible development of an EU NOx and SO2 emission trading scheme by July 2020 for the Intergovernmental Panel on Climate Change (IPCC) installations.

d. Carbon finance parties at risk in CDM/JI projects

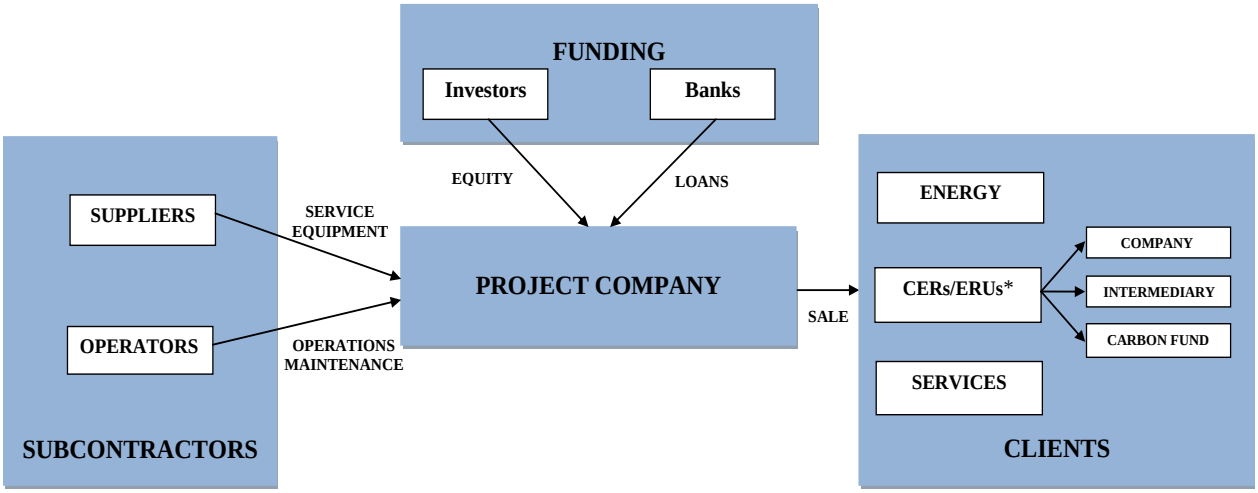
The industries listed in Annex I to the 2009 EU Directive as amended are not the only companies which face carbon credit-related risks. A large number of other stakeholders have an interest in CDM/JI projects:

[44] Annex II to the 2003 EU Directive.
[45] Article 2 of the 2009 EU Directive.
[46] This Annex in fact limitatively refers to activities involving carbon dioxide, perfluorocarbons and nitrous oxide. It is therefore unclear as to whether the "*other gaseous constituents of the atmosphere*" as in Article 2 of the 2009 EU Directive extends beyond the 6 gases listed in Annex II to the Kyoto Protocol.
[47] Article 25 of the 2009 EU Directive.

Project Companies	Design CDM/JI projects. May forward sell the CERs/ERUs which the projects are expected to deliver.
Carbon credit buyers	Purchase CERs/ERUs for compliance (companies subject to the ETS) or speculation purposes.
Suppliers (contractors)	Provide advisory services and/or equipment necessary to run a project. The delivery of CERs/ERUs may be offered as a form of payment in the supplying contracts.
Operators	Deliver operational and maintenance services.
Carbon fund managers	Private or public entities that receive money from investors (companies, trading desks, etc.) to purchase CERs/ERUs. Invest in a large number of CDM/JI projects in order to guarantee the delivery of CERs/ERUs to the participants in the fund.
Project financiers	Banks that lend money to finance CDM/JI projects. Carbon credits can be pledged in return. The delivery of CERs/ERUs may be offered as a security by the Project Company (in addition to cash flow and assets). Will want to on-sell CERs/ERUs.
Investors	Companies or local authorities that invest equity in a project. The delivery of CERs/ERUs may be offered as a security by the Project Company (in addition to cash flow and assets). Will want to on-sell CERs/ERUs.

Stakeholders involved in CDM and JI projects

The main contractual relationships can be summarised as follows:



** net of CERs/ERUs retained for compliance purposes*

An **Emissions Reduction Purchase Agreement** (ERPA) is a contract by which a seller (project company, trader, Annex I or non-Annex I party, etc.) agrees to deliver carbon credits (whether allowances or offsets) to a buyer (end-user, Annex I party, trader, etc.) at a specified price and date (see Futures). Payment may be made upfront or on delivery (i.e. when the buyer's registry account has been credited with the credits).

Specifically in relation to CDM and JI projects, the ERPA may also provide the buyer with an option to purchase additional credits/a right of first refusal. The entire legal and beneficial title of the credits is passed onto the buyer on delivery. The buyer may also bear all costs and expenses relating to the validation, registration and certification process of a project.

Key risks associated with ERPAs involve:
- (for the seller): payment default or insolvency of the buyer
- (for the buyer): shortfall in delivery of the credits, late delivery or delivery failure. Delivery failure may be due to non-compliance with the UNFCCC and/or local regulatory requirements or for reasons beyond the seller's reasonable control such as acts of God, of a government or the UNFCCC.

The financial consequences are multiple:
- (for the seller): unsold carbon offsets
- (for the buyer): project-related costs and expenses incurred for no result, need to purchase credits elsewhere at a possibly higher value in order to meet compliance obligations (if the end-user) or meet a contractual obligation (if a trader).

ERPAs should provide for remedies available in such cases of default. They may include:
- (for both parties): right to terminate the contract (material breach of contract or misrepresentation by a party, failure of the project to achieve milestones within the agreed timeframe or dissolution or bankruptcy of the project, change in law such that the contract becomes illegal or unenforceable, etc.), damages
- (for the buyer): price reduction (in the event of a production failure or a verification failure), right to terminate the contract and reimbursement of all costs and damages (seller's gross negligence, fraud or wilful misconduct), damages, liquidated damages, duty to provide replacement CERs or make-up
- (for the seller) right to terminate the ERPA (buyer's failure to pay the contract price), damages.

The IETA and the Wold Bank have drafted standard ERPA terms which interested parties are free to use (IETA ERPA® version 3.0.2006[48] to be read in conjunction with the Code of Terms® version 1.0 2006[49]).

e. Risks raised by the ETS

At some point in time[50], companies that are subject to the ETS restrictions will cease to receive sufficient allowances to match their actual and/or projected CO_2 emissions. The only option will therefore be to reduce emissions by investing in "clean" applications e.g. running on natural gas in place or in addition to fossil fuels (such as coal, oil or petroleum coke). Cogeneration[51] and combined cycle gas turbine power[52] plants can help achieve significant emissions reductions. However even this may prove insufficient, leaving companies with the option either to purchase carbon offsets (subject to there being enough available on the markets) or to pay a penalty.

[48] http://www.ieta.org/assets/TradingDocs/cdmerpav.3.0final.doc
[49] http://www.ieta.org/assets/TradingDocs/ietacodeofcdmtermsv%201%202.pdf
[50] Which will vary from one sector to another depending on how sectors are treated by the ETS under Phase 3. Some sectors such as the utilities were already faced with a shortage of emission allowances under Phase 2.
[51] A **cogeneration plant** is a plant that simultaneously produces heat and electricity (otherwise known as Combined Heat and Power - CHP). The waste heat from the combustion process is captured and processed through a heat recovery steam generator which extracts energy from the waste heat and uses it to produce steam. Locating the plant next to the point of use adds to the efficiency of cogeneration.
[52] A **combined cycle operation power plant** is a plant consisting of gas turbine generator units, steam generators, a steam turbine and a generator with a feedwater system and a condenser. Such plants offer a high degree of thermal efficiency by capturing the heat exhaust expended by the gas turbine.

Shortage situations may occur as a result of a foreseeable event (such as an expected increase in consumers' demand for a particular good or a drop in prices in the context of a recession period).

Although there can be some debate as to the "foreseeability" concept, this study will assume that perils associated with market forces and economic projections do not meet the universally admitted criteria for insurability notably by lack of fortuity.

This study will therefore focus on two particular types of risks:

- unforeseeable events that may result in a company not holding enough carbon credits to make up for its GHG emissions,
- financial losses as a result of the non-delivery of carbon offsets (whether purchased or self-produced).

Additional cost of purchasing carbon credits as a result of an industrial accident

- Damage to "standard" property

A company may have to increase its CO_2 emissions consequent to property damage, a machinery breakdown or a lack of supply (e.g. gas shortage). In such circumstances, a company may decide to use (or hire) spare or alternative (but more polluting) machinery in order to maintain or restore production as soon as possible[53]. A company will consider such an option in order (a) to meet any contractual obligation it has to supply its clients and (b) to mitigate a (supposedly covered) business interruption loss. Increased emissions will require that the company uses any spare allowances or offsets it has and/or purchases the balance on the spot market if its emissions cap is exceeded.

There are numerous precedents of such situations arising. For example, several years ago, one of Pernod Ricard's plants had to purchase 10,000t CO_2 worth of carbon credits on the spot market following the breakdown of fuel-fired boiler. By using a spare boiler running on coal, emissions rose beyond the plant's allocated allowances. The cost of purchasing additional quotas turned out to be marginal due to low market prices at the time and to the limited volume of credits involved (no insurance claim was made). However amounts at stake could have been significantly greater for an installation emitting much higher levels of CO_2.

Companies may also have to purchase alternative product (ore, gas, etc.) so as to comply with its contractual obligations. The cost of the alternative product may incorporate higher carbon costs if provided by a less efficient company.

- Damage to "energy-efficient" property

In this case damage would affect a company's "green" assets (e.g. a high efficiency natural gas plant) which had been specifically purchased in order to reduce GHG emissions. In addition to a partial or total loss of its asset, a company would lose the value of the carbon credits it could have sold (or saved) but for the accident and would face increased production costs.

[53] Such an option my not prove possible for very heavy production units. One energy underwriter noted that if an insured electricity producer temporarily lost a boiler that was critical for production purposes, it would likely cost it (therefore the insurers) less to have the machinery breakdown repaired and purchase MWts on the spot market to honour its supply contracts than to wait until a spare is delivered and started-up on site. This survey however will assume cases where switching to spare or alternative machinery makes economic sense.

Markus Heiss (MD&D) gave an example of a pulp manufacturer which due to the technology employed in pulp manufacturing was energy self-sufficient. However following an insured incident the company had to start up a stand-by boiler that emitted CO_2. The company as a result had to purchase additional EUAs on the market and incur higher fuel costs.

Both risks of increased emissions above involve the notion of carbon intensity. Natural gas is known to be the less polluting of all the fossil fuels (see EPA figures below). It is primarily composed of methane and its main end products are carbon dioxide and water vapour when it is combusted. Coal and oil contain a much higher carbon ratio (as well as higher nitrogen and sulphur contents) and they release ash particles which do not burn thus contributing further to the pollution of the atmosphere.

Fossil fuel emission levels
(pounds per bn Btu of energy input)

Pollutant	Natural Gas	Oil	Coal
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxyde	40	33	208
Nitrogen Oxides	92	448	457
Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

Source: IEA, Natural Gas Issues and Trends, 1998

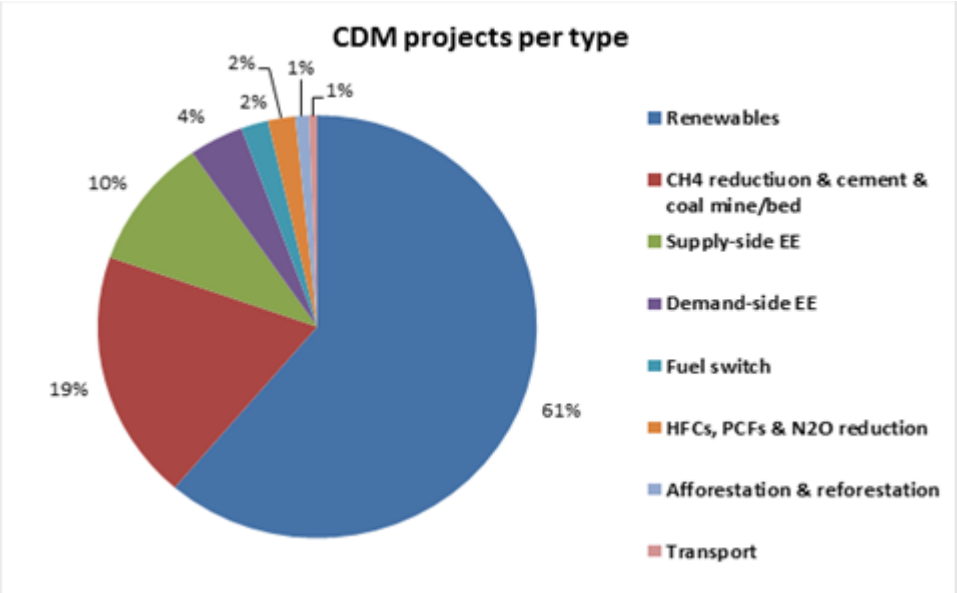
By way of an example, the start-up of a spare or alternate generator fired by coal instead of natural gas can more than double CO_2 emissions (circa 0.4t vs. 1.0t of CO_2/MWh). The difference in the carbon factor gap is even greater with high efficiency natural gas fired power plants which can produce up to 70% lower carbon emissions than coal fired plants.

The impact of carbon allowance price on a company's operating profit as a result of a plant outage and the subsequent need to switch to less efficient production can be significant – see some examples provided by Marsh [54].

Risk of non-delivery of carbon offsets (CDM/JI projects)

CDM and JI projects currently concern approximately 3,000 installations outside the EU that use different renewable technologies including, but not limited to, hydro, wind and solar power, efficiency projects, sequestration, methane recovery, bio fuels, reforestation projects, oil and gas operations (such as avoiding leakage and fuel switching opportunities) and flare gas recovery.

[54] *Remodelling business interruption insurance in the power sector*, Marsh, 2006 – www.marsh.co.uk/media/Power_BII.pdf.



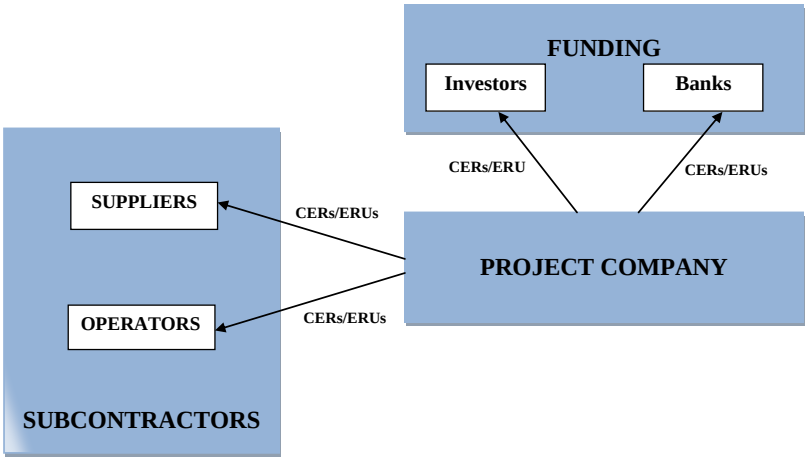
Source: www.cdmpipeline.org, @ 1 February 2011

By way of an example, the Chilean plant of Graneros, which produces instant coffee and infant cereal, is a CDM project run by Nestle. The switch from coal-fuelled boilers to natural gas-fuelled co-generation plants has resulted in a substantial reduction in the local plant's emissions. CERs generated are sold to a Japanese electricity supplier.

The main risks of carbon offsets associated with CDM and JI projects not being delivered are the loss of revenue stemming from the following (non-limitative) perils:

- Project construction risk and delays,
- Physical damage (explosion, natural catastrophe, etc.) or technological failure (machinery breakdown, etc.) of an asset (including buildings, machinery and equipment) which is needed to generate carbon offsets for a company's own needs or with a view to trade them. A loss can cause a temporary or permanent cessation of the planned production,
- Lack of supply (fuel, gas, etc.) causing temporary or permanent cessation of production,
- Insolvency or bankruptcy of a project or its participants,
- Unrest, riots, political violence, instability in the country hosting the CDM/JI, etc.,
- A decision by a local authority (administrative, judicial or other) not to authorize a project, to cancel it or to withdraw a license, to nationalize it, to seize the carbon offsets generated; increased administrative hurdles, etc.,
- A decision by the CDM EB not to register a project or not to deliver the credits or to postpone such delivery (e.g. because a project does not comply or no longer complies with the UN body's requirements or because a methodology is not approved),
- A change in national or international regulation (e.g. increased taxation or further restrictions on GHG emissions; contract law reform, etc.).

As illustrated below, other than those due by virtue of ERPAs to buyers of carbon offsets, CERs and ERUs can be owed by the Project Company to a one or more parties as a form of payment or security. All such parties are therefore potentially exposed to the risk of non-delivery.



1.3 Companies are aware of the costs and risks of the ETS

Companies that are subject to the ETS are generally well aware of its implications and have been very proactive on the lobbying front. They are generally supportive of the cap and trade system to the extent that it does not distort competition. Efforts prompted by carbon leakage threats[55] have succeeded in obtaining a portion of free allowances for a large number of sectors beyond 2013.

a. Reducing energy costs is a priority irrespective of the ETS

Reducing emissions by switching to lower carbon energy sources (such as natural gas or biomass) and means of production has become a primary concern for industries with energy costs increasing[56]**.** The International Energy Agency (IEA) has predicted that fossil-fuel prices will continue to rise in the decades to come as a result of increased price pressures on international markets (with primary energy expected to rise by 36% between 2008-2035) and more costly cap and trade related penalties[57].

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[55] - The Grahame Institute for Climate Change actually concluded in a report published in 2010 that "*most of the sectors entitled to free emission permits are not facing an increased risk of closure or relocation outside of the EU as a consequence of permit auctioning*". See Centre for Economic Performance, "*Still time to reclaim the ETS for the European tax payer"*, 2010.
- Over 80% of respondents to a 2010 Point Carbon survey said that they did not intend to relocate production: http://www.pointcarbon.com/research/promo/research/.
- In a 2008 report, the IEA concluded that the ETS "*has not, so far, triggered observable carbon leakage in sectors studied (steel, cement and primary aluminium)*". *Issues behind competitiveness and carbon leakage*, IEA, October 2008. http://www.iea.org/papers/2008/Competitiveness_and_Carbon_Leakage.pdf

[56] "*La finance carbone: en quoi le marché du CO_2 peut-il être un outil au service de la performance des entreprises ?*", 2006, M. Diakhate, INSEEC dissertation. http://www.developpementdurable.banquepopulaire.fr/ddfr/liblocal/docs/travaux-etudiants/memoire-finance-carbone.pdf. Retrieved on 30 December 2010.

[57] *World Energy Outlook*, IEA**,** http://www.worldenergyoutlook.org/. Retrieved on 22 December 2010.

Energy costs currently account for a third of Rio Tinto Alcan's average global aluminium smelting production costs. They account for 40% of Lafarge's cement production costs and the variations in fuel costs have a significant financial impact on the group's logistical costs.

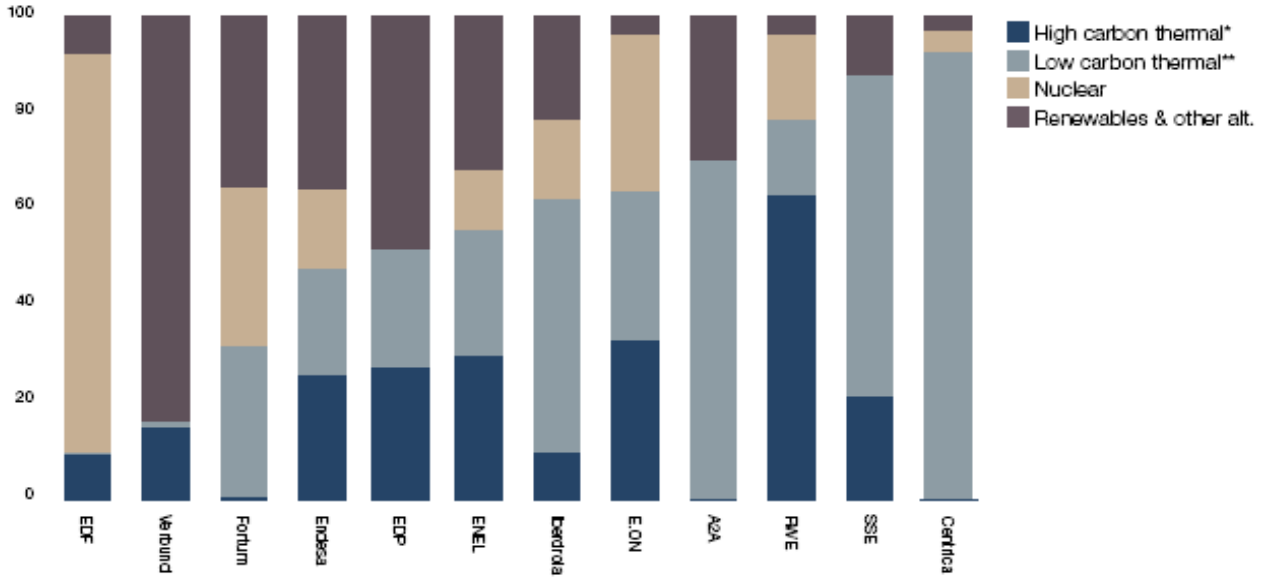
Olivier Dufour (Rio Tinto) said that rising energy costs combined with the level of uncertainty stemming from the EU environmental energy regulation were such that Rio Tinto had made no major investment in Europe since the early 90s. The group instead had turned to countries with no CO_2 (or SO_2) regulation. Dufour also emphasized that nuclear-generated electricity was key to Rio Tinto's European strategy. He said that France stood out in the EU because of its low energy production costs: it is one of the only EU countries in which the company can contemplate the long-term investments which aluminium production typically requires (circa EUR 2 bn for 25-40 years of production).

Higher energy prices will in some cases cause emissions to increase. Shell expects this to happen in the future as higher oil prices offers the group opportunities to extract oil and gas at higher production costs (e.g. oil sands in Alberta and a GTL project in Qatar).

There are various ways of mitigating the increase in energy prices.

One interviewee said that its company had developed a diversified and balanced energy production mix consisting of nuclear, coal, natural gas (CCGT), combined heat and power (CHP), hydro plants, wind farms and biomass fired plants. This enables the group to react to market price fluctuation. The company is also developing CCS solutions.

Companies' exposure to energy costs however is very much dependent upon their energy-mix (high/low carbon thermal, nuclear, renewables & other) which may vary significantly as the following chart shows:



Energy mixes of Utility companies in the EU- Source: CDP 2010

Pierre Albano (Air France) said that his group was totally dependent upon technology and the quality of fuel in its struggle to reduce emissions. 99% of the company's emissions are generated by its planes which consume liquid fuel – which will not change until renewable sources are

available. The way the group believes it can reduce its emissions is mainly by modernizing its fleet and engines, by improving fuel efficiency, fuel management and operating procedures, and by reducing the weight carried by aircrafts[58]. The current ETS scheme also incentivizes the use of bio fuels through a zero emissions factor. It is also noteworthy that an industry-wide effort initiated by the IATA (*International Air Transport Association*), which represents more than 90% of airlines worldwide as well as manufacturers, airports and air traffic control bodies, committed at the Copenhagen Conference to reduce overall carbon emissions by 50% by 2050 compared to 2005 levels.

Dufour said that the aluminium sector had reduced its PFC emissions by 90% since the 1990s, i.e. even before the Kyoto Protocol was adopted. In France, Rio Tinto voluntarily committed to reduce its emissions as a member of the multi-sectorial *Association des Entreprises pour la Réduction de l'Effet de Serre* (AERES) which was established in 2002. Energy efficiency and the reduction of GHG emissions are pillars of the group's Research & Development activity. Rio Tinto prides itself on being the leader of energy efficient aluminium smelting technology which it believes will become a competitive advantage.

Another example of an effort to protect oneself against energy price escalation is *Exeltium*. *Exeltium* is a special purpose vehicle gathering a number of electro-intensive European industrials. The company entered into a long-term partnership agreement with EDF on 31 July 2008. The agreement, initiated by the French government within a specific legislative framework (and with the EC DG Competition's late blessing), will secure around 148Twh (13 Twh per year) over a period of 24 years to 26 companies in France. The financing (EUR 3.7 bn) is based on an upfront payment by the consortium reflecting the evolution of the development costs of new nuclear plants. Dufour formed the view that the *Exeltium* agreement, albeit limited to the French territory, amounted to a form of insurance against the volatility of energy prices but also against CO_2 certificate market risk since the energy supplied is of nuclear origin i.e. CO_2-free.

Companies' efforts to reduce energy costs by using cleaner fossil fuels and renewable sources of energy has already enabled most industries to achieve substantial emissions reduction levels over the past years[59]. The ETS and its penalties are therefore a further incentive to cut down emissions. It is also perceived as an opportunity to develop alternative energies (such as bio fuels) and to invest in new technologies (such as CCS projects).

CDM/JI projects are located in emerging economies due to those societies' increasing demand for energy and new industrial production plants. They present an ideal and timely opportunity to introduce technical measures that reduce pollution emissions during planning phases. Indeed, starting from Greenfield and applying a less polluting process at design stages will cost far less and be a lot more efficient than upgrading and retrofitting existing production installations.

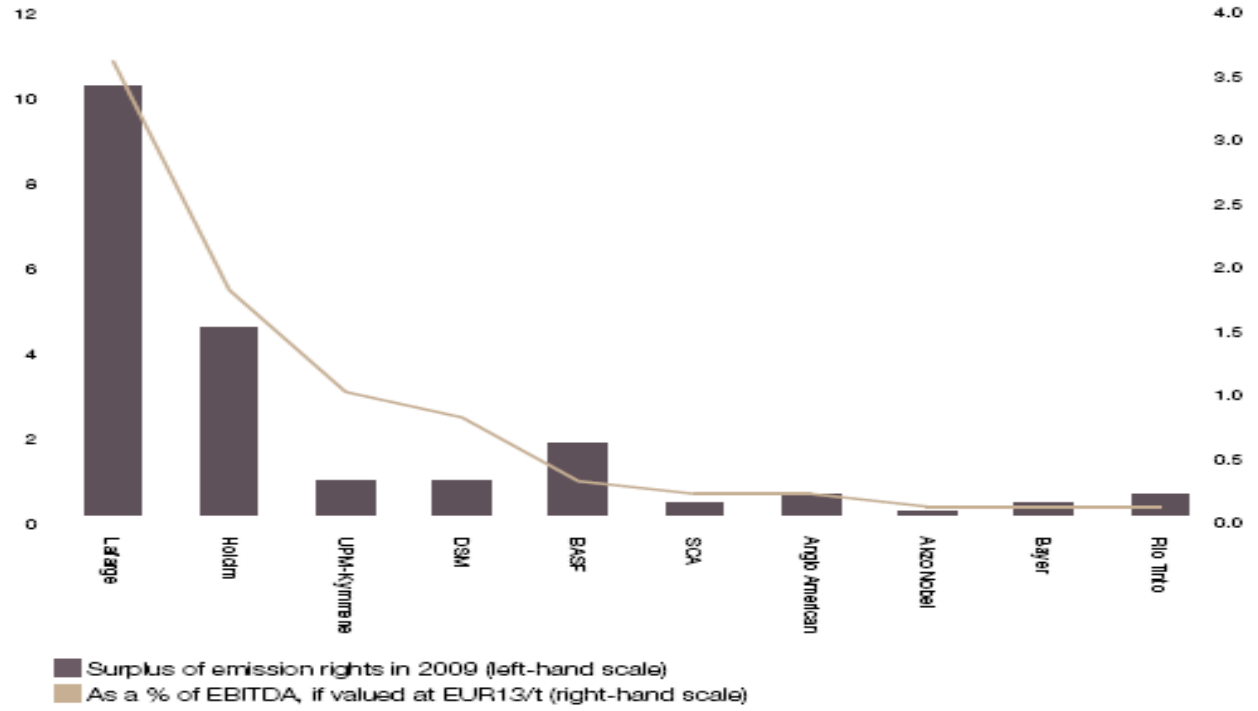
b. Carbon credits so far have made companies richer

During Phases 1 and 2 of the ETS, companies have in fact hardly been exposed to carbon credit risks for two major reasons. The first is that they received allowances for free. The second is that they received more than they actually needed.

[58] CDP 2010.
[59] *Impact of the ETS on power sector investments: a survey of European utilities*, New Energy Finance, 2009.

It must be stressed that until recently companies subject to the ETS have broadly (some sectors excepted) generated windfall profits from the allowances they were granted. A survey by Point Carbon estimated that profits during Phase 2 had reached EUR23-63 bn in 5 countries[60]. The electricity sector alone benefited some EUR20 bn worth of free permits which it was able to trade. The cement industry is also believed to have generated over EUR260 million in sales of allowances in between January and September 2010 which according to calculations made by Moody's amounted to approximately 8% of the sector's operational profit[61]. Quotas received by RWE were worth 5% of the company's balance sheet and 7% of its capitalisation in 2007[62].

The Europe 300 2010 CDP chart below shows the positive impact of emissions rights in 2009 on 10 companies representing the Materials sector.



Positive impact of surpluses of emissions rights (m) in 2009 - Source: CDP 2010[63]

The still awaited ETS Phase 3 rules are intended to prevent profits other than those actually generated through positive efforts to reduce emissions as from 2013.

In actual fact, some companies have seen their actual emissions exceeding permits for the first time in 2008. Electricity producers were mostly affected with a 270Mt deficit i.e. circa 24% more emissions than the allowances which they had received.

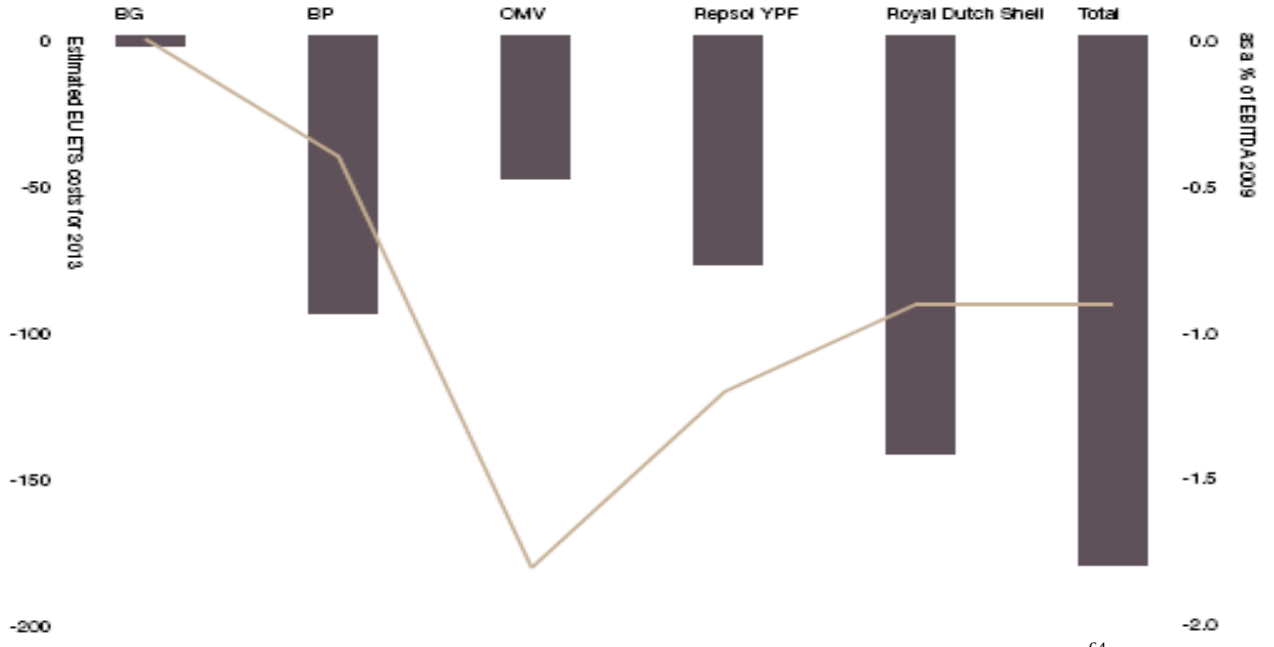
[60] http://assets.panda.org/downloads/point_carbon_wwf_windfall_profits_mar08_final_report.pdf - *ETS Phase II - The potential and scale of windfall profits in the power sector*, a report for WWF by Point Carbon Advisory Services, March 2008. Retrieved on 22 December 2010.
[61] La Tribune, 13 December 2010.
[62] http://www.afte.com/files/afte/Let234_p18-19.pdf Retrieved on 27 August 2010.
[63] https://www.cdproject.net/CDPResults/CDP-2010-Europe-300-Report.pdf. Retrieved on 22 December 2010.

c. Carbon credits are now recognized as a production cost

The cost of reducing emissions and meeting compliance requirements is now part of companies' underlying business operations. Carbon credits are viewed as assets (whether granted or purchased) and a production cost (as are fuel costs).

Alexandre Kossoy (World Bank) agreed that offsetting carbon emissions was just an additional cost in the production process for most industries subject to cap and trade schemes (several European and Japanese industries and utilities participate in the World Bank's carbon funds).

The Europe 300 2010 CDP chart below provides an interesting estimate of the potential CO_2 costs in 2010 under the ETS for 6 companies representing the energy sector. The chart assumes a 30% shortage of allowances in Phase 3 and a CO_2 price of EUR25/tCO_2.



Estimates of potential CO_2 costs (m EUR) in 2013 under the ETS - Source: CDP 2010[64]

Total's economic model and all its operational decisions account for the cost of CO_2 to the company (EUR**25** per ton, rising with inflation). This price is higher than the current carbon price but consistent for the future estimation of the assumptions and criteria which decisions on long-term investments will require. Total estimates that CO_2 could have a potential financial implication on its business of EUR1.5 bn (based on 60Mt CO_2-e times EUR25 per ton, gross of allowances) (CDP 2010). Such estimate is notional however compared to the group's EUR180 bn revenue in 2008 and aims at assisting in highlighting the potential cost of evolving carbon prices.

GDF Suez assumes a carbon credit market price of EUR**20**/t which would amount to an overall cost of EUR1 bn per year (CDP 2010).

Shell also expects a growing share of its carbon emissions to be subject to regulation. The company recognises that this will carry a cost. Shell has factored carbon costs in its financial planning and investment decisions since 2000. It currently assumes a cost of $**40** per ton in its economic modelling (CDP 2010).

[64] https://www.cdproject.net/CDPResults/CDP-2010-Europe-300-Report.pdf. Retrieved on 22 December 2010.

Jean-Luc Dupuis said that Vallourec had estimated a confidential cost range projection for Phase 3 (subject to the evolution of the carbon credit price) with an expectation that more of the company's plants would be subject to the ETS.

Nestlé is expected to end up Phase 2 in a surplus position with profit (relating to carbon credits) in the region of EUR5m. This will change in Phase 3 at which point in time Nestlé has calculated that its 5 coffee factories that are subject to the ETS would cost EUR 6,5m per year (based on current carbon prices) save for any regulatory exemption.

Olivier Dufour (Rio Tinto) said that measuring emissions was not a problem but assessing the future cost of CO_2 was. The post-2013 financial impact of the ETS to Rio Tinto has been assessed to the extent possible (a lack of visibility remains) and factored into the group's business plan and operational decisions. Projections of worst, average and best case scenarios for the cost of CO_2 in Phase 3 are made based on a number of variables (spot prices of aluminium and petrol, inflation, etc.) and a distinction is made between OECD and non-OECD states. More particularly, Rio Tinto has estimated that the cost of the draft legislation recently introduced in the US, Australia and New Zealand would be in the region of $1 bn (CDP 2010).

Carbon is becoming a paramount item of risk management and business/investment decisions in carbon-intensive industries. When the risks are identified and a value is put on them, a high level of uncertainty remains which is a major problem particularly for long-term projects which the larger emitters typically invest in.

Companies know that they will be short of credits in Phase 3 of the ETS[65]. As such, they are already preparing to purchase quotas if energy savings are insufficient to cover emissions in the future.

Many companies believe that carbon credit cost and volatility can be neutralised through price index clauses. The risk is therefore transferred to its clients. Sales contracts are often on a cost plus basis i.e. the price of the goods delivered includes the cost of the item itself but also the seller's expenses in producing it. Specifically, indexation clauses in a contract will allow sales to reflect the volatility of the cost of the fuels used in the company's production. Air France now factors the fluctuation of oil prices in the price of the tickets it sells (fuel surcharge type). One representative of a large energy company said that delivery contracts it entered into now tend to contain flexible contract price provisions in order to factor the possible fluctuation of carbon prices

d. Hedging solutions available on the financial markets

Because carbon credits are commodities[66] companies are inclined to turn to financial markets when seeking some form of protection against the volatility risk. Just like any other commodity,

[65] Over two thirds of respondents to a 2010 Point Carbon survey expect to be short in Phase 3 - http://www.pointcarbon.com/research/promo/research/

[66] Carbon credits are a unique type of commodity in that they have evolved *ex nihilo* out of the idealism of states. They have mainly been characterized as virtual and intangible because they have no underlying inherent value and because there would be no natural demand for them but for state regulation. Some dissenting opinions consider that carbon credits are hybrid assets (or "quasi-commodities") somewhere between commodities (when traded in cash) and financial instruments (derivatives).

carbon credits can be exchanged privately between operators (over the counter or through forward contracts) or traded on a dedicated spot market (exchange trading). As such, they can be managed in the same way as currency risk, interest rates and raw materials prices are.

Carbon credits are considered good quality commodities because they are issued by governments (or international institutions), what is more in a strong currency (euros or dollars). A further advantage is that the CO_2 metric measure is universal. Indeed, there is scientific consensus that 1 ton of CO_2 emitted in China is equivalent to 1 ton of CO_2 emitted in Chile[67]. By contrast, 1 litre of water captured at the Niagara Falls will not equate 1 litre of desalinised water produced in Qatar.

Is a carbon credit a good (as per the General Agreement on Tariffs and Trade definition) or a service (as per the General Agreement on Trade in Services definition)? Should it be classified as a governmental grant or a tradable asset? Is trading carbon credits and derivatives a financial service?[68] There are no clear answers to these questions in the ETS. This is a major concern highlighted by the 19 April 2010 Prada report which was commissioned by the French Government[69]. The report notes that credits traded on exchanges are regulated (as financial services) whereas over the counter and spot transaction are not. Determining which regulatory entity should supervise activities pertaining to commodities such as carbon credits is a further issue. It is not clear, in the USA for example, which of the bodies in Chicago (commodities) or New York (financial instruments) should be competent.

Derivatives are financial instruments which value fluctuates according to the cost of an underlying security such as a commodity. Although very much traded for speculation purposes, their primary purpose is to cover financial risks of a company.

The derivatives most commonly used to hedge against risks are contracts on firm trading of an underlying security between a seller and a buyer (including forwards[70], futures[71] and swaps[72]) or contracts providing the buyer or the seller with an option[73] to buy or sell same underlying security (calls and puts).

Jean Fournier (Global Aerospace)'s view was that what people pay for when they purchase oil is exploration, refining, distribution and sales costs - not the actual value of the resource which, in case of carbon energy, takes thousands of years to reconstitute. In this context, carbon credits stand as a valuation of the consumption of fossil fuels.

[67] According to Pierre Albano, VP Environment at Air France, measuring the GHG emissions generated by aircraft engines raises no difficulty and there is a consensus on the methodology. Burning one ton of kerosene equates to producing 3.15 tonnes of CO_2. However, there is some debate as to how neutral biofuels, which airlines such as Air France are calling for as a sustainable alternative to fossil kerosene, actually are neutral. On another matter, some scientists assert that the water vapours which airplanes also emit contribute to the climate change. Their view is that in the high atmosphere and under certain saturation conditions, water vapours can accelerate the formation of cirrus clouds which, as is well established, prevent infra reds from escaping into the atmosphere thus provoking the greenhouse effect. A number of NGOs have sought - to no avail so far - to have the EU lawmakers include a multiplier factor for such situations.

[68] http://www.iea.org/work/2010/et/Pauwelyn.pdf. Retrieved on 31 December 2010.

[69] http://www.economie.gouv.fr/services/rap10/100419rap-prada.pdf (in French). Retrieved on 31 December 2010.

[70] A **forward** contract on carbon credits is an over the counter contract between a buyer and a seller to buy or to sell a specified quantity of carbon credits at a specified date and price. Payment of the forward price (or "rate") is made by the buyer before the asset changes hand.

[71] A **futures** contract is similar to a forward contract except that it is traded on an organized and standardized market (which clearance house provides protection against counterpart risks) at a market determined price (the futures price). The holder of the futures must make or take delivery at the given date. Futures account for 90% of carbon trading.

[72] Commodity **swaps** are arrangements by which one party exchanges a floating (or market or spot) price of a carbon allowance or offset against a fixed price over a determined period of time.

[73] **Options** on carbon credits (or offsets) are contracts between a buyer and a seller (or "writer") which give the buyer the right (but not the obligation) to buy (call) or to sell (put) carbon credit (or offsets) at a certain date (European

Companies turn to options (on EUAs and CERs) in order to protect themselves against the risk of being short of EUAs or CERs. By way of an example, companies that have committed to deliver a specified volume of carbon credits at a given date (forward or future), purchase calls to hedge the risk that they might not be able to comply with that obligation. To a large extent, options used for hedging purposes can be compared to insurance mechanisms solutions. A put option can be considered as insurance on the price of stock falling. Options therefore offer alternative ways for companies to transfer risks that may or may not be otherwise insured.

The large profits which Air France posted in between 2005-2007 were partly due to its fuel hedging policy (which later turned into potential losses when the fuel prices dropped during the financial and economic crisis). By exercising the calls on fuel it had purchased, the company was able to post profits when its competitors made losses as a result of the sharp increase in fuel prices.

According to the World Bank, the value of the options market for the carbon sector in 2009 was $10.6 bn (8.9 bn for EUA options and 1.8 bn for CER options) with calls accounting for 59% of all options.

Banks and financial institutions have created a large range of trading products involving allowances and their derivatives. One of them was jointly set up by EcoSecurities and Crédit Suisse and pertained to 5 million CERs delivered by several CDM projects. Such products enable investors to choose their level of exposure to the risk of non-delivery of CERs which will depend on how advanced such projects actually are.

Companies that have their own desks trading commodities (such as electricity, gas, oil, freight, biomass or coal) typically use them to manage their stock of carbon allowances and carbon offsets. In most cases, the task assigned to these desks is to manage the company's portfolio of assets for compliance purposes and to hedge carbon price volatility. An emission trader will typically have to decide which is the best trading option (sell, buy, bank, do nothing; hedge now or later, etc.) for its company's EUAs and CERs based on actual and forecast exposure of the company's entities to the ETS (allowances vs. emissions). The trading of EUAs and CERs is performed over the counter, through forward contracts, on exchanges with futures and options and on the spot market.

The main platforms trading carbon credits (AAUs, CERs and ERUs) are:

- The European Climate Exchange (for Derivatives) in London (ECX) which is part of the Intercontinental Exchange group.

- BlueNext, a European carbon allowance and credit exchange platform co-owned by NYSE Euronext (60%) and the Caisse des Dépôts et des Consignations (40%). The platform, which covers more than EUR60 bn worth of transactions every year, was created by Powernext in June 2005 and acquired by NYSE Euronext in December 2007. Its members can trade both spot and derivative products.

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option) or before a specified date (American option) for an agreed price (the strike or exercise price). In return for granting the option, the seller receives a payment (premium) from the buyer. Options can be traded over the counter or on exchange trading. The value of options varies on a number of factors, namely (a) the market price and the volatility of the underlying security, (b) the strike price, (c) the remaining time before the expiry of the option period and (d) the interest rate (which is necessary to evaluate the actual value of future cash flows).

- Nord Pool (Nordic Power Exchange), based in Norway. It was acquired by Nasdaq OMX in 2010.

- The European Energy Exchange (EEX), based in Germany.

There are a number of other emerging markets such as the Commodity Exchange Bratislava (CEB), the TZ1 (New Zealand), Energy Exchange Austria (EXAA), Climex (The Netherlands), SendeCO2 (Spain) and Green Exchange.

In the USA, the Chicago Climate Exchange (CCX) operates a *voluntary* legally binding carbon trading market. Its members trade permits (VERs) for the six Kyoto Protocol GHGs. 26.3 million metric tons of CO2 offsets were registered in 2009. Emitting members that reduce emissions below target may sell surplus allowances or save them. Those who do not comply purchase CCX Carbon Financial Instrument contracts. Some companies such as Veolia Environment decided to enter in the CCX notably to prepare its US subsidiary to potential future federal binding emissions reduction targets.

Selling excess allowances (so far mostly received for free) has proven very profitable (see Oversupply) for the largest emitters in the EU. Clearly, many companies have also approached markets with a view to speculate, particularly in anticipation for the expected rise in carbon credit prices as a result of the economic recovery.

Joffrey Célestin-Urbain, former head of carbon markets division at the French General Directorate for Energy and Climate[74], said that carbon markets had so far structured as an increasingly standardized and liquid financial market with the predominant involvement of banks and trading operated on exchange platforms. He referred to the various financial instruments that are available on the financial markets to cover risks associated with carbon credits (including the volatility of prices) and recognized that such products hardly involved insurers. Celestin-Urbain insisted that carbon markets were young, that consolidation was very much in progress and that they were bound to turn to insurance at some stage in search for additional or alternative risk transfer solutions.

[74] The General Directorate for Energy and Climate (GDECC) of the French Ministry of Ecology, Energy, Sustainable Development and the Sea acts as the French DNA to the UNFCCC Secretariat. The GDECC represents France in international negotiations pertaining to climate change along with other ministerial departments. It is the body that manages and allocates the 2.8 bn Phase 1 Kyoto Protocol allowances delivered to France. It is granted with responsibility to authorise and approve participation in CDM and JI projects. The GDEC is also in charge of implementing the ETS rules in France and supervising the management of the national GHG emissions registry by the Caisse des Dépôts (CDC).

2. THE INSURANCE RESPONSE

ABSTRACT

Limited demand for specific insurance

There are various reasons for the limited demand for specific carbon credit insurance:

- Companies would not immediately look to transfer risks associated with production costs (except where already covered under an ICW section): the volatility of carbon credits is a business risk which a premium would probably not be worth paying for.

- Oversupply of credits until recently has meant that so far, companies virtually faced no shortage risk. Surplus credits could be saved for unforeseeable events which insurance might otherwise have covered. CDM/JI projects (most of which were frozen as a result of the economic downturn) tend to be considered as optional business opportunities rather than for compliance purposes.

- Carbon offset buyers are no longer paying for carbon offsets upfront but on delivery which eliminates any non-delivery risk.

The insurance response (CDM/JI projects)

Niche markets have responded as early as 2005 to the potential needs of the industries. Today however no more than five companies offer dedicated solutions for CDM/JI projects with relatively diverse scope of cover offered (regulatory risks in particular may not be insured).

Policies are basically structured as traditional project policies with imperfect adaptation to the specific risks associated with CDM and JI projects.

Limited sales (if any) to date appear to be due primarily to:
- the financial crisis, which caused some of the innovative insurance solutions to be withdrawn from the market,
- the mismatches between the comprehensive cover sought by potential buyers (when there were actually some) and the narrower insurance actually offered, and
- frontrunners being unable to convince timorous following markets to provide the insurance capacity necessary to cover the large project values at risk.

Despite the high level of regulatory uncertainty (the Kyoto Protocol successor has yet to be agreed and key details of the ETS Phase 3 rules are still awaited), insurers appear to be confident that sales will take off, albeit at a low pace, with the economic recovery and increasing compliance requirements under the ETS.

Key targets would appear to be:
- project companies (the sellers), and
- aggregators (with large portfolios of projects) and captives, both potentially seeking catastrophic protection, on the buyers' side.

2.1 Limited perceived need for specific carbon insurance

Insurance enables a company to transfer a monetary risk to an insurer. Demand for insurance will depend on:

- how adverse a company is to risk
- its ability to manage risks
- how willing it is to pay for its risks to be transferred.

Insurance solutions are a key element in decisions to invest in or to fund projects. They are typically used to lower the cost of capital and to improve investors' risk-return equation.

The CERES "Climate Change Risk Perception and Management" report[75] published in April 2010 revealed that:

- climate change-related political and regulatory risks (and associated costs) are of highest concern to risk managers;

- companies see such risks as imminent however the elaboration of climate risk management strategies is still in its early stages; most companies do not currently anticipate the need for specific insurance solutions (in particular, there appears to be very little interest in specialty coverage for carbon credits/offsets) ; notwithstanding, companies do consider that insurance is a tool for managing climate risk;

- opportunities for new or extended insurance coverage will not arise until there is greater clarity in the regulatory environment and a better understanding by insurers of their clients' needs.

a. A risk companies will typically retain

A business risk

Companies go uninsured for a number of business risks. Petrol companies trade in dangerous parts of the world, pharmaceutical companies market new drugs without liability cover and industries are exposed to the volatility of fuel spot prices.

Most if not all industries interviewed by the author considered that risks associated with carbon credits were part of their normal business (see Business risk) therefore they failed to see the need for specific coverage.

Companies generally believe that carbon credits raise a similar volatility to that of other commodities which they trade. A common reaction to most interviewees was: if insurance isn't procured (because it cannot be found) to cover the volatility of fossil fuel prices (which values at stake are considerably higher than for carbon), why should this be done for carbon?

Gaëtan Cadero (Lafarge) said that carbon was factored in the company's business cases just like any other cost parameter and that it was not the subject of any specific insurance cover.

[75] http://www.ceres.org/Document.Doc?id=591. Retrieved on 21 December 2010.

Brigitte Poot, Climate Energy Adviser at Total, said that the ETS was not currently considered as a source of additional risks but rather as a flexible tool destined to help installations meet their compliance obligations. Total views the ETS as one of many regulations (particularly in the environmental field) which (a) it must comply with and (b) may affect its business, particularly in Phase 3 due to the change of allocation rules (the estimated cost of CO_2 assuming a EUR30/t carbon market price is 20-40% of Total's refinery margin[76]). The only difference with other environmental risks is that there happens to be a value/a market price - with their market's fundamentals - for emitting GHGs beyond the free allowances delivered. In Poot's view there are mainly three ways of mitigating ETS-related risks: (a) by carrying out emissions reduction projects, (b) by trading allowances on the carbon market and (c) by launching CDM/JI projects.

Poot could not see *prima facie* any particular need for external carbon credit insurance. In general, companies have seldom procured management solutions during Phases 1 and 2. Total's response has essentially been to self-prepare to the regulatory changes, to set up an internal steering committee and to follow-up on compliance requirements. This has worked well, notably due to the relatively low market price of permits and to the increasing number of surplus allowances resulting from the reduction of industrial sites' activities in the past years.

One person in charge of CDM projects for a large group said that he did not see the need or added value of insurance to cover the various risks associated with CDM projects. His view was that such risks were identified and factored in the price its company agrees to pay for the delivery of CERs. He added that its company had the expertise to determine the quality of energy-related projects and that its teams would typically conduct an in-depth review of the project specifications prior to entering into a CER purchase agreement.

Two other interviewees said that a way to mitigate the risk of a catastrophic loss when purchasing CERs could be found through dispersion in terms of technology (i.e. varied types of projects), size and geography (i.e. spread over several continents). They accepted that the latter could not yet satisfactorily be achieved because a large majority of CDM projects were based in China (which is due to China offering a particularly attractive environment). In marked contrast, areas such as the Middle East and Africa with promising possibilities to cut oil flaring regrettably do not have the necessary regulatory framework or statistical data in place yet. In addition, companies can seek to optimise the cost of authorised use of CERs in the scheme.

Low risk/amounts at stake for some

Jean Morch (Arkema) said that his company had not as of yet considered insurance (nor indeed financial instruments) to mitigate its carbon credit-related risks. He couldn't immediately think of a situation whereby one of Arkema's plants would need to purchase additional carbon permits on the markets as a result of an accident. If this did happen, his view was that a loss of production would actually lead to a saving of allowances (rather than additional costs) thus providing Arkema with an opportunity to save or sell any surplus credits.

Some companies have already centralised the management of allowances and carbon offsets at group level. This enables plants to pool their credits thus amounting to a form of self-insurance. According to Grégoire de la Motte (Carbonless), by setting up an internal carbon credit cap and

[76] *Assessing the economic impact of the ETS*, B. Poot, Conference on "carbon price", Paris Dauphine, 10/02/2010.

trade system to the group, British Petroleum achieved significant GHG emissions reductions as a result of its teams improving the maintenance of their assets.

By contrast with companies that are heavily exposed to the ETS and therefore actively preparing for Phase 3, other companies which installations' emissions are comparatively lower are much more on stand-by. They await Phase 3 rules to know whether the cost of CO_2 will remain modest and if this is not the case, what strategy they should implement.

Guy Tackels (Saint Gobain) said that although Phase 3 would mean extra costs to companies, he did not believe that the cost of purchasing additional quotas as a consequence of an industrial accident would have any material financial impact on a glass manufacturer's balance sheet.

Eric Beyma said that if France Telecom was exposed to the risk of non-delivery of credits (which is not expected), it would affect the company's reputation and credibility (not meeting its targets) far more than its balance sheet since amounts involved would likely be marginal. For this reason, potential needs for insurance appeared to be slim.

Pierre Albano (Air France) could not see any situation in which his company would need to purchase additional permits as a result of an accidental or unforeseeable event as required for insurance to come into play. Situations such as air controller strikes or preventive immobilization of aircraft as a result of anomalies detected would actually lead to a reduction in airlines' emissions therefore a saving (or a lesser cost) of allowances. Using redundant and likely older (therefore emitting more CO_2) airplanes in order to reduce a business interruption period does not appear to be a realistic scenario. By contrast, more flights (i.e. more emissions) as a result of an increased demand would not be an unforeseeable event and additional revenue would in Albano's view largely outweigh the additional costs that an airline company would have to incur to compensate for its emissions.

Nevertheless a relevant question

One representative of a large carbon offset seller drew a comparison between what he viewed as two relatively different types of (registered) CDM projects from a risk management standpoint. One CDM project involved generating heat and power from the combustion of biomass. The supply of wood had been secured by a contract (with penalties in case of non-delivery of the wood) and the heat so generated had been forward sold. The delivery of CERs had been considered as 90% certain. The second CDM project provided for the combustion of biogas produced by landfills but the delivery of only 30-40% CERs was considered uncertain because there was no contractual certainty that the full stock of waste would actually be supplied. For the first project, the company decided to retain the 10% potential shortfall risk. For the second project, purchasing calls was contemplated but eventually the cost was considered too high. Insurance solutions were also explored via an international broker however the company never obtained a quote. At the end of the day, the company decided not to forward sell the projected CERs in order to avoid the risk of non-delivery risk which it faced.

Olivier Dufour (Rio Tinto) said that risk management of carbon risks was a topic which Rio Tinto's controllership happened to be currently considering. He said that so far no extensive mapping of carbon credit-related risks had been carried out by risk management and that procuring insurance has not yet been contemplated.

Philippe Courrèges (Nestlé) acknowledged that to date risks associated with carbon credits had not been the subject of any significant attention. He said that this was essentially because in a worst case scenario an incident affecting one of their plants, available surplus allowances would suffice to cover the need for additional quotas. He agreed however that such a situation may change with the implementation of Phase 3 and rising carbon prices.

A representative of an energy company that would not be named said that identifying and mapping the various technical, political, regulatory and investment risks associated with schemes such as the ETS and the RGGI had been relatively simple. A far greater challenge in his view was to determine how such risks could affect the company's market capitalization and results.

b. Increased cost of working already covered by conventional PD/BI coverage

This section refers to a situation whereby companies which production units have accidentally failed use (or hire) spare/alternative but higher emitting assets in order to reinstate production as soon as possible. In such circumstances, companies must compensate increased emissions by using spare credits or by purchasing credits.

In practice, such additional costs are in most cases covered under the conventional Business Interruption and Extra Expense insurance which the various sectors involved (energy, utilities, etc.) typically procure. Indeed, they fall (subject to an overall cap and any applicable sub-limit) under the Additional (or Increased) Costs of Working section (A/ICOW) of such policies as part of an insured's effort to mitigate a covered BI loss.

BI cover is intended to put a business back into the financial situation it would have been in but for the occurrence of an insured peril. It is generally triggered in cases where an insured is prevented wholly or partially from producing goods or from continuing business operations or services and is unable to make up for lost production within a reasonable period of time, or to continue business operations or services.

The financial loss must result from physical loss, destruction or damage to insured property caused by any of the contingencies that are insured under the property section of a policy. In sectors such as energy and mining, coverage is typically due for loss of gross profit resulting from[77]:

- the **reduction in net revenue** [or a) loss of standing charges or b) loss of gross profit] which is generally defined as the sum produced by applying the rate of net revenue [or a) standing charges or b) gross profit] to the amount by which the gross revenue [or a) or b) turnover] during the indemnity period shall, as a consequence of a physical damage, fall short of the standard gross revenue [or a) or b) standard turnover)

less

any sum saved during the indemnity period in respect of such charges [or a) standard charges or b) charges and expenses] of the business payable out of the net revenue [or b) gross profit] as may cease or be reduced in consequence of the damage (other than amortization),

[77] The following wording and its alternatives are provided as an example. They should not be understood to be standard wordings and many variations can be found in policies. Wordings will always seek to reflect the specific requirements of an insured and scope of cover granted by an insurer.

or

- the **Increase of Cost in Working**, which is generally defined as the additional expenditure necessarily and reasonably incurred for the sole purpose of avoiding or diminishing the reduction in gross revenue [or a) or b) turnover) which, but for that expenditure, would have taken place during the indemnity period in consequence of the damage, but not exceeding the sum produced by applying the rate of net revenue [or a) standing charges or b) gross profit] to the amount of the reduction thereby avoided

less

any sum saved during the indemnity period in respect of such charges [or a) standard charges or b) charges and expenses] of the business payable out of the net revenue [or b) gross profit] as may cease or be reduced in consequence of the damage (other than amortization).

Business interruption cover will also typically reimburse claim preparation expenses and fixed charges (including pay roll) that would have been incurred but for the incident.

All loss adjusters and forensic experts interviewed agreed that additional costs stemming from the need to purchase allowances on the market would typically be recoverable under the ICOW section of an insurance policy (whether Delay In Start-Up, Construction All Risks, Erection All Risks or PD/BI policies). This view was also shared by Julian Richardson, CEO of Parhelion. Parhelion actually recommends to their clients that they verify that such type of coverage is afforded by the ICOW and/or ALOP insurance they have purchased. He was clear that additional costs in purchasing or using up saved carbon credits as a result of an effort to mitigate a business loss should be covered as part of standard BI/EE coverage if so purchased.

Jason Reeves (Zelle Hofman) confirmed that the adjustment of EU-based energy claims regularly involved carbon credit issues. He has acted as consultant for the insurance industry on such matters. In his experience, in practice, carbon credits are: (a) used to mitigate losses as a variable cost (with potentially negative commercial implications to insurers that compel mitigation), or (b) a clear liability which was perhaps unanticipated.

Ewan Cresswell (Integra) drew a distinction between coverage provided by standard ICW and Extra Expense clauses. ICW generally imposes an economic test to determine whether a cost is recoverable or not (was the cost incurred to minimise a loss?) whereas costs claimed under an Extra Expense section must simply be costs that would not have been incurred but for the loss.

Most companies find themselves (or have until recently found themselves) left with an oversupply of allowances (see Oversupply). As a consequence, very few insurance claims made have been made for costs incurred in purchasing additional credits under an ICOW section of a policy to date. Actually, in most claims involving carbon credits, insurers have considered as Salvage (and therefore deducted from indemnities paid out) the value of unused carbon credits during a production interruption period affecting a company governed by the ETS.

Phase 3 of the ETS however is expected to result in carbon prices rising as a result of more scarcity and the auctioning process. If this does indeed happen, companies will be increasingly exposed to the risk of having to purchase additional credits including when attempting to mitigate

a BI loss. They may also have to pay much higher prices on the spot market if they have no option other than to purchase credits at the time of loss or thereafter.

In such circumstances, insureds may expect their coverage to reflect somewhat higher (potential) monetary amounts (and therefore sums insured) at risk. Insurers in response may feel that the level of premium they normally charge does not reflect such increased exposure and risks (which will mechanically increase as allowances continue to be reduced). They might also consider that specific terms and conditions should govern such specific risks.

Lee Swain and Markus Heiss (MD&D) expected that carbon credits would become a more prevalent item as environmental issues become increasingly sensitive in business. Likely future changes in legislation and regulations may also make this issue a more important cost issue for businesses.

Ewan Cresswell (Integra) believed that carbon credit matters would gather momentum quickly and become a significant factor in the operation of plants with carbon prices expected to rise in Phase 3. This will have some bearing on BI claims. Cresswell foresaw as a very likely scenario that of a plant able to re-start partial production but inefficiently from an emissions standpoint. In such cases and assuming higher carbon prices in Phase 3, companies could be inclined not to resume production simply to avoid the very high additional costs stemming from increased emissions. This might conflict with an insured's duty to mitigate a loss under the terms of an insurance policy.

2.2 Coverage available for non-delivery risks

This section refers to the risks associated with CDM/JI projects. Carbon credit delivery insurance aims at securing financial loss stemming from the failure to generate carbon offsets.

a. Purpose of non-delivery insurance

CDM and JI projects are primarily designed to enable companies to meet their compliance obligations whether based on a mandatory or voluntary emissions reduction scheme.

> France Telecom, a global communications group, is not subject to any cap and trade system and it does not expect this to change in the years to come. The company however committed to reduce its CO_2 emissions by 20% between 2006 and 2020. This followed a voluntary decision aimed at anticipating the increase in energy prices, reducing the company's dependence to fossil fuels and showing its concern for climate change. Eric Beyma said that to meet such targets, France Telecom would likely purchase credits generated by CDM projects.

They can also be intended to generate profit.

> Rhodia, a French chemicals company, publicly announced in 2006 that carbon trading had become a core activity for the group. This was achieved through Orbeo, a joint venture established in 2005 with French bank Société Générale to manage the CERs delivered by two CDM projects in Brazil and South Korea that had cost Rhodia EUR 20 million. In between 2007 and 2008, Rhodia cashed in a little less than EUR100 million after it sold

just 10% of the CERs received from the CDM EB for its CDM projects[78]. This boosted Rhodia's stock price and CERs were at one stage believed to represent up to 30% of the company's stock value. Same stock however later collapsed with Rhodia's sales plunging and a 70% drop on the quota spot market prices due to over allocation. Market analysts were blamed for having improperly factored the volatility risk associated with carbon credits.

According to Jan Holzapfel (Captive Mutual), non-delivery insurance is destined to both CER buyers and sellers predominantly on the primary and the secondary circuit (mostly Greenfield construction projects). The way insurance can be arranged will depend on each party's nature and level of involvement in a project and the specific risks it is exposed to. One of the specificities of CDM projects is that their future owners sell forward the expected CERs before the installations are actually built, commissioned and handed over. The proceeds of the forward sales are an important source contributing to the financing of the projects themselves.

In Nick Silver's (Callund Consulting) view[79], insurance, if available, can help provide greater certainty as to the delivery of offsets therefore increasing the value of forward CERs/ERUs and reducing the gap between current and forward prices[80]. Insurance should attract more project financiers and investors and enable them to hedge future cash-flows thereby reducing a project's cost of capital and improving its internal rate of return.

Project Company	Insurance will assist in securing the funding of the Project Company's project and will provide higher value to CERs/ERUs. Premium may be split between the Project Company (as lead under an ERPA Master Policy) and named third party beneficiaries (e.g. traders). Insurance certificates may be delivered to secondary buyers (that forward purchase CERs/ERUs from the named beneficiaries). Insurers will require Representations and Warranties from the Project Company and its owners.
Compliance buyer	Insurance will ensure that it receives the CERs/ERUs it needs for compliance purposes (or what it needs to purchase substitute credits).
Supplier (contractor)	Insurance will ensure that it will receive the CERs/ERUs it is contractually due as a form of payment (or their value in cash).
Carbon fund manager	Insurance will cover the risk of shortfall in the delivery of CERs/ERUs at project portfolio level. Insurers assess the insureds' risk management procedures and controls, as well as their track record. Only the largest projects might be reviewed on an individual basis.
Project financier	Insurance will cover the risk that CERs/ERUs, a form of security, are not available. Higher security brought by insurance should assist the Project Company in obtaining higher funding.
Investor	Higher security brought by insurance should assist the Project Company in obtaining higher funding. Insurance may cover a portfolio of projects. Insurers will require Representations and Warranties from the Project Company.

Insurable interests of the various parties involved in CDM/JI projects.

Insurance is typically delivered as a specific coverage. CER-related risks however have been included as part of standard property damage and business interruption policies with some limited adaptations and a specific CER premium.

[78] "*La finance carbone: en quoi le marché du CO_2 peut-il être un outil au service de la performance des entreprises* ?", p. 50, 2006, M. Diakhate, INSEEC dissertation.

[79] http://www.actuaries.org/ASTIN/Colloquia/Manchester/Papers/silver_paper_final.pdf.

[80] CERs/ERUs are cheaper to buy than EUAs because they include a discount for the various risks that they might not be delivered (see Spread).

There is currently very limited insurance offer available to cover such risks. Insurance capacity is provided by several global (re)insurers (generally with the involvement of their non-traditional insurance or alternative risk transfer teams) and a couple of niche companies with specific expertise.

b. Products available[81]

The scope of coverage provided varies significantly from one company to another. The following table is an attempted comparison (strictly based on web marketing i.e. not approved by the relevant companies) of the most comprehensive carbon credit non-delivery insurance[82] sold and the key terms and conditions attached to them.

Perils[83]	Examples	Parhelion	Munich Re	Zurich	Chartis	Carbon Re
CAR/EAR[84] DSU/ALOP[85] OAR[86] + BI	Delay in Start-Up, fire, failure, machinery Breakdown Business Interruption					
Regulatory	Revocation of Letter of Approval or licences, non-approval of methodology, etc.					
Political	Nationalisation, expropriation, etc.					
Counterparty	Insolvency, contract frustration, pre-payment, etc.					

Available offer based on comparative study.

[81] This survey looks only at comprehensive delivery-wraps only. Companies mentioned in this section may also market conventional covers.
[82] Only the offer of insurers allegedly marketing carbon delivery wraps has been reviewed. A number of other companies offer cover for some (political, technological, credit, etc.) but not all carbon-credit related risks. For example, the Multilateral Investment and Guarantee Agency (MIGA), a World Bank entity established in 1988, sells PRI to foreign investors in Member countries.
[83] Perils that are covered or that might be covered subject to certain conditions, restrictions and stages of the UNFCCC process, as defined by each company separately.
[84] Construction All Risks/Erection All Risks.
[85] Delay in Start-Up/Advanced Loss of Profits.
[86] Operational All Risks.

c. Insurance markets

Traditional players

- **Munich Re**

Munich Re was one of the first companies to sell carbon risks (re)insurance[87].

Jonathan Young (Munich Re) said that in early 2008, Munich Re had agreed to provide capacity to Carbon Re, a broker which had the intention of establishing a fully-fledged "monoline" insurance company to insure carbon credit non-delivery risks. However Carbon Re (like Parhelion, a company with similar aspirations and for which Young worked prior to joining Munich Re) failed at that time to attract sufficient funding to set itself up as an insurance company because of the credit crunch.

Munich Re now currently markets a range of multi-peril policies available to the buyers and sellers of carbon credits, offered both direct or as reinsurance of its insurance company clients in CDM host countries. Coverage can be delivered in respect of: (a) non-registration by the CDM Executive Board, where it covers the project development costs specifically associated with the CDM process, and/or (b) any project assets owned by the insured, and/or (c) the non-delivery of carbon credits caused by interruptions to the operation of CDM and JI projects.

Risks which a company may elect to purchase cover for include (but are not limited to)[88]:

- Non-registration by the CDM Executive Board
- Marine cargo
- Physical Damage
- Machinery Breakdown
- Delay in Start-Up or Business Interruption (if assets are also insured)
- Political risks
- Insolvency of the project company, suppliers or buyers
- Weather risks and deficiency in resources
- Technical performance.

Additional risks might also be insured subject to Munich Re obtaining a satisfactory level of underwriting information.

Indemnity is based on an agreed value calculation that accepts a capped level of carbon price volatility (the insured chooses the maximum carbon price to be used in the loss calculation). Munich Re does not otherwise insure the commodity risk associated with carbon credits.

Munich Re has different policy wordings for CER/ERU sellers and buyers. Both are tailor-made to reflect the specific needs of a client and the characteristics of its project.

[87] The first product was launched in September 2007.
[88] Munich Re commercial hand-out "*Carbon Risks Insurance – a commitment to climate change mitigation*", 2010.

- **Zurich**

Zurich (Trade Credit & Political Risk) sells traditional forms and of PRI and trade credit insurance which scope extends to specifically tailor-made features relating to the underlying CDM or JI project.

James Brache (Zurich) said that its company would consider providing cover for technological risks when technologies involved are proven and/or have passed the UNFCCC validation and registration tests. Another major criterion for Zurich is that the CDM or JI projects must be financially viable. The weaker a company's balance sheet is, the more challenging it will prove to procure carbon credit delivery insurance.

Zurich can provide capacity for up to $175m on any given transaction ($50m for trade credit). It has in some instances lead a syndication of insurers for carbon credit delivery risks.

So far no carbon credit related claims have been made to or paid by Zurich.

- **Chartis**[89] (in development[90])

Chartis (formerly AIG) designed a program to address the delivery risks of compliance instruments generated by CDM and JI projects as early as 2005. The product was targeted to: project developers as sellers of CERs, industrial companies as buyers and investment funds as investors in CDM projects.

Chartis' program was structured to address technological performance risks, political risks, credit risks and/or pricing risks. The policy covered only the first Kyoto Protocol period. Only CERs were insured under the policy (no ERUs or VERs). The coverage would be triggered by the non-generation and non-delivery of the CERs due to technological performance, political and credit risks and the loss amount would have been the amount by which the price paid in the spot market to replace the undelivered credits exceeded the contracted price.

Niche players

Parhelion and Carbon Re are brokers with aspirations to become direct insurers for the carbon credit market.

- **Carbon Re**[91]

Carbon Re defines itself as a "*pioneering insurance service provider*" which aim is to offer innovative insurance solutions for carbon, clean technologies and sustainability projects. Carbon Re AG was established in 2006 in Zug (Switzerland) as the holding company and a reinsurance broker. Carbon Re Aktiengesellschaft, established in Liechtenstein in 2007, is a licensed broker in the EU and EEC for direct insurance. The company was set up by its founder Dirk Kohler (who was formerly with the Gerling Group) and prides itself to have supported a number of insurance groups including in emerging countries towards the creation of specific products.

[89] www.chartisinsurance.com/Evolving-Risks_911_221594.html
[90] Chartis is currently awaiting Phase 3 rules to redefine the scope of its proposed cover.
[91] www.carbonre.eu

Carbon Re has created several carbon credit-dedicated products, namely:

- Carbon Delivery Guarantee Insurance in 2005, destined to industries (compliance risk) and project developers (delivery risk);
- Carbon Counterparty Credit Risk Insurance, protecting buyers against counterparty credit risk, country and political risks and BI risks;
- Carbon All Risk Insurance in 2006, for sellers (including regulatory, political, physical damage, technology performance and BI risks)
- Kyoto Multi-Risk Policy in 2008.

Dirk Kohler (CEO) said that 60% of Carbon Re's business today involved consulting services and 40% placing insurance business. Most requests from Carbon Re's clients come from brokers and insurers worldwide.

- **Parhelion**[92]

Parhelion Underwriting Limited is the most recent player on the carbon insurance market. Julian Richardson's (CEO) interest in carbon-related risks goes back to 2001 when he wrote an MBA dissertation on carbon credit-related risks. His work developed some years later into theoretical insurance solutions which Parhelion began marketing in 2010. Parhelion is now able to offer an underwriting capacity of EUR50m any one transaction (per project or portfolio of risks) which is provided by 5 Lloyd's syndicates (which could not be named at the time this study was published).

Parhelion's policies seldom include a vertical coinsurance (i.e. primary and excess reinsurance). They typically contain deductibles instead (between 5-10%). The company has so far not had a claim for non-delivery of CERs/ERUs.

Parhelion has also developed specific products destined to address the bankability and eligibility issues which the Phase 3 rules will raise.

- **Insurance4renewables**[93]

Insurance4renewables is an online portal which was developed in 2009 by Royal Sun & Alliance (which sells renewable energy project insurance), Munich Re and Carbon Re. It was established under the umbrella of the United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF). Its aim is to offer standard and customised insurance protection for renewable energy projects in emerging countries. The offer includes coverage protecting carbon credit sellers against risks such as insolvency, non-payment and country risks.

Non participants

Cliff Warman (Marsh) said that before the 2007 financial crisis had struck, Marsh was seeing opportunities to place carbon credit delivery insurance every week for a large spectrum of CDM/JI-type projects. Insurance markets were very prompt to react at the time however the solutions they came up with lacked homogeneity and were seldom set in stone. Few insurers actually issued policy forms and when they did, they were in fact not prepared to offer all risks cover (in particular, no insurance for volatility and regulatory risks was available). Chartis singled

[92] www.parhelion.co.uk
[93] www.insurance4renewables.com

itself out by offering to help its clients manage their risks through more ART-type risk sharing programs.

Swiss Re was the first insurance company to implement, in 2006, a multi-perils product covering risks associated with obtaining carbon credits issued for CDM and JI projects ("*Contingent Cap Forward for Emissions Reduction Trades*"). The purpose of the coverage was to protect RNK, an investor in CDM and JI projects, against the non-delivery of CERs/ERUs. Claims would be settled either in cash or with in-kind CERs/ERUs. Swiss Re entered into a similar transaction in 2008 to cover guaranteed and non-guaranteed CERs/ERUs generated from renewable energy projects in China for the government of Luxemburg. The company decided to withdraw from the market for strategic and restructuring reasons as from May 2009.

ACE Global Markets also launched a political risk and trade credit coverage in September 2008[94].

A number of insurance and reinsurance companies believe that risks associated with carbon and cap and trade schemes are not yet mature enough for insurance.

One global insurer said that it had identified the carbon credit risks as an opportunity to market new products. Such area of development had not however been made a priority because so far none of its clients had raised the need for that type of cover. The company was approached several years ago by a US-based broker seeking to develop carbon credit insurance sales in Europe. The underwriters from the environmental risks department concluded at the time that they lacked statistics and other key material to assess a client's exposure to carbon credit volumes and the related costs (see Risk Assessment). As a result, they found that it was difficult to clearly identify the risks involved and to delimit an acceptable scope of coverage. They also considered that the regulation governing CDM and JI projects was too complex and raised too high a level of uncertainty. In particular, they were uncomfortable with the methodologies used to measure emissions and believed that reliable third party emissions-certifying organizations were required before risks could be properly assessed. When asked whether it would sell carbon delivery insurance if and when the above constraints disappeared, the company's representative noted that many of the largest energy industries in fact retained a large level of their risks which may mean that they would not be interested in purchasing specifically carbon-credit focused insurance.

2.3 Why offer and demand for non-delivery insurance have not yet met

a. CDM/JI projects mostly involve quite typical risks

To a large extent the risk profile of a CDM or JI project is similar to other projects involving innovative technologies and renewable energies.

If a technology is new, it may well be treated as experimental or prototype and therefore not be insured by lack of actuarial data[95]. The more history and statistics, the more likely a risk will be deemed proven.

[94] http://www.acegreen.com/products?productid=15&regionid=11.
[95] Dirk Kohler (Carbon Re) said that prototype risks would not be insured under a policy delivered by Carbon Re.

Perils such as fire, natural catastrophes or insolvency are risks which industrial projects and plants have always faced and to which CDM and JI projects are no more exposed to. Actuaries have the tools necessary to assess and price them. Such risks are therefore not addressed in greater detail in this survey.

Business interruption losses may also be covered (generally on a named perils basis). The non-delivery of carbon credits can theoretically be compared to a loss of revenue subsequent to a physical damage as covered by conventional policies.

Political risks are generally excluded from standard property damage however special/buy-back coverage can be found widely. Political Risks Insurance (PRI) requires an identifiable risk which in most cases is not a problem as ample data to assess frequency and severity per country is available from many research institutions. The effects of political risks must also be quantifiable: in the case of carbon credits, this would be the maximum value of undelivered CERs and/or the costs incurred in setting up and running the project up.

Applying specifically to CDM and JI projects, PRI might cover the following risks:

- Expropriation, confiscation, nationalization or breach of contract or letter of approval by a host government,
- Non-payment by sovereign entities (e.g. governmental bonds not being paid out to bond holders, tighter credit conditions, etc.),
- Supply chain interference,
- Inability to convert revenues into hard currencies and transfer back to home countries,
- War, civil war, civil commotion, riots, strikes, insurrection, terrorism.

James Brache (Zurich) mentioned two examples of non-delivery insurance driven by political considerations which Zurich had sold. The first had to do with the rehabilitation by a private company of gas pipelines in Eastern Europe. The insured had agreed to fix leaking pipes in exchange for the carbon offsets that such project would generate. The risk was political in that the pipelines were owned by governmental entities and that a sub-sovereign entity had issued a guarantee that the insured would make a return on investment. Zurich provided coverage for contract frustration by the government entity providing the guarantee. The second involved a trade credit deal on a hydro plant project in South America also intended to generate CERs. The policyholder was a broker of credits that provided advanced payment to owners of the project in exchange for the delivery of CERs over an agreed period of time. Insurance was delivered to cover the risk of non-delivery of the CERs. Any claim paid would entitle the insurer to subrogate against the company generating the CERs.

Pricing political risks is not an exact science. The magic range seems to be 1-2% of sums insured with significant increases following large losses and pay-back hoped over several years. Coverage and sums insured are always capped. Accumulation is a matter which each insurer will address based on the capacity it is able to bind per risk and per event. Julian Richardson (Parhelion) said that accumulation was addressed in quite the same way as other lines of business. Parhelion has an underwriting limit per country and per type of project/methodology.

Although insurers offering carbon credit non-delivery insurance market it as “all risks” or “wrap-up”, they admit that not all perils are insurable for CDM/JI projects. Regulatory risks are a pivotal feature of “full” coverage however they are very seldom covered by the markets (see Regulatory risks).

One increasingly worrying risk companies face is fraud. Between 19 January and 4 February 2011, the European Commission temporarily suspended spot market transactions (i.e. about 20% of overall transactions volume) in national ETS registries following recurring cyber-attacks in national registries of five EU Member States. The attacks resulted in the theft of over 3 million allowances. Suspected double counting of allowances in 2007 (which it was later proved did not happen) and "phishing" on the German national registry in January 2010 (250,000 allowances stolen on European trading platforms) have prompted calls for stricter regulation of carbon credits. In 2010, the UK government decided to reinstate VAT on CO_2 in order to prevent fraudsters from purchasing VAT-free CO_2 and selling them VAT included without refunding the tax authorities. There are plans to implement similar changes in several other EU states. At EU level, security will be one of the main tasks of the centralised registry which is due to take over from the national registries in 2013. Currently, there are as many penal codes as there are Member States: this should change in Phase 3.

Gaëtan Cadero (Lafarge) said that a major concern for his company was the risk of theft. He believed that this was an area where insurance would make sense with millions of Euros worth of allowances that can vanish in seconds. Dirk Kohler (Carbon Re) however advised that he was not aware of any insurer selling cover for such type of risk or any claim having been made for stolen carbon credits.

b. Regulatory risks a key issue

Companies see a great level of regulatory risk linked to climate change policies. This is highlighted by the CDP Report Europe 300[96]: risks identified include risks associated to cap and trade systems, regulation and tax, product labelling and energy efficiency standards. As will be discussed in section 3.2.a (Regulatory), insurers are generally not prepared to insure such risks.

Jean Fournier (Global Aerospace) insisted on placing the carbon issue back into its initial context before addressing the way insurance might assist companies in dealing with regulatory risks. The management of energy resources is of crucial importance. No new oil reserves have been found since the 1970s (only the proportion of proven reserves has increased) and fossil fuels will disappear at some (close) point in time. With global populations expected to reach 9 bn by 2050, there is an urgent need to find and switch to renewable sources of energy. Governments must raise public's awareness by implementing coercive measures. Phased cap-and-trade schemes are a good way to achieve this smoothly. However sudden and more restricting regulatory changes are sometimes necessary to convey the message more strongly that parties must bite the bullet. The EU Climate Change Committee's decision in 2011 to ban offset credits from HFC23 and N_2O adipic acid production may well have been intended to leave a deep impression on companies that the intent of the ETS is to allow no room to play with regulation. Fournier noted that in the same way, new sets of rules such as Basel II and Solvency II had fundamentally been implemented to maintain pressure on companies and to strengthen the regulators' credibility as evidencing that they take measures to limit the impact of possible crisis.

The ETS is not the only carbon emissions regulation that exposes companies to new risks. Christian Fayard (Shell Butagaz France) referred to the French law of 13 June 2005[97] which imposes constraints on companies selling energy to end-users. In addition to achieving energy

[96] https://www.cdproject.net/CDPResults/CDP-2010-Europe-300-Report.pdf. Retrieved on 21 December 2010.
[97] Loi d'orientation sur l'énergie n°2005-781.

reductions themselves, companies must encourage their clients to do same. When they achieve this they are entitled to certificates ("*Certificats d'économie d'énergie*"). Companies must pay fines if they do not meet the assigned targets. With this in mind, Butagaz, a subsidiary of Shell that sells butane and propane, pays out cheques to those of its clients that reduce their levels of consumption. The CEE system in France is somewhat comparable, albeit at a national level and with significantly lower values at stake[98], to the ETS.

Rigorous public registration and issuance process implemented by the UNFCCC

A number of interviewees involved in CDM/JI projects appeared to be troubled by the burdensome and lengthy process which the UNFCCC imposes for projects to reach the critical registration phase. Problems may be duplicated at a local level: every signatory to the Kyoto Protocol has implemented its own national process chart and charts can vary significantly from one country to another.

The key-stages in CDM projects include:

Project stages and documentation	Entity responsible	CDM specific Risks
1. Idea (**Project Idea Note, PIN**) Pre-screening	PC DNA[99]	
2. Design (**Project Design Document, PDD**) Concept note including: - baseline emissions study - proposed methodology - stakeholders' consultation	PC	Methodology - new ones must be approved - existing ones can be withdrawn by the CDM EB
3. Host country approval of the PDD (**Letter of Approval**)	DNA	Administrative delays Rejection
4. Validation report - compliance with UNFCCC requirements - environmental impact analysis - GHG ERs targeted - baseline and monitoring methodologies	DOE[100]	Compliance (additionality, eligibility) Methodology (id. PDD)
5. Registration - formal acceptance of the project	CDM EB	Administrative delays Rejection
6. Implementation - **Monitoring report** (performance measurement)	PC	Delay in start-up Lower volume of ERs generated due to: - lower than expected production or technology efficacy, or -improper monitoring of equipment
7. Verification and Certification report - actual emissions v. emissions required per PDD - actual GHG ERs	DOE	Compliance Lower volume of ERs certified
8. Issuance of CERs based on Verification and Certification report	CDM EB	Rejection
9. Transfer of CERs	ITL	

[98] Fayard clarified that the financial risks associated with the CEE regulation were not such that Shell would contemplate transferring them to the financial or insurance markets.

[99] The **Designated National Authority** is the CDM authority which is designated and registered by a signatory State to the UNFCCC Secretariat.

[100] The **Designated Operational Entity** is the entity designated based on the CDM EB's recommendation to validate proposed projects, to verify and certify that the expected emissions reductions are actually met.

The following average time delays have been published by UNEP:
- 10.7 months to complete the validation stages (through to phase 4 above)
- 4.9 months for registration (from the request to the actual registration)
- 14.8 months from registration to the date of first issuance of CERs.

The point was made by one interviewed investor that a mere hurdle in the validation and certification process of a project (such as the CDM EB withdrawing an independent auditor's accreditation) could "kill it". Time is money: even delays of several weeks could have the potential to jeopardize a project.

One of the two CDM projects conducted by Vallourec involves a steel mill in Brazil (V&M Forestal) which uses wood charcoal rather than coke to fuel its steel production. Eucalyptus plantations are cultivated such that as trees grow, CO_2 is consumed and oxygen is released. The trees provide the raw material for the charcoal and part of the gases emitted during the transformation of wood into charcoal are used to produce energy on-site. Vallourec announced a landmark deal in 2003 with the Dutch government and Toyota to secure CERs from the project. Attempts so far to obtain CDM EB certification have failed.

Patricia Cuba-Sichler (Savin Martin Associés) mentioned one example of a company that had made an upfront payment towards a CDM project several years ago. The project never generated CERs because the UN Emissions Board decided that it did not meet the additionality test. Cuba-Sichler's client experienced difficulties in recovering the amounts it had paid to its contractor. Her view was that today companies treat contractual matters with greater care and such type of disputes are less likely to occur.

Potentially dramatic effects on projects including at advanced stages

Joffrey Celestin-Urbain (GDECC) stressed the critical importance of regulatory risks in the conduct of projects. In his view they are a concern to all types of companies: (a) those strictly seeking to comply with carbon credit regulation, (b) project developers (e.g. Rhodia, Arkema, etc.) and (c) traders speculating on carbon markets. Celestin-Urbain said that regulatory risks might in some cases be a real deterrent to investors (surprisingly, even hedge funds are hardly involved in CDM projects and in ETS developments for these reasons).

Recent developments confirm the level of uncertainty which regulatory risks entail. The following are examples of decisions that have caused prejudice to one or more CDM projects:

- In 2006, China fixed a floor price for carbon prices in order to prevent the excesses of CDM/JI projects.

- An adverse decision from the CDM EB related to projects involving a Norwegian company that had audited carbon emission certificates. The Board sanctioned its lack of expertise, various dysfunctions in the auditing process, missing documents and inaccurate methodologies used.

- The temporary suspension by the CDM EB of four Designated Operational Entities (DNV in December 2008, SGS in September 2009, Tüv Süd in March 2010 and Kemco in March 2010) resulted in a significant volume of undelivered CDM offsets with investors needing to buy CERs (at a loss) on the spot market to meet their contractual obligations.

- On 18 August 2010, the International Emissions Trading Association (IETA) announced that the UN Emissions Board would question all projects seeking emission credits for reducing hydro fluorocarbon 23 gases[101] .

  Trifluoromethane (HFC-23) is produced as an unintended by-product of chlorodifluoromethane (HFC-22) which is used as a refrigerant and as a polymer ingredient. In 2010, it accounted for 52% of credits supplied under the CDM scheme.

  The CDM EB's decision to investigate such projects followed allegations from lobbying group CDM Watch that the methods for delivering CERs for the destruction of HFC-23 gases were inadequate. According to CDM Watch, companies maintain HFC-23 production at artificially high levels and destroy the gases (rather than sell them) with a view to be granted a larger amount of CERs. Such activity is believed to have generated several billion dollars' worth revenues from sales of carbon credits to EU and US-based companies[102].

  The immediate effect of the UN decision was that four projects in China backed by EU-based industries were halted pending the CDM EB's review with CER issuance requests being placed under the state of "request for review".

The UNFCC's decision is a strong message (and a timely reminder at the eve of Phase 3) that if a project is of questionable environmental integrity i.e. does not in fact make additional savings in GHG emissions, CERs will not be delivered. However it begs the question as to how companies can unexpectedly be deprived from a projected return on investment in circumstances where they - allegedly - have complied with all relevant regulation and have invested significant sums of money. Celestin-Urbain said that France had taken a clear position in international discussions towards stable regulation. He believed that sudden decisions by the UNFCCC bodies to postpone the delivery of CERs to CDM project runners would send the wrong signal to CDM investors when projects had validly passed the many hurdles imposed by the strict regulation in place. In such cases, a phasing out response would appear more appropriate in his view.

On 21 January 2011, the EU Climate Change Committee which gathers EU27 Member States voted to ban from use on the ETS emission offset credits from HFC-23 produced as a by-product of HFC-22 production and N_2O from adipic acid production (which environmental integrity has also been challenged). Companies will be entitled to use the offsets for compliance purposes until 30 April 2013 but not beyond that date. The Committee's proposal has yet to be adopted by the EU Parliament and Commission.

Julian Richardson (Parhelion) agreed that the CDM EB's decision to postpone the delivery of CERs in relation to HFC-23 projects would have caused a large market loss had such peril been insured. In Richardson's view, this type of event would enter the scope of regulatory risks as covered by Parhelion (subject to any contractual limitation and unless specifically excluded for any reason).

The current level of uncertainty surrounding the continuation of CDM projects beyond the date of expiry of the Kyoto Protocol is no incentive to invest at the moment.

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[101] http://www.bloomberg.com/news/2010-08-18/un-emissions-board-will-question-all-hydrofluorocarbon-projects-ieta-says.html; Retrieved on 21/08/2010.

[102] According to the EU Commission, revenues from the sale of HFC-23 credits can represent up to 78 times the initial capital investment and operational costs of the project.

Regulatory risks partly considered as political risks?

Although in principle Zurich would not cover regulatory risks, Jamie Brache (Zurich) said that there may be two exceptions to this. Firstly, some regulatory risks may be covered (albeit narrowly) by PRI policies. By way of an example, if a government imposes a confiscating tax regime, this might be viewed as expropriation (which is an insured peril under PRI). The same conclusion might be reached if, as a further example, a government illegally revokes a mining concession (which is key to the financial viability of an industrial project). Secondly, Brache said that if an insured requested that specific coverage be provided for regulatory risks, Zurich would probably consider such request (but not necessarily grant cover). Notwithstanding, Brache was clear that Zurich would not insure a regulatory risk such as the CDM EB not registering a CDM or JI project.

Jonathan Young (Munich Re) agreed that regulatory risks were not insurable however he accepted that in certain instances the political risks definition may be altered to encompass some risks that also have a regulatory connotation. Munich Re has made an exception for costs associated with the pre-registration of projects, which could be covered on essentially an "all risks" basis, but an arbitrary or retrospective decision or regulation by the UNFCCC that would affect the delivery of ERs by a registered project would clearly not.

c. Room for improvement

Although no figures or estimates could be obtained from any of the companies interviewed, it appears that so far sales of carbon credit delivery insurance, if any, have been very limited. It is probably too early to draw lessons from sales that started only five years and which involve quite diverse insurance products. There is however some feedback from parties that have, at least once, shown some interest in carbon credit non-delivery insurance.

Better understanding the needs for insurance

The primary reason for limited sales might be that companies have in most cases received more allowances than they needed i.e. did not *prima facie* face a risk of shortage. Also, as was discussed in section 2.1, industries do not believe that carbon-related risks deserve any particularly special treatment. In such circumstances, it is hardly surprising that CDM and JI projects are still very much viewed as a "cherry-on-the-cake" (these very words were used by a number of the companies interviewed) rather than as a means to avoid the penalties which industries will more likely face in Phase 3 then Phase 2.

Jean Fournier (Global Aerospace) said that when insurers design new products they tend to focus more on risks than on their clients' actual needs. In his view, there are essentially two ways a risk can be transferred to insurance. The first is when it is market practice to procure insurance such that risk managers might be blamed by their directors (and shareholders) for not conforming to such practice. It would be generally inconceivable for example not to buy insurance for a commercial satellite about to be launched into space. The second way is when insurance helps a client to materialize new business opportunities. So far, none of these two conditions above have been fulfilled for carbon insurance, which is probably why companies retain carbon-related risks as business risks rather than transferring them to a third party.

Cliff Warman (Marsh) noted that companies interested in procuring insurance several years ago in most cases had failed to properly map the risks associated with their projects. As a result, brokers assisted their clients far more in articulating their needs than in placing insurance.

One investor said that it had recently, for its own investing activity in CDMs and more generally in the interest of the industry, carried out an extensive review of existing solutions on the insurance market for carbon-related risks. In his view, no insurance carrier offered the comprehensive coverage that the industries needed. In particular, the proposed scope of coverage appeared to be too narrow, policies contained too many exclusions and indemnity limits were too low.

Alexandre Kossoy (World Bank[103]) said that the lack of adequate insurance supply in the past probably explained the limited sales of carbon credit under-delivery insurance. He mentioned the World Bank's attempt several years ago to obtain insurance for the advanced payments to be provided under its ERPAs. Although a number of CDM and JI projects had passed the validation and registration stages, they were not getting off the ground by lack of further financing and therefore not delivering CERs and ERUs. To unblock such a situation, the World Bank offered to pay upfront up to 25% of ERPAs contractual value which the first CERs delivered would refund. A condition was that stand-by letters of credit be established in favour of the Bank in the event CERs were not delivered. This proved impossible as many project developers simply could not access those instruments. Therefore plan B appeared to be to have the risk of the amount provided in advance to be insured at a portfolio level. The cost related to the insurance premium could then eventually be deducted from the payment for CERs to the sellers. The World Bank could not find the insurance project expected because some risks were deemed uninsurable and because sufficient capacity could not be provided by lack of appetite from the reinsurance markets.

Marketing efforts required

Dirk Kohler (Carbon Re) said that insurers that offer (or have offered) carbon insurance had underestimated the stakeholders' lack of knowledge of insurance and its merits. Insurers had wrongly assumed that insurance was an obvious item of CDM/JI projects. Another factor - specific to carbon traders - is that they were not prepared to further reduce their already small margins by paying an insurance premium. Having realized this, Carbon Re embarked some years ago into a vast educational campaign with a view to raise investors' awareness of the added value of insurance. In particular, it used auspices such as the UNEP and the Global Environment Facility (GEF). Such efforts now seem to be bearing fruit: Kohler noted that banks and investors had shown a growing interest in insurance solutions in 2010.

Warman agreed that premium ranges offered had been perceived as excessively high[104] by stakeholders whereas they were in fact typical of cases where little (if any) credible actuarial data

[103] The World Bank (International Bank for Reconstruction and Development) is a relevant player in the development of carbon finance and, as the Trustee of 11 carbon funds is a large buyer of project-based offsets under the Kyoto Protocol. It currently manages carbon funds and facilities with an overall $2.5 bn value. The funds are public or public-private partnerships comprised of public and private participants such as governments having ratified the Kyoto Protocol and private companies with obligations under the ETS or voluntary schemes. The funds must deliver carbon credits to their participants from CDM and JI projects so that they can meet their compliance obligations.

[104] The writer is unable to provide any reliable estimate of how much more premium an insured would have to pay for full non-delivery coverage as compared to standard industrial projects. Any estimate would in any event have to be considered very cautiously: every project is unique and the scope of cover purchased can vary. Premium will reflect the many specificities of a project (geographical location, technology involved, stage of UNFCCC process, etc.). The various premiums that form the overall non-delivery premium would need to be analysed in detail. PRI premium charged for CDM/JI projects may be in the range of 1,5-4% of amounts of coverage requested (which is much higher

is available and there is not yet any economy of scale. Kossoy said that if any proposal close to the World Bank's needs was available, premium rates were so high that the revenues generated by the CER projects would have been offset by the cost of the insurance and thus, it would not be of sellers interest. He added that that companies' interest for an insurance product would be conditional to the cost of offsets plus the cost of the insurance resulting lower than the alternatives (i.e. allowances or domestic reductions).

There are several possible reasons that may explain the imperfections and limits of coverage currently available on the insurance markets. They may need to be better explained to insureds.

- The Volatility which commodities such as carbon credit prices can be exposed to is not something insurers are comfortable with. The only way an insurer's exposure to carbon credit related losses can be limited is by setting a cap on the sum insured (possibly agreed as a specific sub-limit in the policy).

- Carbon delivery coverage is not intended to insure the efficacy or the performance of a project (e.g. a project not generating as many CERs as expected because the level of supply of waste it is due to transform is lower than expected).

- There is a large consensus that regulatory risks are not insurable. More specifically in respect of CDM and JI projects, regulation is so complex and subject to change that the level of uncertainty is deemed unacceptably high. Although this appears to be well understood by risk managers, some are particularly keen on obtaining at least some partial cover for regulatory risks (including during for the pre-registration phases).

- Insurance companies from developed countries encounter major difficulties in accessing markets of the emerging countries. Paradoxically, where industries bringing green technology from developed countries are welcomed with open arms, insurance companies are at great pains to obtain the necessary licences from authorities to sell insurance locally. Kohler believed that this was at odds with the North-South philosophy promoted by the Kyoto Protocol and that, more importantly, it prevented the development of a large number of CDM/JI projects.

Need for more increased insurance capacity

A further reason for limited sales is the difficulties of gaining interest and support on the (re)insurance markets for such new risks.

Kohler said that unexpectedly, only few (re)insurance companies had actually followed the way paved by pioneers such as Carbon Re. Some companies have made a move forward but they are still reluctant to providing coverage for the entire carbon credits value chain.

There are many reasons for markets not engaging into such new business. An obvious one is the economic downturn which occurred only two years after Phase 2 started (2009 was a "big hole"). However Kohler insisted on another important factor: few (re)insurers have ever shown any interest or appetite for carbon risks and few have staff with the necessary expertise and training.

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than premium charged for standard PRI). Prices could be much higher for non-payment coverage. It has been suggested that delivery insurance overall may cost approximately 10% of the expected trading value of a carbon offset.

Finding capacity on the markets is critical since a company will not have enough to cover the risk itself and if it does, may not be willing to bear 100% of the risk. Reinsurance is a common way of resolving such a problem. Typically, it is in such cases first procured on a proportional basis. The insurer's level of retention then gradually increases and moves towards non-proportional solutions as the business matures.

Another challenge is to obtain satisfactory reinsurance terms and pricing. Reinsurance may indeed be available but view the reinsured risks differently thus imposing, *inter alia*:

- an excessively high reinsurance premium (whether applying to all risks reinsured or by specifically including carbon credit risks in a more volatile - and therefore higher priced - category of risks), or

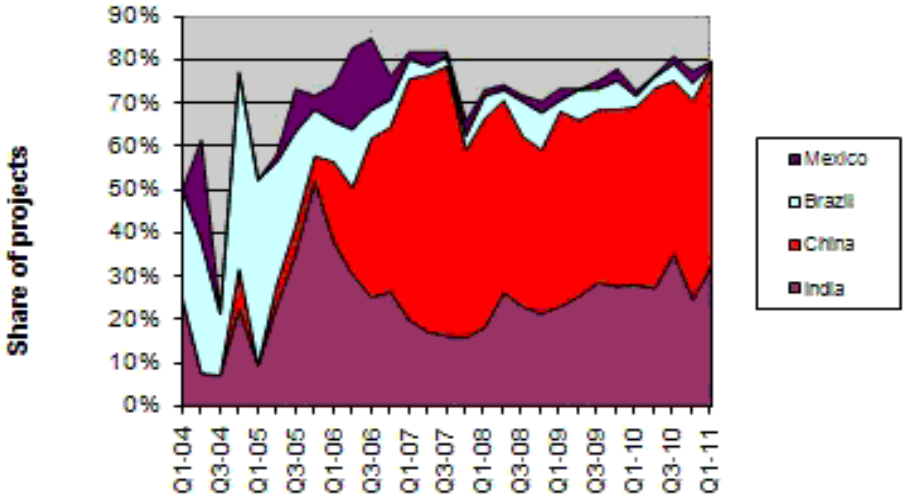
- higher deductibles, lower sub-limits and shorter period of coverage than those provided by the original policies issued, or

- in a less favourable form of risk sharing such as a quota share treaty rather than excess of loss.

d. Prospects for the future

CDM/JI projects badly affected by the financial crisis

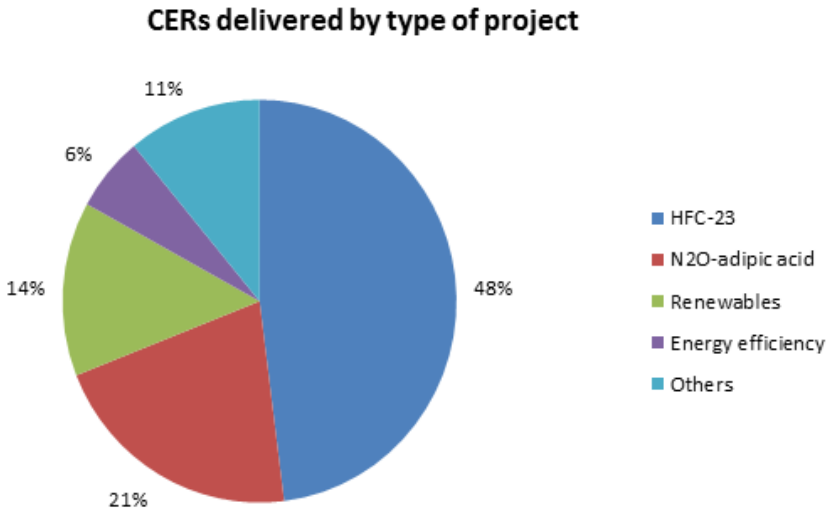
As of February 2011, there were 2,786 registered CDM projects and another 7,106 in the pipeline (source: CDC Climat). As of December 2010, 552,954,451 CERs had been issued[105]. As is shown in the chart below, the main countries hosting CDM projects are China and India. The United Kingdom, New Zealand, Japan and Switzerland stand out as key investors.



All CDM Projects in the Pipeline
Source: www.cdmpipeline.org, @ 1 February 2011

[105] http://cdm.unfccc.int/. Retrieved on 24 February 2011.

CERs delivered in 2010 related to[106]:



Source: Point Carbon, 2010

As of February 2011, there were 211 registered JI projects and another 421 in the pipeline (source: CDC Climat). JI projects are mainly based in Russia and Ukraine (primarily focused on cuts on methane, HFC and N_2O emissions) with companies selling gas packages combined with ERUs.

The crisis has caused a large number of CDM and JI projects to be postponed and in some cases cancelled by lack of funding. The effects of the crisis were highlighted in the World Bank's survey on carbon markets in 2010[107]:

- Project-based transactions have declined sharply with CDM projects particularly affected[108];
- CER issuance projections were lowered to 1 T CO_2e by 2012;
- Less than 200m ERUs are expected to be available by 2013;
- There should be more AAUs ($1.8 bn) as a result of many countries' efforts to implement Green Investment Schemes (GIS);
- The projected CDM and JI demand from EU entities over Phase 3 is about 540Mt CO_2e (200 for Japan).

The ban decided in January 2011 by the EC on HFC-23 and N_2O (adipic acid) projects will also contribute negatively to the number of projects.

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[106] http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.1487593. Retrieved on 20 December 1010.

[107] *State and trends of the Carbon Market 2010*, World Bank. http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf. Retrieved on 24 February 2010

[108] CERs delivered (projections) are expected to reduce to:

- 980m by the end of 2012
- 3.6 bn by 2020, of which:
  - 1.3 bn from industrial projects
  - 1.3 bn from renewables projects
  - 0,53 bn from HFC-23 and N_2O - adipic acid projects (**Nota**: this was before the EC ban on such projects decided in January 2011).

http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.1487593. Retrieved on 20 December 1010.

Exponential trading activity

Global carbon markets represented around $30 bn in 2006[109] and $64 bn in 2007[110].

The World Bank's survey on carbon markets in 2010[111] revealed that:

- The total value of carbon transactions was $144 bn in 2009 (allowances and derivatives) i.e. a 6% increase compared to 2008 despite the financial crisis;
- $122 bn worth of transactions pertained to allowances markets (EUAs, AAUs, RGGI, etc.), $17.5 bn to spot and secondary Kyoto offsets and $3.3 bn to project based transactions (CDM, etc.);
- The ETS alone represented $119 bn in transactions with futures trades accounting for 73% and spot and options markets growing;

In 2007, 2.9 bn tons of CO_2 were traded of which 70% of the volume and 78% of the value stemmed from the ETS. Orbeo has predicted the following market values for the future:

Magnitude of market value ($ bn)	2012	2020
ETS	200	600
USA & Canada	30	1300
Australia & NZ	3	30
Japan	-	150
South Korea	-	40

Source: Orbeo, 2010[112]

Slow progression of insurance sales expected

Still today, carbon insurance markets are considered as a niche area with an embryonic activity involving only the larger companies and some start-ups. However, it is believed that the market's potential is huge and that it will become one of the biggest commodity markets[113].

Despite the limited CDM/JI activity in recent years, insurers involved in carbon delivery insurance appear to be confident that there is a future for their products. They see good prospects of sales with the further regulation changes ahead and environmental issues becoming increasingly sensitive in business[114]. The assumption of course is that CDM/JI projects will not be affected by Phase 3 rules and by the Kyoto Protocol expiring - which is very much an open question.

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[109] http://www.economywatch.com/energy-economy/carbon-market.html. Retrieved 15/08/2010.
[110] World Bank.
[111] *State and trends of the Carbon Market 2010*, World Bank. http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf. Retrieved on 24 February 2010
[112] http://www.iea.org/work/2010/et/Fages.pdf. Retrieved on 31 December 2010.
[113] *Full of promise*, Tanya Havlicek, Best's Review, August 2010.
[114] 70% of respondents to a 2010 Point Carbon survey believed it was "likely" or "very likely" that there would be demand for CERs in Phase 3. The figure is lower for JI projects (52%). (http://www.pointcarbon.com/research/promo/research/). Only 11% respondents believed that their involvement in CDM projects as investors or traders of CERs would reduce.

There are no publicly available projections of insurance sales, only internal ones which could not be shared. According to Jonathan Young (Munich Re), the size of the potential market can be derived from the number of registered or planned CDM and JI projects, available from the UNEP Riso website and the insurable value of the carbon risks (but not the project assets) can be estimated by applying an average premium to the number of ERs.

Young said that the credit crunch had changed the way ERPAs were structured. Instead of making upfront payments, carbon credit buyers, with some exceptions, have decided to pay for CERs only on delivery. The buyers' risks associated with future delivery has therefore vanished and the need for insurance shifted back to the project owners/developers' side, i.e. the sellers, who are generally located in CDM/JI host countries. In the absence of forward purchases, sellers must initially self-fund their projects (which is a major problem) and rely on their standard PD/BI insurance to include their CDM/JI activities. Although some advanced payments have been seen recently, they are limited in number and in size. Young did not expect any material increase in demand on the buyers' side in the very near future.

Julian Richardson (Parhelion) agreed that overall, no significant increase in sales was immediately expected. The only way this could change was if one or several major uninsured losses prompted companies to purchase cover. The recent decision to postpone the delivery of CERs to China-based HFC23 plants could set a precedent.

Targets

Richardson's view was that carbon funds and investment banks were the main carbon finance parties currently interested in carbon credit non-delivery insurance (as opposed to industries that tend to retain risk and actually participate in carbon funds). This was also the view of Alexandre Kossoy (World Bank) who believed that intermediaries and aggregators were another niche that could benefit from comprehensive insurance products covering the catastrophic risk their portfolio of projects might be exposed to (e.g. a decision from the Chinese government to nationalize 100% CDM projects in China).

Dirk Kohler (Carbon Re) believed that the highest prospects of sales currently appear to be with project developers, particularly those that face restrictions as a result of the financial crisis and are seeking to make their projects more "waterproof".

Kossoy believed that with new carbon markets emerging throughout the world, demand for credits should increase and prices could make carbon credits valuable to the extent that the need for insurance could rise.

Key to success?

Kossoy's view was that insurers and their clients should be able to find common grounds despite the large gap between the limited cover currently available and the comprehensive protection required. This however can only happen if insurance is sold at a reasonable price and if regulatory risks are included.

Julian Roberts (Willis) believed that a good way to evaluate the economics of non-delivery carbon credit insurance might be to find out whether a buyer could access carbon assets with a reduced cost of capital (or better price) with carbon insurance in place. Roberts doubted that a large carbon

fund would want to dilute its margin when it is able to mitigate the risk itself by virtue of internal spread of project risk and mitigated exposure to delivery risk.

Roberts also characterized the market for carbon credit insurance as still immature, and said that it had yet to prove that it is viable – or, at least, in what form. The underlying market essentially remains heterogeneous and diffuse. The question remains as to which part of the carbon "food chain" such products are best directed. Buyers, Sellers or the makers of markets and capital providers?

Interestingly, whereas insurers are competing to offer the wrap-up policies which they believe industries need, Cliff Warman (Marsh) said that some clients were looking for more discrete and partial coverage e.g. for technology and efficiency risks but not political risks (which they may have covered elsewhere) or regulatory risks (which they may deem very low in a given country).

New horizons?

The vitality of carbon markets will very much depend upon how clear the awaited Phase 3 rules are. Indeed, if companies are able to identify and assess the risks they face more accurately, they will in a better position to determine whether insurance is an option they should consider or not.

Carbon markets also place their hopes in new growth drivers for carbon trading such as the cap and trade schemes emerging throughout the world and the forestry sector. Both would undoubtedly help boost insurance sales.

Although **forestry** does not currently enter the scope of the ETS, Forest Re[115] has been working on the design of specific forest carbon delivery insurance for several years. The cover focuses on the catastrophic perils which forestry faces namely fire, hurricane and ice storm.

In practise, most carbon delivery projects are at early stages and although some companies have expressed interest such type of insurance, none has actually purchased it. Phil Cottle (ForestRe) however saw promising prospects of sales of carbon delivery insurance in the future for several reasons. Firstly, fire and wind loss severity are on the rise; so is storm frequency. Secondly, commitment levels through voluntary schemes are increasing. Thirdly, and more importantly, mandatory cap-and-trade schemes appear to be prepared to accept forest carbon offsets. This has actually happened recently, in December 2010, with the adoption by the California Air Resources board (CAR) of its mandatory scheme. ForestRe has done some work for the CAR. In particular, it has proposed and priced the buffer insurance pool protection which the CAR is keen on implementing.

By contrast, Jean Fournier (Global Aerospace) could not foresee any specific insurance needs for the **aviation** sector (which will enter the ETS scope in Phase 3). Fuel costs and their volatility have

[115] ForestRe specialises in the design of insurance and reinsurance solutions for forestry and tree crop plantations worldwide. The company entered into a line slip agreement with a group of Lloyd's syndicates to underwrite a global forestry portfolio. ForestRe can accept up to $7.5m sum insured any one risk and location. Additional capacity may be arranged on a case by case basis through coinsurance and/or reinsurance. The company mainly provides FLEXA[115] coverage extending to other catastrophic natural hazards such as wind, cyclone, tornado, hail, frost, snow, ice, drought, land slide, earthquake and flood. It can also offer bundled risk cover to include enterprise risk such as credit, political and liability risks through its insurance partners.
Insurance is primarily destined to forest investors (REITs[115], TIMOs[115], banks, corporations, aggregators, forest funds, etc.), to owners and to managers from the private and public sector in activities such as conventional wood fibre production, biomass, biofuels, industrial tree crops and projects delivering ecosystem services.

been an issue for many years. Hedging mechanisms including options have largely been used by airlines with mixed results. Today the simplest and most common way of dealing with the problem appears to be to buy more efficient aircraft and to reflect fuel price volatility in sales prices. The real concern with airlines that are subject to the ETS is its impact on competition.

Pierre Albano explained that although Air France was preparing for 2012, the group was awaiting to know what the exact rules would be. In particular, Air France has stopped purchasing CERs pending clarification as to what quantity will be allowed by the ETS scheme to compensate for emissions.

Grégoire de la Motte (Carbonless) questioned whether business opportunities for insurers wouldn't more easily be found with **individuals** and **small corporations**. His point was that global companies have adequate tools to manage carbon credit-related risks (internally or through solutions on the carbon markets similar to those used for commodities). By contrast, individuals and smaller size companies are not geared to face the risks which will stem from the carbon-credit regulation throughout the world which they may one day be subject to.

Marc Yana's view (Chartis) was that if and when small companies and individuals did become subject to regulation, insuring them via an investment fund that pools their compliance requirements would be an efficient methodology. Jillian Raw believed that some smaller companies that become subject to the ETS because of aggregation of output might be the entities that require insurance since unlike the large typical carbon emitters they may not have the resources to carry a loss internally.

3. UNDERWRITING CHALLENGES

ABSTRACT

Insurers are familiar with project-based risks. To a large extent, the risks which CDM and JI projects raise are no different to other projects. Pricing carbon-related risks therefore causes no new difficulty prima facie.

There are two notable exceptions however:

1. Price volatility: fluctuation of carbon market prices has been limited in Phase 2 but is expected to increase in Phase 3. To a large extent supply and demand are driven by the regulatory bodies and evolving emissions reduction policies. As in other insurance delivered to industries trading the commodities they produce (such as mining), some level of capped volatility should however be acceptable.

2. Regulatory risks: regulation is constantly changing and decisions are increasingly taken to correct loopholes and prevent abuse (carbon fraud and theft, HFC 23 and adipic acid projects in China). The validation and registration process for CDM/JI projects is demanding and rejections by the CDM EB are frequent. Currently most insurers believe that despite widely available data on projects generally, there is no meaningful material and history from which reliable actuarial models can be derived.

Contract certainty must be a priority for policies that involve carbon credits in some way or another failing which disputes will undoubtedly arise. Attention must urgently be focused on sensitive issues such as the valuation of losses (in the absence of accounting norms), mitigation of loss efforts and salvage.

The following developments predominantly refer to carbon delivery insurance however in some instances (particularly section 3.1.c. Underwriting information) comments made will encompass risks previously described as “ICW” risks.

3.1 Insurability

a. Where are the limits?

Risk management literature proposes a risk matrix consisting of three main risk categories: Market risk, Strategic risk and Carrying out risk. The three categories in turn subdivide in Systematic (or Unsystematic) risk, Pure (or Speculative) risk and Insurable (or Uninsurable) risk. In essence, Systematic (a loss than happens to all e.g. the fluctuation in the value of the Euro) and Speculative risks (win or lose situation) are not insurable. In contrast, insurable risks are caused by sudden and accidental events which are pure, unsystematic and for which one can only lose.

Insurable events are generally understood to be those that are fortuitous and not proscribed by law. Determining the exact scope of insurability (for which there is no universal definition) is a matter for each company to decide on based on its own underwriting policy and guidelines. A decision to insure carbon credit risks will depend on a number of factors such as, for example, the lines of business written by a company, the tools and expertise it has (or can outsource) or its level of appetite for risk (and for high premium).

In an article published in *Insurance Today*[116], Munich Re explained the way it typically contemplated new businesses and decided on insurability. Firstly, it gathers all its teams that have an interest and skills in the subject matter (actuaries, insurers, experts, etc.). It then compares the new risks with similar ones that exist (if any) and finally decides whether the risk is insurable or not (which might change in the future). When a risk is deemed insurable, coverage will generally at first be offered with small limits.

One global insurer that does not market carbon credit insurance assumed, for sake of discussion, that if an insurable interest could be accurately identified, an insurer would, as is typical for other lines of business, first ask its client to list the risks and related costs/values which it wishes to transfer to insurance. Then the insurer would identify its own risks and seek ways of limiting them (e.g. via contractual limitations and/or exclusions) in order to meet its company's insurability criteria. The final stage of the process would be to refine the product so that it meets its clients' requirements to the extent possible.

b. How do carbon credit risks match essential characteristics of insurability?

Referring to CDM and JI projects, Julian Richardson's (Parhelion) view was that they must satisfy minimal risk underwriting needs such as a low probability of occurrence, a high degree of randomness for losses, a small reduced average loss amount and a capped maximum loss. It must also be possible to pool and diversify the risks involved. In order for a company to determine whether it is appropriate to transfer a risk, it should answer the following questions: who has the best opportunity to influence risk? Which is the most appropriate party to own the risk? Is the CDM/JI a good project that was unlucky or was it just a bad project?

[116] *Munich details its approach to uninsurable risk*, Insurance Day, 10/09/2010.

The non-delivery (or late delivery) of carbon credits is in fact a consequence of an underlying peril (that might or might not be insured). As such, premium for the non-delivery risk effectively aggregates the premium charged for each peril insured under a policy. Insurability must therefore be assessed on a risk per risk basis.

- **definite losses**

Insurance must cover events that occur at a known time, at a known place and as a result of a known cause.

Although such requirements can in some instances be relaxed (asbestosis has led to massive insurance pay-outs without such criteria being met), they do not raise any issue for carbon credits risks. Indeed, the causation (e.g. fire, nationalization, machinery breakdown, etc.) and the date of loss (date of a technical incident or damage or date of discovery of such incident or damage; date of a public decree; date of inception of riots, etc.) will be quite easily identifiable. And so will the location (industrial plant; region, country, etc.).

- **fortuitous losses**

A loss must be accidental or at least out of the insured's control. Ordinary business risks are generally not insurable. For example, an increase in pollution stemming from a company's decision to increase its production for any reason would not qualify as an unforeseeable situation as required for there to be an insurable interest.

Julian Richardson explained why coverage for CDM/JI projects only incepts once they are registered. In his view, investors in CDM/JI projects choose reputable project developers/providers and insurers should not provide efficacy or performance cover. If an issue or technical failure arises during the pre-registration phase, it would in any event cost far less to an investor to have its contractor or an expert review the project design than to procure insurance for such a peril. To cover such risks would also raise a moral hazard in that companies procuring such insurance might be encouraged to relax the level of care and quality of their work.

- **a large number of similar exposure risks**

Insurers appear to have a population large enough to pool some (but not all) of the underlying risks of non-delivery. Also, as Richardson stressed, the level of information available with regards to CDM/JI projects is actually higher than in other sectors. It will be seen however that they are at pains to group risks of similar nature (see Pooling) such as types of projects, technologies involved or sectors at stake. In such circumstances, it can prove difficult to establish the law of large numbers in which predicted losses would match actual losses.

A further issue affecting homogeneity requirements stems from the way GHG emissions should be measured. Annex IV to the 2003 EU Directive provides that they shall be monitored by calculation or on the basis of measurement. Calculations of emissions must be performed using the following formula: (Activity data x Emission factor x Oxidation factor). Measurement must be undertaken by using "*standardised or accepted methods, and shall be corroborated by a supporting calculation of emissions"*. Measurements have in fact caused some debate because they are currently based on theoretical calculations whereas actual physical measurements through sensors or flow meters in chimneys for example would also provide a relatively high degree of accuracy.

As highlighted in the CDP Report Europe 300[117], companies from the energy sector use quite different metrics when disclosing emissions (tons of throughput versus output, barrel of oil equivalent versus ton) and different scopes (group versus division level, oil versus gas extraction activities, etc.). Companies (and their insurers for purposes of comparing risks) clearly lack reliable GHG emission and reduction measurement, reporting and verification tools. These could be provided by way of international standards created by organisations such as the ISO.

- **large losses**

A loss under a policy must be of meaningful size to an insured company failing which there will be little value in such company incurring insurance costs. As previously discussed, carbon credit losses are expected to represent high costs, possibly in tens of million Euros to the largest companies. Such amounts are in fact significantly lower compared to the costs which same companies are exposed to when purchasing the other commodities they need for production purposes.

Insurers' businesses do not seem to be more exposed to carbon credit risks than they are to the more conventional risks that they write (including natural catastrophic risks). Accumulation scenarios are conceivable such as, for example, (a) a decision from the Chinese government to cancel all CDM projects on its territory that involve methane or, (b) a generic failure affecting a worldwide population of CCS plants. The CDM EB's decision on HFC23 provides a real example of a potentially catastrophically large loss to industries involved. Such situations should normally be factored by insurers in their determination of a probable maximum loss and accumulation scenarios. In addition, insurers may have specific reinsurance programs covering peak claims of the type.

- **affordable premium**

Premium charged specifically for carbon credit risks must not be too large relative to the sums insured.

The feedback from companies interested in procuring carbon credit delivery insurance included a comment on premium being too high. Price ranges today necessarily reflect the fact that insurers are not able to properly calculate the losses by lack of empirical evidence and statistical data. They will drop (and scope of cover will probably broaden) with insured populations rising and increased dispersion of risk.

- **calculable losses**

An insurer must be able to calculate (or at least estimate) the probability of loss (actuarially fair price) and the attendant cost (an objective evaluation of the amount an insurer might have to pay in case of a claim). As discussed in section 2.3, insurers can do this with certain exceptions.

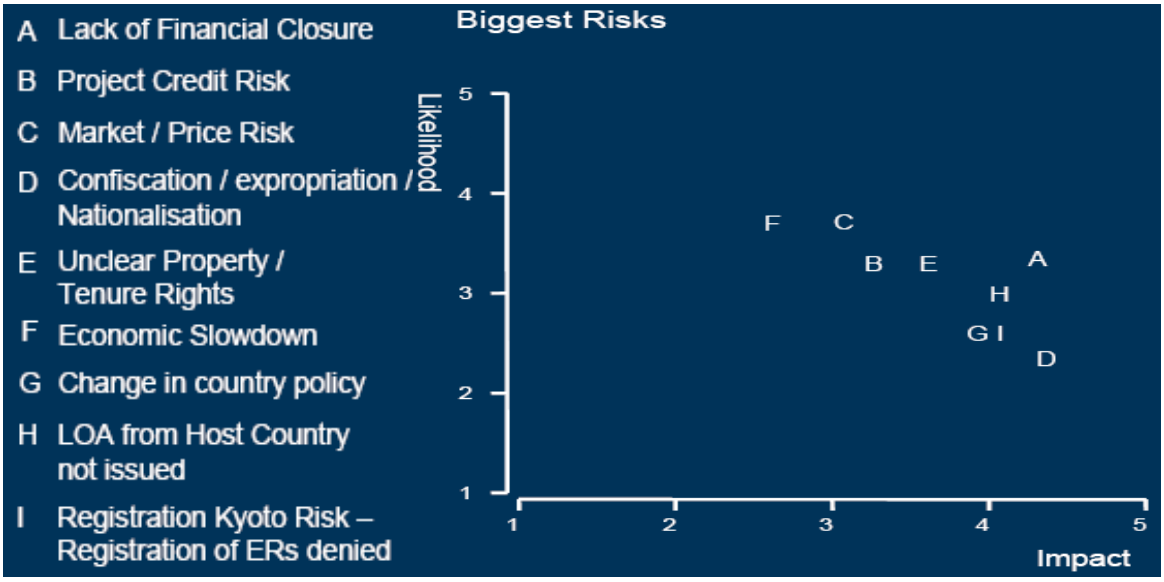
Parhelion, Carbon Re and Munich Re have taken the unique stance that regulatory risks can be covered based on historical efficiency as derived from UNFCCC data. This is discussed in further detail in section 3.2.a (Regulatory).

[117] https://www.cdproject.net/CDPResults/CDP-2010-Europe-300-Report.pdf. Retrieved on 21 December 2010.

3.2 Risk assessment

Measuring risk is generally done in the following way: (a) by identifying the risk, (b) by identifying the various parameters affecting the risk, (c) by ascertaining the correlation of each of those parameters and (d) by assessing the probability of the risk analytically[118].

Nick Silver (Callund Consulting) has identified the following biggest risks for carbon credit non-delivery insurance:



Source: Parhelion/Callund Consulting Limited[119]

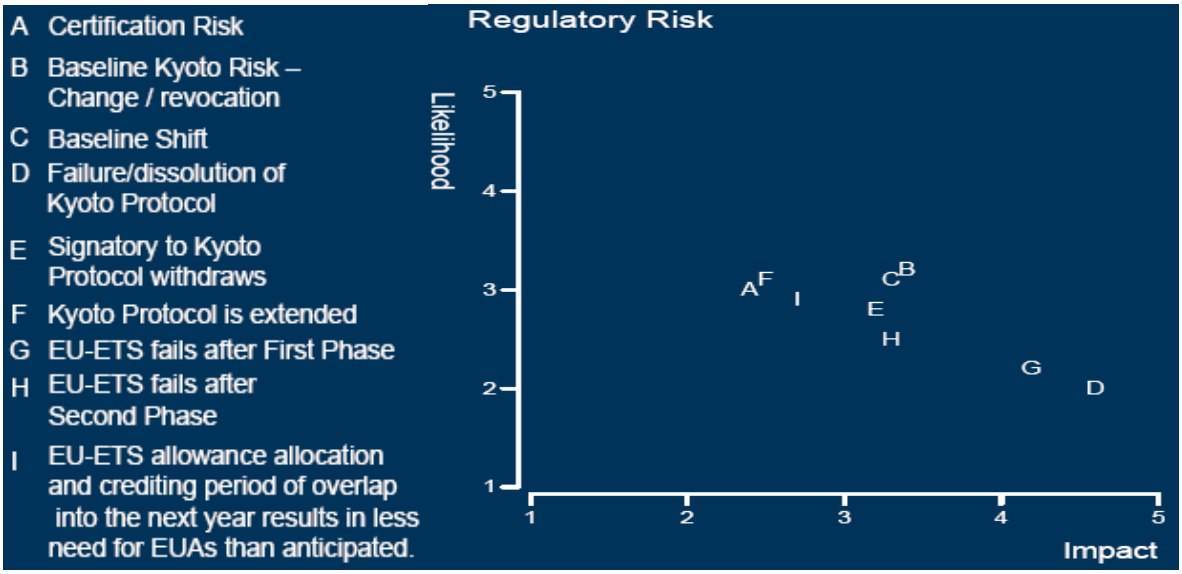
a. Actuarial considerations (regulatory risk)

In contrast with perils such as fire, natural catastrophes, delay in start-up or confiscation by a governmental entity, regulatory and price risks for CDM/JI projects are difficult (if at all possible) to assess. This subsection will focus on regulatory risks (Volatility is discussed under section 3.3), where there is no experience or claim history available for purposes of assessing and pricing risks (except in Parhelion, Carbon Re and Munich Re's view). Actuaries currently do not have a loss database from which they can generate exposure curves and models. Also, little risk dispersion is possible because projects are essentially concentrated in China, India and Brazil.

[118] Management of Risk Due to Climate Change, 10th Global Conference of Actuaries, D. Basu - http://www.actuariesindia.org/GCA/10th%20GCA/Papers/General%20Actuarial%20Topics/15_Management%20of%20Risk%20Due%20to%20Climate%20Change_D%20Basu_10th%20GCA.pdf

[119] http://www.actuaries.org/ASTIN/Colloquia/Manchester/Presentations/Silver.pdf.

Silver has also identified and rated the regulatory risks for carbon credit non-delivery insurance:



Source: Parhelion/Callund Consulting Limited[120]

His view was that currently none of the data pertaining to CDM/JI projects, whether publicly available from the UN or disclosed by project developers, was of statistical significance. In circumstances where assumptions are flawed, models are necessarily spurious. Bertrand Le Gall (SCOR) agreed and said that actuaries could come up with some assumptions based on information available from the UNFCCC however such data did not provide sufficient history to derive credible models. In particular, CDM and JI projects are so different in type and risks that they cannot (currently) be compared or assessed in the same way. All insurers can therefore do is extrapolate - which will likely lead to uncertain results and high prices.

The way regulatory risks might be approached (irrespective of how reliable results may be for the reasons set forth above) can be described as follows.

Available tools

Insurers can rely only on two main sources of information to assess regulatory risks at a macro level:

- data available from official sources such as the UNFCCC and UNEP (number/types of projects submitted/registered, time delays between the various stages of the UNFCCC registration process, reasons for adverse decisions from the international and local instances[121], flow of CERs/ERUs actually delivered etc.), and

- economic, trade and political statistics available from financial information services companies such as Markit which launched a series of indices in September 2009 intended to track the performance of CDM projects across the world[122]. Success rate indices are derived monthly by

120 http://www.actuaries.org/ASTIN/Colloquia/Manchester/Presentations/Silver.pdf

121 It is noteworthy that data currently available from the UNFCCC shows that the number of projects that fail to pass all the many tests is actually increasing.

122 http://www.markit.com/en/media-centre/press-releases/detail.page?dcr=/markit/PressRelease/data/2009/09/2009-09-22-3. Retrieved on 26 January 2011.

comparing CERs actually produced (per type of project, sector or region) to volumes targeted in PDDs over a 24-month rolling period. Measurements are based on an interpretation of UNFCCC data.

Despite the limited history of CDM/JI projects, Dirk Kohler (Carbon Re) considered that there was ample data available from the UNFCCC from which acceptable models could be derived. A strictly actuarial approach of regulatory risks however is not sufficient. An insurer could not afford to sell such coverage without some form of "political" involvement. Indeed, a company must be fully aware of ongoing discussions within the regulatory bodies so as to better identify areas of potential legislative changes. With this in mind, Carbon Re has obtained seats at the UNFCCC negotiations and various other international instances.

Possible methodology

Stage 1: establishing a "standard" model

Irrespective of the specificities of a particular CDM/JI project, a "standard" regulatory risk model could be determined on the basis of observed/known frequency and severity at a macro level.

If samples used to derive models are too small in number, credibility adjustments may be used in order to include them in a larger selection of risks (e.g. aggregating adverse national and international regulatory decisions). This will require applying an acceptable level of weighted average. Some form of segmentation may be possible.

-> a "standard" regulatory risk evaluation rate is available

Stage 2: applying the "standard" regulatory model to the specificities of a CDM/JI project

For each individual CDM/JI project it is asked to quote, an insurer will then look at its specific features and data (design, construction and operation of the project and technologies involved, country, project funding, loss mitigation items, ERPA conditions, etc.).

This will lead him to apply further credibility adjustments thus to either increase its standard regulatory per risk evaluation rate or to decrease it. China for example is known to be a particularly attractive host country for CDM/JI projects which should mean a lower premium for the regulatory risk. By contrast, a higher weight will be given on projects/countries for which little data is available and/or no particular efforts have been made to facilitate the implementation of CDM/JI projects.

-> a "project-based" regulatory risk evaluation rate is available

Stage 3: aggregating the "project-based" regulatory model with all other "project-based" models

The "project based" evaluation rate charged for a project will be based on the aggregation of rates calculated for every risk involved in same project (political, technological, insolvency, etc.)..

-> an "all risks project-based" evaluation rate is available

Stage 4: aggregating the "all risks project-based" model with other "all risks project-based models" in a portfolio

Once all projects and their associated risks have each been assessed individually, an insurer will seek to assess the overall risk at portfolio level in order to come up with a "portfolio-based" evaluation rate. Aggregating risks of quite different type and nature will require some weighted average. A critical point not to miss is that certain types of risk are correlated. By way of an example, a decision by the Indian government to seize all projects of a certain type on its territory may is likely to affect a very large number of projects. Companies must therefore determine their level of maximum overall exposure to such a loss when writing a large portfolio of projects.

-> a "portfolio-based" evaluation rate is available

Final stage: distribution curve

The final result (distribution curve) should tell an insurance company what the overall chances are (accounting for all risks involved) that a project or a portfolio of projects will deliver less (or more) than 100% of the expected credits. It will determine the company's acceptable level of value at risk i.e. which maximum amount it is ready to expose to a centenary loss probability.

b. Alternative solutions

New regulations, market volatility and political risks are commonly referred to as sources of special risks. Special risks are risks which are difficult to quantify (e.g. because they are unique or limited in number or they involve qualitative aspects which cannot accurately be measured or there are too many variables involved) and which can lead to large losses. As such, they are not generally covered by the classic forms of insurance. Some insurers however have developed alternative methods of mutualising risks.

One way to achieve this is to depart from traditional risk categorization and to insure a portfolio of risks which have similar properties and are therefore fairly homogeneous in nature. Another is to adopt a contra-cyclical approach: if for any reason a given risk cannot or is very unlikely to occur simultaneously with another then this may allow an overall balanced exposure to risks.

When statistics are not available (an earthquake risk might for example only be 1 in 1,000 years), risks may be transferred to insurance if a frequency risk and severity can be derived from a model.

A model can be calculated based on either:
- proxy statistics (e.g. terrorism risks in Paris calculated using data available for other locations such as New York or Madrid), or
- purely theoretical scenarios (absent any real data but possibly referring to scientific surveys).

Thomas Renggli (SCOR) insisted that a model cannot be used without the regulators' prior approval. Companies also need the blessing of rating agencies which own models will treat any excessive volatility negatively.

Situations where actuaries have no meaningful data to rely on typically occur when insurance markets seek to cover new risks. There are many examples of insurance delivered in situations where pooling would be difficult if not impossible such as the risk of a batsman hitting six sixes in

a row at the cricket World Cup in 2000. This actually happened, triggering a $1m indemnity which was paid out to charity.

When commercial satellite launch flights were first insured in the late 70s, space technologies were new to insurance carriers. There were a very small number of launches per year and values at stake were already considerably high. Notwithstanding, operators were able to procure insurance - albeit at a high cost and subject to deductibles and limits -. Today, the market is a mature one, with an average 20 insured launches per year and an overall insured fleet of around 150 satellites. Whereas it involved around 15 carriers in the 90s, there are about twice as many on the market today.

Guy Lallour (XL) was involved in space insurance when it was still a new line of business. He explained how easy it had been at the time to insure satellite launches despite very limited statistics and virtually no mutualisation possibilities. Insurers quite simply charged premium based on the launchers' success rates which were disclosed to them: if one launch vehicle in ten had failed, a 10% premium (of the overall sum insured) would be applied. Levels of premium only started to decrease when what became a profitable market attracted more capacity and an experience curve could be derived from a larger number of launches. They increased again and market hardened with claims badly affecting market performance in the late 90s/early 00s.

Lallour's point in comparing carbon credit insurance to space insurance, now a mature market, was that insurance can be procured even when some of the fundamental underwriting criteria cannot be met. An insurer's major concern in Lallour's view is that a premium must be able to pay for the maximum loss under a policy. Therefore whether this is achieved through no mutualisation or through mutualisation of a small or a large number of risks is not so much of an issue.

Terrorism risk provides another good example of a risk that was once difficult to insure and has now become ripe. After the 9/11 events in the USA, the TRIA made it compulsory for insurance companies selling insurance in the country to offer specific terrorism cover (subject to the payment of a separate specific premium). Most companies responded reluctantly however others saw an opportunity to charge high premium which proved very profitable. Today many players can be found on the terrorism market and levels of premium have dropped accordingly.

Although this does not ever appear to have been suggested, governmental environmental policies might one day decide that companies must procure carbon non-delivery policies (in the same way as third party motor insurance is compulsory in most countries), particularly for medium range emitters that couldn't afford to retain the risks. This is probably wishful thinking.

c. Underwriting information

A company seeking to procure insurance involving carbon credits (whether allowances or offsets) should expect to be asked a number of specific questions (in addition to those normally raised with respect to the industrial risks insured) pertaining to the company and its project, e.g. to:

- Its location (country, urban or rural area, etc.)
- Its ownership and management
- The schedule of works, start-up and operations
- The actual and expected number of installations that are subject to ETS scheme

- The actual and expected emissions issued by the company's installations and the way such emissions are calculated (or estimated)
- Any ongoing and projected internal efforts towards reducing GHG emissions
- The actual and forecast number of carbon credits allocated to the company's installations
- Any existing or expected surplus allowances
- The historical balance of carbon credits (shortfall or surplus per year since the implementation of the ETS)
- Mitigation of loss solutions (trade arrangements, if any, as between the company's plants that are subject to the ETS, carbon credit market derivatives, spared stock of carbon credits including offsets, etc.).

Jan Holzapfel (Captive Mutual) emphasized the fact that CDM/JI projects were designed to deliver a product (e.g. electricity, steel, etc.) and to simultaneously generate emissions reductions as such supporting the internal rate of return of the investment. The recognized monetary value of the emissions reduction is expressed on a per unit basis. Incorporating pollution reduction measures raises a number of questions which aim is to ensure that the design objectives are met and that the monetary value of CERs/ERUs (or their bankability) will be recognized. They include the following:

- Have UNFCCC-approved methodologies been used?
- Does the project involve any transfer of technology?
- What is the local contractor's track record?
- What level of experience do the consulting engineer and certification organization have?
- Who are the financing parties?
- What are the collateral requirements?
- Approvals and operating licences from the local and national authorities as well as the national grid?

Insurers will also consider information such as:

- Contractual arrangements (ERPAs) for the delivery of CERs (parties involved, expected volume of CERs, key terms and conditions including warranties)
- Regulatory aspects (status of project registration process before the UNFCCC and the Designated National Authority, local HSE issues if any, etc.).

Full questionnaires and document requests can be found on the Parhelion and Chartis[123] websites.

In most cases, companies will be requested to produce copies of key documents such as the Project Design Document (PDD), the ERPAs in place, contracts relating to the transactions to be insured, audited financial statements for key participants, etc.

All such criteria involve an inherent risk of delay and/or non-delivery of CERs/ERUs for as long as CERs/ERUs are not certified and the additionality of an operational nameplate production capacity is not proven. This is why insuring CERs for delayed or undelivered delivery from renewable energy projects that have yet to be built is not a straight forward process.

123 http://www.chartisinsurance.com/ncglobalweb/internet/US/en/files/Carbon%20Credit%20US%20%20090109_tcm295-210031.pdf. Retrieved on 9 November 2010.

d. Assessing the quality of a project

The quality of CDM/JI projects can vary significantly. The numerous bogus offset projects (see HFC23 and adipic acid projects in China) have prompted the EC to call for a reform of the CDM mechanism, recognising only those projects that genuinely generate additional emission savings and that go beyond the cheapest options[124].

Quality - which should translate into lower exposure to risk from an insurance standpoint - can be assessed based notably on the following key characteristics of offset projects:

- The quality of the underwriting information and supporting documents.

- The decision by a company to develop or participate in a CDM or JI project involving a technology it is familiar with.

- The results of feasibility studies covering financial, technical, geographical, political and regulatory aspects (including the level of the country risk, exchange rates and prospects of changes in law). Pre-validation assessment reports and credit standing of the project sponsor will be valuable elements for an insurer.

Gaëtan Cadero said that the feasibility surveys which Lafarge carries out prior to investing in a CDM project are based on an extensive review of operational data. They cover features such as actual emissions reduction, additionality and prospects of effectively being delivered CERs based on UNFCCC criteria. Surveys also include a comprehensive analysis of all risks (including technical, political and regulatory) associated with a project. The technical, quality and performance characteristics of a CDM project are reviewed and assessed in the same way as any other industrial project.

- The stage reached in the UNFCCC and local administrative process. The more advanced a project the lower the regulatory risk. Being granted the registration status at the CDM EB and meeting the Measurement, Reporting and Verification (MRV) criteria under the Kyoto Protocol should in principle mean that the project has met high quality standards.

- Local monitoring. Jan Holzapfel (Captive Mutual) mentioned EcoSecurities, a project developer and aggregator that produces and purchases primary and secondary carbon credits. EcoSecurities employs teams locally to monitor CDM/JI projects and verify that they are pursued according to plan. The company's goal is to improve the prospects of delivery being achieved within the contractually agreed timeframe. EcoSecurities' business model calls for the purchase of a large volume of CERs/ERUs from various sources and projects it undertakes across the world in order to mitigate the risk of delayed and/or undelivered carbon credits. Any unexpected delays in the delivery of CERs will impact price volatility on carbon markets, increase the level of uncertainty, reduce credibility and may seriously affect the company's shareholders' value as previous experience as shown. Holzapfel also referred to the Gold Standard Foundation as one of several Non-Governmental Organizations that work with local stakeholders in order to provide a higher degree of control and quality of projects (in all their phases) and therefore enhanced probability of delivery of CERs. Gold Standard has entered into an agreement with companies such as Carbon Re and Munich Re.

[124] *Questions and Answers on the Communication Towards a comprehensive climate change agreement in Copenhagen*, European Commission, 28 January 2009, MEMO/09/34.

- Independent certification. Insurers will seek to know which organization will be measuring the offsets and how often this will happen. Asking an independent accredited auditor to provide a report validating offsets to the accrediting body will help. So will asking a second auditor to perform an independent post-start audit comparing actual CO_2 emissions reductions achieved to emissions but for the offsets, whether the emissions are calculated based on design models or in field assessments of similar projects using similar technology.

- Fungibility. Insurers need to know which schemes CDM/JI project accredit is under and which use can be made on the offsets (compliance, trading, voluntary schemes, etc.).

- Mitigating effect of the large portfolio of projects owned by aggregators. Alexandre Kossoy (World Bank) said that ERPAs could mitigate some of the delivery risks through seniority, right of first refusal, call options and sweeping clauses which allow buyers to receive additional annual CERs generated by a project. In addition, delivery risk is naturally mitigated through the diversification (regional and/or sectorial) in the funds' portfolio of investments in carbon projects. Funds can also limit the contractual volume to be purchased (i.e. to 80% of the expected CERs/ERUs generated) to create a cushion in the case of unexpected reduction in the annual generation of CERs/ERUs (i.e. in the case of a hydro project during a draught season).

e. Consideration of the specific identity and needs of an insured party

Jan Holzapfel (Captive Mutual) said that the way an insurer assesses a risk depends on whether the policyholder is a CER/ERU buyer or a CER/ERU seller (and potentially its contractor). One has to contemplate the specific project risk landscape and determine which party(ies) will carry what risk. He added that the manner in which insurance could be arranged depended on a party's type and level of contractual involvement in a project and the specific risks it is exposed to (see Stakeholders). Insuring a buyer implies increased exposure to issues including, but not limited to, moral hazard, risk of a third party (credit) default or political risks. A buyer does not own the asset nor does it have any physical, operational, risk management or loss mitigation control over it. By contrast, it is easier to deliver insurance to a seller, which is the future owner of an asset, because it will have control over the entire process of a project i.e. from design to operational stages. It will also have access to a high level of information from all parties and contractors involved. It will therefore typically procure project insurance covering its assets (including contractor's liability) against material damage and any subsequent financial losses which will secure its financial "debt" and other obligations in the event of a loss occurrence.

Holzapfel said that in some cases, insuring a CER/ERU buyer's risks may reach the limits of insurability because of same buyer's specific situation in the overall risk landscape. Insurers that have no local outlets providing them with access to specific knowledge of local habits, ways of conducting business and the handling of compliance issues may need to factor in specific constraints and hurdles when selling insurance products for renewable projects. Issues notably include the lower level of transparency, restricted access to key data, less reliable contractors, lack of track record, potential bribery and contract uncertainty. The language barrier alone can seriously interfere with an accurate assessment of a risk. A further issue relates to some countries prohibiting foreign companies from owning a share or majority share in a company (such as China), meaning reduced stakeholder control. Depending on the parties involved, this can deprive an insured CER/ERU buyer as well as its insurers from exercising any control over a project, leaving a local joint-venturer's hands free to take decisions (possibly under a government's guidance) which could interfere with (or even jeopardize) the delivery of CERs/ERUs. It could

also mean greater difficulties for insurers in recovering paid losses from the party which fault has been established. Holzapfel insisted on how important it was for a project insurer to have local expertise for CDM projects.

Julian Richardson (Parhelion) agreed that local insurance markets were able to provide the more traditional insurance which local companies need for their CDM/JI projects. However for a company such as Parhelion, to sell insurance locally would require an international network which would not economical.

3.3 Dealing with volatility

a. Carbon credit prices

One of the achievements of the Kyoto Protocol and the ETS is to have put a price - albeit subject to volatility - on GHG emissions.

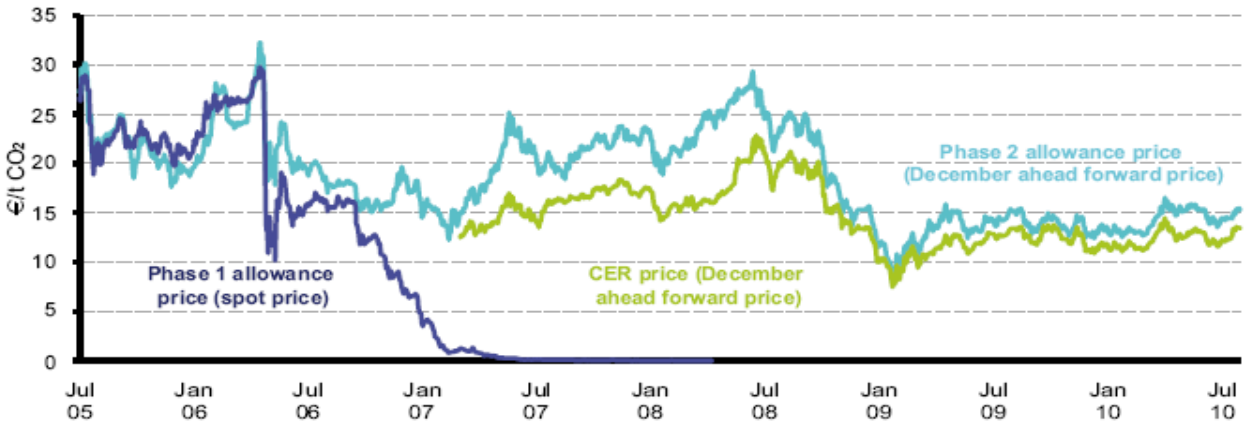
In a cap and trade system such as the ETS, prices are driven by supply and demand.

Supply is essentially controlled by the EU. In deciding on a cap and allocating allowances, the EU seeks to meet the international commitments in terms of emissions reductions. However it also has to prevent its industries from shutting or relocating as a result of the additional costs the ETS imposes on them. To a lesser extent, supply is also driven by the volume of offsets generated from CDM and JI projects therefore dependent upon the level of investment in such a field. Each jurisdiction caps the number of CERs that can be used for annual emissions accounting.

The EU also has an impact on demand since the companies that are subject to the ETS receive limited allowances and are subject to penalties if they are unable to comply with caps set. Demand increases as the volume of allowances reduces. Reversely, it increases when companies have been granted an excessive amount of allowances, as was the case in Phases 1 and 2. Speculation which carbon markets have attracted just like any other spot market can also contribute to scarcity thus higher levels of demand.

Market history

EUAs and CERs have been traded for over five years now and the following can be said about the way prices have fluctuated.



Source: CDC Climat (based on Bluenext and ECX data)

Spot price represents the price for immediate delivery of EUAs/CERs and forward prices the current price of EUAs or CERs delivered at a later date.

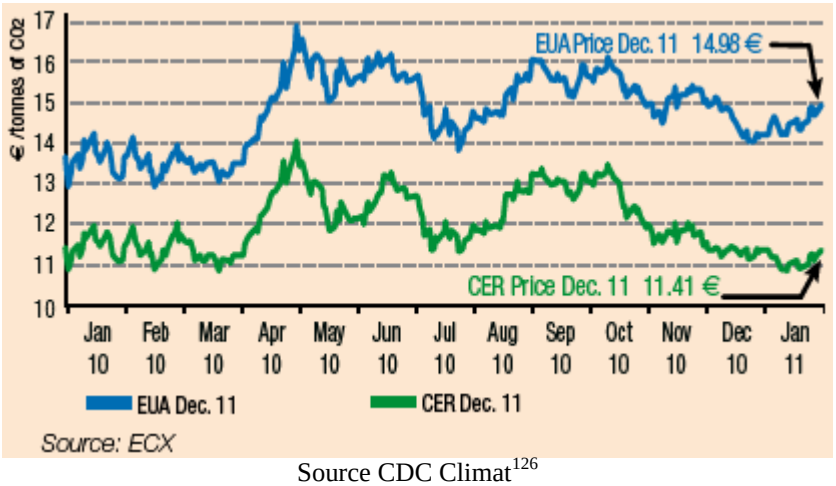
- **Phase 1** of the ETS (2005-2007) has been described as the "*learning by doing phase*". 2,52 bn allowances were traded during that period with peak levels of EUA prices reaching the EUR20-30/t mark in 2005-2006. Prices then dropped to EUR10/t when first verified emissions reports published by the EU in April-May 2006 revealed that actual emissions were in fact lower than expected for Phase 1 and that a group of countries were left with significant amounts of unused CO_2 quotas. The consensus was that emissions projections at the time the reduction targets were made had been calculated on the basis of insufficient data (in the absence of actual measured emissions). In addition to the abovementioned EU reports, the global economic collapse in 2007 severely impacted production levels therefore reducing emissions and the demand for carbon credits. Prices crashed to levels close to EUR0 (which was also bound to happen because allowances could not be carried forward to Phase 2).

  A.D. Ellerman, C. de Perthuis and F.J. Convery[125] commented that overall, Phase 1 had had no restricting effects on EU companies nor did it have any impact on competition as it turned out to be cheaper to buy allowances than to invest in clean technology. Despite this, GHG emissions in the EU actually reduced by 2-3% during Phase 1.

- **Phase 2** (2008-2012) involves the trading of 2,68 bn allowances. According to CDC Climat, 1,908Mt were allocated as against 2,072 Mt actually emitted (all sectors combined), resulting in a deficit of 0,387 Mt.

  Cash constraints associated with the financial crisis caused a number of companies to sell their carbon credit surpluses on the market. The demand for carbon also dropped as financial institutions and private investors turned to safer business. This contributed to EUA prices dropping to a lowest of EUR8/t in February 2009. Prices then went up again during the second quarter of 2009 notably as a result of a strong increase in share of forward contracts for delivery in December 2009. They dropped again after the Copenhagen summit.

  2010 has seen prices driven up slightly by companies' anticipation that they would be short of EUAs in Phase 3 and that prices would rise as a result. Between January 2010 and January 2011, the price of EUAs has ranged between EUR13-17, CERs between EUR11-14 and the spread between EUAs and CERs has increased from EUR2 to EUR3,5.



Source CDC Climat[126]

[125] *Pricing Carbon: The European Union Emissions Trading Scheme*, Cambridge University Press, 2010.
[126] http://www.cdcclimat.com/IMG/pdf/tendances_carbone_cdc_climat_research_no55_eng_.pdf

There has always been a gap (Spread) between the price of EUAs and CERs. CERs should quite normally be cheaper than EUAs because of the limited eligibility of CERs under the ETS. Quality of CERs also affects the price of CERs downwards[127]. The lack of homogeneity between CERs and varying validating risk can also lead to differences in terms of pricing as between CERs.

Market fundamentals

Economists have determined that since Phase 1 had incepted, carbon credit prices at a macro level (i.e. irrespective of the quality of a CDM or JI project) had been sensitive to several types of fundamentals.

The first is a physical fundamental including events such as extreme weather conditions, the increase in fossil fuel prices, technical progress or the switch to cleaner fuels. An economic recession (to the extent it affects usual levels of production) will also affect emissions and therefore spot carbon market prices.

The World Bank noted that the price volatility in Phase 2 had correctly reflected macro-economic fundamentals (in particular, carbon markets had reacted in the exact same way as other energy commodities during the recession) and that prices during the same phase had reflected the demand for carbon assets in line with the levels of emissions cap and the actual level of emissions[128].

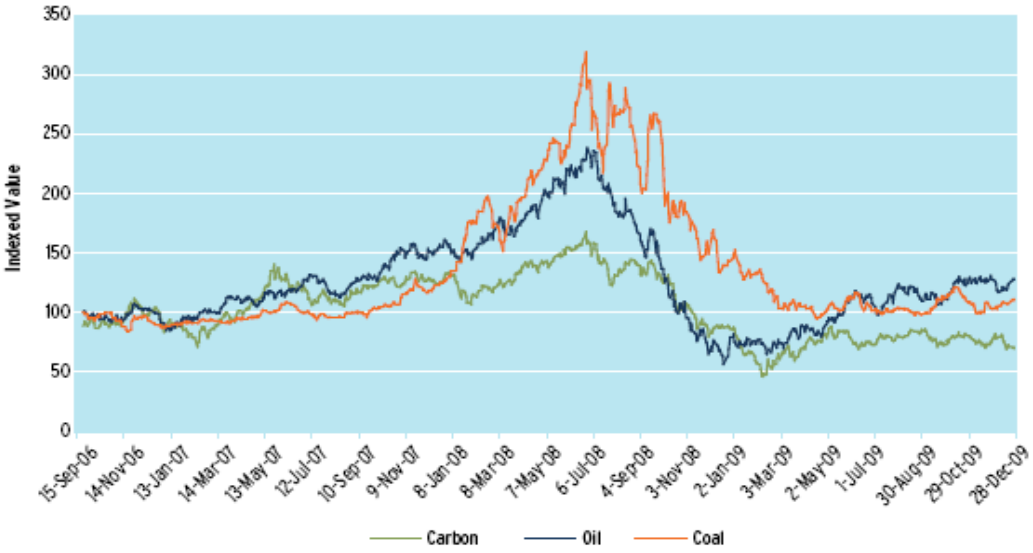


FIGURE 4
Comparison of carbon, oil, and coal prices, Sept. 06–Dec. 09
Source: World Bank

Source: World Bank

The second fundamental is informational: surveys, data (e.g. evidence that excessive level of allowances have been allocated to companies) and rumour.

[127] The less risk a CER will bear (all risk, validation risk, registration risk or volume risk) the higher the price. The involvement of institutions such as Gold Standard, contractual warranties from sellers and the procurement of insurance will also affect prices positively.

[128] *State and trends of the Carbon Market 2010*, World Bank. http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf. Retrieved on 24 February 2011.

The third is institutional. High levels of allowances will push prices down; low levels will push them up. Auctioning may push prices higher up than low levels of allowances would. The ability to bank allowances should sustain prices for a longer period of time. Levels of admissibility of CERs and ERUs will also affect levels of demand for EUAs. The linking of carbon markets should make it possible to achieve emissions reductions at a lower cost.

Projections

Although market prices for permits have been relatively stable since mid-2009, there is considerable uncertainty as to what prices will be post 2013.

Phase 3 (2013-2020) foresees a major change as the auctioning of allowances will become the rule rather than the exception. The third trading period will also see free allowances decreasing in number, new sectors entering the scope of the regulation (including aviation). Further changes will be implemented such as tighter limits on the use of offsets and unlimited banking of permits between Phases 2 and 3.

With such changes, carbon prices are expected to rise which will probably stimulate demand for carbon credits. The consensus among market commentators appears to be that the average price of EUAs will be around or below EUR30/t during Phase 3[129]. They foresee some degree of stability in carbon spot market prices and believe that this will continue in Phase 3 with auctioning actually strengthening price signals and reducing EUA volatility[130]. As for traders, they tend to anticipate EUR10-EUR25/t as a credible price for EUAs.

The industries are generally less optimistic (or more prudent). They expect carbon credit prices to escalate due to increased scarcity and to the auctioning system. One however should bear in mind that this is exactly what was expected for Phases 1 and 2. Quite to the contrary, prices crashed. Julian Richardson (Parhelion) did not believe that carbon prices could crash again in that way because allocations are now based on actual emissions measured rather than estimates.

The price of carbon credits and the volatility risk which inevitably stems from uncertainty as to future supply and demand conditions are central questions for companies (and indeed in turn for their insurers). They require stronger long-term signals on carbon credit pricing in order to meet future requirements and purchase appropriate protection.

A business group formed at the January 2005 World Economic Forum called for "*clear, transparent, and consistent price signals*" through the "*creation of a long-term policy framework*" that would include all major producers of GHG emissions. 150 companies were part of that group as from December 2007. In May 2009, the Institutional Investors Group on Climate Change, representing $5.5 trillion in assets, regretted that carbon markets had not provided the "*strong, long-term price signals that are necessary to support large investments in low-carbon solutions*".

Companies are not pleading for a fixed price. Rather, they request reliable assumptions and variables so that the risk of volatility of carbon credit prices can be properly accounted for in their investment plans. The governments' response has been generally supportive. Putting a price on

[129] The modelling of the EC Commission predicts that carbon prices will be around EUR20 in 2030: SEC (2010) – 650, p.30, pp. 33-34.

[130] *State and trends of the Carbon Market 2010*, World Bank. http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf. Retrieved on 24 February 2010.

carbon emissions now appears to be an integral part of climate and energy policies. The 2009 EU Directive actually introduced an article (29a) that provides for measures in the event that price evolution does not correspond to changing market fundamentals. In 2010, Christine Lagarde, French Minister of Economy, publicly committed to set the ground necessary for a sound price as well as a certain degree of certainty and reduced volatility. The EC, which believes that EUR30/ton would encourage investments in low-carbon technologies, has also expressed some sympathy towards the industries' call however no proposals have as of yet been put forward.

It has been suggested that the price signal might come from insurers based on the premium they would charge for carbon credit-related risks. Unfortunately, there is no such premium to refer to as of yet.

b. Moderating volatility

Jean Morch (Arkema) said that investors saw the volatility of CER prices as a great risk. He stressed the fact that the EC today only allows companies to partially convert their CERs into EUAs and that this was expected to get worse in Phase 3. He wondered whether CERs might actually still have any value at all after 2012 considering the uncertainties regarding the regime that will succeed the current Kyoto Protocol.

There appears to be a general understanding that insurance typically covers costs (stemming from PD and subsequent BI) whereas risks associated with the fluctuation of prices are a matter for the financial markets because they cannot be pooled. Jean Fournier (Global Aerospace) took a different view: he believed that there was nothing to prevent an insurer from covering price volatility so long as there is fortuity.

Julian Roberts' (Willis) view was that insurance generically (regardless of carbon) is very poorly suited to address price risks. Roberts believed however that insurers were broadly obliged to keep such price volatility on their balance sheets, as appropriate contingent hedging is seldom feasible. In contrast, financial instruments such as options and futures which are available on traded markets are far more efficient mechanisms to cover the price risk. As Fournier noted, the financial market is better option in short term trading provided that there is a financial counterpart, as it arbitrates risks (this can be done instantaneously thanks to the highly sophisticated financial trading tools that are available).

In Christoph Möcklingoff's (Marsh) view, the risks associated with carbon price and the smoothing of same are dealt with by bank models however those relating to project certification and the delivery of carbon credits can be handled by insurance.

Julian Richardson (Parhelion) agreed that volatility preventing insurers from offering cover was a distraction. Indeed, volatility is part of standard business interruption coverage in many lines of business involving commodities.

By way of an example, a number of very large insurance claims in the mining industry have been made for loss of sales of ore at a time when market prices for such ore were at their peak. Typically, lost production is valued on the basis of a commodity's average price on a market such as the London Market Exchange (LME) several months (generally three) prior to the date of loss[131].

[131] Example of a Commodity Price Cap provision:

This way an increase of international market prices attributable to the insured's loss (assuming the insured's worldwide market share is sizeable) will not be indemnified. In addition, the very substantial business losses claimed in the recent years (and in some cases underinsurance situations) have lead insurers to cap their exposure to the fluctuation of the market indices.

Coverage would not however be unlimited. Roberts said that generally, if at all covered, insurance provides a "put" option on pre-agreed, fixed prices.

Based on his own experience of a number of BI claims involving commodities, Jason Reeves (Zelle Hofman) agreed that insurers may sometimes unintentionally cover the volatility of carbon prices.

The ways insurers can limit their exposure to volatility are multiple.

- It would seem that a maximum loss per ton of CO_2 would not in the worst case exceed the price of the penalties (for which insurance is generally prohibited) which are imposed by the ETS (currently EUR100/t) because that is the highest price a company can be required to pay (per ton) for increased costs or loss of credits. Such penalties may of course be higher in Phase 3.

- Most insurance policies set a monetary limit on their exposure (one notable exception is motor liability insurance in France). In some cases, sub-limits apply for specific risks covered under the policy.

- Policies can include a provision which states specifically in relation to carbon credits that the premium will be renegotiated (upwards or downwards) at a policy anniversary date (in case of multi-year coverage) or in the event spot market prices fluctuate beyond a certain spread or average during a certain period (typically one year). Same spread should be established based on a stochastic model accounting for the variables (and their respective average weight overall) that can affect market prices (see the variables identified by Economists).

Carbon allowances are allocated on a yearly basis. Quite logically, the closer to the year end (whether the end of a calendar year or that of the cap and trade which is April under the ETS), the more accurately a company will know whether it will be short or have surplus credits available. Market prices are therefore likely to rise or drop more sharply towards the end of a year than at the beginning. This however should not necessarily increase insurers' risk. It would actually reduce it if prices drop at year end and this is when an insured loss arises. Also, as will be discussed in the valuation of loss section, if a BI loss, as is quite typical, lasts several months, indemnities paid out will be based on the average market value of credits over that same period. That way fluctuation will be spread over the period.

"This Policy is subject to the following memorandum: for the purpose of calculating any BI loss hereunder any calculation of the loss of Gross Revenue and/or Turnover, as defined in the Policy Wording, shall be made using the lesser of the spot price prevailing during the period of such interruption or the commodity price caps as below:

- Copper at wUS$ per lb
- Zinc at xUS$ per lb
- Gold at yUS$ per oz
- Silver at zUS$ per oz".

3.4 Contract certainty

Wordings must account for the specificities of carbon credit risks.

This is the message Jason Reeves (Zelle Hofman) publicly raised in respect of conventional PD/BI policies five years ago when he first stated that appropriate wordings were required to avoid disputes on potential multi-million $/EUR claims. There has been little reaction from markets since and Reeves was unaware of any insurer having implemented any specific wordings and/or underwriting and claims guidelines addressing carbon credit-related risks. Lee Swain and Markus Heiss (MD&D) confirmed that they had never seen any specific wording addressing carbon credit related issues in the claims they had handled.

In Reeves' view, this appears to be due to the lack of carbon transparency, to the lack of knowledge in the insurance industry and to the fact that most insurers still perceive carbon credits risks as modest in the overall cover provided for BI and Extra Expense.

Ewan Cresswell (Integra) agreed that if parties intended to include carbon credits in coverage this should be spelt out clearly in policies. He added that adjusters and experts needed to be aware of the whole concept of carbon credits and how policies - most of which are currently silent on the matter - should respond.

The writer's comments on wordings that are agreed in specific carbon credit non-delivery policies are limited since only one sample (hereafter Policy "X", which may not be representative of all) was made available.

Julian Richardson (Parhelion) advised that specific policies used standard industrial and political risk language with some adaptations reflecting the features of carbon credit related risks. The main difficulties he said pertained to the definition of losses and the basis of indemnity (which in most cases is in the form of an agreed value rather than physical replacement of credits[132]).

The comments to follow apply to relatively standard Property Damage and BI policies. Christoph Möcklingoff (Marsh) confirmed that including CDM/JI projects in a traditional PD/BI cover required some tweaking of standard wordings, particularly with regards to the valuation of loss. Delimiting the scope of cover is also key (e.g. is there any supply chain risk and if so, should it be insured under the supplier's policy or that of its client?).

a. Including CER cover in conventional PD/BI cover a risk in itself?

At least one traditional policy (hereafter "Policy Y") has been seen to consider (fortuitous) carbon credit-related losses as indemnifiable BI losses in circumstances where they affected the profits expected by a company from a CDM project.

The Policy Y wording contained special sub-limits (EURx per CER) applying to CERs acquired by two CDM projects. This included an overall monetary sub-limit (per claim and in the aggregate) as well as a sub-limit per ton (up to EUR15). The maximum indemnifiable period was 12 months (as is standard under conventional BI coverage).

[132] Policy "X" provided for indemnity to be paid in cash or in replacement CERs.

Deductibles are included in most insurance contracts as a means of reducing moral hazard (precautionary behaviour tends to relax when companies know they have insurance protection). Specifically in respect of CERs, Policy Y included a 20-business days deductible, which is lower than the average 30 to 45 days waiting period which BI policies delivered to global corporations usually contain.

Policy Y also contained two exclusions that specifically referred to CERs. The purpose of the first was in fact purely technical (as was that of other exclusions in the policy pertaining to various installations). The second exclusion expressly applied to financial losses relating to the trading of CERs as a result of negligence from a supplier or customers not within the insured company.

Justin Crick (RGL Forensics) said that the only way an insurer's exposure to carbon credit related losses can be limited is by setting a cap on the sum insured. General average/coinsurance clauses in cases of underinsurance may also reduce an indemnifiable loss but in practice, this is often excluded by policies written by companies established in developed countries.

The following key provisions appeared in Policy X:
- Failure to deliver is any event not excluded under the policy;
- Cover is subject to successful completion of UNFCCC stages (e.g. no BI claim without the CDM EB's green light on project commissioning, etc.);
- The insured must notify to the insurer any material change that may affect the production of CERs.

One international broker said that he had placed one CAR/EAR policy for a company that had launched two CDM activities in Asia and South America thanks to the efficient technologies it had developed. Placing the risk involved educating the insurance markets to the mechanisms of the Kyoto Protocol. Although at first reluctant to consider the specific features of CDM programs and the high values at stake (several tens of million EUR exposure), markets (mainly continental) were eventually happy to follow the lead on the proposed program and wording. The policy is a standard all risks project coverage which includes indemnity payable in the event of non-delivery of CERs as a result of a physical damage (e.g. machinery breakdown, natural catastrophes, etc.) including interdependency effects on the insured units. Political and regulatory risks are not insured. The insured's main interest in procuring such cover was to ensure that some (albeit not 100% in view of the capped carbon prices in the policy) certainty as to the expected revenue in the event of a fortuitous peril occurring. The broker said that the risk manager he had dealt with was particularly well aware of carbon regulation and its mechanics which made it easy for him to determine the scope of insurance so requested. The policy was the subject of one claim to which the wording had responded adequately.

In Jonathan Young's (Munich Re) view, insurers do not realize that certain carbon credit risks are covered under conventional PD/BI cover and wordings that he has seen are not adapted to such risks. Young also said that on one notable occasion, even when a broker and insurer had attempted to clarify cover for carbon credits under a standard PD/BI cover, the result had been worse than doing nothing, because of a lack of knowledge of even the basic terminology and mechanics of the carbon market. This is why Munich Re's approach has been to separate out the carbon element from standard PD/BI cover and to offer more appropriate, broader cover.

b. Valuation of loss

What wordings should state

Valuation of loss is a very sensitive aspect of carbon credit coverage. There are many ways in which a loss can be adjusted and many variables to be considered. Wordings must address this situation in identifying the correct way to value a loss, i.e. by providing answers to the following questions:

- Which variables should be used in calculating a loss:
  - expected, actual and/or saved emissions?
  - average allowances over a specified period of time?
  - spot market carbon price?

- Which price should be used to calculate the value of lost carbon credits?
  - pre-agreed price/carbon credit forward sales prices?
  - spot market price?

- At which date should losses be valued?
  - at a particular date (date of loss, date of expiry of a contract, date of purchase/sale of additional carbon credits, when the insured loss is settled, when a production interruption starts, etc.)?
  - based on a (daily or monthly) average price over a specified period of time?

The Policy Y wording specifically provided that the relevant price of a ton of CO_2 should be the price at which same ton of CO_2 had been sold forward or, by default, the average spot price during the entire interruption period (subject to applicable sub-limits).

In Policy X, losses should be valued on the following basis:
- if CERs are paid on delivery (i.e. no cash actually paid out yet): insurer will reimburse the difference between the CER spot price at the time of the failure delivery (assuming it is higher than the contract price) and the contractually agreed CER price multiplied by the overall number of undelivered CERs;
- if CERs have been paid upfront: insurer will reimburse an agreed amount per undelivered CER (which may be a fixed EUR amount, a percentage of the CER spot price or any other agreed formula).

Justin Crick (RGL Forensics) said that in practice, the value of saved carbon credits and additional carbon credits required as a result of a loss was often calculated on the basis of the weighted average carbon market price across the loss period. However, consideration needs to be given to how each individual business trades carbon.

The questions which MD&D (forensic experts) will typically ask when adjusting a carbon credit claim include the following: what does the company's business model factor in terms of carbon? Is it supported by historical data? What quantity of physical emissions has actually been saved as a result of the loss? In addition, clear documentary evidence such as invoices for the purchase of additional allowances will be requested to support claims.

Justin Crick, Lee Swain and Markus Heiss (MD&D) confirmed that there were no universal accounting rules governing carbon credits. The IASB IFRIC 3 rules adopted in 2003 were

eventually deemed inappropriate due to many dissensions and therefore retracted. One key problem is that companies receive allowances at no cost (nil reported in balance sheets) and that sales price when they are traded must be booked. In the circumstances, companies generally record the sale as a cost of sale at the end of the relevant accounting year.

Need for accounting harmonization

The absence of a legal definition and classification of carbon credits raises serious accounting issues for the assessment of insurance losses. A number of companies have called for a standard framework to be incorporated in investment-related information and to comply with international accounting standards.

Alan Taylor (Charles Taylor Adjusting) noted that in practice, carbon credits were treated as variable costs and therefore credits should be used to mitigate a loss.

The IASB rules appear to treat (free) allowances as a governmental grant recorded as intangible assets at fair value and amortised during a yearly period (with a corresponding entry as deferred credit).

In a market presentation in 2005[133], Erik Saether, former head of Vattenfall Trading Services, explained that his company booked allowances (whether granted or purchased) as inventories in its balance sheet. If such allowances were received or purchased at a value lower than fair value, the inventory asset would be reported at fair value and as a deferred income. A governmental grant would be carried over the year as income and that both a cost and a liability would be reported to reflect the company's obligation to provide rights to compensate for its CO_2 emissions.

Under French law[134], allowances granted and carbon offsets must be booked as intangible assets (rather than stock or financial instruments). Allowances must be valued at the date they are received based on spot prices. They can be booked as a governmental grant (since allowances must eventually be surrended) or as deferred revenue in the liabilities part of a balance sheet. By contrast with the above companies, trading companies must book carbon credits as stock or as securities.

Swain and Heiss said that valuating carbon credit-related losses had been relatively simple in the claims they had adjusted so far. Calculations are primarily made based on market value during the outage period. Swain and Heiss agreed however that matters could get complex in other circumstances. Swain gave one example of a claim made at a time when carbon credit spot prices were at their highest but resolved much later when prices had dropped to nearly zero. Absent international standards, parties must turn to national laws to find answers (if there are any clear ones). Swain added that free allowances were a key accounting issue because they created a lot of potential variations to profitability. This problem however could be resolved with auctioning becoming the rule by default (however only up to 60% of allowances only) in phase 3 of the ETS (buying allowances would take away at least some of the uncertainty).

Specifically with regards to forestry (which is not covered by the ETS), Phil Cottle (ForestRe) said that one difficulty from an insurance standpoint had to do with the valuation of a "forest" carbon loss. Indeed, when a tree dies for any reason, it releases carbon over a certain period of time (say 5 years within the California Air Resources protocol). If insurance for the moment assumes that the

[133] http://www.vattenfall.com/en/file/Erik_Saether_8458322.pdf slide 21. Retrieved on 29 December 2010.
[134] Avis n°2004-C adopté par le Comité d'urgence du Conseil National de la Comptabilité, 23 March 2004.

tree releases 100% carbon on the date of loss, an insured might be compensated in effect in advance of the actual loss of carbon under the protocol which should be attractive in terms of cash flow, and for the management of the claim is administratively easier for insurers (compared with say 5 annual loss payments).

c. Due diligence and duty to mitigate losses

A fundamental principle in insurance law is that an insured should at all times act as a prudent uninsured. This is otherwise known as acting in due diligence and can be set out expressly in a policy wording or considered as an implied term.

To act diligently requires that an insured does and concurs in doing all things reasonably practical to avoid or diminish any loss of or damage to an insured property.

Ewan Cresswell (Integra) noted that carbon credits were assets of growing financial importance to companies such that a number of them actually dedicated personnel on that front. He wondered whether managers at plant level (as opposed to corporate) were aware of the implications of carbon regulation. Local managers in the event of a loss could innocently be guided strictly by operational considerations ignoring those pertaining to carbon regulation.

A question arises as to what an insured might be actually expected to do in the event of a loss involving carbon credits.

A Resumption of Operations clause in a business interruption cover may require that the insured makes use, *inter alia*, of other property (which might include spare credits) at the location(s) owned by the insured to reduce the claim. Such reduction should then be taken into account in arriving at the amount of loss.

As was discussed, many companies hedge their exposure to commodities costs (including carbon credits) through financial instruments. Companies have also in large part been able to save allowances from Phases 1 and 2. They may also be losing credits on the affected plant but still have surplus allowances at other installations such that overall the company would not have to purchase credits as a result of the loss.

In such circumstances, should an insured first have to use any spare credits (including those that it was granted at no cost) and/or financial instruments in order to mitigate its loss prior to making an insurance claim? If so, should corresponding values be deducted from an insurance claim? If for example an insured company owns calls (options) that can be exercised at a price lower than the price which an insurer would have to pay to make up for the company's lost credits, does he have a duty to exercise the calls in order to reduce the insurer's loss? If this is the case, the insured would lose the benefit of exercising its options at a later (and perhaps more favourable) moment in time.

Jason Reeves' (Zelle Hofman) view on this was straight forward: there is no legal basis to compel mitigation though it might be done in practice. Without adequate statutory provisions or accounting standards it is unclear how carbon credits should be treated. Reeves' view was that carbon credits may be considered assets that belong to a company. As such, it is difficult to compel an insured to sell any of its credits, albeit granted at no cost (as is the case in Phase 2), in order to

mitigate a loss. Reeves's conclusion was that a clear stipulation in insurance contracts would avoid parties disagreeing on a matter with such potential value. In his view, it should be abundantly clear to insurers when rating a policy that unused carbon credits will or will not constitute a saving. Reeves warned that there were potential negative commercial consequences for compelling mitigation in a loss scenario. Indeed, policyholders may want less insurance and if the profit from freely allocated credits was included in the rating then the cost of carbon comes in and goes out of a loss adjustment i.e. there is no net effect.

Justin Crick (RGL) agreed that it would be unfair for an insurer to request that the insured exercises its options (assuming this would be cheaper than to indemnify the company for the purchase of quotas at actual market prices) for any other reason (e.g. increased demand meaning more production thus more pollution). In other words, the insured would not be put back in the position it would have been in but for the loss. An exception to this would be if the insurer could establish that the options in question had been purchased specifically to mitigate a loss insured under the policy.

Lee Swain and Markus Heiss (MD&D) agreed that mitigation of loss was another source of complexity. In principle, they expected that the operating entities of a company and a trading department would be two separate legal entities. As such, by way of an example, an insured having suffered an operational loss should not be expected to exercise calls which its trading department would have purchased for entirely different reasons with a view to reduce the amount of loss. In practise however many other items have to be factored into and there is no certainty as to the exact scope of an insured's duty to mitigate a loss.

d. Salvage stemming from "outage credits" to be set-off claims

The cessation or reduction of production can lead to savings in fuel consumption, operations and maintenance. It would cut a company's emissions as a consequence, as would the reinstatement (or reconstruction) of cleaner production units. Such type of salvage should normally, where legally permitted, reduce a loss accordingly.

The 2003 EU Directive states that no free allocation will be given to installations that have ceased their operations except if their operators can demonstrate that they will resume production within a reasonable and specified time[135]. The legislation does not clarify however whether in the event of a *temporary* cessation of production resulting from a fortuitous physical damage an operator would continue to receive allowances (or have to purchase credits in order to comply with despite the drop in emissions).

In practice, savings have already been taken by insurers for the value of unused carbon credits that companies have been able to save or trade. Amounts at stake in several industrial losses that occurred in between 2006 and 2009 ranged from EUR25,000 to over EUR7,000,000 representing from as little as 0,1-0,5% to as much as 5-13% of the overall claim.

Justin Crick (RGL Forensics), Lee Swain and Markus Heiss (MD&D) attested that most of the (few) claims involving carbon credits that they had adjusted had resulted in savings rather than additional costs to insured companies. Crick said that companies did not instinctively think of

[135] Article 19 of the 2009 EU Directive.

including an assessment of their carbon credit savings in their insurance claim[136]. Lee Swain (MD&D) concurred, saying that deducting such savings from a claim was generally well understood by the insured companies, particularly by the power generation industry which trading desks are well aware of the carbon emissions as a cost factor. When raised by forensic accountants and adjusters most insureds had accepted the concept of saving. Ewan Cresswell (Integra) said that one particular claim had given rise to a disagreement between insurers and an insured as to whether the value of carbon credits saved as a result of a BI should be deducted from a claim or not. The issue was eventually negotiated out.

Swain and Heiss confirmed that if, as a result of the cessation of a production, some CO_2 emissions were saved, this would be treated as an avoided variable cost reflecting the insured's ability to trade surplus allowances (or the fact that same insured does not need to buy as many allowances as initially planned).

Typical calculations of salvage might be based on the following formulae:

(iro industrial production)	
Total lost production (Mt)	100,000t
Less waiting period	50,000t
Net lost production (Mt)	50,000t
Ratio of CO_2 produced to production	1,2
Total CO_2 saved (Mt) [a – possibly per month]	60,000
Carbon price @ x (select date) [b]	x
Carbon saving [a x b] (EUR)	y

(iro production of energy)
[Lost production (MWh)] x (emissions factor in tons CO_2/MWh) = reduction in CO_2 emissions (RCE)
[RCE] x [EUA price @ determined date] = saving in CO_2 emissions (SCE)

Cresswell agreed that if parties intended to deduct the value of unused carbon credits from indemnities paid this should be explicitly provided for in policies. He mentioned American gross earnings wordings which expressly specify what can be treated as savings.

As an alternative solution to salvage deduction value, one might wonder whether insurers would show any interest in taking ownership of saved carbon credits. Although this does not appear to have been ever suggested, the question may be a valid one when considering that insurers could need carbon credits in situations where policies provide for the payment of indemnities in the form of carbon credits instead of cash. Refunds in carbon credits are an ideal way of ensuring that a company is able to meet its compliance obligations. More importantly, owning carbon credits (whether received as salvage or purchased on the spot market) could protect insurers against the volatility of carbon credit prices (as opposed to purchasing credits at a high price if and when a

[136] In Jason Reeves' (Zelle Hofman) view, there is virtually no transparency connected to carbon issues. They may or may not be on balance sheets and some accountants or adjusters may miss that opportunity.

loss occurs). However there is no visibility today as to the potential needs of assureds[137] therefore investing in carbon credits may be premature and a risky bet.

Another open question is whether insurers should be entitled to some form of salvage in case of betterment. One could see a failed production unit being replaced by a greener one - i.e. emitting less GHGs – which would result in surplus credits to the insured (or less credits to buy) possibly for several years. Article 7 of the 2009 EU Directive provides that an operator must inform the competent authority of any planned changes to the functioning of its installation or any significant reduction of its capacity. The authority will in such case update the permit and possibly affect the level of allowances the insured would enjoy post-loss. If this were the case, it would not appear to allocate any salvage or discount value to betterment.

[137] One interviewee potentially interested non-delivery insurance did mention that an issue might arise if indemnities could not be paid out in the form of carbon credits (which will be scarce) rather than cash.

CONCLUSION

The success of carbon credit insurance will very much depend on the way regulation evolves. This is a great source of concern:

- The Kyoto Protocol is due to expire in 2012 and there is currently no certainty that its binding mechanisms will survive beyond that date;

- In the EU, the Phase 3 rules of the ETS will impose further emissions reduction on companies and tighter regulation (auctioning, more restrictions on offsets).

There are some positive signs however:

- The EC has made it very clear that the binding EU emissions reductions were on target and that they should be met by applying the Kyoto Protocol mechanisms. In addition to fighting climate change, the EU sees a long-term comparative advantage for EU industries in terms of energy efficiency and security.

- In further limiting the admissibility of CDM/JI projects and taking steps to eliminate fraud, the EC seeks to reinforce its credibility and that of its policy

- Carbon markets already have a global reach: new cap and trade schemes, albeit not all Kyoto Protocol-based and largely due to regional initiatives, are emerging throughout the world; some of them extend to promising sectors such as forestry

- The economic recovery should see investments in CDM/JI projects increase

- There has been limited volatility on the carbon market prices since mid-2009.

Companies subject to the ETS generally have a good understanding of the legal and financial implications of carbon regulation for their businesses. They are inclined to retain risks associated with the scheme (in the same way as for other production costs) and in most cases have not even thought of insurance as a risk transfer solution. The only exception to this is coverage for Increased Cost of Working typically provided by conventional Business Interruption policies - which insurers may wish to reconsider if massive claims for costs of purchasing additional credits (to meet their compliance obligations) start flowing in.

Demand for specific carbon credit non-delivery insurance is embryonic. It will probably not rise significantly in the very next years and will have to compete with conventional policies allowing for the specific inclusion of CER/ERU coverage. Only a sharp increase in carbon prices or a very large uninsured loss might play in favour of higher interest in insurance.

Due to the recession and investors not paying for carbon offsets upfront, the insurance market is currently more on the sellers' side. As investments on carbon markets resume, the main targets on the buyers' side would appear to be parties interested in procuring catastrophic risk protection (in excess of a relatively high of self-insurance in view of internal pooling of risks) such as (a) captives of global corporations and (b) aggregators with large portfolios of CDM/JI projects.

Carbon insurance will remain a niche market and sales limited for some time. Although Parhelion's recent success in signing up capacity from the Lloyd's may suggest a growing interest in the carbon business, markets are still very much on stand-by and rather looking into other new products such as solar, wind and CCS technologies.

Insurers have yet to prove to their clients why they should transfer risks that they currently retain and why insurance is more attractive than hedging solutions on carbon markets.

The main challenge however is that when they are asked to provide comprehensive insurance, most insurers will not cover regulatory risks by lack of reliable actuarial data, particularly in a context where public policy is so heavily involved and subject to change. Appetite could grow for such risks if the regulatory entities provided more clarity and more foreseeability with regards to compliance and additionality requirements.

So, when will insurers and their clients meet?

Guy Lallour's (XL) view was that the success of specific carbon credit insurance would probably depend on three key factors. Firstly, demand for such cover must be high. Secondly, there must be sufficient market insurance capacity available to cover amounts at stake. Thirdly, clients must accept to be charged a premium reflecting the cost of insurers "discovering" such risks i.e. with no statistics.

Contract certainty is a paramount issue that cannot wait. Poor wordings will inevitably cause disputes between contracting parties. Although parties appear to be keen to include coverage pertaining to carbon offsets within conventional industrial risks policies, these should ideally be the subject of a separate policy (or at the very least a separate section in the contract).

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