The World Bank

State and Trends of the Carbon Market 2007

Washington, D.C. - May 2007

Funded by World Bank Institute - CF Assist

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STATE AND TRENDS OF THE CARBON MARKET 2007

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*The findings and opinions expressed in this paper are the sole responsibility of the authors. They do not necessarily reflect the views of the World Bank or of any of the Participants in the Carbon Funds managed by the World Bank.

ACKNOWLEDGMENTS

We are grateful to many of our colleagues in the carbon market for their cooperation and assistance in preparing this report. In particular we wish to thank Edwin Aalders, Roberto Aiello, Isabel Alegre, Alexandra Amerstorfer, Ellysar Baroudy, Valentin Bellassen, Ulla Blatt Bendtsen, Abhishek Bhaskar, Veronique Bishop, Martina Bosi, Benoit Bosquet, Marcos Castro, Hocine Chalal, Charles Cormier, Jane Ebinger, Garth Edward, Andy Ertel, Jaafar Friaa, Pablo Fernandez, Anita Gordon, Maarten Jos de Jonge, Abyd Karmali, Alexandre Kossoy, Jakob Linulf, Vincent Mages, Andrei Marcu, Renato Marioni, Marco Monroy, Lucy Mortimer, NatSource, John O'Brien, Andrea Pinna, Alexandrina Platonova-Oquab, Neeraj Prasad, Venkata Ramana Putti, Eliano Russo, Laurent Segalen, Sara Stahl, Guy Turner, Jari Vayrynen, Bruce Usher, Kris Voorspools, Xueman Wang, Bernhard Zander as well as numerous others choosing to remain unnamed colleagues from various firms and governments around the world as well as Regional Operations and Carbon Finance Unit staff at the World Bank.

The "STATE AND TRENDS OF THE CARBON MARKET 2007" is supported by resources from the CF-Assist program, managed by the World Bank Institute.

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I EXECUTIVE SUMMARY

IN A YEAR that the need for future action to reduce the risks of climate change has figured prominently on the international agenda, a variety of approaches are being implemented to reduce carbon emissions. These range from efforts by individuals and firms to reduce their climate footprints to initiatives at city, state, regional and global levels. Among these are the commitments of governments to reduce emissions through the 1992 UN Framework Convention on Climate Change and its 1997 Kyoto Protocol, and Europe's carbon constraint for electricity generators and industry under the European Union Emissions Trading Scheme (EU ETS). The carbon markets are a prominent part of the response to climate change and have an opportunity to demonstrate that they can be a credible and central tool for future climate mitigation.

Table 1: Carbon Market at a Glance, Volumes & Values in 2005-06

	2005		2006	
	Volume ($MtCO_2e$)	Value (MUS$)	Volume ($MtCO_2e$)	Value (MUS$)
Allowances				
EU ETS	321	7,908	1,101	24,357
New South Wales	6	59	20	225
Chicago Climate Exchange	1	3	10	38
UK-ETS	0	1	na	na
Sub total	**328**	**7,971**	**1,131**	**24,620**
Project-based transactions				
Primary CDM	341	2,417	450	4,813
Secondary CDM	10	221	25	444
JI	11	68	16	141
Other compliance	20	187	17	79
Sub total	**382**	**2,894**	**508**	**5,477**
TOTAL	**710**	**10,864**	**1,639**	**30,098**

The carbon market grew in value to an estimated US$30 billion in 2006 (€23 billion), three times greater than the previous year (see Table 1). The market was dominated by the sale and re-sale of European Union Allowances (EUAs) at a value of nearly $25 billion under the EU ETS (€19 billion). Project-based activities primarily through the Clean Development Mechanism (CDM) and Joint Implementation (JI) grew sharply to a value of about US$5 billion in 2006 (€3.8 billion). The voluntary market for reductions by corporations and individuals also grew strongly to an estimated US$100 million in 2006 (€80 million). Both, the Chicago Climate Exchange (CCX) and the New South Wales Market (NSW) saw record volumes and values traded in 2006.

EU ETS Phase I demonstrated that a carbon price signal in Europe succeeded in stimulating emissions abatement both within Europe and especially in developing countries. Following the release of verified 2005 emissions data, it became clear, however, that the 2005-07 emissions cap had not been

set at an appropriate level relative to what actual emissions were in that period. As a result, market expectations and the Phase I price signal were based on incorrect assumptions of the carbon constraint, leading to high volatility in the EUA market. The EU Commission stated that Phase I was a "learning phase" and assured the market that it would assess second period plans "in a manner that ensures a correct and consistent application of the criteria in the Directive and sufficient scarcity of allowances in the EU ETS."[1] Market interest in the second half of 2006 shifted out of Phase I, and began to focus on Phase II based on expectations that those caps would be much more stringent.

In contrast to a highly volatile 2006 EUA market, project-based assets showed greater price stability, while transacted volumes also grew steadily. Developing countries supplied nearly 450 $MtCO_2e$ of primary CDM credits in 2006 for a total market value of US$5 billion (€3.8 billion). Average prices for Certified Emission Reductions (CERs) from developing countries were up marginally in 2006 at US$10.90 or €8.40 (with the vast majority of transactions in the range of US$8-14 or €6-11). China continued to have a dominant market-share of the CDM with 61% and set a relatively stable price floor for global supply of CERs.

In 2006, Joint Implementation (JI) projects from economies in transition saw increasing interest from buyers, with 16.3 $MtCO_2e$ transacted (up 45% over 2005 levels) – with Russia, Ukraine and Bulgaria providing more than 60% of transacted volumes so far – at an average price of US$8.70 (€6.70). Preliminary data for the first quarter of 2007 indicate at least the same volumes had already transacted in the first three months alone.

Buyers found it easier to close transactions than six months earlier, while sellers managed carbon price risk by favoring fixed price forward contracts. CER assets traded considerably higher in secondary markets (in a range of US$14.30-19.50 or €11-15) than in primary transactions, although accurate volume data were difficult to confirm for secondary transactions.

Since 2002, a cumulative 920 $MtCO_2e$ (equivalent to 20% of EU-15 emissions in 2004) have been transacted through primary CDM transactions for a value of about US$8 billion (€6 billion). Hydrofluorocarbon (HFC-23) reduction and nitrous oxide (N_2O) destruction projects accounted for approximately half of the market volumes, while renewable energy and energy efficiency transactions together accounted for nearly 21% of the CDM market over the same period.

European buyers dominated the primary CDM & JI market with 86% market share (versus 50% in 2005) with Japanese purchases sharply down at only 7% of the primary market in 2006. The U.K., where the City of London is home to a number of global financial institutions, led the market for a second consecutive year with nearly 50% of project-based volumes, followed by Italy with 10%. Private sector buyers, especially banks and carbon funds, continued to buy large volumes of CDM assets, while public sector buyers continued to dominate JI purchases. A large number of international financial institutions and funds engaged in secondary transactions of carbon portfolios with other banks (primarily in Europe) or companies facing compliance obligations (in both Europe and Japan).

European buyers reported that they increasingly asked for and obtained zero-premium call options to purchase emission reductions beyond 2012. For the most part, the strike price in these contracts was the same as the contract for pre-2012 assets. Others reported a right of first refusal for post-2012 vintages at a future time for an unspecified "market price."

1. See "Communication from the Commission to the Council and to the European Parliament on the assessment of national allocation plans for the allocation of greenhouse gas emission allowances in the second period of the EU Emissions Trading Scheme", COM(2006) 725, 29 Nov. 2006, Brussels.

Outlook

Most market players stated that considerable price risk – and likely volatility – remained in the market for both CERs and EUAs. There is a consensus emerging[2] among market analysts that the expected shortfall in the EU ETS Phase II is likely to be in the range of 0.9 billion to 1.5 billion tCO_2e. Estimates for not-yet-contracted volumes from JI/CDM and projected EU shortfalls are very similar to each other in these projections (unless additional demand before 2012 and the promise of higher prices stimulates additional JI/CDM supply).

The current projected demand-supply balance excluding Canada (and residual demand from Japan) implies that the price of CERs/ERUs is likely to help set the market equilibrium price for EUAs in Phase II. EU ETS companies would be the prime beneficiary of this balance provided that: no significant Japanese or Canadian competition appears for these assets; and provided that there are no surprises from higher than expected under-delivery of CERs/ERUs; as well as no consistent anomalies over the five years from weather or from fuel prices; or any major technological inflection points in that time period. The prospect of EU ETS Phase III – and the ability to bank allowances across the second and third periods – gives a longer time planning horizon to market players considering new investments for abatement from both the CDM/JI and marginal abatement within the EU.

The April 26, 2007 climate change announcement by the Government of Canada calls for improvements in carbon intensity leading to an emission target of 20% below 2006 levels by 2020 (assumed to be 150 $MtCO_2e$ by Canada). The approach incorporates emissions trading and also includes the idea of early action and banking and allows CERs for up to 10% of the projected shortfall. If these assumptions are true, then some demand from Canada could enter the CER market relatively soon.

Developments in California, the eastern United States and Australia hold some promise of market continuity beyond 2012. There is continued debate, especially in California, regarding whether emissions trading, including offsets from overseas will be allowed. Precise rules to be developed will clarify to what extent these emerging carbon markets will seek to maximize value from high quality offsets no matter where they are sourced from. At least two pending pieces of draft federal legislation before the U.S. Senate include provisions that would welcome overseas credits.

The carbon market and associated emerging markets for clean technology and commodities have attracted a significant response from the capital markets and from experienced investors, including those in the United States. Analysts estimated that US$11.8 billion (€9 billion) had been invested in 58 carbon funds as of March 2007[3] compared to US$4.6 billion (€3.7 billion) in 40 funds as of May 2006.[4] 50% of all capital driven to the carbon value chain is managed from the UK.[5] Most of the newly raised money, of private origin, came to the sell-side (project development and carbon asset creation) which currently represents 58% of the capitalization. A key indicator of interest in aligned

2. Based on estimates from average of (central) estimates from Fortis, Merrill Lynch, New Carbon Finance, Point Carbon, Société Générale and UBS for EU-ETS shortfall and demand for CDM and JI.

3. New Carbon Finance, "UK in Pole Position as Carbon Funds Surge – but More Funds required". Press release 4 April 2007, www.newcarbonfinance.com.

4. See R. Bulleid, "The capital begins to flow", Environmental Finance, April 2006.

5. See New Carbon Finance, op. cit.

and closely related fields is the record US$70.9 billion in clean technology investments in 2006,[6] with major investments (and announcements) from well-known investment banks.[7]

Most public companies in the carbon space are in a fast-growth mode and are yet to show a profit. One public company delayed its public disclosure in the wake of an unfavorable analyst report. Some companies cited the delay in the operations of the International Transaction Log (ITL) as a risk that would made it more difficult to earn and book revenues from CER spot sales this year.

There was increased consolidation in the sector and evidence of growing interest in the U.S. markets. A prominent investment bank bought a sizeable stake in a leading project development and asset management company. Another company acquired a boutique analyst firm in the United States, while a third acquired a smaller company in Washington DC specializing in developing Project Design Documents (PDDs). Several European entities opened offices in the United States citing the need to develop a presence in this potentially large market. Reports of early offset transactions in North America filtered in with prices reported in a very wide price range starting at around US$1.50, e.g. from pre-compliance buyers for emission reductions from enhanced recovery from oil and gas fields.

The most promising impact of carbon markets has been its impact on innovation as smart capital takes an early, long-term bet on the quickly growing emerging market for environmentally-oriented investment. A key indicator of interest in aligned and closely related fields is the record US$70.9 billion in clean technology investments in 2006,[8] with major investments (and announcements) from well-known investment banks.[9]

In the emerging fragmented carbon marketplace, efforts to mitigate carbon are multiplying in both the regulated and the unregulated sectors. For regulated markets, emissions trading can help achieve a given level of emission caps efficiently by setting an appropriate price, but this requires that policymakers set the caps consistent with the desired – and scientifically credible – level of environmental performance. Regulated carbon markets can only achieve environmental goals when policymakers set scientifically-credible emission reduction targets while giving companies maximum flexibility to achieve those goals. They also require clarity on the assumptions for economic growth and baseline carbon intensity improvements, orderly and transparent release of periodic market-relevant emissions data and the imposition of strict penalties for fraud or non-compliance. The key elements for well-functioning carbon markets include: competitive energy markets; common, fungible units of measure[10]; standardized reporting protocols of emissions data; and transferability of assets across boundaries.

Markets can, to a certain extent, accommodate the appetite that individuals and companies in Europe, Japan, North America, Australia and beyond have for carbon emission reductions that go well beyond what their law makers require of them. This high-potential voluntary segment, however, lacks a generally acceptable standard, which remains a significant reputation risk not only to its own

6. New Energy Finance, "Clean Energy Deal Volume Hits $100bn". Press release 19 December 2006, www.newenergyfinance.com.

7. Among the most recent ones, see announcement of Goldman Sachs of further investment in the clean and renewable power generation sector, with a large equity stake in an IGCC project, which will include a significant amount of carbon capture and sequestration.

8. New Energy Finance, "Clean Energy Deal Volume Hits $100bn". Press release 19 December 2006, www.newenergyfinance.com

9. Among the most recent ones, see announcement of Goldman Sachs of further investment in the clean and renewable power generation sector, with a large equity stake in an IGCC project, which will include a significant amount of carbon capture and sequestration.

10. One proposed regional scheme in the United States uses "short tons" while most other programs use metric tonnes to measure reductions.

prospects, but also to the rest of the market, including the segments of regulated emissions trading and project offsets.

The enormity of the climate challenge, however, will require a profound transformation, including in those sectors that 'cap-and-trade' markets cannot easily reach. These include making public and private investments in research and development for new technology development and diffusion, economic and fiscal policy changes, programmatic approaches to decouple economic growth from emissions development as well as the removal of distortionary subsidies for high-carbon fuels and technologies.

II MARKET STRUCTURE AND METHODOLOGY

2.1 SETTING THE STAGE: ALLOWANCES AND PROJECT-BASED TRANSACTIONS IN THE CARBON MARKET

CARBON TRANSACTIONS are defined as purchase contracts whereby one party pays another party in return for GHG emissions reductions or for the right to release a given amount of GHG emissions, that the buyer can use to meet its compliance – or corporate citizenship – objectives vis-à-vis climate change mitigation. Payment is made using one or more of the following forms: cash, equity, debt, convertible debt or warrant, or in-kind contributions such as providing technologies to abate GHG emissions.[11] Carbon transactions can be grouped into two main categories:

- *Allowance-based transactions*, in which the buyer purchases emission allowances created and allocated (or auctioned) by regulators under cap-and-trade regimes, such as Assigned Amount Units (AAUs) under the Kyoto Protocol, or EUAs under the EU ETS. Such schemes combine environmental performance (defined by the actual level of caps set) and flexibility, through trading, in order for mandated participants to meet compliance requirements at the lowest possible cost;

- *Project-based transactions*, in which the buyer purchases emission credits from a project that can verifiably demonstrate GHG emission reductions compared with what would have happened otherwise. The most notable examples of such activities are under the CDM and the JI mechanisms of the Kyoto Protocol, generating CERs and ERUs respectively.

Carbon cap-and-trade regimes currently in place allow, for the most part, for the import of credits from project-based transactions for compliance purposes. This helps to achieve the environmental targetcost effectively through access to mitigation potentials from additional sectors and additional countries.[12] Once project-based credits are issued and are finally delivered where and when desired for compliance, then they are at that time fundamentally the same as allowances.[13] Unlike allowances however, project-based credits are compliance assets that need to be "created" through a process that has certain risks inherent with it (regulation, project development and performance, for instance) and can involve significantly higher transaction costs. Such risks are addressed through contractual provisions that define how they are allocated between parties, and, along with other factors, are reflected in the value of the transaction. Through the second half of 2006, a secondary market for CERs has grown in activity, bringing to buyers (almost) standardized compliance-grade assets coming with guaranteed deliveries for firm volume deliveries.

11. Under this definition, we thus exclude transactions whereby one party acquires rights on future potential carbon assets among other components of a transaction: for instance, when a company acquires a stake in another company whose assets might eventually be developed into carbon assets or when a company acquires a stake in a carbon project developer's portfolio.

12. For instance, the EU ETS is focused on CO_2 emissions from major energy-intensive installations. The so-called Linking Directive allows for the import of CDM emission reduction credits from activities located in developing countries and tapping mitigation potential in the industry, in the waste management sector, in the mining sector, etc.

13. "Residual" difference between those units pertains to the regulatory framework under which they are used for compliance purposes. Some of the rules indeed may limit the substitutability of these units at a given point in time (for instance, issue of supplementarity and existence of a cap on the imports of project-issued units, type of projects deemed non acceptable) or over time (relative degree of carry-over allowed across compliance periods).

2.2 SEGMENTS OF THE CARBON MARKET

There are several fragmented carbon markets, encompassing both allowances and project-based assets that co-exist with different degrees of interconnection.[14] These carbon markets are each complex and fast-moving and they continue to be influenced by both the development of policy and regulation that led to their creation and by market fundamentals. These markets are developed to different degrees in different parts of the world as national and regional policies themselves evolve. In 2006 and the first quarter of 2007, there were important regulatory developments in North America and Australia with initiatives to manage GHG emissions at least at regional levels.

The carbon markets can be segmented in a number of different ways: chief among these being, compliance or non-compliance, and mandatory or voluntary markets. Buyers largely engage in carbon transactions because of carbon constraints (current or anticipated) at international, national or sub-national levels. Markets can also be segmented by size and value: the Kyoto Protocol is the largest potential market and the EU ETS, a "tributary" scheme, has spawned a thriving market in the trade of allowances and for the import of project-based reductions.

The main compliance buyers are:

- European private buyers interested in the EU ETS,
- government buyers interested in Kyoto compliance,
- Japanese companies with voluntary commitments under the Keidanren Voluntary Action Plan,
- U.S. multinationals operating in Japan and Europe or preparing in advance for the Regional Greenhouse Gas Initiative (RGGI) in the Northeastern U.S. States or the California Assembly Bill 32 establishing a state-wide cap on emissions,
- power retailers and large consumers regulated by the New South Wales (NSW) market in Australia,
- and North American companies with voluntary but legally binding compliance objectives in the Chicago Climate Exchange (CCX).

There is also a growing retail carbon segment that sells emission reductions to individuals and companies seeking to offset their own carbon emission footprints. Reports of increased interest of banks, credit card issuers, private equity funds and others in this segment suggest that it could grow exponentially if only there were a credible, voluntary standard for such assets.

2.3 METHODOLOGY

Accurately recording the project-based transactions market is becoming more difficult each year since the number of transactions together with the diversity of players involved is increasing dramatically. Prices and contract structures, in particular, are confidential in an increasingly competitive market. The authors have collected information from direct interviews and as well as a review of the major relevant carbon-industry publications.[15] Natsource[16] was also engaged to lead a series of parallel

14. These interconnections arise mainly from competition between these different markets for the same type of offset credits (typically, CDM projects may be purchased by installations under the EU ETS, governments facing Kyoto commitment or Japanese companies with voluntary commitments under the Keidanren Voluntary Action Plan) and to a lesser extent, from trades of compliance instruments across schemes (for some time, EUAs were considered as a valid compliance instrument under the Chicago Climate Exchange).

15. Including online sources such as Carbon Finance (www.carbon-financeonline.com), Joint Implementation Quarterly (www.jiqweb.org), PointCarbon (www.pointcarbon.com) as well as Caisse des Dépôts (www.caissedesdepots.fr), the Climate_L list (www.iisd.ca), Ecosystem Marketplace (ecosystemmarketplace.com) and websites of market players (DNAs, DOEs, Project developers and aggregators, exchange platforms, governments, companies and purchasing vehicles, financial institutions and brokers).

interviews of private companies (in Europe and in Japan), fund managers and traders to gain a broader view on the state and tends of the market. Our focus is on regulatory compliance; therefore our coverage of the voluntary segment of the market is not exhaustive. Retail price data are reported to show how they differ from the biggest segments of the market. For the most part, the information provided here on the voluntary market is from preliminary results of a forthcoming report that the authors agreed to share with us.[17]

The information gathered has been aggregated in a database of more than 930 project-based transactions between 1996 and end of March 2007. Only signed emission reductions purchase agreements (ERPAs) are included. Although the study received a very high level of cooperation from most market players, the authors were not able to obtain complete data for all reported transactions. The completeness of data exceeds 80% in most cases except for information related to contractual terms, especially prices, where reliable data were obtained for only slightly more than 60% of the volume. Prices are expressed in nominal US$ per tCO_2e. In between the periodic reports in this series, the authors have occasionally become aware of unrecorded transactions from previous years that have now been included in the database. This (upward) revision explains why data for the previous years may be slightly different from previous publications in this series.

The authors are relatively confident that the projects database for this series captures most transaction activity entered into by governments and a high proportion of all primary transactions. This confidence does not extend to the many secondary market project transactions that have not been captured by the database. Rather than estimate these, only those have been reported for which reliable data exists. For this reason, the authors consider that the analysis in this series provides a rather conservative estimate of the carbon market, one that provides a good representative view of the carbon market. The reader is invited to do his or her own comprehensive due diligence of the market prior to taking any financial position, and in this regard nothing in this report should be seen as constituting advice to take a position on the market as a whole, or any component there-of.

In contrast to the projects-based market, daily price and volume information on allowances markets is available online. The report draws on data collected from the various trading platforms as well as aggregated information on the volume known to have been exchanged over-the-counter for the EU ETS. The authors have also obtained detailed information on transactions conducted under the CCX, as well as aggregate information on transactions under the NSW Trading Scheme.

16. Per www.natsource.com: The opinions and results expressed in this paper are solely those of the authors, and do not necessarily represent the views of Natsource.

17. V. Bellassen and B. Leguet (2007). "Voluntary Carbon Offsets: the Awakening", Caisse des Dépôts Climate Taskforce Research report N°11, forthcoming.

III ALLOWANCE-BASED MARKETS

3.1 EU ETS IS THE LARGEST CARBON MARKET BY FAR

THERE ARE A RANGE OF active programs to manage GHG emissions that establish a market by setting a target (absolute cap or intensity target) and that allow mandated participants to trade emissions allowances in order to meet compliance requirements at the lowest possible cost.

Carbon emissions trading programs differ from each other in terms of:

- the level of the cap or the level of intensity improvement mandated creates the underlying demand – and scarcity – in the market;
- the type of trading permitted, i.e. allowances only or baseline-and-credit;
- their sector scope (e.g. power sector only as in NSW, large energy-intensive installations as in the EU ETS, or economy-wide as in the UK ETS); and,
- the extent of flexibility (e.g. geography, use of external offsets from developing countries and other industrialized nations, and, ability to carry forward unused allowances or offsets across compliance periods).

Table 2: Annual Volumes and Values of Transactions on the Main Allowances Markets

	2005		2006	
	Volume ($MtCO_2e$)	Value (MUS$)	Volume ($MtCO_2e$)	Value (MUS$)
EU ETS	321	7,908	1,101	24,357
New South Wales	6	59	20	225
Chicago Climate Exchange	1	3	10	38
UK ETS	0	1	na	na
TOTAL	**328**	**7,971**	**1,131**	**24,620**

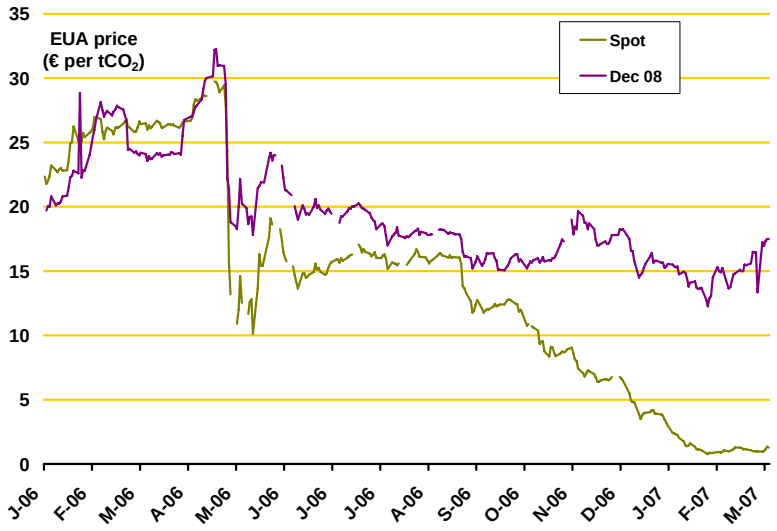
The EU ETS continues to be the most prominent of these markets in terms of overall volume and financial value transacted, with compliance, risk management and arbitrage being its major drivers and spill-over effects being felt in project-based and other allowance markets (Table 2). Both the New South Wales (NSW) Greenhouse Gas Abatement Scheme and the Chicago Climate Exchange (CCX) saw both volumes and values increasing by a factor of three or more in 2006.

3.2 EU ETS

In its second year, the EU ETS saw over one billion allowances changing hands (1.101 million representing a *three-fold increase* over 2005) for a financial value of US$24.4 billion or €18.7 billion (also up slightly more than *three times* from US$7.9 billion in 2005 or €6 billion). This despite a drop in average EUA prices (down 10% from US$24.70 in 2005, or €19, to US$22.10 in 2006, or €17). EUA transactions were mainly struck over-the-counter (with the London Energy Brokers Association, or LEBA, accounting for more than half the volumes). Virtually every month over the past two years saw an increase, on average, in the number of trades over the previous months. A year that saw the geographical scope of the EU ETS widen to include new member states of the EU, also saw an increase in the number and type of participants (beyond the utilities that were the early players) and

more complex transactions occurring (including, for example, options on EUAs and swaps between EUAs and CERs).

Figure 1: Spot and Dec'08 Prices for EUAs 2006-Q1'07 (Source: Powernext, ECX)



Market Volatility

After having soared at one time to over €30 at its peak in April 2006, the EUA-I lost two thirds of its value following the uncoordinated leak and release of verified emissions data at that time[18]. By the end of 2006, and into early 2007, the Phase I EU ETS market had slid even further to levels at or under €1 – as utilities had hedged their position for the whole Phase I. The inability to carry forward (or "bank") unused allowances from Phase I to Phase II contributed to making EUAs-I almost worthless at the close of Phase I (Figure 1).[19]

The overall decline in the Phase I market continued notwithstanding a short-lived summer 2006 spike in EUA-I prices caused by fundamentals of the European power markets. The price spread between Phase II (Dec-08) and Phase I (spot) contracts had increased from €3-5 (US$4-6.50) in October 2006 to more than €16 (US$21) by the close of March 2007. Market players reported that they have been using inexpensive EUAs-I for their Phase I compliance and intend to bank any project-based CERs delivered in 2005-07 for Phase II compliance.[20]

18. In April 2007, there was a coordinated release of verified emissions data for nearly 93% of covered installations, showing tighter management of financially relevant information. With much more interest in Phase II trading, many analysts hoped that the increased confidence in market institutions would lead to increased value in the years ahead.

19. Prices for EUA-I experienced a major correction through late April– early May 2006 as the expectations of market participants changed almost overnight from being about 50 $MtCO_2e$ short to long. Spot (on Powernext) dropped from almost €30 to €10 within five working days. Final data indicate an overall surplus greater than 70 $MtCO_2e$ – although some individual Member States were marginally short (European Environmental Agency, 2006. Greenhouse gas emission trends and projections in Europe 2006, EEA Report No 9/2006). Prices showed some volatility at the time – with significant volumes transacted in reaction to all kind of rumors, first about various emissions reports and subsequently about proposals to amend the scheme (e.g. to adjust ex-post the volume of allowances circulating or the proposal to create a Central Bank for carbon etc.).

20. Meanwhile, there have been reports of Phase I EUAs appearing on the Chicago Climate Exchange (CCX) in the hope of attracting voluntary compliance buyers. Phase II EUA prices have now become the effective reference price for assets booked in the project-based market, including for indexed transactions.

Market Differentiation and Shift from Phase I to Phase II Market

Since April 2006, the EUA market has shifted out of Phase I allowances and over to Phase II allowances.[21] In May 2006, the volume of Phase II allowances that were traded accounted for about 20% of total volumes traded on the LEBA or on the European Climate Exchange (ECX). The share of Phase II in the mix gradually increased through the rest of the year and in early 2007, accounting for 50% of volumes traded in December 2006 and 75% in March 2007 on both these platforms.

EUA-II prices recovered strongly in the summer of 2006 and maintained a €15-20 (US$20-25) price band in the expectation that the Commission would tighten the overall compliance caps for Phase II. Not surprisingly the biggest determinants of pricing in the Phase II market have been expectations of and decisions by the Commission, especially related to two key parameters,[22] viz. the cap allowed to each Member State and the limit on the import of credits from CDM and JI into the program.

Submission of NAPs II

The EU Commission noted that "if more allowances were to be issued by Member States than the likely quantity of actual emissions in 2008-12 from the installations covered, meeting the Kyoto commitments would be severely compromised and little or no environmental benefit would be provided. The development and deployment of existing and new clean technologies would stall, and the evolution of a dynamic and liquid global market would be severely undermined".[23]

Each Member State was to have submitted its National Allocation Plan (NAP) to the Commission for assessment by the end of June 2006.[24] Each Member State was asked to determine the level of effort required under the ETS, after accounting for how it planned to meet its Kyoto target through its policies and measures, through accounting for sinks, and through government commitments to purchases through the Kyoto Mechanisms. The EU Commission, in an effort to improve transparency, provided all Member States with a standard table with a field for each of the above so that a standard format could be used to assess the caps proposed under ETS in light of their Kyoto efforts.

The NAPs tables for only 10 NAPs have been published on the website of the Commission and those are not entirely complete. For those tables that have been published, it is not clear where the assumptions of economic growth and improvements in carbon intensity that were assumed by Member States in their submissions come from.

The EU Commission's Process of Assessment of NAPs II

The Commission published its approach to its assessment of the second period NAPs developed by Member States, emphasizing "assessing the second period plans in a consistent, fair and transparent manner".[25] Each NAP was to be assessed for its (1) meeting the relevant Kyoto commitment; (2)

21. The Commission disallowed a French and Polish proposal to bank unused Phase I EUAs for use in Phase II, further cementing the market shift away from Phase I.

22. They also increasingly factored in power fundamentals of Phase II.

23 See COM(2006) 725, op. cit.

24 Only two Member States, Estonia and Germany submitted them on schedule. The other NAPs trickled in through the Summer and Fall and by early October 2006 the Commission started infringement procedures against 8 Member States for having not submitted their NAPs. NAPs are assessed through 12 criteria that ensure, among others, consistency of the NAPs with Kyoto commitments and with supplementarity obligations or equal treatment of installations across the EU.

25 See COM(2006) 725, op. cit.

emissions development; and, (3) reduction potential. It assessed emissions development and reduction potential on the basis of "a single and coherent methodology and set of assumptions as presented in "European Energy and Transport Trends to 2030 – update 2005"[26].

The guidance[27] then noted that the price signal from EU ETS Phase I would "positively affect carbon intensity trend developments" and notes that various policies and measures put into place and the greater concern for climate change, energy security and innovation would lead it to "base its assessment" on carbon intensity improvements at a rate reflecting a 0.5% improvement per annum over 2008-12 over the "low carbon constraint/no CCS case." The authors would commend the Commission for publishing a consistent and transparent approach by which it assesses NAPs.

However, the submitted NAPs do not contain summary assessments of the realism of each of the policies and measures proposed by Member States (other than EU-ETS). As a result, not only is there limited comparability and completeness to the tables, but there is also the risk that some policies and measures may not produce as many emission reductions in the timeframe expected. This, in turn, raises questions about the ease with which the public can determine to what extent the Commission's revisions of the initial NAPs accurately reflect best estimates for overall emissions scenarios in the EU

Revised Allocations for Phase II

The first set of decisions on a set of ten NAPs was made public by the end of November 2006, and as of April 16 2007, the Commission had so far decided on the NAPs of 19 Member States, representing 80% of 2005 verified emissions. Overall, the reviewed NAPs have been cut by 9% below the caps that individual Member States had proposed and 6% below (adjusted) 2005 emissions.

What is the expected likely shortfall under Phase II? If an analyst were to project the emissions of the EU-15 on the basis of the 'Low carbon without CCS'-scenario formula, for example, and estimate the shortfall in 2008-12 in this manner, the aggregate EU shortfall would be relatively small (in the range of only 400 $MtCO_2e$).[28] Many analysts credibly argue that it is unrealistic to expect that the various policies and measures in the EU would be successful in the intended timeframe. They suggest that Phase II will have a shortfall of allowances relative to projected emissions; however, there is a wide range in their estimates, ranging from 0.9 billion to 1.5 billion tCO_2e, with an average shortfall of 1.25 billion tCO_2e, almost a 8-10% level of effort between projected emissions and the aggregate cap. Some analyst projections are based on a base case with economic growth but no improvements in carbon intensity, while others project partial performance of policies and measures with some improvement in carbon intensity. The illustration of varying analyses is used to demonstrate that the computation of the shortfall is a dynamic, ever-changing process, impacted by each analyst's view of technology diffusion, of fuel prices, of allowance prices, of weather and other variables. There is inherently uncertainty in such projections as each analyst projects improvements of intensity as a measure of the extent to which economic growth is likely to be decoupled from growth in carbon emissions.

The authors of this report have no particular view on how well such policies and measures are likely to perform or of improvements in European carbon intensity. However, it would be reasonable to expect that the Commission publish the assumptions used by Member States transparently on its

26. http://ec.europa.eu/dgs/energy_transport/figures/trends_2030_update_2005/energy_transport_trends_2030_update_2005_en.pdf

27. See COM(2006) 725, op. cit.

28. This shortfall could reach 1 billion tCO2e on the basis of the PRIMES baseline scenario which is much more conservative regarding the carbon intensity improvements in the sectors covered by the EU-ETS.

website. It might also be reasonable to expect a summary assessment of the performance of each these various policies and measures against Kyoto obligations. One way to reduce this uncertainty is for the Commission and Member States to apply consistent – and transparent – models for emissions development and reduction opportunities and publish their shortfall so derived. This coupled with the annual or more frequent publication of annual verified emissions data would go a long way to help reduce excessive volatility in the system, while also ensuring that Member States are on track toward Kyoto.

FACTS AND FIGURES ON THE EU ETS

The EU ETS was launched on January 1, 2005 as a cornerstone of EU climate policy towards its Kyoto commitment and beyond. In its first phase (January 1 2005 to December 31 2007), the EU ETS regulated CO_2 emissions from installations representing some 40% of EU emissions. Those emissions were capped at 6,600 $MtCO_2$ over the period. Germany was allocated almost one quarter of all Phase I EUAs, while the UK, Poland and Italy had almost 10% each. The power and heat sector received almost 55% of allowances, minerals (cements, glass and ceramics), metals (steel production facilities) roughly 12% each, and oil and gas industries roughly 10%.

Actual verified emissions in 2005 were two billion tCO_2e – more than 3% below what had been allocated to countries that year. While as a whole, the scheme was "long", six Member States (Greece, Austria, Ireland, Italy, Spain, UK) together were "short" by some 180 $MtCO_2e$.[29] On a sectoral basis, the power and heat sector was the only one with a shortfall, of about 35 $MtCO_2e$[30]. Preliminary verified 2006 emissions data suggested a long market for 2006 as well, although less so, since caps are slightly tighter while 2006 emissions were slightly higher than in 2005. This overall surplus together with the no-banking rule (rendering EUAs-I worthless beyond compliance year 2007) led to a steady price decline for EUAs-I through 2006. The decline continued as power and heat installations finished hedging their positions for Phase I.

Given the experience of Phase I, it was expected that the constraints on Phase II emissions would be tight, including in those newer members of the EU who enjoy a comfortable position *vis-a-vis* their Kyoto targets. Decisions so far taken on 19 NAPs set, on average, the annual cap at 5.8% below 2005 verified emissions (adjusted for changes in the Phase II perimeter or boundary). Together with a tighter constraint, the penalty for non-compliance will rise from €40 currently to €100, and this remains on top of the obligation to cover any shortfall in that period.

One of the major changes in design between Phase I and Phase II is the inclusion of banking – which will bring market continuity to the EU ETS and possibly encourage additional abatement by installations depending on their current situation and their anticipations of future carbon price. In addition, the scope of the EU ETS has been extended with the inclusion of further installations by Member States. Another significant evolution is the introduction of aviation into the scheme for intra EU-bound flights (from 2011) and for all flights leaving or landing in the EU (from 2012). This is expected to reduce up to 183 $MtCO_2e$ per year by 2020 in the fast-growing sector.

The January 27, 2007 announcement by the EU Commission on energy and climate change provided greater clarity concerning the future of a climate regime beyond 2012. However, many features for Phase III of the EU ETS still need to be drawn up – especially in the light of the key recommendations from the review process of the scheme: harmonization across member States or sectors (new entrants and exiting installations, allocations to installations among others) and linking to other mandatory cape and trade schemes.

29. Bulgaria and Romania joined the scheme in 2007 and Norway is expected to link its ETS for Phase II.

30. C. Kettner, A. Köppl, S. P. Schleicher and G. Thenius (2007). "Stringency and Distribution in the EU Emissions Trading Scheme –The 2005 Evidence", Working Paper #2007.22, Fondazione Eni Enrico Mattei: Milano.

Any limits on JI/CDM in Phase II (Suplementarity)?

The Commission assessed NAPs for imports of carbon assets (including planned and substantiated governmental purchases) ostensibly with a view to limit imports to no more than 50% of the "expected distance to target" for each Member State. According to the vast majority of analysts, this does not place any practical constraints on the demand for CDM/JI from EU installations: The market received the November 2006 EU decision to impose tighter caps with an immediate increase in the price of EUA-II, while uncertainty at that time about supplementarity caps immediately dampened prices for CERs (secondary CER market reacted more quickly than the more stable primary market).

There is also a range of analyst views on the overall amount of CERs and ERUs that are likely to be imported into the scheme (and how this relates to the shortfall). Numbers in the order of 1,000 to 1,200 $MtCO_2e$ over 2008-12 are often quoted. Put in perspective, it means that installations, using credits from CDM and JI, could be in a balanced position or a marginally short one. In the latter case, fuel switching would help bridge the gap. One of the key trade-offs for EUA-II pricing will thus be coal-to-gas-switching price vs. price of a credit. The possibility to bank EUAs from Phase II to Phase III and the existence of a deeper secondary CER market will also progressively become important factors in EUA pricing.

What Have we Learned from the EU ETS so far?

EU ETS operations over the past two years have been a practical experiment in emissions trading as a tool to manage GHGs emissions, with important lessons learned for future stages of the EU ETS and other emerging market-based programs. Perhaps the most important contribution of the market was that market participants became conscious of a constraint on carbon, where previously they emitted unconstrained. The price signal represented the market's view as it evolved about the level of the constraint and the relative effort required to comply with it.

EU ETS as a Functional Market

In its first phase, the EU ETS operated as a rational market should. The market's perception of how short it was on the basis of allocations interacted dynamically with the fuel and weather markets as well as expectations about the rate of economic growth and the improvement in carbon intensity. A price signal emerged in Phase I as companies acted to cover their perceived positions reflecting how the market assessed each of these factors as demand and supply fundamentals in the process of price formation. The EU market did not set artificial price caps or triggers and did not attempt to distort price formation as some emerging carbon markets have proposed, notably the RGGI and NSW markets. Early in Phase I, this resulted in high carbon prices (peaking at €31 in early 2006) as participants anticipated that the interactions of the allocated carbon constraints with power demand, weather patterns and coal and gas prices implied that the market was considerably shorter than it really was. The subsequent crash of the EUA market following the release of the verified 2005 emissions data also reflected rational market behavior as the market declined sharply from is earlier levels.

EU ETS as an Environmental Tool

As an environmental market and a tool for compliance, the carbon market achieved the performance it was set to accomplish. It is a serious matter, however, that the overall compliance level was not set at a rigorous target of emission reductions in Phase I. Even though the caps on the GHGs emissions from the installations were evidently set at a level that would invite broad participation and acceptance into the scheme, it still delivered some level of emissions reductions. Results from

Ellerman and Buchner (2006)[31] suggest that CO_2 emissions were reduced in 2005 by an amount that was probably greater than 50 $MtCO_2$ and less than 200 $MtCO_2$ (compared to 2005 baseline emissions and not the 2005 emissions cap). The Point Carbon 2007[32] Survey indicated that 65% of respondents stated that internal abatement activities were initiated in their companies as a result of EU ETS in 2006 (compared to only 15% in 2005). The high carbon price in the first year of Phase I, combined with heightened awareness of climate change, concerns about energy security and high fuel prices together contributed to this abatement. The price signal also induced abatement in developing countries which brought significant volumes of carbon emission reductions to the EU market.

The inability to carry forward unused balances of allowances between compliance periods was a design flaw of the Phase I market. Linking it to Phase II might have prevented the collapse of the market and might have led to even more early abatement in Phase I and also might have enabled even stronger caps in Phase II. Fortunately, Phase II allows carrying forward or "banking" unused allowances to subsequent compliance periods, thereby increasing flexibility across time and ensuring that a clear longer-term message about carbon constraints reaches market players.[33] In this context, the Commission's January 2007 proposal to integrate energy and climate change to cut emissions for the 21st century also sketches a vision beyond 2012. Although still preliminary, there are indications it is being taken seriously by EU installations considering long-term investment decisions in a progressively carbon-constrained Europe. As the level of the Phase II constraint and the announcements of the Phase III markets became clearer, there is a longer-term time horizon for power companies and industry to plan their future investments in a world where carbon becomes increasingly scarce over time. As the constraint gets progressively stronger, reducing carbon becomes a permanent part of managing the regulatory and strategic landscape and begins to play a role in long-term investment decisions.

Other elements of the scheme also raised some concerns, such as the process of allocations of individual caps across Member States, the role of auctions and the treatment of new entrants and exiting installations, suggesting a need for better harmonization across the EU. Together with the inclusion of other sectors and linkage with other emissions trading schemes, these issues are being addressed through the review process of the EU ETS for Phase III and beyond.

3.3 NEW SOUTH WALES GREENHOUSE GAS ABATEMENT SCHEME

Australia's New South Wales (NSW) has had an operational program called the NSW Greenhouse Gas Abatement Scheme (GGAS) to reduce greenhouse gas emissions until 2012 from the power sector. Retailers and large electricity customers in NSW and since January 1, 2005, in the Australian Capital Territory (ACT) are required to meet mandatory intensity targets to reduce (or offset) the emissions of GHG arising from the production of electricity they supply or use. They can meet their targets by purchasing certificates (NSW Greenhouse Abatement Certificates or NGACs). NGACs are generated through the following activities: low-emission generation of electricity and improved generator efficiency, activities that result in reduced consumption of electricity or on-site generation of electricity and carbon sequestration into biomass. Renewable Energy Certificates are also eligible.[34] No other form of credit (e.g. JI or CDM) is eligible at this time (although the authors have received

31. Ellerman, A. D. & B. Buchner (2006). "Over-Allocation or Abatement? A Preliminary Analysis of the EU Emissions Trading Scheme Based on the 2005 Emissions Data", Report No. 141, MIT Joint Program on the Science and Policy of Global Change: Cambridge (MA).

32. Point Carbon (2007). Carbon 2007 – A new climate for Carbon trading". K. Røine and H. Hasselknippe (eds), Point Carbon: Oslo.

33. The proposal for a National Greenhouse Gas Emissions Trading Scheme (NETS) in Australia also contains permanent ten-year ahead visibility on GHG emissions caps, see below) as does the UK Climate Change Bill draft (with permanent visibility of 15 years on future commitments).

34. Their share in the total number of certificates surrendered for compliance tends to decrease from 29% in 2003 to 11% in 2006.

reports of the sale of CERs into the Australian market). A buy-out penalty applies, set at AU$11.50 (currently approximately US$9) for compliance year 2006. So far, all participants have been in compliance (eventually by carrying forward part of the shortfall – up to 10% of the benchmark).

After the EU ETS, the NSW GGAS is the second largest greenhouse gas abatement market with about 20.2 million certificates exchanged through 2006 for a value estimated at US$225.4 million (€173 million). The 2006 market represented a 3.3 times increase over the volumes transacted in 2005 and about 3.8 times increase in the value for 2005.

As of end of February 2007, 201 projects were accredited, for the most part under the "generation" and "demand side abatement" rules. Credits issued from carbon sequestration into the biomass also entered the scheme in 2005. Over 40 million NGACs have been created by end of March 2007, with "generation" certificates dominating at 70% of volumes followed by "demand side abatement" certificates at 25%. So far, taking into account the certificates that have been surrendered, there is currently an oversupply of over 13 million NGACs. Participants expect that the demand may exceed supply by 2009; however the demand supply balance could quickly reverse as some participants may decide to hedge their position forward. In addition, there is growing interest in the voluntary market for the NGACs.

The main uncertainties regarding the outlook of the program however may depend on developments at the national level, which could affect the eligibility and value of NGACs. In November 2005, the NSW Greenhouse Plan indicated that the Scheme would be extended to 2020 and beyond on a 15 year rolling basis even if an agreement on a national approach to managing emissions is delayed. A Discussion paper "Possible Design for a National Greenhouse Gas Emissions Trading Scheme (NETS)" was released in August 2006. This paper outlined the proposal for a national cap and trade scheme targeting the stationary energy sector starting in 2010. The scheme incorporates regulatory certainty with a permanent ten-year ahead visibility on the caps. The proposal, rejected by Australia's Prime Minister, who launched an alternative Task Group on Emissions Trading, expected to report by the end of May. In February 2007, the various States called for the adoption of NETS by 2010, with or without the support of the Federal Government[35].

3.4 CHICAGO CLIMATE EXCHANGE

Members of the Chicago Climate Exchange (CCX) made a voluntary but, as far as the authors can determine, legally binding commitment to reduce GHG emissions. By the end of Phase I in December 2006, all Members were to have reduced direct emissions 4% below a baseline period of 1998-2001. Phase II, which extends the CCX reduction program through 2010, will require all Members to reduce by 2010 GHG emissions 6% below baseline.

CCX saw record-breaking transacted volumes of 10.3 $MtCO_2$ in 2006 (seven times higher than the previous year) at a value of US$38.1 million or €30 million (thirteen times higher). Most transactions occurred in the second quarter of 2006, which alone saw about 56% of the year's traded volumes, peaking with May 2006 volumes of over 3.2 $MtCO_2e$ transacted for a value of US$10.9 million (€8.4 million). The average price of carbon (for all vintages) on the CCX continued to rise in 2006: from a low of US$1.73 in January 2006, the monthly average price increased to US$4.50 in July 2006 before settling in the US$ 4.00-4.20 price band for the remainder of the year, before declining to about US$3.70 earlier this year.

As new regional initiatives began to take shape in the U.S., membership of the CCX grew from 127 members in January 2006 to 237 members by the end of the year. New members expressed their interest in familiarizing themselves with emissions trading. New participants joining in the scheme can directly assume the target for the end of phase II, viz. 6% reduction in emissions below baseline

35. "Prompt action is essential", states the communiqué of the second meeting of the Council for the Australian Federation on 9 February 2007.

by 2010. Post 2006 vintages ('07, '08, '09 & '10) were listed from mid-April onwards and while activity was increasing on the CCX, trades have been concentrated in the post 2006 vintages (69% of volumes from April '06 to Dec '06), reflecting growing carbon market interest in the United States.

The CCX itself showed a willingness to expand its activity to other schemes and other regions. In mid-March, the CCX announced the formation of the New York Climate Exchange (NYCX) and the Northeast Climate Exchange (NECX) to develop financial instruments relevant to the RGGI. Closer ties with the EU ETS were made known in May with a transaction of 1,000 EUAs from the EU ETS to the CCX by one multinational member (the only one publicly disclosed to date). Concerned that recent price developments in the EU ETS would flood the CCX with very cheap EUA-I assets for compliance, the CCX suspended its linkage with the EU ETS in December 2006. More recently, the CCX announced it was seeking to extend its reach to Asia and Oceania. Offsets from Indian, Chinese and New Zealand projects have also been listed on the exchange. So far, more than 11 $MtCO_2$ from offsets have been issued on the CCX, the vast majority of which originate in North America (US: 34%, Canada: 18%).

3.5 THE UK ETS

The UK had initiated an emissions trading scheme prior to the EU. Launched in March 2002, the UK ETS was, at that time, the first domestic economy-wide GHG trading scheme. Participation was on a voluntary basis for companies that took on absolute targets for reductions. The Government had also negotiated Climate Change Agreements (CCA) with companies that set energy-related targets in exchange for an 80% rebate from the Climate Change Levy, a tax on the business use of energy. Companies with CCA targets used the UK ETS either to buy allowances or to sell any over-compliance. Penalties for non-compliance included the withholding of the tax discount and contraction of allowances. Only domestic credits could be traded under the UK ETS.

The 2005 'Scheme Report and Market Analysis' indicated limited activity in that year (which ran from April 2005 to March 2006). The Scheme's 33 "Direct Participants" were all in compliance and brought the total amount of emission reductions over the four years of the Scheme's existence to 7 $MtCO2_e$. On the whole, the Scheme was scheduled to reduce emissions by 11.9 $MtCO2_e$ for "Direct Participants" during the course of its duration (2002-2006)[36].

Final market reconciliation occurred in March 2007 with a report expected in the second quarter of 2007. Prices on the market have reportedly been around US$ 4.70 (£2.50) recently, slightly higher than before as participants get closer to final reconciliation. Roughly 320,000 tCO_2e traded in the 2006 compliance year. Much of this trade occurred in December 2006 through February 2007 to meet a March 8 compliance deadline. Installations eligible for the EU ETS that opted-out and are currently covered by the UK ETS are expected to join the EU ETS on January 2007.

The UK has also drafted a Climate Change Bill (under consultation until June 2007) which puts into statute the UK's targets to reduce carbon dioxide emissions through domestic and international action by 60% by 2050 and 26-32% by 2020 against a 1990 baseline. This proposal includes five-year carbon budgets beginning with the period 2008-12 established for three periods ahead (15 years). It is anticipated that emissions trading is likely to play a major role in meeting these commitments. A report commissioned by United Kingdom Department for Environment, Food and Rural Affairs (DEFRA)[37] to review the first four years of UK ETS concluded, among other things, that the brief lifespan of the scheme, along with uncertainties regarding its future, had not helped companies make investment decisions with a longer-term horizon than the initial five year term of the scheme.

36. Though the reality of some of these reductions has been questioned, given the ease with which some participants met their targets. This led indeed to a significant surplus and to a further ex-post intervention to withdraw allowances.

37. DEFRA (2006). Appraisal of Years 1-4 of the UK Emissions Trading Scheme: a report by ENVIROS Consulting Limited. Dec. 2006 www.defra.gov.uk.

IV PROJECT-BASED MARKETS

4.1 CARBON MARKET EXPANDS

THE EXPANSION IN THE CARBON SECTOR continued as primary project-based transactions for 493 $MtCO_2e$ were finalized in 2006 (up 30% from the 378 $MtCO_2e$ in contracts in 2005). The overall value for the project-based market for primary credits was US$5 billion in 2006 (€3.9 billion), as values for both CDM and JI more than doubled over what they were the previous year (see Table 3).

A strong majority (about 91%) of primary transactions for project-based credits came from CDM activities that reduced 450 $MtCO_2e$, representing an increase of 32% from 2005 volumes (see Figure 2). This number reinforces the view of the authors that European and Japanese demand, and price formation under the EU ETS sent a clear price signal and incentive to developing countries to develop CDM projects. The CDM, even with its limitations, provided an effective vehicle for developing countries to participate in ongoing efforts to reduce carbon emissions.

Table 3: Annual Volumes and Values (2005-2006) for Project-based Transactions

	2005		2006	
	Volume ($MtCO_2e$)	Value (MUS$)	Volume ($MtCO_2e$)	Value (MUS$)
Compliance	382	2,894	508	5,477
of which				
Primary CDM	341	2,417	450	4,813
Secondary CDM	10	221	25	444
JI	11	68	16	141
other	20	187	17	79
Voluntary market	6	44	10 +	100
TOTAL	**388**	**2,937**	**518**	**5,577**

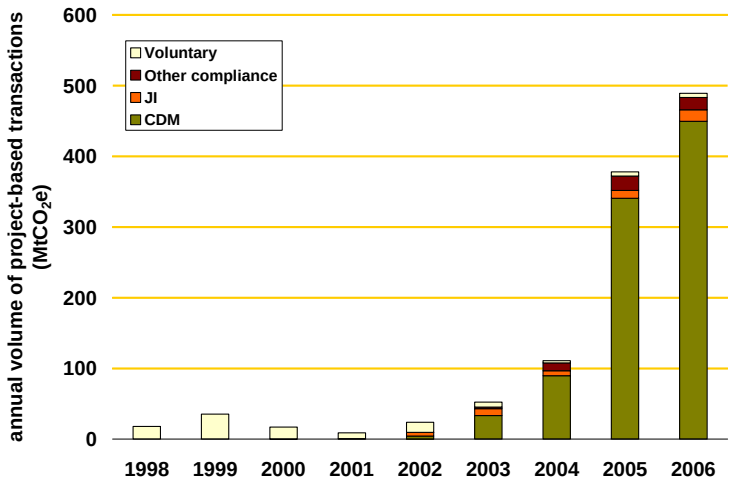
From an historical perspective since 2002, about 920 $MtCO_2e$ from CDM project activities have been transacted. While this number is impressive and demonstrates the ability of the carbon market to stimulate clean investment, the potential to shift to a lower-carbon trajectory has barely been tapped. Stronger action in the future to reduce emissions will be further encouraged if the bottlenecks facing today's CDM are removed and new approaches developed, e.g. encouraging programmatic approaches providing additional incentives for developing countries to make even more significant contributions to a future low-carbon world.

With most of the large HFC transactions having been concluded, the average size of transactions decreased by about 30% to about 1.9 $MtCO_2e$ in 2006. This sustained a high level of activity as buyers spanned the globe and closed over 220 transactions in 2006.

Asia continued to dominate the CDM market with about 80% of volumes transacted, led by China, which contracted to supply 61% of the CERs purchased by industrialized countries since 2002. Renewable energy (including equally, hydro, wind and biomass) contributed 16% of the cumulative emission reduction volumes since 2002.

The market also transacted about 16.7 $MtCO_2e$ from JI transactions valued at US$141 million in 2006 or €108 million. Early reports for 2007 suggest that at least equivalent volumes were transacted in the first three months of 2007 alone. Based on this early date, the authors expect that JI will see strong interest and growth throughout the year.

Figure 2: Annual Volumes ($MtCO_2e$) of Project-based Emission Reductions Transactions (vintages up to 2012)



Prices remained strong throughout 2006 despite the high volatility in the EUA market. Project-based emission reductions attracted, on average, a price of US$10.90 per tCO_2e for CERs (€8.40), representing a 52% increase over 2005 levels, and $8.70 per tCO_2e, or €6.70, for JI (+45% over 2005). Unlike the EU ETS, where the values of Phase I EUAs saw significant volatility, CER prices saw remarkable stability over 2006. Average CER prices for the whole year were only slightly lower than the US$11.10 per tCO_2e observed in the first quarter of 2006 (€8.50).

A major factor in this stability was the market power of China, which maintained an informal pricing policy by raising the minimum price floor in the US$10.40-11.70 (€ 8-9) range. This policy was clearly acceptable to private European buyers who continued to show strong demand at that price range in 2006, although some Japanese buyers shied away at the top end of the range.

Another factor keeping demand – and prices steady – was the fact that considerable public and private capital had already been committed to both the "buy" and "sell" sides of the business. In particular, carbon funds saw CERs as a relatively stable and safe haven compared to the highly volatile EUA market.[38] The only time this did not hold true was when EUA-II prices dipped to around €11 (US$14.30) earlier this year, and European buyers preferred to buy guaranteed secondary market CERs for around €10 (US$13). This behavior suggests that there is support for a CER price of up to €10 or so for primary forward contracts with non-firm delivery, with buyer preferences shifting to guaranteed secondary CERs when EUA-II prices fall below €12 or so. The likely price outlook for CERs will be influenced by the demand and supply dynamics of EUAs and CERs in Phase II, by the actual delivery of CERs and by competition to the EU from Japan and the voluntary markets.

38. Analysis from new Carbon Finance estimates that in the last six months, nearly US$4.7 billion of new capital had entered the market at the end of March 2007 (Source: New Carbon Finance, "UK in Pole Position as Carbon Funds Surge – but More Funds required". Press release 4 April 2007, www.newcarbonfinance.com). Most of the newly raised money was of private origin and was targeted to the sell-side (project development and carbon asset creation). The remainder (about 15%) sits on the buy-side for direct purchases by public and private compliance buyers, compliance funds and investor funds targeted at the compliance segment. The same source estimated in addition that even more funds are required to bring to the market enough emission reductions to satisfy the appetite of compliance buyers.

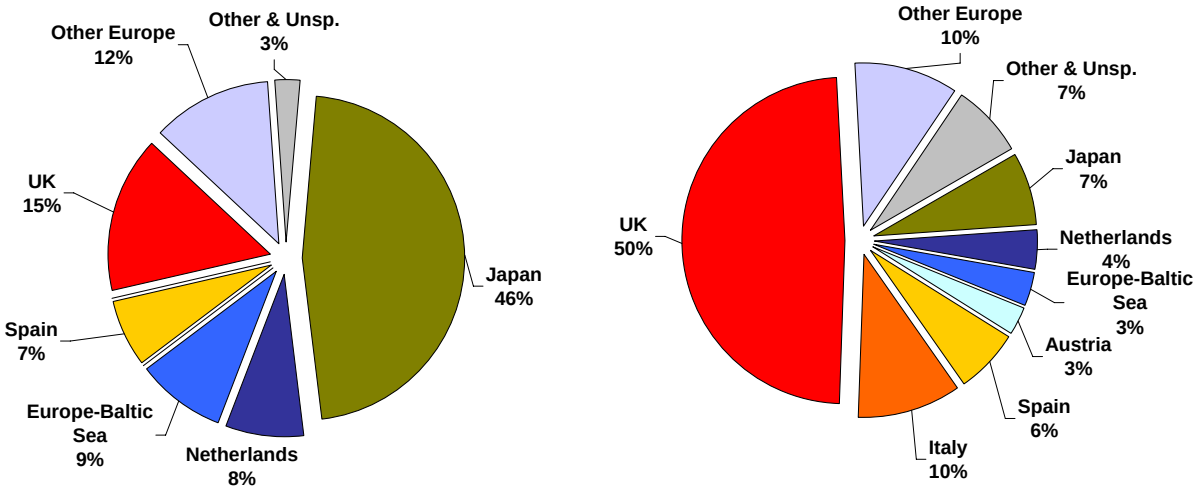
The United Nations Environment Program maintains and publishes a database for projects with project design documents that have been submitted for validation. This database is commonly known as the UNEP/RISOE project pipeline.

The UNEP/RISOE pipeline continued to grow with the overall number of projects nearly trebling in 2006 to about 1,500 projects from January to December 2006 and rose to 1,800 projects by the end of March 2007.[39] If *all* the emission reductions from the projects in the pipeline are actually transacted, realized and delivered, then the volume of expected deliveries up to 2012 could be about 1.5 billion CERs. With additional new demand coming into the system (Canada, voluntary market), it would also not surprise the authors if strong additional demand and price signal could stimulate even further growth in the pipeline.

4.2 WHO IS BUYING?

European buyers totally dominated the CDM market in 2006 with 86% of volumes transacted (Figure 3). This was a change over previous years when Japanese and European buyers had similar market shares. Japanese buyers as a whole were more price sensitive than their European counterparts and more cautious in their approach to contract negotiations. In contrast, European buyers were more likely to pay higher prices, especially in the first quarter of 2006. The World Bank confidential project database recorded some large purchases (for both primary and secondary CERs) by Japanese utilities in the later months of 2006 and in the early months of 2007. In addition, the first purchases by the Government of Japan have begun to materialize (purchases expected to be at least 100 $MtCO_2e$ over the 2008-12 timeframe, according to Japan's Fourth National Communication. Some private Japanese companies have announced they would likely increase their purchases to comply with their voluntary targets under the Keidanren Voluntary Action Plan.

Figure 3: Primary CDM&JI Buyers (as shares of volumes purchased, vintages up to 2012)[40]



2005
Overall volume 352 $MtCO_2e$

2006
Overall volume 466 $MtCO_2e$

39. All analyses in this paragraph are based on the CDM pipeline by Joergen Fenhann et al. (UNEP RISOE Centre, Denmark), at http://cd4cdm.org

40. Purchases by the World Bank-managed family of funds have been attributed to the fund participants' countries pro rata. The chart refers to Europe-Baltic Sea (Finland, Sweden, Norway, Germany, Denmark and Iceland); Other Europe (Belgium, France, Greece, Luxembourg, Portugal, and Switzerland, + Austria and Italy in 2005); Other European purchases refers to buyers based in Europe; and Unsp. refers to purchases where we could not verify the origin of the buyers.

Market Share

Within Europe, the United Kingdom had a 50% market share of volumes transacted (up from 15% in 2005) consolidating its leadership position as the carbon finance hub for the world. Many companies, including project developers and players with an eye on the secondary market, have opened accounts on the U.K. national registry. Italy, which entered the market in 2005 with a 1.5% market share, increased its purchases in 2006 to reach 7% of the market, largely through acquisitions by private companies. Spain has maintained a steady 6-7% market share in 2005 and 2006 (with government purchases at 25% and 15% of volumes transacted, respectively). Austria accounted for 3% of the market's volumes transacted in 2006.

Private sector players were the main buyers of CDM assets in 2006, with about 90% of purchases coming from the European private sector in 2006. In contrast, the JI market has long been dominated by public buyers (mainly the Netherlands, Denmark and Austria), representing 92% of those transactions in 2006 (up from 80% in 2004 and 2005). On a cumulative basis, the EU has accounted for two-thirds of the CDM and JI market since 2003, while Japan has accounted for nearly 30%.

Outlook for Buyers

The authors estimate that by the end of first quarter 2007, EU governments had purchased 143 $mtCO_2e$, about 30% of the assets identified for purchase from the flexible mechanisms (CDM, JI and AAUs).[41] The authors also estimate that 506 $mtCO_2e$, about 45% of the expected demand for CDM and JI credits from EU ETS installations in Phase II has already been contracted by European entities, either directly, by natural compliance buyers and the funds in which they are participants, or indirectly, by entities planning to sell back these credits on the secondary market.[42]

As far as Japan is concerned, the authors estimate that the 266 $mtCO_2e$ credits purchased by Japanese entities so far account for around half of the expected shortfall for Japan (use of Kyoto Mechanisms by the Government and share of the burden borne by the private sector).[43] There still remains some solid residual demand from the private sector in the coming years. One can also reasonably expect both the private sector and public entities to continue to have a demand for purchases from the Kyoto Mechanisms over the next year or two. Together, these sources of demand could add up to at least one billion tCO_2e in the next year or so.

Canada's April 26, climate change announcement that calls for improvements in carbon intensity leading to an emission target of 20% below 2006 levels by 2020 (assumed by Canada to be 150 $MtCO_2e$). The approach incorporates emissions trading and also includes the idea of early action and banking and allows CERs for up to 10% of the projected shortfall. If these assumptions are true, then some demand from Canada could enter the CER market relatively soon. The market data does not show any purchases of note, and certainly confirms that Canadian buyers have not returned to the global CDM or JI markets, leaving those assets largely for the Europeans for now. A growing North American market for project offsets has been observed, perhaps in anticipation of domestic Canadian offsets and emissions trading programs in the USA.

41. Based on Fourth National Communications from EU Members States, the 2006 European Environment Agency report on GHG emissions trends and projections and updates from the NAPs, one may estimate a 450 MtCO2e demand for CDM and JI over 2008-12.

42. Using a 1.25 billion $MtCO_2e$ estimate for CDM and JI demand over 2008-12 by EU ETS installations, an average across assessments by Fortis, Merrill Lynch, New Carbon Finance, Point Carbon, Société Générale and UBS.

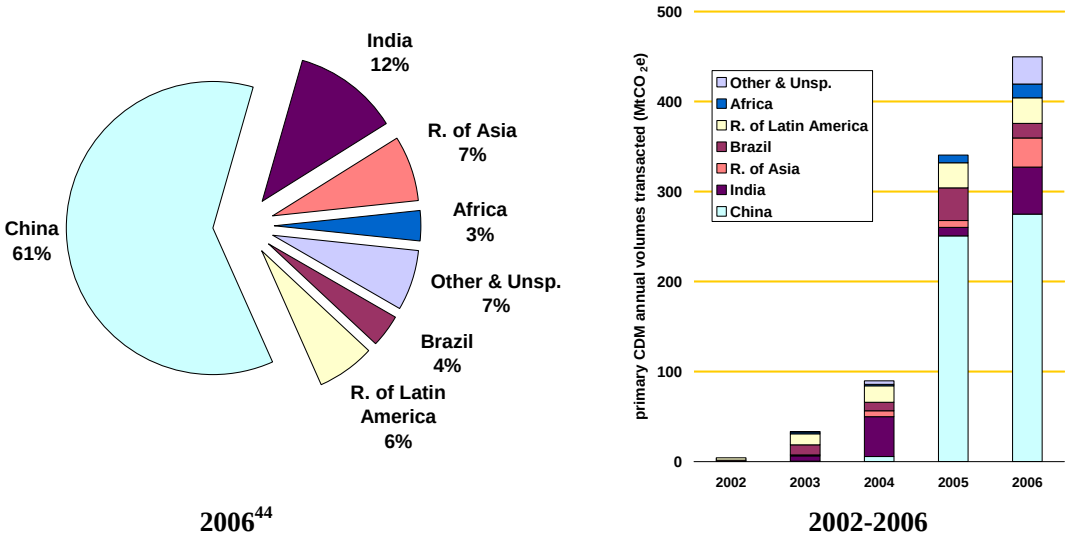
43. I.e., following estimates from the 4th National Communication in the "with existing measures" scenario.

4.3 WHO IS SELLING?

Asia Dominates the Market

For the second consecutive year, China dominated the CDM market on the supply side with a 61% market share of volumes transacted, down slightly from 73% in 2005 (Figure 4). Next was India at 12%, recovering from 3% in 2005. Asia as a whole led with an 80% market share. Latin America – an early pioneer of the market – accounted for 10% of CDM transactions overall with Brazil alone at 4%. The share of Africa remained constant, at about 3%; however African volumes transacted increased proportionally to the increase of overall volumes transacted. The authors estimate that since 2003 some 30 $MtCO_2e$ originating from Africa have been transacted on the Primary CDM market, nearly two-thirds of that volume being from either North Africa or South Africa. The other countries of sub-Saharan Africa account for just over 10 $MtCO_2e$.

Figure 4: Location of CDM Projects



2006[44] **2002-2006**

(As a share of volumes supplied.)

Historically, China has represented 60% of the cumulative CDM market since 2002 and 50% of the UNEP/RISOE CDM pipeline[45] as of the end of March 2007. China is still extremely attractive for buyers, despite some concerns about geographical concentration of such high volumes of carbon. In our interviews, buyers confirmed their efforts to diversify the geographical distribution of their portfolio but in the meantime acknowledge the huge potential still available from China (bringing economies of scale in exploration, sourcing and transactions costs) together with its favorable carbon investment climate (strong support from institutions and experienced project developers).

In addition to building a significant pipeline, Chinese institutions have been also able to diversify its content, by orienting its deployment towards priority sectors, such as renewable energy (wind, hydro long present and biomass coming), energy efficiency improvement in the industrial sector, and methane recovery and utilization. Some larger buyers, who built their project portfolios in China, have begun to look for diversification from industrial assets in China and are reportedly seeking to re-sell parts of their existing portfolio to others, including smaller buyers. Meanwhile, carbon funds and

44. Eastern Europe and Central Asia accounts for less than 1%.

45. See Joergen Fenhann et al., op. cit.

other large buyers are busy closing transactions for new different primary assets in China (renewable energy, biomass etc.) as well as in other regions and countries.

Following the few large HFC destruction projects in late 2005 and early 2006, there were 225 projects that entered the China project pipeline[46] in the course of 2006 (*nine times* the cumulative number of projects from the inception of the pipeline up to December 2005). Although relatively smaller on average, these new projects have the potential to deliver almost twice as many expected emission reductions before 2012 as the ones prior to December 2005.

India has a relatively low market share at 12%. However, India is *second* (at 17%) only to China in the CDM pipeline by the *number of expected CERs* by 2012 and *first by volumes of issued CERs* to date at about 18 million (coming mainly from two HFC projects). This is partially as a consequence of the relatively small size of projects (70% of projects with deliveries below 50 $MtCO_2e$ per annum). A concerted effort to increase the participation of banks and appropriate intermediaries or bundling agents to increase the average project size could help attracting private carbon buyers to India. Others have pointed out difficult negotiations, with high price expectations from the seller-side that may have driven buyers to other countries. There is evidence, however, of this issue becoming less of a constraint in recent months. Increasingly, Indian financial institutions have entered the market by wrapping the credits for guaranteed delivery sale at a premium to un-guaranteed delivery sales.

There are several unilateral CDM projects in India, where project entities finance the registration of projects themselves in the hope of selling issued CERs on a spot market in order to attain a better price than they could by selling forward streams of CERs. There long has been speculation that the owners of issued CERs might prefer to hold on to these assets in the belief that prices would continue to rise above the current value of EUAs (which is used as benchmark price in India). However, recent trends seem to contradict this, with indications of issued CERs coming to the market as well as projects with forward streams.[47] With the ITL up and running, this trend could even accelerate with greater access to sellers through auctions or exchanges.

Systematic Bias in Favor of Large, Industrial Opportunities?

All of Africa (including South Africa and the countries of North Africa) remain at 3% of the market, and all the other countries of Sub-Saharan Africa account for just about one third of that number. These numbers clearly demonstrate the difficulty of expanding carbon business in much of Africa, where electricity access is a major challenge and therefore mitigation opportunities are also limited, e.g. in Uganda or Zambia, just around 10% of the country's population has access to the grid for electricity. Yet, a clean, grid-connected electricity project in such a country has to demonstrate under CDM rules that it displaces "carbon-intensive" electricity on its grid; the fact that it derives mainly power from clean hydro sources is seen as a reason for it not to receive credits for proposed new clean energy sources.

This unintended consequence unnecessarily punishes the poorest people in poor countries, who can least afford to use expensive diesel, kerosene or fuel-wood for their basic needs. The poorest usually forego even the most basic benefits of modern energy services that so many others take for granted. No approved methodology exists as yet through which countries with such obvious energy needs such as these can be rewarded for clean development. The broader eligibility of projects expanding opportunities for clean electricity in countries with largely hydro grids would help make more development opportunities available for people, with CDM playing a role in helping to meet their aspirations. In these cases, a simple methodology could consider using a proxy for the current use of

46. All analyses in this subsection based on Joergen Fenhann et al., op. cit.

47. Consult Global Environmental Markets, April 2007, TFS.

diesel generators, kerosene lamps and fuel-wood as part of the baseline, and multiplying that with a large correction factor to compensate for the suppressed demand.

In the next decade, many African countries will embark on major new infrastructure development, including regional transmission and regional power markets, which could enable, for example, clean hydro to be generated where the resources are (e.g. Mozambique) and transmitted to where the demand is (e.g. South Africa, where cheap coal is plentiful). It is important that investments be encouraged to be low emissions to the extent possible.

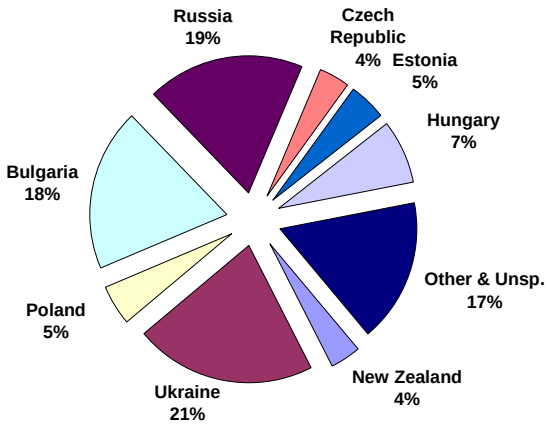
The CDM rules should also consider why opportunities in the agricultural and forestry sectors demonstrating real reductions should not be encouraged in the same way as some opportunities in mitigation from the energy and industrial sectors are. Even within the limitations of the current CDM rules, African countries have demonstrated the potential of such opportunities to mitigate (and help poor communities and ecosystems adapt to climate change risk). This creates a wealth of experience on innovative ways to sequester carbon through afforestation and reforestation activities that also deliver strong local community, environmental and economic benefits.[48]

African countries may do well to look even further beyond the CDM at the quick growing carbon market in the voluntary and retail segments.[49] The voluntary market – expected to expand exponentially in the coming years with growing popular interest in mitigating climate change – could also be an opportunity for countries that have had limited access to the current compliance-driven global carbon market. It may be too late for some African countries to raise awareness from both public and private stakeholders, to develop institutional capacities and technical expertise and source projects in the 2012 timeframe. Alternative sources of demand such as the voluntary market may have the flexibility to reward these efforts regardless of future developments on market continuity.

JI: Moves East

Ukraine, Russia and Bulgaria accounted for 20% each of the ERUs supply traded through 2003-2006 (44 million tCO_2e transacted, or about 10% of the Primary CDM market in 2006). Other countries – and not only in Eastern and Central Europe, but also New Zealand for instance – have also taken part to the market, although to a lesser extent (Figure 5).

Figure 5: Location of JI projects (as a share of volumes supplied 2003-2006)



48. For an overview of the situation of Africa in the Carbon market and the barriers to Carbon finance on the continent, consult State and Trends of the Carbon Market – 2006: A focus on Africa (Nov. 2006) www.carbonfinance.org.

49. Consult E. Harris (2006). "The Voluntary Carbon Market: Current & Future Market Status, and Implications for Development Benefits", IIED Working Paper, http://www.iied.org/CC/projects/VCM.htm.

This picture will change in the coming year as the focus for JI moves further east, to Russia and Ukraine. Transactions in the second half of 2006 and the first quarter of 2007 already exhibit a trend with fewer ERPAs signed in Europe (as was historically the case) and more ERPAs in Russia and Ukraine. This is no surprise as the biggest potential is expected to lie in these two countries, with huge projects in the oil and gas sector as well as power sector (refurbishment and energy efficiency improvements as well as methane capture). The JI pipeline indicates Russia leading the market, with 48% of deliveries over 2008-12, followed by Ukraine with 16%[50]. Other countries, including those in Western Europe and other Annex B countries are also considering JI opportunities (see, for instance, France's announcement on domestic projects with a potential estimated at 15 $MtCO_2e$). However, the EU decision on double counting means that the JI potential can only be realized from projects outside the sectors covered by the EU ETS in the newer members of the EU.[51]

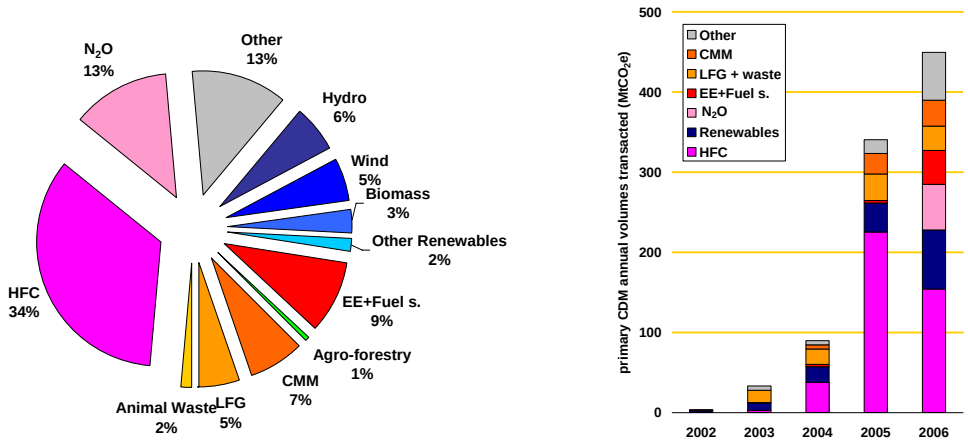
Relatively large numbers are often cited for the large potential in Russia, to upgrade outdated technologies used in gas pipelines, as well as from chemical and steel facilities, and in Ukraine, in the steel and cement sectors. These numbers, if realized, are small compared to what China has already supplied to the market. It remains to be seen what portion of the JI potential may indeed materialize, given remaining uncertainties with regard to issuance procedures and a limited five-year crediting period that may not be sufficient to get many projects up and running. In the next year or so, this pipeline may be exhausted as new opportunities may not be able to obtain financing on the basis of only three years of credits to sell.

4.4 CARBON ASSET CLASSES AND TECHNOLOGIES

Industrial Gases Still Dominate

HFC23 destruction projects, although still the dominant asset class transacted (34% CDM market share), peaked in 2005 (when HFC had a 67% CDM market share) (Figure 6). This could be interpreted as a sign that the stream of HFCs is drying up, especially given questions regarding the treatment of new HCFC-22 facilities under the CDM (a final decision postponed to the next COP/MOP in Bali).

Figure 6: Asset Classes of CDM projects.



As a share of volumes contracted in 2006 **2002-2006**

50. Together with Bulgaria, these three countries account for 75% of supply in the JI pipeline so far. See the JI pipeline by Joergen Fenhann et al., http://cd4cdm.org.

51. In addition, several of these opportunities in the EU newer Member States countries may already have been secured by early public procurement programs.

Projects for the destruction of N_2O – another potent GHG with a global warming potential of 310 – started to appear in the transaction database in 2006, on the basis of two approved methodologies. N_2O projects captured a 13% market share of volumes transacted in 2006. There remain quite a few N_2O projects not yet transacted, although most appear to have been committed exclusively for contract to a buyer. In the next year or so they could be among the ones that buyers find desirable – because of their large volumes and low delivery risk. Together with HFC23 projects, they account for 50% of purchases since 2003 (at 480 million tCO_2e) and represent 40% of expected deliveries by 2012 in the CDM pipeline (and probably quite a bit higher, when adjusted for risk).[52]

Methane in the Market

Coal Mine Methane (CMM) saw an absolute increase over 2005 volumes transacted during 2006 (with a market share constant at 7%). Among projects targeted at abating methane emissions this could be one of the asset classes gaining importance in the future with relatively important and more predictable volumes.

Landfill gas (LFG) projects saw their market share drop from 8% to 5% in 2006. This asset class showed weak project performance and delivery yield in the early set of Issued CERs. To date, some 40 million CERs have been issued across all asset classes (4% of the total volume of CDM transacted so far). Preliminary analysis of the overall project yield (defined as the ratio of the actually issued CERs to the expected emission reductions according to the project design document over the same period) indicates an average yield of 80% across all asset classes with considerable fluctuations across asset classes and within a given asset class. In particular, carbon assets from LFG score the lowest, with an expected yield close to 20%. Reasons cited include, among others, overestimation of the potential generation of gas at the modeling stage, inadequate design of gas capture systems, sub-optimal operation of the landfills, or other external factors. A delay in a project's start date caused by something unrelated to the carbon process (e.g., difficulties in obtaining the required equipment, a late permit, or the failure to close its financing as expected), can substantially reduce the likely volumes that can be delivered by 2012.

Share of Clean Energy Jumps

Carbon credits derived from renewable energy saw their share increasing by 50% in 2006, at 16% compared to 10% in 2005, buoyed mainly by China's decision to identify these alternative sources of energy as a priority. The share of transactions from energy efficiency projects and fuel switching projects increased dramatically from 1% last year to 9% in 2006. Those were mostly energy efficiency projects at industrial facilities. Demand-side management energy-efficiency projects were held back by methodological challenges (additionality requirements for activities that are considered economically rational or because of issues with monitoring). It is, of course the case, that many economically rational activities are not always implemented for a wide variety of reasons, e.g. barriers to information or inertia in consumer behavior.

LULUCF and Agro-forestry Credits

Carbon assets from Land Use, Land-use Change and Forestry (LULUCF) remain at 1% of volumes transacted so far. Their regulatory complexity and limited market access to the EU is likely to limit their demand (at least from private compliance buyers and their intermediaries). On the other hand, the proven community benefits and competitive cost (LULUCF ERPAs typically include post-2012

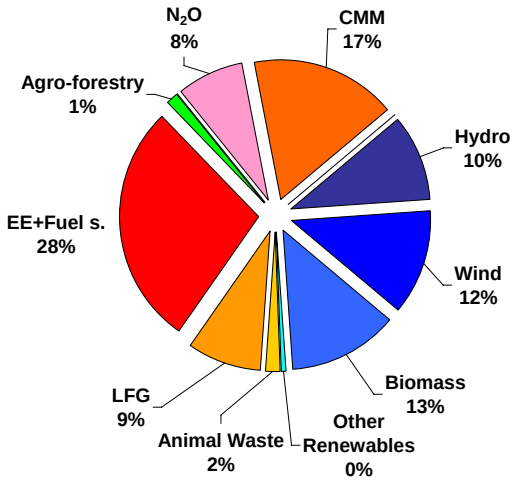
52. Joergen Fenhann et al., op. cit.

vintages and discount price to allow for replacement credits) may result in some additional demand from public buyers, including European governments[53]. Voluntary markets may consider less complex and costly ways to manage permanence risk than the current approach of temporary credits under the CDM. Large classes of LULUCF assets including possibly soil sequestration, fire management and avoided deforestation, among others, remain attractive opportunities to promote sustainable development in Africa and in other natural resource-based economies, but are still systematically excluded from the CDM and other regulatory markets.

JI Enters Market

Carbon credits from clean energy projects comprise the greatest share of the JI market, with slightly less than two thirds of volumes transacted over 2003-2006. ERUs from Energy Efficiency Improvement and Fuel Switching projects came first at 28%, followed by Biomass, Wind and Hydro with respectively 13%, 12% and 10% of the market. N_2O projects from industrial installations account for 8%. This picture could change notably in the coming years as Russia and Ukraine bring opportunities from the oil, gas and power sectors. The UNEP/RISOE pipeline for JI indicates expected credits by 2012 from reducing fugitive emissions will come from pipelines (44%), emission reductions from Energy Efficiency Improvement and Fuel Switching (32%) and CMM (12%).[54] Unlike in developing countries, where green-field projects have long lead times, many such opportunities in JI countries are associated with existing facilities and sites and have relatively shorter lead times. Many such projects are likely to be implemented within the 2012 time-frame provided financing is available before the window of opportunity starts to close.

Figure 7: JI Asset Classes (as a share of volumes supplied 2003-2006)



53. While the EU ETS currently does not allow market access for any assets from LULUCF assets, European Governments (and those in Japan, New Zealand, Canada etc.) can purchase afforestation and reforestation credits under the Kyoto Party rules, where LULUCF can account for up to 1% of baseline emissions. So far the global amount of LULUCF credits transacted is under 6% of this allowable limit.

54. The term "fugitive emissions" refers to pollutants released to the air other than those from stacks or vents. They can be occur due to equipment leaks, evaporative processes, and windblown disturbances.

What is Next?

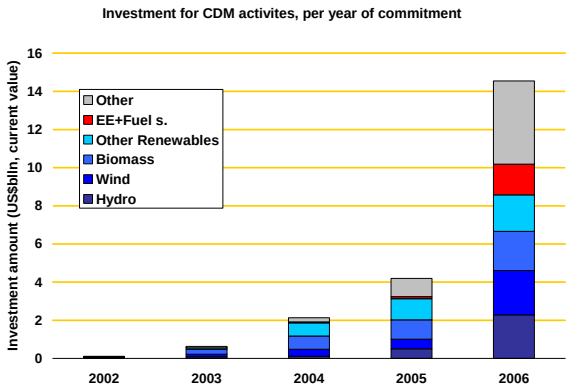
A new facility to help developing countries preserve their tropical forests is being designed with the support of several developing and industrial countries. The proposed Forest Carbon Partnership Facility is aimed at setting the stage for a future large-scale system of positive incentives for reducing the rate of deforestation and degradation. It would build countries' capabilities to harness this future system and a few pilot performance-based payments for reduced emissions from deforestation and degradation. The Forest Carbon Partnership Facility is the second World Bank fund to address the forestry and land use sector, following the BioCarbon Fund (launched in November 2003) to support mostly afforestation and reforestation project activities.

THE ROLE OF CARBON FINANCE IN CLEAN ENERGY INVESTMENT

Since 2002, US$2.7 billion of ERPA value (€2.1 billion) in credits from clean energy investments (renewable energy and methane recovery, fuel switching and energy efficiency) have been contracted, leveraging an estimated US$16 billion in investment in those areas.

At the time when the concept of the CDM was first proposed, it was believed that it could help catalyze new investment into climate mitigation, and, in particular, to support clean energy investments. Policymakers, in particular, would have interest to explore the extent to which the CDM has leveraged such investments for clean energy.

In all, about 920 $MtCO_2e$ have been transacted under the CDM between 2002 and 2006, corresponding to a cumulative value of US$7.8 billion or €6.1 billion (at current prices). About half (52%) of these volumes and a little over half (54%) of the value in the market comes from HFC23 and N_2O destruction operations. Investments associated with reductions of HFC23 emissions, as an example, are not especially large.



In the case of renewable energy, on the other hand, a small amount of carbon requires a much larger financial investment associated with it. The authors examined this "leverage factor" across assets in the World Bank-managed Funds' portfolio. This was defined, simply, as the ratio of capital investment required for project commissioning to the nominal value of the corresponding ERPA. This ratio so derived is assumed to be representative of all such transactions for each asset class and is then applied to all transactions in our database. This approach helps to get an order of magnitude of the financial flows associated with the CDM. Clearly, the prevailing price of carbon at the time of the ERPA (so far increasing over time), the volume contracted and the capital costs of projects (varying by region and technology, but largely declining over time) are key inputs to the computation of the ratios[55].

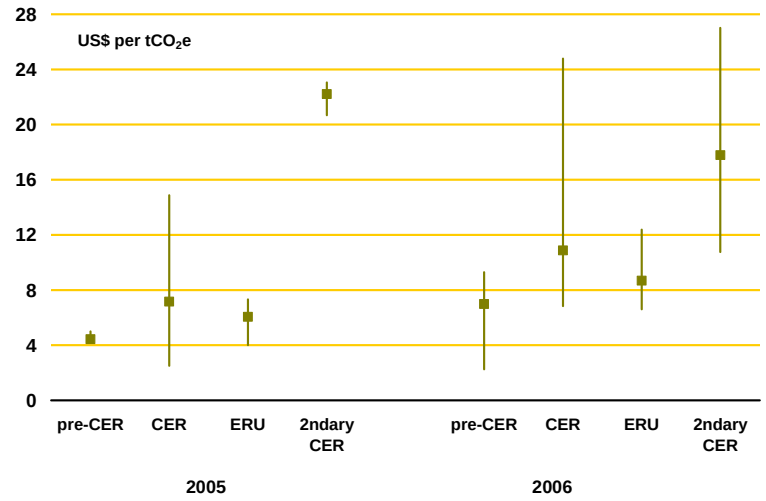
On average, we find a cumulative committed investment to CDM projects activities over 2002-2006 of about US$21.6 billion or €16.9 billion (see figure), for an average leverage ratio of 2.8. If industrial gas transactions are not considered, there is a much higher global leverage ratio at 5.7. The leverage ratio for renewable energy tends to be around nine. Renewable energy account for two-third of the total capital leveraged with biomass at 20% and wind and hydro at 15% respectively.

55. In the case of unilateral projects, the capital investments are made even before a transaction has occurred. On the other hand, there are also carbon transactions that have not reached financial closure, but have yet to secure that financing and may yet be abandoned. Therefore, the authors believe that they have made a rather conservative estimate of the total investments committed.

4.5 INSIGHTS ON THE PRICE OF PROJECT-BASED ASSETS

Prices are up across the board in every segment of the primary project-based carbon market, with weighted average prices for primary CERs at about US$10.90 or €8.40, representing a 52% increase over 2005 levels (see Figure 8).[56] These average prices mask a range that varies based on the specific terms of the contracts entered into (see section on "Terms of project contracts" below). The lowest price paid for a permanent CER in 2006 was US$6.80 or €5.20 from a low US$2.50 or €1.90 in 2005 (a 73% increase).[57]

Figure 8: Observed Prices for Project-based Transactions in 2005 & 2006



The prices at which ERUs transacted in 2006 increased to an average of US$8.70 or €6.70, representing a 45% year-on-year rise, but ERUs remained cheaper than CERs on average. JI assets traded in a range from US$6.60 up to US$12.40, which is lower than the range at which primary CERs (US$6.80-US$24.75) and secondary CERs (US$10.75-US$27) were transacted. Competition in the East was reported to be fierce for large-scale JI projects, with large expected delivery volumes. The higher average price and the upper end of its price range paid for an ERU clearly reflects this strong interest. Some price convergence with CERs is expected; however, the rules and procedures for project approval are not yet ready in Russia and so far, there is no guidance regarding issuance of ERUs by host countries governments. Until all necessary laws are passed, this sovereign risk may well dampen the enthusiasm of buyers for JI or translate into a discount compared to the CDM price. Market players report that the key to closing JI deals is the ability to bring upfront financing (up to 50% of ERPA value). The price of ERUs is often discounted in transactions to reflect the cost of providing upfront finance.

Though the average price of pre-CERs also experienced a significant increase from its 2005 level (+58%), pre-CERs still traded at a discount to CERs and this has widened from 2005 to 2006. This may no longer reflect concerns for project registration but concerns for the actual certification of pre-CERs.

56. All prices in US$ per tCO_2e, unless otherwise indicated.

57. The prices at the top end of the observed value in 2006 correspond to deals that were signed early in the year, including transactions incorporating guarantees.

China's Influence on Pricing

China, as dominant market leader in the project CDM, influenced the overall market price through its informal policy of requiring a minimum acceptable price before providing DNA approval to projects. China's floor price (around US$10.4-11.7 or€8-9 in 2006 and reportedly moving upward in 2007) had a strong impact on CER price development, especially during a period of high EUA volatility in the second half of 2006.

There is very little variance across countries or even regions for CDM, suggesting that other countries were able to use China's price floor as a basis of negotiation of near-equivalent prices in their transactions as well. In the case of countries more willing to risk the market through a floating price, there was the possibility of commanding a price higher than China's in the market. A small discount (€0.50) was discernible in contracts from some countries which were relatively new to the CDM market, with new institutions, a nascent pipeline and few projects at the registration stage.

CER Index

From both buyers and sellers, there seemed to be a desire for a benchmark for CER pricing, with buyers and sellers asking whether the Chinese floor price was the benchmark; or if a fraction of the EUA price was the appropriate way to price it; or, if it was at a certain premium above the marginal cost of reduction of the relevant GHG. Greater price information and transparency on the secondary market for CERs as exchanges soon start listing some index products will provide additional insights on CER pricing and value. The increase in the volume of Issued CERs and the operation of the ITL, will also hopefully help foster the development of the market for issued CERs. Although EU ETS has been and will be a major source of demand, there could emerge some transparent third party index for CER prices in recognition that CER buyers are not limited to EU ETS participants, and Japanese or other buyers may not want to base CER prices on volatile EUA prices which have little to do with their own willingness to pay.

Guaranteed CERs and Issued CERs

On average, primary CERs traded at US$8-10 or €6.20-7.70 (without penalties for under-delivery) while higher prices were observed for guaranteed delivery contracts or transactions involving issued CERs. Where a seller was able to offer issued CERs, a price similar to that of a secondary market guaranteed CER of around 80% of the EUA Dec-'08 delivery was obtained. The authors can only speculate that the delay in ITL completion is the reason for the price discrepancy between an Issued CER and the EUA-'08, since it limits the ability to deliver and transfer CERs into and across national registries.

Discussions with brokers indicate that currently projects at an early stage command US$10.40-12.40 €8-9.50 and registered project transactions command an amount close to US$14.7 or €11.30. Issued CERs have been entering the market and are trading on terms similar to guaranteed forward CERs from investment-grade entities. Secondary guaranteed CERs traded at a price very similar to Issued CERs.

The Rise of the Secondary Market

The secondary market for CERs largely consists of portfolios of guaranteed-delivery CERs offered by blue-chip sellers to deliver CERs (or if not, an equivalent instrument valid for Phase 2 EU ETS compliance), with most if not all delivery risk assigned to the seller. Most of these have contracts calling for fixed prices, although the contract may be pegged to a percentage of a specified forward

EUA price, e.g. 78% of a Dec-'08 EUA. Buyer preferences are also expressed and realized as sustainable development and portfolio diversification.[58]

The secondary market for CERs grew rapidly through the second half of 2006 and continues to grow rapidly in 2007. Several observers noted this segment's growth occurred at a time when there was uncertainty regarding the EUA market and when the price of the EUA went below €15. At that price and below, buyers preferred to purchase a secondary market guaranteed CER than either a forward EUA or a primary CER. It is difficult to draw an accurate estimate for the size of the secondary market since besides a number of transactions executed through brokers and financial institutions, an unknown number of bilateral deals have known to have occurred. The authors note a range of estimates of the current size of this market relative to the primary market for CDM from 10% to 20%. Our database, however, records 39 $MtCO_2e$ transacted through 2006 (slightly less than 9% of the primary CDM market volume).

Buying a secondary market CER certainly has some advantages for the buyer. For one, the buyer is purchasing a near compliance-grade asset with firm volumes deliveries and guarantees. Some transactions included swaps, for instance, in the form of a physical settlement: replacement of CERs by EUAs. The buyer is immune from the risk of project performance on any one project and from any other risks related to the quality and timing of deliveries into registries. The buyer also does not have to create an infrastructure or team to source and structure carbon transactions.

There is increased standardization of contracts in the secondary markets and this standardization considerably facilitates the trade of CERs for compliance purposes, for hedging purposes and for arbitrage purposes. Players on this market are primarily financial institutions, large energy players (including large compliance players like utilities (on the buy –side from their compliance groups and on the sell side from their trading groups) and speculators (such as investors' funds). Both European and Japanese clients actively trade through brokers, with the UK and Japan perhaps accounting for the largest number of buy-side secondary transactions by country.

Potential delivery risks in secondary CER transactions include ITL risk – the risk that the ITL will not be operational at the time of CER delivery – and/or the risk that the buyer and/or seller country will not be eligible for international emissions trading pursuant to the requirements of Article 17 of the Kyoto Protocol. These differences on the basis of regulatory factors (delivery date and registry) and contractual factors (cost of carry-over and walk-away provisions) translate into price differences among secondary CERs. Once the regulatory issues are resolved, a standard could appear on the secondary market.

The only risk that the seller of a secondary CER generally does not take on is ITL risk. In cases where some highly creditworthy sellers assumed ITL risk in secondary CERs, those contracts were priced at just over 90% of the December 2008-delivery EUA price prevailing at that time. Although there is a small risk differential between a secondary CER contract where the seller assumes all the risk and an Issued CER, the market perceives the risk differently – and accordingly prices differently – an Issued CER and a secondary CER.

Secondary CERs were priced in 2006 at a 10 to 30 % discount to the EUA index and recently, they have traded at a floating price at a 25% discount to the EUA Dec-'08. This does not imply that all transactions are indexed to EUA forward price on delivery; rather offers for fixed prices are also common. Although the EU ETS is the largest source of demand on the project-based market and though EUAs are among the only carbon compliance instruments whose price are daily quoted, some buyers may not wish to tie the value of their transactions too closely to a market where they do not

58. One buyer reported purchasing a portfolio of guaranteed delivery and specified that the portfolio include no HFC23 assets at all. (When pressed, he stated that given a choice between HFC23 and no HFC23, he preferred no HFC23). Another market player, a broker, reported having over 60 different counterparties for secondary market transactions, including every major European utility and every private carbon fund as his clients.

belong (eg Japanese utilities). As exchanges start trading secondary CERs, another benchmark could emerge – a secondary CER benchmark that takes into account considerations other than EUA prices, e.g. Japanese buyers' willingness to pay.

The commonly cited 10-30% price gap between the secondary guaranteed CER and the EUA reflects fundamentals of supply and demand. Some market analysts stated that they considered concerns about the quality of underlying projects as being over-stated, especially in a market still uncertain about the actual delivery performance yield from projects contracted. They also pointed out that while some buyers were in fact not interested in HFC23 assets, that only affected their willingness to enter into negotiations but did not really impact price considerations. It is clear, at the time of writing, that concerns about CER "quality" were coming into the market (e.g., the questions raised about oil palm projects in Malaysia).

4.6 TERMS OF PROJECT CONTRACTS

Indexed transactions were a lot less prevalent in the second half of 2006 and the first quarter of 2007. Fixed forward prices were the norm, with buyers and sellers reporting that these were less complex to negotiate and agree before moving on to the next transaction. Those projects that had a floating component, usually incorporated a combination of fixed (around US$6.50-7.80 or €5-6) and indexed pricing. In these transactions, a floor price (at a level lower than fixed price transactions) was agreed, and the buyer and seller shared any potential price upside. The potential higher price was based on a percentage of an EUA index price, e.g. 75% of Dec-'08 delivery.

One reason for the shift away from indexed transactions is recognition of the volatility of the EUA market and a belief that prices would not simply rise forever. From the perspective of the buyer, there is recognition that gross margins in this business are thinner and that re-selling the purchased contracts without any risk mitigation was quickly becoming more of a commodity business in the wake of price volatility in the EUA market. Further, primary buyers discovered that there were no longer large premia available for non-value added secondary transactions from non-blue-chip buyers without a strong balance sheet. Finally, European buyers were more comfortable with indexing to EUAs, while Japanese buyers stated that they had no reason to anchor their contracts to the EUA benchmark. Public buyers often had finite budget allocations and were not in a position to risk indexed ERPAs. Among sellers, the price setting policy of the Chinese government meant that it was more difficult to "meet the floor price expectations" and also offer an upside on top of that.

Strong delivery guarantees are not the norm for Primary CDM transactions. Many buyers seem to prefer to negotiate a lower price and hedge any expected delivery shortfalls through contracting only a fraction of expected deliveries from the project design document ("over-collaterization"). One buyer, for example, secured seniority in contract deliveries through the acquisition of the *first* CERs generated by the project and call options (often as a 'Right of First Refusal') for additional CERs. This contractual structure also appeals to project developers in having an interest in project performance. Some, although not all, of these contracts included a premium for the option. Several contracts also had conditions precedent that require that the project be validated and registered with the CDM Executive Board within a specified time-period, typically 12 months from the date of the contract. Some contracts have provisions for either party to claim damages for losses suffered for willful default or gross negligence by either party in addition to making the other party whole under the contract.

A small percentage of buyers and sellers reported that advance payments were made in the case of CDM projects, they appeared to be the norm for JI projects, where project financing is an absolute requisite to a successful negotiation (given the short timeframe to obtain credits, there is no time to lose to get the project up and running). When upfront payments were used, payments for up to 50% of the ERPA value were not uncommon – and a portion of these were backed up by guarantees from internationally rated banks. The schedule of payment is associated to technical, operational or

regulatory milestones. Upfront payments were sometimes obtained against a letter of guarantee and recovered against first deliveries of emissions reductions. This clearly translated into a discount on price.

A number of insurance products have been developed to cover a range of risks e.g. regulatory risk, delivery risk and political breach of contract risk etc. Products to cover these risks have been developed by the World Bank's Multilateral Investment Guarantee Agency (MIGA) or International Finance Corporation (IFC), Carbon Re, Swiss Re, Munich Re, AIG, Allianz, and Rabobank, among others. Many project developers and asset managers that we interviewed stated that insurance products have not been popular. The market for insurance products was described as "little developed" by some market participants, and the products were seen as very expensive. There are, of course, many ways to manage risk across commodities (e.g. EUAs and CERS, or carbon and energy) and the growth of the secondary market have enabled market participants to use carbon as an instrument to do so. Portfolio management seems still to be the favourite way to manage delivery risk, through project type selection and geographical diversification. In addition, there is a developing market for call/put options on CERs that help hedging at the margin for underdelivery or overcommitment of the whole portfolio.

4.7 DEMAND ON OTHER FRONTS: NORTH AMERICA AND THE VOLUNTARY MARKETS

North America and the Carbon Market

Canada made an announcement in late April 2007 to slow down emissions growth by 2010 and then reduce emissions by 150 million tCO_2e by 2020– or 20% below current levels.[59] This approach would use intensity targets and unlimited emissions trading by 2010 and allows the unlimited use of domestic offsets and the use of certain Kyoto Clean Development Mechanism CERs up to a 10% limit. Banking is allowed and credit for early action is encouraged. Under these assumptions, some demand from Canada could enter the CER market relatively soon. The proposal also envisages a Technology Fund and market linkages across North America. A growing North American market for project offsets has been observed, perhaps in anticipation of domestic Canadian offsets and emissions trading programs in the USA.

It is not at all obvious from recent regulatory developments in the U.S. that the new markets will translate into a new source of significant near-term demand for CDM and JI credits. First, the expected level of demand in the early years is low (see below), and, second, the nascent markets in the U.S. appear likely to generate a demand mainly for domestic offsets. This would be a missed opportunity to use the efficiency of the global market to ensure the maximum environmental benefit through ambitious emission reduction targets.

Overall emission reductions in RGGI relative to the reference case will be approximately five $MtCO_2e$ in 2012, approximately 10 $MtCO_2e$ in 2015, and approximately 30 $MtCO_2e$ in 2018.[60] Prices in the RGGI system have been estimated to increase gradually from US$1 in 2009 to US$2 in 2021.[61] Based on the RGGI Model Rule, average prices over the course of a year would need to exceed US$10 before CERs became eligible for compliance. Therefore, at present it appears that RGGI will not have significant or any demand for CERs, and will not impact CER prices. The authors suggest that a judicious use of proceeds of allowance or permit auctions could protect the most vulnerable consumers from price shocks without distorting the market. A fully competitive carbon market

59. Adapted from Macleod Dixon LLP analysis of the Government of Canada's Regulatory Framework for Air Emissions, which elaborates on the greenhouse gas and air pollution emission reduction targets, April 26, 2007.

60. http://rggi.org/docs/ipm_modeling_results_9_21_05.ppt.

61. ICF modeling documents published to date are available at http://www.rggi.org/documents.htm.

coupled with a fully competitive energy market could also help expand the choices for consumers and go a long way to have consumers benefit from competition among power suppliers and distributors.

Following passage of Assembly Bill 32 (AB32) – enacted in California in August 2006 – from 60 to 80 $MtCO_2e$ are needed from 2010 to 2020 to achieve the target of bringing down emissions by 2020 to their levels in 1990.[62] This figure could be revised as considerable uncertainties surround the computation of 1990 baseline. It suggests however that California could potentially have an impact on CER/ERU markets, should a California cap-and-trade program be established and should that trading program allow for CER/ERU use (and even more so if other Western States joined in). Until program design elements are known (notably the stringency of the cap and the eligible asset classes and their location), it is difficult to guess what prices might be under a California trading program, and whether there could be significant demand for CER/ERUs. In particular, if California sources have extensive access to inexpensive domestic offsets, this could reduce or even eliminate demand for CERs.[63] From a policy and program design perspective, allowing for the maximum "where, when and what" flexibility should make achieving strict targets easier.

The U.S. State of Minnesota recently announced its intention to develop a carbon emissions management program. A mish-mash of various laws across the nation poses unique problems for compliance with the risk of a lack of common reporting standards and the lack of fungibility of offsets. In this context renewed interest in and business support for a federal approach to reducing greenhouse gas emissions should be viewed with interest. There are several legislative bills to regulate greenhouse gas emissions that have been proposed in the U.S. Congress. An update from the Pew Center on Global Climate Change shows that the S.280 Bill (McCain-Lieberman) and the S.485 Bill (Kerry-Snowe) offer both flexibility and absolute reductions as well as a long-term horizon without distortionary price caps or triggers.

The Rise of the Voluntary Markets: Caveat Emptor?

The voluntary carbon markets have seen dramatic growth since 2003-2004. There is something extremely appealing about a business model that caters to the better instincts of mankind to make the world a better place. Inevitably, a wide-open space such as this attracts some bad apples that create problems for other players in the segment. This is why it is critical that responsible market players develop a simple but credible standard for voluntary emission reductions.

This is important since a significant number of companies are now offering project-based emission reductions to:

- individuals that may wish to offset GHG emissions linked to their way of life (residential energy use, commuting, travel),
- to customer-facing companies that wish to offset GHG emissions from their operations or from specific products or events (sports, concerts, conferences but also travels, mortgages, utility bills, shipping and other goods and services their customer may wish to render carbon neutral)
- to high emitting companies that may wish to voluntarily offset the GHG emissions from some portion of their activities that they cannot immediately reduce through their operations.

62. http://www.energy.ca.gov/2005publications/CEC-600-2005-025/CEC-600-2005-025.PDF, p. 13.

63. While linking to RGGI would create a larger U.S. market, it probably would not lead to higher prices in a California program, given that modeled price estimates under RGGI are in the US$1-2 range until 2021. Though CERs may be used for compliance by CCX participants, it seems unlikely prices will be high enough to render CERs attractive from now on till the end of the scheme by 2010 given that participants are likely to have cost-effective internal abatement options available, as well as inexpensive domestic offsets.

One market participant described the efforts of the authors to attempt to estimate the size of the voluntary market as "heroic."[64] Clearly, determining the true nature of this segment of the carbon market is not an easy task, even when one is able to reach suppliers and corporate or individual buyers in this highly fragmented business.

This "tCO2e"-frenzy has encouraged new businesses to enter the market for project origination. Carbon offset suppliers are increasingly "just another one of the many" business suppliers that compete to provide the climate-friendly face of the company to its customers, one more customer-facing attribute of its service. In addition, a number of major companies (in the US, for instance) have been issuing 'Request for Proposal' tenders to source offsets linked to voluntary commitments, carbon neutrality or anticipated compliance. To the extent the emission reductions from the underlying projects are credibly "additional", these numbers could further enhance the effort for global emission reductions. In particular, this segment could be of interest to those African countries not reached by the compliance market, but where there are good opportunities to reduce emissions by efforts that could bring electricity, health or education services to a village, where there was little or no prospect for any development.

Prices observed on the retail market range widely from a low of US$1 to US$78 (Bellassen and Leget, 2007[65]). The authors are aware of companies in this segment looking for bigger volumes of VERs of around 50,000 to 100,000 tCO_2e in the range of US$1 to US$15. The integrity of the offset traded has the biggest influence on price and is often measured across one or more of the following parameters:

- the additionality of the project (making sure the project is not claiming reductions that would already occur),
- the actual existence of the emission reductions (making sure the project activity is monitored and that emissions reduction claimed are verified),
- the exclusion of double-counting (making sure the same emission reductions are not sold to several buyers at the same time),
- the permanence of the reduction (making sure the emission reductions are not temporary) and the existence of community benefits.

The major risk and constraint to this segment is the lack of a respected voluntary standard for emission reductions. Rarely does "a ton is a ton is a ton" hold less true than in this segment.[66] Credibility is important to both the responsible individuals and corporate houses for whom reputation is an important motivator to reduce their climate footprints. A credible voluntary standard will do more to attract value to this segment than any other action. Credibility is also critical to the extent that suspicion may spread to the (regulated) CDM and JI market. In order to be credible, a voluntary standard does not need to be exactly the same as the standards created by the CDM Executive Board. It could, for example, have a much more simple and intuitive standard for additionality. It may, for example, require third party verification, but perhaps that could be community-based and enforced.

64. Fortunately, two forthcoming market studies focused on the voluntary markets will soon help to draw a map of this outer space.

65. V. Bellassen and B. Leguet (2007). "Voluntary Carbon Offsets: the Awakening", Caisse des Dépôts Climate Taskforce Research report N°11.

66. Several recent newspaper articles have pointed out the risks to the uninformed buyer to pay for unverified environmental and community benefits. The co-authors recently observed two retail offerings that illustrate this point quite dramatically. An individual on a prominent on-line auction site offered for sale a carbon offset created by his commitment to climb the stairs to work every day instead of taking the elevator. (Any reduction of obesity from climbing stairs is, presumably, a related community benefit). In another offer on the same site, customers could purchase a "lifetime carbon credit" in exchange for persuading "native communities to reduce carbon emissions by resuming their traditional practices of hunting whales". While these are rather extreme examples, they drive home the urgent need for standards before one or more less than serious or unscrupulous entities destroy the potential for this segment to motivate people to protect the climate.

In recent months, several different standards have been proposed by NGOs and professionals, as well as by some governments (e.g. the UK government[67]). One can hope that the market would sort this out and allow the best standards to flourish. Alternatively, it might be worth considering a process, such as the Gold Standard (endorsed by some 40 NGOs) and the Voluntary Carbon Standard (developed by The Climate Group, the International Emissions Trading Association (IETA) and the World Economic Forum Global Greenhouse Register) or other, to synthesize an acceptable standard from the ones already proposed.

4.8 IS THERE A POST 2012 MARKET?

Preliminary findings from IETA's recent Market Sentiment Survey indicate that more than 90% of respondents believe that the GHG Market is an established instrument that will continue post 2012. In addition, more than 65% of those surveyed anticipated that a global market will be established in the next 10 years.[68] In this context, the recent EU announcement regarding its climate and energy policy for 2012-2020 and beyond appears to been taken seriously by the business community. Investment decisions are now more likely to take into account the high likelihood of a carbon-constrained environment, at least in the EU. Similarly, the recent announcement by the Government of Canada, including a role for CERs, banking and credit for early action may also trigger efforts by Canadian companies to start identifying and pursuing abatement options at home and abroad. Developments in the EU, USA, Canada and Australia have helped kick off a modest post-2012 market in abatement domestically; however there is much ambiguity about the extent to which CDM and JI will play a role in compliance.

Since there is still some uncertainty at play about details of each of these post-2012 regimes, there is some risk that origination of new carbon projects tapers off. This should not imply however a weakening of prices for CERs and ERUs in the short run as there still is some strong residual demand before 2012 to be met. Further, if the emerging North American regimes encourage early action and banking of CERs, this could stimulate further demand.

Some buyers have been purchasing post-2012 vintages, extending the horizon of the stream of carbon revenues and improving the financial viability of projects that require additional help to meet hurdle rates. The uncertainty about demand post-2012 may justify a lower price – given the uncertain compliance value of the credits that may be generated.[69] The most common way to address post-2012 uncertainty in the market is through a zero premium call option provided to the buyer in which the strike price is at the same level as the contract price for pre-2013 vintages or at the prevailing market price should there be a system in place in which the reductions can be used for compliance. Some buyers do not put a value on this option at the moment, and sellers are essentially giving away the option. But this may evolve quickly as more confidence appears on the post-2012 front.[70]

67. See the consultation launched by the DEFRA last January on a Code of Best Practice for the provision of carbon offsetting to UK customers. Interestingly, though the development on the non-regulated markets are acknowledged and supported, the document only considers credits from mandatory schemes. http://www.defra.gov.uk/environment/climatechange/uk/carbonoffset/codeofpractice.htm

68. IETA's recent market sentiment survey is available at www.IETA.org.

69. One or more multilateral financial organizations are exploring the possibility of establishing a post-2012 facility.

70. One broker reported an option transaction for post-2012 emission reductions priced in the range of U$3-8 per tCO2e. Another transaction for 5MtCO_2e expiring in December 2015 offered a €2.39 premium and €5.00 strike price.

V OUTLOOK

MARK TWAIN famously reacted to a newspaper obituary mistakenly published in America prior to his death by sending a cable to the press that read, simply: “Reports of my death are greatly exaggerated”. More recently, the British folk/rock violinist Dave Swarbrick, was reported in The Daily Telegraph as having died in April 1999 following a visit to hospital in Coventry. After having read the favorable obituary, he stated: "It's not the first time I have died in Coventry".

The carbon market – and innovation around it – is alive and well in 2007, having emerged from its best year yet. The price signal for carbon emerging from the level of constraints set by policy makers is a strong motivator for abatement activities as well as innovation. It also makes managing carbon part of the “business of business”. The voluntary markets give each individual a choice to contribute to the solution. The significant new capital in the market motivates the best and brightest in our societies to put their considerable talents in favor of a low-carbon future.

5.1 STILL SOME STRONG DEMAND ON THE PRIMARY JI AND CDM MARKETS

The reviewed European NAPs-II do not place any significant constraints to JI & CDM and about an additional one billion tCO_2e could potentially be contracted in all on the Kyoto projects market[71]. Adding aviation to the EU ETS could add marginally to demand for EUAs by 15-30 $MtCO_2e$ in 2011 and 30-80 $MtCO_2e$ in 2012, resulting in some additional demand for JI/CDM. Japan’s targets for domestic abatement are not likely to be met without a significantly higher share of JI & CDM than is currently envisaged by both government purchases and private buyers. In this context, there is the prospect that governments could turn to the flexible mechanisms, including JI, CDM as well as GIS/Green AAU schemes to contribute to overall compliance.

Even without factoring in any potential demand from Australia, Canada and the United States, there is still significant potential demand for CDM and JI from Japan and the EU before 2012 (see Table 4). By being out in front of the others, the EU, and in particular the private companies regulated by the EU ETS, has benefited in its efforts at compliance by securing the highest share of project-based transaction volumes. The authors expect that there will be increasing demands for quality reductions in the voluntary market as well, which could bring additional demand for CDM and JI.

Flexibility is key to ensuring that there is a built-in safety valve for compliance without resort to market distortion through price caps (as being considered by some sub-national regimes in the U.S. and Australia). It would be appropriate to recall here that flexibility is not the goal of climate policy; rather it a tool to help achieve the most stringent targets. In this regard, the use of flexible mechanisms in Phase II coupled with much stronger reductions in Phase III and the unilateral European target announced for 2020 should be at stringent enough levels that can help stimulate a low carbon clean investment future. Setting an arbitrary price cap distorts the level of innovation required to meet the compliance target and dilutes the ability to meet the environmental target.[72] The authors welcome the flexibility enshrined in the compliance plans of the EU ETS in Phase II.

If EU emission trends put the Kyoto targets within closer reach than is anticipated, then incentives to over-comply could be considered within the EU ETS as a reward for early and additional emission

71. Given the challenges experienced from performance risk and on-time delivery, it is another, but important, matter what proportion of the volumes contracted will actually be available for compliance when needed.

72. Protecting the welfare of poorer communities to pay higher electricity prices is an important concern important for many governments. Auctioning allowances and using the proceeds from the auction judiciously as a buffer for poorer consumers may be an approach worth considering.

reductions. This could also serve to stimulate domestic abatement at a significant level so that the flexible instruments remain truly supplemental as a means of enabling cost-effective compliance in Europe. In this regard, European action becomes more meaningful for the climate system when accompanied by strong actions by other major emitters.

Table 4: Supply and Demand in Perspective:
Analysts' Current Views on the Kyoto Markets

Potential Demand 2008-12					Potential Supply 2008-12	
Country or Entity	Distance to target ($MtCO_2e$)	KMs demand ($MtCO_2e$)	CDM&JI Contracted ($MtCO_2e$)	Residual demand for KMs ($MtCO_2e$)	Potential surplus of AAUs ($MtCO_2e$)	
					Russian Fed	3,200
EU-15 govts	1,300*	450	143	307	Ukraine	2,200
EU ETS	1,250 (900-1,500)	1,140 (900-1,400)	506	634	EU-8+2	700 -1,500
Japan (govt & cies)	500*	350 (100-500)	266	84	Other EITs	200
Ro Europe & N. Zealand	200	60	2	58	**TOTAL**	**6,300-7,100**
TOTAL		**2,000**	**917**	**1,083**	CDM & JI Potential ($MtCO_2e$)	
Canada	*1,300*	*??*	*0*	*??*	CDM	1,500†
					JI	200‡
					TOTAL	**1,700**

Notes: **KMs** = Kyoto Mechanisms. Range for the estimates indicated between parentheses.
*****: gross shortfall once sinks are taken into account.
†: expected CERs deliveries in the CDM RISOE pipeline, adjusted for observed yields (as of end of March 2007).
‡: estimate from Point Carbon.

Sources: **4th National Communications**, for Distance to target as well as KMs demand for Kyoto Parties and Potential surplus of AAUs under the "with existing measures" scenario; average of (central) estimates from **Fortis, Merrill Lynch, New Carbon Finance, Point Carbon, Société Générale and UBS** for Distance to target and KMs demand for EU ETS.

5.2 GIS AND AAUS

There is currently a projected compliance shortfall of 3.3 billion tCO_2e for Kyoto Parties, including Canada (and after accounting for domestic sinks). Assigned Amount Units (AAUs) have the potential to deliver more than 7.1 billion tCO_2e. This raises a question about the potential impact of the oversupply of AAUs on the prices of project-based emission reductions. Clearly, this potential exists, but there are several factors that reduce the likelihood of this happening:

- EU ETS-regulated companies cannot use AAUs to meet their EU ETS obligations,
- A seller country needs to fulfill the eligibility requirements under the Kyoto Protocol to acquire and transfer AAUs (no country is yet fully eligible and some of the Economies in Transition (EIT), notably Russia and Ukraine, may not fulfill the eligibility requirements for some time to come),

- There may be reputational risk for buyer countries from purchasing excess AAUs (perceived to have no environmental additionality) on the side of the buying governments, and,
- It is likely that Economies in Transition will bank a significant portion of their excess AAUs for future commitments as well as to seek a way to have some pricing power for these assets.

There is political resistance in Annex B countries to simply write a check for what is perceived as no additional environmental effort to reduce emissions. The concept of "greening AAUs" emerged as an approach to overcome this issue of environmental additionality which is a barrier to transacting these stranded assets. "Greening AAUs" is seen as a way to use the proceeds of an AAU sale in to other projects with environmental integrity. This sort of "Green Investment Scheme" (GIS) could include direct investment in projects or policies to encourage fuel switching and non-fossil energy use and improve energy efficiency; or could support environmental objectives such as slowing the rate of deforestation or other measurable policy and investment initiatives. Some countries have started to identify potential projects and defining approval guidelines or identify key priority areas for environmental greening policies.

Bulgaria had emerged earlier as a first mover in announcing its intention to consider setting up a GIS, but is yet to operationalise it. More recently, Latvia and Ukraine have expressed their interest in this regard.[73] From a Kyoto compliance perspective, some governments could be viewing GIS/AAU transactions as a safety valve just in case domestic measures to reduce carbon intensity do not kick in within the timeframes expected. Ultimately, the volumes under consideration will depend on the ambition and performance of domestic policies and measures to close the Kyoto compliance gap, as well as the delivery record and price points of CER and ERU markets.

5.3 SECONDARY MARKET FOR CERS

The secondary market for CERs is expected to grow rapidly in the coming years. Reasons include:

- Several buyers like the delivery certainty of guaranteed secondary CERs and are willing to pay a higher price for the certainty.
- Secondary markets provide companies and funds with the opportunity to liquidate some part or all of their positions for cash. This is especially true when the ITL is not in place, prolonging the time they have to wait before transacting their assets.
- Secondary markets provide access to a wide variety of regulated and unregulated markets.

The growth in secondary transactions is a good sign of a well-developing commodity market with the possibility over time of accessing additional resources from the capital markets.

5.4 VOLUNTARY MARKET: GAINING MOMENTUM?

Some of the more optimistic estimates for the size of the voluntary market by 2010 are as high as 400 $MtCO_2e$ (or almost as high as the CDM market is today)[74]. Earlier this year, U.S. analyst Trexler[75] estimated that US demand alone for offsets under the voluntary market could almost double annually from today to 250 $MtCO_2e$ by 2011. While such numbers may be hard to imagine today when the voluntary retail segment accounted for only about 20 $MtCO_2e$ in 2006, such a future is certainly possible.

73. Quite recently, Ukraine declared its intention to sell through GIS up to 1.2 billion tCO2e and Latvia is expected to launch a small pilot GIS later this year.

74. ICF (2006). Voluntary Carbon Offsets Market: Outlook 2007, ICF International: London.

75. M. Trexler (2007). "US Demand?", presentation at the Point Carbon Carbon Market Insights 2007, Copenhagen, 13-15 March 2007.

Consider, for example, that per capita, every American emits 20 tCO_2e annually[76]. More than 100 million Americans have one or more credit cards. If it would be possible to reach 1% of American credit card holders a year every year for the next five years, one could imagine a customer base addition of one million customers a year. Assuming each customer offsets his or her own per capita share gives a potential demand of five million customers offsetting 50 million tons annually by 2012. Double that rate of market penetration and one could see demand for 100 million tons annually. At a price of US$10, this would translate into a market opportunity of US$1 billion. With venture capitalists and "smart money" entering this field, numbers at this scale and beyond could be possible in that time frame.

The growth of the voluntary markets is a welcome indicator of the appetite that ordinary individuals and companies across the world have to take personal responsibility for the problem of climate change. Sadly, their rapid, uncontrolled growth is also a reflection on how much more their governments could be doing to reduce emissions. It also reflects that other governments need to participate in the effort to spur innovation towards a low-carbon future by taking steps to reduce their emissions.

5.5 BEYOND THE CARBON MARKET

There is a tendency to believe that the carbon market is somehow a magic bullet that will alone save the world from global warming. While the authors recognize the enormous strength and potential of the market to achieve results, it would be wise not to assume the market will provide a painless, magical way to mitigate climate change.

First, the market does not set the level of a cap, policy-makers do. The market can only be a tool to help achieve that target. It cannot be a surrogate for a target and policy makes should not expect to be let off the hook from their jobs – making sensible policy.

Second, policy makers need to set targets and support mechanisms that meet two massive challenges. They have the responsibility of taking into account the risks of climate change, especially on the poorest, as well as the opportunity of expanding clean development choices to meet the basic needs and aspirations of billions worldwide, many without access to electricity or clean water.

Third, there is no free lunch. The exuberance of creating value – and enormous wealth – in a new market should not mask the fact that there are costs for mitigation.

Fourth, the integrity of a market rests on the clarity and simplicity of its rules, the transparency of information and on institutions that guard against fraud and manipulation.

Fifth, it is not fair to expect "cap-and-trade" or emissions trading to work in all sectors globally; clearly, housing and transport are sectors that do not lend themselves easily to an elegant emissions cap-and-trade approach. There may be other policies – including other market-based approaches or removal of subsidies – that may be more suitable in some contexts.

Finally, a solution to urgent problem of the climate change problem will require sustained effort by all of us. Policy has a role, as does individual action by each of us. It will also require applying market-based principles to the likely need for society – especially its most vulnerable members – to adapt to climate change.

76. Based on 2003 total GHG emissions (excluding LULUCF) from Climate Analysis Indicators Tool (CAIT) version 4.0. (Washington, DC: World Resources Institute, 2007). Available at http://cait.wri.org.

GLOSSARY

Additionality: According to the Kyoto Protocol, gas emission reductions generated by Clean Development Mechanism and Joint Implementation project activities must be additional to those that otherwise would occur. Additionality is established when there is a positive difference between the emissions that occur in the baseline scenario, and the emissions that occur in the proposed project.

Afforestation: The process of establishing and growing forests on bare or cultivated land, which has not been forested in recent history.

Assigned Amount Unit (AAU): Annex I Parties are issued AAUs up to the level of their assigned amount, corresponding to the quantity of greenhouse gases they can release in accordance with the Kyoto Protocol (Art. 3), during the first commitment period of that protocol (2008-12). AAUs equal one tCO_2e. AAUs may be exchanged through emissions trading (KP. Art. 17). Unlike CERs or ERUs, AAUs can only be used by sovereign entites.

Banking or carry over: Compliance units under the various schemes to manage GHG emissions in existence may or may not be carried over from one commitment period to the next. Banking may encourage early action by mandated entities depending on their current situation and their anticipations of future carbon constraints. In addition banking brings market continuity. Banking between Phase I and Phase II of the EU ETS is not allowed but will be allowed between Phase II and further Phases. Some restrictions on the amount of units that can be carried over may apply: for instance, AAUs may be banked with no restriction by a Kyoto Party while the amount CERs that can be carried over is limited to 2.5 % of the assigned amount of each Party.

Baseline: The emission of greenhouse gases that would occur without the contemplated policy intervention or project activity.

Biomass Fuel: Combustible fuel composed of a biological material, for example, wood or wood by-products, rice husks, or cow dung.

Carbon Asset: The potential of greenhouse gas emission reductions that a project is able to generate and sell.

Carbon Finance: Resources provided to projects generating (or expected to generate) greenhouse gas (or carbon) emission reductions in the form of the purchase of such emission reductions.

Carbon Dioxide Equivalent (CO_2e): The universal unit of measurement used to indicate the global warming potential of each of the six greenhouse gases. Carbon dioxide— a naturally occurring gas that is a byproduct of burning fossil fuels and biomass, land-use changes, and other industrial processes— is the reference gas against which the other greenhouse gases are measured.

Certified Emission Reductions (CERs): A unit of greenhouse gas emission reductions issued pursuant to the Clean Development Mechanism of the Kyoto Protocol, and measured in metric tons of carbon dioxide equivalent. One CER represents a reduction of greenhouse gas emissions of one tCO_2e.

Chicago Climate Exchange (CCX): Members to the Chicago Climate Exchange make a voluntary but legally binding commitment to reduce GHG emissions. By the end of Phase I (December, 2006), all Members will have reduced direct emissions 4% below a baseline period of 1998-2001. Phase II, which extends the CCX reduction program through 2010, will require all Members to ultimately reduce GHG emissions 6% below baseline. Among the members are companies from North America as well as municipalities or US States or Universities. As new regional initiatives began to take shape in the U.S., membership of the CCX grew from 127 members in January 2006 to 237 members by the end of the year while new participants expressed their interest in familiarizing themselves with emissions trading. More information at www.chicagoclimateexchange.com

Clean Development Mechanism (CDM): The mechanism provided by Article 12 of the Kyoto Protocol, designed to assist developing countries in achieving sustainable development by permitting industrialized countries to finance projects for reducing greenhouse gas emission in developing countries and receive credit for doing so.

Conference of Parties (COP): The meeting of parties to the United Nations Framework Convention on Climate Change.

Eligibility Requirements : There are six Eligibility Requirements for Participating in Emissions Trading (Art. 17) for Annex I Parties. Those are: (i) being a Party to the Kyoto Protocol, (ii) having calculated and recorded one's Assigned Amount, (iii) having in place a national system for inventory, (iv) having in place a national registry, (v) having submitted an annual inventory and (vi) submit supplementary information on assigned amount. An Annex I party will automatically become eligible after 16 months have elapsed since the submission of its report on calculation of its assigned amount. Then, this Party and any entity having opened an account in the registry can participate in Emissions Trading. However, a Party could lose its eligibility if the Enforcement Branch of the Compliance Committee has determined the Party is non-compliance with the eligibility requirements.

Emission Reductions (ERs): The measurable reduction of release of greenhouse gases into the atmosphere from a specified activity or over a specified area, and a specified period of time.

Emission Reductions Purchase Agreement (ERPA): Agreement which governs the purchase and sale of emission reductions.

Emission Reduction Units (ERUs): A unit of emission reductions issued pursuant to Joint Implementation. This

unit is equal to one metric ton of carbon dioxide equivalent.

European Union Allowances (EUAs): the allowances in use under the EU ETS. An EUA unit is equal to one metric ton of carbon dioxide equivalent.

European Union Emission Trading Scheme (EU ETS): The EU ETS was launched on January 1, 2005 as a cornerstone of EU climate policy towards its Kyoto commitment and beyond. In its first phase from 2005 to 2007, the EU ETS regulates CO_2 emissions from energy-intensive installations representing some 40% of EU emissions. Those emissions are capped at 6,600 $MtCO_2$ over the 2005-2007 period. Following this pilot phase, Phase II of the EU ETS (extending from 2008 to 2012) should see a tighter constraint on obligated installations, given that the decisions so far rendered on 19 NAPs set on average the annual cap at 5.8% below 2005 verified emissions (adjusted for Phase II perimeter). To meet their compliance requirements, installations may use EUAs, CERs and ERUs (the latter for Phase II only). Supplementarity rules restrict the use of CERs and ERUs in Phase II, at different levels in each Member State. Further information may be found at http://ec.europa.eu/ environment /climat/emission.htm

Greenhouse gases (GHGs): These are the gases released by human activity that are responsible for climate change and global warming. The six gases listed in Annex A of the Kyoto Protocol are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_20), as well as hydrofluorocarbons (HFC23), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

High quality emission reductions: Emission reductions of a sufficient quality so that, in the opinion of the Trustee, at the time a project is selected and designed, there will be a strong likelihood, to the extent it can be assessed, that PCF Participants may be able to apply their share of emission reductions for the purpose of satisfying the requirements of the UNFCCC, relevant international agreements, or applicable national legislation.

Host Country: The country where an emission reduction project is physically located. Internal rate of return: The annual return that would make the present value of future cash flows from an investment (including its residual market value) equal the current market price of the investment. In other words, the discount rate at which an investment has zero net present value.

International Transaction Log (ITL): the ITL links together the national registries and the CDM registry and is in charge of verifying the validity of transactions (issuance, transfer and acquisition between registries, cancellation, expiration and replacement, retirement and carr-over). It is the central piece of the emission trading under the Kyoto Protocol. It is currently undertaking tests with a number of registries.

Joint Implementation (JI): Mechanism provided by Article 6 of the Kyoto Protocol, whereby a country included in Annex I of the UNFCCC and the Kyoto Protocol may acquire Emission Reduction Units when it helps to finance projects that reduce net emissions in another industrialized country (including countries with economies in transition).

Kyoto Mechanisms (KM): the three flexibility mechanisms that may be used by Annex I Parties to the Kyoto Protocol to fulfill their commitments through emissions trading (Art. 17). Those are the Joint Implementation (JI, Art. 6), Clean Development Mechanism (CDM, Art. 12) and trading of Assigned Amount Units (AAUs).

Kyoto Protocol: Adopted at the Third Conference of the Parties to the United Nations Convention on Climate Change held in Kyoto, Japan in December 1997, the Kyoto Protocol commits industrialized country signatories to reduce their greenhouse gas (or "carbon") emissions by an average of 5.2% compared with 1990 emissions, in the period 2008-2012.

Monitoring Plan (MP): A set of requirements for monitoring and verification of emission reductions achieved by a project.

National Allocation Plans (NAPs): The documents, established by each Member State and reviewed by the Commission, that specify the list of installations under the EU ETS and their absolute emissions caps, the amount of CERs and ERUs that may be used by these installations as well as other features such as the size of the new entrants reserve and the treatment of exiting installations or the process of allocation (free allocation or auctioning).

New South Wales Greenhouse Gas Abatement Scheme (NSW GGAS): Operational since 1st January 2003 (to last at least until 2012), the NSW Greenhouse Gas Abatement Scheme aims at reducing GHG emissions from the power sector. NSW and ACT (since 1st January 2005) retailers and large electricity customers have thus to comply with mandatory (intensity) targets for reducing or offsetting the emissions of GHG arise from the production of electricity they supply or use. They can meet their targets meet their targets by purchasing certificates (NSW Greenhouse Abatement Certificates or NGACs) that are generated through project activities. More information at http://www. greenhousegas.nsw.gov.au

Offsets: Offsets designate the emission reductions from project-based activities that can be used to meet compliance – or corporate citizenship – objectives vis-à-vis greenhouse gas mitigation.

Operational Entity (OE): An independent entity, accredited by the CDM Executive Board, which validates CDM project activities, and verifies and certifies emission reductions generated by such projects.

Pre-Certified Emission Reductions (pre-CERs): A unit of greenhouse gas emission reductions that has been verified by an independent auditor but that has not yet undergone the procedures and may not yet have met the requirements for registration, verification, certification and issuance of CERs (in the case of the CDM) or ERUs (in the case of JI) under the Kyoto Protocol. Buyers of VERs assume all carbon-specific policy and regulatory risks (i.e. the risk that the VERs are not ultimately registered as CERs or ERUs). Buyers therefore tend to pay a discounted price for VERs, which takes the inherent regulatory risks into account.

Primary transaction: A transaction between the original owner (or issuer) of the Carbon asset and a buyer.

Project-Based Emission Reductions: Emission reductions that occur from projects pursuant to JI or CDM (as opposed to "emissions trading" or transfer of assigned amount units under Article 17 of the Kyoto Protocol).

Project Design Document (PDD): A project specific document required under the CDM rules which will enable the Operational Entity to determine whether the project (i) has been approved by the parties involved in a project, (ii) would result in reductions of greenhouse gas emissions that are additional, (iii) has an appropriate baseline and monitoring plan.

Project Idea Note (PIN): A note prepared by a project proponent regarding a project proposed for PCF. The Project Idea Note is set forth in a format provided by the PCF and available on its website www.prototypecarbonfund.org.

Reforestation: This process increases the capacity of the land to sequester carbon by replanting forest biomass in areas where forests have been previously harvested. Registration: The formal acceptance by the CDM Executive Board of a validated project as a CDM project activity.

Secondary transaction: A transaction where the seller is not the original owner (or issuer) of the Carbon asset.

Sequestration: Sequestration refers to capture of carbon dioxide in a manner that prevents it from being released into the atmosphere for a specified period of time.

Supplementarity: Following the Marrakesh Accords, the use of the Kyoto mechanisms shall be supplemental to domestic action, which shall thus constitute a significant element of the effort made by each Party to meet its commitment under the Kyoto Protocol. However there is no quantitative limit to the utilization of such mechanisms. While assessing the NAPs, the EU Commission considered that the use of CDM and JI credits could not exceeded 50% of the effort by each Member State to achieve its commitment. Supplementarity limits may thus affect demand for some categories of offsets.

UK Emission Trading Scheme (UK ETS): Launched in March 2002, the UK ETS was at the time the first domestic economy-wide GHG trading scheme. Participation was on a voluntary basis and combined incentives (reduction by 80% of the Climate Change Levy for some participants, under the Climate Change Agreement, or CCA), penalties (withholding of fiscal abatement, contraction of allowances) and flexibility (through an exchange). Only credits under the UK ETS can be traded. On the whole, the Scheme is scheduled over its duration (2002-2006) to reduce emissions by 11.9 million tCO_2e for "Direct Participants". Installations eligible for the EU ETS have joined the EU ETS from 1st January 2007 onwards. The UK ETS registry will remain open for CCA Participants to trade through the voluntary market to meet their targets. More information at ww.defra.gov.uk/environment/climatechange/trading/UK/index.htm

United Nations Framework Convention on Climate Change (UNFCCC): The international legal framework adopted in June 1992 at the Rio Earth Summit to address climate change. It commits the Parties to the UNFCCC to stabilize human induced greenhouse gas emissions at levels that would prevent dangerous manmade interference with the climate system.

Validation: The assessment of a project's Project Design Document, which describes its design, including its baseline and monitoring plan, by an independent third party, before the implementation of the project against the requirements of the CDM.

Verified Emission Reductions (VERs): A unit of greenhouse gas emission reductions that has been verified by an independent auditor. This designates emission reductions units that are traded on the voluntary market.

Verification Report: A report prepared by an Operational Entity, or by another independent third party, pursuant to a Verification, which reports the findings of the Verification process, including the amount of reductions in emission of greenhouse gases that have been found to have been generated.