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State and Trends of the Carbon Market 2008

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STATE AND TRENDS OF THE CARBON MARKET 2008

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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.
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I EXECUTIVE SUMMARY

CLIMATE CHANGE captured the public's imagination in 2007, as a major report prepared by the Intergovernmental Panel on Climate Change (IPCC), a Nobel Peace Prize and the launch in Bali of the negotiation process for a post-2012 climate change regime, contributed to making climate change a key part of the global economic and environmental debate. January 1, 2008 also marked the formal start of the compliance period of the Kyoto Protocol and of Phase II of the European Union Emission Trading Scheme (EU ETS).

Table 1: Carbon Market at a Glance, Volumes & Values in 2006-07

	2006		2007	
	Volume ($MtCO_2e$)	Value (MUS$)	Volume ($MtCO_2e$)	Value (MUS$)
		Allowances		
EU ETS	1,104	24,436	2,061	50,097
New South Wales	20	225	25	224
Chicago Climate Exchange	10	38	23	72
UK ETS	na	na		
Sub total	**1,134**	**24,699**	**2,109**	**50,394**
		Project-based transactions		
Primary CDM*	537	5,804	551	7,426
Secondary CDM	25	445	240	5,451
JI†	16	141	41	499
Other Compliance & Voluntary Transactions	33	146	42	265
Sub total	**611**	**6,536**	**874**	**13,641**
TOTAL	**1,745**	**31,235**	**2,983**	**64,035**

*: Clean Development Mechanism; †: Joint Implementation
M: million.

THE GROWTH OF THE CARBON MARKET

The carbon market is the most visible result of early regulatory efforts to mitigate climate change. Regulation constraining carbon emissions has spawned an emerging carbon market that was valued at US$64 billion (€47 billion) in 2007 (see Table 1). Its biggest success so far has been to send market signals for the price of mitigating carbon emissions. This, in turn, has stimulated innovation and carbon abatement worldwide, as motivated individuals, communities, companies and governments have cooperated to reduce emissions.

Allowance markets

The EU ETS market has been successful in its mission of reducing emissions through internal abatement at home,[1] and of stimulating emission reductions abroad. The European Commission, learning from the experience of Phase I, has strengthened several important design elements for EU ETS Phase II. Along with recent EU proposals for Phase III,[2] these improvements include tighter emission targets, stronger flexibility provisions for compliance (at least for EU Allowances, or EUA, although not for project-based credits, see below), more attention to internal EU harmonization and, most importantly, longer-term visibility for action to reduce emissions until 2020. These proposed reforms have helped create confidence in emissions trading as a credible and cost-effective tool of carbon mitigation.[3]

In 2007, US$50 billion (€37 billion), almost entirely in Phase II allowances and derivative contracts were traded over-the counter, bilaterally, and, increasingly on exchange platforms that publish transparent data about price formation in the markets.[4] Energy utilities and industrial companies hedged their carbon exposure by buying the EUA and financial companies bought and sold the EUA for their clients ("flow trading") and for their own account ("proprietary trading").

Project-based markets

In 2007, buyers also continued to show a strong appetite for primary project-based emission reductions, reflected by continued growth in the project pipeline showing that 68 countries had identified and offered to reduce 2,500 million tonnes of carbon dioxide equivalent ($MtCO_2e$) through over 3,000 projects. This potential supply received strong interest, mainly from private sector buyers and investors, who in 2007 transacted 634 $MtCO_2e$ from primary project-based transactions (up 8% from 2006) for a corresponding value of US$8.2 billion (€6.0 billion), up 34% from 2006.

Compliance-driven market

CDM accounted for the vast majority of project-based transactions (at 87% of volumes and 91% of values) and JI saw transacted volumes doubling and values tripling in 2007 over the previous year. The CDM alone saw primary transactions worth US$7.4 billion (€5.4 billion), with demand coming mainly from private sector entities in the EU, but also from EU governments and Japan. The voluntary markets, supporting activities to reduce emissions not mandated by policymakers, also saw transacted volumes doubling to 42 $MtCO_2e$ and value tripling to US$265 million in 2007. There were reports of growing demand for voluntary "pre-compliance" credits for U.S.-based forestry projects under the California Climate Action Registry (CCAR).

China dominates, Africa emerges

China was again the biggest seller, and expanded its market share of CDM transactions to 73%. Countries in Africa (5%) and Eastern Europe and Central Asia (1%) emerged in the carbon market and offered buyers an opportunity to diversify their China-overweight portfolios. The share of India and Brazil (6%) reflected a preference from some sellers favoring the sale of already issued Certified Emission Reductions (CER), of which there are a total of only 130 $MtCO_2e$ in the market so far.

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[1] Ellerman and Buchner find that although some over-allocation of allowances had occurred in Phase I, that considerable "internal abatement" had occurred in the EU ETS, in the range of an estimated 50-100 million tCO_2e. Source: D. Ellerman and B. Buchner (2008). "Over-Allocation or abatement? A Preliminary Analysis of the EU ETS Based on the 2005-06 Emissions Data", *Environmental and Resource Economics*, forthcoming.

[2] On January 23, 2008 the European Commission proposed the "Climate action and renewable energy package", a pillar of its climate change strategy with a vision to 2020 and beyond.

[3] Australia, Japan and others announced that they too would develop their own emissions trading schemes (ETS).

[4] The major European carbon marketplaces are the European Climate Exchange (ECX) and the London Energy Brokers Association (LEBA). Markets and exchanges also emerged around the world, including New York, New Delhi & Mumbai, India and elsewhere.

CDM delivers on clean energy
Carbon contracts from clean energy projects (energy efficiency and renewable energy) accounted for nearly two-thirds of the transacted volume in the project-based market, appropriately reflecting the CDM's mission of supporting emission reductions and sustainable development. These project types typically use sound, road-tested technology, are operated by utilities or experienced operators, and have predictable performance, resulting in CER issuances that are expected to yield between 70-90% of expected Project Design Document (PDD) volumes, based on current expectations. This explains why they are being targeted by buyers, now that the known industrial gas project types have been more or less contracted.

Prices and price differentiation
The growth in transacted values reflected higher prices for primary forward contracts, which had an average price of €10 in 2007. Prices for primary market forward transactions were in the range of €8-13 in 2007 and early 2008. The generally higher prices reflected the intense competition and activity in the global market to encourage projects that reduce global emissions. Prices in the higher end of that range typically rewarded projects that were further along in the CDM process (such as registered projects), projects that were being developed by experienced and established sponsors (low credit risk and performance risk), and/or for projects with high expected issuance yields. Spot contracts of issued Certified Emission Reductions were transacted at €16-17, a nice premium to the primary CER, but still at a discount to the EUA, reflecting a combination of the impact of the European Commission's 2020 proposal (see below), the time value of money, and some remaining procedures related to the delay in connectivity of the International Transaction Log (ITL) to the EU.

Climate-friendly investment
Analysts estimated that US$9.5 billion (€7 billion) were invested in 2007 in 58 public and private funds that either purchase carbon directly or invest in projects and companies that can generate carbon assets. The total capitalization of carbon vehicles could reach US$13.8 billion (€9.4 billion) in 2008, with 67 such carbon funds and facilities. This capital inflow was characterized by a substantial increase in the number of funds seeking to provide cash returns to investors and by more funds getting involved earlier in the project development process, taking larger risks through equity investment in expectation of larger returns.[5] The authors estimate that in 2007 alone, CDM leveraged US$33 billion (€24 billion) in additional investment for clean energy, which exceeded what had been leveraged cumulatively for the previous five years since 2002.

Secondary markets
The biggest overall market development in 2007 and early 2008 was the emergence of the secondary markets. A segment of the secondary markets that the authors had discussed in the 2007 report had largely involved *primary project developers* providing *project-specific* guarantees, often along with credit enhancement.

In 2007, as a wide range of procedural delays and risks of CER registration and issuances grew (see below), the carbon market innovated by providing *portfolio-based* guarantees. In these transactions, a secondary seller, typically a market aggregator, sold guaranteed CER (gCER) contracts that were secured through a slice of its carbon portfolios. These guarantees were also usually credit-enhanced through the balance sheet of a highly-rated bank engaged by the secondary seller for this purpose.[6] Some banks originated CER through spot contracts and sold gCER contracts forward, making small margins on a large number of transactions. This segment had greater price transparency and gCER contracts were listed on major exchanges.

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[5] I. Cochran and B. Leguet (2007). "Carbon Investment Funds: The Influx of Private Capital", Mission Climat Caisse des Dépôts (Paris:France).

[6] Some aggregators and banks also provided services warehousing, selling or swapping other tranches of the risk with partial guarantees. Some banks also structured equity- or debt-like notes to institutional investors looking for some exposure and diversification to carbon.

CDM MARKET FACES CHALLENGES

Procedural delays in the CDM

In spite of its success, or perhaps even because of it,[7] the carbon market came under close public scrutiny in 2007. The success of the CDM was weighed down by a creaking infrastructure that, despite efforts to streamline it, is still struggling to process the overwhelming response from project developers worldwide in a timely manner.

Procedural inefficiencies and regulatory bottlenecks have strained the capacity of the CDM infrastructure to deliver sufficient CER volumes on schedule, as too many projects await registration and issuance:

- Out of 3,188 projects in the currently pipeline, 2,022 are at validation stage.
- Market participants report that it is currently taking them up to six months to engage a Designated Operational Entity (DOE), causing large backlogs of projects even before they reach the CDM pipeline.[8]
- Projects face an average wait of 80 days to go from registration request to actual registration. The Executive Board has requested a review of several projects received for registration, has rejected some of them, and has asked project developers to re-submit their projects using newly revised methodologies. There is a very short grace period allowed to grandfather the older methodology, and the additional work adds to delays and backlogs.
- Projects are currently taking an average of one to two years to reach issuance from the time they enter the pipeline. Over 70% of issued CER volumes come from industrial gas projects, with the vast majority of energy efficiency and renewable energy projects remaining stuck somewhere in the pipeline.

Complex rules and the capacity constraint

DOEs, who are accredited to validate and verify CDM projects, are unable to keep up with a large backlog of projects awaiting registration, and are finding it difficult to recruit, train and retain qualified, technical staff to apply the complex rules consistently. As a result, some projects have been registered incorrectly, resulting in a call for more reviews being requested by the CDM Executive Board, which, in turn, causes even more delays.

Important concerns have been voiced about CDM on issues of its additionality, its procedural efficiency and ultimately, its sustainability. Some critics of the CDM maintain that its rules are too complex, that they change too often and that the process results in excessively high transaction cost; they ask for relief from the rules. Other critics question whether certain project activities are truly additional, or whether CDM can create perverse incentives; they ask for even more rules.

Delays can and do impact carbon payments

CDM project registration and CER issuances are generally lower and slower than expected and regulatory efforts to reform and streamline the process are urgently needed.[9] The authors are sympathetic with those primary project developers that are facing delays in financing and

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[7] As one market participant told the authors in an interview: "If there had been only five or 10 CDM projects in the market, we would not have any problem."

[8] DOEs report staffing shortages, especially for hiring and retaining trained technical staff with appropriate language skills (for example, in Chinese). The process for accreditation of a new DOE, for example, a national accreditor, requires an application fee of €150,000. Since the accreditation process takes eighteen months or more, it would only make sense for a company to apply to become a DOE if it had confidence in market continuity since that would impact their long-term business viability beyond 2012.

[9] In this report, the authors consider and comment on specific ways to reduce transaction costs, including issues related to Programmatic CDM. The authors also urge consideration of the use of new monitoring technologies, such as remote sensing, satellite data and technology to improve the efficiency, quality and rigor of emission reductions monitoring.

implementing projects because of the delay in project registration and CER issuances. Delays for any reason in a project's schedule can jeopardize elements of its financing package, and ultimately its construction and implementation.

Those delays, in turn, affect expected CER delivery schedule, as well as dampen enthusiasm for further innovation, which is urgently needed to mitigate climate change. Delays in payments also increase a systematic bias in favor of those projects that can be self-financed by large, wealthy project developers. Projects that really need the carbon payments to overcome barriers are more likely to fail as a result of these delays. Conversely, projects that are not as reliant on carbon payments for their construction and implementation, are more likely to be able to take the financial hit from the delays. Clearly, the delays are untenable and are a major risk to CDM momentum and market sentiment.

Private companies and commercial risks
There is a troubling tendency of some companies in the market to point a finger at the CDM and to hold its procedural delays to be solely responsible for the poor performance of their companies. In a market where the "production" of the asset or commodity is not in the control of market players, but rather in the hand of a regulator, the risk of regulatory delay must be treated as a core element of commercial risk. Some companies clearly made incorrect and imprudent commercial decisions, for example, by taking on excessive risk or burning too much cash, or guaranteeing too many CERs for delivery by a certain date against penalties without adequate risk management. Their commercial contracts should balance the risks and rewards of various parties. While the carbon regulatory infrastructure clearly needs urgent reform, it is simply wrong to blame the regulator for all problems. Companies also have to examine at the appropriateness of their commercial and business decisions.

OUTLOOK

Carbon market momentum is strong for now
After some growing pains in its first phase, the EU ETS has created a robust structure to cost-effectively reduce greenhouse gas emissions. Created by regulation, the carbon market's biggest risk is caused, perversely, by the absence of market continuity beyond 2012 and this can only be provided by policymakers and regulators. This will require increased efforts well beyond what is envisaged by the current policies of major world emitters.

The CDM is at a crossroads
The European Commission's post-2012 proposal, which strengthened several design elements of the EU ETS, however, did not provide much comfort for the project-based market, which, after its strongest year yet, finds itself at a significant crossroad. By linking additional EU ETS demand for CDM and JI credits to the success of post-2012 global climate change negotiations, the European Commission proposal has the risk, surely unintended, of slowing the momentum for the project-based mechanisms. Under the proposal, the resulting issued CERs and the Emission Reductions Units (ERUs) would be less flexible and less fungible, limiting their risk management and compliance utility vis-à-vis the EUA. The EUA spread over the secondary CER widened to nearly €10 at the time of this writing, and even higher for most primary CER contracts. The key challenge, in our view, is not how to reduce the success of the CDM, but rather how to raise the ambition of the world, including the EU, to set science-based emission reduction targets and meet them cost-effectively.

Time to re-think the CDM
The CDM's biggest strength has been its ability to bring developing and developed countries and the public and private sectors together to reduce emissions cost-effectively. In the years ahead, all countries will want to scale up their efforts to reduce emissions while growing their economies in a sustainable manner. As the world considers scaling up serious action to combat climate change, it would be desirable to re-think the CDM as a helpful tool for the challenges ahead.

The forest for the trees
In its next phase, the CDM needs to move up the learning curve and evolve toward approaches and methodologies that conservatively estimate emission reduction trends on the aggregate level, and

away from the current focus on trying to account for every last ton reduced or removed from the atmosphere. The next generation CDM should focus on catalyzing step changes in emission trends, and on creating incentives for large-scale, transformative investment programs.

Built to last
Several jurisdictions, including various states, regions, and countries are considering whether and how to link up with international opportunities for reducing emissions. It would be helpful to find ways for them to learn together from and build on the CDM experience so far, with the goal of encouraging efficiency, reducing transaction costs, avoiding unnecessary duplication and creating, from the start, compatible infrastructure with strong linkages and inter-operability.

Global cooperation on climate change
Given enough incentive and a long lead time, developing countries can deliver large volumes of cost-effective emission reductions which can help meet science-based emission reduction targets. This puts a special responsibility on countries to cooperate under the Bali Action Plan to reach an ambitious international agreement to reduce emissions. It also makes it important for the EU, the U.S. and other major emitters to find ways, even before 2009, to encourage the continued engagement of developing countries in mitigation activities. International negotiators (and regulators of domestic programs) should consider providing incentives for early action with sufficient lead time to develop emission reduction programs and projects.

Solving the problem of climate change will need ingenuity to encourage a scaling up of action to reduce or avoid emissions as early and efficiently and in as many sectors and countries as possible. Long-term policy signals about intended carbon constraint policies and well-designed regulatory systems and infrastructure will send the appropriate signals to investors. The experience of the carbon market so far shows that the private sector is capable and willing to cooperate in solving the problem, provided that policies are predictable, consistent and transparent and regulations are efficient.

II ALLOWANCE-BASED MARKETS

2.1 THE EU ETS IS STILL THE MAJOR CARBON MARKET, BY FAR

THE EU ETS IS THE MAJOR MARKET for greenhouse gas (GHG) emission allowances, and is the engine, perhaps even the laboratory, of the global carbon market (see Table 2). Its most notable achievement is that it helps discover the price to emit GHG in Europe. Several exchanges now transparently disclose prices at which allowances change hands: for example, the EUA for December 2008 delivery (EUA-Dec-08) has durably traded in the €20-25 price band since May 2007. This price signal also encourages project developers to reduce emissions globally through climate-friendly CDM projects in developing countries and JI projects in Annex B countries that generate carbon credits for sale into the EU ETS.

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

	2006		2007			
	Volume ($MtCO_2e$)	Value (MUS$)	Volume ($MtCO_2e$)	y-to-y growth rate	Value (MUS$)	y-to-y growth rate
EU ETS	1,104	24,436	2,061	87%	50,097	105%
New South Wales	20	225	25	26%	224	-1%
Chicago Climate Exchange	10	38	23	124%	72	90%
UK ETS	na	Na				
TOTAL	**1,134**	**24,699**	**2,109**	**86%**	**50,394**	**104%**

M: million

Smaller, but also important, is the continued growth in the voluntary Chicago Climate Exchange (CCX) which benefited from increased interest and activity as market players responded to state-level, regional and federal developments in climate policy in the U.S. The pioneering New South Wales (NSW) market saw a sharp increase in volumes traded, but prices slumped because of a temporary over-supply of credits and from clarity about transition arrangements to Australia's proposed national emissions trading market, which is to be operational by 2010. New Zealand launched its own ETS, covering all GHG and progressively including all sectors, starting with forestry in 2008. Japan was reportedly still "finalizing" the contours of its own emissions trading scheme.

2.2 EU ETS

The EU Emission Trading Scheme (EU ETS) continued to dominate the global carbon market in 2007, both in transaction volume and monetary value. More than two billion EUAs changed hands for a market value of US$50 billion (€37 billion) in 2007.[10] This corresponds to nearly a doubling in both volume and value transacted compared to 2006 and nearly six times the volume and value transacted in 2005.

[10] This corresponds to spot, futures and option trades. Futures contracts account for the major part of volume and value of transactions while options represent a 2-3% share of activity (both volumes and values), possibly more over-the counter (OTC) transaction of options not reported here. Spot trade is almost non-existent at 2% of volumes transacted and less than 1% in value given the low price of the Phase I EUA in that period.

The average market price also kept on increasing through 2007, corresponding to a shift of the market to ETS-Phase II transactions, beginning in the summer of 2006. By January 2007, close to 60% of transactions involved Phase II assets and by the second half of 2007, virtually no EUA-Phase I allowances were being transacted. The market focused its activity on the Phase II December 2008 contract.

Eighty percent of transaction volumes were struck over-the-counter (OTC), with the London Energy Brokers Association, or LEBA, accounting for slightly more than half the OTC activity at 54%, followed by OTC trades cleared through the European Climate Exchange (ECX), at 38%. ECX was the leader with more than 84% of exchange-traded transaction volumes, with Nordpool, Bluenext and the European Energy Exchange (EEX) sharing the remainder. Continuing a trend initiated in 2006, more complex transactions occurred (such as options on the EUA or contracts for guaranteed delivery of the CER (gCER) and swaps between the EUAs and the gCER, facilitated – among others – by the launch of new products by exchanges aiming at offering a wider suite of financial instruments to market participants.[11]

Design of EU ETS Phase II

From a review of the specific elements of EU ETS Phase II (and also Phase III), certain elements of the policy design are apparent. First, it appears that the European Commission has tried hard to ensure that Phase II is short (unlike Phase I) and, second, it appears that competitiveness concerns were on its mind as it designed certain elements of the scheme.

Is EU ETS Phase II Short?

At the beginning of any compliance period, the fundamental "emission shortfall" number is estimated as the difference between what emissions will be in the future (unknown, but thought to be estimable based on reliable recent data) and the allocated emissions cap or imposed constraint (known). Emission growth during the compliance period is tied to a number of factors, including initial allocation (known) as well as economic growth, weather patterns and primary energy prices, as well as the price of carbon, among others (unknown but estimable). Also relevant to emissions growth analyses are the impact of other policy measures, efficiency standards and the extent to which internal abatement is likely to be induced by high oil prices, the price of carbon or other influences.

How short is Phase II?
The April 2008 release of 2007 verified emissions data was therefore eagerly awaited by market actors and observers since it was considered relevant for the analysis of estimated shortfall in the Phase II allowance market (2008-12). The numbers accessible on the Community Independent Transaction Log (CITL) showed that despite a mild winter, emissions had continued to rise within the EU ETS perimeter. Economic growth in the region had been higher than many analysts had expected and EU ETS emissions in 2007 grew by an average of 1% per year since 2005 – with more vigorous growth in the Eastern Member States. This caused some analysts to revise their forecasts slightly upward for the likely shortfall in Phase II, and eventually for their projections of EUA prices in Phase II.[12]

[11] See discussion on exchanges in the Market Structure section.

[12] Market actors and observers would recall the precipitous fall of the EU ETS Phase I allowance from its April 2006 peak of over €30 to €1 following the release of verified, actual 2005 emissions data that showed that actual emissions that year were lower than the initial allocation or target. Results from Ellerman and Buchner suggest that although some over-allocation of allowances had occurred in Phase I, that considerable "internal abatement" had occurred in the EU ETS, in the range of an estimated 50-100 million tCO_2e. Source: D. Ellerman and B. Buchner (2008). "Over-Allocation or Abatement? A Preliminary Analysis of the EU ETS Based on the 2005-06 Emissions Data", *Environmental and Resource Economics*, forthcoming.

Table 3: A View of Analysts' Expectations for EU ETS Phase II&III

Company	Projections for Phase II				Projections for Phase III (20% target)			
	overall shortfall	CDM/JI	internal abatement	price	overall shortfall	CDM/JI	internal abatement	price
	(MtCO2e)	*(MtCO2e)*	*(MtCO2e)*	*(€)*	*(MtCO2e)*	*(MtCO2e)*	*(MtCO2e)*	*(€)*
Deutsche Bank	95	20	75	<€35	235	160	75	
Fortis	150	114	36	<€48	480	104	376	<€48
Société Générale	305	240	65	<€27	500	25	475	<€35
UBS	200	108	92		440	108	332	

Note: for sake of comparison, all volumes are annualized.
M: milllion

Most analysts agree that the road to Copenhagen, where international negotiations on post-2012 commitments are scheduled to be concluded in December 2009, as well as the definitive contours of Phase III, are likely to have a much stronger influence on EU ETS developments than the release of 2007 verified emissions data.

Assessment of EU ETS Phase II

The European Commission completed its review of the National Allocation Plans (NAPs) for the 27 Member States, a process that took 10 months before completion between the first decisions in late 2006 and the latest decisions rendered in early October 2007. The aggregate allocation for EU ETS Member States during Phase II was then articulated, giving market participants some of the needed regulatory clarity.

Overall, the reviewed NAPs have been cut by 10.4% below the caps that were originally proposed by Member States, leading to a maximum of 2,098 million EUAs (see Table 4). This corresponds to a cut of 130 $MtCO_2e$ (6.0%) below 2005 verified emissions (adjusted to Phase II perimeter) or almost a cut of 160 $MtCO_2e$ (7.1%) below 2007 verified emissions (adjusted to Phase II perimeter). Throughout the review process, the European Commission appeared to show considerable will to demand a meaningful cap on emissions for Phase II and, in particular, for Phase III (see below).

Table 4 displays the NAPs as they emerged from the review process:

Which countries hold the most allowances? On the whole, the new revised NAPs for Phase II show a concentration of allowances in the larger countries, with Germany accounting for 22%, UK 12%, Poland 10%, Italy 9%, and Spain 7%. Together, these five countries account for nearly 60% of allowances.

Table 4: 29 NAPs for Phase II at a Glance

Member State	Proposed cap	Allowed cap	Adjustment to proposed cap	Share of allowances	Corrected 2005 emissions at PhII perimeter	Adjustment to 2005 emissions	Cap on CDM/JI	Max CDM/JI demand
	(MtCO2e/yr)	(MtCO2e/yr)	(%)	(%)	(MtCO2e/yr)	(%)	(%)	(MtCO2e/yr)
Austria	32.8	30.7	-6.4%	1.5%	33.8	-9.0%	10.0%	3.1
Belgium	63.3	58.5	-7.6%	2.8%	60.6	-3.4%	8.4%	4.9
Bulgaria	67.6	42.3	-37.4%	2.0%	40.6	4.2%	12.6%	5.3
Cyprus	7.1	5.5	-23.0%	0.3%	5.1	7.5%	10.0%	0.5
Czech Rep	101.9	86.8	-14.8%	4.1%	82.5	5.2%	10.0%	8.7
Denmark	24.5	24.5	0.0%	1.2%	26.5	-7.5%	17.0%	4.2
Estonia	24.4	12.7	-47.8%	0.6%	12.9	-1.6%	0.0%	0.0
Finland	39.6	37.6	-5.1%	1.8%	33.5	12.2%	10.0%	3.8
France	132.8	132.8	0.0%	6.3%	136.4	-2.6%	13.5%	17.9
Germany	482.0	453.1	-6.0%	21.6%	485.0	-6.6%	20.0%	90.6
Greece	75.5	69.1	-8.5%	3.3%	71.3	-3.1%	9.0%	6.2
Hungary	30.7	26.9	-12.4%	1.3%	27.4	-1.9%	10.0%	2.7
Ireland	22.6	22.3	-1.2%	1.1%	22.4	-0.3%	10.0%	2.2
Italy	209.0	195.8	-6.3%	9.3%	225.5	-13.2%	15.0%	29.4
Latvia	7.7	3.4	-55.5%	0.2%	2.9	18.3%	10.0%	0.3
Lithuania	16.6	8.8	-47.0%	0.4%	6.7	32.3%	20.0%	1.8
Luxembourg	4.0	2.5	-36.7%	0.1%	2.6	-3.8%	10.0%	0.3
Malta	3.0	2.1	-29.1%	0.1%	2.0	6.1%	-	-
Poland	284.6	208.5	-26.7%	9.9%	209.4	-0.4%	10.0%	20.9
Portugal	35.9	34.8	-3.1%	1.7%	37.2	-6.4%	10.0%	3.5
Romania	95.7	75.9	-20.7%	3.6%	70.8	7.2%	10.0%	7.6
Slovakia	41.3	32.6	-21.1%	1.6%	27.0	20.8%	7.0%	2.3
Slovenia	8.3	8.3	0.0%	0.4%	8.7	-4.6%	15.8%	1.3
Spain	152.7	152.3	-0.3%	7.3%	195.6	-22.1%	20.0%	30.5
Sweden	25.2	22.8	-9.5%	1.1%	21.3	7.0%	10.0%	2.3
the Netherlands	90.4	85.8	-5.1%	4.1%	84.4	1.7%	10.0%	8.6
UK	246.2	246.2	0.0%	11.7%	281.9	-12.7%	8.0%	19.7
Total EU 27	**2325.3**	**2082.7**	**-10.4%**	**99.3%**	**2213.8**	**-5.9%**	**13.4%**	**278.3**
EU-15	**1636.5**	**1568.8**	**-4.1%**	**74.8%**	**1717.9**	**-8.7%**	**14.5%**	**227.0**
EU-12	**688.9**	**513.8**	**-25.4%**	**24.5%**	**496.0**	**3.6%**	**10.0%**	**51.4**
Liechtenstein	-	0.0		0.0%	-	-	8.0%	0.0
Norway	-	15.0		0.7%	18.0	-16.7%	20.0%	3.0
Total EU&EEA		**2097.7**		**100.0%**	**2231.8**	**-6.0%**	**13.4%**	**281.3**

MS contemplating a legal action against EC

Source for data: European Commission.

Share of overall effort. EU-15 installations will undertake most of the overall 2008-2012 effort, with a cap set at -8.7% below verified 2005 (per. adj.) emissions (-9.4% below preliminary 2007 emissions). In contrast, emissions in EU-12 will be allowed to grow by 3.6% above the 2005 benchmark (2.9% above preliminary 2007 emissions).[13]

The biggest cuts by European Commission to nationally-proposed caps were in the Eastern part of EU (cut of 56% from proposed NAP for Latvia, 48% for Estonia and 47% for Lithuania), leading to an average reduction of slightly more than 25% from proposed NAPs for the EU-12 as a whole. The NAPs proposed by EU-15 have experienced comparatively lower revisions in their caps (about -4% on aggregate). Only four Member States (Denmark, France, Slovenia and UK) saw no downward adjustment by the European Commission to the maximum amount of allowances they proposed to distribute to their installations. The European Commission's decision was accompanied in addition by requests for clarification regarding the list of installations, the new entrants reserve and the amount of eligible CDM/JI credits

[13] Although EU-12 countries are long under Kyoto, some of their installations will face a meaningful carbon constraint, since they have been allocated on an equal footing to other installations in the same sector in Western Europe. CEZ, the large utility in the Czech Republic, for instance, has announced plans to purchase 30 $MtCO_2e$ emission reductions from CDM and JI projects up to 2020, starting 2008, to meet (along with other measures) its objective of reducing GHG emissions by 15% in 2020.

The New Face of EU ETS in Phase II

In many ways, the EU ETS design in Phase II (and, arguably in Phase III) reflects a desire of the European Commission to gradually improve certain elements of its design. Several of the newer features of the EU ETS in Phase II reveal a tension between the European Commission's intention to have all major sectors face a true cost of carbon and its desire to preserve the competitiveness of and between the Member States.

Sector responsibility
It is quite apparent to the authors that competitiveness concerns, both internal to the EU and outside the EU, were important to the design of the EU ETS. The EU ETS places most of the responsibility of reductions on the power sector, where mitigation opportunities are believed to come at lower costs compared to other sectors and where the sector is less exposed to competition outside the EU. This sector is also the only one not to receive all allowances for free in Phase II, again, a measure targeted at a sector which can expect to pass along costs through to its customers.

Auctioning allowances
The NAPs allow for more auctioning of allowances in Phase II compared to Phase I, which had limited auctioning, to less than 0.2% of the total allocation.[14] Following the EU Directive, Member States could choose to auction up to 10% of allowances during the second trading period (5% during the pilot phase). Except for Germany and UK, auctioning will still be limited for Phase II, at 4-5% globally, as more than 15 Member States (including those representing a big share in allowances) do not plan auctions. It will be a while before all sectors and all Member States will face broader auctioning. Germany plans to sell and later auction 40 million EUAs, taken from the allocation that utilities would have received. This selling of allowances will hopefully address the issue of windfall profits.[15] Revenues from the sale of allowances are to be used for national and international climate protection measures and for promoting renewable energy. Similarly, the UK will auction 7% of allowances of large power producers. That number may rise eventually if any unused allowances from the New Entrant Reserve (NER) and allowances from closure of installations become available.

Extension to new sectors
Two countries, notably France and the Netherlands, unilaterally extended the scope of EU ETS in Phase II to include installations emitting nitrous oxide (N_2O) of about 5.2 $MtCO_2e$ and 1.4 $MtCO_2e$ respectively. It is expected that these sectors would have an attractive cost of internal abatement.

The proposed inclusion of air transport (3% of total EU emissions, mostly from international flights) would be the most significant sector extension of the scheme in Phase II. Legislation on this matter is still under discussion as the EU Council rejected the proposal by the European Parliament (EP) as too ambitious. Unresolved issues include:

- starting date: 2011 for EP vs. 2012 for Council;
- level of cap: 90% of 2004-2006 average for vs. 100% for Council;
- level of auctioning: 255 for EP vs. 10% for Council;
- articulation with EU ETS and amount of CDM/JI credits eligible.

Given the unresolved issues, it is difficult to assess the likely shortfall of the sector. However, estimates indicate a potential annual shortfall of 60-70 $MtCO_2e$ per year, roughly half to be covered by allowances and half through ERs from projects.[16] The impact on cost per passenger is believed to

[14] Only four Member States (Denmark, Hungary, Ireland and Lithuania) had made specific provisions to auction or sale allowances during Phase I while other Member States indicated their intent to eventually auction/sell unused allowances resulting from the NER or from the closure of installations. So far only, three Member States (Hungary, Ireland and Lithuania) effectively auctioned Phase I allowances, representing a total amount of 4.13 million EUAs.

[15] Those sales started (daily) in January 2008 on ECX. From 2010, they should be replaced by monthly auctions.

[16] L. Segalen (2008). "Aviation in the Carbon market", Point Carbon Market Insights, March, Copenhagen (Denmark).

be limited when compared to major cost drivers such as the fuel bill, and is not considered difficult to pass along.

Extension to new countries
Norway, Liechtenstein and Iceland, all part of the European Economic Area, have joined the EU ETS in Phase II. NAPs of Norway and Liechtenstein have been reviewed and add their allocation of 15 $MtCO_2e$ per year to the EU ETS cap. In 2005-2007, Norway had operated its own ETS with the goal of linking with the EU ETS for 2008-12. Similar in design to the EU ETS, the Norwegian ETS covered 51 installations in 2005-07 (6-8 million tCO_2e per year or 10-15% of emissions), that had not been subject to the carbon tax levied since 1991 on CO_2 emissions. As of January 1 2008, other installations, for example, from the offshore petroleum industry have been added, bringing the ETS coverage to 40% of Norway's GHG emissions. Norway expects its ETS to address a significant part (80%) of its shortfall under the Kyoto Protocol. As part of their accession process to the EU, Bulgaria and Romania joined the EU ETS in 2007 and participated in the last year of Phase I in 2007.

Harmonization within the EU ETS countries
Some market participants point to the differential treatment of installations across Member States, which can potentially create distortions within the common economic area. In particular, they point to the heterogeneity of rules governing the management of the NER (ranging from 1-38% across countries), creating very different barriers to entry for new industry. In addition, the wide range of limits on the import and use of CDM/JI limits across Member States, causes some concern, especially in the light of the EU Phase III proposal.

Better design with regard to banking
The main difference – and improvement – from Phase I design is the ability to "bank" the EUA from Phase II onward to future compliance periods. To this end, the draft proposal for Phase III released in January 2008 (see below) has extended the horizon decision a further eight more years beyond 2012 until 2020. This provides market continuity to the EU ETS and can encourage business managers to consider additional abatement at installations based on their assessment of various business and investment inputs, including carbon. In short, with banking allowed and better regulatory clarity beyond 2012, analysts are beginning to consider Phase II and Phase III together, as well they should.

Gaps and questions remain
Significant information gaps and questions remain, including:

- the list of specific installations and their corresponding allocations has been published for only six Member States (Austria, Czech Republic, Denmark, Estonia, Finland Ireland), but not for any others, as of the time of this writing;
- six Member States (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland) are suing the European Commission over the decisions regarding their NAPs, raising the question whether there may be a future revision of the allocations;
- additional clarification or harmonization may be required regarding the transfer of CERs across countries, since different Member States have varying national approaches to project approval, for example, does the CER/JI limit apply annually or does it apply over the entire 2008-2012 period?

The Road Ahead to Phase III

On January 23, 2008, the European Commission proposed a strategy entitled "Climate action and renewable energy package". The EU has committed to reducing its overall emissions to at least 20% below 1990 levels by 2020, and is prepared to scale up this reduction to as much as 30% under a new global climate change agreement provided other developed countries make comparable efforts. It also set itself the target of increasing the share of renewable energy in overall EU consumption to 20% by 2020 (including a 10% target for biofuels in vehicle fuel) and a 20% increase in energy

efficiency. The package also seeks to promote the development and safe use of carbon capture and storage (CCS).

Strengthening and expanding the EU ETS is central to the EU's strategy. Emissions from the sectors covered by the system will be cut by 21% by 2020 compared with levels in 2005. [17] A single EU-wide cap on ETS emissions will be set, and free allocation of emission allowances will be completely eliminated by 2020. Sectors able to pass along costs (for example, in the power sector) will face full auctioning by 2013, while free allocation will be progressively phased out (from 80% in 2013 to 0% in 2020) for those sectors exposed to international competition.[18]

Review of EU ETS has resulted in reform that is credible

The draft Directive addresses many of the issues highlighted for reform during the review process, including the call for "more transparency, greater harmonization, and more predictability." The draft proposal for Phase III also better aligns incentives for low carbon investment than in earlier trading periods. For example, one of the innovations proposed would promote more benchmarking (rather than grandfathering) for allocation. Other innovations include more auctioning, clearly tighter cap, and a likely central (not national) reserve for new entrants.[19] The announcement more or less confirmed analyst expectations of a bullish outlook for EUAs

EU ETS misses opportunity on developing countries

The biggest exception to the move toward "more predictability" was the surprising restriction outlined in the draft Directive on the use of CERs and ERUs. Intended to encourage other countries to take on meaningful commitments, the use of CERs and ERUs in Phase III was made contingent upon the emergence of a successor to the Kyoto Protocol. The proposal missed an opportunity to provide continuity to developing country efforts to reduce emissions through the CDM. Given the lead time requirements for abatement, this could surely have the unintended consequence of losing valuable momentum to reduce global greenhouse gas emissions through the CDM. Analysts also asked if the EU criteria could accommodate GHG reductions by major emitters in significant ways other than those defined only by joining the successor to the Kyoto Protocol.

Limit on CER and JI extended until 2020

The draft Package regulates the amount, origin and type of eligible credits, under a two-tiered system depending on whether or not a satisfactory international successor agreement on climate change materializes. Absent such a commitment, the amount of CDM/JI credits allowed during Phase III is restricted to what is left from the 1,400 $MtCO_2e$ allowed during Phase II, effectively removing any new demand for CERs and ERUs, and perpetuating the geographical exclusion of projects from countries less represented in the CDM (for example, African countries), just as efforts toward inclusion are paying some dividends.[20] In addition, only credits from project types approved by all Member States during the 2008-2012 period may be used. Under this scenario, forestry projects will still be excluded.[21] For non-ETS sectors, credits may be surrendered up to a level of 3% of 2005 emissions (one-third of the commitment).

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[17] The draft Directive also provides guidance that the annual cap on emissions is to decrease linearly from the mid-point of Phase II to the 2020 target. Based on NAP 2 decisions by the Commission and ETS scope as applicable in Phase II, this implies a reduction from 1,974 $MtCO_2e$ in 2013 to 1,720 $MtCO_2e$ in 2020, or about a 1.74% annual decrease in the number of allowances. These numbers are indicative and need to be adjusted for opt-ins in Phase II and extension of scope in Phase III as well as inclusion of Iceland, Liechtenstein and Norway for Phase II.

[18] Amounts of allowances to be auctioned will be given to Member States largely in proportion to their past verified emissions, with some room for manoeuvre "in the name of solidarity and growth with EU". At least 20% of the revenues from auctioning are to be invested in climate-friendly projects, at home and abroad.

[19] Limited to 5% of the global quantity of allowances and with no free allocation to new entrants from the power sector.

[20] There are some exceptions noted to allow projects that start after 2012, for example, from Least Developed Countries (LDCs), but even these will be subject to the overall 1,400 $MtCO_2e$ limit, which is likely to be exhausted in Phase II. As such, the LDC exception is not meaningful.

[21] In the Q&As released with the package, one could read "global deforestation could be better addressed through other instruments."

Under the no international agreement scenario, potential demand for ERs from EU ETS installations during Phase III would be extremely limited. Demand from non-ETS sectors could lead to modest overall annual demand of around 100-150 $MtCO_2e$ (assuming these sectors saturate their caps on ERs), which is at a considerably lower level than demand in the booming primary market for CDM over the past two to three years.

In the event of an international agreement, the overall EU ETS target of reducing GHG emissions further tightens to a 30% below 1990 levels by 2020. The potential demand for ERs could then increase to 300 $MtCO_2e$ per year. Targets for both the EU ETS and sectors not covered by the ETS will be adapted in a manner that is proportional to their share of total emissions in 2020. The use of credits (for CDM/JI or other eligible mechanisms that may be created under a new international agreement) will then be allowed for up to 50% of the additional effort required. This could bring the total volume of credits from projects allowed to some 7% of 2005 GHG emissions (as opposed to 14% of capped emissions during Phase II), or 30% of the effort. Only credits from projects in countries that ratify the new agreement become eligible.

An international agreement still needs to be negotiated and can take time to conclude, and detailed modalities of any new agreement could take even more time to hammer out. This creates a period of uncertainty in the market, and raises the likelihood that several projects that are in the pipeline may be abandoned. Either way, whether or not an international agreement is eventually reached, the effect would be to derail the project market's momentum in the next two or three years.

Other design aspects of the EU ETS Phase III

The scope of EU ETS in Phase III will be extended to new sectors (chemical sectors and ammonia producers), which would bring new gases (PFC and N_2O) into the scheme. Abatement of these gases may offer lower-cost abatement opportunities within the scheme. This expansion of sector scope could represent about 140-150 $MtCO_2e$ per year more below the cap. Aviation may join earlier toward the end of Phase II and maritime transport is tentatively next on the list.

Small installations (with annual emissions lower than 10,000 tCO_2e and a rated thermal input lower than 25MW) may be excluded from the scheme, provided they face equivalent measures (a tax for instance) to control their emissions. This could cover almost 4,200 installations accounting for approximately 0.70% of ETS emissions. Finally, the draft Directive allows for the linking of the EU ETS to systems in other "administrative entities," provided that their design elements do not undermine the environmental integrity of EU ETS, i.e., only cap and trade systems with rigorous registries, strong monitoring, reporting and verification guidelines and no price control mechanisms would be considered.

Emissions from sectors not included in the EU ETS – such as transport, housing, agriculture and waste – will be targeted for a reduction of 10% of 2005 levels by 2020. Each Member State will contribute to this effort according to its relative wealth, with national emission targets ranging from -20% for richer Member States to +20% for poorer ones. Limited borrowing at the level of Member State (2% of allowed emissions in the following year) is to be allowed as well as banking. The draft Directive also includes provisions concerning domestic projects, i.e. projects that reduce GHG emissions in those sectors not covered by the ETS.

National renewable energy targets are proposed for each Member State which will contribute to achieving emission reductions as well as to increasing the EU's energy independence. These include a minimum 10% share for biofuels in petrol and diesel by 2020. The package also sets out sustainability criteria that biofuels must meet to ensure they deliver real environmental benefits.

Analyzing Market Demand for the EU ETS in Phase II and Phase III Together

With the release of part of the 2007 verified emissions reports by early April 2008, carbon market analysts have somewhat revised their projections for Phase II and Phase III. They also had more time to review the draft proposal and assess its implications. Their expectations are presented Table 3.

Carbon market analysts largely expect a shortfall of at least 100 $MtCO_2e$ a year for Phase II and on average close to 200 MtCO2e. Even allowing for maximum allowable utilization of the CER and the ERU at 1,400 $MtCO_2e$ for Phase II and III combined, this still leaves room for additional actions at home. Some internal abatement will be required, and most analysts expect that fuel switching will be the dominant part of EU internal abatement and most now expect that the price of switching (not of CDM) will likely set the price for the EUA.

Analysts have modeled various scenarios for the schedule of surrender of CER and ERU balances (ranging from some to full banking to Phase III) and have projected that the EUA will likely trade at or above €25, reaching €30-35 by end of Phase II and at €40 at the start of Phase III. These projections are based on a range of assumptions at a certain point in time (now) about the future (from now going forward 13 years). Readers are urged to do their own estimates, taking into account the large number of uncertainties, including various views and expectations of regulation and regulatory clarity, the exact scope and timeframe of coverage expansion to other sectors, the role of CDM and JI post-2012, and the actual performance of EU internal policies and measures (for example, energy efficiency and renewable energy targets), not to mention various projections of economic growth and the impact of high fuel prices.

2.3 NEW SOUTH WALES GREENHOUSE GAS ABATEMENT SCHEME AND CARBON-WAKE-UP CALL IN AUSTRALIA

With the election of the Australian Labour Party with Kevin Rudd as Prime Minister, the year 2007 ended with a landmark decision by Australia to ratify the Kyoto Protocol. According to recent projections,[22] Australia is on track to meet its Kyoto target (+8% above 1990 levels), thanks largely to a significant contribution of forest and land-use activities. The expected outcomes of the new Rudd Labor Government measures (in particular the 20% Renewable Energy Target by 2020) are also expected to help bridge the Kyoto gap.

National ETS Proposed

The only measure not factored in into these projections is the introduction of a national emissions trading scheme, since many of the policy design elements remain under consideration. In June 2007, (former) Prime Minister John Howard had announced that the Australian Government would introduce a domestic emissions trading scheme by 2012 at the latest, and possibly in 2011. The new Government introduced an accelerated timetable aiming at a national emissions trading scheme starting no later than 2010, with the detailed design to be finalized by the end of 2008 and legislation through 2009.[23] Other features of the scheme still need to be clarified, such as its linkage to the Kyoto Framework (eligibility of AAU, CDM and JI for mandated installations) and linking to other regional initiatives (most notably the EU ETS and with Pacific economies) as well as the framework for domestic offsets.[24]

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[22] See: Tracking the Kyoto Target 2007, Department of Climate Change, Australian Government: http://www.greenhouse.gov.au/

[23] http://www.climatechange.gov.au/emissionstrading/timetable.html

[24] In addition to the work conducted under the former government, the Garnaut Climate Change Review currently underway will recommend medium to long-term policy options for Australia, and inform decisions regarding the emissions cap. The Review was launched in April 2007 led by Professor Ross Garnault, and a draft report is due by end of June 2008 with a final report by end of September 2008. A recent interim report, stressing economic opportunities together with the

NSW and Uncertainty about Transition to National ETS

The rapidly changing Australian policy and regulatory environment had an impact on existing markets and initiatives to manage GHG emissions in Australia, viz. the markets for Renewable Energy Certificates (REC), as well as the New South Wales (NSW) GHG Abatement Scheme which targets emissions from the power sector.[25] The NSW market showed a moderate 26% increase in activity in 2007 with about 25 million certificates (NSW Greenhouse Abatement Certificates (NGAC) traded for a value estimated at US$224 million (€164 million).[26] However, from September 2007 onward, the NGAC market plunged with prices retreating from their earlier spot trading band of AU$10-12 to AU$4.75 (or about US$4 or below €3).

The proximate reason most frequently cited for this price collapse was the popularity of demand-side Management (DSM) projects for energy and water use, leading to oversupply of credits in the NSW scheme. The Australian national ETS, which is in the process of providing program details, indicated its concerns about whether such DSM projects were additional and unsure whether credits from DSM would be eligible under the new program. Project developers shared their anxiety about transition from the NSW scheme to the Australian ETS, and, in particular about the future eligibility of DSM and other offset project types in the national program.

McKinsey, a consultancy, pointed out last year in a prominent report, that energy efficiency remains an attractive "low-hanging fruit" opportunity, which has been barely tapped despite their obvious financial rationality.[27] While they are financially attractive, these kinds of projects need to overcome barriers of upfront financing, public education and smart and efficient monitoring to succeed. DSM, energy efficiency or any other project type, should be a welcome part of any mitigation efforts and every incentive should be provided in order to encourage them to be fully tapped. Policymakers should concern themselves primarily with guaranteeing environmental performance, and should not be so concerned about the rate of return for desirable actions that they discourage the desired – and cheap – actions. If there are concerns about flooding the market with too many emission reductions, then policy makers should consider setting tighter caps now, so that action to reduce emissions starts sooner rather than later. A clear signal encouraging all project types, including DSM, to credibly reduce emissions worldwide, could help Australia set even more ambitious national ETS targets than Kyoto would require, with the comfort that many of these efforts would pay for themselves over time.

Interest in Australian Voluntary Market Rises

In parallel, 2007 saw the emergence of the voluntary market in Australia, with some interest in Verified Emission Reductions (VER). Small lots of wind Gold Standard (GS) assets have reportedly received, in one voluntary market transaction, an unprecedented €80, although larger volumes of the same asset transacted closer to €10. An additional 7,760 NGAC were voluntarily surrendered in 2006 and 2007. Their relatively low NGAC price in recent months together with their high credibility may

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exceptional sensitivity of the Australian economy, recommends going beyond the stated 60% reduction target (below 2000 levels) by 2050 in an effective global agreement that includes developing nations. (http://www.garnautreview.org.au).

[25] Retailers and large electricity customers in NSW (since 2003) 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. No other form of credit (for example, JI or CDM) is eligible at this time. A buy-out penalty applies.

[26] These numbers correspond to movements of certificates in the registry. Future contracts (for instance with expiry in 2010) are thus not taken into account, leading to a potential under-estimation of market activity. So far (up to compliance year 2006), all participants have been in compliance (eventually by carrying forward part of the shortfall – up to 10% of the benchmark) Shortfalls are not allowed to be carried forward in 2007 to ensure that NSW fully meets the greenhouse abatement target (which is 5% below the Kyoto Protocol baseline year of 1989-1990).

[27] P. A. Enkvist, T. Nauclér & J. Rosander (2007). "A cost curve for greenhouse gas reduction", *The McKinsey Quarterly*, Number 1.

have contributed to making this trend quite popular. Finally, VER contracts developed through the Greenhouse Friendly Initiative, [28] a governmental program, could receive more interest from pre-compliance buyers, as there is a perception that these may become eligible as early action credits under the proposed Australian National ETS.

The Australia Climate Exchange (ACX) – the first electronic emissions trading platform in Australia – was launched in July of 2007. Trading is open to government accredited emission commodities and so far, certificates from the NSW-GGAS as well as certificates under the Greenhouse Friendly initiative. Activity has been limited so far, with 6,300 tCO_2e traded since July 2007 for an average price of US$7.42 (or about €5.30)

2.4 CHICAGO CLIMATE EXCHANGE

Members of the Chicago Climate Exchange (CCX) made voluntary, but firm commitments to reduce GHG emissions 6% below a baseline period of 1998-2001 by 2010. The past year (2007) closed with record-breaking transacted volumes on CCX of 23 $MtCO_2e$ representing slightly more than a doubling of volumes over 2006. This 2007 volume represented a value of US$72 million or €53 million (nearly twice the value recorded in 2006). Against its trend since 2003, the monthly average price of carbon (for all vintages) on the CCX decreased for the first time in 2007, before rallying again in the first quarter of 2008 on the back of favourable regulatory and political developments.[29] By the end of March 2008, volumes transacted since the beginning of the year almost equalled 2007 volumes with 19.7 $MtCO_{2e}$ traded, while market value had already surpassed that of 2007 by some 12 percent at US$81 million (€54 million).

CCX clearly also benefited from the overall direction of climate policy within the U.S. as new regional initiatives began to take shape in the U.S. and as interest in and prospects for an economy-wide Federal cap and trade scheme grew. In October 2007, CCX claimed that its recent growth in membership had brought more than 540 $MtCO_2e$ below its cap (or about 7-8% of reported 2005 US GHG emissions). The prospect of U.S. engagement in climate policy also attracted a major new exchange, the New York-based Green Exchange, into to the market.

CCX also pursued an expansion strategy to other schemes and other regions. In August 2007, CCX started listing futures on CER contracts, followed in September 2007 by futures on EUA contracts and, in December 2007, listing CER options. By offering a wider suite of carbon financial products tracking several segments of the Carbon market, CCX hoped to attract more players, in particular financials, at a time when competition between carbon exchanges is intensifying.

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[28] The Greenhouse Friendly initiative, a governmental program, comprises of the certification of carbon neutrality for products and services and the supervision of the Greenhouse Friendly approved abatement projects (that may be used to offset GHG emissions and obtain the Greenhouse Friendly certification). Offsets have to meet the basic additionality, monitoring and permanence requirements. Projects have to be located in Australia. As of May 2007, there were 20 approved projects: 12 LFG, four other waste management, two Forestry, one fuel switching and one energy efficiency. Together they are expected to annually reduce GHG emissions by more than 1.8 $MtCO_2e$.
Further information: www.greenhouse.gov.au/greenhousefriendly.

[29] The price trends on CCX make it clear that it certainly did not hurt the CCX that the three top candidates in the run-up to the U.S. Presidential election are all in favor of a cap and trade scheme. After opening in January 2007 at a daily average settlement price for all vintages of US$3.67, prices gradually trended down to US$1.88 in November 2007, reflecting that the market was probably quite long. Prices thereafter picked up to slightly above US$2 in December 2007 and continued to rise. February 2008 repeatedly saw record breaking daily traded volumes and in March 2008 the average monthly price for all vintages crossed the US$5 mark, settling on average at US$5.20.

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III PROJECT-BASED MARKETS

3.1 MARKET MOMENTUM STRONG; WILL IT LAST?

Volume Transacted in Primary Market Plateaus

IN 2007, BUYERS CONTINUED to show strong interest in the CDM and JI, and this was supported by higher flows of capital into the carbon arena.[30] While transacted volumes grew slightly to 634 $MtCO_2e$ for finalized primary project-based transactions (up 8% from 2006), the value of all primary carbon purchase transactions was much higher, at US$8.2 billion (€6.0 billion), up 34% from 2006, a sign of the intense competition and activity in the market (see Table 5 and Figure 1).

Table 5: Annual Volumes and Values (2006-2007) for Project-based Transactions

	2006		2007	
	Volume ($MtCO_2e$)	Value (MUS$)	Volume ($MtCO_2e$)	Value (MUS$)
Compliance	597	6,466	832	13,376
of which				
Primary CDM	537	5,804	551	7,426
Secondary CDM	25	445	240	5,451
JI	16	141	41	499
other	19	76	na	na
Voluntary market	14	70	42	265
TOTAL	**611**	**6,536**	**874**	**13,641**

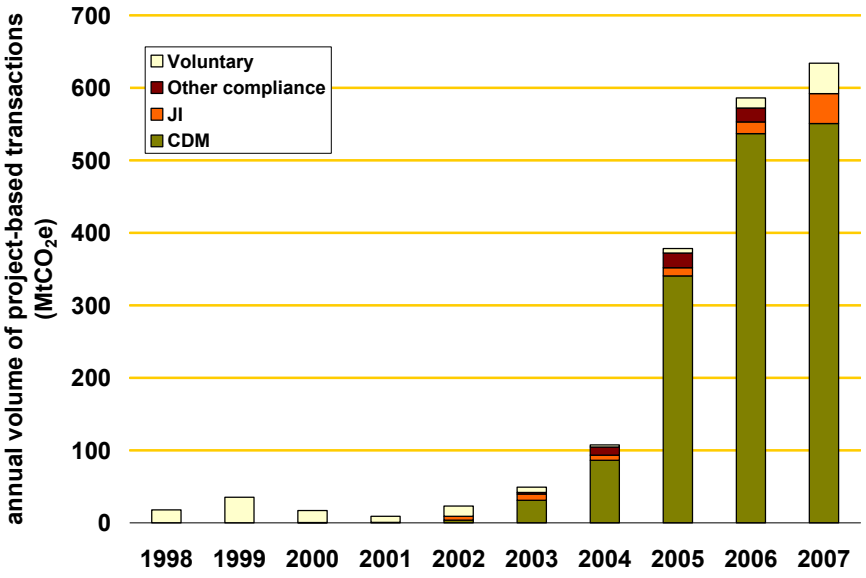
M: million

CDM accounts for most of the project-based market activity (at 87% of volumes and 91% of value transacted). JI and the voluntary market as a whole each experienced a doubling of transacted volumes and a tripling of transacted values. The dynamic of the project-based market changed in early 2008, as buyers became more cautious in response to a combination of mounting delivery and issuance challenges, higher perceived credit risks amid the generally bearish sentiment in the financial markets,[31] as well as continuing uncertainty about the role of and demand for CDM and JI in the post-2012 climate regime(s). These market trends, as well as the limits to demand from the EU ETS have the potential to leave behind, in particular, projects in poorer countries which have only just begun to take advantage of the carbon compliance market. Many of these sellers have begun to look increasingly toward voluntary and pre-compliance markets for buyers.

[30] Analysts estimated that US$9.5 billion (€7 billion) had been invested in 58 carbon funds in 2007 and further projected that the total capitalization of carbon vehicles could reach US$13.8 billion (€9.4 billion) in 2008, with 67 such carbon funds and facilities. This capital inflow was characterized by a substantial increase in the number of funds seeking to provide cash returns to investors and by more funds getting involved earlier in the project development process, taking larger risks through equity investment in expectation of larger returns. Source: I. Cochran and B. Leguet (2007). "Carbon Investment Funds: The Influx of Private Capital", Mission Climat Caisse des Dépôts (Paris:France).

[31] Through 2006 and H1'07, the number of new projects entering the pipeline (public comment period of the validation stage in the CDM project cycle) grew extremely rapidly, from 35 to a record-breaking 176 by July 2007. Since then, this number decreased sharply and is currently around 100-120 or so.

Figure 1: Annual Volumes ($MtCO_2e$) of Project-based Emission Reductions Transactions (vintages up to 2012)



Expected supply by CDM in 2008-2012

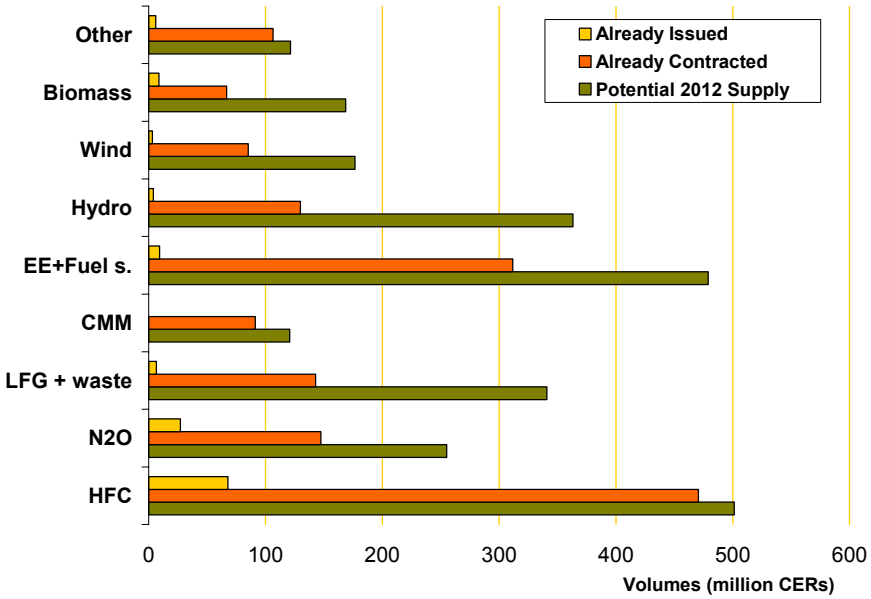
As projects gradually make CER deliveries (Figure 2), analysts have tried to estimate expected deliveries adjusted for risk. With the exception of the so-called industrial gas projects (i.e. HFC and N_2O), which have delivered (even over-delivered), the other asset classes are just beginning to deliver. Every fund manager and aggregator that we are aware of has their own expected delivery discount factor (in the range of 15-50% or more) applied to the contracted project types and volumes in their portfolio. Some analysts estimate that CER supply could eventually reach 1.6 billion by 2012, with a range of 1.4-2.2 billion.[32] These estimates largely rely on estimates of the observed "yield" of issued CER from the emission reductions initially projected in Project Design Documents (PDD) for projects in the pipeline. These yields by project types are applied to projects already in the pipeline as well as projects known to be under preparation outside the pipeline. If the initial yield observed for certain project types holds, then it is likely that ultimately the CDM will deliver somewhere in the upper end of that range. If however delays continue and yields are revised downward, then it is likely that the CDM will deliver somewhere in the lower end of that range.

Secondary CER market

The secondary market for guaranteed CERs (gCERs) grew exponentially in 2007 to an estimated 240 $MtCO_2e$ worth about US$5.5 billion (€4.0 billion). This segment of the market, is, in effect, "derived" from the underlying primary market; and volumes transacted record the sale and resale of contracts in this financial market. Doubts about timely delivery of issued CER volumes have widened spreads by boosting demand and liquidity for exchange-traded contracts of the gCER as buyers seek compliance security.

[32] See "An assessment of CER supply in the first Kyoto commitment period", IDEAcarbon Weekly Commentary (14 March 2008).

Figure 2: CER Potential Supply to 2012, observed issuance and contracted volumes



Source: J. Fenhann *et al.* UNEP Risoe CDM/JI Pipeline Analysis and Database, April 1st 2008 & World Bank.

At the time of this writing, the secondary market for gCER contracts for delivery *before 2012* had largely decoupled from the EUA market, reflecting the risk premium exacted due to the EU's proposal that has eroded the perceived fungibility of the CER *after 2012*. The large price spread (nearly €10 at the time of this writing in late April 2008) between the EUA and the secondary, guaranteed CER reflects the strong reaction of market players to the European Commission's proposal and reflects how the CER is currently being perceived by the market, relative to the EUA.

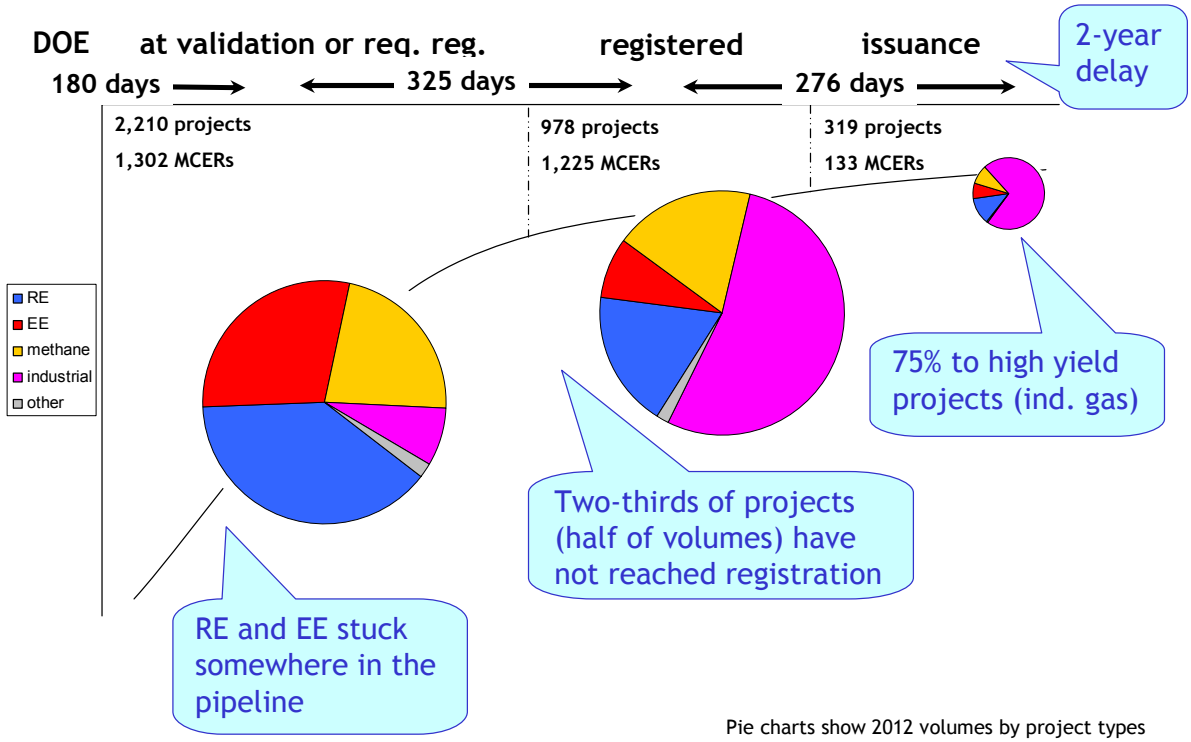
Challenges Facing the Carbon Market

At the end of March 2008, there were 3,188 projects in the CDM pipeline, of which roughly one-third are registered (978), or in the process of registration (188) while roughly two-thirds are at validation stage (2,022). The project-based market became, in some ways, a victim of its own success and obtaining timely CER issuance proved to be quite challenging in 2007. Market infrastructure and institutions as well as regulators are struggling to keep pace with the huge momentum of CDM supply (Figure 3). Increased scrutiny by the CDM Executive Board, resulting in requests for review of projects occur, and rejection of projects at a record rate, also contributed to further delays.

The cost of delays

It can take between one and two years for a project to go from validation to registration and technical delays. This does not even include the six months or so that it is taking to book the services of a DOE (see below). Project delays cost project developers valuable financial resources, cost buyers valuable emission reductions and can delay desired environmental outcomes. Delays for any reason – since payment for carbon is often linked to delivery – can put elements of the financing package of projects in jeopardy. This, in turn, may further impact on the expected delivery schedule, not to mention dampening the enthusiasm for further innovation. Clearing bottlenecks and accelerating the application of necessary procedures has become a priority challenge. It is time that every stage of the CDM approval process take on professional service standards.

Figure 3: CDM: A Victim of its own Success?;
Delays Hold Back Clean Energy Projects



Pie charts show 2012 volumes by project types
Source: World Bank based on data from UNEP RISOE

Other reasons for delays

There were also other reasons, more intrinsic to projects themselves (among others delays in project permitting, financing and commissioning, poor project implementation and operation or unrealistic expectations in the PDD) that added to the challenge of timely approvals and low CER issuances. Some companies took on undue commercial risks that did not sufficiently take into consideration the panoply of risks involved in getting a project to be successfully implemented as well as getting the carbon asset created on time.

Timing delays: Whom do they impact the most?

Delays in the timing of CER issuances are of immediate concern to primary project sellers, who may be expecting carbon payments as part of their project financing package. The *timing* is of no particular concern to compliance buyers, for whom the *overall volume* delivered by 2012 is of greater importance. Compliance buyers have flexibility because the design of the EU ETS accommodates an overlap between the surrender of allowances for 2008 compliance and the receipt of allowances for 2009. Delivery delays, however, can have real costs and risks for those companies on the secondary markets[33] that have provided guarantees for the *timing* of a certain specified volume of delivery obligations by a specified date, in exchange for a higher price for their deliveries.

[33] Several publicly listed project aggregators disclosed in late 2007 that they would write down the value of their expected delivery portfolios. Ecosecurities, which is regarded as the market bellweather, disclosed that it had cut its expected volume of pre-2012 deliveries by 24% to 142 million CERs and its pipeline of projects had also shrunk to 402 projects from 458. This disclosure dragged down the value of their stock and of other carbon pure plays in the market and one, Agcert, filed for the equivalent of bankruptcy proceedings in Ireland.

THE TWO WORLDS OF PRIVATE CAPITAL AND ENVIRONMENTAL COMPLIANCE

The world has truly changed today when power company executives and investment bankers talk about climate risk and environmentalists talk about leveraging the power of markets. Climate policy has mobilized the world of private capital to work in favor of protecting the environment. In so doing, it has brought together two widely different worlds with very little experience and knowledge of each other. A good example of the disconnect between the two worlds was the unauthorized release of verified EU ETS emissions data in April 2006, which highlighted the need for environmental officials to safeguard emissions data, which, for the first time, had large financial implications.

Each of the two worlds described above has very different mental models and very little knowledge of how the other world operates, let alone any deep insights into the other's assumptions, motivations, language and behavior. Considering how widely different these two cultures are, it is quite extraordinary to recognize how successfully they have worked together so far to produce concrete action to reduce carbon emissions. In 2007, some prominent investment banks tried to further bridge the gap between the two worlds, as they hired specialist carbon staff, bought small and boutique carbon originators and made investments in the "infrastructure" of the carbon market, including exchanges and registries.[34]

Prudent risk management

Some aggregators and funds have been less than prudent in the way that they sold large volumes of secondary guaranteed CERs for early delivery, including for December 2007. Other aggregators and funds have instituted high quality internal processes for portfolio risk monitoring and management. Regulated financial entities are required by financial regulators to manage risk by marking to market the value of their securities or portfolios,[35] using value-at-risk[36] techniques to manage risk and having to maintain capital adequacy requirements.[37] Companies can manage delivery ("volumetric) risk by provisioning the first and most secure tranche of risk prior to selling a certain "reasonable volume" of guaranteed CERs. Another risk management approach consists of selling secondary guaranteed contracts covered by buying call options on issued CERs for an equivalent volume.

Flight to quality

In the context of the broader slowdown in the financial sector, many project developers and banks reported a "flight to quality" in terms of their credit policies and this was reflected in much greater selectivity in terms of the credit quality of counterparties they were able to contract with. On the other side, this selectivity and attention to risk were matched by equally discriminating sellers that tried to attract buyers with strong balance sheets. These trends favor highly credit-worthy and "low-risk" buyers and sellers alike at the expense of smaller companies in poorer countries. Reforming the CDM ecosystem's administrative and processing time is of importance to all countries, but especially the smaller project developers in the poorest countries.

Carbon market governance

Markets need a balance between innovation and stability. For the carbon markets, this includes the need for better overall market governance, as well as a clear delineation of which areas fall under the

[34] It is anticipated that the wave of industry consolidation through mergers and acquisitions that started in 2006 and accelerated in 2007, would continue to rise in 2008.

[35] Mark to market is the act of assigning a value to a position held in a financial instrument based on the current market price for that instrument or similar instruments. Marking-to-market virtually eliminates credit risk, but it requires monitoring systems that usually only large institutions can afford. See Crouhy, Galai, & Mark (2001). *Risk Management*, page 445.

[36] A technique used to estimate the probability of portfolio losses based on the statistical analysis of historical price trends and volatilities. VaR is able to measure risk while it happens and is an important consideration when firms make trading or hedging decisions.

[37] These guidelines are used to evaluate capital adequacy based primarily on the perceived credit risk associated with balance sheet assets, as well as certain off-balance sheet exposures such as unfunded loan commitments, letters of credit, and derivatives and foreign exchange contracts.

ambit of the carbon regulator and which fall under ambit of more traditional financial regulators.[38] This last point is increasingly relevant as financial institutions in secondary carbon markets develop a range of carbon-linked instruments, including those with debt-like and equity-like characteristics that are marketed to investors.

3.2 WHO IS BUYING?

European Buyers Dominate

For the second consecutive year, European buyers dominated the CDM and JI market for compliance and at the close of 2007, their market share reached almost 90% (up from 2006). Private companies have been the most active buyers, with 79% of volume transacted in 2007, up slightly from 77% in 2006. The most active buyers (large European compliance buyers with installations in several countries, project developers and aggregators as well as financial institutions with an eye to the booming secondary markets largely operate or are administered out of London, which, at 59%, is still considered the carbon finance hub of the world (up from 54% in 2006).

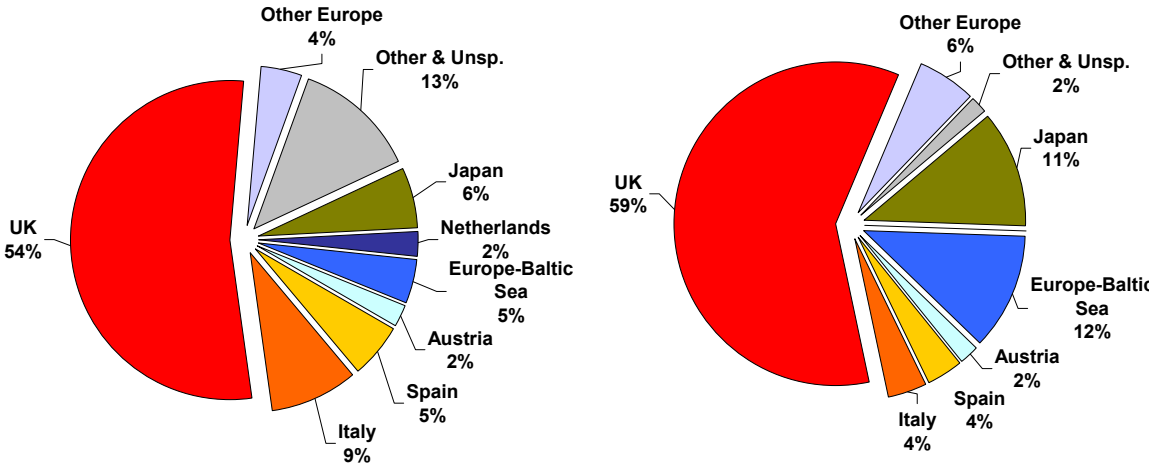
Japan is back in the carbon compliance market with its 2007 market share nearly doubling from 6% to 11% market, with both public and private sector intensifying their activity. The Government of Japan has been regularly increasing its funding to the Kyoto Mechanisms Credit Acquisition Program since its inception in April 2006, roughly doubling its budget every fiscal year. For FY08, the amount committed for purchases of Kyoto credits through 2008-12 now exceeds JPY80 billion or US$815 million (€490 million). In April 2008, Japan's New Energy and Industrial Technology Development Organization (NEDO) announced that about 23 millions CERs had been contracted since FY06, an important marker toward the minimum 100 $MtCO_2e$ target. Expectations of Japan's 2010 GHG emissions are likely to be revised upward to include an additional 19-34 $MtCO_2e$ per year (95-170 $MtCO_2e$ over the whole Kyoto period), suggesting the likelihood of higher purchases, including from the Japanese private sector.

A key towards the achievement of the Kyoto target by Japan is the coordination between the Government's Kyoto Protocol Target Achievement Plan and the Keidanren Voluntary Action Plan, a voluntary commitment by major industries to stabilize CO_2 emissions from fuel combustion and industrial process at 1990 level by 2010. In late 2007, major industries announced that they would tighten their targets under the Keidanren Voluntary Action Plan, thereby assuming responsibility for 45 to 76% of the additional Kyoto gap. Part of these additional efforts could also translate into extra demand for Kyoto units, including CDM and JI.[39]

[38] As recently highlighted by J. Hill, T. Jennings and E. Vanezi (2008). *The emissions trading market: Risks and challenges*. FSA Commodity Group (London: UK).

[39] To illustrate, the steel federation now intends to purchase 44 $MtCO_2e$ (up from 18 $MtCO_2e$) over the 2008-2012 period and the federation of electric power companies (who are struggling with their target under the Keidanren VAP) announced they would increase their acquisition objective four-fold to 120 $MtCO_2e$.

Figure 4: Primary CDM&JI Buyers (as shares of volumes purchased, vintages up to 2012)[40]



2006
Overall volume 553 $MtCO_2e$

2007
Overall volume 592 $MtCO_2e$

The JI market, which had long been thought to be the quasi-exclusive domain of sovereign buyers such as the Netherlands, Denmark and Austria, saw the emergence of private sector buyers for the first time in 2007. As JI regulatory uncertainties appeared to decline in 2007, a good-sized JI pipeline emerged and the Japanese private sector, in particular, made some important purchases in Eastern Europe.

Outlook: How much more Demand is Likely?

Near-term prospects for growth of CER market
Regardless of the eventual number of CERs delivered by 2012, the prospects of unfettered and consistent growth of the primary CER market in the next two years or so are uncertain, especially considering the likely competition from new supply from Russia, Ukraine, Poland, Latvia etc. After accounting for volumes already contracted, the remaining compliance market demand for CDM and JI is, at best, about 600-800$MtCO_2e$ of additional demand from all sources combined, i.e. the EU ETS, EU governments, Japan and minor demand from small Annex I Parties.[41] Project-based primary credits will continue to have some demand in 2008, but the outlook beyond that is unclear. This poses a major risk to the continuity of the CDM and JI markets.

The authors estimate that the remaining compliance demand (still primarily EU and Japan) could add up to a maximum of about 1,000 $MtCO_2e$ over the next years or so, with perhaps 50-75% of that being exclusively for CERs and ERUs. Private entities and governments would likely be equal components of this demand. In the absence of firm and sustained demand post 2012, the outlook for CDM and JI is thus relatively limited.

Cumulatively since 2002, EU buyers have accounted for nearly three-fourth of the primary CDM and JI market since 2002, while Japan has accounted for about a fifth. The authors estimate that by the end of 2007, EU governments had purchased 178 $MtCO_2e$, or about one-third of the assets they had identified for purchase from the flexible mechanisms (CDM, JI and AAUs). Private EU buyers had already contracted 1,070 MtCO2e, or about 76% of their expected demand for CDM and JI credits

[40] Purchases by the World Bank-managed family of funds have been attributed to the fund participants' countries pro rata. Europe-Baltic Sea refers to Finland, Sweden, Norway, Germany, Denmark and Iceland; Unsp. refers to purchases where we could not verify the origin of the buyers.
[41] Demand estimates are further discussed in Annex I.

from EU ETS installations in Phase II (&III). These buyers are not all natural compliance buyers and several are financial institutions that are planning to sell back these credits on the secondary market.

As far as Japan is concerned, the estimated 320 $MtCO_2e$ credits purchased by Japanese entities so far account for more than half of the expected demand from Japan (use of Kyoto Mechanisms by the Government and share of the burden borne by the private sector). One can also reasonably expect both the Japanese private sector and public entities to continue to have a demand for purchases from the Kyoto Mechanisms over the next year or so.

The authors estimate that so far other Annex I Parties (Australia, Canada, Iceland, Liechtenstein, Monaco, New Zealand, Norway and Switzerland) have purchased 17 $MtCO_2e$, or about one-third of the assets identified for purchase from the flexible mechanisms (CDM, JI and AAUs).

Beyond 2012: European Commission proposal could cap ETS demand for CDM until 2020
The current stalemate in international climate negotiations – and the prospects for additional CER demand – will not be clear until late 2009, at best. The likely timeframe for the implementation of any United States-based regulatory system is also a few years away. The project-based compliance market is facing the ceiling of 1,400 $MtCO_2e$ until 2020 ceiling proposed for the EU ETS. The European Commission, whose Member States have benefited greatly from the availability of CERs at a reasonable price is limiting its continued use conditional upon the decisions of major emitters on post-2012 commitments.

Demand from other sources
Demand from voluntary markets, while growing rapidly, is neither firm enough nor long-term enough to continue the momentum created by project-based actions to mitigate climate change. Markets for pre-compliance assets are developing slowly, and in the words of one experienced market participant "could be in the tens of millions" within a year or so. Absent strong, clear regulatory signals about their acceptability, the fragile successes of the project-based markets may not be sustained much longer beyond 2008. Continuing a reformed CDM is a proven way of engaging a more global effort to mitigation. Further, the broad success of the CDM, and its continued promise, should encourage major emitters that there are cost-effective ways to meet ambitious emission targets.

Real leadership on climate change needed
The big elephant in the room, of course, is the continued uncertainty about the role and scope of project-based mechanisms in future climate policy, including in the EU ETS Phase III, in proposed U.S. federal legislation and in regional and state markets, as well as in emerging Japanese, Australian and Canadian markets. The EU's proposal is clearly the first salvo in what will undoubtedly be a long post-2012 negotiation process.

It is not known now whether the EU's proposal will achieve its worthy goal of encouraging major emitters to join post-2012 commitments through the Bali Action Plan. One thing, however, that is known is that the impact of the EU proposal to effectively limit CDM and JI to no more than 1,400$MtCO_2e$ until 2020 would be to penalize the projects that have been transacted more recently. These tend to be smaller energy efficiency and renewable energy CDM projects and programs in smaller developing countries, for example, in Africa, that are only just beginning to enter the global carbon market. In the words of the African proverb: "When two elephants fight, it is the grass that suffers[42]."

[42] Setswana proverb.

3.3 WHO IS SELLING?

China Dominates Primary CER Transactions

For the third consecutive year, China was the world leader in CDM supply with a 73% market share in terms of 2007 transacted volume (compared to 54% market share in 2006) – see Figure 5. Leading 62% of primary CER supply so far under contract, China is still the destination of choice for buyers of credits, who cite its large size, economies of scale in origination, and its favorable investment climate. Buyers generally reported the ability to close primary forward carbon transactions in the range of €8-11, with one or two notable transactions at above €13 in the last few months.

China consolidated its position as the pre-eminent carbon supplier, by quadrupling its number of projects in the pipeline from January 2007 to March 2008. China is well ahead of other countries in the CDM pipeline with 53% of potential CER supply until 2012, and, with 1104 projects, also pulled ahead of India in the number of projects in the CDM pipeline.[43] China also nearly doubled its expected CER deliveries by 2012 over that period of time.

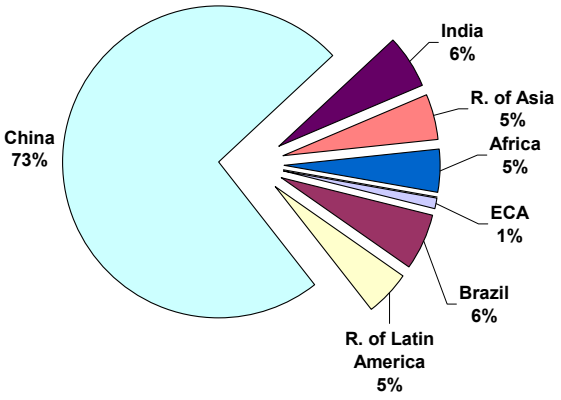
India, Brazil… and Africa

Brazil and India, at 6% market share each, transacted the highest volumes after China, although this represented a drop in volumes for each from 2006 levels. Africa followed with 5% of the market. Compared to their position in the CDM pipeline, India and Brazil have a relatively low market share of transactions. Market participants repeatedly cited high price expectations in these two countries, and reported that project sponsors focused on transacting issued CERs at attractive prices in the range of €15-16.50 instead of selling (riskier and therefore less remunerative) forward CER streams. With CER issuances gradually ramping up and the market infrastructure for spot CER transactions being operational,[44] one could reasonably expect higher volumes of spot primary transactions reaching the market in the coming years. This may also indicate an inclination away from the conventional, stand-alone ERPAs from the past, with implications for their value as project finance instruments.

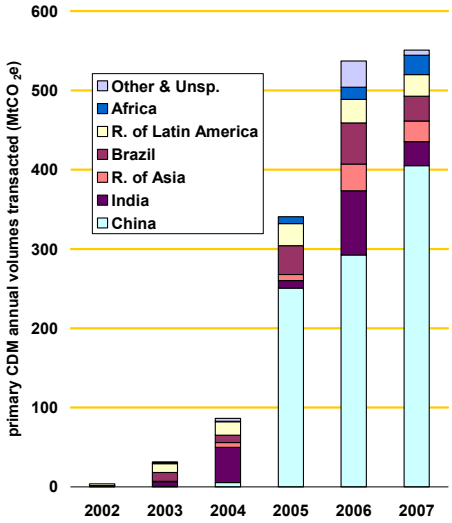
[43] India (15 %) and Brazil (7%) are the only two countries other than China with a share of the CDM pipeline volume of greater than 5%.

[44] At least outside EU jurisdiction, with a number of countries successfully connected to the ITL and eligible and some transactions reported. In addition, exchanges have been set up in India and Brazil.

Figure 5: Location of CDM Projects



2007
(as a share of volumes supplied)[45]



2002-2007

A number of countries entered the project pipeline for the first time, particularly in Sub Saharan Africa and Central Asia[46] and transacted volumes grew several-fold in a number of other countries, most notably in Malaysia and Indonesia. Although they account for a much smaller share of the primary CDM market, some countries in Africa (Kenya, Uganda, Nigeria), Asia (Malaysia, Philippines, Thailand) as well as in Eastern Europe and Central Asia (Uzbekistan), reported sharp increases in transaction volumes. Projects in Africa have contracted to supply about 50 $MtCO_2e$ to the market so far, with more than 20 $MtCO_2e$ transacted in 2007 alone.

Russia and Ukraine Dominate Potential JI Supply

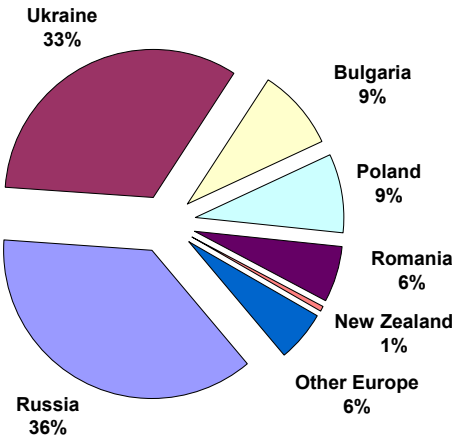
The near-tripling in transactions volumes through 2007 seems to confirm the market's interest in JI potential, after years of hesitation. Market's focus moved from Eastern Europe to Russia and Ukraine, with roughly one-third of market share each (Figure 6). The EU decision on double counting has substantially restricted the potential of JI largely to projects outside the scope of EU ETS (for instance, CMM, LFG or N_2O, for instance), thereby limiting the growth of the pipeline in the newer EU Member States. Therefore the dynamic growth in the JI pipeline occurred almost entirely in Russia and Ukraine,[47] which now account for 69% and 21% respectively of the project pipeline of expected 2012 supply. The number of track II projects nearly quadrupled from 34 projects in January 2007 to 129 projects in the pipeline as end of March 2008. If approved, these 129 projects are expected to deliver 240 million ERUs by 2012, which is almost four times the 66 million ERUs that were expected from the pipeline back in January 2007.

[45] Numbers may not add up to 100% due to rounding.

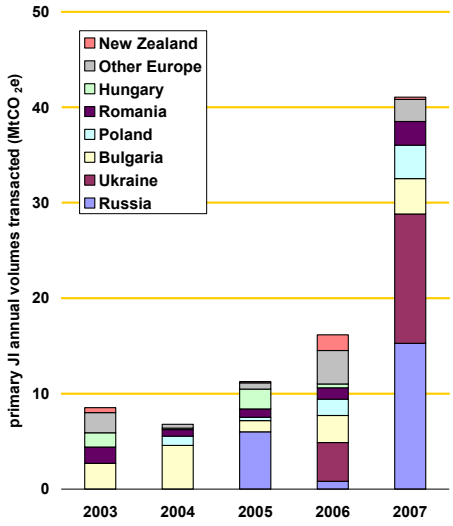
[46] Thirteen countries entered the pipeline between January 2007 and March 2008, bringing the number of countries with at least one CDM project to 68 at the end of the period.

[47] Russia and Ukraine have long been regarded as the countries having the greatest JI potential, with huge opportunities in the oil and gas sectors as well as in the power sector (refurbishment and energy efficiency as well as methane capture)

Figure 6: Location of JI Projects



2007
(as a share of volumes supplied)



2003-2007

With the establishment of JI procedures in a number of countries, especially in Ukraine and Russia - the two biggest suppliers,[48] regulatory uncertainties would appear to have been substantially reduced. However, procedural bottlenecks continue to hamper JI potential. Launched officially in October 2006, the Track II JI project approval process has so far decided on only two projects out of 129 submitted, approving one project in April 2007 (energy efficiency at a cement plant in Ukraine) and rejecting one in February 2008 (hydro rehabilitation in Bulgaria). With more Parties expected to gain eligibility in the coming months, one may wonder to what extent project sponsors will contemplate shifting their projects from track II to track I (including early movers) to speed up process – in spite of the reputation risk mentioned by some market participants.

3.4 PROJECT TYPES

CDM Delivers on Clean Energy

Continuing a trend that began in 2005, volumes transacted from clean energy projects (renewable energy, fuel switching and energy efficiency) reached 358 $MtCO_2e$ in 2007 (or a 64% market share, compared to just 33% in 2006 and 14% in 2005). Energy efficiency projects at large industrial facilities account for the most of these emission reduction transactions (Figure 7). The mystery of the low penetration rate of energy demand side management-related projects (even in countries undergoing power emergencies and rampant blackouts, as 35 countries in Africa are currently experiencing)[49] is usually explained by the high upfront costs such programs require as well as the barrier of public education and acceptance. The CDM could have contributed greatly to removing these barriers, but instead the complex existing CDM monitoring methodology for large-scale projects is itself a barrier. New submitted methodologies use "deemed savings"-related approaches to reduce unnecessary monitoring complexity. In addition, programmatic approaches could help weave

[48] The whole framework for JI (approval and ERU issuance and transfer) was developed in Ukraine through 2006 and approval started May 2007. These rules could be soon amended to include a floor price. With Ukraine soon expected to gain eligibility (tentative date: 29 April 2008), Track I procedure are also under development. JI procedures for Russia were issued late May 2007 while it took about 10 months to build the whole institutional framework: since March 10, 2008, projects can be submitted for approval.

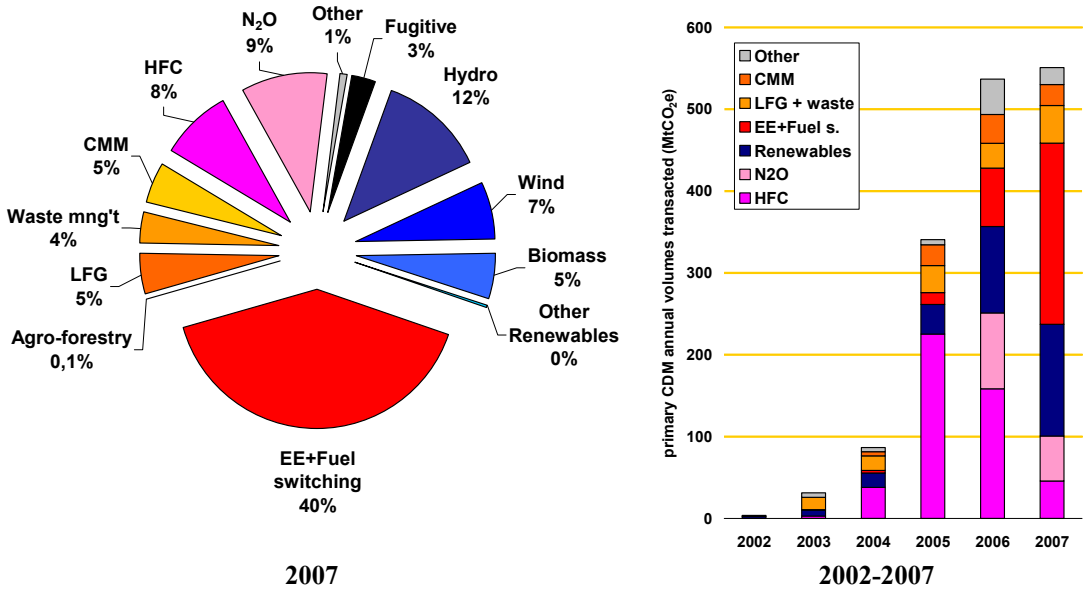
[49] http://www.infrastructureafrica.org

together various dispersed, smaller activities while promising initiatives targeting demand side energy efficiency (for example, efficient lighting, efficient appliances) could help carbon finance unleash the great potential in energy demand-side management.

Leveraging clean energy investments

The authors estimate that in 2007 alone CDM has leveraged US$33 billion (€24 billion) investment in the field of clean energy, or 63% of what has been leveraged in those same areas since 2002 (US$52 billion or €39 billion).[50] On average, the authors find a cumulative committed investment to CDM projects activities over 2002-2007 of about US$59 billion or €44 billion, for an average leverage ratio of 3.8. If industrial gas transactions are not considered, there is a much higher global leverage ratio at 6.4. The leverage ratio for renewable energy tends to be around nine. Renewable energy account for two-thirds of the total capital leveraged with hydro at 22% and wind at15% respectively.

Figure 7: CDM Project Types



2007 (as a share of volumes supplied)

2002-2007

The Rise and Fall of Industrial Gas

The share of HFC-23 decomposition projects continued to decrease from their 2005 peak, reflecting the exhaustion of existing opportunities under the current methodology[51] and persistent questions regarding the inclusion of new HCFC-22 facilities under the CDM. A decision on this matter has been postponed by the two previous meetings of the COP/MOP, in the light of growing concerns about the CDM and perverse incentives broadly publicized over the past few years. A report by UNEP[52] recognized the key role of CDM as an instrument to accelerate the phasing out of HCFC-22.[53] Acknowledging the increase in demand for refrigeration around the world, the UNEP report recommended the inclusion of new plants under the CDM with a number of amendments.

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[50] Methodology for computation of investment and leverage factors is presented in the 2007 edition of the State and Trends.

[51] Only two such projects entered the pipeline in 2007, bringing their number to 19 and adding only 4% to the total expected 2012 CERs from these projects (501 million). Following our transaction database, this potential supply has largely been contracted.

[52] UNEP (2007). *Response to Decision XVIII/12: Report of the Task Force on HCFC Issues (with Particular Focus on the Impact of the Clean Development Mechanism) and Emissions Reductions Benefits Arising From Earlier HCFC Phase-out and Other Practical Measures* UNEP Technology and Economic Assessment Panel. http://ozone.unep.org/teap/Reports/TEAP_Reports/TEAP-TaskForce-HCFC-Aug2007.pdf

[53] Reducing emissions of HFC-23 by-product from this one gas alone is likely to produce close to 500 million issued CERs by 2012.

Projects abating N_2O (a potent GHG with a global warming potential of 310) entered the CDM pipeline by mid 2005, offering large volumes along with low performance risk, limited requirements for investment and short lead times, all attractive characteristics for buyers. After HFC-23 decomposition projects, this asset class has been competitively pursued globally and contracted in the last two years. At 250 million CERs expected by 2012, most of these projects have already been transacted on forward contract or identified for spot transactions. Sulfur hexafluoride ($SF_{6)}$, a potent gas used as an insulator in transformers and switchgear in electricity transmission and distribution systems also was transacted for the first time in Nigeria.

CAN CARBON FINANCE HELP REDUCE GAS FLARING IN NIGERIA?

The practice of gas flaring adds about 350 million tonnes of CO_2e annually to global GHG emissions. The potential for local economic development and for emission reduction is significant, if only there were a way to create viable local markets for the gas, such as for power generation or Liquefied Petroleum Gas (LPG) for domestic cooking use. However, many barriers exist as the example below demonstrates, and carbon finance has the potential to help mitigate some of these risks.

In a country like Nigeria with an "official electricity grid" of just over 3000 MW, there is "unofficial electricity capacity" of another 3000-4000 MW in the form of expensive, inefficient and high-polluting diesel generators. This is, in theory, an opportunity to collect the associated gas that is currently being flared and process and sell it to power generators that could supply electricity to the grid. However, the price for gas in the local Nigerian market is several times lower than in world markets, providing little incentive to invest capital in gas recovery, processing and pipelines. The gas supply risk, in turn, prevents project developers from making investments in new power generation. In addition, project developers and their lenders also need assurance that they would be paid in a timely manner for their supply of electricity to the troubled state-owned utility.

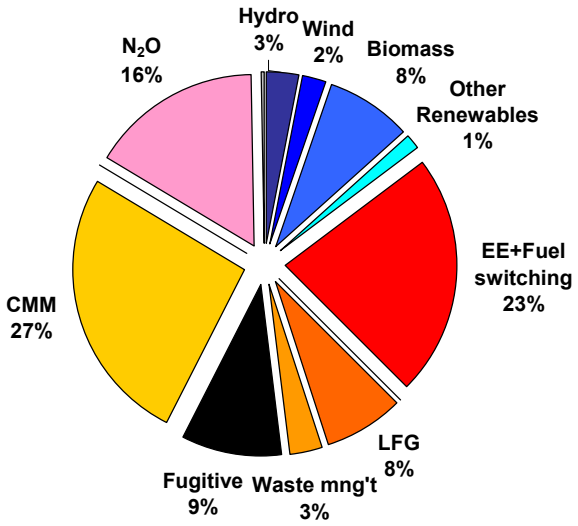
In Nigeria, a sustained, mid-to long-term program to reduce or eliminate gas flaring could clearly benefit from carbon finance as part of a risk mitigation package for the sector. This could support the Government's efforts to make the energy sector more attractive to investors through its proposed new gas supply obligation and a new gas policy. At this time, however, there is no approved CDM methodology that would allow carbon credits for gas-generated, grid-connected electricity to displace off-grid diesel generation.

Methane Madness

Emissions from waste currently account for about 4% of global greenhouse gas emissions and emissions from municipal waste account for a large share of methane emissions. Methane reduction from waste management is back in favor, although concern about expected performance yields has resulted in Emission Reduction Purchase Agreements (ERPAs) that substantially discount the expected volumes in contracts. Buyers conduct enhanced due diligence during project design and selection and exercise some influence on technology selection, commissioning and operation. While the current pipeline suggests potential supply of up to 245 million CERs by 2012, only about a third of that volume (90 million CERs) have been contracted so far, a discount corresponding to the observed yield of these projects.

In addition to low performance yields, other barriers to landfill gas (LFG) projects include the lack of awareness and capacity of municipalities and the absence of appropriate regulatory frameworks. A more systematic approach to solid waste management through local programmatic carbon finance activities, such as composting waste in the hundreds of African cities with no sanitary landfills at all, could be one way to help create an incentive for better waste management practices.

Figure 8: JI Project Types (as a share of volumes transacted in 2007)



Fugitive Emissions

Projects targeting fugitive methane emissions account for an 8% market share of transacted volumes, with coal mine methane (CMM) projects decreasing slightly from 2006, now at a 5% market share. Forty-nine projects are in the pipeline and 40 of these are still at validation stage. Seven projects have been registered and two have only just requested registration. Only two DOEs are accredited to validate and verify mining projects and this explains why there is a backlog of projects in this project type. Projects to reduce gas flaring also emerged in the transaction data, with a 3% market share.

Project Types Transacted in JI

The project types transacted under JI during 2007 is quite different from the CDM, with a suite of projects targeting methane leading with 47% market share, followed by clean energy projects at 37% and N_2O abatement projects at 23% (Figure 8). This is a change from project types transacted in 2006, which had clean energy at two-thirds of transacted volumes. The numbers for fugitive gas projects reflects the market shift to the promise of Russian and Ukrainian potential in the oil, coal, gas and power sectors.[54]

3.5 INSIGHTS ON PRICES AND CONTRACT TERMS FOR PROJECT-BASED ASSETS

Prices for primary forward CERs ramped up throughout 2007 and early 2008, with the vast majority of transactions in the range between €8-13, with an average contracted price of US$13.60 or €9.90 (up 24% from 2006). The two main market benchmarks for price were the tacit price floor in China (reportedly evolving from €8 to €9 through 2007) and the observed price on the secondary market, which effectively played the role of a price ceiling. Also a reflection of sustained interest in CDM and increased competition during 2007, the minimum price for CERs (except for temporary CERs and long-term CERs from forestry projects) rose to US$9 (€6.5) in 2007 from US$7 (€5.6) the year before (a 26% increase).

[54] For instance, Russia has specified that two-thirds (or 200 $MtCO_2e$) of ERUs are to be generated by projects in the energy sector. Fugitive gas projects are among the top candidates in energy, accounting for half of current volumes in the Russian JI pipeline.

Price Differentiation

Price for projects at an early stage of regulatory and operational preparation transacted at around €8-10 (possibly even €7-11, depending on countries and projects), while registered projects with streamlined technology (for example, HFC with storage options) attracted prices between €11-13. Projects demonstrating strong sustainability attributes and community benefits (such as those certified under the Gold Standard) could easily fetch a €1-1.5 premium: obtaining a price of €15 for Gold Standard CERs was not uncommon toward the end of the year.

Country of Origin

China is by far the biggest primary CER supplier, as its size and industrial base would suggest. Buyers continue to cite the economies of scale, the reliability of business partners, the predictability of regulatory processes and what they considered higher, but still fair, prices for contracts. Projects from experienced sponsors and streamlined technology fetched the €10-12 price mark while less mature projects traded in the €8-10 price range. A small (€0.25-0.50) premium to similar contracts from projects outside China was reported by some interviewees, reflecting buyers' willingness to pay a premium for regional diversification in their portfolio.[55] Although some market participants have, again, reported avoiding the Indian market given its hurdles, a few reported that they had been purchasing issued CERs from India, typically at a €2-3 premium compared to Chinese ones. Prices in Brazil span the entire range from €8-15, while other countries in Latin America may have not seen such high prices.

CERs and ERUs

ERUs traded at an average price of US$12.2 or €8.9 (up 38% from 2006), catching up further with CERs in 2007, although they remained cheaper on average. The strong interest for ERUs is also reflected in the year-to-year increase in the minimum and maximum price range offered for an ERU. Full convergence between CDM and JI did not occur as private buyers systematically reported their concerns about sovereign risks governing, in particular, the issuance process (under Tracks I and II).

Experienced Sellers, Known Technologies Command Premium

In the first quarter of 2008, there have been reports that prices for primary CERs increased again, up €1-2 higher than the price ranges recorded last year and this is reflected in recent surveys of the primary market.[56] In particular, stronger prices were recorded in China, with transactions of some unregistered and not yet commissioned projects from large, experienced power companies reaching €13 and beyond. This may reflect the emergence of a two-tiered market in China: premium prices, on the one hand, for well publicized tenders and auctions for CERs from wind energy and other projects by large power companies, and, on the other hand, discount prices for projects requiring more effort to get off the ground. These tenders attract all the major players in the carbon market and create intense competition, resulting in the high prices reported recently. This may reflect another element of the flight to quality discussed earlier as buyers recognize the quality of the counterparts and their experience as project managers and sponsors, and the choice of projects with streamlined, tested technologies. Equally importantly, buyers reported a low "hassle factor" of engaging in carbon business in China, and stated that they were pleased with their experience of generally good-faith negotiations with counter-parties and the ability of sellers to conclude contracts in a reasonable time-frame.

[55] Not all interviewees confirmed the existence of a premium.
[56] See IDEAcarbon *pCER Index* March and April 2008.

Issued CERs

There were a few confirmed transactions for issued CER in 2007. Notable among them was the widely publicized 808,450 issued CERs auction from the Bandeirantes Landfill Gas to Energy Project on the Brazilian Mercantile & Futures Exchange, which cleared at €16.40 (compared to €16.70 for a December 2008 gCER contract on Nordpool traded on the same date). With the ITL operational and connected to Japan, the first trade of a lot of 10,000 spot CER from an HFC-23 decomposition project in South Korea at an undisclosed price was reported in Japan in late November. In January 2008, Climex claimed the first spot CER transaction settled through an exchange, using the Swiss registry, which is also connected to the ITL. The Climex transaction at €16.50 compares to a December 2008 gCER contract, which traded on the same date at €17.17 on LEBA. In March, the first international cross-border spot CER trade was reported between Switzerland and New Zealand.

With more primary CER issuances expected this year and more registries expecting to get connected through the ITL, the authors expect the spot CER market to pick up through the year (for sellers directly through a spot primary market as well as through intermediaries through a spot secondary market). Considering the administrative hurdles for trading on the primary spot market – one example is obtaining Letters of Approval (LOA), a possible time-consuming requirement to become a project participant to enter a primary transaction with risks of legal or public exposure – the secondary spot market may become more attractive to some buyers.

Further delays may be expected for the connection of the EU, as a whole, to the ITL. While this may be problematic for gCER contracts coming to maturity soon, market activity remains firm. During the last quarter of 2007, the Dec'08 gCER contract has traded in a price band of €16-18 (75-80% of December 2008 EUA). Small transactions of forward CER lots on the CCX were reported at a slightly higher price than in the broader European secondary market.

EUA Decoupling from CER?

The EUA and CER markets currently appear to be decoupling from each other. The price spread between future EUA (currently €26) and high quality forward primary CER contracts has widened to nearly €13 at the time of this writing, reflecting a combination of registration and issuance risk, ITL, as well as the limitation on CER fungibility. The EUA-CER spread (for gCER or issued CER) is currently at €10, giving a sense of how the market values the higher fungibility and flexibility of the EUA over the CER for compliance in the context of the EU's proposal. Subtracting the two (i.e. €16-€13 = €3) gives an indication of how the market values registration and issuance risk at this time,[57] and of the uncertainties that impact demand from compliance buyers. The concern over registration and supply risks have given rise to the gCER market with current traded volumes of between 2-3 million estimated daily.

Fixed Forward Pricing Contracts

Fixed forward prices are still the norm in the primary market. Indexing the CER price to EUA used to be more popular at the peak of Phase I back in early 2006, but strong volatility in the EUA market made sellers most interested in fixed price contracts. There have been reports of indexing primary contracts to exchange-listed gCER in lieu of EUA. When indexing occurs, it is usually structured with a price cap and floor or collar structure, with a floating component (instead of floor price and floating component), so that the buyers and sellers can share both upside and downside around a mid-point benchmark.

[57] Such as regulatory risks, delays in the project implementation or external factors that negatively impact the project sponsors' ability to deliver the emission reductions as expected.

No Guarantees in the Primary Market

Both buyers and sellers reported doing enhanced due diligence on counterparties. When sellers offered guarantees for delivery from primary transactions, buyers had limited interest. Buyers did not report paying for many delivery guarantees in the primary market, and were generally prepared to take all the volumes that a project may generate (except for funds which cannot have open obligations). When buyers did guaranteed transactions, they reported a strong preference for projects where the counterparty was a very good credit risk and where the project company had strong experience managing and operating several projects in its line of business.[58] There was less confidence about actual project execution and delivery from projects where the counterparty has weaker credit risk profile or where the seller is not an experienced project company. Some compliance buyers, mainly industrials, reported their preference to purchase gCER contracts on the secondary market. Other derivative contracts, including options, whose market has developed well over the past few months, also offer interesting risk management opportunities, as do more complex structured products under development.

What could change in the coming year or so? There are likely to be a number of more integrated transactions with underlying financing and investment in companies with "embedded" carbon assets. Such transactions require integrative skills that require deep regulatory knowledge, strong technical skills and sophisticated financial and structuring background.

Post-2012 Market

What of the post-2012 market? With limited prospects of long-term CER and ERU demand from the EU at this time, and no consistent embrace of international offsets in either the regional ETS' or the U.S. regional markets, the outlook for the post-2012 market do not appear bright. Compliance players in Europe and Japan are mainly interested in the 2008-2012 timeframe. The commodity desks of banks do not typically take positions in markets in which there is limited or no liquidity. That leaves either governments or multilateral funds or other investors with mandates for alternative investments, including venture capital and hedge funds. For those willing to bet on the post-2012 market, contracts with options with an unspecified exercise price linked to a future "market price", or forward contracts with nominal payments beyond 2012 are the norm.

3.6 SECONDARY MARKET FOR CERS: COMPLIANCE & RISK-MANAGEMENT

EUAs were the most active carbon market in 2007 as European utilities began to increasingly hedge their power risk in the EUA market, and then in turn hedging their EUA risk in the CER market. The creation of a viable secondary market in 2007 enabled this activity. Standard terms for secondary CERs, including guaranteed CER (gCER) contracts were developed.

The reaction to the European Commission's recent proposal for a Phase III EU ETS shifted the spread between EUA and CER prices. The European Commission proposed two scenarios for the acceptance of issued CER and ERU into a Phase III for EU ETS which were tied to whether or not a global agreement would be reached on a successor to the Kyoto Protocol. The scenario under no agreement would impose a tight limit on the number of credits accepted in the program, while the scenario under a Kyoto successor could made way for a much larger role for CER contracts.

CER contracts had generally tracked EUA at a discount of about €6-8; however, news of the European Commission's proposal for post-2012 initially drove down prices for both. The EUA bounced back as analysis of the announcement focused on the 1,400 $MtCO_2e$, while the CER remained lower for several weeks, due to additional perceived risk associated with those credits. This

[58] The only exception being the case of upfront payment.

led to a narrowing of the spread between gCER and primary CER contracts, as the gCER price remained lower, with primary CER contract prices seeing no real change (and even recently rising). This made gCERs more competitive with primary CERs as a result.

More recently, gCER contracts have nearly returned to the price range that they were trading at before the EU announcement, although prices for the EUA are up by even higher and the spread between the EUA and the gCER is almost €10. CER option contracts will soon be offered on exchanges like the Green Exchange, the European Climate Exchange, and over-the-counter and will provide another layer of risk management.

3.7 REFORMING THE CDM

The authors believe that experience of the CDM has demonstrated its power as a tool to engage developing countries to contribute meaningfully to climate change mitigation. The experience so far is simply the tip of the iceberg of the potential of the market mechanisms and other approaches to mitigating and adapting to climate change. The CDM will need to continuously innovate to catalyze the scale of action required to help prevent dangerous global warming efficiently and economically.

As the CDM has expanded, so also has the scrutiny that it faces from a wide variety of quarters. The challenges put to the CDM have included questions regarding its support of development benefits, the issue of additionality and about project performance/delivery.

Sustainable Development and the CDM: Myths and Reality

As clean energy projects begin to dominate the CDM, their developmental benefits are a lot more direct and visible than in the case of so-called "industrial gas" projects. Energy efficiency and renewable energy projects are now emerging as the most common type of CDM projects and this development should be encouraged. Many projects in Africa, likewise, have finally been transacted and this momentum too should be encouraged, including for land use, land-use change and forestry (LULUCF), which is still weighed down by complexity.

There is a widespread perception that projects that deliver huge volumes of CERs, such as industrial gas projects do not or cannot deliver other sustainable development benefits. A study by the International Institute of Sustainable Development[59] suggests that this trade off can exist, although it acknowledges that at the time of the study, the benefits related to activities to be supported through revenues from CER sales had not yet been launched and their benefits had not been assessed.[60] Many large projects, however, provide local economic, social and environmental benefits and often involve the transfer of technology.[61] A small but distinct market niche is developing, which rewards CDM projects that deliver strong sustainability benefits.

[59] See A. Cosbey (2006). "Measuring the CDM development dividend", Joint Implementation Quarterly 12(4), pp. 6-7.

[60] Some related activities supporting sustainable development are funded through a levy on CDM projects (for example, China's differentiated CDM tax of 65% on HFCs and PFCs, 30% on N_2O and 2% on all other projects), which will result in the generation of about €1.5 billion to support climate friendly initiatives in the coming years.

[61] See A. Dechezleprete, M. Glachant and Y. Meniere (2007). "The North-South transfer of climate-friendly technologies through the Clean Development Mechanism", CERNA (Ecole des Mines de Paris), mimeo.

THE POPULARITY OF THE GOLD STANDARD

Projects with attractive sustainable development attributes are able to attract healthy price premia for CERs from projects that use the Gold Standard or similar standards certifying strong development attributes. The Gold Standard has emerged as an attractive choice for compliance buyers (and some voluntary market buyers) of CDM and JI projects that also demonstrate strong local benefits. Unlike pure voluntary market plays, where several standards try to capture the development dimension of projects, the Gold Standard has long been the only label in existence on the compliance market to do so. The label helps to place a value on the additional benefits delivered by CDM projects. The Climate, Community and Biodiversity Alliance Standard (CCBS), also a project design standard, could join the Gold Standard and help forestry projects to grab a premium.

So far, the Gold Standard has been applied only to renewable energy and energy efficiency projects and just twelve CDM projects have received the Gold Standard certification. Gold Standard CERs are in high demand, from compliance buyers as well as from buyers on the voluntary market and the highest priced-primary carbon transaction in our 2007 data is a Gold Standard project that transacted at €16, a healthy premium to regular primary CERs.

The International Energy Agency (IEA) has projected that fossil fuel, including coal and natural gas will continue to play an important role in the energy mix of the world in the next several decades. Several developed countries, including Germany and the United Kingdom, are considering new, relatively efficient coal plants, as part of their strategy to secure their energy supply. Many developing countries have large coal or oil reserves which they are looking to as they seek to fuel their development.[62] Incentives to use these resources responsibly are important and the CDM Executive Board approved a new "Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plants using a less GHG intensive technology" (ACM 0013). A possible project activity could be, for example, the construction and operation of a supercritical coal fired power plant where prevailing technology is sub-critical and less efficient. However, more clarity is needed in the methodology since the version that was finally approved and adopted is written ambiguously, leaving open as many questions as it answers, especially on the ability of the methodology to support the scaling up of the selected efficient technology across the host country's energy sector.

Concerns about sustainable management of CDM projects related to the extraction of palm oil plantations have been articulated. Strong underlying demand for palm oil is the reason that, in some countries, natural forests are being cleared and natural habitat and biodiversity are being destroyed. With or without carbon finance, perverse incentives need to be eliminated and sustainability needs to be addressed. Remote sensing, satellite data and monitoring can be important parts of the solution and CDM buyers have the responsibility of buying carbon assets from those projects that meet national sustainability criteria. The controversy about the energy balance of biofuels derived from corn in the United States has spilled over to the CDM and there is no approved methodology for biofuels derived from other crops or plants, such as sugar cane. At a time of growing concern about food supply and food security, these issues are complex are not easily resolved.

Reducing Transaction Costs

Reducing transaction costs has been a stated objective of the CDM since its very beginning. It has, however, been difficult to reduce them, despite various efforts to do so. To their credit, the carbon regulators have tried to move in this direction, although that movement needs to accelerate and to be harmonized with other goals.

[62] Indeed, following the Reference Scenario from IEA's *World Energy Outlook 2007*, fossil fuels remain the major source of energy in 2030, led by oil at 32% of energy demand, followed by coal at 28% and gas at 22%. Coal sees the biggest increase in absolute terms (73% between 2005 and 2030).

A NEW SMART CDM

- **S**treamline approval process; reduce transaction costs;
- **M**onitoring through new tools;
- **A**dditionality demonstrated using simple, conservative benchmarks;
- **R**each new potential through programs and innovative methodologies;
- **T**rends important, not exact Tons.

Materiality, discounting and transaction costs

Safeguarding the rigor of the CDM is important and partly because of this, the CDM Methodology Panel and the CDM Executive Board have so far been consumed with requiring precision, down to the exact last ton of real, additional and verifiable emission reductions. Given the scale of the changes required as the world moves toward a low-carbon economy, there is a trade-off between desiring exact precision in calculating emission reductions and encouraging good, innovative action to reduce emissions anywhere as the world moves in the desired direction of lowering emission trends.

At its April 2008 meeting, the Methodology Panel made, what the authors consider, a thoughtful recommendation, which appears to be an important step in the right direction. It proposed guidance on dealing with what it called "random uncertainty" in CDM projects. Its guidance, to be considered by the CDM Executive Board, seeks to reduce transaction costs from measuring and monitoring emission reductions. The guidance recognized that sometimes there can be a trade-off between the high cost or practicality of installing certain measurement equipment and obtaining exact measurements from monitoring. The guidance notes the concept of materiality and recommends that emission reductions from projects that use "good practice" measurement equipment be discounted based on the level of uncertainty. The guidance also provides a corresponding "conservativeness factor" to discount emission reductions. This is a welcome development and the authors commend the Methodology Panel for this innovation.

Programmatic CDM to reduce transaction cost

The move toward programmatic CDM is an extremely positive development and the authors commend the CDM Executive Board for its progress in this regard. It has the potential to help scale up transformative initiatives, while also reducing transaction costs, which is of particular importance for smaller countries, which may have several, smaller dispersed opportunities in important sectors.

A recent well-intentioned CDM requirement seeks to deter the incorrect inclusion of CDM activities into broader Programs of Activity (POA). The CDM Secretariat and Board have included provisions for a penalty/liability clause to act as a deterrent to the acceptance of incorrect inclusion of such activities on the part of the DOE during the inclusion of each discrete activity into the broader program. If any CER units are issued for an invalid or ineligible project activity into a broader program, then the DOE would be responsible to acquire and cancel an equivalent volume of CER units.[63]

Deterring fraud is an important objective to safeguard the integrity of the CDM. Existing checks and balances in the system include the requirement to use one DOE for validation of a regular CDM project and a different DOE for verification. DOEs have liability for their errors, but it is not clear whether that liability can be penalized through the courts in some countries. This clearly raises the question about enforceability of liability provisions for DOEs. This penalty provision has so far had the unintended effect of deterring DOEs from taking on such projects at all, or, proposing to charge the program significantly higher fees for validation in order to cover their additional risk. This clearly defeats the intended purpose of reducing transaction costs for smaller projects and jeopardizes the

[63] CDM Executive Board. EB 32 Annex 38 and 39

success of the effort. One carbon program of activities in a small, landlocked African country is seriously considering bypassing the compliance market and instead accessing the voluntary market where no such liability concerns – and related transaction costs – exist.

Methodologies and Innovation

Fear of liability, in general, can discourage innovation, and that is clearly the wrong signal to be sent by the CDM regulator. Rather, the CDM ecosystem, including DOEs, should be encouraged to be open to new and practical ways to encourage innovation to reduce emissions and monitor results. New proposed methodologies have been delayed, and the Methodology Panel has communicated to project developers, in some cases, that their review may take two years or more. As the types of projects and even the sectors become more diverse and specialized, there are understandable limitations on the expertise of the handful of experts on the Methodology Panel. The Methodology Panel may benefit from the establishment of ad-hoc expert groups on call on retainer in cases where they would seek to get quick, additional inputs into specific technical questions.

Validation and verification

There are problems with the health of essential infrastructure in the CDM ecosystem, including some severe bottlenecks. To illustrate, DOEs who are responsible for providing independent third party validation and verification services, struggled to find the necessary staff resources to serve the vast number of projects seeking validation and/or verification. They have significant backlog in their work programs as delays of six months or more for validations become commonplace. Are site visits to all projects always necessary for rigorous validation and verification? The widespread access to and use of smart monitoring tools, including satellite imagery, global positioning systems, smart chips and remote sensing technologies should be explored in order to efficiently extend the reach and capacity of the monitoring and verification system be extended?

Additionality

The CDM Executive Board makes its assessment of whether a project activity is additional by relying increasingly on financial data or investment analysis in addition to barrier analysis. This information, when publicly available, is of limited value because requirements for return vary for projects from country-to-country and even within countries, based on the cost of capital and other inputs available to a project company. Appropriate rates of return for projects rest on various assumptions about inputs, and are difficult for a DOE to assess. Given these difficulties, the EB should ask what the added value of relying on such analysis really is.[64] Intelligent and considered risk taking can and should be rewarded handsomely by markets, and the authors applaud those innovators that have created and harvested value in this manner.

Overcoming financial barriers

Other legitimate barriers that carbon finance may well help mitigate include currency risk, perceived country risk, off-taker risk, liquidation risk, help pay for political, risk or credit guarantees, be part of the owner's equity or the project's debt package. In the business world, managers make project investment decisions based on careful analysis and after including both financial and strategic risks and opportunities into their decisions.

[64] Seventeen percent of projects were rejected because they failed to substantiate investment or financial additionality. Source: IGES CDM Rejected Projects List (24 March 2008 updated) - http://www.iges.or.jp/en/cdm/report.html
In a report commissioned last year by WWF, the Oeko-Institut found that additionality was unlikely or questionable, and included "opaque investment analysis", for roughly 40% of a random sample of 93 registered projects they selected. Source: L. Schneider (2007). *Is the CDM fulfilling its environmental and sustainable development objectives? An evaluation of the CDM and options for improvement.* Oeko Institut, 75p.

Eligibility and deviations from approved methodologies

A recent example may illustrate the point that there needs to be an emphasis and openness on the culture of innovation and continuous improvement. Consider a recent example, when a project developer in an African country re-submitted a PDD to the validator with what appears to be a reasonable request for deviation from the eligibility criteria of an approved methodology.

In that African country, the energy master plan and the merit order for electricity dispatch clearly demonstrate that coal is the lowest cost investment option for generation. A sugar estate has a cane growing season of *five months* in a year,[65] during which the CDM project proposed to operate specially procured, expensive high pressure dual-use boilers to efficiently generate enough electricity and steam from bagasse to sell power to the power utility. In the remaining months without cane and bagasse, the sugar company will use coal to fulfil its electricity supply obligations under the Power Purchase Agreement (PPA) with the utility. However, the applicability of the relevant scenario of the CDM approved methodology extends only to those projects which operate on biomass for *more than six months* of a year.

Acceptance of this common-sense deviation to this methodology for the PDD would rightfully result in the generation and issuance to CERs for this project. As it stands, the PDD with a request for deviation is awaiting validation and approval, even as the project has begun operations and is generating power which is compensated and emission reductions which are uncompensated

Sector transformation potential

The CDM Executive Board has stepped up the extent to which it rejects carbon projects, including, unfortunately, those in the renewable energy area which have significant development benefits. As an example, several biomass projects have been rejected in India, on the basis that they are now "common practice". The authors are not in a position to comment on the specific merits of the rejected projects. However, we would observe simply that we would hope that the rejections were not based simply on the fact that the projects were not "first-in-sector" type of projects and therefore, not additional. Remaining focused only on "first-in-sector" type of projects misses the opportunity to scale up beyond the one-off "demonstration" project and to scale up the transformation of entire sectors in favour of cleaner alternatives.

[65] In another host country in the Caribbean, climate variability has drastically shortened the cane growing period to less than six months in a year, putting it at jeopardy of meeting the applicability criteria.

IV OTHER DEMAND, OTHER SUPPLY

4.1 DEMAND FROM OTHER FRONTS

Voluntary Markets: an Opportunity for Pre-Compliance Assets?

IN PREVIOUS YEARS, SOME PLAYERS in the compliance market for carbon had watched the voluntary carbon markets with a mix of hope and horror. Interest in the voluntary market soared in 2007, with volumes and values tripling to 42 million VERs for US$265 million (€196 million), and to 65 million VERs for US$337 million (€246 million) including CCX trades.[66] This demonstrated the progress this segment had made to overcome some of the problems that had characterized it in the past. The authors have long felt that this market niche holds the promise of much innovation, but could certainly benefit from higher quality and consistent standards. Voluntary markets matured in 2007 and early 2008. Consideration of additionality and permanence of reductions has led buyers closer towards well understood project types like methane capture and destruction from landfill gas and agricultural waste, and renewable energy projects. This "flight to quality" has been assisted by the further development of standards and registries such as the Gold Standard, Voluntary Carbon Standard (VCS), VER+, the Climate Registry, and the California Climate Action Registry (CCAR). A whole new segment called "pre-CDM VERs" emerged, consisting of buyer demand for credits produced by projects that are awaiting their registration or issuance through the CDM regulator.

Standards emerge

Differences are observed in prices based on which standard is used in the verification of VER projects. For instance, projects which have been verified to stringent standards such as the Gold Standard or pre-CDM VERs command the highest prices. Conversely, projects verified to the CCX standard brought comparatively much lower prices in the VER market, trading in the US$1-4 range for much of 2007. The year also provided some progress in finding overarching standards, such as the Voluntary Carbon Standard 2007 (VCS 2007) which started to emerge as a widely used, scaleable and recognizable standard. Pre-compliance transactions through the CCAR also received considerable attention, but currently have limitations on the project types that they can be applied to.

In 2006, the voluntary market had largely consisted of European firms purchasing wholesale VERs intended for resale on the retail level and US firms purchasing credits for corporate social responsibility (CSR) purposes. This changed in 2007 as three buyer groups emerged. These include corporate buyers purchasing credits for CSR purposes, US firms aiming to purchase pre-compliance VERs that may be grandfathered into future regulations, and funds managing clients' carbon risk, with the potential to take speculative positions on credits and which can credit-enhance deals to resell these VERs.

North American Markets: Demand for International Offsets?

U.S. climate change landscape shifts

The prospects of a U.S. president signing federal legislation on climate change appear quite good, at the time of this writing, irrespective of which political party prevails in the 2008 presidential and congressional elections.[67] The politics of climate change in the U.S. has changed, caused in part by extreme weather events, high oil prices and concern about energy security. The rapidly changing U.S. landscape includes the possibility of political pendulum shift in November as climate programs

[66] For a more detailed discussion, refer to Ecosystem Marketplace and New Carbon Finance (2008). *State and Trends of the Voluntary Market 2008*.

[67] One of the authors of this report believes that this could happen even earlier, but he was not able to convince his co-author; hence this observation has been consigned to a footnote.

adopted at the state level proliferate[68] and following the Supreme Court decision finding that the U.S. Environmental Protection Agency (EPA) has the authority to regulate carbon dioxide (CO_2) and other GHG emissions.[69]

A new alliance, U.S. Climate Action Partnership (U.S.-CAP) consisting of major businesses and leading climate and environmental groups, issued a report stating that the climate change challenge will "create more opportunities than risks for the U.S. economy",[70] and has called on the federal government to enact legislation requiring significant reductions of greenhouse gas emissions. Several bills to reduce carbon emissions have been debated in the U.S. Congress since the 2006 election cycle, and since California adopted legislation requiring reductions in GHG emissions.[71] It is also noteworthy that the current U.S. Bush administration has publicly committed to engaging in international negotiations and has agreed to be part of the Bali Action Plan.[72]

*Federal and state-level legislative action on climate chan*ge
From 2006 onward, there have been a number of legislative initiatives and proposals that seek to establish greenhouse gas (GHG) emissions trading programs in the United States. At least 12 federal legislative proposals calling for a national GHG cap and trade program have been introduced in the 110th United States' Congress.

Estimates of possible U.S. demand for international offsets
It is unclear to what extent emissions trading schemes in the U.S. (and Canada, for that matter) would be open to the global carbon market, since the current proposals put the greatest emphasis on domestic action, followed by domestic offsets,[73] and then by international emissions trading and international offsets in that order. Most of these initiatives are still at an early stage, and making projections of various features of regulation before any details are finalized is fraught with uncertainty. Despite this, the authors, with assistance from Natsource[74], conducted some initial assessment of potential demand for international offsets from North American compliance markets.

The two most advanced federal legislative bills in the U.S. Congress place limits of 10% on international *offsets* (S1766, Bingaman-Specter) and of 15% on international compliance *allowances, not offsets* (S. 2191, Lieberman-Warner).[75] Assuming that U.S. legislation will proceed with the inclusion of international offsets, estimates of low-high potential demand from each bill can be made. This provides a potential opportunity for international offsets in the range of 400-900 $MtCO_2e$ annually by 2020, if constrained provision for international offsets is included in the final U.S. law.

More flexibility = better environmental performance + lower compliance costs
Recent analyses by the U.S. EPA show that unlimited flexibility for the use of international offsets can reduce the *costs* of compliance,[76] while safety valves can distort the environmental integrity of the

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[68] Forty-four state and provincial governments in the U.S. and Mexico have already established GHG emission reduction targets and/or renewable portfolio standard targets, or are participating in one of three emerging regional GHG emissions trading programs in North America.

[69] Supreme Court, *Commonwealth of Massachusetts v. EPA*, 05-1120, April 2007 http://www.supremecourtus.gov/opinions/06pdf/05-1120.pdf

[70] Source: *A Call for Action*; http://www.us-cap.org/about/report.asp

[71] Topics ranging from federal preemption of state and regional programs, international competitiveness concerns, cost containment provisions, and incentives for coal and nuclear power have been discussed in Congress.

[72] The administration also hosted a meeting of the major GHG-emitting countries in Washington, and plans to hold several more such meetings.

[73] Examples include Oregon's Climate Trust (a non-profit implementing offset projects, funded through a fee large energy facilities in Oregon can chose to pay to comply with the State GHG standards) or a ten-year track record of voluntary transactions (including through the Chicago Climate Exchange).

[74] Natsource prepared a document for the World Bank that provides a synthesis of analysis of various potential North American compliance initiatives.

[75] Further details in Annex.

[76] The *price* of international offsets would, of course, be determined by global market demand and supply conditions, not on the basis of cost of abatement.

program.[77] For the Lieberman-Warner proposal, compliance costs would be three times lower with *full* international flexibility (including international offsets), compared to what is currently proposed. The EPA also discusses the challenges of designing the price-cap feature of the Bingaman-Specter proposal, known as the Technology Accelerator Payment (TAP). Setting the price cap too high, will "lead to higher costs of abatement when the TAP is triggered." Conversely, if the price cap is set too low, "the TAP may be triggered in all expected scenarios, nullifying the expected GHG reductions from the emissions cap, and there will be less of an incentive to develop new GHG reduction technologies."

Timing, costs, prices and competition
In the U.S., the promulgation of detailed regulations can typically take 3-5 years following the passage of legislation. The authors therefore expect that it could be a few years before demand in the range mentioned above will materialize. Pre-compliance transactions may begin to emerge soon after the final legislative compromise is signed into law, but only if it includes provisions for domestic and international offsets and if the law provides for credits for early action.

International offsets under the CDM or JI have two possible advantages: one, the *cost* of abatement is likely to be lower internationally; and two, *timing*, in that there is likely to be considerable potential supply of real, additional and verifiable offsets by the time U.S. pre-compliance demand comes into the market. However, early market reports of pre-compliance forestry-based transactions under the California Air Resources Board (CARB) protocols suggest reasonable *prices* and significant supply of forestry-based U.S. domestic offsets. If this is indicative, and if domestic forestry offsets are included in a federal program, then they will provide stiff price competition to international offsets.[78]

Demand from Canada
Canada is also putting forward a climate change plan, at the Federal level, which includes emissions trading provisions to control GHG emissions from the industrial sector[79]. Last year, the authors had estimated five $MtCO_2e$ in annual compliance demand for international offsets from Canada potentially starting as early as 2010. In the year since, our review of new information leads us to neither validate nor invalidate our previous estimate.

4.2 CLOSING THE KYOTO GAP WITH GIS?

There is currently a projected compliance shortfall of 2.3-2.7 billion tCO_2e for Kyoto Parties excluding Canada. AAUs could potentially fill this gap three times over. This sometimes 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,
- There may be high perceived political costs and/or reputational risk for buyer countries purchasing excess AAUs, which are perceived to have no environmental additionality, and,
- It is likely that Economies in Transition will bank a significant portion of their excess AAUs for future commitments as well as seek a way to have some pricing power for these assets. In addition, popular opposition to the sale of national assets has been reported in several countries.

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[77] *EPA Analysis of Senate Bill S.2191 in the 110th Congress, the Lieberman-Warner Climate Security Act of* 2008, Office of Atmospheric Programs, Environmental Protection Agency, March 14, 2008; *EPA Analysis of the Low Carbon Economy Act of 2007 (S. 1766*), Office of Atmospheric Programs, Environmental Protection Agency, January 15, 2008.http://www.epa.gov/climatechange/economics/economicanalyses.html

[78] Early pre-compliance demand for offsets created under the protocols of the California Climate Action registry (CCAR) suggest that there is considerable supply of U.S. offsets at a price of about US$10.

[79] For a detailed discussion of current U.S. and Canadian proposals, see Annex.

Green Investment Schemes (GIS)

There is political resistance in Annex B countries to simply write a check to compensate for emission reductions that occurred not because of environmental action, but as a result of economic collapse two decades ago. 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. A "Green Investment Scheme" is a voluntary mechanism established by a selling country to assure buyers that proceeds from AAUs transactions will finance bilaterally agreed environment- and climate-friendly projects and programs through and beyond 2012. These could include direct investment in projects or policies to encourage fuel switching and non-fossil energy use and improve energy efficiency; or to support environmental objectives such as slowing the rate of deforestation or other measurable policy and investment initiatives.

Broader than mitigation
GIS may target broader environmental issues than mitigation.[80] Contractually agreed activities between buyers and sellers could be relevant in various different ways to the goal of reducing GHG emissions: ERs from various activities may be more or less difficult to monitor; ERs could occur in the seller country or a third country (for instance in Africa); and there need not be a systematic one-to-one match between AAUs transacted and actual ERs generated.

Opportunity to innovate
GIS is also not bound by some of the more problematic concepts of the CDM, and can be used to innovate and test better ways of estimating and measuring emission reductions. The key element in a successful GIS is the credibility of the host country to implement in a transparent manner the agreed upon activities. These could include identification of a portfolio of activities, set up of the institutional structure to oversee implementation, management of the required financial flows, engagement of third party verification and governance structure to protect GIS against fraud and corruption.

Some countries have started to identify potential projects and to define 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 operationalize it. More recently, Latvia, Czech Republic, Romania, Hungary and Poland as well as Ukraine and Russia have expressed their interest in this regard. This could add up to a potential supply of about 700 $MtCO_2e$ in Eastern Europe and upwards of 1,000 $MtCO_2e$ in Russia and Ukraine. Given the potential magnitude of supply, the AAU/GIS market can be viewed as a buyers market where sellers will have to compete to offer the most attractive green programs. In this context, there exists a genuine advantage to early movers who can engage in transactions before the larger supply (from Russia and Ukraine) enter the market.

Potential GIS/AAU deals in the offing?

In the past few months, a number of industrialized Annex B countries have announced their interest in such AAU/GIS. Japan signed a Memorandum of Understanding with Hungary and is discussing further transactions with Czech Republic, Latvia, Poland and Ukraine. Spain and Ireland also expressed interest in AAU/GIS from Hungary; talks are reported to be at an early stage. Finally, Austria is looking at potential deals in Hungary and Latvia while the Netherlands could contract AAU/GIS from Latvia. Exploratory transactions could be expected this year, at least around Latvia's pilot scheme, which is at an advanced stage of preparation.

[80] Interestingly, there is an incentive for the host country to really back-up AAUs transactions with some actual ERs, to avoid depleting its surplus of AAUs.

Competition with CERs & ERUs

From a Kyoto compliance perspective, some governments could be viewing GIS transactions as options to create a "safety valve" in case domestic measures to reduce carbon intensity do not kick in within the timeframes expected or in case CDM under-delivers. The ultimate 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. . JI track I and/or GIS could, of course, have a more profound impact on the CER/ERU market. Very streamlined host country JI track I guidelines could lead to higher than expected transfer of ERUs.[81]

[81] Since the Kyoto eligibility requirements for emissions trading under Article 17 and for using JI track I procedure are essentially the same, host countries could potentially utilize Track I and transfer ERUs instead of engaging in activities to "green" AAUs. A difference is that emission reductions underlying the ERUs have to be verified ex post under JI track 1, whereas GIS may have various ways of demonstrating credibility and the timing of AAU transfer is a matter of bilateral negotiation to be agreed between buyer and seller.

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V OUTLOOK

THE PROSPECTS FOR THE CARBON MARKET must be seen in the context of broader economic trends and outlook. Earlier this year, the liquidity crisis in the U.S. turned into a full-blown credit crisis and recession or economic slowdown is widely expected. The broader credit crunch has driven investors (such as hedge funds and pension funds) to a "flight to quality" where they are seeking a hedge against expectations of rising inflation and a falling U.S. dollar.[82] "Tangible" assets have become attractive and there is currently a broader emergence of many commodities (including oil, agricultural commodities, gold) as an asset class of interest to investors.[83]

The carbon market is correlated with energy markets, but it differs in important ways from other booming commodity markets, notably because there is no natural demand for carbon reductions.[84] Long-term expectations of future policy and regulation are the primary source of the carbon market's *demand* and action by regulators determine much of the available *supply* in terms of allocation of sufficient allowances as well as the issuance of carbon credits. Policymakers and regulators bear the biggest responsibility for the continuation of carbon market momentum by setting expectations for their role in long-term climate change mitigation.

The carbon markets are currently witnessing their own flight to quality, where compliance certainty, flexibility and fungibility are valued very highly. This trend will favor EUAs, and the authors expect that the EU ETS market will likely continue to expand in the coming years. Both EUAs and issued CERs will likely be more attractive for compliance in the coming years. The spread between the two may or may not persist, but they will each continue to trade at a premium to other, less secure assets offered on the market. A swap market is emerging as companies will want to manage their portfolios across compliance assets, vintages and contract types. A market for delayed or otherwise distressed CDM assets emerged and another market for distressed companies is emerging.

Price Differentiation

Stronger price differentiation across project-based assets and contracts will occur, for example between issued and forward CERs, with a higher spread for projects earlier in the regulatory process. The authors do not predict future prices in the market. A tiered CDM market is likely to emerge, providing risk management and arbitrage opportunities. These include:

- Private buyers (primarily EU-based power companies, banks, Japanese utilities and trading houses) will likely compete and offer the highest prices for the finite number of issued CERs. (currently priced around €16-17) until the registration/issuance backlog is cleared.
- Project aggregators will likely transact the most secure tranches of their portfolios as secondary guaranteed CERs on exchanges or through their bankers (to European industrials and the Japanese private sector) at a slight nominal discount to issued CERs (currently trading forward at around €16 at future settlement). There will also be continued interest,

[82] Unlike many other commodities, there is no "natural" or "intrinsic" demand for carbon reductions as an asset with intrinsic value and fundamental analysis is heavily informed by the impact of regulation and the expectation of future regulation.

[83] Traditional fundamental analysis consists of underlying physical demand and supply from natural players and is usually a fair indication of value in markets. Many analysts believe that traditional fundamental analysis does not, however, fully explain recent appreciation of prices in some major commodities, which have seen strong investor interest. A recent analysis by Société Générale states that "most investors coming to commodities are not really trading the fundamentals in the old sense (…) [rather] their [fundamental] analysis is based on long-term expectations, while their short-term dashboard is made of the U.S. dollar, inflation, rates decisions and relative performance versus other asset classes. Therefore this does not leave much space for the old-style physical supply-demand balance, at best the shape of the forward curve." *Commodities Review: Surfing the investor wave*, Société Générale, March 2008.

[84] The only part that may be considered "natural" is some components of voluntary market demand.

especially from the financials, in trading gCERs on exchanges and offering them as compliance instruments.

- Private buyers and sovereign buyers will likely offer slightly lower prices for early delivery forward CER contracts (currently around €12-13) from high-yielding project types offered by credit-worthy and experienced project developers.
- Hedge funds will likely buy across the line, including some post-2012 vintages, as well as partially guaranteed CER contracts, at a discount (currently around €11-13 based on the seller's credit risk and assessment of regulatory risk across portfolio) to the gCER.
- Sovereign buyers, pre-compliance buyers expecting regulation beyond 2012 and voluntary market buyers will likely continue to support purchases from more complex projects with strong sustainable development attributes or from countries not well represented in the market (currently €8-13).
- A CER or VER produced under reputable standards such as the Gold Standard will likely command the highest prices (currently €10-15), followed by pre-CDM VERs (€6-8) and CCX (currently €4).
- Sovereign buyers, who also have the option(s) to contract and bank AAUs, and this potential competition could have the effect of influencing primary CER prices generally lower.

Market Continuity Needs Action Now

Created and driven by regulation, the carbon market's biggest risk today is caused, perversely, by the absence of market continuity beyond 2012, and only policymakers and regulators can create that continuity. Market continuity depends on the sense of urgency by policymakers in beginning to address climate change seriously. The challenge ahead is huge and will need ambitious efforts, if we are to succeed, including encouragement to early action, assuming science-based mitigation targets and re-thinking the CDM. Markets are a dynamic and important part of society's response to climate change. Market momentum and sentiment can change overnight absent the correct incentives. Policymakers need to set policies and regulations for carbon markets to expand, but also for other necessary interventions beyond the reach of the market, in order to solve a multi-generational problem of this scale.

ANNEX I: INTRODUCTORY ELEMENTS TO KYOTO DEMAND AND SUPPLY

UNDER THE KYOTO PROTOCOL, 38 industrialized countries[85] are required to reduce their greenhouse gas (GHG) emissions by an average of 5.2% below 1990 levels over the 2008 - 2012 period. They may do so through:

- reducing domestic emissions, drawing on a wide range of policies and measures (carbon tax, carbon trading, standards, subsidies…);
- trading (Art. 17) emission permits (AAUs) among governments (Art. 3); or,
- purchasing emission reductions credits from CDM and JI projects.

Several countries, alone or jointly, have elected carbon trading (or have plans to do so) as a key component of their climate change policies, with the EU ETS as the chief example. Through EU ETS, the cornerstone of EU climate policy, Member States allocate part of their efforts to meet Kyoto commitment to those entities in the private sector that are responsible for those emissions. The EU ETS regulates CO_2 emissions from energy-intensive installations (chief among those, power sector), representing some 40% of EU emissions.

From 2008 onwards, the EU ETS covers installations located in other countries of the European Economic Area (Iceland, Liechtenstein and Norway). Sectoral extension, notably to aviation, is under active consideration. Mandated installations – in a similar fashion to governments under the Kyoto Protocol - may internally reduce emissions, purchase EUAs or acquire CERs and ERUs.

Beyond the EU boundary, New Zealand and Switzerland have launched national ETS. The NZ ETS aims at covering all sectors of the economy and regulate all six Kyoto GHG and sectors will be progressively phased into the scope of the scheme, starting with forestry in 2008. In Switzerland, companies may opt for emissions trading in lieu of a carbon tax; in the event of non-compliance, the carbon-tax is to be paid. Here again, together with other units, installations may surrender CDM and JI credits for compliance. Both countries are contemplating linking to other schemes (EU ETS for Switzerland and an Oceanian carbon market for New Zealand).

Australia and Japan also have plans for carbon trading over the next two years or so. Design features such as target, eligible units and linking are not public yet. Although Canada is still officially a Party to the Kyoto Protocol, it will follow an alternative reductions schedule (postponing reaching its Kyoto target to beyond 2020). Emissions trading is still under consideration, but with limited linking to an international carbon market.[86]

Likely Demand for Kyoto Mechanisms (KMs) from Governments

Governments have indicated a demand of about 660 O_2e from the KMs, as follows:

- EU-15 Member States plan to address part of their Kyoto gap with 540 $MtCO_2e$ through the Kyoto Protocol flexibility mechanisms (CDM, JI and AAUs).

- Japan is struggling to reach its Kyoto target (notably because of emissions growth in the residential and transport sectors) and is currently revising its Kyoto Target Achievement Plan, or KTAP (in particular, through the introduction of an ETS). So far the government is planning to purchase at least 100 $MtCO_2e$ through the KMs but this number could well be revised upward.

[85] Of which one country (USA) has not ratified the Kyoto Protocol.

[86] See Annex II on nascent U.S. and Canada carbon markets.

- The remaining industrialized Annex B governments are planning to purchase about 20 $MtCO_2e$ from the Kyoto mechanisms:
  - Australia should be able to bridge its Kyoto gap through domestic policies and measures, thanks largely to a significant contribution of forest and land-use activities.
  - Liechtenstein and Monaco together represent less than 0.5 $MtCO_2e$ over the whole Kyoto period, and no shortfall is projected for Iceland.
  - New Zealand faces a Kyoto gap of around 100 $MtCO_2e$, with domestic sinks as a major option to close the gap. The launch of a NZ ETS could address another 10-15 $MtCO_2e$ of the shortfall. It is unclear however to what extent this would translate into a demand for CERs and ERUs, since NZ ETS installations are allowed to use also AAUs for compliance. The Government of New Zealand has made no announcements regarding its plans to purchase Kyoto units.
  - Norway projects a shortfall around 50 $MtCO_2e$ during the Kyoto Period and has plans to secure at least 10+1 $MtCO_2e$ of CDM and JI units, with a growing demand beyond 2012 in line with its carbon neutrality target. An additional demand of 15 $MtCO_2e$ could come from Norwegian installations under the ETS.
  - Finally Switzerland plans to bridge its 12-15 $MtCO_2e$ Kyoto gap roughly half-half between domestic policies and measures (including domestic offsets) and procurement of CDM and JI credits (and the Climate Cent Foundation has already been extremely active in this respect).

Private Sector Compliance Demand

Private sector demand is likely to be about 1,775 $MtCO_2e$, almost entirely focused on the CDM and JI markets.[87] This demand arises mainly from installations regulated under the EU ETS,[88] which is limited to about 1.4 billion tCO_2e.

The Japanese private sector under the Keidanren Voluntary Action Plan[89] will likely add another 350 $MtCO_2e$ to KM demand. Installations under a proposed Japanese ETS could also bring some additional demand; however the authors expect that that this demand would be more or less the same as Keidanren demand.

Likely KM demand from installations under the Norway ETS will add 15 $MtCO_2e$, and installations under the NZ ETS could add another 10 $MtCO_2e$. It is too early (and perhaps over-optimistic) to count any potential demand from Australia, although the Canadian private sector may well demand up to 25 $MtCO_2e$ by 2012.

[87] Except NZ installations that are allowed to import AAUs as well.

[88] Under the 20% target for EU, the maximum amount of CDM and JI credits allowed into EU ETS for PhII&II jointly can not exceed 1.4 billion tCO_2e.

[89] Keidanren Action Plan is a voluntary commitment by major Japanese industries to stabilize CO_2 emissions from fuel combustion and industrial process at 1990 levels by 2010. It is a key part of the country's strategy to meet its Kyoto targets.

Table 6: Supply and Demand in Perspective – Kyoto Market Balance (2008-2012)

Potential Demand from Industrialized Countries (2008-12)		**Potential Supplies (2008-12)**		
Country or entity	KMs demand *(MtCO2e)*		Potential surplus of AAUs *(MtCO2e)*	Potential GIS *(MtCO2e)*
EU	**1,940**	Russian Fed	3,330	(0<???)
gov't (EU-15)	540	Ukraine	2,170	(1,000 -1,200)
private sector (EU ETS)	1,400	EU-8+2	1,720	(100-700)
questionable P&Ms	*(200)*	Other EITs	85	???
Japan	**450**	**TOTAL**	**7,305**	**(1,100-1,900)**
GoJ	100			
private sector	350			
add'al demand	*(200)*			
RoEurope & NZealand	**45**			
gov't	20			
private sector (Norway and NZ ETSs)	25	CDM and JI Potential *(MtCO2e)*		
add'al demand	*(20)*			
		CDM	1600	(1,400-2,200)
Australia	**0**	JI	230	(180-280)
TOTAL	**2,435**	**TOTAL**	**1,830**	**(1,580-2,480)**
gov't	660			
private sector	1,775			
add'al demand	*(420)*			

Sources: **4th National Communications, review of National Allocation Plans for 2008-2012 and other governmental documents**, for KMs demand for Kyoto Parties and Potential surplus of AAUs under the "with existing measures" scenario; for GIS potential supply, **World Bank estimates**.

Total Demand for KMs

This brings the total demand for KMs to about 2.4 billion tCO_2e over 2008-2012, with private sector demand accounting for 73% and government demand for the remainder.

Governments have not yet made clear the amount of AAUs that they plan to purchase along with CDM and JI. Assuming 50% of their demand of Kyoto mechanisms could be addressed to the AAU market, the demand for CDM and JI assets from all public and private sector sources in industrialized countries could at least amount to 2.1 billion tCO_2e. These are conservative estimates of demand: disappointing deliveries from CDM and JI as well as lower than anticipated performance of domestic policies and measures[90] could push the demand from governments by 300-400 $MtCO_2e$.

What's on the Supply Side?

Supply from each of the flexibility mechanisms of the Kyoto Protocol will likely be needed to bridge the Kyoto Gap.

AAUs and International Emissions Trading: the main source of AAUs lie in Eastern Europe and Former Soviet Union countries, Parties to the Kyoto Protocol: Russia holds 46% of these "surplus"

[90] For instance, during the review of the National Allocation Plans (NAPs) for Phase II, the European Commission questioned some 320 $MtCO_2e$ of reductions from policies and measures for EU-15 Member States. Part of this gap has been addressed through a tightening of the EU ETS cap but some will likely translate into an additional demand for Kyoto mechanisms. Same would apply in other industrialized countries of Annex B.

AAUs, Ukraine 30% and EU-10 24%. Given the restructuring of their economies since 1990 (the base year for the Kyoto Protocol), these countries have received significantly more AAUs than needed to cover their expected emissions over the 2008-2012 period. The potential supply of AAUs is sizable and could flood the market. For a number of reasons (in particular since these assets are perceived as insufficiently additional since their transfer is not matched by emission reductions), it is likely that this whole supply will not reach the market as such and will require being greened under a GIS to become palatable to buyers.

CDM for ERs from projects based in developing countries: As buyers showed an increasing appetite for CERs, the CDM project pipeline has grown unabated over the last few years, dominated by China. As of end of March 2008, there were 3,188 projects in the pipeline, which could deliver about 2.5 billions CERs by 2012. However, given a number of bottlenecks along the project cycle, delays in project financing and commissioning as well as views on the inflow of new projects (and dormant projects), some analysts estimate the CERs supply by 2012 to reach 1.6 billion, with a range of 1.4-2.2 billion.

JI for ERs from projects based in Annex B countries, mostly Economies in transition: JI full deployment has long been hampered by regulatory uncertainties. With JI procedures established in a number of countries, especially in Ukraine and Russia - the two biggest suppliers, JI pipeline also experienced a very dynamic growth through 2007: there were 129 projects in the pipeline as end of March 2008, that could deliver up to 240 million ERUs by 2012. Procedural bottlenecks still hamper JI potential and with a limited crediting period, ending 2012, it remains to be seen how this potential will effectively materialize.

ANNEX II: INTRODUCTORY ELEMENTS TO DEMAND FOR OFFSETS IN U.S. AND CANADA NASCENT MARKETS

THE AUTHORS REVIEWED two of major U.S. federal proposals for an economy-wide cap and trade scheme. The importance of state and regional emissions trading programs is acknowledged in this report, but the authors resist making any projections of possible demand from these programs, either because they have not yet provided any detail regarding how they view international offsets (California and the Western Climate Initiative), or because current emission trends do not suggest any significant demand in the near future (Regional Greenhouse Gas Initiative - RGGI).

Towards a Federal Cap-and-trade Scheme?

At least 12 major pieces of legislation[91] have been introduced in the 110th Congress that would require GHG reductions and incorporate an emissions trading program. Of these, the *America's Climate Security Act* (S. 2191, sponsored by Senator Lieberman and Senator Warner) and the *Low Carbon Economy Act* (S. 1766, sponsored by Senator Bingaman and Senator Specter) have garnered the most significant political support. Although S. 1766 was introduced first, S. 2191 has since moved to the forefront of the climate change debate at the Federal level. On December 5, 2007 the Senate Environment and Public Works (EPW) Committee passed S. 2191 by an 11-8 vote and the bill is expected to be brought to the Senate floor by summer 2008. Although S. 1766 has not been reported out of committee, the bill contains several industry-supported provisions (i.e. safety valve, unlimited use of offsets, 10% limit on international offsets) which will likely be influential in shaping future debate. Key design elements of these two draft bills are compared in Table 7.

Table 8 summarizes available estimates of installations shortfall in the U.S. that would be created under the Lieberman-Warner proposal and the Bingaman-Specter proposal. Emission targets are more stringent in the Lieberman-Warner proposal than in the Bingaman-Specter proposal, as discussed above, while flexibility in compliance through the use of domestic and international offsets is lower. As a result, greater emission reductions are required from covered sources under Lieberman-Warner, particularly in the earlier years of the program. The range of estimates of emission shortfalls that would be created under each proposal is wide. Differences in estimates are the result of different underlying assumptions regarding emission projections and the exact coverage of the program. Estimated demand in 2020 ranges from 0.66 $BtCO_2e$ to 1.07 $BtCO_2e$ under Bingaman-Specter and from 1.58 $BtCO_2e$ to 2.47 $BtCO_2e$ under Lieberman-Warner.

[91] Of which, seven aim at regulating emissions economy-wide: Lieberman/McCain (S. 280), Olver/Gilchrest (H.R. 620), Bingaman/Specter (S. 1766), and Lieberman/Warner (S. 2191) would regulate emissions from the electric power, industrial and transportation sectors under a cap and trade program. Other proposals including Sanders/Boxer's (S. 309), Kerry/Snowe's (S. 485), and Representative Waxman's (H.R. 1590) do not provide significant detail on coverage, but do call for economy-wide trading programs, and assign responsibility for determining coverage to EPA. The remaining emissions trading proposals only cover the electricity sector, although the Collins/Lieberman (S. 1554) bill also includes vehicle performance and clean fuel standards.

Table 7: Side-by-side Presentation of Low Carbon Economy Act (S. 1766) & Lieberman-Warner Climate Security Act (S. 2191)

	Bingaman/Specter (S. 1766)	Lieberman/Warner (S. 2191)
Scope	Economy wide, 6GHGs 86% of GHG emissions	Economy wide, 6GHGs 84% of GHG emissions
Cap in 2012	6,652 $MtCO_2e$ (8% above 2005)	5,775 $MtCO_2e$ (4% below 2005)
Cap in 2020	6,188 $MtCO_2e$ (~2005)	4,924 $MtCO_2e$ (18% below 2005)
Cap in 2030	4,819 $MtCO_2e$ (22% below 2005)	3,860 $MtCO_2e$ (36% below 2005)
Cap in 2050	4,819 $MtCO_2e$ (22% below 2005)	2,796 $MtCO_2e$ (71% below 2005)
Allowance allocation and auctioning	Some sectoral allocation specified, such as industry (53% in 2012 declining to 25% in 2030) or agriculture (5%). Increasing auctioning for remainder: 24% in 2012 to 32% in 2020 and 53% in 2030 Auction proceeds funneled into tech fund	Some sectoral allocation specified, such as industry (43% in 2012 declining to 7% in 2030) or agriculture&forestry (5%). Increasing auctioning for remainder: 28% in 2012 to 71% in 2031 thru 2050 Auction proceeds funneled into 7 funds in US Treasury, for technology development
Offsets	Unlimited use of domestic offsets 10% for int'al offsets (subject to President's decision)	15% for domestic offsets 15% for int'al allowances
Banking	Unlimited	Unlimited
Borrowing	No borrowing	Limited to 15% (not from periods more than 5 years ahead, interests accrue)
Other cost control	Safety valve: US$12 per tCO_2e (+5% p. a. above CPI) Payment funneled to tech fund	Carbon Market Efficiency Board to monitor economic and envt'al effectiveness of C-mkt and implement cost relief measures such as less restrictive conditions on borrowing
Early action	1% of allowances, from 2012 to 2020	5% of allowances for early action in 2010, declining to 0% in 2017
Other provisions	Bonus allocations for carbon capture and storage Funds and incentives for technology R&D Target subject to 5-year review of new science and actions by other nations	Bonus allocations for carbon capture and storage Funds and incentives for technology, adaptation, & mitigating effects on poor Cap-and-trade system performance and targets subject to 3-year NAS review

Source: Natsource & Pew Centre on Global Climate Change

Table 8: Summary of U.S. Estimates of Emissions Shortfalls under Proposed Legislation

		2012 ($BtCO_2e$)	2015 ($BtCO_2e$)	2020 ($BtCO_2e$)	2030 ($BtCO_2e$)
Lieberman-Warner	**Average**	0.53	1.12	2.04	3.66
	Range	0.47-0.58	0.71-1.51	1.58-2.47	2.45-4.40
Bingaman-Specter	**Average**	-0.19	0.18	0.81	2.65
	Range	-0.19	0.03-0.37	0.66-1.07	1.19-3.63

Source: for Lieberman-Warner: New Carbon Finance,[92] Duke University, [93,94] EPA[95] & Point Carbon[96]; for Bingaman-Specter: New Carbon Finance, EPA[97] & EIA [98]

[92] New Carbon Finance, Global Kyoto Analysis –Research Note, January 2008; and North America White Paper – February 2008.

[93] The study is based on the Lieberman-Warner version of the bill prior to mark-up.

[94] Nicholas Institute for Environmental Policy Solutions, Duke University, The Lieberman-Warner America's Climate Security Act: A Preliminary Assessment of Potential Economic Impacts, October 2007 http://www.nicholas.duke.edu/institute/econsummary.pdf

[95] *EPA Analysis of Senate Bill S.2191 in the 110th Congress, the Lieberman-Warner Climate Security Act of* 2008, Office of Atmospheric Programs, Environmental Protection Agency, March 14, 2008; http://www.epa.gov/climatechange/economics/economicanalyses.html

[96] Point Carbon, Carbon Market Analyst "American Climate Policy: A Tale of Two Billings," February 2008.

Demand for offsets under a U.S. cap-and-trade scheme will likely be subject to some limits on the use of offsets for compliance, in particular for offsets from overseas. Current legislative proposals limit the use of international and domestic offsets. Under Lieberman-Warner, covered sources may use domestic offsets and international allowances up to 15% of compliance obligation in a given year (this excludes international credits from the Clean Development Mechanism and Joint Implementation projects). The Bingaman-Specter proposals does not specify a limit on the use of domestic offsets but limits the use of international credits/allowances to 10% of compliance obligation.

Simulations suggest that offsets from overseas could provide a source of relatively inexpensive credits that would reduce GHG allowance prices and the costs of compliance in a U.S. Federal trading program. In particular, allowing international project credits (like CERs and ERUs) for compliance in a U.S. program could create significant demand for these instruments, in the range 400-900 $MtCO_2e$, if they are competitively priced relative to U.S. allowances, U.S. offsets or both.

EPA estimates a 611 $MtCO_2e$ demand in 2020 for project-based credits from overseas under the Lieberman-Warner draft bill (assuming international offsets could be used for compliance). These credits come at an international price in between US$10-12, making those inexpensive relative to domestic offsets and abatement opportunities from covered sources. In the same way, NCF reports a demand for international offsets up to 900 $MtCO_2e$ (the 15% limit on offsets) available at a US$10-15 price at the time, should they be allowed into a U.S. program.

These simulations emphasize the large and tangible benefits of allowing offsets into cap-and-trade schemes, in particular as they aim at targets ambitious (but commensurate with the required efforts to address climate change), such as the Warner-Lieberman draft bill. Estimates however vary significantly across modeling teams, based on eligibility considerations (and inclusion of potentials in agriculture and forestry are amongst the main source of variation) and technical and economic factors that introduce a wedge between marginal abatement cost curves and actually supply curves. In addition, for those offsets from overseas, different views on competition for these assets in the global carbon market directly impacts views on supply for the U.S. market (which in turn may influence the global carbon market).

Other Initiatives: State and Regional Emissions Trading Programs

In addition to developments at the Federal level, states[99] and provinces throughout North America have undertaken a number of GHG legislative initiatives that seek to implement emissions trading programs. California is moving forward in developing an approach for meeting its mandatory state GHG target by including a state-wide emissions trading program for its electricity sector. The majority of other states and provinces that have taken action on GHG limits have passed, or are in the process of passing, legislation that will implement their respective regional emissions trading programs.

- In New England, for example, ten states are participating in a carbon dioxide trading program known as the (RGGI) in which an emission cap will be set at current levels in 2009, and then reduced 10% by 2019.[100]

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97 EPA Analysis of the Low Carbon Economy Act of 2007 (S. 1766), Office of Atmospheric Programs, Environmental Protection Agency, January 15, 2008; http://www.epa.gov/climatechange/economics/economicanalyses.html

98 EIA, "Energy Market and Economic Impacts of S.1766, the Low Carbon Economy Act of 2007," January 2008, http://www.eia.doe.gov/oiaf/servicerpt/lcea/pdf/sroiaf(2007)06.pdf

99 The Pew Centre thus enumerates 18 States with state-wide greenhouse gas reduction targets, 27 States to have regulations requiring a given fraction of electric power to come from renewable sources (+2 States where utilities made voluntary commitments). Many other instances of these low-carbon policies (not systematically motivated by climate change concerns) are reported. See http://www.pewclimate.org/what_s_being_done/in_the_states.

100 The Regional Greenhouse Gas Initiative was established in December 2005 by the governors of Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York and Vermont. Massachusetts, Rhode Island and Maryland have

- The passage of Assembly Bill 32 (California Global Warming Solution Act) in August 2006 sets economy-wide GHG emissions targets as follows: bringing down emissions to 1990 levels by 2020 (considered to be at least a 25% reduction below BAU) and to 80% of 1990 levels in 2050. California will face an annualized emission shortfall estimated in the range of 60 to 80 $MtCO_2e$ per year to achieve the target of 1990 emissions levels.[101]
- In the West, seven states and the Provinces of British Columbia and Manitoba are participating in the Western Climate Initiative (WCI), in which the aggregate emissions target, calculated based on individual states' separate GHG targets, is 15% below 2005 levels by 2020.**[102]**
- Another regional effort comprised of six states and Manitoba[103] known as the Midwestern Greenhouse Gas Accord (MGGA) was announced on November 15, 2007, although the program's targets will not be finalized until July 2008.**[104]**

Each of these programs will seek to establish a regional multi-sector cap-and-trade system within the next few years (except RGGI, which will begin in 2009). In addition, the large majority of these states and several others have already established individual state-wide GHG emission reduction targets, such as California.

Canada: Proposed Target of 20% below 2006 Levels by 2020

On April 26, 2007, the Federal Government of Canada released its climate change plan, which regulates both GHG emissions and air pollution.[105] The initiative aims to reduce Canada's total GHG emissions 20% below 2006 levels by 2020.[106] This could bring about emission reductions 330 $MtCO_2e$ or 35% from baseline scenario (will still be 6% above 1990 level). On March 10, 2008, following consultations with stakeholders, further details were released.[107] Draft legislation is expected later this year, with potential approval by late 2009.

Canada's climate change plan targets GHG emissions from the industrial sector (roughly 50% of sources) and sets mandatory intensity targets:

- In 2010, existing installations (in operation before 2004) must reduce their emissions intensity by 18% below 2006 level, followed by an additional 2% per year improvement.
- The plan also includes measures to limit industrial air emissions, improve fuel efficiency standard in new cars and light trucks, strengthen energy efficiency standards (incl. a ban on incandescent light bulbs), increase the share of renewable fuels and a number of other

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also joined RGGI. The District of Columbia, Pennsylvania, the Eastern Canadian Provinces and New Brunswick are participating as observers.

101 New Carbon Finance, a carbon market consultancy, has projected higher numbers for the shortfall: ranging from 35 $MtCO_2e$ (0-45 $MtCO_2e$) in 2015 to 91 $MtCO_2e$ (8.5-115 $MtCO_2e$) in 2020. Source: "North America and Global Carbon Market", New Carbon Finance, *op. cit.*.

102 The Western Climate Initiative (originally the Western Regional Climate Action Initiative) was established in August 2007 by the governors of Arizona, California, New Mexico, Oregon and Washington. Utah, British Columbia, Manitoba, and Montana have also joined the WCI. Alaska, Chihuahua, Coahuila, Colorado, Kansas, Nevada, Nuevo Leon, Ontario, Quebec, Saskatchewan, Sonora, Tamaulipas and Wyoming are participating as observers

103 Manitoba is also participating in WCI.

104 The Midwestern Greenhouse Gas Accord (MGGA) includes Illinois, Iowa, Kansas, Manitoba, Michigan, Minnesota and Wisconsin as participants. Indiana, Ohio, and South Dakota are participating as observers.

105 See "Regulatory Framework for Air Emissions" and other related documents at *Turning the corner: a plan to reduce greenhouse gases and air pollution* http://www.ecoaction.gc.ca/turning-virage/index-eng.cfm

106 Among Kyoto ratifying Parties, Canada is patently not on track to meet its Kyoto target (-6% below 1990 levels). GHGs emissions have been steadily increasing since the 1990, reaching 747 $MtCO_2e$ in 2005 (24.7% above 1990 levels). Projections for the first commitment period under the Kyoto Protocol indicate emissions could rise to 830 $MtCO_2e$ in 2010, widening the "Kyoto gap" on average to 260 $MtCO_2e$ per year. Source: National GHG inventory for Canada (2007). UNFCCC website & "The Cost of Bill C-288 to Canadian Families and Business". Environment Canada April 2007.

107 Among those further details are targets by sectors and rules for emissions trading and new measures targeting oil sands production (requiring operations starting in 2012 to implement carbon capture and storage) and power sector (banning the construction of dirty coal plants by 2012).

initiatives aimed at supporting technology development and adoption (with many hopes relying on carbon capture and storage).

- Articulation with initiatives at the Province level[108] is also considered in the Federal Climate Change Plan (based on "equivalency")[109] and this is a key challenge, given the large diversity of approaches followed by Provinces.[110]

Table 9: Estimated Demand under Canada's Regulatory Framework

	2012 ($MtCO_2e$)	2015 ($MtCO_2e$)	2020 ($MtCO_2e$)
Ministry of Environment, Canada[111]	80	100	125[112]
ICF[113,114]	80	95	105
Own calculation[115]	60	71	116
AVERAGE	**67**	**89**	**85**

For industrial installations (power, petroleum industry, chemistry, cement and metallurgy), compliance may be achieved through one of the following routes:

- internal abatement measures;
- domestic emissions trading (based on an intensity-based target);
- use of domestic offsets;
- access to CERs, limited to 10% of each firm's total target. All CDM project credits are eligible with the exception of credits for sinks projects;
- contribution to a technology fund;[116];
- one-time credit for early action (max of 15 $MtCO_2e$ will be allocated; with no more than five $MtCO_2e$ to be used in any one year), to recognize actions taken between 1992 and 2006;
- potential linkages with regulatory-based emissions trading systems in the U.S.[117]

A range of estimates for covered sources are indicated (Table 9). There are many factors that will influence the compliance strategy of the installations from among the many options listed above, notably the proposed fee contributed to the carbon fund, which effectively acts as a ceiling on the

[108] So far only Prince Edward Island, Yukon and Nunavut have not set recent GHG reduction targets while the other Provinces have adopted more or less stringent commitments, ranging from a transposition of Canada's Kyoto obligations on their territory to deeper cuts on emissions by mid-century.

[109] Such "equivalency" between Federal Plan and Provinces' initiatives set GHG standards at least as stringent as the federal standards.

[110] To name but a few stumbling blocks: preferred policy instruments (cap-and-trade and carbon taxes), level of ambition, existence of cost-control mechanism and role of international offsets.

[111] Government of Canada, "Turning the Corner, Detailed Emissions and Economic Modeling," March 2008, http://www.ec.gc.ca/doc/virage-corner/2008-03/pdf/571_eng.pdf

[112] This is the only estimate provided in the text of the study, which also includes a bar chart with estimated reductions over 2010-2020. Estimates for 2012 and 2015 provided below are based on a rough approximation of numbers in the chart.

[113] ICF International, "Canadian Federal Climate Change Initiatives," Presentation at Bali, December 2007

[114] Estimates are based on a rough approximation of the numbers in the chart depicting regulated sectors' emissions and proposed target.

[115] Assuming industrial installations comply with the energy intensity target (with no reduction in output): starting in 2010, existing installations (in operation before 2004) must reduce their emissions intensity by 18% below 2006 level, followed by an additional 2% per year improvement. One also assumes no new installation is coming in operation.

[116] This fund would comprise two components: Deployment and Infrastructure, and Research and Development. Contribution rates to the two components of the fund will be at CAD15 (nominal) per tCO_2e for each of 2010, 2011 and 2012; CAD20 (nominal) per tCO_2e for 2013 and CAD20 (nominal) per tonne escalating with GDP for each of the years out to 2017 (no further contribution accepted after 2017).

[117] The Regulatory Framework makes specific reference to the Western Regional Climate Action Initiative (later renamed WCI and described in detail later in report) and the Regional Greenhouse Gas Initiative (established in December 2005 by the governors of Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont) in this regard.

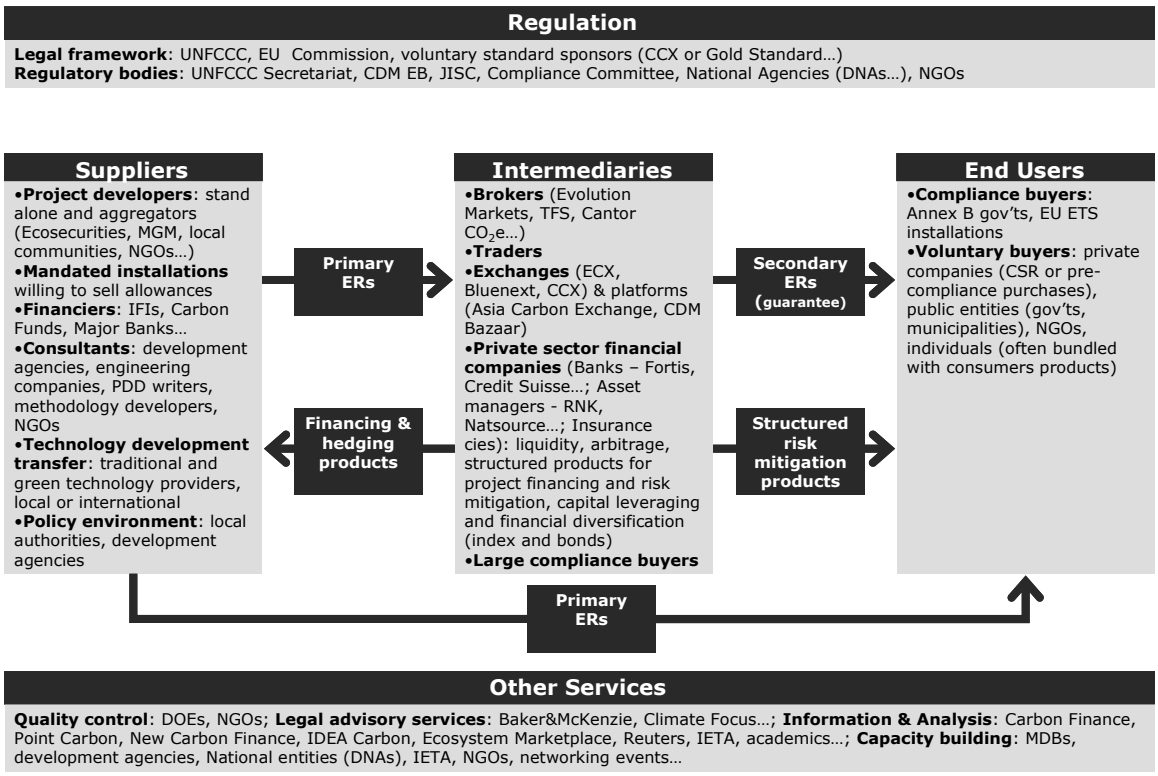
price of carbon. Although the fee gradually increases from CAD15 to CAD20 at the end of the decade, this may not be high enough to trigger a sufficiently high level of low-carbon investment decisions (with the exception of some internal abatement measures available at a low carbon price).

The choice of *relative targets* through an intensity baseline-and-credit mechanism makes linking more difficult with the proposed (and possible) cap-and-trade schemes in the US that largely consider *absolute targets* (see below). Canadian installations will either contemplate acquiring offsets or investing in the compliance fund, depending on the relative price of both options. Prices for CERs on the primary (and secondary) markets are currently higher than the Canadian price ceiling. The use of CDM for compliance is capped at 10% of each installation's shortfall, further restricting the demand. To conclude, it is thus quite unlikely a substantial demand for offsets will materialize in the next ten years or so in Canada. In this context, demand for CERs would likely represent a limited market, in the order of an annualized volume of 5-10 $MtCO_2e$ (average eight $MtCO_2e$) over 2010-20.

ANNEX III: MARKET STRUCTURE AND MARKET PLAYERS

EMISSIONS TRADING is poised to become one of the key tools to support the transition to a low-carbon economy. As countries take steps toward meeting their commitments under the Kyoto Protocol, the global carbon market has experienced extremely rapid growth over the past few years. Strong market growth continued in 2007 as the market more than doubled in value at US$64 billion (€47 billion), compared to US$31 billion in 2006 (€24 billion) and almost US$11 billion in 2005 (€9 billion).

Figure 9: Players and Institutions in the Carbon Market



Note: Names of companies are only provided here for sake of illustration. The inventory is not exhaustive and should not be understood as an endorsement or recommendation of their services.

This growth and accompanying diversification has been made possible by a burgeoning ecosystem of players and institutions (Figure 9), each a part of the carbon market's value chain, starting with the identification and creation of a carbon asset to delivery of the asset to the final user. Beyond Kyoto, important regulatory developments have occurred since late 2006 in North America with several initiatives to manage greenhouse gas (GHG) emissions at regional levels. In addition, a number of existing (or proposed) cap and trade schemes in Australia, Japan and Canada are contemplating post 2012 actions. So far these schemes have mostly operated in isolation from each other, except when an indirect linkage has existed (for example, through the CDM and JI markets). More effective linkages have been hampered by barely compatible design features. Several challenges still exist before there can be a true global carbon market, with a meaningful international carbon price signal to trigger the competition to supply emission reductions in countries and sectors cost-effectively.

Cap and trade schemes are appealing to many since they set a desired maximum ceiling for emissions (the cap), and allows the market to determines the price for keeping emissions within that cap. This provides regulated entities the flexibility to comply with its emissions targets through internal abatement, or, if it is more cost-effective, to acquire compliance units (for instance, EUAs) by trading

with others on the market who have found cheaper ways to reduce their emissions. Depending on the market price of carbon, the entity may find it attractive to reduce its own emissions and sell compliance units to others on the market. The Carbon market is based on the fact that:

- the location of abatement is irrelevant to the global goal of stabilizing atmospheric GHGs concentrations (since GHGs mix in the atmosphere);
- the wide diversity of mitigation potentials and costs, across countries and sectors, provides for lower cost abatement options and mutual gains from trade between entities sharing different commitments to reduce emissions.

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 assets that the buyer can use to meet its 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.[118] Carbon transactions can be grouped into two main categories:

- *Allowance-based transactions*, in which the buyer purchases emission allowances issued by regulators under cap-and-trade regimes, such as AAUs under the Kyoto Protocol, or EUAs under the EU ETS. Such schemes combine environmental performance (defined by the total amount of allowances issued by the regulator, setting a cap on the global level of emissions from mandated entities) and flexibility, through trading, in order for participants to meet compliance requirements at the lowest possible cost;

- *Project-based transactions*, in which the buyer purchases ERs from a project that can verifiably demonstrate GHG emission reductions compared with what would have happened otherwise (for instance investing in wind power or other renewable energy sources instead of coal-fired power generation or improving energy efficiency at a large industrial facility to reduce energy demand and hence, GHG emissions from power generation). The most prominent examples of such activities are under the CDM and the JI mechanisms of the Kyoto Protocol, generating CERs and ERUs respectively.

The Role of Project-based Credits in the Market: Fungibility and Supplementarity

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 target cost-effectively through access to mitigation potentials from additional sectors and additional countries.[119] Once project-based credits are issued and are finally delivered where and when desired for compliance, then they perform at that time essentially the same compliance function as allowances do. "Residual" difference between the value of those units may arise due to the regulatory framework or the compliance period under which they can be used for compliance purposes, and it impacts their relative prices. Some of the rules may indeed limit the substitutability of these units at a given point in time (for instance, supplementarity caps which establish upper limits on the imports of project-issued units,[120] or certain type of projects deemed not acceptable)[121] or over time (relative degree of carry-over allowed across compliance periods).[122]

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[118] 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.

[119] 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 potentials in the industry, in the waste management sector, in the mining sector, etc.

[120] As such, mandated installations under EU ETS cannot surrender for compliance more than 1,400 million CERs and ERUs (or 13.4% of the whole amount of allowances during Phase II). Though it also recommends that the use of Kyoto

Allowances and Project-based Emissions Reductions: Risk Profiles and Standardization

Unlike allowances, project-based ERs need to be generated (or issued) through a process that has certain risks inherent with it (regulation – is the project eligible under a given standard and will the ERs be approved under this standard?, project development and performance, for instance) and can often involve significant transaction costs (for example for validation and verification). In addition, since they are generated by projects located in different countries, implementing various technologies, involving diversely skilled sponsors, yet-to-be issued ERs show extremely different risk profiles to a potential buyer. 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. Together with other factors (confidentiality in an increasingly competitive market, fragmentation in over-the-counter transactions), this heterogeneity contributes to explain why attempts to achieve price discovery and transparency for project-based ERs have been only partially successful so far.

By contrast, allowances are extremely homogeneous commodities, a characteristic that lends itself well to the definition of standard financial products, thereby facilitating transactions and price discovery through exchanges. To bridge the gap between a heterogeneous primary market for projects-based ERs and a standardized allowances market, the financial sector has been instrumental in developing (from H2'06 onwards) a secondary market for ERs, bringing to buyers standardized assets, coming with guaranteed firm volume deliveries and achieving full price discovery (quotes for a number of maturities are available on a daily basis).

SEGMENTS OF THE CARBON MARKET

A Compliance-driven Market

The carbon market has so far been essentially a compliance-driven market, where buyers largely engage in carbon transactions because of carbon constraints (current or anticipated) at international, national or sub-national levels. The Kyoto Protocol is the largest potential market and EU ETS, a tributary scheme, has spawned a thriving market for allowances and for project-based ERs. The main buyers of compliance units in carbon market today are:

- European private buyers interested in EU ETS;
- Government buyers interested in Kyoto compliance;
- Japanese companies with voluntary commitments under the Keidanren Voluntary Action Plan (which though a voluntary initiative is fully integrated into the Government of Japan Kyoto Target Achievement Plan);
- A number of intermediaries, such as aggregators, trading houses, compliance funds and banks (the latter entered the carbon market massively in 2007);
- Asset managers (investors carbon funds, hedge funds), investing in a new commodity market, also relatively recent entrants to the carbon market;
- U.S. multinationals operating in Europe or Japan or preparing for the Regional Greenhouse Gas Initiative (RGGI) in the Northeastern U.S. States, or anticipating California Assembly Bill 32 which would establish a state-wide cap on emissions;
- Powers 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 under the Chicago Climate Exchange (CCX).

Mechanisms be supplemental to domestic action, the Kyoto Protocol does not quantify supplementarity (except for the acquisition of tCERs and lCERs, limited together at 1% of base year emissions of each Party, times five).

[121] For instance, mandated installations under EU ETS can not surrender for compliance CERs and ERUs from LULUCF projects.

[122] Under Kyoto rules, AAUs may be banked in unlimited amounts which is not the case of CERs and ERUs (2.5% of the assigned amount of each Party) or RMUs (no banking allowed).

Voluntary Market

A voluntary carbon market, with demand not motivated by compliance requirements, has steadily gained momentum since 2005. It encompasses all the transactions of ERs by entities that voluntarily decide to limit their carbon footprint. To the extent ERs offered in this marketplace are credibly additional, the voluntary carbon market may also contribute to the global mitigation effort. The voluntary market remains small in volume and value, especially in comparison to the broad Kyoto compliance market.

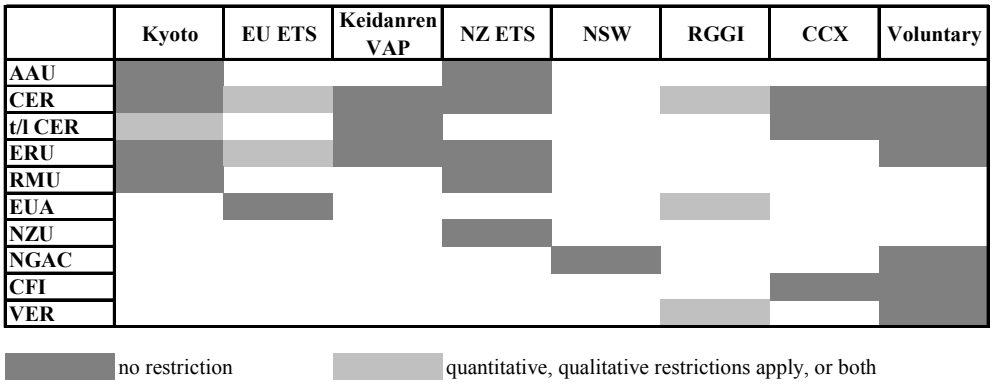
Corporate Social Responsibility and green buzz are indisputably drivers of demand for offsets in this category which are often "charismatic" in dimension, i.e. they arise typically from projects demonstrating community benefits or strong sustainability components. The regulatory vacuum in some countries and the anticipation of imminent legislation on GHG emissions is central to the growth in the activity of the voluntary market in recent months. This is particularly true in the U.S. and Australia where buyers are seeking to secure pre-compliance and early action offsets and constitute thereby a significant fraction of demand. The recent growth in the voluntary market has increased the interest of several private sector financial institutions, in parallel to their activity in the compliance carbon market.

A Fragmented Carbon Market: Proliferation of Currencies and Poor Linking

There are several carbon markets, encompassing both allowances and project-based assets, that co-exist with different degrees of interconnection, leading to a fragmented global carbon market (see Table 10). The emergence of multiple regimes to manage GHG emissions has so far resulted in a proliferation of carbon units or currencies with limited linking between markets. The main interconnection to date has been indirect in nature through competition on the project-based market, chiefly for CDM assets, a United Nations Framework Convention on Climate Change (UNFCCC) supervised standard considered to convey a high degree of credibility. They also are regarded by many participants as being high in transaction costs, arising out of their use of expert-vetted methodologies, third-party verification and monitoring, subject to second-guessing by the CDM Executive Board, and requiring a high degree of public disclosure and reporting.

European companies interested in EU ETS, Japanese companies with voluntary commitments under the Keidanren Voluntary Action Plan, Governments with a Kyoto commitment and more recently buyers on the voluntary market have been competing for CERs. However, a number of qualitative and quantitative restrictions apply and limit global demand for CDM. With regard to other regimes, the New Zealand ETS is the most progressive in its open market-oriented stance on linking and a number of compliance units, including allowances, from other regimes are eligible, as are JI and the CDM.

Table 10: A Patchwork of Currencies, with Limited Convertibility



The Challenge of Linking Carbon Markets and Broadening the Scope of Carbon Finance to Achieve the Required Mitigation Effort

Carbon markets so far have mostly been operating in isolation from each other, except where there is a linking through the CDM and JI markets. Provisions for linking exist for a number of cap and trade schemes but their diversity in design creates a significant challenge. A number of issues need to be considered and agreed upon before effective linking and some of the most important are listed below:

- ambition of target and existence of cost control mechanisms (safety valve, penalty for non-compliance);
- treatment of offsets: supplementarity limit, eligible offsets standards and asset classes and treatment of domestic offsets;
- treatment of installations (grandfathering or benchmarking, sale, auction or free allocation, treatment of new entrants and existing installations);
- differential treatment of sectors, with potential leakage and competitiveness issues;
- absolute vs. intensity target;
- emergence of a financial and regulatory governance in the carbon market.

Achieving better linking across carbon markets would better connect mitigation potential across sectors and regions with sources of demand. A more efficient and inclusive global carbon market could also encourage nations to take on tougher targets while allowing for more flexibility through trading.

Science-based Mitigation Targets

In its latest assessment report, the IPCC made clear that the evidence of warming of the climate system is unequivocal and that a delay in reducing GHG emissions significantly constrains opportunities to achieve lower GHG atmospheric concentration stabilization levels while increasing the risk of severe (and possibly irreversible) impacts. A range of stabilization levels under consideration can be achieved by the deployment of a portfolio of technologies that are currently available or soon expected to be available at commercial scale. Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low-GHG products, technologies and processes.

Mitigation Potential

IPCC also reports that by 2030, a global mitigation potential of 13.5 $GtCO_2e$ can be tapped at a cost of below US$20 per tCO_2e. Half of this potential is in developing countries, many of which are investing heavily in long-term infrastructure. At a carbon cost below US$50 per tCO_2e, the

mitigation potential expands to 19.5 $GtCO_2e$ – with slightly more than half of mitigation located in developing countries.

Buildings often represent the cheapest mitigation opportunities, with a significant portion of the potential coming at "negative" cost. At a cost below US$20 per tCO_2e, these opportunities represent 40% of all mitigation opportunities and between 25-30% at costs below US$50 per tCO_2e. Mitigation opportunities in the forestry and agriculture sectors account also for a meaningful share of abatement opportunities: 30% in developing countries, 20-25% globally. These sectors have barely been touched by the carbon market so far and it is encouraging to observe initiatives aimed at cultivating these new sources of supply, among others by developing new methodological approaches to address technical issues and decrease transaction costs.

FINANCIAL PRODUCTS AND EXCHANGES

Financial Innovation

The large potential of the market has attracted major financial actors into the carbon space and they, in turn, have introduced several financial instruments that have the potential to attract further capital and put it to work to clean up the global environment. The authors requested World Bank Senior Financial Specialist Alexandre Kossoy to provide an overview of proposed or existing financial instruments in the carbon world.

FINANCIAL INNOVATION IN THE CARBON WORLD

Financial institutions have entered the carbon world acquiring pioneering carbon aggregators and building a base for origination of carbon assets globally. An increasing number of carbon contracts and carbon-based derivatives are becoming available. Specialized companies and institutions have sprung up to service several aspects of the carbon value chain; some have begun to pair carbon finance with more traditional skills found in other commodity markets.

Several dedicated funds focusing on developing and participating in greenfield projects have been launched (i.e., these funds are either partially replenished with carbon revenue streams or account with the sale of the credits to meet investor expectations of return). Large international banks have established structured origination teams to pick up principal positions in carbon-rich projects and have set up carbon trading desks, seeking arbitrage opportunities. Financial institutions offer products that reduce or transfer risk, for instance by offering delivery guarantees for carbon assets in the secondary market. Some financial products being rolled out include:

Monetization of future carbon receivables: loans are provided by financial institutions against future carbon credit proceeds in forward purchase contracts. The purchase contracts are pledged for the loan's repayment under a commodity-backed, corporate or project financing models. The structure allows the future carbon revenue streams to be frontloaded and used in the project's investments monetizing. Full securitization structures have not been identified yet, as insurers/reinsurers report not been able so far to undertake the risk of many spending political and regulatory issues involved in the discussions of a new international regime;

Carbon delivery guarantees: A few financial institutions, including the World Bank Group's International Finance Corporation (IFC) have maximized the price of credits to project developers through back-to-back forward contracts. These institutions provide a credit enhancement and guarantee the delivery obligation of primary market projects to secondary market buyers, and the premium in pricing obtained by the investment grade sellers in the secondary markets is passed on to the projects net of guarantee fees. Similar structures have been provided by many financial institutions, although the arbitrage gains are usually retained by them;[123]

[123] By taking a considerable share of risks – mainly associated with the delivery guarantee for these assets in the secondary market – these financial institutions primarily absorb the rewards too. These activities often lead to a dynamic where some sophisticated local project developers in richest developing countries try to develop their projects unilaterally and sell their credits on a spot basis, or ensure their access to potential market upsides through carbon hedge derivatives.

Derivatives: These financial products were rare to find until last year due to the low liquidity and factored in a very high level of implied volatility. They have become more liquid since mid last year alongside with the increased liquidity in issued credits. Swaps between CERs and EUAs, as well as CERs and ERUs provide a hedging alternative for investors over-exposed to a specific carbon asset. Carbon spread options based on the differential price between CERs and EUAs (i.e., option's strike price represents the difference between these two asset prices) allow investors to access to pricing upsides, as call options will pay a higher premium if the differential between the two asset prices widen. In addition, call options on future carbon credits have supported selected project finance structures, as the upfront premium can be used by project developers to face project's investment expenses. Other derivatives based on a basket of carbon assets have been developed;

Insurance/guarantees: Guarantees and insurance can protect investors from factors such as advance payments, pricing fluctuation, delivery risks, and projects/credits eligibility under the regulatory schemes. Insurers (Multilateral Investment Guarantee Agency or MIGA for example) insure against investor loss in the event that specified political events in the host country results in a breach of contract related to the investment. The long involvement of insurance providers in the market, reduced uncertainties in a long-term market and better weather-related data and on the costs of mitigation and adaptation to climate change lead us to believe that new comprehensive tools are soon to come;

Carbon-linked bond transactions: Investment and retail banks started to issue notes with payouts based on the future prices of carbon credits (i.e., investors get higher returns on coupons with increase in carbon prices). These bonds are targeted to retail and institutional clients seeking climate friendly investments. Some vary, linking coupons to spot prices and are without delivery risk, while others are linked to delivery of carbon credits in specific projects. In addition, some institutions have targeted their bonds to large investors and use the capital raised to invest in new carbon credit-rich projects, which in turn may generate more credits;

Others: These include green credit cards, carbon neutral products, the sale of German EUAs, the upcoming auctioning of the UK EUAs, and the sale of the CERs of the adaptation fund and initiatives focusing the climate change agenda (such as the Climate Investment Fund) are expected to support financial engineering structures. The core functions in carbon trading are undergoing rapid standardization and evolve fast. While the carbon exchanges facilitate price discovery in the (still not transparent) primary market and offer hedging products, the development of platforms for auctions might reduce the gap between the primary and secondary markets.

The urgency and the scale of the climate agenda posts challenges and opportunities to financial institutions. The carbon market will benefit from the development of: (i) comprehensive insurance/guarantee products underwriting political risks inherent in international negotiations and collective international action, as well as contract frustration risks at the project level, (ii) financial engineering solutions to frontload future demand to allow transition until new international regime(s) are agreed (for instance, bonds backed up by future commitments and post-2012 carbon funds, such as funds announced by the European Investment Bank and the World Bank), and, (iii) project-level mechanisms to leverage the limited impact of carbon credits in low-carbon technologies.[124] *Source:* Alexandre Kossoy, World Bank.

A Year for Exchanges

Earlier in 2008, several announcements about alliances between exchanges or the launch of new exchanges were made. This launches a period of intense competition for a share of the broader global carbon market, which has so far been dominated by OTC transactions. The launch of BlueNext (formed on December 21st, 2007 by NYSE Euronext and Caisse des Dépôts) and of the Green Exchange (formed by New York Mercantile Exchange, NYMEX, and Evolution Markets along with other partners) which went live on March 16, 2008, were among the major announcements in the past few months. Other Annex B countries, such as Australia,[125] Japan[126] and New Zealand,[127] also saw

[124] Carbon revenue streams are a function of the: (i) volume of credits (for instance, ERs can be particularly low in renewable energy projects located in countries with clean energy grids), (ii) longevity of purchase (for example, purchase contracts have been largely constrained by the post-2012 uncertainties), and (iii) carbon prices, which are linked to the risks associated with the generation and delivery of the carbon credits (such as higher risks in new, expensive projects). Small volumes, low prices and short contracts result in a substantial reduction in the carbon impact for low-carbon technologies.

[125] The Australian Climate Exchange (ACX), the first electronic emissions trading platform in Australia, was launched in July of 2007. Trading is open to government accredited emission commodities: so far, certificates from the New South Wales Greenhouse Gas Abatement Scheme as well as certificates under the Greenhouse Friendly initiative. Following Australia's ratification of the Kyoto Protocol, the exchange is currently looking at listing Kyoto units (CDM and

the emergence of electronic trading platforms or new exchanges, in anticipation of imminent regulation or to accommodate nascent interest in carbon trading. Finally, the Montreal Climate Exchange (MCeX) announced it would start listing carbon contracts for the Canadian carbon market by the end of May 2008.

Exchanges have also strived to reach a wider base of members in particular, beyond the core base of energy sector participants, and have diversified their offering to attract financial sector players. They typically start proposing screens for carbon and other commodities[128] and then develop a wider suite of carbon products for their participants. For instance the European Climate Exchange (ECX) started to list options on EUAs by late 2006 and futures on CERs in March 2008, and is planning to launch options on CERs relatively soon. Dec-13 and Dec-14 EUAs also started being offered on ECX on April 8, 2008. It will also diversify to the spot market through the Climate Spot Exchange (CSX), a subsidiary of ECX's parent, Climate Exchange.

Nordpool was the first exchange to launch futures contracts on CERs of all exchanges, in June 2007. Beyond Spot contract on EUAs, Bluenext has plans to list spot CERs (ITL permitting) and later in the year, futures contracts on both assets. The European Energy Exchange (EEX) and Eurex joined forces by the end of 2007 and now offer futures and options on EUAs as well as futures on CERs. On the other side of the Atlantic, CCX started futures on CERs in August 2007 and options on CERs in November 2007. CCX had also launched futures on EUAs in September 2007. Finally, carbon products listed on the Green Exchange include futures and options on both EUAs and CERs.

Emerging Market exchanges

Two exchanges in India recently started to list carbon assets, the Multi Commodity Exchange (MCX) with futures on EUAs and the National Commodity & Derivatives Exchange (NCDEX) with futures on CERs. Other countries have also announced plans to do so, such as Korea, China and the United Arab Emirates. The Brazilian Mercantile Exchange (BMF) reported one auction for the sale of issued CERs last September.[129] The Asia Carbon Exchange – more an electronic platform than an exchange– has long organized auctions of forward or issued CERs or VERs. However the limited activity reported so far on ACX (less than four $MtCO_2e$) demonstrates all the challenges for exchanges to trade forward a non-standardized product like credits on the primary market. With more CERs and VERs being issued, such initiatives could receive more interest.

While one can reasonably expect strong competition among exchanges, with perhaps no more than one leader in each regional hub (Asia, Europe, America, Africa), it is much more difficult to predict the balance between OTC and exchange. There is still a need for a primary market to source credits, with its diversity of projects and risks not conducive to standardization. OTC may still offer more innovative and customized financial solutions, even on standard assets like EUAs.

ERUs). The Australian Securities Exchange (ASX) has also plans to develop a trading infrastructure for the upcoming Australia's ETS and possibly the NZ ETS.

126 Launched on November 1st, 2007, the Carbon Credit Trading Platform (CCTP) is intended to meet domestic demand for carbon credits in small amounts. The platform is set up jointly by Japan Bank for International Cooperation (JBIC) and the Japan Institute for Overseas Investment (JOI). Following the connection of the Japanese registry to the ITL, the CCTP saw the first ever spot transaction of CERs, of 10,000 credits from an HFC decomposition project in South Korea in late November 2007.

127 TZ1, not yet operational, plans to trade CERs and ERUs, credits allocated under the NZ ETS (NZUs) or other federal ETS or voluntary credits, such as VCUs.

128 The Green Exchange for instance is listing other environmental products like NOx and SO_2 contracts and links to the energy markets. As for Bluenext, the exchange announced its intention to list weather derivatives.

129 Those were about 800,000 issued CERs from the Bandeirantes Landfill Gas to Energy Project, in São Paulo. Fortis Bank was the successful bidder at €16.20 per CER.

ANNEX IV: 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 a gradually more competitive market. The authors have collected information from a review of the major relevant carbon-industry publications[130] and direct interviews covering a range of market players: private companies (in Europe and in Japan), fund managers and traders to gain a broader view on the state and tends of the market.

Natsource was also engaged to provide elements on the North American nascent Carbon Markets and Evolution Markets on transactions activity and characteristics over the year.[131] Our focus is on regulatory compliance; therefore our coverage of the voluntary segment of the market is not exhaustive. For the most part, the information provided here on the voluntary market is from preliminary results of two forthcoming reports that the authors agreed to share with us.[132]

Only signed emission reductions purchase agreements (ERPAs) are included in the project-based transaction database. Although the study received a high level of cooperation from 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 50% of the volume. Prices are expressed in nominal US$ per tCO_2e.[133] 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 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 primary transactions. Data for secondary transactions (guaranteed CERs) were obtained from exchanges and through interviews with brokers.[134] 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.[135] The authors have also obtained detailed information on transactions conducted under the

[130] 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), Carbon Positive (www.carbonpositive.net), the Climate_L list (www.iisd.ca), IDEAcarbon (www.ideacarbon.com), Ecosystem Marketplace (ecosystemmarketplace.com) or Reuters (www.reutersinteractive.com) and websites of market players (DNAs, DOEs, Project developers and aggregators, exchange platforms, governments, companies and purchasing vehicles, financial institutions and brokers).

[131] Per www.natsource.com and new.evomarkets.com: The opinions and results expressed in this paper are solely those of the authors, and do not necessarily represent the views of Natsource or Evolution Markets.

[132] Reports from Caisse des Dépôts and Ecosystem Marketplace jointly with New Carbon Finance.

[133] Exchange rates from oanda.com

[134] For year 2007, such exchanges were: Chicago Climate Exchange (CCX), London Energy Brokers Association (LEBA) and Nordpool.

[135] Transactions data of EUAS (Spot, Futures and Options) were obtained from the following exchanges and market places: Bluenext (formerly Powernext), Chicago Climate Exchange (CCX), Climex, Energy Exchange Austria (EXAA), European Climate Exchange (ECX), European Energy Exchange (EEX), Italian Power Exchange (IPEX), London Energy Brokers Association (LEBA) and Nordpool.

CCX, as well as aggregate information on transactions under the New South Wales Greenhouse Gas Abatement Scheme (NSW GGAS).[136]

[136] For NSW, data come from registry (volumes) as well as Ecosystem Marketplace (prices).

ANNEX V: 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.

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 of 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 tonnes 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 U.S. 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-compliant 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 (HFC-23), 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 emissions 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 European 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 European 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.