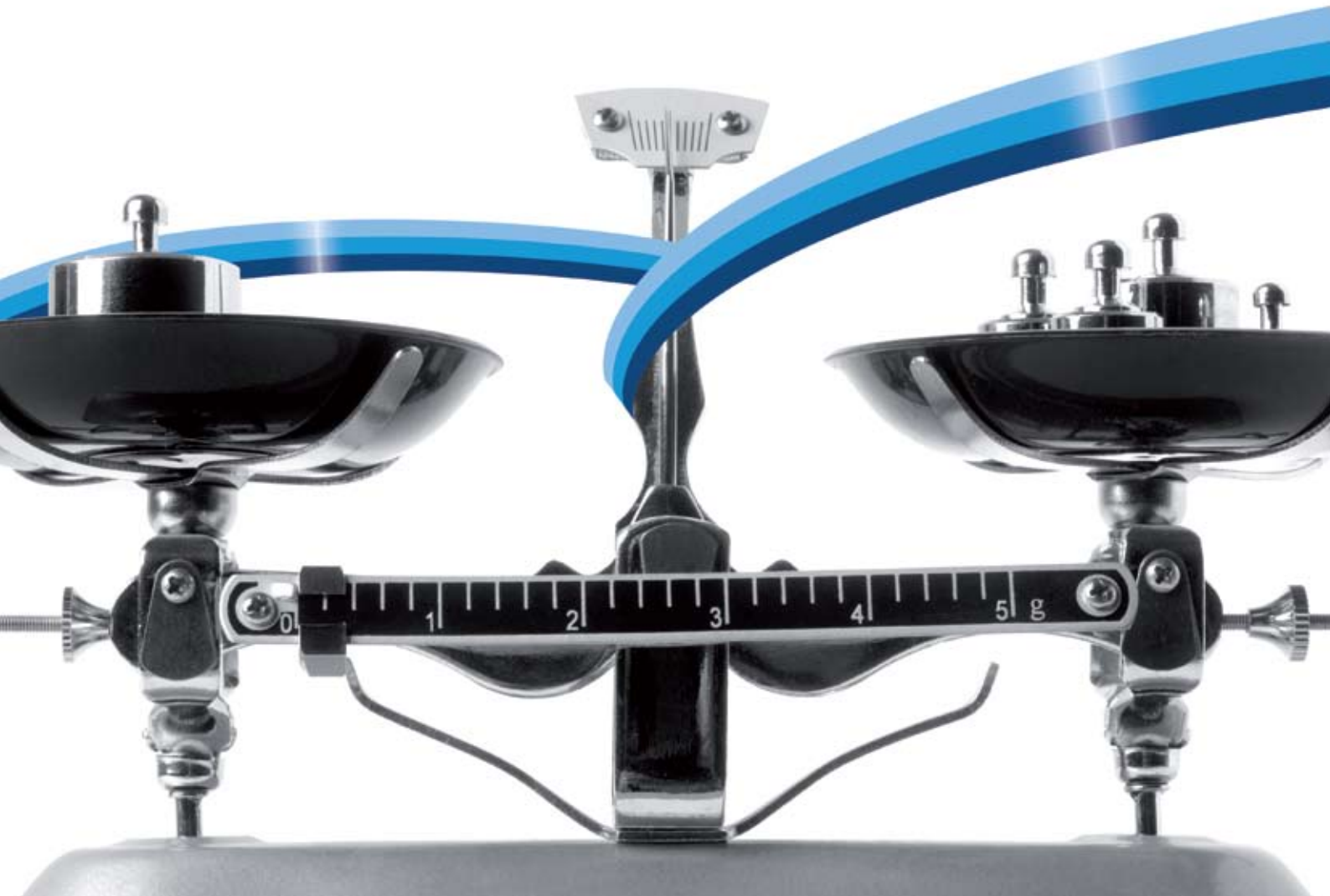
CARBON TRUST

Global Carbon Mechanisms

Emerging lessons and implications



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This report is dedicated to the memory of Bernhard Schlamadinger, Research Director of Climate Strategies, who tragically passed away in August 2008. Bernhard made huge contributions to the world's understanding of the links between land-use, forestry and climate change policy, and was widely regarded as the world's leading expert on their potential incorporation in the Global Carbon Mechanisms.

This Carbon Trust report draws in part upon research by Climate Strategies*, an international network organisation that develops and delivers rigorous, independent academic analysis to meet the needs of international climate change policymaking. The Carbon Trust is a founding supporter of Climate Strategies.

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Climate Strategies

* Three Climate Strategies studies examined the emerging lessons from the three main Kyoto mechanisms: P. Castro and A. Michaelowa, *Empirical analysis of the performance of CDM projects* (June 2008); A. Korppoo and O. Gassan-Zade, *Joint Implementation: looking back and forward* (October 2008); D. Urge-Vorsatz et al., *Green Investment Schemes: maximising their benefits for climate and society* (November 2008). The report also draws tangentially upon two other Climate Strategies studies: P. Baalman and B. Schlamadinger, *Scaling up AFOLU Mitigation activities in Non-Annex I countries* (June 2008); and Neuhoff et al., *International support for domestic climate policy* (December 2008).

Preface

To tackle climate change, a key challenge is creating incentives for companies – and indeed governments – to invest in activities that reduce greenhouse gas emissions internationally. This report provides an overview of the various different 'Global Carbon Mechanisms' that exist today, and surveys the evidence on how they have developed to date.

Over the next year or so, the shape of the next global deal on climate change will be negotiated. The successor to the current Kyoto Protocol commitments offers an opportunity to improve the Mechanisms that are used to motivate countries around the world and their companies to change what they do. The final sections of this report highlight the strengths and weaknesses of the existing Mechanisms, where changes are appropriate and where carbon markets are unlikely to work and therefore other policies are required.

This report focuses on global mechanisms; however, local carbon markets such as the European Union Emissions Trading Scheme (EU ETS) are increasing in number and importance – the Carbon Trust has analysed the EU ETS in a series of reports culminating in an analysis of the future of the scheme. More directed and interventional policies are also required, particularly to stimulate innovation, as identified for instance in a major Carbon Trust report on the offshore wind sector. We have also examined how the global transition to a low carbon economy could be accelerated by a network of 'innovation' centres, designed to stimulate low carbon technology innovation and diffusion, with an emphasis upon their possible contribution in developing countries.

Finally, the power of consumer and employee choice to influence corporate behaviour needs to be nurtured and supported, topics that the Carbon Trust has recently addressed through: standards for measuring and reporting carbon emitted by products, services and organisations; and work with companies to measure and communicate these carbon footprints in practice.

Through such different and complementary approaches, tackling climate change will result in opportunities for well-prepared companies to make significant profits and the unprepared to make significant losses – as described in our 'Climate Change: a business revolution' report last year.

The report in your hands represents our latest contribution to the international debate as we enter a crucial year for international policy – and its consequent implications for business.

Tom Delay
Chief Executive

Michael Grubb
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March 2009.

Key findings

The Global Carbon Mechanisms are and will continue to be a central pillar in the global response to climate change to 2020, but are not on their own sufficient.

The global carbon offset and trading Mechanisms established under the Kyoto Protocol have grown rapidly to support compliance with national commitments and to channel billions of euros towards lower carbon investments in developing countries.

Their success has overcome initial scepticism and persuaded most countries to support market-based flexible mechanisms: the existing Mechanisms can, should and will continue post 2012 as a key part of tackling climate change globally.

To cope with the rapidly growing volumes in the Clean Development Mechanism (CDM), to learn from experience gained, and to increase public confidence, reforms are required in implementation structures and operating rules, supported by a more sophisticated debate about ensuring environmental integrity:

- Too many roles are concentrated in the Executive Board: strategy and governance should be separated from executive project decisions, with a separate appeals procedure.
- This would free the Board to focus on increasing stability, transparency and administrative efficiency of the rules for assessing the additionality of project emission savings, and adapting rules to facilitate a broader interpretation of environmental integrity and wider scope of individual project types and programmes.

Despite shortfalls in project performance, the strong response to the mechanisms overall, combined with the progress in cutting emissions (particularly in some of the big EU emitting countries) and the impact of high energy prices in 2008, means that supply will exceed demand to 2012:

- Several factors including the ability to bank European Emissions Trading Scheme (EU ETS) and Kyoto allowances forward will soften the impact of this surplus, but the market may heavily discount for political risk and a major 'shakeout' will occur as prices fall below €10/tCO_2.
- Industrialised countries could choose to support prices by making early commitments on post-2012 cutbacks; by purchasing and retiring credits; by announcing decisions to bank allowances forward; and/or by setting a reserve price on EU ETS auctions (predominantly in the UK and Germany).

Sustaining project inflow at present rates could make a large contribution by 2020 to the abatement required in the sectors currently engaged. This reinforces the need for a strong global agreement and for far more attention to the future balance of supply and demand:

- Cutbacks over 2013-2020 will have to absorb 15-20,000 $MtCO_2$ of credits and allowances – equivalent to over one third of one year's global emissions. This is divided roughly three ways between the existing surplus from transition economies, ongoing credits from projects already active by 2012, and projects that would be implemented post-2012 if they continue at the present rate – plus any EU ETS allowances banked forward.
- The lack of any internationally accepted process to analyse the interaction of supply from the Mechanisms with the demand implied by future emission targets is the greatest single weakness in the current negotiating process.

Tackling climate change to 2020 will require new mechanisms for engaging developing countries that should learn from the experience with the wider diversity of mechanisms available to industrialised countries:

- The CDM is an effective vehicle for decarbonising investments in no more than three of the seven main sectors that need to be addressed.
- At least four international mechanisms operate across the industrialised countries and each has found a niche; Green Investment Schemes are particularly interesting for their potential to finance programmes upfront that harness multiple and longer term benefits, notably in building and land use sectors, though much remains to be proven given their slow start.

The Mechanisms can only deliver part of the overall effort required:

- Harnessing the economy-wide potential for low-cost mitigation requires extensive policy reforms, for example around building and vehicle efficiency standards, land use policies, and regulatory structures to overcome diverse barriers.
- The Mechanisms will not drive innovation at the pace or scale required to prepare the world for longer term, deeper emission reductions.

Thus the Global Carbon Mechanisms are and will continue to be a central pillar in the global response to 2020, but are not on their own sufficient.

Key recommendations

1 The Global Carbon Mechanisms should continue post-2012, but reforms are required particularly to professionalise the operation of the Clean Development Mechanism and to provide greater public confidence about its environmental integrity.

2 Because the additional emission savings delivered by individual projects cannot generally be measured directly – it is a judgement not a science – environmental integrity can and should be defined at a higher level. The unifying theme should be to work from project-by-project emissions additionality towards the wider goal of channelling *additional investment* into low carbon economic development, with debate also extended to consider whether and how 'additionality' should be appropriately applied to Green Investment Schemes.

3 With a looming surplus of supply over demand, governments cannot rely on markets to maintain carbon prices based on uncertain expectations about the scope or strength of post-2012 cutbacks:

- Industry should prepare for a year (at least) of mostly low but very volatile prices driven by fluctuating expectations about the prospects for a meaningful post-2012 deal.
- If governments wish to support prices the options to consider are: coordinate retirement of credits/allowances; commit to 'bank' part of current Kyoto targets; specify post-2012 cutbacks prior to a global deal; and/or set a reserve price in the major countries auctioning EU ETS allowances (predominantly Germany and the UK).

4 The Kyoto post-2012 negotiations process should develop a capacity to analyse the consequences of its decisions on post-2012 mechanisms and targets for the balance of supply and demand in an integrated manner.

5 The range of mechanisms available to developing countries should be expanded beyond the current CDM and World Bank/Global Environment Facility (GEF) financing mechanisms, and learn from the wider diversity of mechanisms available to industrialised countries (mainly as a result of accepting emission caps).

6 The following should be examined as options to evolve the geographic, sectoral and temporal effectiveness of the Mechanisms and thereby support low carbon economic development:

- *Incremental reform of CDM project additionality methodologies and eligibility rules* to streamline (e.g. programmatic CDM) and to review current exclusions.
- *Radical reform of project crediting rules* towards 'top-down' assessments based on benchmarked performance and/or levels of market penetration.
- *Evolution to sector and possibly policy-based crediting and trading mechanisms* for more advanced developing countries.
- *Establishing norms for Green Investment Schemes*, mostly likely through a forum of participating countries which could also ensure collective international learning.

Credit discounting could be applied to any or all such developments, to help maintain aggregate additionality and/or contribute to the global supply-demand balance.

7 Beyond the Global Carbon Mechanisms, the international negotiations also need to consider incentives for policy reforms and low carbon infrastructure, and more direct means to enhance technology innovation and commercialisation.

Executive summary

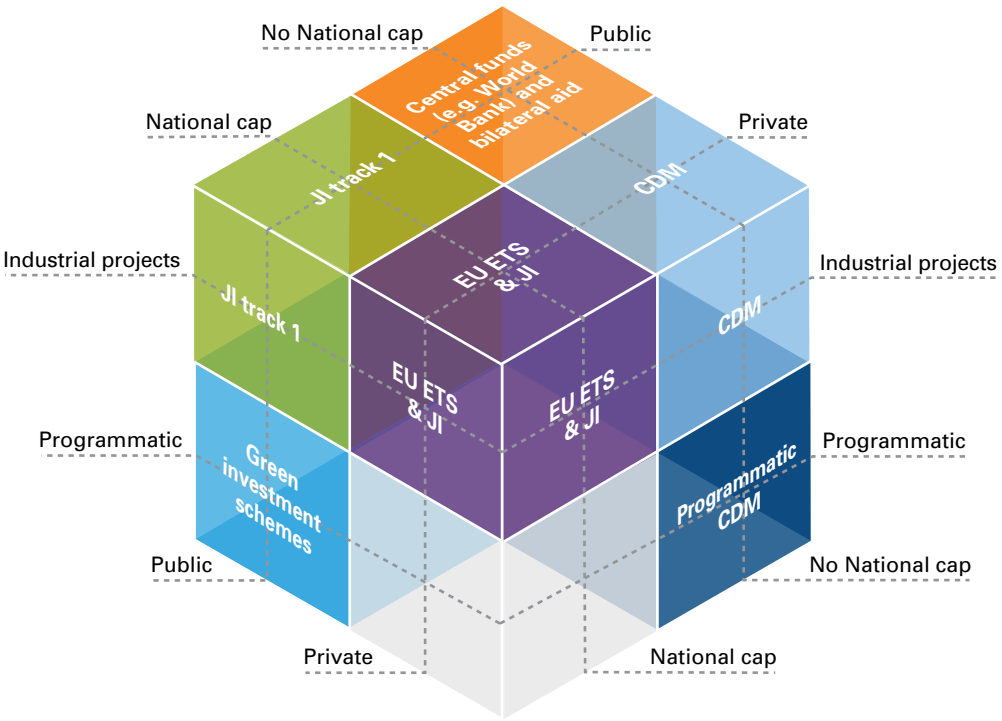
To stabilise the atmosphere, emissions must be reduced globally. In an unequal world, moving towards this requires richer countries (and companies) to fund emission reductions elsewhere. Mechanisms that create incentives for countries and companies to support emission reductions wherever they are cheapest also enable targets to be met as efficiently as possible.

The Kyoto Protocol established several global incentive mechanisms that rely on the international transfer of emission 'offset credits' or allowances:

- Projects in developing countries can generate 'certified emission reductions' for transfer through the Clean Development Mechanism (CDM).
- Projects in industrialised countries can generate 'emission reduction units' for transfer through Joint Implementation (JI). This takes two forms ('Track 1' or 'Track 2') depending on the host countries' depth of institutional compliance with the full set of Kyoto inventory and reporting provisions.
- Industrialised countries can also directly trade emission allowances, which has also generated two variants – direct industry trading such as the EU ETS, and intergovernmental Green Investment Schemes (GIS).

These complement funds operated by the World Bank, notably the Global Environment Facility (GEF) established in the early 1990s. Together these form a range of mechanisms that each have different focal areas regarding the intersection between: countries with and without emission caps; private and public sectors; and project versus programmatic-type activities (Chart 1). The desire for simplicity would suggest fewer mechanisms; practical experience suggests that even the present mix is insufficient for the real depth and complexities of the global challenge.

Chart 1 *The different Mechanisms*



Note: Joint Implementation (JI) has two variants: 'Track 2' refers to projects that are subject to direct international oversight (like the CDM); 'Track 1' involves bilateral procedures.

The response to date

The response to these Mechanisms has confounded expectations in both scale and nature:

- The most heavily regulated Mechanism – the CDM – has seen explosive growth, with around 3,000 $MtCO_2e$ of emission savings out to 2012 projected in the 'nameplate' estimates of design documents, assuming prompt implementation. A little over half of this is likely to be delivered by 2012 in practice, due to under-performance in approved projects, the potential for rejection or revision in those awaiting approval, and delays in project registration and start-up.
- Growth in Joint Implementation has focused mainly upon the component subject to direct multilateral supervision ('Track 2'). A phase of early growth in Central and Eastern Europe was eclipsed by the processes of EU Accession and EU ETS in the New Member States; about 300 $MtCO_2e$ (to 2012) is now proposed in 'nameplate' estimates from projects mostly in Russia and Ukraine. Procedures for the simplified 'Track 1' process, which formally relies on internal supervision within countries that have met the Protocol's full set of national inventory and reporting procedures, have been established more recently and in practice generally still involve third-party verification. Their greater flexibility in terms of scope and process has attracted about twenty 'Track 1' projects across Germany, Hungary and New Zealand; the volume remains small, but growing.
- The first direct intergovernmental emission trades under the Kyoto Protocol were only finalised in Autumn 2008, consisting of pilot sales of allowances to finance Green Investment Schemes that have been legislated in Hungary and Latvia to guarantee appropriate use of the revenues.

These experiences underline that for international exchanges of a publicly-created good – 'credited' emission reductions – political and environmental legitimacy of the product is crucial. No country has acted purely to 'minimise costs' through use of the international Mechanisms: governments have avoided least-cost purchases of surplus allowances, and mostly (except New Zealand) blocked private sector access to foreign surplus in domestic trading schemes. Regulated markets can grow only when relevant authorities on both sides of any transaction are convinced that it does indeed provide 'a good.'

A voluntary market for offset credits has also grown rapidly and traded 65 $MtCO_2e$ in 2007, but is undermined both by the lack of a regulatory driver and greater exposure to public doubts about the legitimacy of the product. To address these concerns and criticisms (and in some cases to help shape expected future regulation), the markets are seeking to establish credible voluntary standards, but voluntary buyers are also increasingly looking to the CDM for supplies of greater legitimacy and official oversight. However, the voluntary market remains the only route for activities – like most land-use projects – that remain either exempt or impractical under the regulated mechanisms, and this provides valuable experience.

There is no evidence that the existence of these Mechanisms has weakened the efforts of industrialised countries to control emissions. Domestic action, as constrained by domestic politics, has led; and some of the strongest efforts are emerging in countries that face the biggest gap and have made the biggest financial provisions for international purchases, like Spain. The Canadian government, the only other large Kyoto Party with a shortfall comparable to that of Spain, is eschewing both use of the Mechanisms and stronger domestic action, the consequences of which remain to be determined. In all other Kyoto Parties, the Mechanisms are facilitating compliance with commitments in appropriate ways, and channelling several €bn/yr toward emission reductions in developing countries in the process.

Strengths and weaknesses of the Mechanisms

The Mechanisms were introduced into the Kyoto Protocol by the US government in the face of considerable scepticism and fierce opposition from many developing countries. In the decade since, they have proved a remarkable political success.

The Mechanisms have attracted growing support globally. One of the few decisions so far taken in post-2012 negotiations is that the Mechanisms will continue. In such a divided world with almost two hundred sovereign governments, this is no small achievement.

Inevitably, growth and attention has led to many criticisms. Potentially the most fundamental was the risk that crediting emission savings from individual projects relative to a 'baseline' would create perverse policy incentives to worsen the baseline, or at least, reduce incentives to improve policy. This has been addressed through provisions that allow policy baselines to be 'backdated.'

A second criticism – particularly levelled at the early industrial projects – was that paying a uniform carbon price resulted in large profits for cheap projects. This is inevitable when any new, single-product market (like the CDM) succeeds in uncovering low cost options. Critics recommended instead a centralised funding approach, but this already exists in the form of the UN Global Environment Facility. The GEF's impact is constrained by its centralised public funding and the difficulty of applying this to private investments; these constraints, coupled with continuing political disputes and its failure to support some of the least-cost options subsequently identified under the CDM, suggest that a centralised fund approach is not credible as the primary means for driving the scale and nature of global decarbonisation efforts required.

Indeed, the most striking feature of criticisms of the Mechanisms has been the lack of credible alternative approaches proposed. The main debates now are not about replacing the Mechanisms, but improving them. Specifically, debates over the CDM have identified issues in rules, implementation, structures and scope.

Rules and implementation

A founding principle in the CDM is the need for environmental legitimacy. This has been widely equated with proving that each project generates additional emission savings as credited. However this is theoretically problematic, and experience confirms that assessing such 'additionality' unavoidably involves judgement that can be challenged. Moreover experience suggests that the task of 'proving additionality' is getting more difficult over time, not less.

In addition, the CDM has become a victim in part of its own success, with long procedural delays and growing criticism about the consistency of decision-making when the Executive Board has sought to learn from experience and thus deviate from precedents.

An honest political debate is required based on recognition that project-by-project additionality is an imperfect art with an unavoidable trade-off between administrative costs and the level of assurance. Several other options have been proposed, including credit discounting to account for the uncertainties in additionality associated with different types of projects and rules. Increasing economic returns to low carbon investment, particularly in emergent industries, itself has value and such wider benefits indicate that 'environmental legitimacy' could be recognised as a broader concept than just project-by-project additionality.

With an expanding scale of operation, the CDM cannot efficiently deliver its mission without greater professionalisation of staffing (rather than relying on government secondees) and its structures.

Structures and scope

The CDM's structures need reform to improve operations, clarify accountability and facilitate strategic development. The key need is to separate more clearly the governance and strategic tasks of the Executive Board from the implementation task of accredited agencies; a separate appeals procedure could further increase the legitimacy of decisions.

Such reforms, however, will not in themselves address other concerns that have focused on the realised scope of CDM activities:

- The main investments have focused upon certain regions and kinds of projects: the CDM has brought least benefit to the poorest regions (like Africa).
- The extent to which projects have brought 'sustainable development' benefits is varied and contested.
- In addition to officially excluded project categories (like nuclear), others like forestry and infrastructure projects are in practice also almost absent, and efforts to launch 'programmatic' activities in the CDM have yielded little to date.

These concerns all reflect fundamental features of a market mechanism that specifically credits greenhouse gas emission reductions: the market will seek out the most cost-effective options with the highest returns within the given set of rules. The biggest and most cost-effective opportunities will be in the biggest emitters with stable, attractive operating environments for investment; governments may seek to vet projects for their contribution to national development, but this will never be a driving force. The focus of investment will be upon projects that deliver maximum returns on the timescales for which credits can be generated, for minimum risk.

Some objectives cannot credibly be delivered by the CDM: rather than seeking to distort its fundamental principles, developing countries need rather to consider additional mechanisms.

The industrialised country Mechanisms

The experience in Central and Eastern Europe sheds important light on these issues. Initial Joint Implementation activities focused upon the most developed countries in this region and this provided a spur for other countries to improve procedures. However, the collapse of JI in the EU's New Member States illustrates the complexities of introducing mandatory standards and emissions trading on top of pre-existing crediting mechanisms; revisions in CDM rules should carefully consider the lessons.

Subsequent Joint Implementation projects, which could not start until 2008 and whose credits formally expire after 2012, have focused upon projects under direct international supervision ('Track 2') that generate very high returns, like plugging methane leaks from pipelines and mines, and on industrial gas and energy efficiency projects. The emerging interest in 'Track 1' projects suggests that full-scale national inventory and reporting procedures can build trust that facilitates greater flexibility around projects and procedures.

Early decisions are needed regarding future crediting to facilitate longer term investments under Joint Implementation. J1 'Track 1' should continue after 2012 and maintaining 'Track 2' could provide a valuable bridge for projects (including CDM projects) in countries that move to take on emission caps post-2012.

Green Investment Schemes are now also emerging as a means through which governments can attract finance to projects and programmes that generate multiple social and developmental benefits. Additionally, benefits may have much longer time horizons reflected through the ability to sell the present emission allowances that would otherwise be banked forward. Securing such benefits requires governments themselves to trade on the basis of criteria other than simple short-term minimisation of abatement costs. It remains too early to evaluate the practical experience – and there is a danger that the experience will be missed due to a collapse in demand.

Supply, demand and market outlook

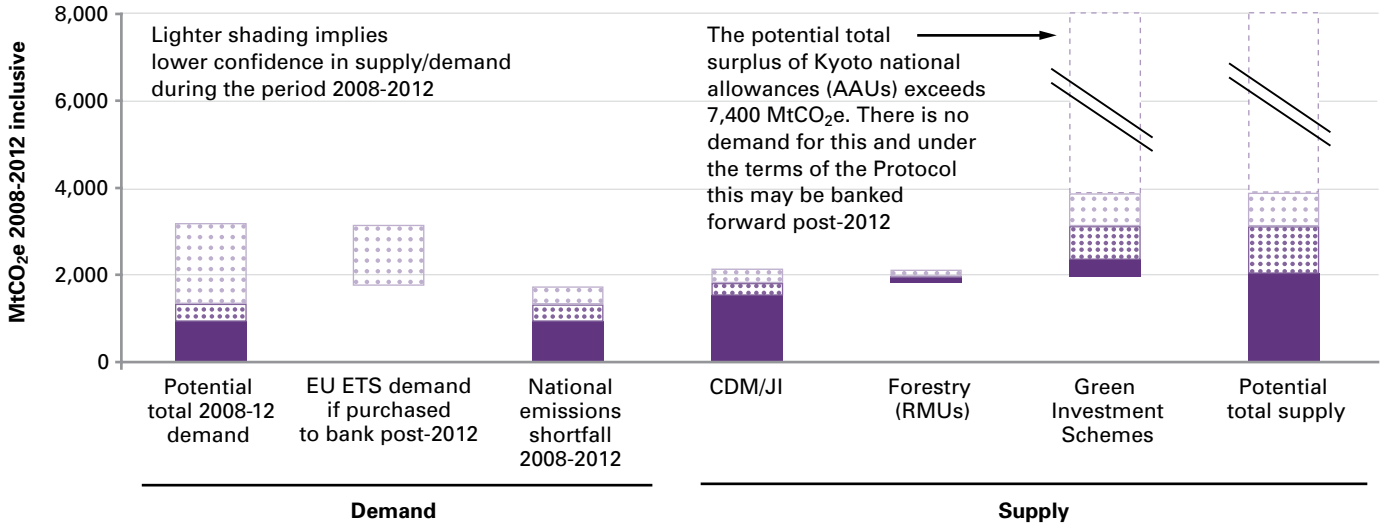
The prices of over €20/tCO_2e prevalent during 2008 are unsustainable. This mirrors the situation in Phase 1 of the EU ETS, but the outcome will be different.

During 2008, estimates of CDM supply declined as analysts looked more critically at project performance and delays in the system, and as the CDM Executive Board toughened its stance on approvals: likely delivery from the project mechanisms (CDM and JI) out to 2012 is about 1,800 $MtCO_2e$ ± 15%. Prices initially rose accordingly given expectations of reduced supply. However earlier projections that demand out to 2012 would exceed this are not credible (at least without Canada): after accounting for the impact of recent trends in emissions and fuel prices, demand from the remaining Kyoto Parties is unlikely to exceed about 1,500 $MtCO_2e$ (Chart 2), and could be much lower particularly if recession is prolonged. The prices of over €20/tCO_2e prevalent during 2008 are thus unsustainable, particularly after allowing for carbon sinks and GIS.

As with Phase 1 of the EU ETS, this reflects a combination of response exceeding expectations matched against insufficient overall cutbacks. The spectacular growth of the CDM has been joined by credible JI projects and GIS programmes. The Kyoto emission targets have proved less onerous than projected at least in some of the biggest European emitters; German success in renewables has greatly curtailed its emissions and UK progress on energy efficiency has contributed to an overall surplus; Spain is also now making rapid progress. The situation also of course reflects the impact of high fuel prices, and the absence of US and (at present) Canadian demand. Nevertheless, the resulting situation poses major dilemmas.

The price will not collapse to zero (as in the EU ETS Phase 1). Many factors will support prices despite the looming surplus, the single most important being that surplus EU ETS and governmental allowances can be banked forward post-2012. The ultimate value of this will depend entirely upon the strength of post-2012 commitments, and the extent to which these drive a demand that can absorb the likely supply.

Chart 2 *Supply and demand 2008-12*



Note: The data on demand do not include Canada, which is a Party to the Kyoto Protocol but not currently participating in the Mechanisms (see pp.46-47). Canadian participation would add c. 500-600 $MtCO_2e$/yr of demand and so do much to restore a balance between demand and the supply of project-based emission reductions.

During 2013-20, projects already established or expected from current inflow are likely to generate more than 5,000 $MtCO_2e$ credited savings. Continued expansion at present rates would add as much again. Assuming the banking provisions of the Kyoto Protocol, the likely surplus of Kyoto allowances from the EU's New Member States, other east European countries, and Russia may add another 7,500 $MtCO_2e$, to which would be added any surplus EU ETS allowances banked forward by industry. Over these eight years, the total supply is thus likely to be 15,000-20,000 $MtCO_2e$, divided roughly equally between credits from the CDM and the combination of credits and banked allowances from industrialised countries. This is more than 20% of total projected emissions from the EU and Japan over the period, which clearly could not on their own absorb such volumes. The Kyoto structure needs major cutbacks after 2012 across all the industrialised countries to ensure a carbon price sufficient to tackle climate change meaningfully.

During 2009, private markets are likely to apply a strong discount to the prospects for the deep and wide-ranging cutbacks that would be required to drive up carbon prices substantially post-2012. Also government demand is likely to broaden to include more significant purchases at lower cost from Green Investment Schemes, increasing downward price pressures.

If governments wish to shore up prices, different options would have different consequences. The present EU policy to protect its post-2012 package from excessive imports can help to sustain EU ETS prices and domestic action, but will further weaken demand and price in the global mechanisms. However, opening up the EU ETS unilaterally could not remotely absorb the future supply. Approaches that could support near-term term prices more broadly include:

- Retiring units (or buying units specifically for retirement) would support prices generally, but looks implausible particularly given the credit crunch.
- Government commitments to bank some of their Kyoto allowances post-2012 could increase demand in the present period, but would add further to the level of post-2012 supply.
- A reserve price set on forthcoming EU ETS auctions (dominated by the UK and Germany) could sustain both EU ETS and to some degree international credit prices.
- Commitments to steeper cutbacks post-2012, in advance of a global agreement, would send the strongest and most consistent signals but still only provide a partial solution.

In the absence of such measures, credit and allowance prices are likely to fall, and average below €10/tCO_2 during 2009, provoking a major shakeout in the global carbon markets. Prices may also be highly volatile as perceptions of the prospects for an effective post-2012 agreement fluctuate. The only positive side to this is that such a shock would focus attention on the need for post-2012 negotiations to embody an integrated balance of supply (from the Mechanisms) and demand (implied by negotiated cutbacks on a wider group of countries, and possibly sectors). The lack of any internationally acknowledged independent source for such analysis is the greatest single weakness facing the global negotiating process.

The future challenge

The Global Carbon Mechanisms are only effective in some sectors, and other instruments will be required to address the parts they cannot reach.

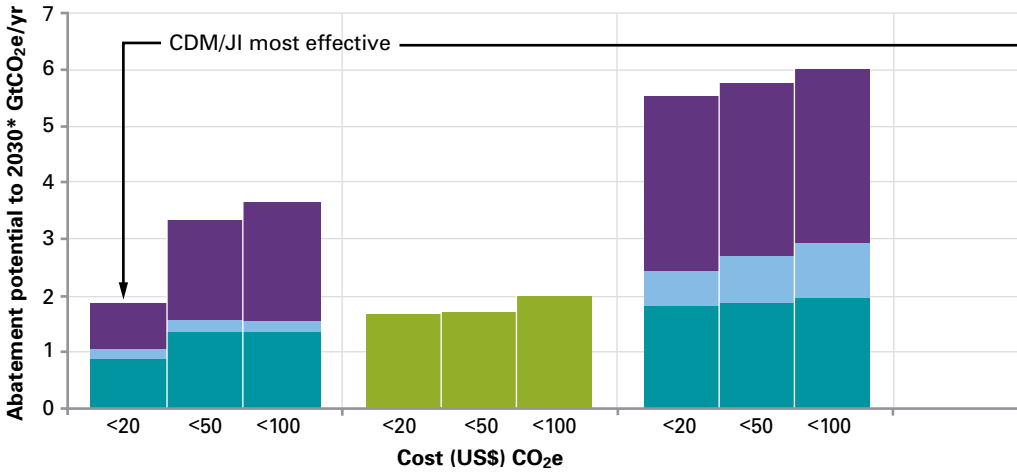
Pathways to stabilising the atmosphere at concentrations of 450-550ppmCO_2e imply cutbacks (relative to projections) by up to 10 GtCO_2e/yr by 2020 – at least half of this from within the OECD. The cutbacks will require, at a minimum, strong action across the industrialised countries; and approaching the tougher targets requires strong global action. If developing country action is financed predominantly through crediting mechanisms, much deeper targets will need to be adopted across industrialised countries. Lesser cutbacks to 2020 imply much higher costs and cutbacks later on to achieve a given stabilisation goal.

Financially, pathways to stabilisation at 450-550ppmCO_2e are estimated to require additional investments of 40-15% respectively in the energy sector alone, over and above the $26 trillion required out to 2030 to finance 'business as usual' growth. If spread evenly over the period, this implies incremental costs *globally* of around $200bn/yr for 550ppm$CO_2$e or over $500bn/yr for 450ppm.

If project inflow to the Mechanisms continues at the rate experienced since 2006, by 2020 they would be crediting about 2 GtCO_2e savings annually, and financial transfers from the project Mechanisms could approach levels for 550ppm pathways by about 2020 for the sectors they address. However, this would be insufficient to prevent huge lock-in to carbon-intensive investments in the interim, and will not prepare the world for lower levels and the more radical global transformations required in 2020-30.

Experience has demonstrated that the CDM is appropriate to incentivise investment in commercially-available low carbon technologies, mainly in energy supply (including power generation) and industry, and potentially waste sectors. These are sectors in which major investment decisions are driven by informed analysis of financial costs and benefits. CDM growth at current rates could reasonably capture most of the lower cost potential in these sectors by 2020. However, these technologies and sectors form only a minority of the total global saving potentials identified to 2030 (Chart 3).

Chart 3 *Long-term (2030) abatement potential by sector, with sector characteristics and focus of current CDM and JI*



	Energy supply	Transport	Buildings
Common project scale	Years construction, lasting decades; €m or €bn	Vehicle purchase: few years; €1,000s. Infrastructure: decades, €bns	Retrofit: household scale, few years, €100s. Construction: years lasting decades
Dominant investment driver/barriers	Costs, risks and returns at commercial or World Bank interest rates	Behavioural choice: fuel cost savings minor influence. Infrastructure: usually strategic state-funded decisions taking decades	Planning, tenant-landlord splits, high consumer discount rates. Dispersed, small scale companies for building insulation/services
Relevance of CDM/JI	Highly relevant for mature technologies close to cost-effective	Very limited	Almost irrelevant – a handful of projects – except through indirect effect of power sector decarbonisation

* Building & industry abatement includes their share of emissions reductions from using less electricity. See also Chart 22 for other estimates and comparisons.

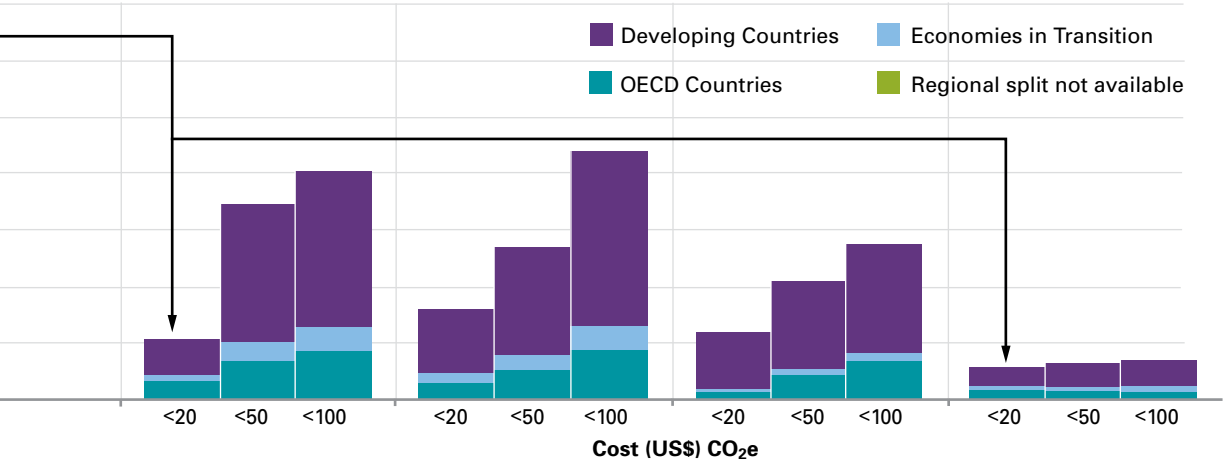
Adapted from: IPCC (2007) Working Group III Report *Mitigation of Climate Change.*

The CDM is intrinsically far less appropriate for capturing the potential in building efficiency, transport, agriculture and forestry and additional support is required to drive innovation.

- Project-based crediting mechanisms cannot overcome the main barriers that account for the large 'negative cost' potential, predominantly around buildings and transport energy efficiency.
- Perceived risks and high transaction costs in the face of measurement uncertainties and dispersed sources, combined with a conservative approach to crediting, deter projects in agriculture and land use.
- The limited time periods of crediting and uncertainties around future prices preclude options that deliver long-term or more uncertain benefits (like infrastructure and forestry projects).
- Innovation support is required to bring new technologies to market. Renewables and CCS are examples where support over and above the CDM is required short term – the CDM should, however, stimulate investment in these technologies once they have been adequately developed and could be crucial in their commercialisation and international diffusion.

Experience with the four Mechanisms in industrialised (Annex I) countries has shown the value of a diversity of instruments: though they share a common basic economic incentive, each has found a niche and started to deliver opportunities that others could not. Annex I countries do not have too many instruments; rather, there are not enough that engage developing countries across the full spectrum of potentials. The Annex I experience should inform the development of new instruments post-2012 to assist lower carbon developments in the developing world.

However, mechanisms that hinge on crediting or carbon pricing can only address the central part of the global 'supply curve' potential. Tapping the 'negative cost' potential mainly from energy efficiency hinges upon domestic regulatory policies. Other instruments will be required to foster large scale innovation and structural changes. These fall outside the scope of the Global Carbon Mechanisms and remain the biggest missing components in the global armoury. Ideas and support to fill these gaps could be one of the biggest contributions of the new United States Administration as it starts to engage with the international system after its long absence.



Industry	Agriculture	Forestry	Waste
Varied but often €m investments lasting decades	Distributed farm-level actions; plans as short as annual	Cumulation over years/ decades	Varied but often €m investments
Costs, risks and returns at commercial interest rates. Subject to focus on core business	Varies between agrobusiness and small farmers. Multiple considerations including nature of national agricultural support schemes	Long-term returns subject to multiple land risks in developing countries	Complex chains: emission/ cost savings modest influence
Highly relevant	Poor track record where attempted	Only one project registered	Relevant mainly to landfill gas capture.

Part I: From theory to practice

The first part of this report explains the intellectual and political origins of the Global Carbon Mechanisms, describes how the main mechanisms established by the Kyoto Protocol work, and outlines the response over the past decade. The final section explores the roles of the different mechanisms and presents a way of thinking about how they relate to each other.

1. Origins and development

Mechanisms that give companies – and countries – incentives to reduce emissions internationally can increase the scope and efficiency of the effort to tackle climate change and can provide finance to engage poorer countries. After a long, slow effort to turn these ideas into practice, the response has been spectacular.

Origins

The idea of introducing some flexibility into pollution control, to increase its scope and reduce the costs, is not new. Pollution can come from many sources. If some of these sources are directly capped by regulation, others may still be tackled if companies subject to a cap can receive credits for reducing these other emissions. In theory, that enables the regulated companies to reduce emissions however and wherever it is cheapest to do so – thereby also enabling stronger and deeper emission reduction targets to be set.

Such mechanisms were used extensively in pollution control programmes in the United States from the 1980s. The diffuse and global nature of greenhouse gas emissions made climate change a natural candidate to consider the use of such mechanisms. In the United Nations Framework Convention on Climate Change (UNFCCC) (1992), a number of countries insisted on a phrase enabling 'flexibility' in the application of commitments, and a programme of 'Activities Implemented Jointly' (AIJ) was sanctioned, to encourage industrialised countries to invest in emission reduction projects in others – itself a sensitive topic at the time.

However, the quantified commitments in the UNFCCC were vague and non-binding, and the AIJ programme was based on a general exhortation to cooperate, without crediting. Whilst there was useful learning and engagement, with over 150 projects developed, the results overall were very modest, for obvious reasons: one critic commented that it was like constructing a cage in the forest and then wondering why the tigers wouldn't go inside, when there was no meat.

The three basic mechanisms

The Kyoto Protocol, adopted in December 1997, provided the 'meat' in the form of legally binding emission caps on industrialised countries, and adopted three forms of flexible mechanisms:

- The Clean Development Mechanism (CDM) allows industrialised countries to meet part of their caps using credits from emission-reduction projects in developing countries, subject to international oversight to ensure that the projects represent real and 'additional' emission savings.
- Joint Implementation (JI) enables similar project-based exchanges between industrialised countries that have caps under the Protocol, providing these are matched with a corresponding transfer of the negotiated overall emission caps.
- Emissions trading allows direct exchange of emission caps between industrialised countries.

The CDM was the most complex, novel and controversial of these, with two main concerns addressed in the Protocol. One was the need to establish that such projects would result in real and 'additional' emission savings, compared to what would have happened otherwise – if not, the net effect would be a weakening of the overall environmental integrity of the commitments. Yet establishing a likely 'baseline' projection and estimating 'additional' emission savings relative to this is inherently complex. The Marrakech Accords (2000) that defined the 'rulebook' for implementing the Kyoto Protocol established a 10 person Executive Board, which is charged with formally registering projects and giving final approval to the issuance of 'certified emission reduction' credits (CERs) from them on the basis of subsequent monitored performance.

The other main concern was whether such a mechanism might enable rich, northern countries – and in particular companies – to impose projects that were in fact contrary to the development interests of host countries. However, the idea that the international community should try to define such criteria was anathema, and the CDM instead requires that host countries confirm that CDM projects 'contribute to their sustainable development'. Nevertheless, the international rules do prohibit credits for some kinds of activities, notably from nuclear power and avoided deforestation.

Joint Implementation was widely regarded as less potentially problematic: because emission credits would be accompanied by a corresponding transfer of emission caps, JI projects could not inflate the overall cap adopted by industrialised countries. For the same reason, however, crediting could not start until the first commitment period of the Kyoto Protocol began in 2008. In practice, the Marrakech Accords established two variants of JI, one being modelled broadly on CDM procedures to enable countries to start developing projects before they had met the full panoply of Kyoto inventory and reporting requirements, as explained later.

The provisions for direct emissions trading took concrete form with the development of the European Emissions Trading Scheme (EU ETS), which was launched in 2005. The EU ETS caps emissions from industrial facilities in the EU and forms the core instrument for the EU to meet its obligations under the Kyoto Protocol.

Its second phase, which is synchronised to the Kyoto Protocol's first commitment period (2008-12), utilises the Kyoto trading provisions to ensure that transfers of emission allowances between EU countries are matched by equivalent transfers of their national obligations under the Kyoto Protocol. The rules also enable companies to comply with their obligations by using emission credits generated under the Kyoto project mechanisms (with some exceptions, like land-use projects), up to a certain limit. Our earlier studies have examined the EU ETS in considerable depth, and it is only addressed here as it relates to the global mechanisms.

Whilst the intergovernmental community was slowly establishing the institutional architecture to enable formal crediting of emission savings under the Kyoto Protocol, the desire for emission offsets was gathering pace in the private sector. This was for a mix of reasons, including a desire to hedge against possible future regulation, but more generally, a desire to be 'green' – or at least, to be seen to be green. The voluntary market continues to grow (section 12), but credits trade at a much lower price and volume than the regulated market, on which most of this report focuses.

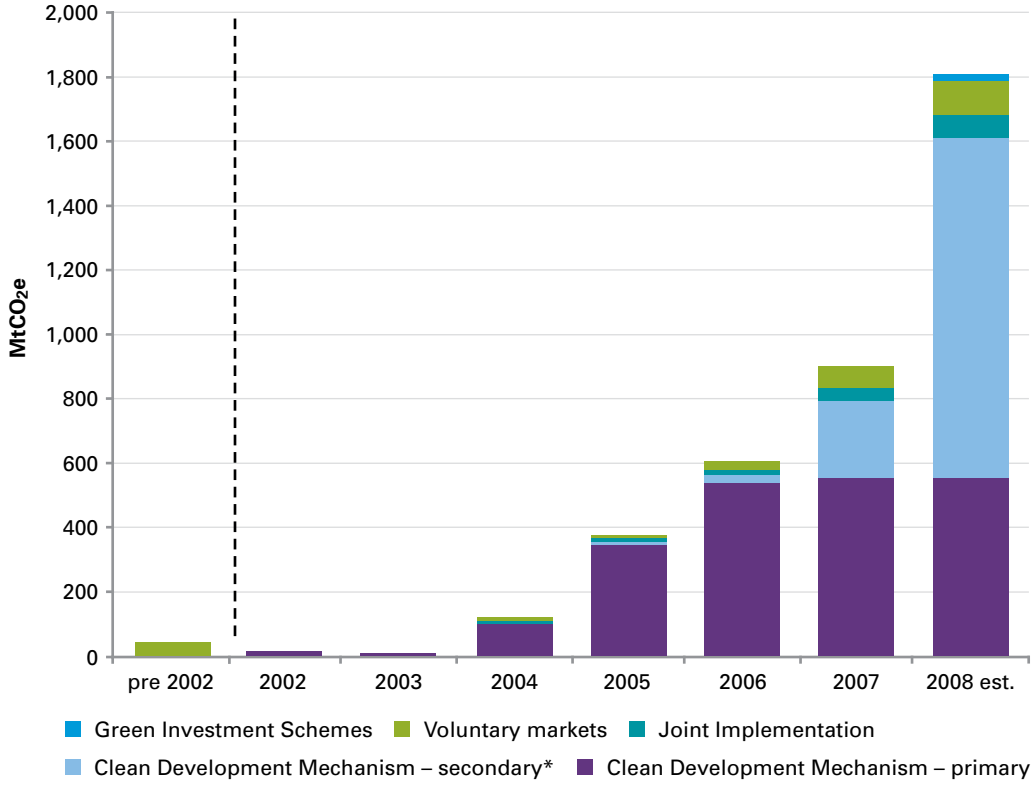
The response

The legal basis established under the Kyoto Protocol and Marrakech Accords took several more years to spring into life, as the institutions were established, and then awaited the entry-into-force of the Kyoto Protocol, which finally occurred in February 2005. However, starting around then – and aided by the establishment of the European Emissions Trading Scheme – a massive surge in projects began (see Chart 4), particularly under the CDM. Over 4,000 projects have been submitted, dominated by the CDM, in which projects already approved at the time of writing (by 1st November 2008) are projected to save around 1,400 million tonnes of greenhouse gas emissions cumulatively by 2012 (when the current provisions expire). As Chart 4 shows, the generation and trading of the emissions reductions both achieved and expected has been very active.

Development of JI projects has been much slower, as explained in this report. In addition, the 'voluntary offset' market has grown rapidly, mostly through projects in emission-reducing (or absorbing) activities that fall outside the scope of the official international regulatory framework.

As can be seen from Chart 5, CDM projects dominate both the volume of the trading activities, and their economic value to an even greater extent, because voluntary offsets are much cheaper per unit of emission credits[1].

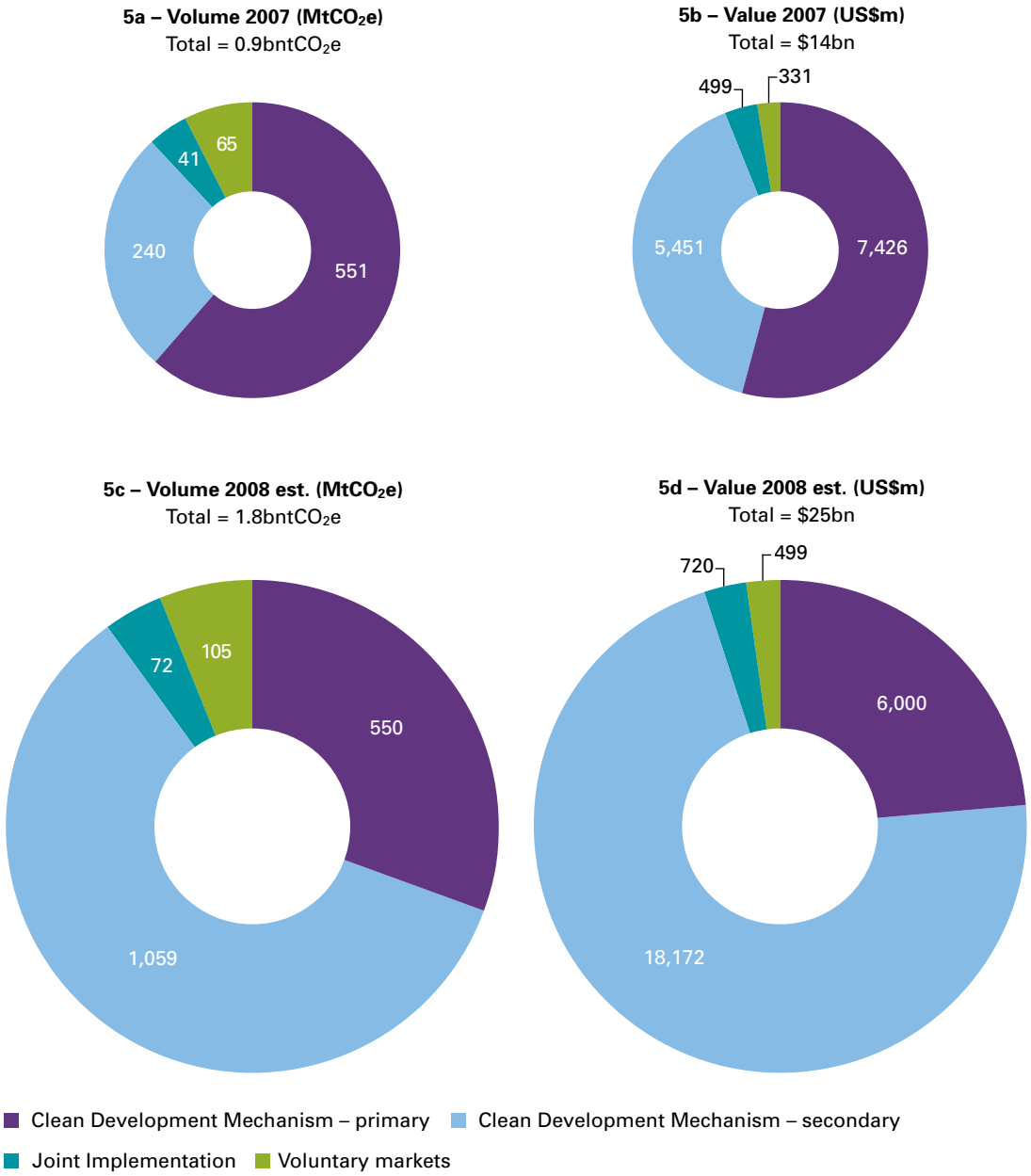
Chart 4 *Volume of credits traded each year from the different Mechanisms 2002-2008*



Sources: World Bank, Ecosystem Marketplace, New Carbon Finance, Point Carbon
* Secondary trading will include resale of credits

[1] For comparison, the value of emissions trading itself under the EU ETS during 2007 was €34bn – almost entirely based upon forward trading of allowances for emitting during Phase II of the scheme, 2008-12.

Chart 5 *Volume and value of transactions in the Mechanisms during 2007 and 2008*



Sources: World Bank, Ecosystem Marketplace, New Carbon Finance, Point Carbon

Most recently there has also been development of 'Green Investment Schemes' that operate under the third possible form of flexible mechanism. These Schemes link the revenues from intergovernmental emissions trading to specific emission reduction investment programmes, with the first transactions completed in autumn 2008, as explained in section 4 of this report.

The explosive growth of these 'offset' activities has inevitably led to heated debate around a number of issues. How good (or bad) are these mechanisms? Do these projects really result in emission savings in the host countries, and what other consequences are there? To what extent is there a risk that the volume of emission credits through these mechanisms may undermine actions in the rich world to get their own emissions under control? And, most broadly, what are the lessons from the emerging experience with these mechanisms, and what does this imply for the future?

This report sets out to explain the developments and to answer these questions.

2. The growth of the CDM

After its slow build-up, explosive growth revealed a huge appetite for emission-reduction projects under the CDM. The emerging experience across different project types reveals important lessons.

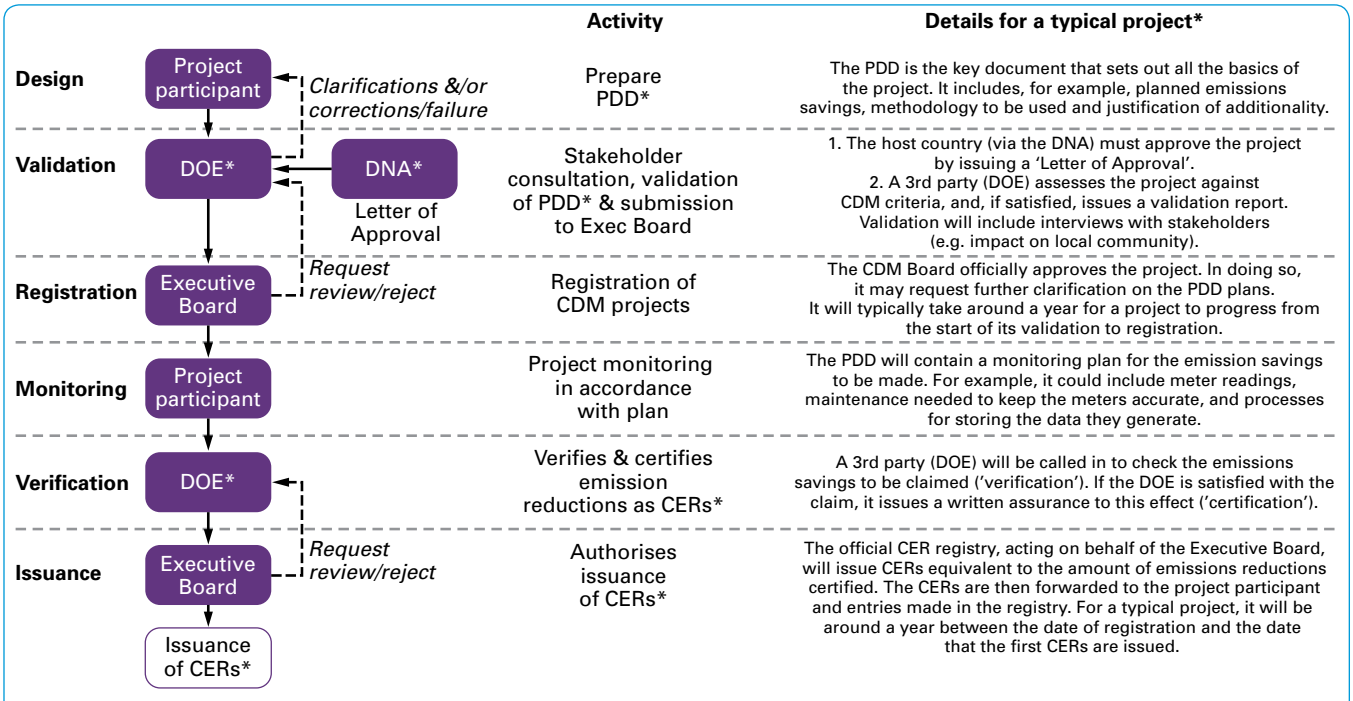
For the first half of this decade, the flow of projects under the regulated carbon market mechanisms amounted to a slow trickle: by 1st January 2005 projects submitted to the CDM amounted to less than 100 $MtCO_2e$ of total projected savings by 2012, and other mechanisms had not started (see Chart 4 earlier and Chart 6 opposite). Technical work gradually clarified the 'CDM project cycle' through which projects can be submitted for validation and registration under the Kyoto Protocol, enabling them to be issued with CERs according to their subsequent monitored performance (Box 1 below).

Methodologies for calculating emission savings were approved, and institutions established and certified. Thus the system was slowly primed, but still waiting for larger political developments to give impetus to the proposed global carbon market.

The long wait was eventually rewarded in a spectacular fashion. In addition to the culmination of technical work, two big developments revolutionised the situation. January 2005 saw the start of the EU ETS, the first instrument to set a significant price on carbon emissions – a price that rose steadily in the first few months to levels much higher than had been anticipated. By allowing companies the option to comply with caps under the scheme by buying offset credits, this transmitted through to a perception of real and measurable value associated with such projects.

And a month after the EU ETS started, in February 2005, the Kyoto Protocol finally entered into force. This made emission caps on participating industrialised countries legally binding under international law and set the intergovernmental machinery for managing the CDM on a firm legal footing.

***Box 1** The CDM project cycle*



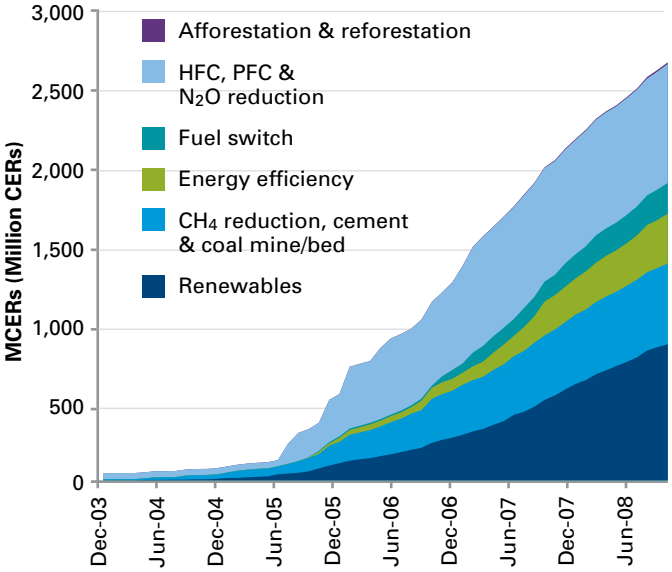
*Note:
- PDD = Project Design Document
- DOE = Designated Operational Entity
- DNA = Designated National Authority
- CERs = Certified Emission Reductions

For a full explanation of these abbreviations and other terms please see the Glossary.

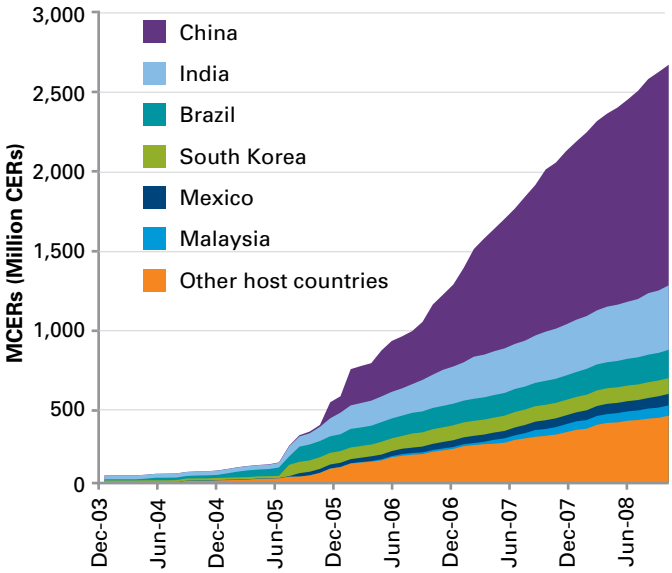
Sources: adapted from Norton Rose *CDM – an introduction* (May 2008)

Chart 6 *Accumulation of total expected CERs by 2012*

(a) by project type



(b) by host country



Source: UNEP Risoe database November 2008

Note: The charts indicates the total CERs that could be generated by the end of 2012 from all of the projects currently in the CDM pipeline, across all stages from beginning of validation to those already registered and issuing. CERs are counted at the date that the project began its public comment period in validation. The values used are the 'nameplate' unadjusted values taken from Project Design Documents – i.e. before making any adjustments to estimate delivery in practice.

What had seemed nebulous and uncertain to many in the business world was suddenly on a convincing, legal footing with strong incentives derived from the EU ETS.

As has often proved the case with market-based mechanisms, the response was quite unexpected in its scale and nature. In particular, companies and countries came forward with a flood of projects that reduce emissions of industrial greenhouse gases, notably hydrofluorocarbon-23 (HFC-23) and nitrous oxide (N_2O) that have a high climate change impact but can be reduced at low cost. Given the incentive of the CDM, such projects proved highly profitable, and there was no doubt about the emission savings from these projects. A veritable 'gold rush' ensued. Some specific concerns were subsequently raised about these projects, and rules were later modified to exclude new greenfield HFC-23 projects, as discussed in section 11. During 2006, a wider diversity of projects came forward, and the industrial HFC and N_2O projects tailed off in 2007 whilst others continued to expand apace (Chart 6a).

By the end of 2008, over 4,000 CDM projects had been submitted for validation and of those over 1,000 were already registered at the CDM Executive Board and therefore entitled to generate CERs. The registered projects alone could save around 1.4 billion tonnes CO_2e cumulative to 2012, the end of the Kyoto Protocol's first compliance period; in total, including all submissions for validation, projects could save twice this, based on the performance estimated in the official registration documents.

Later parts of this report examine the emerging evidence on the actual performance of projects to date, and implications for likely issued CER volumes.

As noted above, HFC-23 and N_2O projects made up a large portion of the initial rush, with around 750 $MtCO_2e$ of potential savings by 2012, from only about 80 projects. Energy-related projects had a minority share, with a very small contribution from energy efficiency projects. However, the balance has shifted as most HFC and N_2O projects are already identified and taken, the role of other types of projects has sharply increased. The distribution between project types, and their performance and the reasons, is analysed more closely in Section 6 of this report.

The way in which projects have been distributed between host countries has also developed (Chart 6b). The initial rush of industrial gas removal projects included large contributions from South Korea and Brazil, which were rapidly joined by projects in India and other countries. From late in 2005 these were followed by rapid expansion in China, which had been initially cautious, but which within two years had come to account for half of all the projected emission savings. The geographic distribution – and notably, the absence of Africa – has been a source of concern (section 11).

Since the response to the CDM has dominated the Global Carbon Mechanisms to date, it forms the main focus of our analysis of project performance and supply (Part II), and its environmental effectiveness and efficiency is examined in Part III of this report.

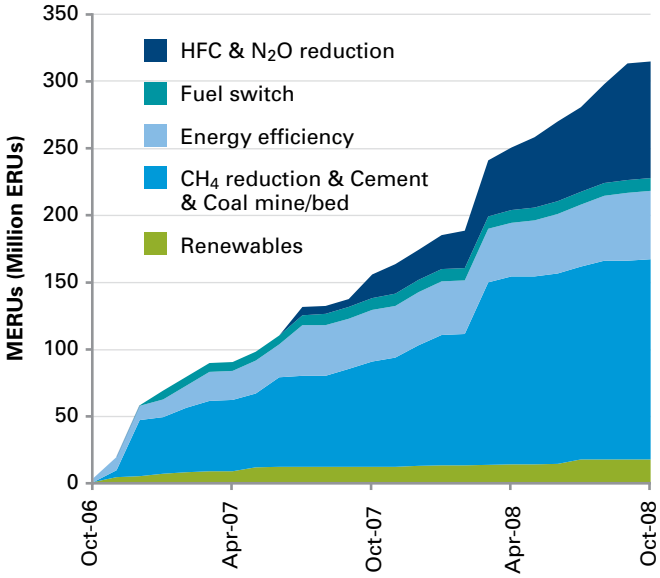
3. The growth of Joint Implementation

Joint Implementation – projects between industrialised countries that generate 'emission reduction units' (ERUs) – had a later start than the CDM, and its more recent growth reveals different kinds of lessons.

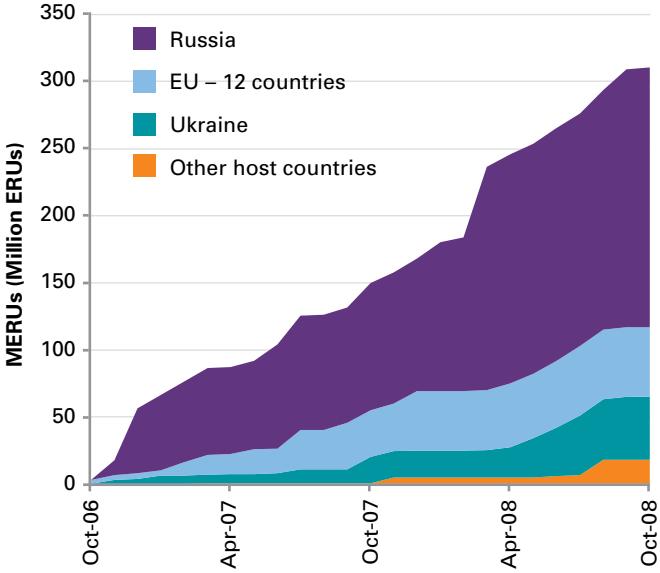
Unlike CDM projects, which could accumulate credits in principle from 2000 onwards, the formal crediting period for Joint Implementation is aligned with the first commitment period of the Kyoto Protocol, and thus did not start until January 2008.

In addition, whilst special provisions had been enacted to establish the governing machinery for the CDM on an interim basis prior to the Protocol entering into force, the equivalent machinery for JI was not put into place until the Montreal Conference of Parties at the end of 2005.

Chart 7 *Accumulation of total expected ERUs by 2012*
(a) by project type



(b) by host country



Source: UNEP Risoe database November 2008

Note: The chart indicates the total ERUs that could be generated by the end of 2012 from all of the projects currently in the JI pipeline, across all stages from beginning of publication of project documents to those already registered. ERUs are counted at the date that the project design publication began its public comment period. The values used are the 'nameplate' unadjusted values taken from project plans – i.e. before making any adjustments to estimate delivery in practice. The chart includes projects from both Track 1 and Track 2 JI.

Despite this, in anticipation a surge of JI projects were initiated in eastern Europe. However the initial impetus in several of the New Member States of the EU was choked off by the body of legislation they had to incorporate as part of joining the EU, and emergence of the EU ETS and associated rules to prevent 'double counting' of emission savings[2]. Officials in these countries also became overwhelmed by the rush of EU legislation they had to incorporate and respond to as part of the process of Accession to the EU.

Russia, having hesitated so long before ratifying the Kyoto Protocol, remained struggling with internal procedural disputes, and few other east European countries were in a position to move forward with JI projects. As a result, little happened until late in 2006. Chart 7 shows the subsequent growth in submitted projects, and how these are distributed between project types (7a) and countries (7b). The total projected emission savings (by 2012) from JI projects submitted to date (only 22 had been officially approved and registered at the time of writing this report, November 2008) is about one tenth that of the CDM.

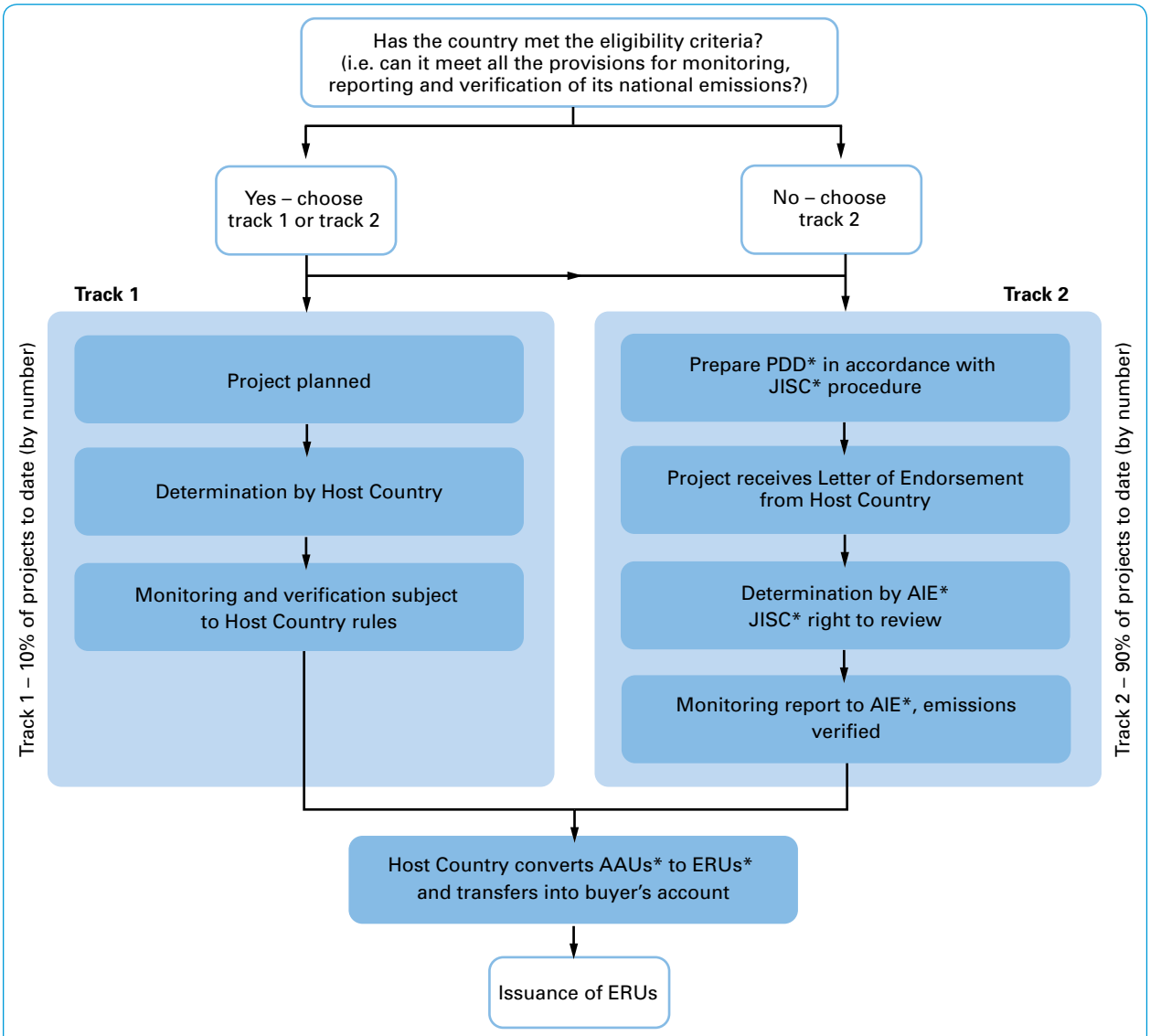
Despite its hesitant start, Russia accounts for almost two thirds of the projected savings to 2012. Most of the remainder is divided roughly equally between Ukraine and the EU's New Member States[3]. In 2008, the Russian portfolio has been the only one growing significantly while Ukraine and the European countries have only submitted a few new projects since September 2007.

A paradox of JI is that these projects almost all utilise procedures conceived after the Kyoto Protocol was adopted, to provide a 'second track' of JI. The original idea had involved minimal international oversight of projects originating in countries that had complied with the full panoply of the Protocol's provisions for annual reporting and review of national emission inventories. Many transition economies were worried that they would be unable to meet these extensive requirements, which include for example reporting full inventories on land-use and non-CO_2 emissions, and argued that this should not inhibit them developing projects, for example in the energy sector, that could go through procedures akin to the CDM. A 'second track' of JI was thus established, which operates more like the CDM, with projects being directly endorsed through a multilateral Joint Implementation Supervisory Committee (Box 2). Most JI projects to date have gone through this route. The respective project cycles are outlined in Box 2.

[2] The rules to prevent 'double counting' applied both directly (prohibiting ERUs from emission reduction projects at facilities that now fell within the scope of the EU ETS), and indirectly (notably, any energy efficiency project that reduced electricity consumption would indirectly save emissions from power stations in the EU ETS – and that part of the emission savings would be discounted). The double counting rules thus undermined any incentive for JI projects to increase end-use electricity efficiency. In addition, some abatement efforts now become mandatory under the EU's *acquis communitaire*. The net result meant that most of the emerging JI projects in the new Member States became ineligible for crediting.

[3] This and subsequent discussion refers to projects submitted under the JI 'Track 2' procedures: see Climate Strategies (2008): A. Korppoo and O. Gassan-Zade, 'Joint Implementation: looking back and forward', **www.climatestrategies.org**

***Box 2** JI project cycle*



*Note:
- PDD = Project Design Document
- AAUs = Assigned Amount Units
- ERUs = Emission Reduction Units
- JISC = Joint Implementation Supervisory Committee
- AIE = Accredited Independent Entity

For full explanation of these abbreviations and other terms please see the Glossary.

Source: adapted from Norton Rose *JI – an introduction* (May 2008)

The distribution between project types varies fundamentally between the three main contributing regions, as indicated in Chart 8. Russian projects were initially dominated by gas pipeline refurbishment. These accounted for 60% of the volume in September 2007[4], but are now less dominant (see Chart 8 below where pipeline projects fall under the category of fugitive emissions) as they are joined by other major project types such as coal mine methane projects and N_2O reduction. Some of the special issues around the 'additionality' of Russian gas projects are considered in section 10.

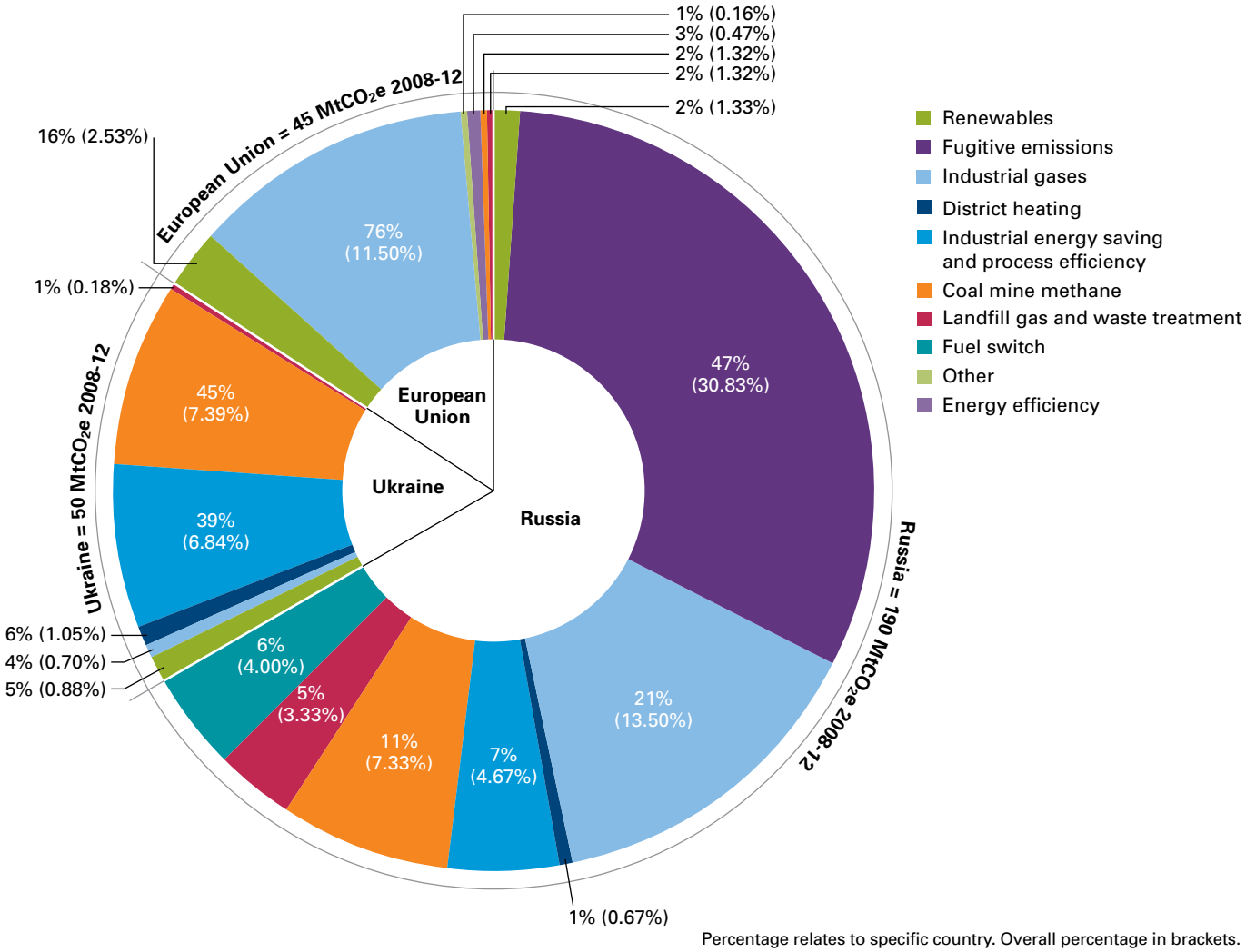
The vast majority (almost 90%) of projected emission savings from Ukrainian projects come from just two categories, namely coal mine methane and industrial energy saving. The latter are mostly in the steel sector but there is also one significant cement project.

Ukraine was the first country to receive final determination for a JI project in March 2007.

In sharp contrast, by number most JI projects in the EU focus on renewable energy, mainly small hydro, wind and biomass, though overall emission reductions are dominated by a few large N_2O projects in western Europe.

The vast majority of the EU projects originate from the transition economies which joined the EU in the 2000s. However, participation is open to any industrialised country, and more recently some JI projects have also been submitted and registered from Germany and New Zealand. Together with some projects from Hungary, these were the only ones to utilise the bilateral Track 1 procedures until recently, when interest in Track 1 has begun to expand.

Chart 8 *Distribution of projected emission reductions from Joint Implementation projects by country and project type*



Percentage relates to specific country. Overall percentage in brackets.

Source: Climate Strategies (2008): Korppoo and Gassan-Zade. Data derived from JISC Track 2 project database, as of 1 Oct 2008.

[4] Korppoo, Anna (2007). Joint Implementation in Russia and Ukraine: Review of projects submitted to JISC. Climate Strategies Briefing Paper, October 2007.

4. Intergovernmental emissions trading and Green Investment Schemes

The third of the 'Kyoto flexibility mechanisms' is intergovernmental emissions trading. In concept this is by far the simplest – but its development has not entirely been as expected.

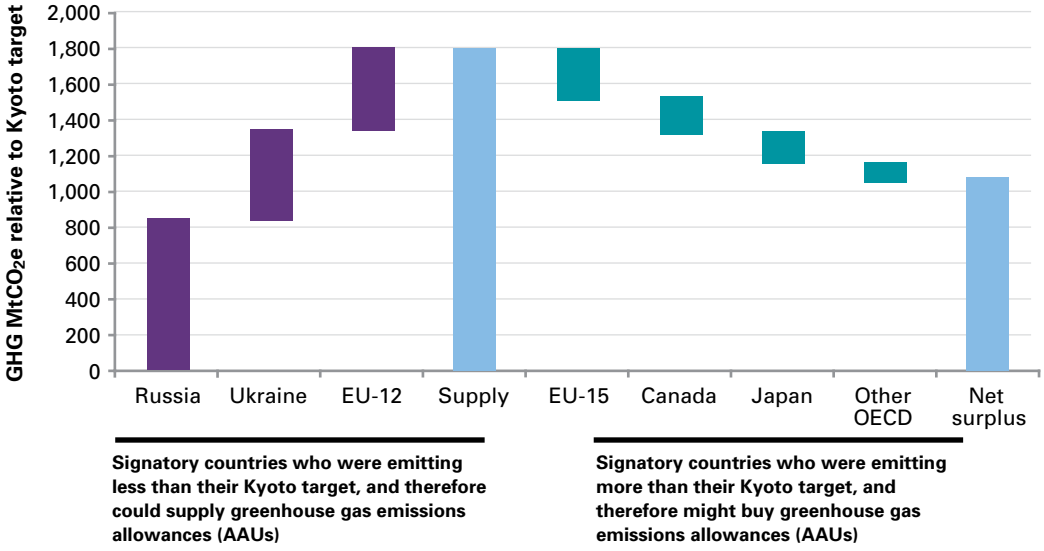
Intergovernmental emissions trading is already implicitly used in the context of the EU ETS: although it applies to industrial emissions, emission trades between facilities in different EU Member States are matched by an equivalent transfer of national obligations under the Kyoto Protocol. Apart from that, however, no intergovernmental emissions trade was completed in the ten years after the adoption of the Kyoto Protocol – despite the almost complete freedom to do so under the terms of the Protocol and its subsequent Marrakesh Accords.

The essential stumbling block was concern about the environmental legitimacy of such trading, driven by doubts not about the principle, but rather the specific Kyoto Protocol targets. With a couple of exceptions (the UK being the most notable), most OECD countries look to be falling short of delivering their targets domestically. Thus they are looking to acquire, not to sell, Kyoto emission units in order to comply. This would be acceptable if such trade did not increase overall emissions – which would require additional effort in the country exporting the allowances. However, this is only true as long as the targets do actually constrain emissions in all countries that have caps.

This is not the case. Specifically, the Kyoto targets were negotiated in the years after the collapse of central planning in the former Soviet Union and east European countries, with the consequent massive contraction of their heavy industry-based economies and associated reductions in their fossil fuel consumption and emissions. The common assumption was that, after the transition, their economies would recover and their emissions would rise again. For most such 'transition economies', economic recovery did arrive but it was largely associated with reducing waste, increasing efficiency and often the closing down of old, energy intensive manufacturing capacity. In many cases, emissions continued to fall for some years even as strong economic growth resumed.

Chart 9 shows that overall emissions from these regions remain well below their Kyoto targets, for reasons that have little to do with their climate change policies. Moreover, their degree of surplus far exceeds the potential shortfall in the OECD Kyoto countries without the United States. Emissions projections for the different regions are outlined in section 8, but no scenarios to 2012 change this basic picture.

Chart 9 *2005 net surplus emissions relative to Kyoto targets for signatories*



Source: UNFCCC using latest available data as at Oct 2008 – which covers country emissions to 2005. Excludes forestry.

Some of the transition economies regard their resulting 'Kyoto surplus' as potential compensation for the trauma of the transition and a reflection of the global benefits associated with this; the rest of the world, however, has labelled it as 'hot air'. Selling it would alleviate the cap elsewhere but not require any additional emission reduction effort in these countries (at least in the absence of commitments to steep future reductions that might mop up the surplus, if banked). Consequently all OECD governments have spurned this apparently 'easy way out.'

The theory of intergovernmental emissions trading was that by increasing flexibility in the face of uncertain emission trends, it would also facilitate countries agreeing to tougher targets. This to some degree it did; but the practical application of intergovernmental trading looked like being still-born, due to the highly asymmetric nature of the Kyoto targets in the aftermath of economic transition.

Realising the unacceptability of simply selling their surplus, however, several of the transition economies have started to develop a creative solution. Hungary and Latvia were the first to enact legislation based on detailed, concrete proposals for targeting revenues from selling some of their Kyoto allowances, to projects and programmes that would reduce their emissions. They have been joined by several others.

Turning this basic idea into concrete action took several years. The transition countries had first to accept that simply selling their surplus was unlikely to be an option; the growth of the CDM was probably vital to the realisation that they would have to compete for buyers of their allowances, with environmentally credible proposals.

To be credible would require a long-term commitment to appropriate use of the revenues, and a high degree of international transparency to convince buyers of this. In some transition countries this is still regarded with suspicion, as a foreign intrusion in their domestic budgetary affairs.

The required conditions were most easily achieved in the transition economies that had joined the EU. However, another hurdle raised its head, namely EU State Aid legislation that prohibits use of public funds for many commercially-related applications. Designed to protect a level competitive playing field in the EU, this restricted the kinds of projects that could be funded.

These complexities took a long time to navigate. However during 2007/8, Hungary and Latvia both passed laws through full Parliamentary procedures to establish such 'Green Investment Schemes' that met these criteria; Ukraine has now also done so, though in a less complete form and without the constraints of EU State Aid legislation. Laws in the Czech Republic and Romania are now also well advanced. The first GIS transactions took place in autumn 2008, with Hungary selling 8 $MtCO_2e$ of their Kyoto Allowances (AAUs) to Belgium and Spain.[5]

The main characteristics of the different GIS schemes at present are summarised in Table 2 overleaf. This shows that Green Investment Schemes can take different forms. The Hungarian pilot GIS focuses upon a major programme to refurbish its building stock, which like many in central and eastern Europe remains inefficient. The Latvian scheme includes this, but also small scale renewable projects such as biomass CHP and biogas recovery and use. Others target district heating schemes, as well as a range of 'softer' measures.

Table 1 *Principal applications of main Green Investment Schemes*

	Potential Greening activities	Country examples
Hard greening	Retrofitting old buildings	Hungary, Latvia, Ukraine, Czech Republic, Romania
	Other energy efficiency in buildings	Czech Republic, Romania
	Construction of small co-generation installations	Romania
	Rehabilitation of district heating systems	Czech Republic, Latvia, Ukraine, Romania
	Renewable energy (small scale)	Hungary, Latvia, Romania
Soft greening	GIS management capacity building	Czech Republic
	Capacity related climate change awareness	–
	Monitoring and observation on climate system	–
	Building capacity on climate-related legislation and policy	Latvia

Source: Climate Strategies: Urge Vorsatz *et al.* (2008)

[5] At the end of 2008, Slovakia was reported to have sold 10 million AAUs to a private company, at a price of €6.05/tCO_2. It stated that the money would go to a pre-existing environmental fund. However, the ultimate buyer was unclear, we were unable to ascertain details of the deal or the application and governance of the fund, and the Slovakian Environment Ministry later denied the reports. Slovakia was also reported to have sold AAUs to Japan in 2003, but again we could not find subsequent corroboration or details.

Table 2 *Principal Green Investment Schemes**

	Hungary	Latvia	Ukraine	Czech Republic	Romania
GIS progress	• First to pass GIS legislation (2007) • First to announce GIS sales (autumn 2008)	• Legal framework and institutional system established	• General legislation adopted • First GIS deal expected soon	• General legislation adopted	• General legislation adopted • First GIS deal expected soon
Greening option**	Hard greening	Hard greening preferred + soft greening options	Hard greening to be at least 75%+ soft greening options	Hard greening preferred + soft greening options	Hard greening to be at least 90% + soft greening options
Programmatic or project approach	Both	Both	Project only	Both	Both
Revenues separated from state budget?	Yes	Yes	No	Yes	Yes
Defined approach to additionality?	Yes	No	Yes	No	No
Relative level of monitoring and verification	High	tbd	High – but still tbd	High	Low
Priority areas	In pilot phase: • Energy efficiency in residential and public buildings • Renewable energy for heating • Biogas production for transportation • Non-CO_2 emissions	• Energy efficiency in buildings • Small scale renewables • District heating • Industrial power intensity Soft greening: • Innovative low carbon technologies • Capacity building in climate change policy	• Housing and public utilities • Reconstruction of district heating systems • Forestry • Water supply	• Retrofit of old building stock • Other buildings & appliance energy efficiency • Biomass for district heating Soft greening: • Administrative procedures • Others tbd	• Rehabilitation of district heating systems • Small co-generation installations*** • Urban landfill methane recovery • Fuel-switching in power production*** • Industrial non-CO_2 • Buildings energy efficiency • Agriculture, forestry and transport

* Green Investment Schemes refer to firm and credible commitments to use revenues from selling AAUs for environmental purposes. The table indicates only those countries which have taken specific legislative steps that ensures this. Other countries that could potentially offer GIS, but have not taken legislative steps to establish a Scheme include Bulgaria, Poland, Lithuania, Estonia and Russia.

** 'Hard greening' uses funds from AAU sales to deliver quantifiable emission reductions; 'soft greening' refers to activities for which emission reductions cannot be measured or readily quantified. (e.g. environmental education, technology development).

*** Where these investments fall outside the scope of the EU ETS.

Source: Climate Strategies: Urge-Vorsatz et al. (2008)

Indeed an important distinction to emerge is that between 'hard greening', which funds specific activities that directly reduce emissions in ways that can be quantified and monitored, and 'soft greening', which funds supporting activities. The principal activities in these two classes are summarised in Table 1 on page 25.

Overall, the GIS schemes can differ in many respects other than just the activities funded, including the time horizon, extent and nature of any 'additionality' requirements, the extent and governance of financial separation from other funds, and the legal channels through which this is guaranteed. Also GIS in the New Member States are more constrained (notably by State Aid legislation) than in Ukraine.

The initial experience and case studies illustrate five main characteristics of Green Investment Schemes that distinguish them from the project mechanisms.

Flexibility. The various schemes and proposals display a diversity of potential activities. Free from the restrictions of the project-by-project additionality criteria of the project mechanisms, GIS proposals within the EU New Member States include programmes in residential and public sector building refurbishment, efficiency programmes with small businesses, various renewable energy schemes, waste reduction and methane capture – with agriculture and forestry projects also under consideration. Outside the EU, the absence of State Aid restrictions enables the list of potential activities to expand even further to include, for example, industrial energy efficiency.

Time horizons. Any unused emission allowances under the Kyoto Protocol can be banked forward into the Kyoto second period, post-2012. Thus, countries with a surplus can in effect sell a future stream of emission allowances, brought forward and sold to help other countries comply with the present Kyoto commitments. This offers a way in which the present surplus in transition countries can be eroded over time, providing that their future emission obligations do represent binding constraints.

Upfront finance. GIS deals intrinsically involve upfront finance. Whereas CDM and JI transactions are financed against the expectation that they will generate emission credits in the future, GIS contracts involve an immediate transfer of national emission allowances (AAUs) that can be used by a purchasing country for compliance with its Kyoto obligations.

Government-led. National emission allowances cannot be used for compliance under the EU ETS, thus GIS deals are led by governments as part of national strategies for complying with Kyoto obligations. Of course, the private sector can be involved in implementing the deals – which could for example offer a major boost for the buildings refurbishment industry – but the operation is very different from a decentralised market operating under internationally negotiated rules for crediting.

Co-benefits. GIS projects may have a broad range of socio-economic and ecological co-benefits. For instance, improving building energy efficiency can yield many benefits beyond the value of saved energy and reduced emissions: improved health and comfort, jobs and new business opportunities, lower energy bills, and improved energy security. This is a direct consequence of GIS being government-led. The private sector could not monetise most of these benefits, and although 'contribution to sustainable development' is a criterion for CDM projects, it has little operational value to private investment. In contrast, host governments can use GIS to finance efforts that address a wide range of public concerns, within which carbon savings may be merely one element amongst many. The public sector can also seek to co-finance programmes in which emission savings are just one of the benefits.

These characteristics may make GIS increasingly attractive as time goes by and willingness to engage on both sides increases. However, there are important issues that remain. The schemes vary in their commitment to matching AAU transfers 1-to-1 with verifiable 'additional' emission savings even for the 'hard greening' components; this could be justified in terms of other benefits accruing, or addressed over a longer time frame, but its acceptability remains to be tested.

Also, with the first transactions only just completed, the actual performance remains to be proven. Nevertheless, GIS is an interesting concept that, as illustrated later, could address important gaps in the coverage of the project mechanisms.

5. Implementation and development of the Mechanisms: a comparative overview

In many ways, the different Mechanisms all spring from the same basic idea, namely that global emission reductions can be secured most effectively, fairly and efficiently by separating who pays from where reductions are delivered. In practice, their different structures and governance serve different needs.

At the time that the fundamental decision to adopt the Mechanisms was made in the Kyoto Protocol, many economists were sceptical of the case for having more than two instruments – the CDM for developing countries without an emissions cap, and emissions trading between those countries that took on a cap. They were not alone in suspecting that JI might prove to be simply a more bureaucratic and less attractive version of emissions trading.

In practice, in addition to the distinction between capped and non-capped countries, experience has spawned several additional variants.

These are illustrated in Chart 10, and their different legal and procedural channels and other characteristics are summarised in Table 3. This underlines in particular the fundamental difference between the two tracks of Joint Implementation. The CDM-like 'JI Track 2' involves direct international oversight to assure the integrity of project credits, whereas 'JI Track 1' allows bilateral exchanges of project credits between countries that have fulfilled a deeper level of compliance with the Protocol's requirements on annual monitoring, reporting and review of national emission inventories.

Chart 10 *Characteristics of the Global Carbon Mechanisms*

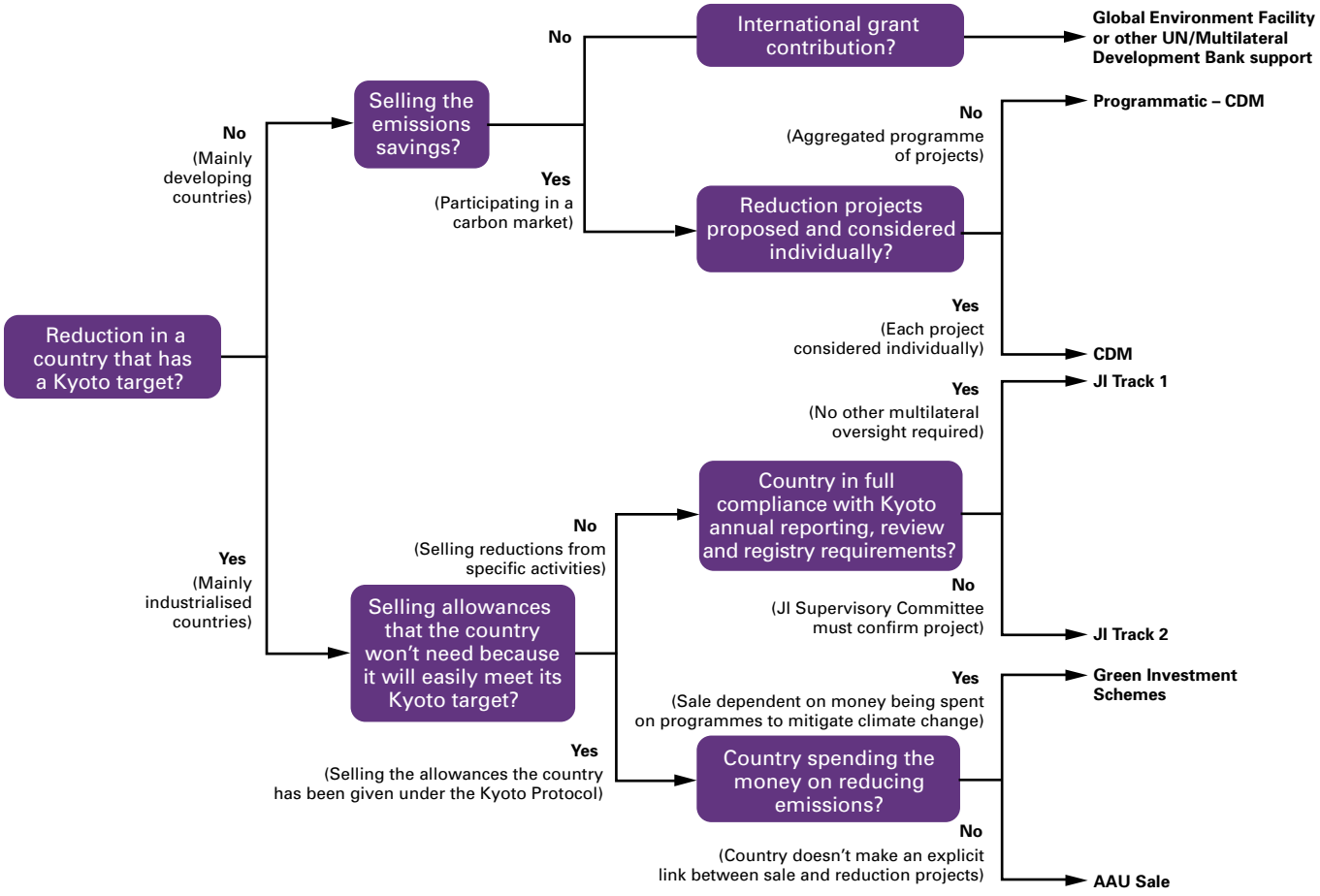


Table 3 *Legal and procedural comparison of global carbon mechanisms*

Eligible host parties	**Developing countries (UNFCCC Non-Annex I)**	**Industrialised countries (UNFCCC Annex I)**			
Supervision of transactions	**Multilateral supervision**		**Bilateral supervision subject to national compliance with full-scope Kyoto Protocol inventory procedures**		
Mechanism	**Clean Development Mechanism (CDM)**	**Joint Implementation (JI) 'Track 2'**	**JI 'Track 1'**	**Green Investment Schemes (GIS)**	**Industry-level cap-and-trade (EU ETS)*** **
Reduction unit	Certified Emission Reduction (CER)	Emission Reduction Unit (ERU)*	ERU*	Assigned Amount Unit (AAU)	EU Allowance (EUA) backed by AAU
Governing body and procedure	CDM Executive Board, 'registration'	JI Supervisory Committee, 'final determination'	Host country	Host country	EU
Units issued by	Executive Board	Host country*	Host country*	Kyoto Protocol	EU
Crediting period	From registration for 10 years (non-renewable), or 7 years (renewable)	Kyoto first period: from 1st Jan 2008, currently to end 2012.	As JI Track 2	Variable	Kyoto Protocol first period with banking forward allowed
Eligibility of land-related activities	Limited to afforestation and reforestation	Afforestation and reforestation plus other uses as selected under Kyoto Protocol Article 3.4	Afforestation and reforestation plus other uses as selected under Kyoto Protocol Article 3.4		Excludes land-use
Third party verification	'Validation' of Project Design Document by accredited 'Designated Operational Entity'	'Determination' of Project Design Document by 'Accredited Independent Entity'	Kyoto Protocol provisions for national emissions, bilateral agreement for projects plus ITL procedures**		Kyoto Protocol + EU + ITL procedures**
Methodologies	Methodologies approved by CDM Executive Board based on Methodology Panel recommendations.	Projects can use: – Approved CDM methodologies – Elements of CDM methodologies – New methodologies	Bilateral	Bilateral	n/a
Additionality	CDM Executive Board additionality tool (mandatory if required by baseline methodology)	Projects can use: – Additionality tool from CDM – Other scenario or comparability approaches	Host country determination	Not explicitly required	Not explicitly required

* Joint Implementation: host countries issue Emission Reduction Units (ERUs) by conversion of Assigned Amount Units (AAUs), thus for every ERU issued an AAU needs to be cancelled;
** ITL = International Transaction Log that tracks issuance and transfer of Assigned Amount Units.
*** EU ETS is the only current example of industry cap-and-trade scheme operating across national borders.

The developing country effort is focused on the CDM, plus the direct financing programmes of the pre-existing World Bank/Global Environment Facility (GEF) and the new Climate Investment Funds. The CDM developed first because its 'prompt start' provisions (crediting in theory from 2000) created a strong incentive both to initiate projects and to sort out the institutional machinery (which was developed and began operating in 'shadow' form well before the Protocol finally entered into force in 2005). So primed, within one year the CDM eclipsed the scale of GEF programmes – indicating the power of carbon market mechanisms to generate levels of activity and finance far greater than centralised, donor-dependent, funding programmes. The underlying engine, however, was the establishment of the EU ETS, bringing Kyoto's cap and trade principles down to the industry level.

The EU ETS forms only one of several mechanisms of bilateral exchanges between countries that comply with the panoply of national inventory reporting and review requirements. Industries outside the scope of the EU ETS can exchange project credits under JI; and governments can transfer national allowances directly – in practice, most such exchanges are being considered in the context of Green Investment Schemes. In total the industrialised world has thus developed four mechanisms. They have come into conflict only when the adoption of EU ETS – and other EU policies – in the New Member States arrived on top of initiated JI (Track 2) projects, many of which were then aborted due to the double counting rules (see note 2 earlier). The mechanisms see some competition in Ukraine, where JI (Track 1) and GIS – freed from constraints like the EU's State Aid rules – offer similar routes for some project types. Apart from this, the instruments do not noticeably compete. Moreover, the different instruments have different risk profiles, as indicated in Table 4, and this also means the diversity of instruments has some benefits.

Table 4 *Indicative risk profiles of the different Mechanisms*

Mechanism	Clean Development Mechanism (CDM)	Joint Implementation (JI) 'Track 2'	JI 'Track 1'	Green Investment Schemes (GIS)	Industry-level cap-and-trade (EU ETS)
Market price risk[1]	●	●	●	●	●
Developer risk[2]	●	●	●	●	●
Seller risk[3]	●	●	●	●	●
Buyer risk[4]	●	●	●	●	●

● High ● Medium ● Low

1. Prices for credits from the project credits are generally driven by the primary buyer market of EU ETS and some governments, and thus have some added risk element. However, this may change if and as governments become more active buyers and/or other national or regional trading schemes develop.
2. Developers of CDM and JI Track 2 projects face risk of rejection by international panels; these risks are mitigated for projects developed in and requiring consent primarily by host governments.
3. Risk facing the seller after projects have been approved and credits/allowances issued. GIS and EU ETS face the risk that the seller has miscalculated and could face future compliance problems due to selling of allowances.
4. The main buyer risks arise either from third-party risks of non-delivery, or reputational risks that the environmental integrity of specific units they buy is challenged.

Source: Authors. For a similar table with breakdown of components of seller and buyer risk, see Climate Strategies (2008): Urge-Vorsatz et al., Green Investment Schemes.

Indeed, the evidence from sections 3 and 4 is that the different instruments now available to industrialised countries mostly complement each other, with each adapted to different niches. The key insight from this is that industrialised countries have used the greater flexibility afforded to countries with emissions caps to address two other distinctions:

- *Public vs private.* Structures based on clear rules and procedures facilitate private sector participation. The strong and growing role of private capital in many of the relevant emitting sectors means that this has dominated CDM and JI projects. The bilateral and discretionary nature of JI Track 1 tends to mean greater government involvement, but frequently still led by the private sector, in open competition to sell the credits on to the carbon market. In contrast, governments take the lead in GIS, and indeed in the EU have to focus mainly on non-commercial end-user domains (such as building refurbishment) to avoid challenges under the EU's State Aid rules.
- *Project vs programme.* CDM and JI are explicitly designed to credit specific project investments. More than three years after a decision to launch a 'programmatic' variant of CDM, it remains largely moribund, reflecting the difficulty of designing procedures that enable programmes to fulfil efficiently the underlying principles of discrete investments that directly generate continuously monitored and additional emission savings. However, GIS has been equally applied to programmes – most of the proposed GIS schemes are explicitly designed for both.

Together with the distinction between the routes available to industrialised vs developing countries this enables the different instruments to be roughly mapped on a '2 x 2 x 2' cube (see Chart 1 in the Executive Summary for illustration), that corresponds approximately to the end points in Chart 10. The present 'carbon market mechanisms' directly target four of the eight possible combinations, with some others partly but incompletely addressed by the programmatic CDM and 'Track 1' JI. Far from the original concern that Kyoto had spawned a superfluous instrument for industrialised countries, the evidence is that on the contrary, there are good reasons for the diversity, as they fulfil different roles and engage different actors and types of activity – and that the existing mechanisms still do not provide a comprehensive set of incentives, as illustrated more fully in Part III of this report.

Part II: Performance, delivery and projections

Part II of this report looks at the evidence on project performance in the Clean Development Mechanism, by comparing initial projections with realised delivery, and uses this to build up a picture of likely supply of emission credits. The section also critically examines projections of emissions, which drive the overall demand for credits from OECD countries – and the additional potential supplies from many of the transition economies. These are combined to give an overall assessment of the balance of supply and demand, out to 2012 and beyond to 2020.

6. Project performance in the CDM

With more than a thousand projects now operating, evidence is accumulating about the performance of CDM projects in reality. As with many industrial projects and 'new markets', the emerging evidence suggests that many projects have not so far performed as well as hoped, but to a degree that differs greatly between project types.

Growing experience with the CDM now makes it possible to start comparing actual performance against that initially predicted in the 'project design documents'. In addition to the possibility that submitted projects may not be accepted (registered), registered projects may still 'under-perform' for various reasons. This section looks at the emerging evidence on project performance, and identifies key factors affecting this. It is based on an initial in-depth analysis of a random sample of over 300 of the 650 projects that had been submitted for registration by July 2007 published by Climate Strategies, supplemented with more recent data from a study by New Carbon Finance (for more details, please see web Annex 1)[6].

The first phase: revision, acceptance or rejection

The first hurdle is to complete procedures that lead to a project being officially registered with the CDM. Box 1 in section 2 illustrated the stages. The project must be accepted by the host government's Designated National Authority, and a Designated Operational Entity has to validate the documents so that the project can be sent (along with a validation report) for registration by the CDM Executive Board. Project design and estimated emission savings can go through several revisions as the project passes through these various stages. Detailed data are not available but the in-depth project sample concluded that compared to first estimates, '… each step of the CDM project cycle tends to lead to a downward adjustment of [predicted] emission savings.'

Out of the sample of 300 projects, 20 were ultimately rejected by the Executive Board. Of these rejected projects, 65% were categorised as 'energy efficiency' projects, although energy efficiency only accounted for 17% of submitted projects. A significant proportion of the rejected projects involved cement blending, where it was judged that the emission savings were not really 'additional' – the projects would have proceeded anyway[7].

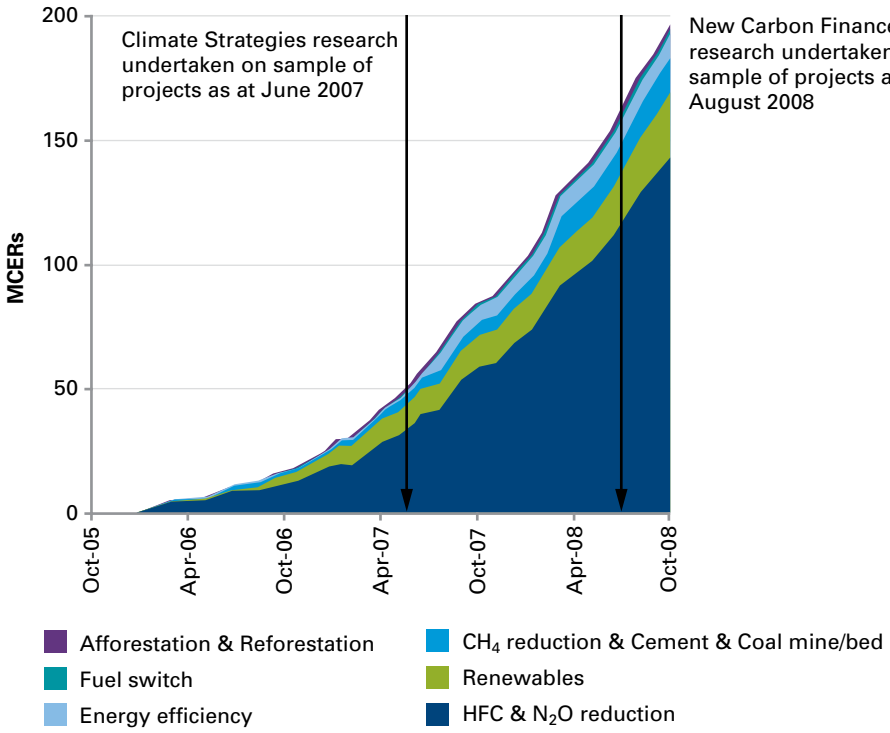
This in itself hints at one limitation of the CDM. Energy efficiency projects account for only a small part of the total portfolio (see Chart 6a earlier), and featured disproportionately in rejections. Yet energy efficiency offers a huge potential that is also often cost-effective. The paradox is that the sheer cost-effective nature of many energy efficiency projects makes them harder to justify as additional to what would have happened otherwise; once such a project is identified, would it not proceed anyway? A separate study identifies numerous other potential barriers to foreign investment in energy efficiency in China[8], but some are linked to this paradox in terms of how China has implemented its CDM programme.

[6] Technical Annex I: *CDM project performance* available from the Climate Strategies website at **www.climatestrategies.org**. The original study was published as Climate Strategies (2008): A. Michaelowa and P. Castro, *Empirical analysis of the performance of CDM projects.*

[7] Out of 22 such cement blending projects submitted for registration, 8 were rejected as the Executive Board clarified its interpretation of additionality arguments.

[8] W. Chandler and H. Gwin, *Financing energy efficiency in China*, Carnegie Endowment for International Peace, Washington, 2008.

Chart 11 *Issued CERs accumulated over time, by project type*



Source: UNEP Risoe database November 2008

Note: The chart shows the cumulative number of million CERs issued by the date shown on the x-axis, stacking the different project categories to indicate the total.

Subsequent performance

Once a project has been officially accepted and registered by the CDM Executive Board, it can start to generate CERs on the basis of retrospective verified assessment of its actual performance. The most basic indicator of its performance relative to expectations is thus the ratio of delivered, verified CERs to the amount projected in the project design documents at registration – its 'yield'.

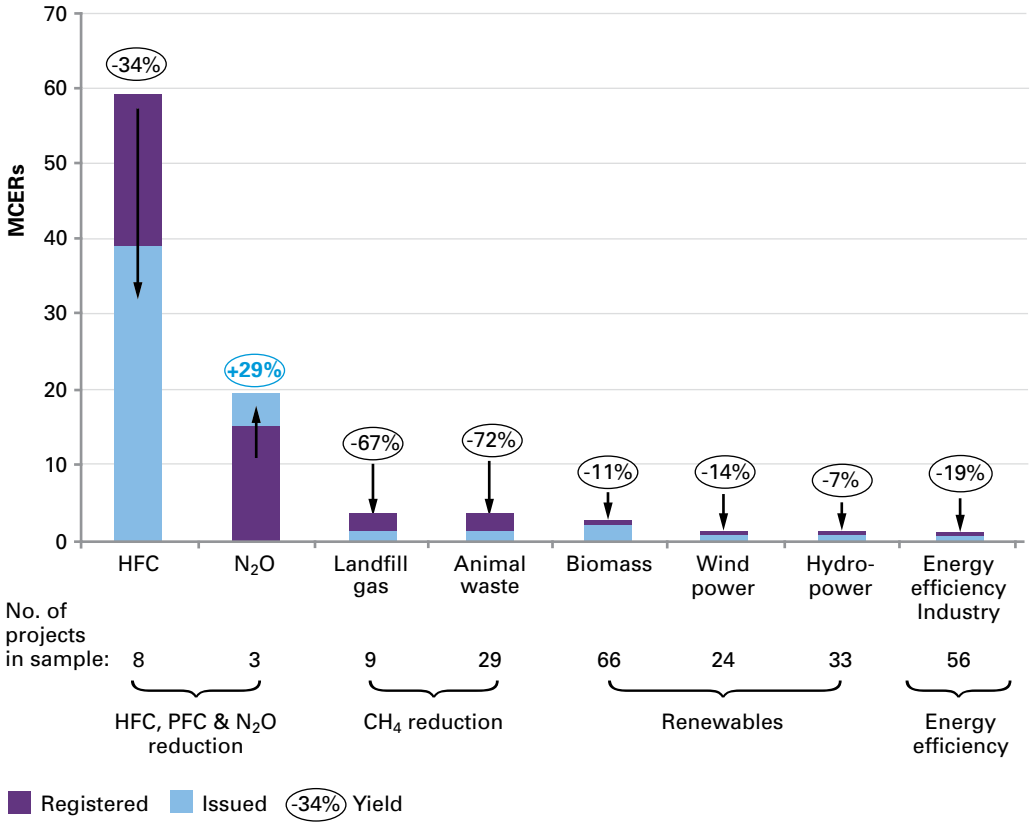
Chart 11 shows the growth of issued CERs to date, which remains a very small fraction of the projected total over the next few years. The CDM itself is only just now moving into the era of full, verified delivery. The volume of issued CERs has more than doubled between the cut-off of the initial sample (of 300 projects by Climate Strategies), and the more recent (but smaller) sample by New Carbon Finance, and remains heavily dominated by the large industrial gas projects.

The projects in the initial sample were expected to save 85 $MtCO_2e$ per year; however only 65 million CERs were actually subsequently issued (in terms of standardised 'annual equivalent')[9]. The average yield across the sample by July 2007 was thus 76% of that projected in the registered design documents. Failure to perform as initially projected is not surprising, and is hardly unique to CDM projects – optimism, regarding timescale and/or other dimensions of performance, pervades industrial project planning, like many other walks of life. However, a shortfall close to 25% merits closer attention.

[9] For these purposes 'annual equivalent' has been calculated as the total CERs issued at the time of analysis divided by the total period in days for which the project has been issuing and multiplied by 365 to gain an estimate of annual issuance rate.

Chart 12 *Forecast and issuance of CERs*

(a) by project category



Source: Climate Strategies (2008): Castro and Michaelowa
Data derived from UNFCCC and UNEP Risoe database 2007

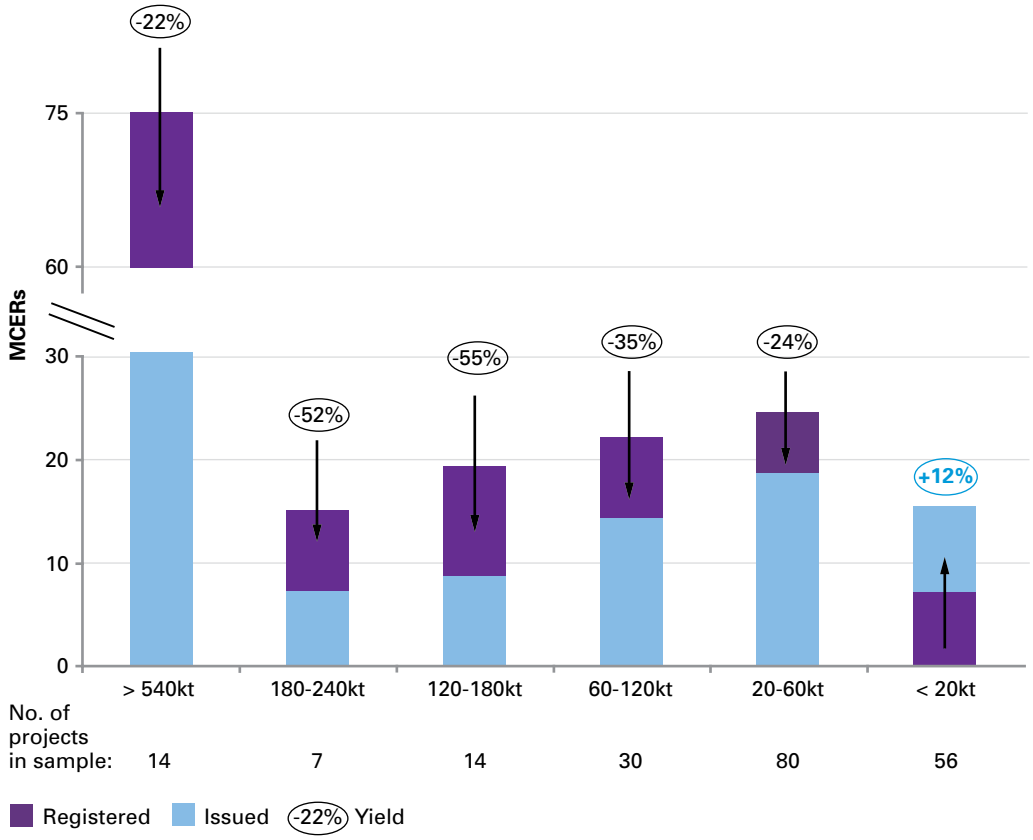
The yield would be expected to vary for different types of projects. For example projects involving new technologies might face more implementation and monitoring difficulties, and/or be harder to predict. The emerging evidence, summarised in Chart 12a, confirms that different types of projects have indeed performed very differently. N_2O projects have had the highest yields – indeed these are the only project type that generated more CERs than expected, by almost 30%. The performance of the eight HFC-23 projects disappointed in aggregate, mainly due to two poorly performing projects in China (though their performance has subsequently improved).

Hydro, a well established and understood technology, performed close to prediction. Landfill gas projects (particularly those which produce electricity) and animal waste projects showed the lowest performance, delivering under one third of projected CERs[10]. Other renewables have tended to under-perform by about 10%, and energy efficiency projects in aggregate by almost 20%, with distinct differences also between the underlying project sub-categories[11].

[10] This is noted in the World Bank's *State and Trends of the Carbon Market* (2007) report, which suggests as causes 'overestimation of the potential generation of gas at the modelling stage, inadequate design of gas capture systems, suboptimal operation of the landfills, or other external factors' (p.28).

[11] Agricultural plant waste projects performed better (95%) than wood waste projects (76%). Run-of-river hydropower projects perform slightly better (94%) than projects based on reservoirs. The very few geothermal and cement blending projects had produced disappointing performance as of the sample's mid-2007 cut-off (47% and 45%, respectively).

(b) by project size



Source: Climate Strategies (2008): Castro and Michaelowa
Data derived from UNFCCC and UNEP Risoe database 2007

The size of project seems to matter. Very large projects (above 540,000 tCO_2e) include the big N_2O projects that have performed exceptionally well. However, in general smaller projects tend to be simpler and easier to assess; over most of the size range, the yield has been higher for smaller projects, and very small projects (below 20,000 tCO_2e) produced 12% more CERs than predicted. CDM rules embody simplified procedures for 'small' projects, which encompass roughly the two smallest categories in Chart 12b and imply an average performance around 84%[12].

The more recent study from 2008, although with a smaller overall project sample, appears to support most of these findings[13].

About half (48%) of sampled projects that had issued CERs by August 2008 were yielding within +/- 20% of predicted performance. The 10% of projects exceeding this were mostly industrial gas projects, with a few renewable, cement and industrial energy efficiency projects. Agricultural, coal bed methane and most biogas projects systematically fell far below expectations. Various types of energy efficiency projects also delivered very varied yields. Overall, with the exception of a few big HFC projects and some improvement in hydro, there was little evidence of improving performance in the year between the two studies, and the broad patterns appear consistent.

[12] Limits to qualify for small-scale procedures are expressed as a maximum of either 15 MW capacity of the project activity, 60 GWh annual energy savings or 60,000 CO_2 emission reductions in any year of the crediting period. Amalgamating all projects below 60,000 tCO_2, the yield is 84%.

[13] New Carbon Finance research note *False Expectation: Why CDM projects under perform* November 2008. This assessment sampled 150 projects.

The more detailed earlier analysis also examined whether project performance varied according to other factors such as the host country, the degree of international participation, or the choice of consultant or validator involved.

- The ***host country*** determines the political and economic context, and specific energy, industry and other sector-specific policies that may affect a project. As indicated in Part 1, most CDM activity has focused on China, India and Brazil, which provide relatively stable investment environments, well established procedures and large markets. More than half the 20 *rejected* projects in the sample were from India and 5 from Brazil, but none were from China; but in *aggregate*, Indian projects in the sample had performed above expectations, whereas projects in Brazil and China had underperformed. However, all these results are dominated by a few large industrial gas projects and the survey found no evidence that any one country performs consistently better or consistently worse – in all projects – than the others.
- CDM projects do not have to involve foreign participants – to be ***'bilateral'*** in their development and registration. **'Unilateral'** projects can be developed principally by the host country to generate CERs for sale on the international market. After registration, bilateral projects had a somewhat higher yield, about three quarters compared to two thirds from unilateral projects. Possible reasons for the better performance of bilateral projects – apart from differences in project type – might be improved access to technology, technical support and upfront financing.
- The ***type of consultant*** may influence prospects, with technology-specific consultants having had more success than multi-project ones in getting their CDM projects *registered*, but the picture is more mixed in terms of subsequent performance. Projects with in-house development of design documents performed better on average than those led by external consultants, but the limited number of sampled projects and high variance in each type suggests that other factors are probably more important.
- Project performance also varied with different ***validators*** – the Designated Operational Entities that perform due diligence for the design documents – but this appears to depend mostly upon the type of projects they were handling: poorer performers are associated with project types that have struggled to deliver. The data also show the market for validation services is quite concentrated, with one validator accounting about half of all the CERs issued.

The main data are summarised in the Technical Annex (note 6). Overall, there are interesting observations about other factors that could affect performance, but the data on these cannot be taken as statistically significant compared to the dominant driver: the widely divergent performance of different project types, including the performance of individual very large projects. Also notable is that many projects have now been placed under review by the Executive Board, introducing substantial delays and raising questions about the performance of and relationship between these different parts of the approval process.

There is indeed some debate about whether the fact that project developers pay for the validation services may influence their assessments. This reflects the norm in other areas of private sector quality assurance services – where producers are paying to convince purchasers of the quality of their products or services – or to comply with legal requirements (as with financial auditing). However, with the CDM there is at least one difference, as the Executive Board stands between validated projects and final approval. At its 42nd and 43rd session in September and October 2008, the Board rejected an unprecedented proportion of projects – reflecting either a toughening of the Board's criteria, or a slackening in those of validators. The relationship of private company-based validation to public institution-based registration is considered briefly in Part III.

One final observation is that the emerging record shows the wisdom of having based the issuance of CDM credits on verified, monitored project performance, rather than any projections. The investor or buyer thereby takes the risks of underperformance ('buyer beware'), rather than the regulators or the environment – a risk which for some project types has turned out to be very high. In terms of issued credits, the CDM is still in its early days, and it remains too soon to evaluate the actual delivered performance of the other mechanisms given their later start.

7. Supply projections, 2008-12

The development of the CDM in particular, combined with the growing experience of the other mechanisms, enables more robust estimates to be made about the likely volume of emission credits available to 2012.

The 'nameplate' projections from the Project Design Documents of projects in the pipeline – i.e. those that have been formally submitted for validation before considering any additional potential from future submissions – now amount to over 3,000 $MtCO_2e$ reductions cumulative to 2012. Of these, 90% are CDM projects and the remainder JI. As detailed in the previous section, however, experience has shown that not all these credits will materialise:

- Projects may be rejected or revised during the validation process.
- Validated projects may still be rejected by the Executive Board or returned for revision to get through to registration, bringing delays and potentially reductions in estimates of emission savings.
- Registered projects may start late or otherwise not deliver as projected.

In response to the first studies of actual delivery, during 2008 analysts cut forecasts. For example, PointCarbon and the French bank *Société Générale* in early 2008 had projected cumulative supply of around 2,500 $MtCO_2e$. In summer 2008, *Société Générale* reduced its projection to 1,950 $MtCO_2e$ (around 1,700 $MtCO_2e$ from the CDM, and 250 $MtCO_2e$ from JI); a few months later, PointCarbon also dropped its CDM estimates below 2,000 $MtCO_2e$. Continuing procedural delays, and decisions by the Executive Board to reject more projects than anticipated in autumn 2008, could further curtail such estimates.

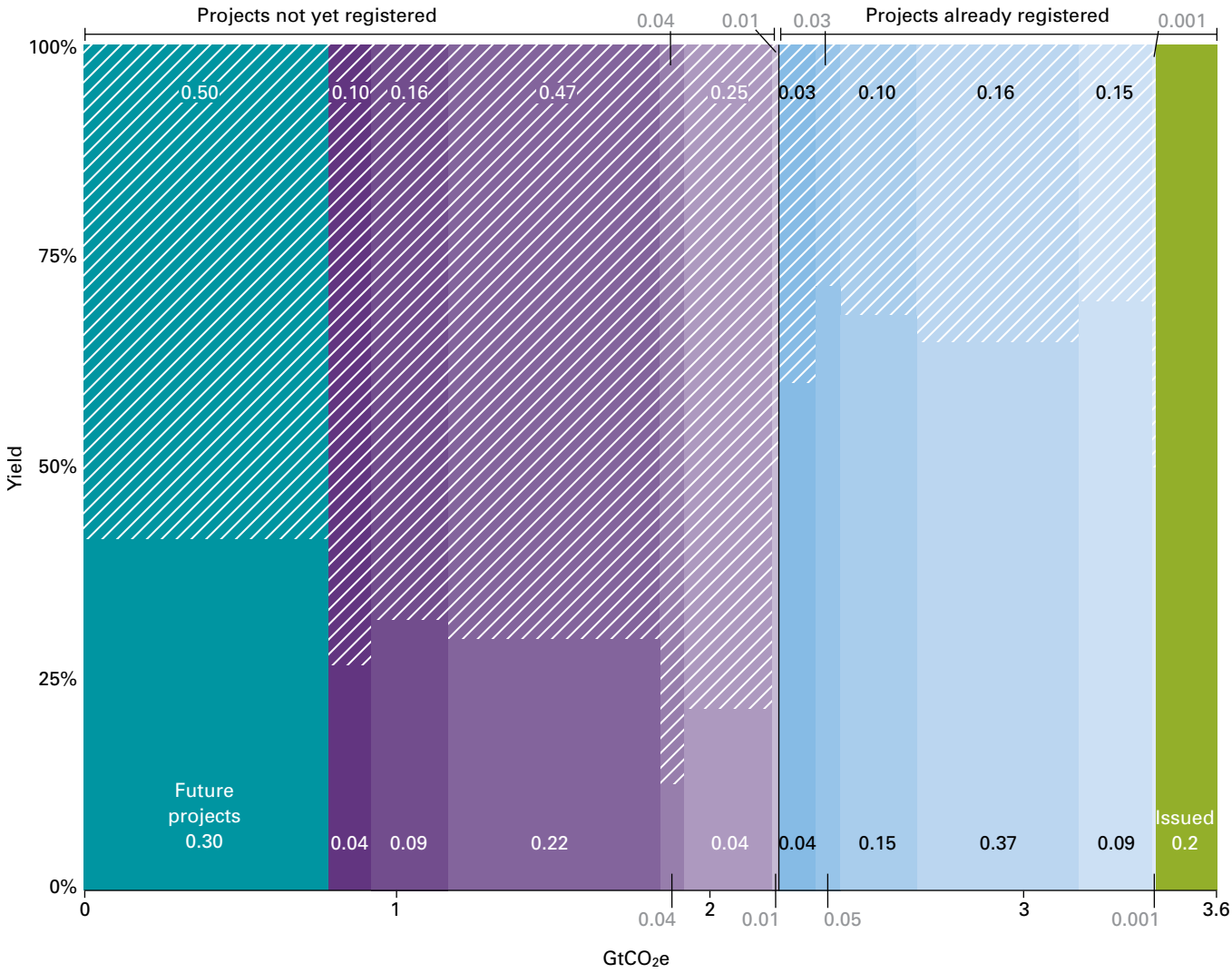
Our own analysis recognises that the future portfolio and performance may differ considerably from the past:

- Well-performing industrial gas projects no longer dominate the mix, forming only about 30% of total projected CERs to 2012; conversely, however, the worst-performing project classes (e.g. animal waste) are also less significant than before.
- Wind, biomass and hydro, which account for another 30% going forward, have had yields to date typically around 85-95%. The remaining project types that form the balance (methane and cement projects, industrial efficiency and fuel switching among others) have more varied performance.
- Much of the under-delivery was due to teething troubles – institutional and technical – that delayed project start-up. Reports of run-rates for established and operating projects are much closer to projected output, in the range of 90-100%.
- In addition experience should improve performance more broadly, as existing projects mature, methodologies improve, developers gain experience, and investors become more discriminating about project types.

Set against these broadly positive indicators, delays in approval have increased due to overload in the system, and the toughening stance of the Executive Board. Time lags are typically 1-2 years; some projects have been languishing in validation for much longer, raising doubt as to whether they are still really being pursued at all.

Chart 13 (over) illustrates graphically the impact of these discount factors on the volume of CDM delivery from projects at each of the different stages of development. It shows a mid-point in the potential yield range, which represents a plausible scenario in which yield rates improve for certain types of projects as developers learn from the experience of earlier projects and in which delays in the registration process are partially unblocked.

Chart 13 *Potential supply of credits from CDM 2008-2012, including future project inflow*



Total potential = 3.6 $GtCO_2e$ (of which est. delivery 1.6 $GtCO_2e$)

Future projects
Estimated delivery of CERs by 2012, associated with future project submissions, and based on extrapolation of current submission and delivery rates

Pre-registration
Estimated delivery of CERs by 2012, as projected in the PDDs of projects that were not registered by the Executive Board as at 1st November 2008, but had begun the validation process with a DOE (defined as the commencement of the public comment period) or had made a submission for registration to the Executive Board

	Del	Non-Del
Fuel switch		
Energy efficiency		
Renewables		
Industrial gases		
CH_4 reduction & Cement & Coal mine/bed		
Other		

Registered
Estimated delivery of CERs by 2012, as projected in the PDDs of projects registered with the Executive Board as at 1st November 2008, and excluding CERs already issued

	Del	Non-Del
Fuel switch		
Energy efficiency		
Renewables		
Industrial gases		
CH_4 reduction & Cement & Coal mine/bed		
Other		

Issued
Total of CERs issued as at 1st November 2008

The right-hand side of the Chart represents projects already registered with the CDM Executive Board. The factors discussed above suggest a high yield for these projects, though continuing delays in start up will still affect the final volumes available by 2012. Projects already registered with the CDM are likely to generate around 700 $MtCO_2e$ over 2009-2012, in addition to the 200 $MtCO_2e$ already delivered by late 2008.

The bigger questions surround the delivery from projects earlier in the process – represented by the left-hand side of Chart 13. These face the risks discussed – that the projects will not be validated, or subsequently registered; downward revisions during validation and registration processes; and reduced delivery due both to continuing delays in gaining approval, and delayed project start. We make adjustments based on the historical evidence in order to estimate the impact of delays, which are set against the ticking clock in relation to estimates of credits generated by 2012, and which rapidly truncate the volume.

Projects officially 'in the pipeline' but not yet registered are likely to generate at least 400 $MtCO_2e$ CERs by 2012. In addition there is continuing inflow. New proposals for CDM projects submitted in the first ten months of 2008 averaged at least 50 $MtCO_2e$ (total CERs projected to 2012) per month. If current submission rates are maintained this could amount to further nameplate potential of around 800 $MtCO_2e$ for the CDM, but delivery by 2012 will, however, start to be cut off by the ticking clock, and new projects may be harder to finance given the post-2012 uncertainties combined with the credit crunch[14]. A reasonable estimate is that new arrivals into the pipeline will add another 200-300 $MtCO_2e$, bringing the total CDM estimate to 1,600 $MtCO_2$.

Any estimate of the number of CERs to be generated in the 2008-2012 period is clearly sensitive to the assumptions made around project performance, continued blockage in the pipeline, rates of validation and registration failure and project inflow. Our sensitivity studies suggest that the total possible range of CDM delivery could be between 1,400 and 1,800 $MtCO_2e$ (see Table 5 in section 8).

Including a wide range (150-300 $MtCO_2e$) of estimates for JI, the total plausible range of project credits by 2012 is thus 1,550-2,100 $MtCO_2e$.

Two other factors add to the overall supply:

- Although firm Green Investment Scheme sales to date are very small compared to the project mechanisms, they are gaining credibility and interest, and are set within the context of the much larger overhang of surplus allowances respectively in the new EU Member States, Ukraine, and the Russian surplus itself. Some estimates are presented in the next section. However with the key legislative steps in several countries completed, several hundred $MtCO_2e$ could be 'brought to market'.
- The Kyoto Protocol allows industrialised countries to offset their emissions against 'Removal Units' generated by domestic afforestation, reforestation and deforestation. Data on the likely contribution is difficult to establish, but an estimate by the EU's Working Group on Forest Sinks suggests a contribution in the EU of approximately 30 $MtCO_2e$/yr, or 150 $MtCO_2e$ over the Kyoto period, whilst the EU Environment Agency estimates 57 $MtCO_2e$/yr in the EU-15. A conservative range for 2008-12 across the relevant industrialised countries is 100-300 $MtCO_2e$[15].

The overall result is that supplies of all forms – excluding non-GIS forms of surplus AAUs – will fall in the range 2,000-4,300 $MtCO_2e$ out to 2012. We now consider the implications of these levels of supply for the global carbon market.

[14] There was no evidence of slowdown in CDM/JI project submission as of November 2008, as measured by cumulative projected savings to 2012. Until new rules are agreed for post-2012, the uncertainties may start to deter developers particularly for projects in which the emission credit sales form an important part of the economic returns. The contribution from new projects is most sensitive, however, to the assumption about delay from submission to first issuance, which can be at least 2 years or more. Such projects would, of course, deliver most of their emission savings post-2012.

[15] Annex to the Fourth National Communication from the European Community under the UNFCCC, SEC(2006) 138/2, available from unfccc.int/resource/docs/natc/eunce4add.pdf. This estimates a mitigation potential of 14 $MtCO_2eq$/yr for the period 2008-2012 from Afforestation, Reforestation and Deforestation, which when added to the estimated mitigation potential for Forest Management (capped at 19Mt CO_2/yr by the protocol) comes to 33 $MtCO_2$/yr. Land-use contributions in Japan, the transition economies, and Australasia are likely to be bigger.

8. Implications for the global carbon market

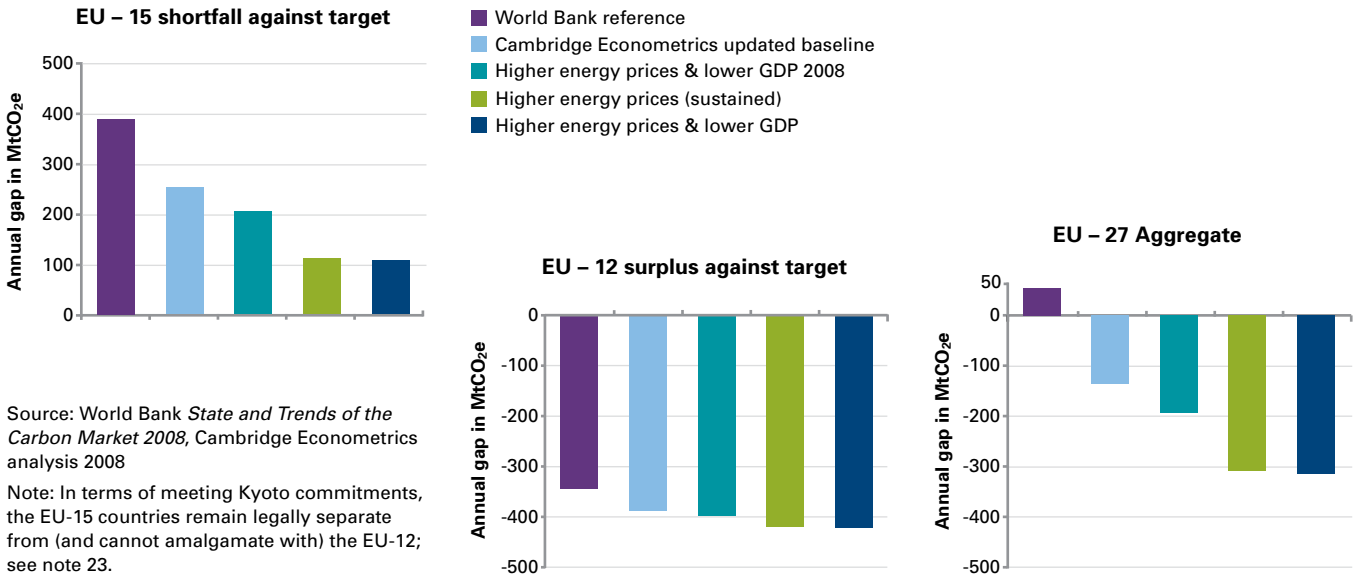
Demand for international emission units comes from both the private sector, and purchases by governments under the Kyoto Protocol. Both have been affected by the successful impact of domestic policies combined with the high fuel prices and credit crunch of 2008 – to levels well below the likely supply.

The private sector demand for emission credits comes mainly from companies in the EU ETS, together with Japanese companies complying with their negotiated targets, and smaller additions potentially from a few other nascent regulatory systems. These will be complemented by public purchases from governments which are falling short of their Kyoto targets, and thus need to acquire international units to comply with their international legal obligations. The World Bank 'Carbon Markets' report in 2008 estimated total demand of 2,435 $MtCO_2e$, with 60% of this being private sector demand from the EU ETS. Similar estimates have been reproduced in other market projections[16].

Re-evaluating the demand for Kyoto credits

There is, however, a long and consistent history of inflated industrial emission projections based upon classical approaches of estimating future levels of industrial activity and GDP[17]. These tend not to take account of policies being implemented to cut emissions; moreover, energy prices up to 2008 rose far beyond any expectations, driving changes in investments and attitudes that are unlikely to reverse quickly as prices fall; and the fallout from the credit crunch is likely also to have an impact on emissions. To check demand estimates against this background, the Carbon Trust commissioned Cambridge Econometrics to conduct a revised analysis using updated data, and to use econometric methods to explore the impact of recent developments on future trends, with a particular focus on the EU-15 countries (which account for around two thirds of expected demand), combined with offline estimates for Japan. The results in terms of aggregate annual average demand are summarised in Chart 14.

Chart 14 *Annual gap between emissions and Kyoto targets, average 2008-12 under different scenarios for the EU-15*



Source: World Bank *State and Trends of the Carbon Market 2008*, Cambridge Econometrics analysis 2008

Note: In terms of meeting Kyoto commitments, the EU-15 countries remain legally separate from (and cannot amalgamate with) the EU-12; see note 23.

[16] The *Société Générale* study states demand estimates over 2008-12 are 'stable at 2,400 $MtCO_2$'.

[17] A short review of evidence is contained in M. Grubb and F. Ferrario, *False Confidences: forecasting errors and emission caps in CO_2 trading systems (Climate Policy,* Vol.6 pp.495-501, 2006), and applied to debates about future carbon prices in Carbon prices in Phase III of the EU ETS, Climate Strategies briefing note, **www.climatestrategies.org**

The scenarios project emissions given a fixed EU ETS carbon price of €20/tCO_2 – below the trading price in Europe for much of 2008. The baseline estimate is that the EU-15 countries fall short of their Kyoto targets by about 250 $MtCO_2e$/yr, or 1,250 $MtCO_2e$ over 2008-12[18]. The impact of updating fuel prices and GDP to 2008 on its own – assuming everything then reverts to prior assumptions – reduces this to 1,000 $MtCO_2e$. However if energy prices stay at levels defined by oil at US$100/bbl, the net shortfall in EU-15 countries is just 600 $MtCO_2e$. Interestingly, the reduced GDP projections have very little impact on emissions. This is partly because the projection of high international energy prices itself reduces EU GDP, so the additional changes are not large; reduced GDP also implies less investment in efficient new capital stock, which offsets the reduced level of economic activity[19].

This represents a radical change compared to other estimates. This is not only due to updated data, but also reflects a different approach to the EU ETS. With updated data and a carbon price of €20/tCO_2, the Cambridge Econometrics study shows *no aggregate* shortfall in the EU ETS – for which an overall surplus cannot now entirely be ruled out[20]. This result is broadly consistent with applying updated data to our own earlier studies, since fuel price and GDP trends have both been at or beyond the extreme of the uncertainty ranges we considered in 2006[21]. These earlier studies also imply that a price slump from €20 to €10/tCO_2 over the period 2009-2012 might add around 250 $MtCO_2e$ to EU ETS demand compared to the 'baseline' estimate at €20/t CO_2[22].

All the other studies cited have simply assumed that demand for credits from the EU ETS is at the legally capped maximum 1,400 $MtCO_2e$. Our analysis shows that this bears no relationship to the actual need, based upon emission projections to 2012. The main need will be from government purchases for compliance with their Kyoto commitments. The combination of EU-15 governmental demand with plausible range of actual shortfall in the EU ETS suggests a range of 550-1,000 $MtCO_2e$ to 2012, or 550-1,250 Mt CO_2e if the upper end allows for the increased EU ETS demand if the carbon price falls to around €10/tCO_2. Estimates in the lower part of the range appear more plausible given economic and policy trends[23].

The offline estimates for Japan project that in the baseline case, Japanese emissions will remain at about current levels, 120 $MtCO_2e$/yr above their Kyoto target (approximately 600 $MtCO_2e$ total shortfall over the Kyoto period). Updating for 2008 energy prices alone cuts the shortfall by 20%; projecting energy prices forward at €100/bbl roughly halves it. These are crude estimates, not using direct modelling (see separate Technical Annex II).

[18] The Kyoto EU targets apply separately to the EU-15 countries as at time of ratification; the EU cannot count the surplus in the new Member States against this. The net demand from the EU ETS sectors in the new Member States is negligible, and in practice they may be aggregate sellers in the EU ETS.

[19] These results, however, reflect simple GDP adjustments; a fuller analysis would require considering the impact on the structure of the EU economy.

[20] Cambridge Econometrics' analysis of the EU ETS suggested that at the present price of €20/tCO_2, EU ETS emissions will remain below the EU ETS cap out to 2012. The average surplus would be 56 $MtCO_2$/yr in the base case, 70 $MtCO_2$/yr taking into account the price shock of 2008, and over 100 $MtCO_2$/yr if energy prices of €100/bbl are sustained.

[21] Carbon Trust (2007): EU ETS Phase II allocation: implications and lessons.

[22] The earlier study (note 21) found that a carbon price of €20/tCO_2 might cut emissions from the EU ETS sectors by more than 100 $MtCO_2$/yr – about 5%.

[23] Under the terms of the Kyoto Protocol, the EU-15 is treated as a 'bubble', which cannot simply add in the surplus from the New Member States. EU shortfall to 2012 is therefore a combination of overall EU-15 shortfall, but some adjustment for EU ETS demand from the New Member States. Scenarios with low emissions would indicate a likely surplus in EU ETS particularly in these countries. This informs our estimate drawing on the lower end of the Cambridge Econometrics range, which also does not fully reflect possible impact of energy efficiency and renewable energy policies to 2012. The lower end of our estimates is also supported, for example, by projections published in November 2008 by the European Environment Agency: for comparison see Technical Annex II: *Emission and demand projections to 2020* available from **www.climatestrategies.org**

Table 5 *Comparison of supply and demand balance (excluding banking) from various sources 2008-12*

Demand ($MtCO_2e$)	World Bank[1]	Point Carbon [2]	Société Générale[3]	Carbon Trust
European Union:	1,940	2,352	2,015	550-1,250[4,7]
EU-15 Governments	540	895	615	550-1,000
Private Sector EU ETS	1,400	1,413	1,400	0-250
Aviation EU ETS	-	44	-	
Japan:	450	803	250	300-500
Government	100	393	100	300-500[4]
Private Sector	350	410	150	-
Other (incl. Norway, Switzerland, Croatia, Australia and New Zealand):				
Government	20	80	35	40-80
Private Sector	25	2	-	
Other subtotal	**45**	**82**	**35**	**40-80[5]**
Canada*	-	-	-	-
TOTAL	**2,435**	**3,237**	**2,300**	**890-1,830**
Voluntary market	-	-	100	50-150[7]
TOTAL incl. voluntary	**2,435**	**3,237**	**2,400**	**940-1,980**

Supply ($MtCO_2e$)	World Bank[1]	Point Carbon[2]	Société Générale[3]	Carbon Trust
Potential surplus AAUs:	7,305	10,000	-	7,400-8,600
Russian Federation	3,330	6,000	-	3,500-4,000[5]
Ukraine	2,170	2,000	-	2,000-2,300[5]
EU-12**	1,720	2,000	-	1,900-2,300[6]
Potential GIS:	1,100-1,900	850-1,700		400-1,900
Russian Federation	-	-	-	-
Ukraine	1,000-1,200	Up to 1,000	-	100-1,200[5]
EU-12	100-700	Up to 730	-	300-700[5]
Land-Use Removal Units (RMUs):	-	-	-	100-300[5]
CDM and JI:	1,580-2,480	2,215	1,947	1,550-2,100
CDM (CERs)	1,400-2,200	1,936	1,697	1,400-1,800[5]
JI (ERUs)	180-280	279	250	150-300[5]
TOTAL	**2,680-4,380**	**3,065-3,915**	**1,947**	**2,050-4,300**
Voluntary market	-	-	-	[8]
TOTAL	**2,680-4,380**	**3,065-3,915**	**1,947**	**2,050-4,300**

* The position of Canada is unclear. The Harper Administration has not indicated intent to comply with its Kyoto obligations, but after the recent elections it remains unclear whether the Administration has sufficient support to withdraw from the Treaty. See note 24.

** To avoid confusion we use the term EU-12 to describe the New Member States, though the data do not include the very small role of Malta and Cyprus. Croatia is the only other east European country (other than Ukraine and Russia) that has a binding cap under Kyoto.

1 World Bank *State and Trends of the Carbon Market* May 2008 (excluding additional demand of 420 $MtCO_2e$ arising from uncertain policies and measures)

2 Point Carbon – Carbon Market Analyst *The Kyoto Balance: Saved by the AAUs* 18 September 2008. Note that Point Carbon treat Land-Use Removal Units as a reduction in demand.

3 *Société Générale* – Global Commodities Special July 2008 *European CO_2 Market.*

4 Cambridge Econometrics analysis for the Carbon Trust. Low end range for demand takes account of sustained high energy prices and low GDP growth. High end range for demand is baseline case.

5 Carbon Trust analysis, using input from Climate Strategies and own calculations from UNFCCC and other sources.

6 Cambridge Econometrics analysis for the Carbon Trust along with Carbon Trust analysis using inputs from Climate Strategies and own calculations from UNFCCC and other sources. For details of these and related data see Technical Annex II: *Emission and demand projections to 2020*, available from **www.climatestrategies.org**

7 Higher levels of private sector demand (EU ETS and voluntary market) conditional upon carbon prices falling to about €10/tCO_2.

8 Credits from voluntary market cannot be used for compliance with legal obligations.

Implications for 2008-12 market balance

Table 5 summarises the overall implications. At a carbon price of €20/tCO_2, the maximum government demand for Kyoto credits in all forms will be just short of 1,600 MtCO_2e, if energy prices decline back to the levels projected a few years earlier (oil at about $40/bbl), or below 1,000 MtCO_2e, if they average close to $100/bbl. This does not distinguish between private and government demand in Japan, and we see little prospect of net demand from the EU ETS or voluntary sectors at carbon prices of €20/tCO_2. We thus see few credible scenarios in which the gap between emissions and Kyoto targets out to 2012, at a price of €20/tCO_2, remotely matches the level of assured supply from the project mechanisms.

Additional supplies (from GIS and land-use Removal Units) further increase the supply overhang. These are relevant only to the intergovernmental Kyoto balance, and cannot be used by companies, for example under the EU ETS. However the conclusion is just as stark for the private sector considered on its own. Individual facilities may need to purchase allowances, but the shortfall in the private sector is clearly far smaller than the supply of CDM and JI credits which it can access.

The dynamics between private and public sector demand could be important. Since government demand is a crucial part of the balance, the government supply of surplus Kyoto allowances is relevant. And government demand is different. It is, quite properly, the result of political process, not a purely economic one, and two factors will drive some governments towards purchasing Kyoto allowances through GIS. Austria is a clear example. Burgeoning transport, due to rising trade and tourism with the New Member States that surround it, has combined with other factors including a very limited domestic climate programme, to drive up emissions way beyond its Kyoto target. Austria has close political relations with many of the New Member States and not surprisingly has strong interest in their emerging Green Investment Scheme proposals. It would seem politically implausible that Austria would try to meet all its needs through purchasing CDM and JI credits, if credible GIS schemes offered allowances at much lower cost. These factors in themselves will exert strong downward pressure on CDM and JI credit prices, as governments increasingly focus on their compliance needs in practice, and ask why they should be expected to eschew cheaper options for compliance, if they are just as environmentally credible.

Quite simply, most plausible scenarios now deliver a large surplus of aggregate supply compared to the plausible shortfall. At a carbon price of €20/tCO_2, the gap is so big that even a large fall in carbon prices could not close it. That leaves a major puzzle: why did the EU ETS price remain around €20/tCO_2 for most of 2008, with most studies projecting increase? Reasons include the fact that most market studies have included government demand but ignored government supply from land-use and GIS; and the fact that the impact of higher energy prices and lower expected GDP growth has yet to feed through sufficiently to market analysis. There are, however, other factors.

Carbon pricing dynamics, the EU ETS and banking

The estimates in the table refer to aggregate supply and demand over 2008-12, which is the period for national compliance with targets under the Kyoto Protocol's first commitment period. Outside of this, three other factors could explain continued high prices during 2008:

- EU ETS participants require credits to comply during 2008, and even the CDM was only at the earliest stage of actually issuing verified, certified emission reduction credits. Any shortfall of needs for compliance with 2008 obligations under the EU ETS could drive transitional demand whilst supplies remain limited.
- The market may not have confidence in such a dramatic turnaround until verified data on 2008 emissions – national, and EU ETS under the first year of Phase II – are revealed, likely to be in Spring 2009.
- Allowances still have a value because EU ETS allowances, and national AAUs under the Kyoto Protocol, can be banked forward for use post-2012.

The first two are transitional. Under the EU ETS, companies have to balance emissions and allowances annually, and most EU governments have committed to issue EUAs equally across the five years. An overall global surplus to 2012 may thus not be incompatible with high EU ETS prices, feeding through to the global carbon mechanisms, in the early years, before credit supplies from the Mechanisms have accumulated.

However, a decline in EU ETS prices towards the end of 2008 suggests that companies overall reduced emissions enough in 2008 to comply on the basis of the limited credit purchases made by then. Companies can 'borrow' between years in the EU ETS since allowances for each year are issued before accounts for the previous year have to be settled. Moreover the gathering economic recession, and falling fuel prices, make it less likely that the market will 'shorten' during 2009. The situation may become clearer with EU ETS verification reports in April 2009, but we consider it unlikely that the 2009 balance – and by implication prices – will diverge fundamentally from the basic pattern of net surplus indicated in the table.

The ability to bank forward post-2012 is not transitional, but as a support for prices it depends on faith that cutbacks post-2012 will be substantial enough to drive up carbon prices again, to levels that make it worth EU ETS companies deliberately buying project credits, leaving them surplus EU allowances to bank post-2012. The potential entry of voluntary market demand for the regulated (and thus more credible) compliance units, as discussed in section 12, could also help, but only if and as their prices fall towards the much lower levels in the voluntary sector.

In other words, the private market during 2009 may be sustained only by the prospect of 'jam tomorrow' – four or more years hence – that itself depends upon a strong global deal. However, as discussed in the next section, such a deal will itself have to absorb a large built-in supply of allowances, and the markets will have twice experienced the consequences of inadequate cutbacks – in the first phase of the EU ETS, and the first phase of the global carbon mechanisms. The private sector may thus be reluctant to risk much on the prospects for a sufficiently tough post-2012 deal, making it hard to sustain prices through this route. The evidence suggests that in the absence of intervention, prices could average below €10/tCO_2 until such a deal is completed, though they could also be highly volatile as perceptions of the political prospects fluctuate.

The EU ETS Phase I experience occurred partly because companies delivered more emission reductions than expected, but with strong suspicions also that allocations exceeded legitimate needs. The shakeout in the global carbon mechanisms will, ultimately, reflect the fact that the volume of response has exceeded all expectations, and that – combined with the absence of the United States (and maybe Canada) – the Kyoto targets have for many countries proved less challenging than expected. The Kyoto system risks being a victim of its own success, but the market players – and potentially its reputation – could be victims nonetheless. The question in 2009 may be what, if anything, should be done to sustain the market.

Policy options

Any downward correction in international carbon prices (through both the EU ETS and the global mechanisms) throughout 2009 could have serious consequences, both for individual companies and projects, and more broadly for confidence in the Mechanisms. When added to the experience of the EU ETS Phase 1, it may also seriously undermine the confidence of markets about the ability of governments to set targets that drive significant prices.

Consequently, if the analysis above does indeed prove to be robust, governments may wish to consider options for sustaining a more significant carbon price during 2009. The options depend upon which governments are willing to act, and how.

The most obvious step would relate to Canada, which is faced with an emissions gap almost as big as Spain's. Its approach to addressing this gap is currently unclear.[24]

[24] In 2005 the annual shortfall relative to Kyoto targets was about 25% in both Canada (186 MtCO_2e, 25% of their current emission levels) and Spain (110 MtCO_2e, also 25% of current levels). Japan's shortfall was 164 MtCO_2 (12% of current levels). Under the Kyoto Protocol, compliance measures include that a country which exceeds its target will have the difference x 1.3 deducted from allowed emissions in the next period. The 'enforcement branch' of the Kyoto Protocol compliance system cannot formally act until compliance reports are assessed, in 2014. However, countries in difficulty can notify the 'facilitative branch' of the system and seek assistance.

If Canada were to stabilise emission levels domestically, it would have to purchase about 500-600 $MtCO_2e$ of emission credits over the Kyoto period. Assuming that the government would eschew 'hot air' purchases, new demand of this magnitude – coupled with the signal it would send in terms of the expected legal integrity of any future commitments – would clearly make a huge difference to the global balance and help to restore the global carbon price to significant levels during 2009.

There are, however, some other options that other governments could consider, and different options have different consequences. The present focus of EU policy to protect its post-2012 package from excessive imports can help to sustain EU ETS prices and domestic action. However, it does largely isolate the EU system from the global mechanisms and this would further depress the *international* price. To support near-term prices more broadly, the main options would appear to be:

- Leading industrialised countries could retire emission units (or buy units specifically for retirement) without using them for compliance. However, the direct cost this would imply, potentially on those countries already bearing the principal costs, makes it look politically very difficult at a time of looming recession, particularly given the apparent Canadian position of not complying with its existing commitments.
- Governments could commit to bank some of their present Kyoto allowances post-2012 to increase demand in the present period; however, this would add further to the level of post-2012 supply.
- A reserve price set on forthcoming auctions of EU ETS allowances (dominated by the UK and Germany) could help to sustain EU ETS prices. If governments retired the unused allowances, this would tighten the EU ETS and increase overall private sector demand.
- Those countries with surplus (notably the transition countries) could soften the impact by voluntarily cancelling some, or all, of their surplus. However this in itself is a rather indirect mechanism since it acts only on perceptions of the post-2012 balance.
- Early commitments by key countries to steeper cutbacks post-2012, in advance of a global agreement, would send the strongest and most consistent signals but still only provide a partial solution, again because of the indirect nature of the linkage. A declaration by the new United States Administration of this nature could have a particularly powerful impact, both in terms of its scale and the political signals this would send.

Finally there are in principle options on the supply side, to restrict or raise the price of credits, in which China would clearly be the only country big enough to make a substantial difference.

None of these options look easy, but without them, 2009 may be a very tough year for those who have invested in the world's carbon markets to date.

9. Supply post-2012

The implications of developments in the present period for future supply have received little attention. This has to change.

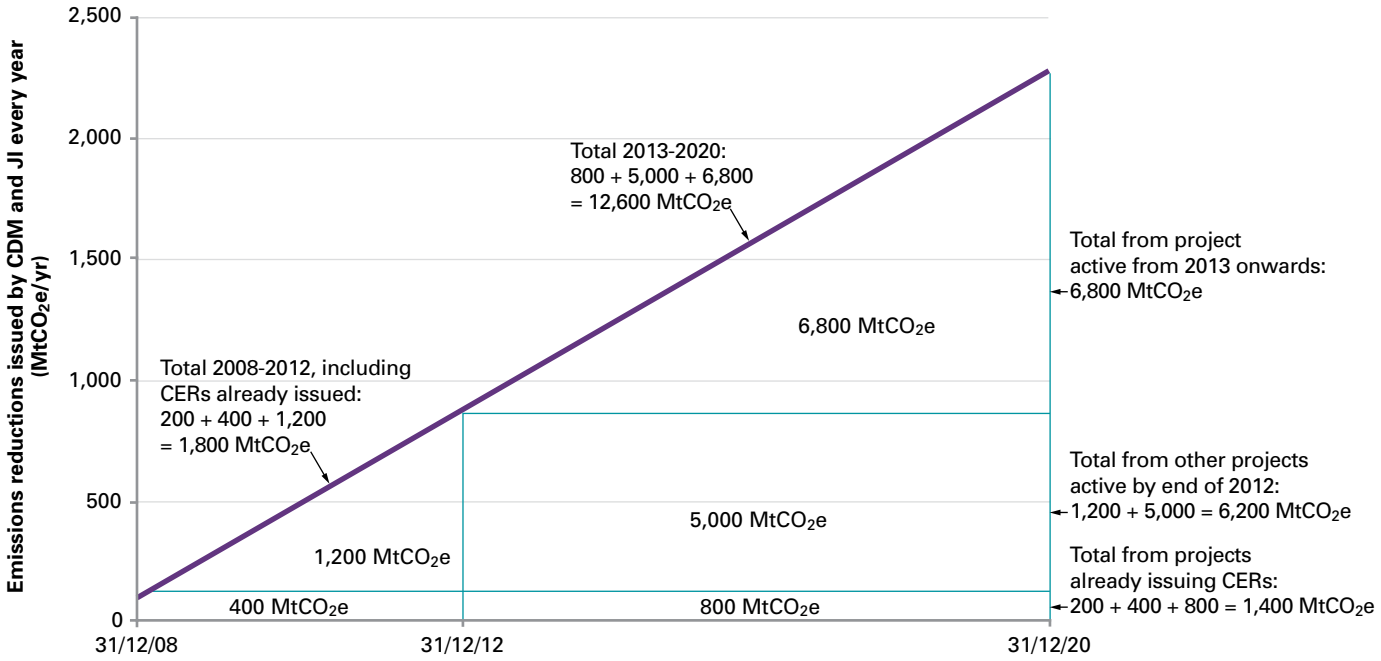
The biggest single lesson from the experience of carbon markets to date is that they hinge on a balance of supply and demand. This is obvious, and yet little attention has been given to the obvious corollary – if the global carbon mechanisms are to continue post-2012, the emission commitments that are expected to drive global decarbonisation need to be set against an understanding of likely supply.

Chart 15 illustrates the implications if the recent pace of inflow to the project mechanisms were to continue out to 2020. Roughly, each year since 2006 has seen an inflow of projects, across the CDM and JI, that is expected to save at least 190 $MtCO_2e$/yr, after taking account of expected delivery shortfalls. Most of the emission savings from this ongoing project flow will be delivered after 2012, and indeed many of the existing projects will continue to deliver long after 2012[25]. The chart illustrates that if these projects continue to accumulate at the same pace throughout the period, the total emission savings over 2013-2020 would be at least 10 $GtCO_2e$, divided roughly equally between projects that start operating before and after the end of 2012.

Of course, this is simplistic. About one quarter of the emission savings from CDM projects so far registered have a single guaranteed 10-year crediting period; those projects that have started generating CERs before 2010 will thus cease to do so before 2020. The other three quarters of savings arise from projects that have opted for successive 7-year crediting periods, subject to two renewal reviews; their future crediting level is uncertain. However, given that the volume that started before 2008 is relatively trivial, the drop-off overall from these factors will be relatively modest.

It is also possible that the rate of inflow will slow down – indeed it could decline sharply in the face of the credit crunch combined with uncertainties about post-2012 rules. However, this view becomes self-contradictory as a way of reassuring investors and analysts that the carbon market post-2012 can sustain a good price – investor confidence can hardly be maintained by arguing that a principal factor supporting future prices will be a collapse of ongoing investment.

Chart 15 *Projected emissions savings from CDM and JI by 2020 if project inflow continues at recent pace*



Source: team analysis using data from UNEP Risoe as at 1st November 2008

[25] The CDM allows projects to receive credits either for a single 10-year period, or for a 7-year period with renewal. The renewal provisions have yet to be tested.

A subtly different argument is that the rate of expansion in 2007-8 in particular is unsustainable, because it drew heavily on 'one-off' options like the industrial gas projects that will no longer be available. However, set against this is the possibility of new frontiers. We have already noted that a wider range of mechanisms would unearth a wider range of project and programme types. And key options – like CCS, nuclear and most land-use activities – are currently excluded. There are few pressures to narrow the scope further; and quite understandably there are many trying to broaden it to include a wider range of mitigation options.

For example, avoiding deforestation offers a seemingly obvious, and potentially low cost way of cutting emissions, if the finance can be made available and targeted effectively. A UK government review recommends that the global effort on land-use should be linked to the global carbon markets, and estimates that forest sector abatement in developing countries could generate 3.6 $GtCO_2$ savings annually by 2030, of which almost 1 $GtCO_2$/yr would actually be reforestation[26]. One of the many challenges is clarifying who would be buying at such scales.

Finally, a considered analysis of the ultimate scale of the challenge – as outlined in section 13 of this report – leads inexorably to the conclusion that the kind of expansion sketched in Chart 15 is the minimum required to actually move us towards the objective of getting on a path towards stabilising the atmosphere without unacceptable risks. In short, if the final deal on post-2012 is to be considered a success, it surely has to plan for expansion of overall project flow, not contraction. This – however derived – implies at least 10 $GtCO_2e$ emission reductions from project mechanisms in the period 2013-20.

Under the present provisions of the Kyoto Protocol, the surplus in the eastern European countries, Russia and Ukraine can be banked into Kyoto's second period. Table 5 has indicated our best estimates, that this will amount to at least 7,500 $GtCO_2e$. Politically it is not easy at present to see why this region – which has already demonstrated is political muscle around Kyoto ratification – would sign up to a deal that simply cancelled its surplus.

Chart 16 sets out the overall picture, within which the present contribution of the Mechanisms is seen to be very modest compared to the huge volumes potentially available to 2020. The total of around 20 $GtCO_2e$ equates to roughly the total annual emissions of the entire industrialised world, including all of North America, Russia and Ukraine. It is a vast amount of credits and allowances to be absorbed by stronger commitments that have yet to be negotiated[27].

The most troubling aspect, however, is that at present the negotiations have little or no process or institutional basis for conducting an integrated analysis that can set decisions that influence supply against the cutbacks that would have to drive purchases. Many have proposals for adding to supplies; but in the absence of corresponding cutbacks to provide an integrated picture, these will simply depress the price rather than drive additional actions.

All these issues combined will also underline questions about how much of the projected emission savings are real[28]. In terms of volume, the Kyoto system may risk being a victim of its own success, but this will just sharpen an underlying debate, which the rest of this report considers: how good are the Mechanisms?

[26] *Climate Change: financing global forests* (Eliasch Review, HMSO 2008), Chapter 11.

[27] The UNFCCC update report on financial flows ('Identifying, analysing and assessing existing and potential new financing resources and relevant vehicles to support the development, deployment diffusion and transfer of environmentally sound technologies', FCCC/S B/2008/INF.7, 20 Nov 2008) projects that the likely demand for emission reduction credits in 2020 to be in the order of 0.5 to 1.7 $GtCO_2$/yr.

[28] In practice this is a close parallel, since credits are issued in terms of the gap between actual emissions and the projected 'without project' baseline.

Chart 16 *Potential supplies of credits and allowances from Global Carbon Mechanisms 2008-2020*

Developing World

Clean Development Mechanism (CDM)

- **Additional potential delivery 2013-2020 from projects active from 2013 onwards**
  Estimated delivery of CERs in the period 2013-2020, arising from new projects starting to generate credits from January 2013, based on historical inflow and delivery rates
- **Additional potential delivery 2013-2020 from projects already active by end of 2012**
  Estimated delivery of CERs in the period 2013-2020, arising from projects in the four categories described below – i.e. those that are anticipated to have already started to generate credits before the end of 2012
- **Future projects**
  Estimated delivery of CERs by 2012, associated with future project submissions, based on extrapolation of current submission rates
- **Pre-registration**
  Estimated delivery of CERs by 2012, as projected in the PDDs of projects that were not registered by the Executive Board as at 1st November 2008, but had begun the validation process with a DOE (defined as the commencement of the public comment period) or had made a submission for registration to the Executive Board
- **Registered**
  Estimated delivery of CERs by 2012, as projected in the PDDs of projects registered with the Executive Board as at 1st November 2008, and excluding CERs already issued
- **Issued**
  Total of CERs issued as at 1st November 2008

Industrialised World

AAU surplus and Green Investment Schemes (GIS)

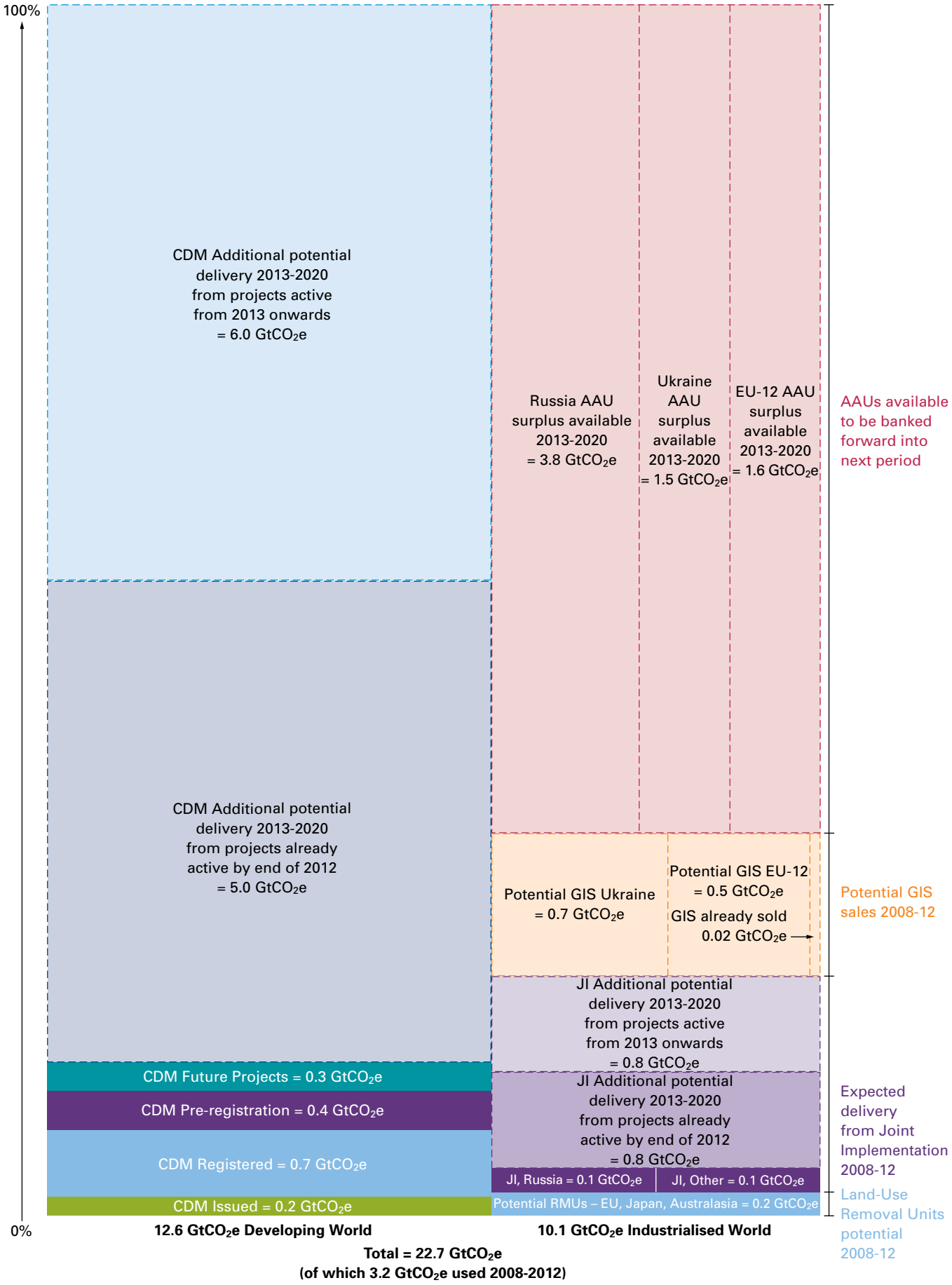
- **AAU surplus available 2013-2020**
  Estimate of surplus of AAUs available to bank 2013-2020, based on difference between agreed national Kyoto caps and current estimates of emissions, excluding any AAUs expected to be traded through GIS
- **Potential GIS 2008-2012**
  Estimated potential sales of surplus AAUs through Green Investment Schemes in the period 2008-2012. Includes any GIS already sold, as based on announced intentions to sell by individual countries as at the time of writing

Joint Implementation (JI)

- **Additional potential delivery 2013-2020 from projects active from 2013 onwards**
  Estimated delivery of ERUs in the period 2013-2020, arising from new projects starting to generate credits from January 2013, based on historical inflow and estimated delivery rates
- **Additional potential delivery 2013-2020 from projects already active by end of 2012**
  Estimated delivery of ERUs in the period 2013-2020, arising from projects in the category described below – i.e. those that are anticipated to have already started to generate credits before the end of 2012
- **JI expected delivery 2008-2012**
  Estimated delivery of ERUs by 2012, as projected in the PDDs of projects that, as at 1st November 2008 were registered, or had begun the determination process (defined as the commencement of the public comment period) or had made a submission for registration

Land-Use Removal Units 2008-2012 (RMUs)

- **Potential RMUs 2008-2012**
  Estimated mitigation potential in the EU for the period 2008-2012 from Afforestation, Reforestation and Deforestation from UNFCCC data and estimated mitigation potential for forest management, plus land-use contributions from elsewhere in the world.


100%
0%
CDM Additional potential delivery 2013-2020 from projects active from 2013 onwards = 6.0 GtCO2e
CDM Additional potential delivery 2013-2020 from projects already active by end of 2012 = 5.0 GtCO2e
CDM Future Projects = 0.3 GtCO2e
CDM Pre-registration = 0.4 GtCO2e
CDM Registered = 0.7 GtCO2e
CDM Issued = 0.2 GtCO2e
Russia AAU surplus available 2013-2020 = 3.8 GtCO2e
Ukraine AAU surplus available 2013-2020 = 1.5 GtCO2e
EU-12 AAU surplus available 2013-2020 = 1.6 GtCO2e
AAUs available to be banked forward into next period
Potential GIS Ukraine = 0.7 GtCO2e
Potential GIS EU-12 = 0.5 GtCO2e
GIS already sold 0.02 GtCO2e
Potential GIS sales 2008-12
JI Additional potential delivery 2013-2020 from projects active from 2013 onwards = 0.8 GtCO2e
JI Additional potential delivery 2013-2020 from projects already active by end of 2012 = 0.8 GtCO2e
JI, Russia = 0.1 GtCO2e
JI, Other = 0.1 GtCO2e
Potential RMUs – EU, Japan, Australasia = 0.2 GtCO2e
Expected delivery from Joint Implementation 2008-12
Land-Use Removal Units potential 2008-12
12.6 GtCO2e Developing World
10.1 GtCO2e Industrialised World
Total = 22.7 GtCO2e
(of which 3.2 GtCO2e used 2008-2012)

Part III: How good (or bad) are the Mechanisms?

This section turns from explaining (Part I) and analysing the quantitative performance (Part II) of the Mechanisms, to consider a more fundamental question: how good are the Mechanisms? What do they deliver, and how efficiently, compared to other possible alternatives? And what might this imply for their future development?

10. Are credited emission savings real?

Whether emission credits generated under the project mechanisms represent real and 'additional' emission savings, compared to what would have happened anyway, was always going to be thorny to assess. Time has not made it easier.

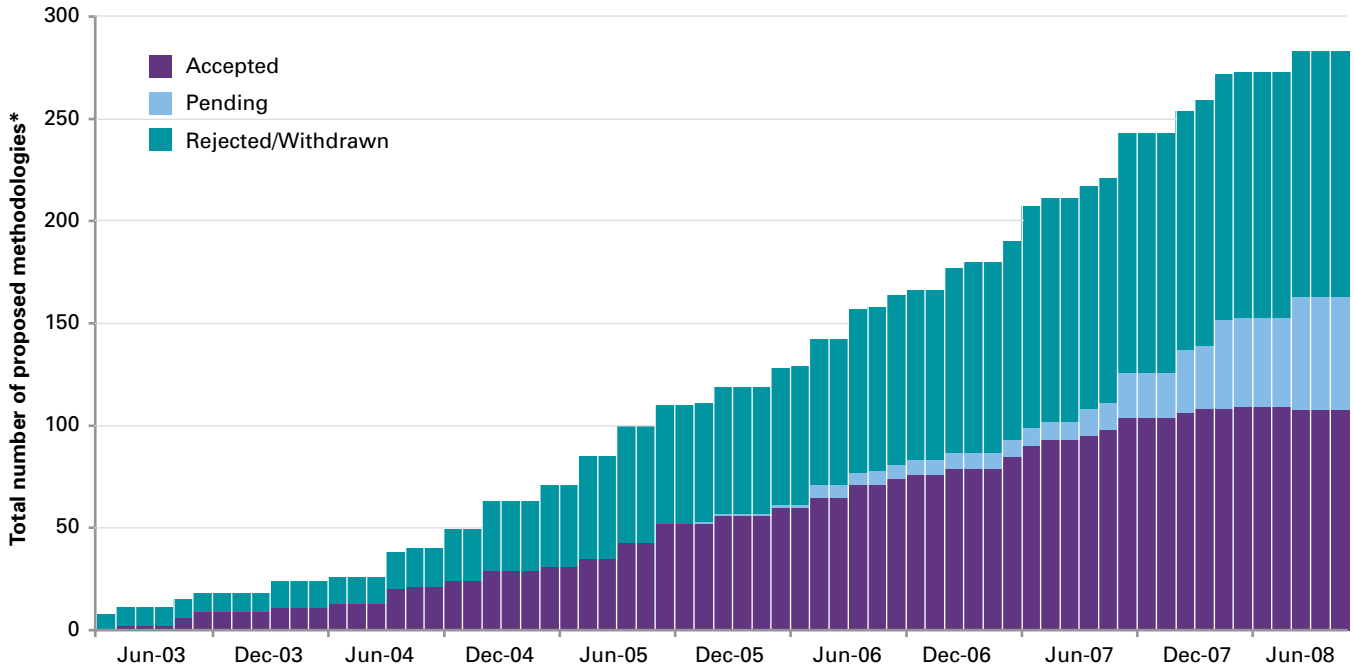
A tough assignment

The selection and crediting of CDM projects under the Kyoto Protocol is governed by the principles that they should contribute to sustainable development, and deliver 'real, measurable and long-term benefits related to the mitigation of climate change', including emission reductions that are 'additional to any that would occur in the absence of the certified project activity'. The contribution to wider sustainable development is left to host countries to determine. Interpreting and implementing the additionality of emission savings from CDM projects is governed through the decisions and processes subsequently established by the 10-person CDM Executive Board (see section 2). Amongst its first actions was to establish a generic 'tool for the demonstration and assessment of additionality', setting out the basic steps that need to be followed. This covers the assessment of: alternatives to the project activity; financial and other barriers; and of the extent to which the technology is already in use in the relevant area.

Over subsequent years, a deeply technical debate ensued about how to establish additionality. This resulted in a series of methodologies to assess the emissions reductions from, and additionality of, different kinds of projects. An indication of the complexity of the issue is the number of different project methodologies considered: more than 250 have been officially proposed, with more than a hundred different methodologies accepted and many still pending (Chart 17).

The Executive Board was initially grossly under-staffed and under-resourced; demonstrating additionality takes time and money. The Board carried a huge workload and made many innovations in response to the demands of the system, which directly contributed to the extraordinary success of the CDM in terms of project flow.

Chart 17 *Number of accepted and proposed methodologies for baseline and monitoring under CDM*



* Excluding additional 16 proposed Small Scale and 37 proposed Afforestation/Reforestation methodologies.
Source: UNEP Risoe database November 2008

Note: Shows cumulative accepted, proposed and rejected methodologies for baseline and monitoring under CDM, based on submissions to the Executive Board. JI projects may also make use of approved CDM methodologies.

Box 3 *Intrinsic difficulties in assessing additionality of emissions savings from offset (CDM and JI) projects – an old warning*

"The problem of defining and measuring the 'additional' emission savings arising from a CDM project, as compared with what would have happened otherwise, is an Achilles' heel. The fundamental difficulty is having to estimate emission savings relative to a 'baseline' estimate of 'what would have happened without the project', that is by definition unobservable. For some kinds of projects that is easy... but these are exceptions, rather than the norm...

The reasons for this are basically simple: the future is uncertain and decision makers are human. Businesses make their money by exercising managerial judgment in the face of uncertainty... is the bureaucracy of the CDM really supposed to assess competing claims about long-term project viability that depend upon perhaps confidential projections of costs and performance, and inherently unknown prices?

There may be also the vicious paradox that the more cost-effective the project, the more uncertain the additionality... any project that would only require a small incremental benefit (such as a CER at low cost) to make it proceed would also only require a small shift in market conditions to make it viable without crediting. This problem is less stark if there is consensus to credit projects which are 'cost-effective' but which clearly would not otherwise be implemented due to other barriers; but it is enough to throw a big question mark over the supposition that the CDM should be explicitly oriented towards 'least cost'...

Another danger of the conventional approach to 'additionality' is that it gives perverse policy incentives. Environmentally sustainable projects are least likely where the policy environment is least encouraging to them. Therefore, additionality is greatest, and most easy to prove, in the worst policy environments; this is hardly something one would wish the CDM to encourage.

A final observation is that market conditions evolve. Particularly since the world is supposed to be moving towards sustainable development, one would expect lower-emitting projects to become intrinsically more attractive over time. This indeed is the case in many respects: the cost of natural gas and of renewable energy sources, for example, is generally declining relative to coal-based power, and 'clean coal' technologies are also improving. Similarly, it is obvious that most cities will have to develop and improve public transport infrastructure; this will have the side-effect of reducing greenhouse gases. The most that can be said in many cases is that crediting under the CDM might enable certain kinds of projects to proceed earlier than they otherwise would have."

Source: Grubb, Brack and Vrolijk (1999), *The Kyoto Protocol: a guide and assessment,* Chatham House/Earthscan, Chapter 7: The Clean Development Mechanism.

Despite this, experience highlights the fundamental nature of the challenge of seeking 'additionality' in emission savings, as was flagged more than a decade earlier (see Box 3). For some classes of projects, it proved easy to demonstrate at project level: fitting equipment to remove HFCs and N_2O from industrial projects would clearly not happen without some incentive to do so. Some low-carbon electricity supply projects have been implemented which clearly displace coal-powered generation.

However, the *Climate Strategies* review of projects discussed in section 6 did find cases of approved projects which could be debated in each of the most important steps of the additionality assessment (barrier analysis, investment analysis, common practice analysis, demonstration of the impacts of CDM registration). Many design documents did not have independent evidence to support the assessment of additionality. The issue is not which assessment is correct, but rather that the task is inherently one requiring judgement. Additionality in practice cannot match the black-and-white ideal that credits should only go to projects that result in proven additional emission savings.

A common thread in many approved projects was citing barriers to investment that CDM finance could help to overcome. Maturing capital markets in the countries studied should have helped to ease the investment barrier on which many were justified – though the impact of the credit crunch may set things back.

Rejected projects had tended to rely more on arguments around other barriers, particularly after the Executive Board underlined that citing barriers was not sufficient: the case has to show why CDM credits would help to overcome the barriers, and many did not and were consequently rejected.

Overall, the dilemma of assessing additionality is a bit like the balance of evidence in a legal system. Certainty is rare; a high standard of proof risks letting some criminals go free, but lower standards risk innocent people being convicted. The higher the standard of proof on project additionality, the more good emission savings projects may be rejected or deterred. Ironically though, it appears that assessing additionality of emission savings has if anything become harder over time, for several reasons.

Progress and policy

Few projects can now be simply rejected as having been initiated before the CDM. As word of the CDM spread, more project developers applied with a wider range of projects. With the CDM in full flood, it has become harder to identify projects which unambiguously would (or would not) have happened without it.

Moreover, time and success have themselves changed the context. For example, many Brazilian CDM projects use bagasse – the waste from the sugar cane industry – to fuel high-efficiency cogeneration plants. In this respect the CDM has succeeded wildly beyond the impact of a decade of World Bank efforts in the 1990s to encourage the technology. Indeed the CDM has proved so successful that using bagasse for co-generation has now become the norm in Brazil. This in turn raises the question, 'when does the prevalence of CDM projects change the baseline?'[29]. If it is now common practice – thanks to the CDM – does this mean that new projects cease to be additional? Some proposals for changing the rules, outlined in the next section, would automatically cease when a project type reaches a defined market share.

The Asian experience sheds light on another potential dilemma, namely that of perverse policy incentives (see Box 4). To negate the potential perverse incentive either to adopt bad policies (to inflate baseline emissions), or to eschew good ones (which could make low-carbon projects happen in the absence of the CDM), in 2004 the Executive Board adopted the principle that:

- Policy changes that drive up baseline emissions ('E+') could not be counted in the baseline if they were implemented after adoption of the Kyoto Protocol.
- Policy changes that give positive comparative advantages to less emissions-intensive technologies ('E-'), and that have been implemented since the adoption of the Marrakech Accords in 2001 (that defined the rules for implementing the Kyoto Protocol), need not be taken into account.

Countries thus cannot generate more credits by making bad policy, and emission-reduction policies do not reduce CDM credits because 'the baseline scenario should refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place'.

China's ambitious programmes for renewable energy clearly fall into the latter category. They have helped to stimulate a huge surge of wind and small hydro power projects, which under the 'E-' rule are generally considered additional. Critics argue that given these policies would have happened without the CDM, and some might even have happened without China's renewable energy support policies (particularly given the surge in coal prices). Whether and how to draw the line is of course a matter of judgement.

'Environmental integrity' across the CDM

This also complicates a macro-level assessment of the overall additional emission savings from the CDM. The 'retrofit' projects for industrial gases and landfill waste are clearly additional. The scale of renewable energy credits from India and China is now the critical determinant; in recent years almost all hydro, wind and other renewable energy projects have applied for CDM credits. If these are all considered additional – on the basis of the E- rules and a judgement that in the absence of supportive policies, coal would be the default power source – the overall emission savings from the CDM are probably close to the credited level. Critics contend that renewable energy would be pursued anyway in these countries (though perhaps not at such a scale) from which perspective the truly additional savings from the CDM may be only 70-80% of that actually credited.

[29] Discussion of examples in this section from Climate Strategies (2008): A. Michaelowa and P. Castro, *Empirical analysis of performance of CDM projects*, **www.climatestrategies.org**. Specific citation p.48. The Executive Board decision on the E+/E- rules, that were accompanied by similar rulings on sectoral regulations ('L+/L-') are in http://cdm.unfccc.int/EB/016/eb16repan3.pdf

This still, however, represents a major achievement, compared to a default of no incentives for emission savings in the developing world. Moreover, by contributing to the development of whole industry sectors – notably renewable energy industries in Asia – the CDM over the longer term may have generated valuable spillover effects with an enduring legacy. The wider contribution to sustainable development remains debated, though the growth of renewable energy industries and improved industrial energy efficiency must be broadly positive. The CDM, through various channels, is also likely to reduce potential carbon leakage from industrialised countries[30].

Given all the complexities noted, an institutional capacity to learn is essential, and this requires flexibility; demonstrating this implies changes. Yet change implies the possibility that decisions will not be fully consistent over time. Apparent lack of consistency has now become one of the major complaints of business in dealing with the system – and such concerns will hardly be softened by an unprecedented number of project rejections at a recent meeting of the Executive Board.

… and across the other Mechanisms

Joint Implementation has a different institutional process – which places more onus upon issuing governments and less on the Joint Implementation Supervisory Committee (JISC) – but the experience to date reveals similar dilemmas, particularly with respect to the huge volume of methane capture projects now proposed. These projects clearly reduce emissions. They also clearly yield overall economic benefits, as the value of gas saved, at least on the international market, greatly exceeds the cost of plugging leaks in distribution systems. Yet the projects haven't happened before because the benefits go to the gas producer, rather than the distribution companies. Under a more efficient regulatory structure, the projects should happen anyway. The JISC has so far judged – probably correctly – that the projects are providing additional emission savings compared to what would have happened otherwise. An extension of the CDM's 'E+/E-' rules to JI would imply such projects could receive credits even if, for example, Russia acts to remove the regulatory barriers that currently impede such projects.

Since in theory national emissions in 'transition economies' are capped under Kyoto, this shouldn't matter anyway; but in practice given their surplus of allowances, it could. However, this also brings in the role of Green Investment Schemes, which have emerged to date as the only way that any of these countries have actually been able to sell any of their surplus allowances. These schemes lie at the opposite of the process from the strict Executive Board oversight of the CDM, in that there is no multilateral oversight at all, beyond verification of the Assigned Amount Units and their international exchange. In practice, this has slowed down GIS schemes, not speeded them up, as explained in Part I.

Intergovernmental emissions sales implemented through Green Investment Schemes face no formal need to demonstrate that they yield 'additional' emission savings, and they can rely on the criteria and monitoring regimes that the participants deem appropriate. This enables them to 'reach the parts' that other mechanisms cannot – most strikingly, with respect to energy efficiency in buildings and transport, and land-use/bioenergy projects. Moreover, a critical difference is the ability of GIS schemes to leverage the banking of emission allowances over time. This gives far greater flexibility to use carbon finance in more imaginative ways, and for longer-term programmes and infrastructure-related projects whose main environmental benefits may accrue over years or even decades.

The remarkable lack of attention given to Green Investment Schemes to date probably reflects the fact that the allowances cannot be used by companies under the EU ETS, which has to date been the main driver of the global carbon market. That driver is likely to change. GIS programmes could yet prove to be an important long-term product of the Kyoto Protocol, with implications above and beyond the current schemes.

[30] Steffen Kallbekken, *Why the CDM will reduce carbon leakage*, Climate Policy vol.7 no.3 pp.197-211. This study estimates that the global carbon mechanisms halve the scale of potential carbon leakage.

The surplus behind GIS may not be just a one-off phenomenon of the post-communist transition. It cannot be assumed that future negotiations would result in caps that turn out to bind on all countries, given intrinsic uncertainties; and new entrants to emission caps post-2012 (such as South Korea) may be particularly cautious about their first round of commitments. Indeed the general question of whether and how other countries trade surplus allowances arising in part from domestic policies (such as in the UK) remains to be determined.

In addition, the GIS experience could offer valuable insights into the design of some proposals for expanding the scope of (or for complementary instruments to) the CDM, such as 'sectoral crediting' against an aggregate baseline – which like national commitments, could turn out to be inflated if economic trends change.

Moreover, for all of the attention given to 'sustainable development' as a (host country) criterion for CDM projects, government-driven GIS schemes are showing far greater potential to really factor in such wider considerations to programme design from the outset. GIS programmes are emerging not just as a way to reduce emissions, but as a way to use carbon finance to drive structurally cleaner and greener investment programmes in the transition economies, which in some cases address other concerns, such as 'fuel poverty' in building efficiency programmes.

However, GIS schemes are in their infancy and the lack of multilateral oversight obviously poses dangers. There are incentives on both parties to GIS contracts to cut corners. In particular, the underlying Climate Strategies research raises questions about the extent to which some of the current GIS programmes will deliver emission savings as projected or commensurate with the AAUs transferred, even taking account of the longer time horizons applicable. If GIS is a potentially valuable instrument, it will not help if the first efforts discredit its contribution. An international forum of participating GIS countries could help to establish norms of good practice, monitor the extent to which current schemes deliver these, and ensure collective international learning.

Conclusions

In the international politics of the global carbon mechanisms, project-by-project additionality of emission savings has become a very strong political driver. Each credit generated can be used by another entity – company, or country – to emit more greenhouse gases. This makes it extremely difficult for a system that is justified in terms of environmental objectives through emission caps to accept a possibility that mechanisms promoted in the name of 'economic efficiency' could in fact result in a weakening of the net cap. And yet, the empirical evidence has now firmly established three things:

- Strict project-by-project additionality can be pursued as a goal, but rarely fully, objectively ensured, and the time and cost of ever more stringent efforts in this direction can start to undermine the wider objective of securing more investment towards a wider range of low carbon developments.
- The pursuit of strict project-by-project additionality is inherently in tension with incentives for wider policy reforms – the E+/E- rules used to grapple with this are an important step in acknowledging the higher importance of policy reform, but of course they mean that project-level additionality becomes harder to prove as time goes by.
- It is entirely possible for schemes with less formal requirements on additionality (like GIS) to deliver greater environmental and social benefits, at least when the prime investors and recipients are governments.

Most striking of all, the evidence suggests that the challenge of assessing additionality is not getting easier with experience – if anything, it is getting more and more difficult: as easy and clear cases become a minority; as market facilitators become more adept at presenting as strong a case as possible; and as time compounds changes in national policies and the evolution of technologies and systems, to make the question of what is truly 'additional' relative to the absence of the CDM more and more difficult to assess. The potential correction in carbon prices – set against fluctuations in fossil fuel prices that are far bigger – will only increase the problem of attributing a technology choice to the incentive of the CDM. The concluding section of this report considers some of the possible implications.

11. Effectiveness and efficiency

The Global Carbon Mechanisms have many purposes. The claim of economic efficiency – which depends on the alternatives – is but one of the objectives.

Compliance and supplementarity

In fact, the first declared purpose of the Mechanisms is to assist industrialised countries to comply with their emission commitments under the Kyoto Protocol. There is no question that they are succeeding in this – and without any resort to simple 'hot air' trading of the transition economy surplus. Contrary to early pessimism that the project mechanisms might be strangled by transaction costs, the CDM in particular has resulted in a flood of projects that, as illustrated earlier, are likely to be sufficient in themselves to enable compliance.

Nor is there any evidence that countries have deliberately used the Mechanisms to escape domestic action. To the contrary, governments that have been most active in purchasing credits have in many cases also been those most vigorously pursuing domestic action – partly under pressure from their Finance Ministries to minimise international expenditures.

The UK, which is on course to over-achieve its Kyoto target, is an example where the strength of domestic action has entirely obviated the need for the government to make purchases. This raises the possibility instead of the UK potentially supplying emission allowances should it choose to offer this. A couple of OECD governments that are falling short of their commitments have not been active internationally, drifting further on a path towards non-compliance – most notably the present Canadian government. The consequences of this remain to be played out. For most OECD countries however, the Mechanisms have played an entirely appropriate role, facilitating compliance and reducing costs by enabling money to be spent on emission reduction credits that were either cheaper, and/or easier politically, to implement.

Countries that earlier deferred domestic efforts are now having to foot a bigger bill to make up the shortfall; as with the current Spanish government, that inherited a shortfall as big as Canada's, and has now embarked on a huge international purchase programme combined with much tougher domestic measures to secure compliance.

The extent to which countries should actually limit their use of international mechanisms remains heavily debated. The idea that international purchases should be just 'supplemental' to domestic action is widespread, based on a mix of arguments about moral responsibility (cleaning up one's own mess, not other people's), political leadership, policy demonstration, unspecified reluctance to spend money abroad, and the pressure that domestic action may create for enhanced innovation. The problem is that none of these make sense as absolutes: to indiscriminately force high-cost actions in industrialised countries whilst ignoring far greater opportunities to help poorer countries curtail emissions makes no sense, and can result ultimately in futile outcomes – such as avoiding international assistance entirely and/or leaving the system. Analysts have failed to give governments any coherent sense of where the appropriate balance between domestic and international action should really be struck, but it is not at either extreme.

Scope and formal constraints

One concern about the efficiency of the Mechanisms emerged from the experience of early industrial gas projects (see Box 4). The fact that industrialised countries were paying around €20/tCO_2 for credits from projects that reduced emissions at a cost of below €1/tCO_2 prompted strong criticism, yet raises an obvious paradox. A prime purpose of market mechanisms is to uncover least-cost solutions. If the implicit price paid for emission reductions suddenly jumps from zero to €20/tCO_2, it is not surprising to find some very cheap reduction opportunities; complaining when this happens seems perverse. Critics argue that very cheap projects should have been disqualified from the CDM and addressed, for example, through targeted funding. With hindsight it is easy to argue this, but apparently no-one did so before the CDM's operation highlighted these opportunities. Any commodity market is based on price, not cost, and this has the potential to generate such 'resource rents' from the cheapest options. The experience of alternative, cost-based international funding mechanisms (notably, the Global Environmental Facility) is mixed, but as argued below cannot realistically address the main dimensions of the climate problem.

In practice, the CDM's Executive board moved quickly to minimise the more significant problems arising from the industrial projects (see Box 4), and the problem of large resource rents is by definition most likely in the start-up phase; going forward, most of the exceptionally cheap options will already have been taken up.

Another potential inefficiency arises from limits on the legal or practical scope of the project mechanisms. Nuclear power is explicitly excluded. Carbon Capture and Storage (CCS) is under consideration. Emission reductions from avoided deforestation were also excluded, due to the difficulty of establishing baselines, the associated risks of leakage (displacement of deforestation to other regions) and perverse incentives (threats to deforest an area in order to gain emission credits for not doing so) – and also due to fears of excessive supply swamping other mitigation efforts. In practice the rules around other forestry projects are so onerous that only one (a reforestation project) has been registered under the CDM at the time of writing.

These are specific constraints, which exist for particular reasons, rather than being fundamental to the architecture of the project mechanisms; also none in principle need apply to Green Investment Schemes. Moreover, since the Kyoto first period is probably over-supplied already, in practice these constraints do not affect its environmental effectiveness. However, they could matter if extended to future periods.

Box 4 *The HFC-23 controversy*

An early controversy in the CDM concerned projects to remove HFC-23, a potent greenhouse gas produced as a by-product of manufacturing the industrial gas HCFC-22. Facilities to destroy HFC-23 cost only 0.2-0.5 €/tCO_2e removed, thus offering potential for huge profits if such reductions could be sold as CDM credits. Not surprisingly, a methodology for calculating these emission savings represented one of the first official methodologies submitted and approved in the CDM; such projects dominated the CDM's initial growth, and are expected to generate an estimated 20% of all credited emission reductions to 2012.

The controversy was not just about the level of profits to be made. HCFC-22 is not only a greenhouse gas, but also depletes the ozone layer (though by much less than some of the gases it displaces). Industrialised countries had committed to phase out production under the Montreal Protocol, in which developing countries had a ten-year grace period for growth up to a cap in 2015. The scale of profits threatened distortions in competitiveness with plants in industrialised countries that had already cleaned up the emissions – and could have made it profitable to build whole new facilities just for the value of destroying the by-product.

Faced with these concerns, the CDM Executive Board stepped in, restricted crediting only to facilities that had been operating since 2001, and revised the level of crediting downwards, basing it on actual plant output during 2001-2004. These steps effectively ensured that the potential to capture emissions from existing plants was exploited whilst reducing distortions and capping the risk of perverse incentives. However, the experience served as an early lesson in the complexities and risk of unintended consequences – and the need to accept that revisions in methodologies can sometimes be required in the light of experience.

Transaction costs

The most oft-cited inefficiency arises from the transaction costs of the mechanisms. The CDM project cycle is long and laborious; that for Joint Implementation (Track 2) is not much better. Any market system requires regulatory oversight, and this is all the more the case when the system requires regulation to define and monitor legitimate emission reductions that would otherwise have no value. Legitimacy does not come cheap.

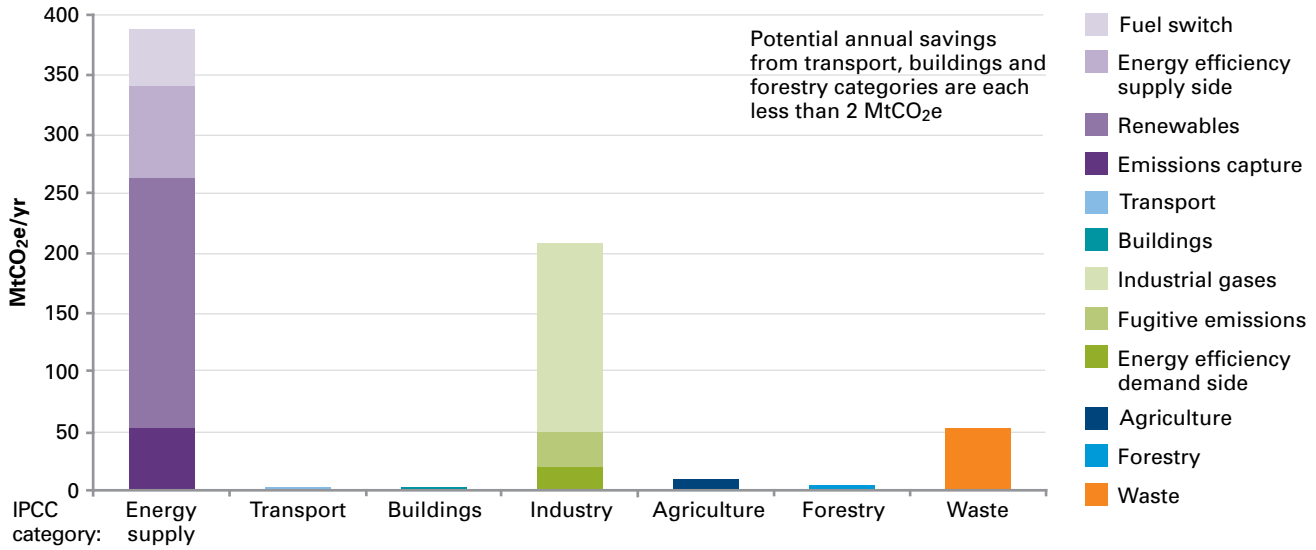
Early experience with projects under the pilot 'Activities Implemented Jointly' phase, the World Bank Prototype Carbon Fund, and early CDM project developments indicated transaction costs typically of several hundred thousand Euros per project[31]. In addition the CDM charges a sliding scale of project registration fees, typically US$0.2/CER for projects exceeding 30,000 tCO_2e annual savings (capped at US$350,000). Finally, 2% of CERs generated are set aside to finance the Adaptation Fund established under the Kyoto Protocol to help poorer countries adapt to the impacts of climate change. The relative significance of transaction costs obviously depends on project scale, but for most projects they amount to a few percent of total project costs, and well under €1/tCO_2.

The CDM also introduces special simplified procedures for 'small projects', defined as those under 15MW (electricity production), 60GWh annual energy savings (energy efficiency projects), or 60,000 tCO_2e annual emission reductions. About 45% of projects fall under this classification, suggesting that the rules have been relatively effective at managing such costs. Overall, transaction costs are not such as to eclipse the large efficiency gains from accessing the potential for emission reduction projects in developing countries – as evidenced by their growth, and by modelling studies[32]. In combination with other factors, however, they do limit the kinds of projects for which the project mechanisms make sense.

Practical scope and the absence of energy efficiency

This is most evident from Chart 18. This divides the project portfolio, in terms of potential annual emission savings, into the seven main sectors as classified in the IPCC Fourth Assessment. The dominance of projects in industry and power generation, with a lesser contribution from waste (mostly landfill gas capture) is striking. There are virtually no projects operating in the buildings, transport, or forestry sectors – and very few even submitted.

Chart 18 *Total abatement potential from CDM and JI project portfolio 2008-2012, by IPCC sector*



Source: UNEP Risoe database as at 1st November 2008. Figures given are undiscounted 'nameplate' projections from project design documents and represent annual savings figures

[31] Climate Policy Vol.3 no.3 (2003): W. Fichtner et al, *The impact of private investor's transaction costs on the cost effectiveness of the project-based Kyoto Mechanisms*; and A. Michaelowa et al., *Transaction costs of the Kyoto Mechanisms*. There are a wide variety of more recent, project-specific data, though many remain confidential.

[32] N. Anger, C. Bohringer and U. Moslener (2007), *Macroeconomic impacts of the CDM: the role of investment barriers and regulations, Climate Policy*, Vol.7 no.6.

This is particularly troubling because, as discussed in the concluding section of this report, these other sectors offer substantial low-cost potential for emission reductions. Even setting aside the complexities of agricultural and forestry potentials, the lack of projects for improving buildings energy or transport sector efficiency is striking, given the repeated identification of these sectors as offering large, cost-effective potentials.

The reasons are not hard to identify. There are many well-mapped barriers to improving end-use energy efficiency (such as split incentives between tenants and landlords, or indeed between vehicle buyers and the lifetime users), that price incentives alone cannot overcome. The scale of building, or even some vehicle fleet, investments is off the small end of the 'small project' scale of the CDM, and thus potentially swamped by transaction costs even with simplified rules. It is also inherently harder to measure 'energy use avoided' rather than 'carbon fuel displaced' by a low carbon supply source. Moreover, energy efficiency projects are most prone to the 'additionality paradox': that because they are potentially so cost-effective, their additionality can most easily be challenged. The poor showing of energy efficiency is a major limitation to the claim of cost-effectiveness in the global carbon Mechanisms – as, indeed, it is with respect to many national policies.

The development of 'programmatic CDM', allowing bundling of discrete projects into one programme, was intended to help with this but has made very limited impact in the three years since it was formally adopted, with only ten programmes submitted at the time of writing. It remains unclear how far an incentive structure that is fundamentally based on crediting project-by-project additional emission savings can really be adapted to the fundamentally different characteristics of programmatic activities.

The experience of the Carbon Trust itself is instructive in this respect. Over the six years since its establishment, the Carbon Trust has saved an estimated 17 $MtCO_2$ of emissions savings (and delivered £1bn of estimated associated cost savings) through its carbon and energy management activities with UK businesses and the public sector. Many of its energy efficiency activities have been highly cost-effective to the participating companies and public sector organisations (even more so as energy prices rose). If credited at €20/tCO_2, the value of the carbon saved would be €340m – nearly twice the cost of the programmes over the same period, thus recouping the investment costs in establishing and running the energy efficiency programmes over the same period.[33]

Yet, an organisation like the Carbon Trust could never have been funded through the promise of sales of future emission reduction credits. The investment required would have been swamped by the multiple levels of risks around institutional costs, performance, and prices, and strangled by the transaction costs of project-by-project verification, which contrasts starkly with the independent assurance of procedures used for evaluating aggregate emission savings actually developed. A mechanism like the CDM can never reach the major potential for energy efficiency from distributed sources.

To reach such potentials through international finance will require a wholly different approach. One may be to evaluate and build upon the emerging experience of Green Investment Schemes. Even though GIS can generate upfront financing, there remains a looming problem of timescales (as well as questions over the scale of demand). In particular, potential investors are keen to see their money dispersed on emission-reduction projects before 2012. The Carbon Trust experience suggests that less than four years risks being too short a timescale over which to build up and effectively disperse substantial expenditures, given the complexity of engaging effectively with the distributed opportunities represented by most energy efficiency programmes.

[33] Carbon Trust Annual Report 2007/8. Emissions savings represent estimated annual, persisted energy savings made by business and public sector customers working with the Carbon Trust in the six years since 2002/3. Cost of delivering the energy efficiency programmes represents both direct programme costs plus relevant overheads and indirect costs.

Technology and capacity transfer in the Mechanisms...

Another hope from the Mechanisms was that they will help to diffuse lower carbon technologies globally. Early evidence tentatively suggests some success in this. Half the CDM projects registered by 2006 involved foreign technology, and over 60% of the (much smaller set) of proposed JI projects did too. If the build-up of renewable energy industries in Asia is attributed in large measure to the CDM (although it is worth noting that production costs will be another driver for European manufacturers looking to establish bases in Asia), this represents a major success in terms of technology transfer, with European renewable energy technology in particular playing a dominant role, presumably due to the combination of the strength of the European renewable industries, and the role of Europe as by far the biggest buyer of CDM credits, given the absence of the US[34].

As technology classes become more established in host countries, however, continued crediting becomes both less likely to contribute to technology transfer, and the real additionality of emission savings becomes less certain. This is now obvious in respect of technologies such as Chinese hydropower.

To try and increase the focus of the CDM on transformational changes and tackle problems of weakening additionality, analysts have suggested subsidies for investments that contribute more directly to technology innovation and transfer (e.g. note 34), or have suggested changing rules to phase out crediting for established practices. Specifically, automatically crediting new low carbon technology investments until they achieved 10-20% penetration within a given market would focus crediting on 'take-off' industries, and lessen the scale of emission credits going to industries once they become well established[35]. In effect, this might start to move the CDM incentives a little earlier in the chain of innovation and diffusion – though like other reforms, it would pose other dilemmas, and would represent a major step away from the underlying principle of creating a level playing field to give value to additional emission savings.

... and geographic spread

A similar challenge is posed by efforts to address one other, politically highly-charged issue around the CDM, namely the geographic focus of projects on the bigger, more industrialised developing countries, and the virtual absence of Africa. This is a natural consequence of a free market mechanism with carbon savings as the prime mover, which attracts private capital to the areas (and project types) with lowest risk and greatest regulatory stability and implementation capacity.

These issues are in fact both new manifestations of a well-established dilemma. An undifferentiated market mechanism will always search to deliver the solutions that have least cost and risk to investors. As a consequence, the money will flow to the options that are best established, whether or not this serves other objectives. In the UK for example, the undifferentiated renewable obligation incentive mechanism helped to support the most cost-effective technologies, such as onshore wind energy but little else, until the government decided to 'band' the mechanism so that some technologies were discounted whilst other technologies, that were less developed or were applied in more risky environments (such as offshore wind) received multiple credits.

In guiding its future evolution, the Parties need to decide whether the CDM market is exclusively aimed at cutting emissions at least cost and risk, or also is intended to achieve political and developmental objectives which would include rules and/or incentives to increase the relative investment in less established technologies and markets. If there is a shift to encompass the latter objectives, the means available would include rewarding initial market share of low carbon technologies, and/or multiple and discounted credits. The fact that one adjustment could help to address both the innovation and geographic concerns, suggest that these might be of particular interest.

[34] R. Youngman, J. Schmidt, J. Lee and H. de Coninck (2007), *Evaluating technology transfer in the CDM and JI*, *Climate Policy*, vol. pp.488-499, found that about half of CDM projects and 62% of JI projects sampled as of Jan 2006 involved transfer of foreign technology into the host country. Dechezlepretre A. M. Glachant, and Y. Meniere (2008), *The CDM and the international diffusion of technologies: an empirical study*, *Energy Policy Vol.6 1273-1283*, found that 43% of the 644 projects registered at the time of their study involved technology transfer. A report by David Popp *(International technology transfer for climate policy, Centre for Policy Research, Syracuse University US, 2008)* usefully sets the CDM experience in the context of wider literature on technology innovation and transfer.

[35] A. Mathur, A. P. Chikkatur, A. D. Sagar (2007), *Past as prologue: an innovation-diffusion approach to additionality*, *Climate Policy* Vol.7 pp.230-239; drawing also upon A. Kartha, M. Lazarus, M. LeFrance (2005), *Market penetration metrics: tools for additionality assessment*, *Climate Policy*, Vol.5 pp.147-166.

The Mechanisms and the Markets

A final set of issues arise from the carbon market itself. The carbon price differs significantly between different segments of the market, due mainly to differing risk profiles[36]. The price itself has fluctuated considerably, driven partly by external factors (like volatile energy prices), and by developments in the sector itself (such as EU ETS emissions and allocations, and supply projections) – but with a large element also attributable to fluctuating perceptions of both these factors, and the wider political prospects. Part II of this report concluded that the carbon price over the coming year (or longer) may be largely driven by private perceptions of the prospects for a global post-2012 deal. The development of derivative markets could amplify price fluctuations from all these sources. This does not create an efficient, stable basis for low carbon investments.

The incentives for efficient low carbon investment are further undermined by the sequential nature of commitments. Future crediting for JI projects is likely but not certain; future crediting for most CDM projects is reasonably assured, but the value is beset by the uncertainties about adequacy of post-2012 commitments; and policy will also need to remove uncertainties about crediting for projects in countries that may join the club of industrialised country commitments. Even a successful Copenhagen deal is unlikely to establish commitments beyond 2020; the composition and basic structure of the longer-term regime is much more uncertain still.

Ironically, this means that the Mechanisms may most reward countries that put greater emphasis upon domestic policies. Notably, the huge surge in Chinese renewable energy has not been driven only by the CDM; its domestic support programmes have been a key driving force. The projects receive additional finance from the CDM, being eligible under the E- rules. The result is that, in effect, the CDM rewards investors in Chinese projects and reduces the net costs to China of its renewable energy programmes. Since these programmes serve both domestic (e.g. local environment and energy security) goals, and international (climate) goals, such a mix is not inappropriate, but it serves to emphasise the complexities of the Mechanisms and their interactions with domestic policies. Given perceived risks of relying on the Mechanisms alone, the E- rule in effect enables the CDM to become a means of rewarding developing countries for adopting domestic policies that create an additional, and potentially more secure, incentive for such investments.

The efficiency of the Mechanisms thus also hinges on the stability and longer term predictability of the markets, and of the framework of commitments within which they reside. Some policy measures – such as price floors established through reserve prices on allowance auctions – could help considerably. Other uncertainties may be much harder to eliminate, being more intrinsic to the fundamental problem of negotiating commitments for a problem of unfolding severity in an evolving global economic and political context.

Conclusions

Policy assessments are almost always relative. Relative to the theoretical economic ideal of a perfect global carbon market with long term predictability – residing within an equally perfect set of energy and land-use markets of equal stability – this section has sketched numerous ways in which the Global Carbon Mechanisms clearly fall short.

Yet, in the real world, the extraordinary achievement (in terms of EU politics) of establishing within a few short years a single carbon trading price across Europe, has been matched by the equally remarkable feat of establishing working structures with global reach. These structures lessen the costs on industrialised countries by enabling them to help finance emission reductions wherever they are cheapest, within the scope of the mechanisms, thus dramatically increasing the reach and efficiency of the fundamental commitments to cut emissions – and also their political effectiveness, by engaging an initially deeply sceptical developing world in the global effort to tackle climate change. There is no evidence that other mechanisms, like centralised funding programmes, would work better as the primary instrument. The key is to build on the experience and adopt reforms to implement the fundamental principles of allowing entities to trade against their comparative opportunities and advantages, in this case, for delivering emission reductions.

[36] For example, forward sales of primary CERs sold from CDM projects before registration trade at a discount of 10-40% below the EU ETS marker price due to the risks of non-registration or degraded performance; project types which may not be eligible within the EU ETS are still more heavily discounted.

12. Comparison with the voluntary carbon market

As climate change rose up the political agenda during the 1990s, some companies started acting to offset their emissions, or to offer emission offsets to consumers, through purely voluntary channels. The voluntary market has also grown rapidly in recent years and adds important complementary experience.

A small but rapidly growing market

The voluntary market represents purchases of carbon credits by organisations or individuals who are not legally obliged to make any emissions reductions, or who wish to make emissions reductions claims over and above that legally required, and therefore are under no legal constraints governing the kind of emission offsets that they purchase. The market has two main elements: the Chicago Climate Exchange (CCX), representing 30-40% of the traded volume in 2007; and the remaining 60%+ arising from a diffuse market of numerous and varied providers. The concept of voluntary offsets predates formalised emissions trading, but was stimulated as the Kyoto mechanisms came into force in 2005 and the concept of carbon trading became more of a reality.

As shown in Chart 5 (page 17) the volume and value of credits traded on the voluntary market is far smaller than in the compliance market of the Kyoto Protocol – just 65 $MtCO_2e$ traded in 2007, with estimates for trading in 2008 at around 100 $MtCO_2e$. The price of credits is also lower, averaging around $6 per tonne in 2007[37], though with wide variation. Most purchasers are businesses in the United States and the EU (including end-purchasers, intermediaries and investors), with additional demand from the public and NGO sectors, and from individuals. However, growth has been very rapid, with ~165% increase in 2007 over 2006.

However, initial enthusiasm for the voluntary market has been tempered by growing controversy over the past couple of years, as it is subjected to scrutiny from increasingly educated commentators and purchasers, raising obvious questions about how it compares to the Kyoto-based compliance market.

Rules and regulations have grown organically

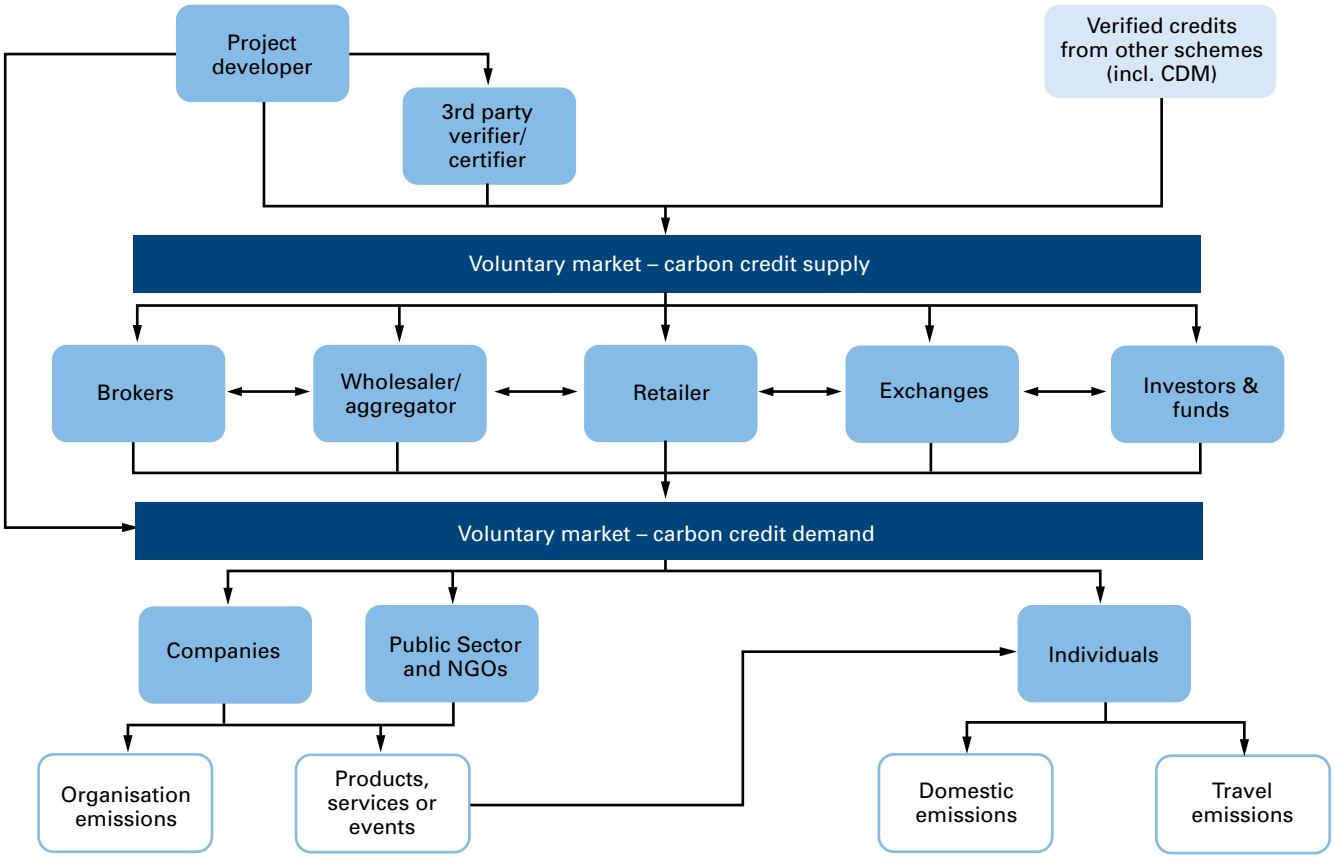
Without the defined regulatory framework that supports the compliance market, the voluntary sector has grown organically, with many of its mechanisms and controls still in the early days of evolution. One example has been the demand for credits to be certified to a standard, led by concerns over quality. The use of standards has been a major development in the last two years, with a number of competing and complementary types emerging. Many of these standards have only recently been introduced, but despite this about 50% of transactions in 2007 were verified to a third party standard. Of these, the Voluntary Carbon Standard, VER+ and Gold Standard account for nearly half of market share. All were launched recently.

Compared to the fixed transaction processes of the CDM and JI markets, the voluntary market has a profusion of market participants offering credits to customers at various stages of a sometimes lengthy supply chain. Chart 19 provides a schematic of the many ways in which credits pass through the voluntary market.

Accurate transaction data is harder to come by for this market, and analysis to date has frequently relied on market surveys or proprietary data. Registries are now growing up which allow credits to be traced through their lifetime. This will give confidence as to retirement which would prevent selling on the same credit twice or more. However, we still do not have a consolidated or entirely transparent view of the market.

[37] The price estimate is sourced from Ecosystems Marketplace and New Carbon Finance's publication *Forging a Frontier: State and Trends of the Carbon Market 2007* and excludes CCX transactions.

Chart 19 *Voluntary market supply chain*



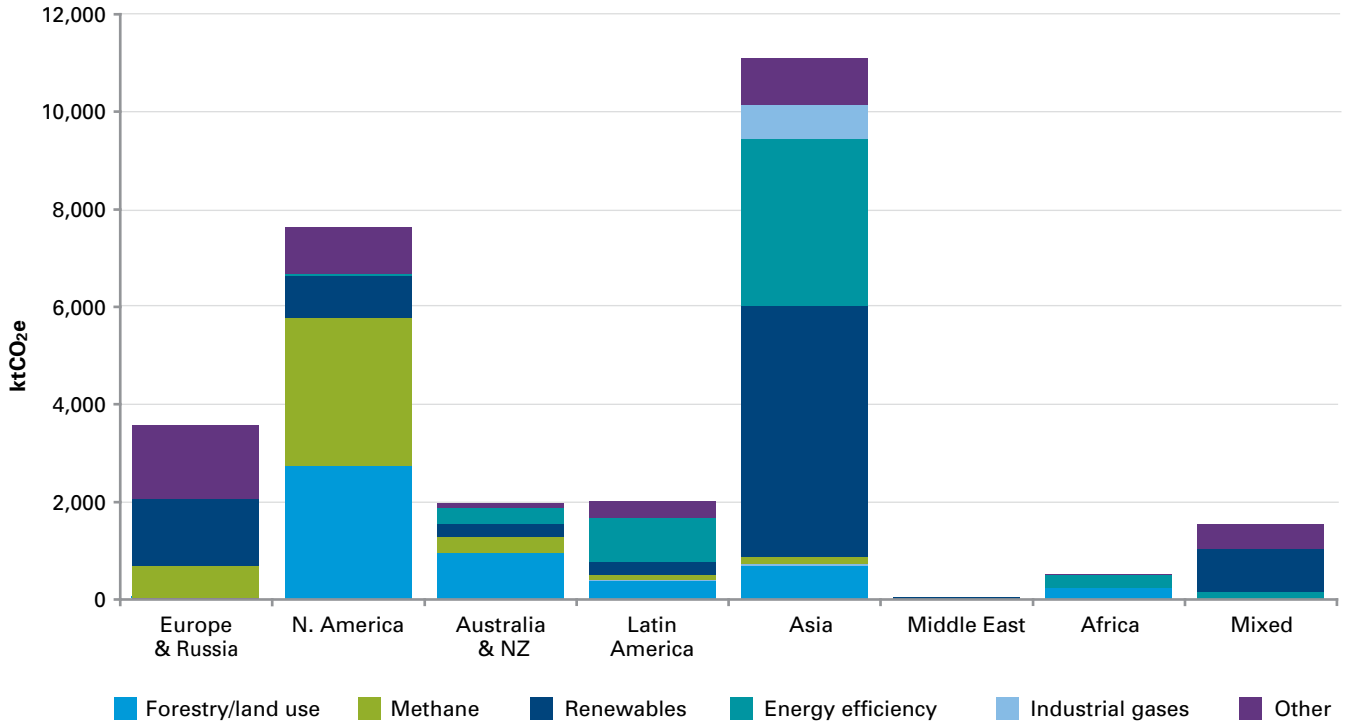
Projects appeal to a different sort of customer

The types of technology vary more in the voluntary market – unlike the dominance of industrial gases, renewables and other industrial projects in the CDM and JI, voluntary projects are more likely to feature forestry projects and a wider mix of other activities. Demand on the voluntary market differs in nature from that for compliance credits, as purchasers may be looking for emotionally-appealing propositions that fit with their motivation to demonstrate corporate social responsibility. In these cases, a good story is required to acquire purchasers who are keen to 'do the right thing', and as such sustainability benefits or projects involving the less obscure technologies are often preferred.

This is an interesting counterpoint to CDM, where sustainability value is judged by the host country and is not quantified by the Executive Board as part of the assessment process.

Voluntary projects can occur anywhere in the developed or developing world. As with CDM, Asia was the dominant seller in 2007 but a very large number of projects are initiated in North America and some in Europe. Often the rationale is that purchasers can more easily identify the source of their credits when closer to home, and consequently feel a greater identification with and confidence in the emission reductions made. This is illustrated in Chart 20.

Chart 20 *Voluntary market transacted volumes by project type and by geography 2007 (excluding CCX transactions)*



Source: Ecosystem Marketplace, New Carbon Finance. Breakdown of volumes transacted 2007 where information available on type, totalling 28 $MtCO_2e$.

Offsetting has been the focus of public scrutiny

Given that corporate social responsibility considerations drive many voluntary purchases, the decision to offset is inherently caught up with an organisation's branding and its communications with stakeholders and customers. For this reason the voluntary market is more visible to a mainstream audience and has probably attracted more popular media debate than the compliance market.

Additionality has been as much an area of contention for the voluntary market as it has been for the compliance market. Both the Chicago Climate Exchange and some credit retailers have encountered criticism for selling 'anyway tonnes': offsets from projects that commentators have claimed would have happened anyway. However, other concerns have frequently been more at the forefront of public criticism.

In particular, the higher incidence of forestry-related projects, with their associated complexities around time-scales, permanence, and leakages as well as in-project additionality, means that there have been many stories of failed tree-planting schemes in the headlines.

Also, given the absence of a regulatory driver generating demand, the calculation of what exactly is offset is frequently not transparent. A 2008 survey found widely diverging emissions figures being offered to consumers for offsetting the same airline journey[38].

More fundamentally, some purchasers have been accused of 'greenwashing', either because the offsets they have purchased are not robust, or because commentators dispute the acceptability of paying for carbon reductions elsewhere if it is at the expense of taking real action at home.

[38] Omega and the Centre for Air Transport and the Environment, Manchester Metropolitan University 2008 *Final OMEGA Project Report: An Assessment of the Potential of Carbon Offset Schemes to Mitigate the Climate Change Implications of Future Growth of UK Aviation.*

Interaction with the compliance market

In the desire for high-quality and accredited offsets, there is a growing tendency for purchasers on the voluntary side to focus on compliance generated credits as more reliable investments. Hence there is an overlap between the voluntary and CDM markets, as companies and individuals outside the regulatory regime look to purchase either CERs, or credits from CDM projects in the process of validation or registration. In 2007, CERs represented around 14% of voluntary purchases (excluding the CCX), and some analysts predict that CERs could grow to form half of all voluntary trades, although this will depend on the evolution of voluntary standards as trusted alternatives. The UK Government is currently working on a Code of Best Practice accreditation scheme for offset providers. The Code will initially cover only the sale of compliance credits and will await further standardisation of voluntary offset credits by the industry before covering these.

In addition, there is a large, but unquantified, market for pre-registration CDM project credits, which provide a quick and easy income stream for project developers caught up in the CDM approval process. Given the growing CDM (and JI) pipeline of projects, this available volume is likely to be greater in the future.

Where next?

As the market matures, and purchasers feel more able to trust transactions (especially if a few commonly accepted standards take hold as seems likely), popularity is likely to increase further.

However, there are many factors that could cut short voluntary market growth. The current economic slowdown may deter new entrants, and also future legislation, in particular in the United States, is likely to shift more companies into the compliance markets. Allied to these uncertainties, the lack of robust data makes it hard to predict future market growth, but estimates of the voluntary market have projected annual volumes of between 200 and 550 $MtCO_2e$ by 2012.

The voluntary market has proved it has an important role to play, on both the supply and demand side. On the supply side, it can reach project types and locations that are either outside the scope of the regulated market mechanisms, or where the transaction costs or other factors impeded progress – like land-use. In this sense, it is a useful trail-blazer, allowing the private sector to pursue more diverse project types and streamlined mechanisms whilst shouldering the CSR risks of false claims or non-performance. On the demand side, the voluntary market has helped to bring in many actors that would not have considered buying compliance units, but can more readily engage in the lower-cost voluntary market. By doing so, they can get used to the notion and infrastructure of carbon offsetting, and help their customers to do so too. How exactly the balance between the voluntary and compliance systems will develop remains to be seen.

13. The bigger picture

The question 'how good are the Mechanisms' only makes sense when compared against alternative and complementary approaches, and set in the wider context of the pressing need to foster a global low carbon transition over the coming decades.

Money and the Mechanisms

As noted in the introduction, the Mechanisms have grown rapidly to a significant scale not just in terms of emissions, but also finance. The value of CDM and JI emission credits in 2007/8 was US$4.5-8.5bn/yr, and this is estimated to leverage 10 times as much overall investment (Table 6). This far exceeds that from all other UNFCCC and other public transnational sources combined.

It is very hard to define precisely either leveraged investment or the overall investment in mitigation technology (since this is not easily separated from other energy-related investments), but the Mechanisms clearly represent a substantial share – perhaps a quarter to a half – of the total mitigation technology investment in developing countries.

Table 6 *Estimates of current mitigation financing for technology*

Source of financing	Estimated annual US$bn
Sources under the UNFCCC	
The UNFCCC financial mechanisms (funds)[a]	0.2-0.3
Private and public sources leveraged by the UNFCCC financial mechanisms	1.2
Kyoto flexibility mechanisms (CDM, JI)	4.5-8.5
Private sources leveraged by the Kyoto flexibility mechanisms	45-85
Sources outside the UNFCCC	
Private investment*	63-103[b,c]
Export credit agencies*	1-2
Bilateral and multilateral sources*	5-10[c]
Climate Investment Funds (agreed at G-8, administered by World Bank) – Clean Technology Fund, and Strategic Investment Fund[d]	>1 (6 announced over several years)
Philanthropic private sources	1
Total	121-212*

* Includes funding for commercially mature technologies not requiring any incremental mitigation finance. Total excludes double-counting of finance leveraged from Kyoto mechanisms (note c).

a GEF (Global Environment Facility) Trust Fund, Special Climate Change Fund, Least Developed Countries Fund. These include funding for capacity building and other activities that are not technology-specific.

b Restricted to energy sector. Does not include all energy efficiency investments or some low carbon technology investments.

c Excludes some finance leveraged from UNFCCC financial mechanisms.

d 'To be disbursed as grants, highly concessional loans, and/or risk mitigation instruments, will be administered through the multilateral development banks and the World Bank Group for quick and flexible implementation of country-led programmes and investments' (World Bank press release 01.07.08). The Clean Technology Fund is for 'demonstration, deployment and transfer of low carbon technologies in the power sector, transportation and energy efficiency in buildings, industry and agriculture.' (UNFCCC, 'Investment and financial flows to address climate change; an update' (UNFCCC/TP/2008/7), para 357).

Source: *UNFCCC (2008), Identifying, analysing and assessing existing and potential new financing resources and relevant vehicles to support the development, deployment diffusion and transfer of environmentally sound technologies, FCCC/S B/2008/INF.7, 20 Nov 2008.*

The new Climate Investment Funds agreed at the G-8 summit, are to be administered through the World Bank, separately from the Global Environment Facility. With US$6bn pledged over the next few years, these are significant but still modest in comparison with other sources, and will only have a substantial impact if they are applied to reach the parts that the crediting mechanisms do not reach. The various avenues for funding need to complement rather than compete, within a clear conception of the overall strategic goals, as indicated in this section.

Energy investment to 2020

The IEA's World Energy Outlook (WEO 2008)[39] offers the most recent and detailed energy sector studies. On current trends, energy-related CO_2 emissions are projected to rise, from the present 28 $GtCO_2$/yr, by 30% by 2020, and by 45% (to over 40 $GtCO_2$) by 2030. Three quarters of the projected increase is from China, India and the Middle East, though on average the developing world overall would still be emitting only about a third the level of OECD countries per capita. It estimates that this 'Business as Usual' global energy scenario requires cumulative investment totalling $26tr out to 2030, about half of this going to the power sector.

The WEO abatement scenarios curtail CO_2 emissions by just 3.5 $GtCO_2$ below the reference case by 2020, due to assumed inertia in the growth of energy-related CO_2 emissions, escalating sharply after 2020 as discussed below. This requires additional investments, which are largely offset against fuel savings, so that overall over the twenty years to 2030:

- The 550ppm scenario requires $4.1tr more investment, of which most goes to improving energy efficiency and $1.2tr to low carbon power generation; the extra investments are ultimately eclipsed by the value of the fuel savings, at $7tr over 2010-30.
- The additional investment required more than doubles for the 450ppm scenario.[40] Again much of this goes to energy efficiency, with investment in efficient buildings dominating power sector investments, and with $5.8tr returned in additional fuel savings.

The WEO scenarios assume less aggressive action is taken in developing countries than in the OECD: they account for about half the emission savings by 2020 but only a quarter of the added investment required for the 550ppm case. The cheaper emissions savings in developing economies reinforce the case for mechanisms that facilitate such action.

Out to 2020, the additional emission savings and developing country investment required for the WEO abatement scenarios (a few tens of US$bn)[41] is clearly within reach of the mechanisms to support, based on extrapolation of trends as discussed in section 9.[42] Beyond 2020, the scale clearly falls short of that required to achieve 450ppm or the mid-Century 50% target.

[39] International Energy Agency, World Energy Outlook 2008, IEA/OECD Paris. The WEO reference scenario emissions are very similar to those of WEO 2006, and are similar to those used in the UNFCCC Investment and Financial Flows report (2007).

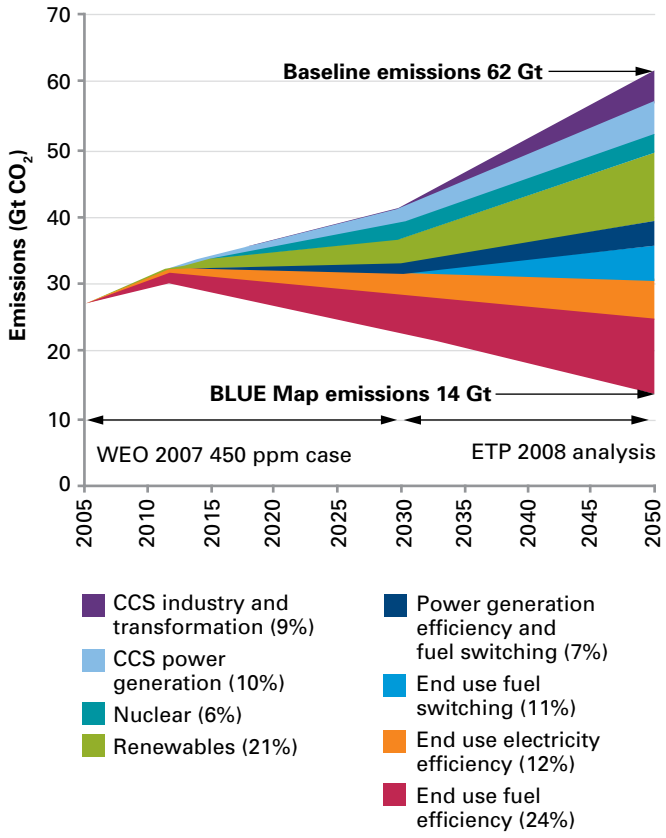
[40] Because of growth in global CO_2, even the most ambitious WEO scenarios do not prevent overall atmospheric concentrations rising well above 500ppm, though they return to 450ppm later in the century. All concentrations are cited in terms of parts per million CO_2-equivalent ($ppmCO_2e$), covering all the radiatively active Kyoto gases. Concentration-equivalent ppm is a physical measure of atmospheric impact which does not depend on an assumed timescale for comparing cumulative impact of different current emissions (taken as 100 years for comparing the climate change impact of the different Kyoto gases).

[41] A 50% share of 3.5 $GtCO_2$ abatement by 2020 is less than projected in Chart 15. The current capital flow of $5-8bn in the project mechanisms looks modest compared to the IEA numbers overall (global average US$200bn/yr), but the developing country share is only a few tens of billions annually out to 2020. The UNFCCC offered a similar number for the additional global investment, projecting that even out to 2030 only US$65bn/yr would be in developing countries (UNFCCC (2007), Investment and financial flows to address climate change). The UNFCCC 2008 Update reiterates the detailed estimate by sector (Table 6), but notes that IEA estimates for all investment requirements increased substantially during 2008. This reflects general rises in costs, but it is unclear how sustained the increase will be.

[42] Capital flows in the mechanisms would grow broadly in line with volumes and prices. At a credit price of €20-40/tCO_2 by 2020, a projected volume of 2,000 $MtCO_2$ /yr by 2020 would equate to €40-80bn/yr, say US$50-100bn/yr directed towards decarbonising energy sector growth in developing countries.

The WEO estimate that the incremental cost of the measures would have to rise steadily, to US$40/tCO$_2$ in 2020 and to US$ 90/tCO$_2$ by 2030 (much higher prices would be required by the 450ppm scenario, partly to bring in CCS at scale). In Chart 3 (see page 10) in the Executive Summary, which sets out the sector potentials as estimated by the IPCC for different cost levels, we placed the main emphasis of the CDM and JI on investments in the lowest cost categories. This is not only because of our analysis of the supply-demand balance to 2012 and beyond, in Part II. It is also because, for the present, the private sector may attach considerable risks to more costly investments on the basis of carbon prices alone, given their historic volatility and their dependence upon political decisions that are extremely hard for the private sector to judge – even more so in developing countries.

Chart 21 *Contribution of energy-related emission reduction options 2005-2050*



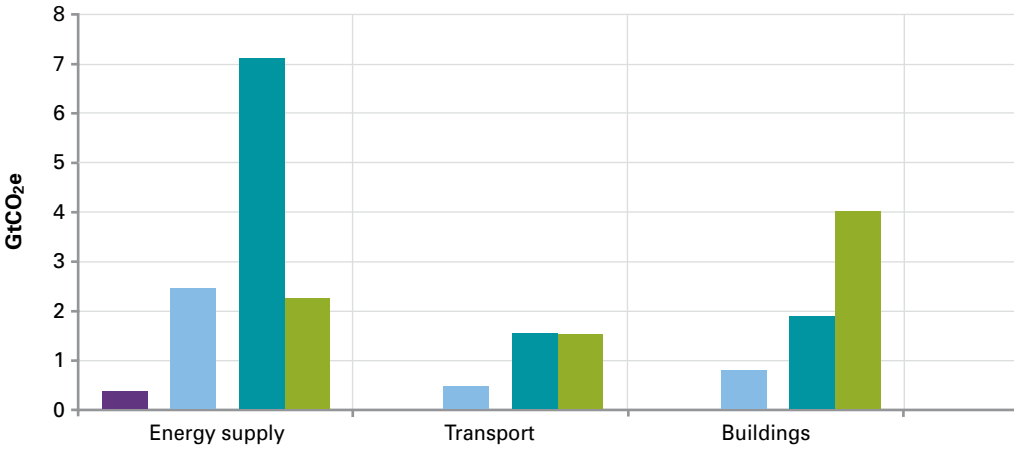
Source: IEA, Energy Technology Perspectives (2008) see note 42

To secure the more widespread investment required, industry would need confidence about future (and growing) carbon prices. This will be much more difficult if 2009 sees a market correction, and if future markets are not underpinned by a carbon price floor mechanism and/or by more extensive domestic action (as with the Chinese renewable energy supports).

More ambitious targets of course would require more ambitious global action. The IEA's other main study, Energy Technology Perspectives, sets out a detailed picture of the path required to achieve the G-8 proposed goal of 50% reductions by 2050. This would require even more rapid and wide-ranging changes across all regions and all components of the global energy system, as set out in Chart 21. Relative to the reference case, reductions of almost 10 GtCO$_2$ by 2020 bring the world's CO$_2$ emissions back close to 2005 levels by 2020 on the path to the 2050 goal. This assumes a common global 'cost of carbon' from the outset, in contrast to the WEO, which assumes less initial action in the developing world – though inevitably this leaves their emissions as an even bigger part of the challenge after 2020.

Reluctance to act more strongly, in both industrialised and developing countries, is not a fault of the Mechanisms. But improving them, and better understanding their role, limitations and potential evolution, could facilitate tougher action. The rest of this section outlines the issues and options.

Chart 22 *Sectoral breakdown of mitigation potential outside the OECD, 2020 and 2030*



	Energy supply	Transport	Buildings
Common project scale	Years construction, lasting decades; €m or €bn	Vehicle purchase: few years; €1,000s. Infrastructure: decades, €bns	Retrofit: household scale, few years, €100s. Construction: years lasting decades
Dominant investment driver/barriers	Costs, risks and returns at commercial or World Bank interest rates	Behavioural choice: fuel cost savings minor influence. Infrastructure: usually strategic state-funded decisions taking decades	Planning, tenant-landlord splits, high consumer discount rates. Dispersed, small scale companies for building insulation/services
Relevance of CDM/JI	Highly relevant for mature technologies close to cost-effective	Very limited	Almost irrelevant – a handful of projects – except through indirect effect of power sector decarbonisation

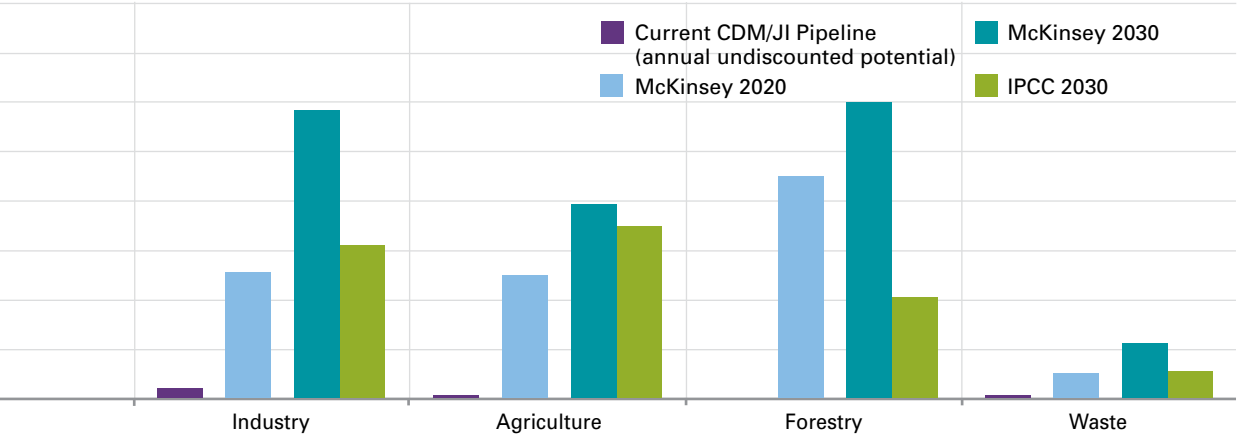
* Building & industry abatement includes their share of emissions reductions from using less electricity.

Sources: IPCC (2007) Working Group III Report "Mitigation of Climate Change", McKinsey "Pathways to a Low Carbon Economy" (2009)

Role and limitations of the project mechanisms

The analysis above suggests that the CDM, given a more stable market basis to drive reasonable growth projections, could support extensive decarbonisation in developing country power supply and industry sectors to 2020. However the limitations are also apparent: apart from the overall questions surrounding the scale of ambition, the cost in the abatement scenarios is contained by the energy efficiency improvements, where the CDM in particular has delivered little. Moreover, the WEO cutbacks are modest compared to the theoretical potential identified.

A broader view, comparing this outlook against overall potentials across sectors and over time, shows the strategic limitations of the project mechanisms in addressing the climate challenge. This is clear from Chart 22, which contrasts current delivery against abatement potentials estimated by McKinsey for 2020 and 2030, with the latter also compared against IPCC estimates. As noted, CDM and JI projects to date have been largely confined to only three out of the seven sectors (see Chart 18 for more detail), which represent maybe half of the overall mitigation potential. Even in these sectors, the actual savings by 2012 from the existing project pipeline are tiny compared to any of the 2030 potentials. Thus the challenges are much greater if horizons are expanded, to other sectors and sources, and further into the future:



	Industry	Agriculture	Forestry	Waste
	Varied but often €m investments lasting decades	Distributed farm-level actions; plans as short as annual	Cumulation over years/ decades	Varied but often €m investments
	Costs, risks and returns at commercial interest rates. Subject to focus on core business	Varies between agrobusiness and small farmers. Multiple considerations including nature of national agricultural support schemes	Long-term returns subject to multiple land risks in developing countries	Complex chains: emission/ cost savings modest influence
	Highly relevant	Poor track record where attempted	Only one project	Relevant mainly to landfill gas capture.

- **Other sources and sectors**. Developing countries dominate the non-energy-CO_2 potentials even to 2020, due in part to the contribution of avoided deforestation and methane reductions. UNFCCC scenarios correspondingly imply that the total reductions outside the OECD by 2020 could be up to 7 $GtCO_2e$, with the majority from non-energy sources.[43]
- **... and longer time horizons**. Including all sources, global greenhouse gas emissions could reach almost 60 $GtCO_2e$ by 2030 in the absence of any action. There is disagreement over the total abatement potential relative to this, but there is consensus that less than a third of it by 2030 is in OECD countries; investments in the rest of the world are thus crucial. At costs up to about US $100/$tCO_2$, the non-OECD abatement is variously estimated in the range 15-25 $GtCO_2e/yr$.[44]

The much bigger McKinsey estimates are due partly to a far more optimistic outlook on the potential rate of growth of CCS in power and industry sectors, particularly in the decade 2020-2030. Much of the large potential in the power sector, agriculture and industry are at costs far above 2008 carbon prices, and for the Mechanisms to deliver investment at scale the markets would need high confidence in future prices sustaining such investments, in addition to the required innovation.

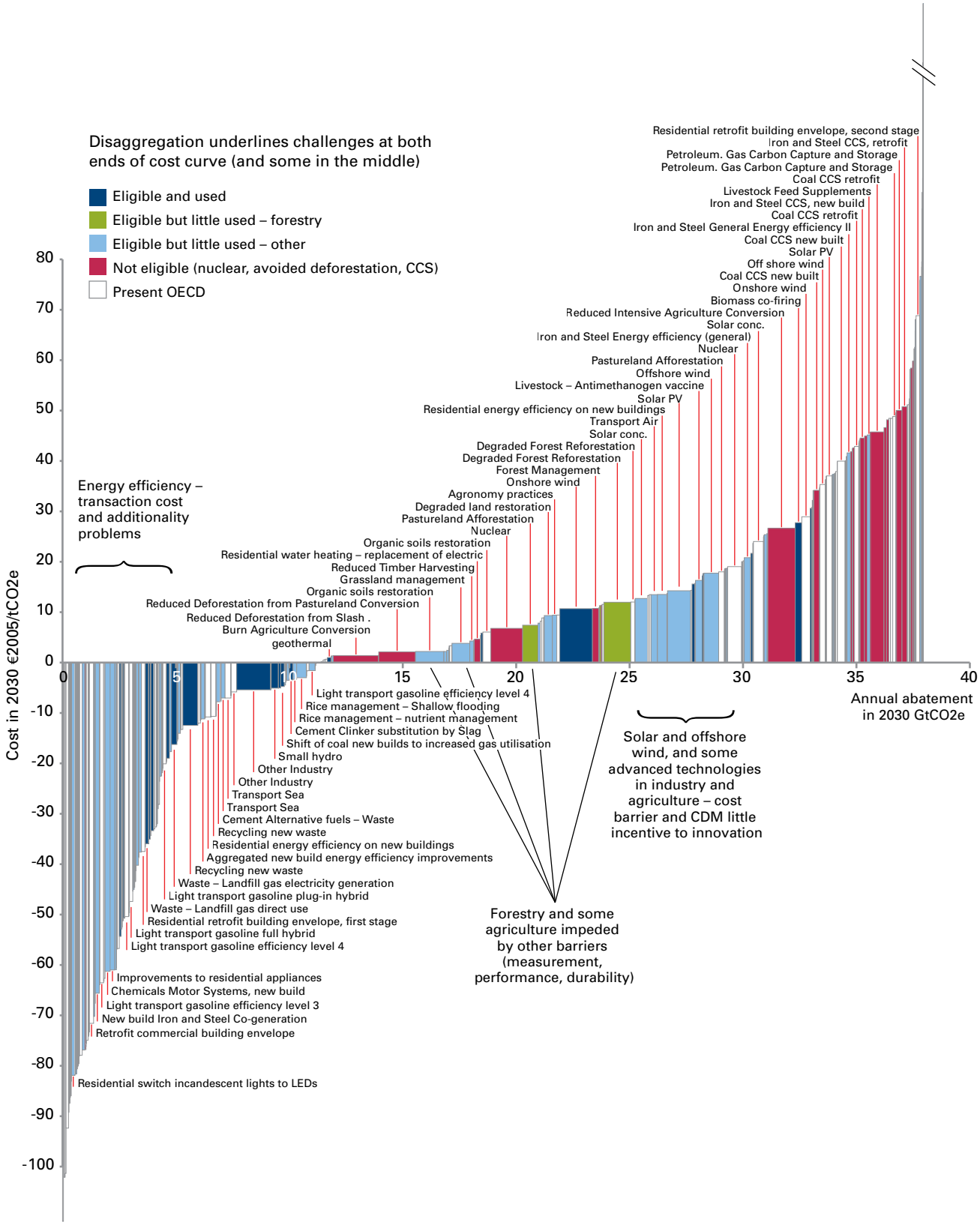
Overall, the comparison gives a sense of the vastly greater scale at which the Mechanisms would have to operate if they themselves were to deliver a large part of the changes to 2030. We return to some implications of this at the end of this section.

[43] The UNFCCC estimates the potential in developing countries in 2020 to be approximately 7 $GtCO_2$ (UNFCCC, Investment and financial flows to address climate change; an update (UNFCCC/TP/2008/7). The UNFCCC estimates that by 2030 the savings from developing countries could expand to 21.7 $GtCO_2$, about two-thirds of the global reductions.

[44] In the WEO scenarios, abatement rises sharply to 15 $GtCO_2e/yr$ by 2030, roughly matching the potential assessed by the IPCC, whilst the non-OECD reduction in the UNFCCC scenarios by 2030 exceed 20 $GtCO_2/yr$ and the McKinsey study estimates far greater potential still, particular in power generation, industry and forestry by 2030.

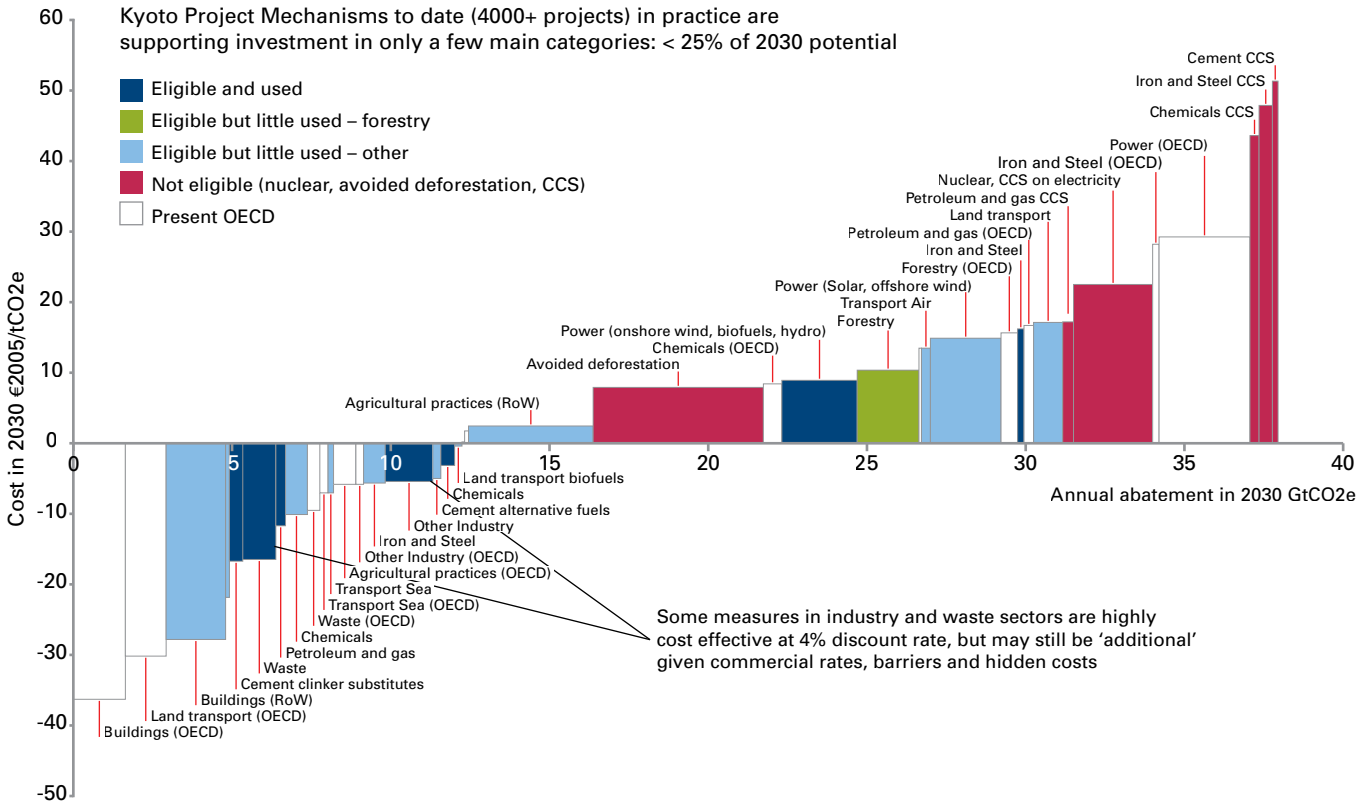
Chart 23 *Estimates of global mitigation potentials by 2030 – McKinsey*

(a) – McKinsey full cost curve



Source: Carbon Trust (2009), using McKinsey data from *Pathways to a low carbon economy* (2009)

(b) – McKinsey aggregated to sector level



Source: Carbon Trust (2009), using McKinsey data from *Pathways to a low carbon economy* (2009)

Performance vs potentials

Interesting insights emerge by mapping the technology focus of the project mechanisms against these identified potentials. Chart 23 delves into more detail by dividing the options identified by McKinsey (outside the OECD, which is shown as white) into four groups:

- Potential savings from the kinds of investments that have dominated the project portfolio to date, and which account for less than a quarter of the total identified potential, despite the more optimistic McKinsey estimates for renewables and industry potentials.
- Options that are formally excluded from the CDM (nuclear, avoided deforestation, and currently CCS) and which account for about 30% of the total potential.
- Forestry-related projects, that face particular kinds of barriers, and which account for about 7%.
- Almost 40% of the (non-OECD) potential is attributed to non-forestry options that are formally within the scope of the CDM, but are in practice largely absent (compared to the potential).

Of the last, 'absent' activities, two significant measures, saving around 2 $GtCO_2e$/yr between them at moderate costs, are land-use related (grassland management and organic soil restoration).

Most of the rest fall into two broad groups.

The majority are options, particularly related to energy efficiency, that dominate the 'negative cost' potential. This has been partly because many of these would face a major struggle to prove their 'additionality', given their intrinsic cost-effectiveness – the paradox already noted.

As demonstrated by the Russian methane capture projects, this obstacle is not insurmountable if it can be reasonably proven that institutional barriers prevent projects happening and that the value of the project credits enables this to be circumvented. However, most of the 'negative cost' potential is in energy efficiency in buildings and transport sectors, where this is generally not the case. Additional barriers include transaction costs, split incentives (e.g. between tenants and landlords, and between vehicle manufacturers and drivers) and lack of focus or awareness due to energy costs being small compared to other costs.

The other 'absent' activities lie towards the other end of the supply curve. These include options like solar power and offshore wind, as well as advanced technologies in industry and agriculture. The projected costs – which include reductions from expected learning at scale – are not as high as for CCS, but the costs and risks today far outweigh any incentive from credits obtained under the project mechanisms.

In both the IPCC and McKinsey analysis, a big additional potential at higher cost arises from CCS. In principle, this is a technology that would be almost perfectly suited to support by the project mechanisms, since additionality would be unquestionable and it would feature large, discrete single project investments. The challenges lie in the potential scale of its application and the extent of innovation required (and the associated risks).

In short, despite having surged rapidly to become the dominant source of low carbon financing, the Mechanisms in their current form will still only tap a very modest fraction of the potentials identified. Tapping the potential will require tougher action accompanied by both reforms and complementary measures.

Reforming CDM rules

Some modest changes in rules could help to expand the scope of the CDM in particular. Approval for 'programmatic CDM' in December 2005 was intended to help increase the flow of programmes that aggregate many small investments, which could be particularly important for energy efficiency. The poor uptake to date however indicates some of the difficulties in implementing this in the context of the over-arching principles around closely-monitored, demonstrated additional emission savings.

Forestry projects have been deterred by severe rules relating to the fears of 'non-permanence', including possible reversal of emission savings if forests burn down. This resulted in special categories of 'temporary CERs'; but their temporary nature – combined with the fact that the EU ETS does not accept forestry-related projects – means that the market discounts these by up to 75%, effectively killing such projects. This treatment may vastly exaggerate the real risks, and an alternative would be for projects to fund a set-aside reserve to cover project failures; this would lessen individual project risks and could enable the CDM to start fostering some land-use projects[45]. However the underlying fact remains that most forestry projects are very long-term endeavours, which are unlikely to absorb much CO_2 on the timescales of the current structures. Moreover, there are no easy answers to the questions of 'crediting' avoided deforestation, given the potential for leakage and perverse incentives. A careful, independent evaluation of the lessons from the voluntary markets would help.

Another intriguing suggestion would act on the relationship between the supply and demand sides, by 'discounting' CERs for certain types of projects. Differentiated crediting ratios, including discounting, could in fact be used in many ways to change relative preferences between project or technology types, stages of development, or host countries/regions – though this broad scope of options is perhaps also part of the risk of the approach, given the complexity of global negotiations.

However, it will be hard for modest reforms of the CDM – even extending to discounting proposals with some associated relaxation of project rules – to magically unlock whole project classes and sectors. However, much flexibility may be appropriate in interpreting the 'additionality' of emission savings, it remains a bedrock principle for a mechanism that provides emission credits that might directly be used to offset emission reductions elsewhere. Assessment for small projects and programmes is inherently costly and complex, and will remain an obstacle for classes of investment that have either more diffuse or system-wide benefits, or are motivated partly by public co-benefits. Moreover, contemporaneous crediting within a structure of periodic, relatively short-term commitment periods also inherently discriminates against investments whose main benefits may accrue over the longer term.

Learning from the experience with the industrialised country Mechanisms

If the big question for the CDM is why it is leaving such a large part of other potentials untapped – and what can be done about it – a part of the answer can be found by looking at the experience amongst the industrialised countries of Annex I. This highlights the benefits of having 'horses for courses' through different instruments.

As much by accident as by design, the industrialised countries in effect have four distinct international mechanisms. The two different tracks of Joint Implementation are institutionally almost different instruments, but both appear to provide the same basic incentive as the emissions trading context within which they both reside – and which itself is now complemented

[45] Climate Strategies (2008): P. Baalman and B. Schlamadinger, Scaling up AFOLU Mitigation activities in Non-Annex I countries. 48 Rae Kwon Chun, A CER discounting scheme could save climate change regime after 2020, Climate Policy, Vol.7 pp.171-176.

by the emergence of Green Investment Schemes. From a simple economic standpoint this sounds like a huge duplication of instruments.

Yet in practice, each is finding a niche. The EU ETS, which rests under the Kyoto structure of intergovernmental emissions trading, is central to European implementation and a major driver of the whole Kyoto structure. 'Classic' Joint Implementation ('Track 2', under international supervision), despite its late start and narrow time-window, is generating key large-scale, high-return industrial investments that reduce emissions cost-effectively, particularly in Russia and Ukraine.

JI 'Track 1' is providing a mechanism for incentivising projects in the EU and some other OECD countries that fall outside the scope of their internal emission trading schemes. Most interestingly, Green Investment Schemes are emerging as an instrument to harness international finance for precisely the kind of programmes, for example on building energy efficiency, that provide long-term emission savings with high co-benefits, and yet which demonstrably could not be delivered through mechanisms operating under the constraints of strict project-by-project short-term additionality.

A key question from our analysis of supply and demand is whether there will be enough demand across these mechanisms to learn fully from the experience. However, the emerging evidence is already clear in one respect. It is not that the industrialised countries have too many international instruments, but quite the contrary: the developing world does not have enough. Key opportunities in developing countries will continue to languish until that is fixed, and new instruments are introduced to support clean investments in developing countries that fall outside the natural scope of the CDM.

Most industrialised countries in reality also use direct funding and there clearly is a role for this internationally. To avoid excessive profits, exceptionally cheap project classes could in theory be removed from crediting under the Mechanisms and targeted with direct funding, or addressed through other means – such as agreements on efficiency standards to a certain level, perhaps with some support for implementation.

Funding is also the most obvious way to support technology development. The case for supporting the initial build-up of technology-based industries that are close to commercial but not yet competitive at prevailing carbon prices is debated in theory, but in practice most industrialised countries also do this – either with direct funding, or by differentiating the level of market supports (e.g. with technology-specific feed-in tariffs or differentiated levels of crediting in renewable energy supports). Each approach, as noted, has parallel international options either by funding outside, or by creating different crediting ratios within, the Mechanisms.

Evolving the mechanisms

Finally, sheer scale considerations will limit the extent to which global decarbonisation can be delivered by mechanisms that hinge entirely upon additional international financial transfers. Even for the energy-related sectors alone, the potential abatement 'relative to reference' by 2030 in developing countries could be 15-20 $GtCO_2$/yr, comparable to the entire projected emissions from the present industrialised countries under such scenarios. For industrialised countries to support the entire difference through credit mechanisms, they would thus have to agree to 'targets' of zero emissions, and financial transfers vastly bigger than at present. If other sectors – notably forestry – were to be fully included the gap becomes even bigger. With the balance of global economic and political power shifting anyway, this is clearly implausible.

Willingness to pay – whether through credit-based or other systems – will thus be a defining constraint on the use of international mechanisms. The mechanisms must become much more selective, and the way in which they should be focused will be a matter of enduring analysis and political debate. Cost-effectiveness is an obvious aim, but raises the question: if some options are so cost-effective, why should international finance pay rather than developing countries themselves? Thus the debate over project additionality in the CDM has some analogue with the large-scale political question of who should pay for what – as well as how – particularly in relation to energy efficiency.

Arguably the most urgent need is to try and forestall the lock-in that would be represented by the construction of long-lived capital assets – like coal power plant and industrial facilities – and to build up industries capable of displacing them, like renewable energy industries. From this perspective, the present focus of the CDM may thus be quite appropriate. However, the sooner that some of these activities can be migrated out of international financing mechanisms, and become more reliant on domestic policies, the greater the scope to consider other activities.

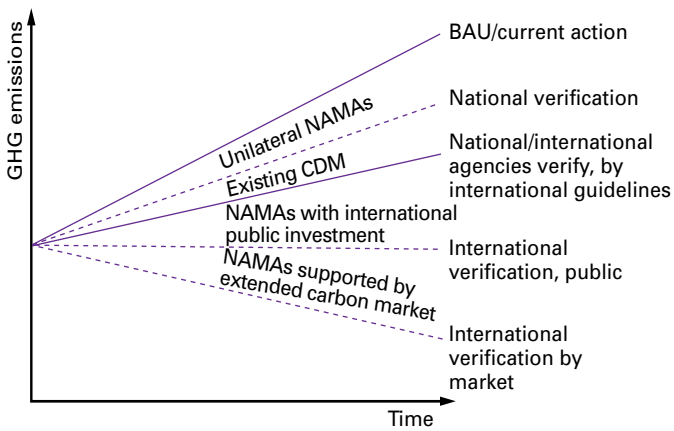
The implication is that the Mechanisms could play an expanded role in supporting a transition over the next

decade or so in key sectors, helping the world to establish low carbon industries and lessen 'carbon lock-in' at least in power generation, if they are complemented by appropriate efforts at energy efficiency and technology innovation. Major changes are anyway required to improve operations and to start tapping the 'missing sectors'. But over time the fundamentals need to change even more radically, to focus the Mechanisms either on much less developed regions, and/or on more confined technology classes, with the decarbonisation effort becoming more self-sustaining particularly in the major Asian developing countries.

The pace of such evolution will be influenced by the global negotiations, but not solely determined by them. Multilaterally-agreed systems can determine what kinds of emission credits can be made available with a reasonable degree of international assurance; they cannot force countries to buy them. The EU ETS has historically shunned forestry credits; it is entirely possible that some major industrialised countries, like the US, will make different unilateral decisions about what kind of project credits they are willing to buy. There is, however, a cost to such an approach: by making the global carbon market progressively more complex and differentiated, rather than the opposite, this will clearly reduce its overall efficiency. In the long run, to move towards stabilising the atmosphere, the most stable way to develop the system will be to minimise such distortions and for the balance between supply and demand to be maintained through negotiations that include increasing the number of countries that take on binding emissions caps across, at least, important parts of their economy.

A context for the future

Chart 24 *A four-tier categorisation of mitigation activities in developing countries*



Source: M. Ward et al as cited in H. Winkler, *Measurable, reportable and verifiable: the keys to mitigation in the Copenhagen deal, Climate Policy*, Vol.8(6), pp 534-547.

Note: NAMAs = Nationally Appropriate Mitigation Actions

Finally, this observation can be set in the broader context of debate about the involvement of developing countries in mitigation actions post-2012. The key lies in accepting that the current project mechanisms are but one part of a much broader span of what needs to be done, much of which inevitably falls outside the scope of the current project mechanisms. This is illustrated schematically in Chart 24, which divides the actions required into four main categories:

- Unilaterally-adopted policy reforms. These are measures that countries could sensibly adopt on their own because of domestic benefits, but which also contribute to emission reductions. These could include, for example, the removal of energy subsidies, which totalled a staggering US$300bn in the 20 largest non-OECD countries in 2007, and various types of regulatory reform, and tougher standards on the energy performance of new buildings and cars.
- Existing CDM, which is likely to remain the bedrock for financing the incremental costs of specific, separable emission-reduction projects, but hopefully with a number of specific incremental reforms such as those indicated in this report and explored much more fully in the existing international debate.
- Domestic programmes that would benefit from international public investment, or other support. These could include a wide range of policy instruments and programmes. The emerging Green Investment Schemes may provide important lessons for the possible design of such activities, whether or not the actual mode of finance is similar.
- Domestic policy reforms supported by an extended carbon market. This brings in options for much more radical departures in terms of developing country engagement with carbon markets.

At the extreme, the last of these would involve developing countries adopting full emissions trading schemes and linking them into a global carbon market at a common global carbon price. There are, however, many intermediate options being explored, often under the guise of more radical reforms for the CDM that would involve crediting emission savings attributed at the level of whole sectors, rather than individual investments; or crediting for the adoption of emission-saving policies that would fall outside the credible scope of normal development policies.

14. Conclusions

The Mechanisms have transformed the global effort, and yet are but a beginning. The big outstanding challenge is to build on their core success by learning, adapting, reforming, and expanding the set of instruments.

A qualified success

Ten years ago, the big political challenge was to find any mechanism that could positively engage developing countries in the global effort to tackle climate change, and to fund investments that would help to tap the potential to reduce emissions irrespective of geographic boundaries. For wide-ranging reasons it was entirely appropriate that such investments should be funded largely by richer countries. After the difficult start, the volume of response – and its relative integrity in terms of avoiding simple 'hot air' purchases under intergovernmental emissions trading – has exceeded expectations. The main prior alternative, of using centralised global funding mechanisms, has a useful role but does not pass serious consideration as the mainstay of global decarbonisation. The generic difficulties in any such centralised spending programmes have, not surprisingly, become further exacerbated by North-South conflict around such funds, underlining the implausibility of this as a model for something a hundred times bigger.

The CDM, in contrast, is also notable for its political success. It has received wide support from both developed and developing countries – helping to convert many of the latter towards accepting a valuable role for international market-based mechanisms after initially strong resistance. Through this, it has achieved a remarkable level of global engagement around the decarbonisation agenda. All countries under the Kyoto Protocol – which now means virtually all countries other than the United States – have already committed to the continuation of the Kyoto Mechanisms post-2012. At this broad, high level, the CDM in particular has succeeded beyond the wildest dreams of its early architects.

This political success, however, carries with it a real risk of sclerosis. The UN is nothing like a company, continually assessing its options in the light of experience and the threat of competition; nor like an elected government, with eyes on the next election and the ideas of opposition parties. Its decisions reflect a political compromise between almost two hundred sovereign states. Such decisions are hard to reach, and even harder to change. This study has pointed to a number of searching questions around the Mechanisms and the need for improvement if they are to fulfil their full potential.

Supply and demand: the need for global participation with an integrated perspective

Part II of this study has explained how the combination of rapidly expanding supply, the success of mitigation efforts particularly in some of the big EU countries, and the current absence of Canadian purchases (as well as the US exit), has led to an overall surplus. Even excluding the potential supply of Kyoto allowances from transition economies, there is not enough demand to absorb supply just from the regulated project mechanisms. Without US participation, the Kyoto system overall has a huge net surplus. None of the options for alleviating the problem look easy, and the imbalance will pose serious difficulties for the Mechanisms, confined not just to the present period, but potentially spilling over to their role post-2012.

With or without banking of the national surpluses from the transition economies, there is no satisfactory long-term solution without US re-entry into the global carbon markets in some form. As noted, however, there remains an institutional gap in the system: the lack of any internationally-accepted process to analyse the interaction of supply from the Mechanisms with the demand implied by future emission targets is a huge weakness in the current negotiating process.

The re-entry of the US into the negotiations could also provide strong political impetus to implement reforms and expand the horizons of the system. Apart from the overall need to enhance both the breadth and depth of emission cutbacks post-2012, the main issues and options fall into the following broad categories.

Reforming the CDM – governance

As described, the CDM is not without its problems. Section 10 in this report has explained why debates over the 'additionality' of emission savings are not subject to cast-iron, scientific resolution: they involve judgement, which puts the focus on the quality of procedures and their efficiency, including the extent of delays. Section 11 has noted many other difficulties around its efficiency, effectiveness and scope.

A common concern is that the CDM Executive Board is both overloaded, and potentially suffers from conflicts of interest between its different roles. Many have called for 'professionalisation' of the Board, which currently relies upon elected representatives nominated by and still in post with their governments[46]. More fundamentally, the Board's former Chairman noted that the CDM 'monopolises in one and the same body – the Executive Board – regulatory, executive, and quasi-judicial functions[47]'. During 2008, the Executive Board rejected or returned for revision more projects, and culminated with wielding its governance tool – removing accreditation from one of the validating agencies (DOEs) that had approved the projects in the first place. It would be part of a natural evolution of the system that the different functions are better separated over time. Several specific options are under active consideration by the governing UNFCCC/Kyoto Protocol Meeting of Parties[48].

Reform in this respect is particularly urgent given the looming questions over the design of post-2012 commitments, and the possibilities for more radical reform not just of governance, but of some of the bigger issues around the appropriate scope and design of the CDM itself. The CDM Executive Board – the first limited-membership body established under the UNFCCC – is the entity best placed to foster such developments and take them up to the UNFCCC itself, but this would also require reform. Currently, "the Board is so preoccupied by issues requiring immediate action that no time remains for the 'big' issues'" (IETA, note 46).

As indicated, there is no shortage of bigger issues that will need attention, both within and outside the CDM.

Enhancing the credit-based mechanisms

Apart from implementation structures, the options noted in this study for reform of the credit-based mechanisms fall into three main categories.

- *Incremental reform of CDM project additionality and eligibility rules.* These range from relatively micro reforms of assessment methodologies, to big political decisions around the inclusion of new categories, and bigger shifts to enhance, for example, programmatic CDM. Some other modest adjustments could support greater take-up in some of the least developed regions. They would, however, involve no changes of the principles of additionality or the corresponding legal basis.
- *Radical reform of project crediting rules* towards "top-down" assessments based on benchmarked performance and/or levels of market penetration. Such adjustments could also be accompanied by consideration of discounting emission credits for some of the more established or debatable project classes, to help 'err on the safe side' of simplified procedures. Some of these reforms could also improve the geographic distribution of projects, and credit discounting could also offer another means to address potential major imbalances in supply and demand. Many, however, may not be consistent with a strict interpretation of the current international legal basis.
- *Sector and policy-based crediting mechanisms.* These options are in widespread discussion under the banner of 'enhanced CDM'. In reality they might be most effective if considered as quite distinct mechanisms, since they represent a fundamental departure from the principle of international project-by-project based assessment, whilst retaining the principle of emission crediting as the driving incentive.

Implementing such changes – in addition to more fundamental features of ensuring a greater degree of stability and predictability in the emerging global carbon market, coupled with adequate investment in innovation – should enable Global Carbon Mechanisms to deliver a large fraction of the potential in the sectors for which they are intrinsically well suited.

[46] The International Emissions Trading Association notes that 'the CDM necessitates reform precisely because of its astounding success … it needs a system-wide upgrade, a grand leap towards the professionalisation of its governing bodies and the management systems they work within … the extended and increasing amount of [Executive Board] time spent dealing the registration and issuance of individual projects … has impacted on the ability of the Board to address some of its core responsibilities …' (IETA, State of the CDM 2008, Geneva)

[47] H. J. Stehr, *Does the CDM need an institutional reform*, published within UNEP Risoe Centre CD4CDM Perspectives Series 2008, *A Reformed CDM – including new Mechanisms for Sustainable Development*.

[48] UNFCCC Technical Paper FCCC/TP/2008/2 outlined options, and as formal input to the Review of the Kyoto Protocol negotiations, the Secretariat compiled national proposals in UNFCCC, *Compilation and analysis of available information on the scope, effectiveness and functioning of the flexibility mechanisms under the Kyoto Protocol*, 16 October 2008, FCCC/KP/CMP/2008/INF.3.

Beyond the carbon markets

The scale of the overall challenge is to greatly expand the degree of emission cutbacks globally, in line with the scenarios set out in section 13. As also illustrated there, this must involve expansion of the effort in three key dimensions:

- More comprehensive global engagement, including the least developed countries and those with emissions dominated by land-use.
- Wider sectoral focus to encompass the huge potentials in buildings and transport, as well as agriculture and forestry, which differ fundamentally in their characteristics and generally involve smaller dispersed activities.
- The fostering of investments for the longer term, through both innovation and appropriate infrastructural choices including public expenditure decisions with consequences that may persist across the whole century.

The global carbon mechanisms encompass a subset of these geographic, sectoral and temporal agendas: they spread action beyond the industrialised countries, they are helping to decarbonise investments in some key sectors, and by bringing in international capital they increase time horizons beyond those found in many developing country domestic markets. But they do not fully address any, and it remains unclear how far reforms such as those indicated will tackle these wider challenges. The fundamental incentive is for the investment to flow to the regions with the least political and regulatory risk, to the sectors in which additionality can be easily established by directly removing emissions or displacing carbon-intensive generation in big projects, and to those investments that will deliver emission savings as quickly as possible. Moreover, if the horizons are expanded so widely as to credit all savings in the developing world, including those associated with broad policy or sectoral reforms, supply will soon flood any conceivable level of demand generated by cutbacks in the present industrialised countries.

Some of these challenges can be addressed if more countries take on emission caps and utilise the wider set of international mechanisms available as a consequence; expansion of GIS based on such national commitments might help more money flow towards some new and longer term investments in those countries. Yet this is likely to remain a limited group of countries and still begs the question of internationalising policy and incentives in some of the most difficult sectors, like transport and some land uses. The revenue potentially available from auctioning of emission allowances, domestically and from international transport, may also provide an important link to funding-based approaches, but the need for other kinds of interventions cannot be avoided.

Thus the challenges involve more fundamental questions about the relationship between international finance and development, incentives for good policy and innovation, and other regulatory interventions including sectoral approaches and global standards. The agenda is huge. The Global Carbon Mechanisms are already making a big contribution, and they can offer much more with appropriate reforms. But they can only ever form a part of the overall solution.

Glossary

Term	Definition
Assigned Amount Unit (AAU)	National emission allowances that are allocated to countries in line with their 'assigned amount' of greenhouse gas emissions – i.e. the amount that they can emit in accordance with their target under the Kyoto Protocol (q.v.). Each AAU is equivalent to 1t CO_2e.
Additionality	A project activity is additional if GHG (q.v.) emissions are reduced below those that would have occurred in the absence of the activity (as defined by the project baseline (q.v.)).
Accredited Independent Entity (AIE)	National or international legal entities acting as independent verification institutions for JI (q.v.) projects. AIEs are accredited by the JI Accreditation Panel.
Activities Implemented Jointly (AIJ)	A pilot phase of activities under which Annex I Parties (q.v.) could implement emission reduction projects in other countries. The pilot did not attempt to issue any emissions credits. Effectively this formed the pilot phase for CDM and JI (q.v.).
Annex I/II	The UNFCCC (q.v.) divides countries into three main groups (who have differing commitments): • Annex I Parties include the industrialised countries that were members of the OECD (q.v.) in 1992, plus countries with economies in transition, including the Russian Federation, the Baltic States, and several central and eastern European states. • Annex II Parties consist of the OECD members of Annex I, but not the EIT (q.v.) Parties. • Non-Annex I Parties are mostly developing countries.
Annex B	The individual targets for Annex I Parties are listed in the Kyoto Protocol's Annex B. Countries included in Annex B are: EU-15 (q.v.), Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland, United States, Canada, Hungary, Japan, Poland, Croatia, New Zealand, Russian Federation, Ukraine, Norway, Australia, Iceland. Note: Although they are listed in the Convention's Annex I, Belarus and Turkey are not included in the Protocol's Annex B as they were not Parties to the Convention when the Protocol was adopted.
Banking	Process by which Parties may save some emissions allowances or credits for use in the next commitment period (q.v.).
Baseline	The GHG (q.v.) emission levels that would occur in the absence of the emission-reducing project activity – i.e. business-as-usual emissions.
Bilateral projects	CDM (q.v.) project activities that have an Annex I Party (q.v.) Letter of Approval (i.e. a partner in the industrialised world).
Carbon Capture and Storage (CCS)	The process of capturing and storing CO_2 emissions from significant sources such as fossil fuel power plants and storing it, thus preventing it being released into the atmosphere.
Carbon dioxide equivalent (CO_2e)	A measure used to compare the emissions from various greenhouse gases, given their differing potential to contribute to global warming. For example, methane gas emissions have at least 21 times the warming potential of carbon dioxide over 100 years, so 1 tonne of methane is equal to at least 21 tonnes CO_2e.

Certified Emission Reduction (CER)	Credits issued by projects under CDM (q.v.), representing the verified emissions reductions made by a project. One CER represents 1t CO_2e. *Primary CER (pCER)* is a transaction between the original owner (or issuer) of the carbon asset and a buyer (e.g. a project developer). In a primary transaction the buyer is subject to project risk. *Secondary CER (sCER)* is a transaction where the seller is not the original owner (or issuer) of the carbon asset (e.g. a broker). The seller provides a delivery guarantee, for which there is an associated price premium. CERs may be traded once issued or sold forward.
Chicago Climate Exchange (CCX)	A voluntary carbon trading exchange based in North America. Members of the CCX make a voluntary, but legally binding commitment, to reduce their greenhouse gas emissions.
Climate Investment Funds (CIF)	Funds established in July 2008 and administered by the World Bank, which aim to help developing countries with climate change mitigation and adaptation.
Clean Development Mechanism (CDM)	Mechanism provided by the Kyoto Protocol (q.v.) allowing industrialised countries with a greenhouse gas reduction commitment to receive credit for investing in projects that reduce emissions in developing countries.
Compliance (commitment) period	A range of years within which parties to the Kyoto Protocol (q.v.) are required to meet their greenhouse gas emissions target, which is averaged over the years of the period. The first compliance period is 2008-2012.
Conference of the Parties (COP)	The supreme body of the UNFCCC (q.v.).
Crediting period	The period for which emission reductions from the baseline (q.v.) are verified (q.v.) and certified by a Designated Operational Entity (q.v.) for the purpose of issuance of credits.
Determination	The process of independent evaluation of a JI (q.v.) project by an Accredited Independent Entity (q.v.) in order to determine if the Project Design Document (q.v.) fulfils all requirements under Article 6 of the Kyoto Protocol (q.v.) and the JI guidelines.
Designated National Authority (DNA)	Body granted responsibility to authorise and approve participation in CDM (q.v.) projects. A Party (i.e. a country) cannot take part in CDM unless it has established a DNA. The DNA provides a letter of approval, which is required for participants to register their CDM projects. In practice a DNA is often linked to a country's environment ministry.
Designated Operational Entity (DOE)	Independent auditors that assess whether a potential project meets all the eligibility requirements of the CDM (q.v.) (validation q.v.) and, once the project has successfully registered, whether the project has achieved greenhouse gas emission reductions (verification q.v. and certification). DOEs are accredited by the CDM Executive Board.
Executive Board (EB)	Supervisory authority of the CDM (q.v.), comprising a board of representatives elected from a cross-section of parties. It makes decisions on whether projects meet the CDM rules and decides how they are supervised and regulated. Its functions include: maintaining the approved methodologies, rules and procedures; approving new baseline and monitoring methodologies; accrediting DOEs (q.v.) and reviewing their decisions; making recommendations for new policies to the COP/MOP (q.v.) (to whom it ultimately reports); maintaining the registry of CERs (q.v.).
Economies in Transition (EIT)	A transition economy is one which is changing from a centrally-planned economy to a free market. Here we use it refer to states in central and eastern Europe, including Ukraine and Russia.
Emission Reduction Units (ERU)	Credits issued by projects under JI (q.v.), representing the verified emissions reductions made by a project. One ERU represents 1t CO_2e.

European Union (EU or EU-27)	Unless otherwise specified (see below) this is used to denote the European Union in its current full membership of 27 countries (i.e. EU-27).
EU-12 countries (EU-12)	Comprises new entrants to the EU: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia.
EU-15 countries (EU-15)	Comprises members prior to expansion of the EU that took place in 2004-2007. (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom).
EU Emissions Trading System (EU ETS)	In January 2005 the EU ETS commenced operation as the largest multi-country, multi-sector greenhouse gas emission trading scheme in the world. The first compliance phase (q.v.) ran from 2005 to 2007; the second runs from 2008 to 2012.
G-8	Forum for the world's major industrialised democracies comprising: Canada, France, Germany, Italy, Japan, Russia, the United Kingdom, and the United States.
Global Environment Fund (GEF)	Provides grants to projects in developing countries that tackle biodiversity, climate change, water, land degradation, ozone or persistent organic pollutants. It is run by the United Nations Environment Programme, the United Nations Development Program and the World Bank. Since 1991 it has given $7.4billion to 1,950 projects.
Greenhouse Gases (GHG)	Gases released by human activity that are responsible for climate change. The six gases listed in Annex A of the Kyoto Protocol are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC-23), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6).
Green Investment Schemes (GIS)	Under a GIS, a Party commits to use revenues from selling Assigned Amount Units (q.v.) to the development and implementation of the emission reduction projects, a process referred to as greening (q.v.).
Greening	Terms relating to GIS (q.v.). In 'hard greening' proceeds received from AAU (q.v.) sales go to projects generating measurable emissions reduction units; in 'soft greening' proceeds go to projects where emissions reductions cannot be as reliably quantified, e.g. awareness-raising or capacity building.
Hydrofluorocarbon-23 (trifluoromethane) (HFC/HFC-23)	A potent greenhouse gas with around 12,000 times the warming potential of carbon dioxide over 100 years. The vast majority of HFC-23 emissions are created as a by-product in the manufacture of refrigerant gases.
Host country	The country where an emission reduction project is physically located.
International Energy Agency (IEA)	Intergovernmental organisation which acts as energy policy advisor to its 28 member countries.
Intergovernmental Panel on Climate Change (IPCC)	Scientific intergovernmental body which provides independent information on climate change. Work by the IPCC has been a major source of information for negotiations under the UNFCCC (q.v.).
Issuance	The instruction by the CDM Executive Board (q.v.) to the CDM registry administrator to issue a specified quantity of CERs (q.v.) for a project activity.
Joint Implementation (JI)	Mechanism provided by the Kyoto Protocol (q.v.), allowing emissions reductions projects to generate credits (ERUs q.v.) to be traded amongst the industrialised countries party to the Kyoto Protocol. NB Projects that are subject to the oversight of the JISC (q.v.) are referred to as Track 2 – those that rely on host country oversight are Track 1.

Joint Implementation Supervisory Committee (JISC)	Supervisory body of JI Track 2 projects. Its responsibilities include: accredits AIEs (q.v.); supervises the verification of ERUs (q.v.) generated by JI projects; reviews reporting procedures, guidance on baselines and monitoring; recommends revisions to JI guidelines to MOP (q.v.); and verifies monitoring results for those JI projects that fall under its scope.
Kyoto Protocol	Adopted at the Third Conference of the Parties to the UNFCCC (q.v.) held in Kyoto, Japan in December 1997, the Kyoto Protocol specifies emission obligations for countries (known as the Annex B countries) and defines the three Kyoto mechanisms: JI, CDM and emissions trading. It entered into force on 16 February 2005.
Land-Use, Land-Use Change and Forestry (LULUCF)	LULUCF can reduce emissions, either by increasing the removals of greenhouse gases from the atmosphere (e.g. by planting trees or managing forests), or by reducing emissions (e.g. by curbing deforestation).
Land-Use Removal Units (RMUs)	A unit relating to an emission removal generated by an Annex I Party from LULUCF (q.v.) activities. One RMU represents 1t CO_2e. RMUs can be used to meet Kyoto targets. They may be converted into Assigned Amount Units (q.v.) and traded between Parties but cannot be banked (q.v.).
Marrakesh Accords	In 2000, these defined the 'rulebook' for implementing the Kyoto Protocol (q.v.): amongst other things they covered the implementation of CDM (q.v.), JI (q.v.) and emissions trading.
Methodology	Defines how emissions reductions will be quantified for a particular type of project.
Monitoring	The collection and analysis of data in order to determine the emissions baseline (q.v.) and measuring the reductions made for a particular project.
Nationally Appropriate Mitigation Actions (NAMA)	The Bali Action Plan of December 2007 calls for "nationally-appropriate mitigation actions by developing country Parties in the context of sustainable development, supported by technology and enabled by financing, in a measurable, reportable and verifiable manner".
Nitrous oxide (N_2O)	A greenhouse gas.
Meeting of Parties (MOP)	MOP is the Supreme Body of the Kyoto Protocol (q.v.).
Organisation for Economic Co-operation and Development (OECD)	An international organisation bringing together countries in the interests of helping governments tackle the economic, social and governance challenges of a globalised economy. The 30 member countries of OECD are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.
Offset	The concept of selling emissions reductions from projects made by one entity to another who is required to, or wishes to, make a reduction of the same amount in the emissions from their own activities.
Project Design Document (PDD)	The key document that describes an emission reduction project, and which is completed by project developers in order to register their project under the CDM (q.v.) or JI (q.v.).
United Nations Framework Convention on Climate Change (UNFCCC)	The UNFCCC was established 1992 at the Rio Earth Summit. It is the overall framework guiding international climate negotiations. Its main objective is "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man-made) interference with the climate system".

Unilateral CDM	CDM (q.v.) project activities that do not have an Annex I Party (q.v.) Letter of Approval at the time of registration of the project (i.e. those that do not yet have a buyer from an industrialised country).
Validation	The assessment of a CDM (q.v.) project's PDD (q.v.) by an independent third party (a DOE q.v.), which is required before the project can be sent for registration by the Executive Board (q.v.).
Verification	The process of confirmation by a recognised independent third party that the claimed emissions reduction activity has occurred.
Verified/Voluntary Emissions Reduction (VER)	The abbreviation VER is used for both verified and voluntary reductions: • A verified emissions reduction is a unit of greenhouse gas emission reductions from a project that has been verified by an independent auditor – but are not part of the UNFCCC (q.v.) framework such as CDM (q.v.) or JI (q.v.) projects. • A voluntary emissions reduction designates emission reductions units that are traded on the voluntary market, whether independently verified or not.

Technical Annexes to this publication are available:

Annex I – Analysis of CDM project performance

Annex II – Emissions and demand projections to 2020

These are available for download from the Climate Strategies website at: **www.climatestrategies.org** and from the Carbon Trust website at **www.carbontrust.co.uk**

Sources

This Carbon Trust report draws upon findings of Climate Strategies research on the Clean Development Mechanism, Joint Implementation and Green Investment Schemes. A series of technical reports are available from **www.climatestrategies.org**. Charts may be reproduced from this report on the condition that they are cited either with the full reference accompanying the chart, or in the abbreviated form as 'Source: Carbon Trust and Climate Strategies'. All other content is strictly subject to the copyright provisions on the back cover.

About Climate Strategies

Climate Strategies is an international network of leading academic specialists on economic and policy issues in tackling climate change. It provides a bridge between research and international policy challenges. Its aim is to help government decision makers manage the complexities both of assessing the options, and of securing stakeholder and public consensus around them. The Climate Strategies secretariat, hosted at Cambridge University, convenes international teams of leading researchers focused on specific projects; its reports and publications have a record of impact in the public and private sectors.

In addition to the support of the Carbon Trust, Climate Strategies receives funding from an expanding range of governments, foundations and business sponsors. Its work has been primarily with decision makers in the public and private sectors in the countries of the European Union, initially concerning the EU Emissions Trading Scheme (EU ETS) and related issues of industrial competitiveness and carbon leakage, but it has become increasingly active on other issues and in other regions.

Climate Strategies' research programme for 2008 spanned a range of topics on the future design of economic instruments in industrialised countries and strengthened engagement with developing countries. Forthcoming Carbon Trust Reports drawing on this work will cover the linkage of emission trading schemes, options for tackling carbon leakage, and incentives for policy reform and technology transfer in developing countries.

For 2009 the principal projects on industrialized countries and carbon markets will include Kyoto track negotiations; price floors, caps, and exchange-rate mechanisms in emission trading schemes; and distribution and comparability of effort including lessons from effort-sharing in the EU 2020 package. Further research on extending and reforming the CDM, and international support for domestic policy and implementation, is under way; and we plan studies on sector-specific approaches, including international marine and steel sector studies.

Collaborating research institutions 2007-2008

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* Institutions directly contributing to Climate Strategies' research on the Global Carbon Mechanisms.

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The Carbon Trust was set up by UK Government in 2001 as an independent company.

The Carbon Trust's mission is to accelerate the move to a low carbon economy, by working with organisations to reduce carbon emissions now and develop commercial low carbon technologies for the future.

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- By stimulating demand for low carbon products and services.

We cut future carbon emissions

- By developing new low carbon technologies through project funding and management, investment and collaboration.
- By identifying market barriers and practical ways to overcome them.

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ACT ON CO_2 is the UK Government's initiative to help individuals understand and reduce their carbon footprint. Visit http://actonco2.direct.gov.uk for more information.

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