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Abbreviations and Acronyms

AAU	Assigned Amount Unit
AF	Adaptation Fund
A/R	afforestation/reforestation
AWG-KP	Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
BAP	Bali Action Plan
BAU	business as usual
CCS	carbon capture and storage
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COP	Conference of the Parties
ERU	Emission Reduction Unit
EU-ETS	European Union Emission Trading Scheme
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
IET	International Emissions Trading
IETA	International Emissions Trading Association
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
lCER	long-term Certified Emission Reduction
LDC	least developed country
LULUCF	Land Use, Land-use Change and Forestry
MMSD	market mechanism for sustainable development
MRV	measurable, reportable and verifiable
Mt	megatonne (millions of tonnes)
NAMA	nationally appropriate mitigation actions
REDD	reducing emissions from deforestation and forest degradation in developing countries
tCER	temporary Certified Emission Reduction
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

U.S.	United States
VCS	Voluntary Carbon Standard

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1.0 Introduction

Market-based mechanisms have the potential to play a large role in the global effort to address climate change under the United Nations Framework Convention on Climate Change (UNFCCC). Three such instruments—International Emissions Trading (IET), Joint Implementation (JI) and the Clean Development Mechanism (CDM)—were introduced in the Kyoto Protocol to help countries meet their targets and effectively created the "carbon market."[1] These market mechanisms are designed to help countries meet their targets in a cost-effective manner, encourage the private sector to contribute to Greenhouse Gas (GHG) emission reduction efforts, and encourage the participation of developing countries as well as stimulate sustainable development, technology transfer and investment in these countries.

The goal of the UNFCCC (Article 2) is "to achieve…stabilisation of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The UNFCCC, which was ratified in 1994, sets out an overall framework for international efforts to tackle the challenge of climate change. The Kyoto Protocol, which entered into force in 2005, is an addition to this treaty that sets legally binding targets for reducing GHG emissions for 37 developed nations and the European Community. These targets amount to an average of 5 per cent reductions in GHG emissions from 1990 levels over the five-year period 2008-2012.

Countries have entered into formal negotiations on a climate change agreement after 2012 when the Kyoto Protocol's first commitment period ends. There are expectations that a comprehensive post-2012 climate agreement will be adopted at the 15th Conference of the Parties (COP 15) in Copenhagen in December 2009. There is considerable uncertainty as to what this post-2012 regime will look like and what market instruments and mechanisms could be employed within this. The Bali Action Plan (BAP), adopted in December 2007, set out broad parameters to guide the two-year negotiating process, including mitigation, adaptation, technology and financing. In regard to mitigation, the Plan emphasized the importance of "Various approaches, including opportunities for using markets, in order to enhance the cost-effectiveness of, and to promote, mitigation actions, bearing in mind different circumstances of developed and developing countries" (UNFCCC, 2007, p. 2).

[1] The market is referred to as the "carbon" market because carbon dioxide (CO_2) is the principle GHG. Other GHGs are traded based on their global warming potential (GWP) relative to carbon. For example, methane's GWP is 23 times greater than that of CO_2. The other GHGs included under the Kyoto Protocol and their GWPs are nitrous oxide—300, hydrofluorocarbons (HFC)—120-12,000, perfluorocarbons—5,700-11,900 and sulphur hexafluoride—22,200 (Intergovernmental Panel on Climate Change [IPCC], 2001).

The Stern Review (Stern, 2008, p. 487) concluded that a "broadly similar global carbon price is an essential element of international collective action to reduce greenhouse gas emissions." A broadly similar price of carbon could keep down the overall costs of making GHG emission reductions and could be created through tax, trading or regulation. The review noted that the next 10 to 20 years will be a period of transition as the world moves toward universal carbon pricing. The credibility of climate policy will be established in this transition period. The decisions made on market mechanisms in a post-2012 regime will impact on this credibility and help to put in place the structures to move the world toward a global price for carbon. Linking and expanding the various GHG emissions trading schemes and including developing countries in the carbon market requires the development of appropriate market mechanisms that facilitate international trading of carbon credits.

This background paper provides an overview of the role and profile of international carbon market mechanisms in a new international post-2012 climate change agreement. The paper first reviews the three market-based instruments under the Kyoto Protocol and then examines a range of possible market mechanisms under consideration in the international climate change negotiations. The concluding section discusses critical issues that will need to be considered in choosing and further developing international market mechanisms for a new climate regime.

2.0 Kyoto Protocol Market-based Instruments

Parties with commitments under the Kyoto Protocol (Annex B Parties) have accepted targets for limiting or reducing GHG emissions. These targets amount to a 5.2 per cent reduction in GHG emissions from 1990 levels over the five-year period 2008-2012. The targets are expressed as levels of allowed GHG emissions or assigned amounts over the commitment period. The allowed GHG emissions are divided into Assigned Amount Units (AAUs), equal to one metric tonne of carbon dioxide equivalent (CO_2e). Each country receives AAUs equivalent to how many tonnes of GHGs each can emit.

Canada is obliged to reduce its GHG emissions 6 per cent below the 1990 level by the compliance period, from 2008 through 2012. Canada's assigned amount of GHG emissions during the five-year period amounts to 2.81 billion tonnes of CO_2e or about 563 megatonnes (Mt) of CO_2e per year. Canada emitted 598.9 Mt of CO_2e in 1990 and 747 Mt in 2007 (Environment Canada, 2009). To be in compliance, Canada will need to reduce its GHG emissions through domestic actions or purchase credits from other nations to offset its GHG emissions or some combination of the two. The three Kyoto mechanisms, which are discussed below, allow countries to buy credits from other nations.

Trading in carbon tentatively started as the Kyoto Protocol moved toward ratification and is now one the world's fastest growing markets (see Table 1). The market was worth US$64 billion in 2007 with 70 per cent within the European Union Emission Trading Scheme (EU-ETS) (Capoor and Ambrosi, 2008). The bulk of the remainder of the market was for credits generated under the CDM. Markets for voluntary offsets and trading of AAUs under the Kyoto Protocol's IET facility have recently experienced strong growth.

Many countries use or are planning to implement GHG emissions trading schemes, individually or cooperatively, as part of their mitigation frameworks. This creates different regulatory carbon markets formally outside the Kyoto Protocol, such as the EU-ETS. In parallel, another type of carbon market, the voluntary carbon market, has emerged. This market includes all transactions of carbon offsets that are not required by regulation. It is basically conducted by non-regulated individuals who or companies that compensate for their GHG emissions. These trading systems are not discussed in this paper, which is focused on international carbon market mechanisms in a new international post-2012 climate change agreement.

Table 1: Volumes Exchanged and Corresponding Values on the Global Carbon Market, 2004-2007

	2004	2005	2006	2007
Estimated volume ($MtCO_2e$)	126	710	1,745	2,983
Growth (%)		435	146	71
Estimated value (million US$)	n.a.	10,864	31,235	64,035
Growth (%)		-	288	105

Source: Capoor and Ambrosi, 2006, p. 13, 23; Capoor and Ambrosi, 2007, p. 3; and Capoor and Ambrosi, 2008, p. 1.

2.1 IET

AAU trading under Article 17 of the Kyoto Protocol (or IET) allows countries with commitments under the Protocol (Annex B Parties) to buy and sell parts of each country's AAUs. Those countries with spare AAUs—GHG emissions permitted but not used—are allowed to sell their excess capacity to countries that are over their targets. Although the IET market has a large potential—several billion tonnes of CO_2e (Røine *et al.*, 2008, p. 37)—the first AAU transaction only occurred in 2008. The non-ratification of the U.S., many other countries likely to significantly miss their targets and concerns over Eastern European "hot air"[2] have all been contributing factors.

The AAU market is picking up with Point Carbon (2009a) reporting that up to 100 million GHG emission rights will be sold in the first half of 2009, up from the 18 million units that traded hands in 2008. These transactions include:

- The Czech Republic sold 40 million AAUs to Japan in March 2009 (Point Carbon 2009d).
- Ukraine announced that it had agreed to sell 15 million AAUs to Japan in 2009 and a further 15 million in 2010, all at a price of US$10/$tCO_2e$, with estimates that their total sales of AAUs could be 100-200 million AAUs (noting they have a surplus of around 2.5 billion AAUs) (Point Carbon, 2009e).
- Slovakia announced that it had sold GHG emissions rights worth US$66.3 million to a private investor on December 11, 2008 (Point Carbon, 2008).
- Hungary has sold GHG emission units to Spain, Belgium and Japan (Point Carbon, 2009f).
- Latvia sold 2 million AAUs to Austria and 3 million AAUs to the Netherlands in early 2009. Latvia also intends to sell AAUs to Japan (Point Carbon, 2009b).

[2] Large emission reductions (decreases averaging 35 per cent in 2005 from 1990 levels) occurred in Russia and Eastern European countries in the 1990s because of the economic collapse that followed the fall of the Soviet Union. The large amount of tradable emissions available from these countries is referred to as "hot air" because they resulted from an unintentional deviation from business as usual (BAU) emission patterns, rather than new investment in clean energy.

The exact reasons for these sales are not clear—mostly they are thought to be compliance sales but they could also be some form of hedging, purchases made for reputational reasons or could be for some other purpose. If the market becomes large it could act as competition to developing country credits.

There is concern that some of the AAUs sold to date are hot air and thus should be excluded from the market (Point Carbon, 2009c). There is likely to be increased pressure from buyer countries for green investment schemes—where the selling country uses the revenues from AAU sales for climate protection projects—to avoid the allegation that they are meeting binding GHG emission reduction targets through the use of hot air. The Czech Republic launched a green investment scheme in April 2009, but other recent actions suggest this may not be a priority of all governments in times of economic downturn. Hungary plans to use revenues from AAU sales in 2009 to prop up its ailing economy. And Slovakia's recent sale of AAUs failed to ensure that the revenue would go to climate protection programs (Point Carbon, 2009e and 2009g).

2.2 JI

JI, defined in Article 6 of the Kyoto Protocol, is a project-based mechanism that allows an Annex I country to earn credits from a project implemented in another Annex I country. For example, Japan (through the government or a company) could invest in a GHG emissions reduction project in Russia and then use the credits to offset its national reduction target. The goal of the program is to increase market efficiency by allowing developed countries to meet a part of their obligation by investing in GHG abatement projects in an Annex I country if the cost of abatement is lower in the other country. JI GHG emission reduction projects earn Emission Reduction Units (ERUs), each equivalent to one tonne of CO_2e.

The final determination (similar to registration) of the first JI project was completed in March 2007. As of May 1, 2009 there were a total of 204 JI projects in the pipeline (UNEP Risoe Centre, 2009). The JI pipeline has been dominated by projects in the following sectors: fugitive (17 per cent of total projects), biomass energy (12 per cent), nitrous oxide (10 per cent), wind (10 per cent), landfill gas (9 per cent) and coal-bed methane (9 per cent). Projects are located in Russia, Ukraine, Germany, France, New Zealand and Eastern European countries. The buyers tend to be from Western Europe. The JI market is a less significant segment of the global carbon market than CDM, but experienced a growth in traded volumes of 156 per cent from 2005 to 2007 with close to a tripling of transactions (see Table 2).

Table 2: Volumes Exchanged and Corresponding Values on JI Market, 2005-2007

	2005	2006	2007
Estimated volume ($MtCO_2e$)	11	16	41
Growth (%)	-	45	156
Estimated value (million US$)	68	141	499
Growth (%)	-	107	254

Source: Capoor and Ambrosi, 2007, p. 20; and Capoor and Ambrosi, 2008, p. 19.

2.3 CDM

The CDM, defined in Article 12 of the Kyoto Protocol, is a project-based mechanism whereby a project or program of activities to mitigate climate change in a developing country can generate credits that can be used by an Annex I Party to help meet its GHG emissions reduction commitment. CDM is currently the only mechanism that engages developing countries, which is not subject to binding GHG emission reductions under the Kyoto Protocol. The CDM has two goals—to assist developed countries in cutting GHG emissions in a cost-effective manner and to assist developing countries in achieving sustainable development. CDM GHG emission reduction projects earn Certified Emission Reductions (CERs), each equivalent to one tonne of CO_2e. From a carbon market basis, CERs have been sold into the EU- ETS and have been bought by a range of governments as offsets against their Kyoto Protocol targets.

The annual volume of CER transactions has been growing strongly since 2002, although the growth rate of volumes transacted slowed to an estimated three per cent in 2007 (see Table 3). As of May 1, 2009, the CDM pipeline contained 4,733 projects with 1,596 registered, 3,137 in the registration process and 500 with CERs issued (UNEP-Risoe Centre, 2009). China and India host 64 per cent of all CDM projects in the pipeline (1,766 and 1,251 projects respectively). Other active host countries are Brazil (361 projects), Mexico (206 projects) and Malaysia (152 projects). The largest buyers of CERs are United Kingdom, Switzerland, Japan and the Netherlands.

Table 3: Volumes Exchanged and Corresponding Values on Primary CDM Market, 2005-2007

	2005	2006	2007
Estimated volume ($MtCO_2e$)	341	537	551
Growth (%)	-	57	3
Estimated value (million US$)	2,417	5,804	7,426
Growth (%)	-	140	28

Source: Capoor and Ambrosi, 2006, p.13 and 23; Capoor and Ambrosi, 2007, p. 3; and Capoor and Ambrosi, 2008, p. 1.

The May 2009 CDM pipeline is dominated by projects in the following sectors: hydro (27 per cent of total projects), biomass energy (15 per cent), wind (15 per cent) and energy efficiency own generation (9 per cent). An examination of the distribution of CERs by project type indicates that the largest sectors are hydro (17 per cent of CERs expected by 2012), hydrofluorocarbon (HFC) destruction (16 per cent), energy efficiency own generation (10 per cent), landfill gas (9 per cent) and wind (9 per cent). China is the host country for the majority of CERs issued (53.6 per cent).

A large share of CERs is derived from electricity generation in one form or another with the destruction of industrial process gases also having a significant share. The volume of CERs from afforestation/reforestation projects is low, at less than 1 per cent of the total.

Programmatic CDM was introduced in 2007, opening the possibility to register an unlimited number of similar CDM project activities under a single CDM program of activities. Programmatic CDM is intended to be attractive in sectors that involve GHG emission reductions from several dispersed and/or small GHG emissions sources by reducing their CDM-related transaction costs. Procedural and methodological barriers have impeded the uptake of this mechanism, which has been slower than expected. There were 18 projects at the validation stage in the May 2009 UNEP-Risoe pipeline, including six in the solar sector and four in the energy efficiency households sector.

The CDM is now a significant instrument, although concerns remain about its environmental integrity. Some argue that the current CDM does not reflect real reductions in GHG emissions and as a result the CDM represents little more than a forum for wealth transfer (Wara and Victor, 2008). Each CDM project must demonstrate additionality or that reductions in GHG emissions go beyond BAU and are additional to any GHG emission reductions that would occur in the absence of the project. If the project would happen anyway, regardless of CDM benefits, then their offsets would not represent any real reduction in GHG emissions. The demonstration of additionality has been a challenging and controversial aspect of the CDM.

Another point of contention is the extent that CDM projects contribute to sustainable development. All CDM host countries are required to assess projects to ensure they are compatible with their sustainable development objectives. There have been a range of different approaches adopted by countries in terms of how they screen projects for achievement of these objectives. HFC-23 destruction and nitrous oxide projects are the most contentious in this regard, attracting criticism about their inability to contribute to sustainable development, and their potential to divert investments from renewable energy and energy efficiency—the project areas with greater sustainable development benefits.

3.0 International Market Mechanisms in a Post-2012 Regime

Most of the international climate discussions on expanded or new market mechanisms in a post-2012 regime are focused on the supply of credits from developing countries, taking the CDM as a starting point and seeing how it could be expanded and/or if new market mechanisms would be required. Capoor and Ambrosi (2008) believe the experience of the CDM has demonstrated its power as a tool to engage developing countries in mitigation activities. They note that the CDM represents only the tip of the iceberg of the potential of market mechanisms and other approaches to mitigating and adapting to climate change in developing countries.

The Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP) is discussing possible improvements to GHG emissions trading and the project-based mechanisms under the Kyoto Protocol for the period after 2012. The options and issues being considered are set out in an AWG-KP report (UNFCCC, 2009a) and listed below.

CDM

- include other LULUCF activities (afforestation and reforestation or A/R; reducing GHG emissions from deforestation and forest degradation; restoration of wetlands; sustainable forest management and other sustainable land management activities; soil carbon management in agriculture; and revegetation, forest management, cropland management and grazing land management);
- include carbon capture and storage (CCS);
- include nuclear activities;
- introduce sectoral crediting of GHG emission reductions below a previously established ("no-lose") target;
- introduce crediting on the basis of nationally appropriate mitigation actions (NAMAs);
- encourage the development of standardized, multi-project baselines;
- ensure environmental integrity and assess additionality through the development of positive or negative lists of project activity types;
- differentiate the eligibility of Parties through the use of indicators;
- improve access to CDM project activities by specified host Parties;
- promote co-benefits for CDM projects by facilitative means; and
- introduce multiplication factors to increase or decrease the CERs issued for specific project activity types.

JI

- introduce modalities for treatment of CDM project activities upon graduation of host

Parties;

- include nuclear activities; and
- promote co-benefits for JI projects under "Track 2" by facilitative means.[3]

GHG emissions Trading

- introduce GHG emissions trading based on sectoral targets;
- introduce GHG emissions trading based on NAMAs; and
- introduce modalities and procedures for the recognition of units from voluntary GHG emissions trading systems in non-Annex I Parties for trading and compliance purposes under the Kyoto Protocol.

Cross-cutting Issues

- relax or eliminate carry-over (banking) restrictions on Kyoto units;
- introduce borrowing of assigned amounts from future commitment periods; and
- extend the share of proceeds.

The Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) is discussing opportunities for using markets and there "appears to be a convergence of views on the positive role that market-based approaches can play in making mitigation actions cost-effective" (UNFCCC, 2009b, p. 16). The main options for new mechanisms are sectoral crediting based on non-binding targets (no-lose), sectoral GHG emissions trading and crediting or trading mechanisms for reducing emissions from deforestation and forest degradation in developing countries-plus (REDD-plus) actions.

The potential and implementation of an allocation-based market mechanism for sustainable development (MMSD), REDD and expanded CDM are explored below.

3.1 Allocation-based MMSD

Most mitigation actions in developing countries are taken without the benefit of international recognition under the current climate regime. While some of these measures directly target the mitigation of GHG emissions, most aim at other objectives (such as energy efficiency), which have a co-benefit of reducing climate change. Many developing countries want a mechanism through which such measures would be recognized as part of their climate change international efforts. The Republic South Korea (2009) has suggested the creation of a registry through which developing

[3] If a host Party meets all eligibility requirements to transfer and/or acquire ERUs (see http://ji.unfccc.int/Eligibility/index.html), it may verify the emission reductions from a JI project as additional to any that would otherwise occur, and upon verification the host Party may issue the ERUs. This is the "Track 1" procedure. If a host party does not meet all eligibility requirements, verification of emission reductions being additional has to be done through the JI Supervisory Committee. This is the "Track 2" procedure.

country NAMAs would be listed, such as REDD activities, sector-wide technology standards, laws and regulations, carbon taxes and gas mileage of motor vehicles. Most post-2012 regime proposals of this type do not entail binding commitments from developing countries, but involve commitments of support from developed countries (for example, for technology incentives and funding).

An allocation-based MMSD could be one way to provide support for NAMAs. This would operate by first granting an "allocation" to a sector, which would include the impacts of expected reductions. Any reductions beyond this allocation (measured in tonnes of carbon) could be eligible for sale through the carbon market. These allocations could be set out in NAMA plans and agreed to by the COP, and the allowances subject to MRV requirements. The intent of a broader MMSD is to move away from credits for project-based GHG emission reductions and the need to demonstrate additionality—an issue that has proven controversial over the life of the CDM. Allocation MMSDs could include a range of options where countries will receive saleable units if their GHG emissions from a sector are below an "allocated" value.

A key question will be the determination of the allocation for a sector or activity. While there are issues around the setting of appropriate baselines for CDM projects, there are at least firm protocols and methodologies covering how to set boundaries, how to measure GHG emissions and how to account for leakage.

Through a reporting system, which could take the form of a registry, allocation-based MMSDs would generate saleable carbon units. Similar to the proposal from the Republic of Korea (2009), only those actions not supported with financing and technology transfer by developed countries would be eligible to generate carbon units. An allocation-based MMSD would act as an incentive to mitigate climate change in areas that would not have seen action because of a lack of financial support. As such, activities that could be implemented without relying on revenues from the market mechanism would not be allowed.

3.2 REDD

Two prominent proposals in the negotiations on REDD view financing in different ways. Brazil's 2006 proposal indicated that REDD support should be through a fund that is based on grant contributions from developed countries, rather than a market mechanism. The 2005 Papua New Guinea and Costa Rica proposal put forward a market-based financing approach to REDD activities, allowing developing countries access to the carbon market. The second proposal was based on "compensated reduction" and suggested establishing national baseline rates for deforestation. Any difference below the baseline compared to participating Parties' deforestation rates would be granted units to sell on the carbon market. Allocation-based MMSDs could help to realize forestry mitigation potential in developing countries.

There are uncertainties regarding the magnitude of forestry and other land-use GHG emissions, and outstanding questions for monitoring, permanence, baselines and leakage. These issues have contributed to the decision not to include CERs from A/R CDM activities in the EU-ETS; some other developed countries (including Canada) have indicated they will not allow the use of CERs from forest sink activities in their GHG emissions trading systems. Recent efforts, such as the 2006 Intergovernmental Panel on Climate Change (IPCC) inventory guidelines on the Agriculture, Forestry and Other Land Use sector (IPCC, 2006) and the protocol work of the Voluntary Carbon Standard (VCS) and the Alberta government, indicate that monitoring and permanence barriers can be overcome. [4]

3.3 Expanded CDM

One area of discussion in the international negotiations is expanding the CDM. The scope of mitigation activities is quite narrow in the land use sector and could be significantly expanded. In the energy sector, nuclear and CCS are possible project areas to add to the CDM. These are important sectors that have the potential to reduce GHG emissions from electricity generation, the largest single emitter in developing countries, particularly in China and India. Issues associated with expanding the CDM to include these three sectors are discussed below.

3.3.1 Land-use Projects: Agriculture and Forestry

Many activities with the greatest value to rural communities in poorer developing countries were excluded from the CDM in the first commitment period with sinks activities restricted to A/R. These projects have not been widely taken up under the CDM. As of May 1, 2009, there were three registered CDM projects in the A/R sector with two requesting registration and 37 at the validation stage. The slow uptake in of A/R projects may hold lessons for including market-based mechanisms for broader land-use projects in a post-2012 agreement. REDD is being discussed as a separate mechanism/activity for the post-2012 period, and there are strong arguments for expanding the CDM to include sustainable forest management, agricultural soils and other sustainable land management practices.

Some barriers to the CDM market have to be removed to better include the land-use sector in the CDM. The Food and Agriculture Organization and the International Fund for Agricultural Development (FAO and IFAD, 2008) found that land-based climate change mitigation project activities, especially in rural areas, face several barriers to entering the carbon market, such as high start-up and transaction costs, expensive entry fees, insufficient knowledge about project registration cycles, small project scale and fragmentation. As well, there is a current cap on A/R project activities

[4] The VCS (2008) has developed the *Tool for AFOLU Non-Permanence Risk Analysis and Risk Determination* that includes a project risk assessment to determine the number of non-tradable buffer credits to be held in reserve to cover unforeseen losses in carbon. The Alberta government has developed an afforestation protocol, see: http://www.carbonoffsetsolutions.ca/offsetprotocols/finalAB.html.

under the CDM; A/R CDM activities are limited to 1 per cent of a country's total GHG emissions in 1990 multiplied by five.

A major barrier is the temporary nature of credits from A/R projects (and other land-use projects that could be included under the CDM) since the credits expire after a predefined period. The issue of non-permanence of the carbon sequestered through A/R projects has been addressed through temporary CERs (tCERs) and long-term CERs (lCERs). tCERs expire at the end of the commitment period following the one during which they were issued, while lCERs expire at the end of the project's crediting period, which can be 20 years (renewable up to two times) or 30 years (without a renewal option). Once these tCERs and lCERs expire, the holder of the credits must replace them with new ones or achieve an equivalent amount of GHG emission reductions elsewhere. The expiring nature of these credits means that A/R projects are regarded as a less attractive investment option than other types of CDM projects. The temporary nature of credits under forestry CDM projects is a major barrier preventing funds and companies from purchasing these CERs (Ecosecurities, 2006), and it influenced the decision of the EU-ETS to exclude forestry CDM credits.

CDM projects are not equally distributed over the different regions and among developing countries. Expanding land-use activities under the CDM is likely to improve this distribution as many developing countries are interested in having a market mechanism that includes more land-use activities. For example, the African Bio-Carbon Initiative calls for a post-2012 agreement to encourage sustainable agriculture in Africa, including crediting and financial mechanisms that reward improved agriculture and forest-management practices and also help the poor adapt to climate change (Common Market for Eastern and Southern Africa, 2008). It should be noted that not all developing countries support expanding the CDM in this manner. Tuvalu (2008) is not in favour of the expansion of the land use and forestry sector in the CDM.

3.3.2 CCS

Since CCS has no benefit other than GHG emission reductions, a long-term price for carbon is essential for its widespread implementation. The incorporation of CCS into the CDM has been discussed at several COPs and there are concrete proposals on the table that have informed the negotiations. [5] Whether CERs from the CDM would be sufficient in scale and whether their value could be guaranteed over a sufficiently long period to incentivize CCS is uncertain and will depend on the size of demand within carbon markets, itself driven by the stringency of future developed country targets. Carbon markets are one source of finance for the very significant investments that fitting CCS technology to electricity generation and other industrial processes would entail. The other alternative for governments would be to mandate the use of CCS for at least some applications (for example, coal-fired electricity plants). This would radically increase the costs of

[5] See, for example, the submission of the International Emissions Trading Association (IETA, 2008) to the UNFCCC.

these options and may not be cost effective. The abatement costs of CCS could be higher than other options that are not mandated by government. It is difficult at this stage to see governments in developing countries mandating CCS unless there was some source of external finance. The carbon market could potentially provide at least part of this.

Before 2020, funding is needed to incentivize demonstration plants; after 2020, CCS is expected to move into the deployment phase. The carbon market is best suited to assist CCS technologies in the deployment phase and would not provide sufficient incentive for financing demonstration plants. [6] CDM would have the greatest impact on CCS after 2020 through support of deployment.

3.3.3 Nuclear

Nuclear, like CCS, would also benefit from a long-term value for carbon. There are many other issues regarding its use in developing countries with pros and cons including long-term waste storage and disposal, the possibility of accidents with potentially severe impacts and insuring against them, potential links between civil and military programs, the contribution to energy security of supply and the very low emissions of acidic gases and GHGs across its lifecycle. Debate to date has not led to nuclear coming close to being an accepted technology under the CDM. Whether this continues to be the case is somewhat a moot point; it is difficult to see any major growth in nuclear capacity in developing countries outside China and India, both of which already have nuclear programs without any contribution from carbon markets or other internalization of the value of avoided carbon emissions. It appears the highly-charged nuclear debate can be largely avoided—carbon pricing is unlikely to make any significant difference to uptake in the developing world, at least within the medium term.

3.3.4 Sectoral CDM

Sectoral approaches cover a range of different options, from technology oriented agreements to transnational sector schemes where a single sector effectively takes on a target covering many countries and trades internally to meet this. Many of these options could still be developed and applied in the long term, but it is sectoral CDM that has received focused attention in the current round of negotiations. Sectoral CDM refers to specific sectors within a country and should not be confused with transnational targets applying to a sector as a whole.

Sterk and Wittenben (2007) describe two types of sectoral CDM—policy-based CDM and clustered CDM. Clustered CDM is a mechanism through which private actors implement local projects that are clustered along the lines of a specific sector. Baselines would be defined for a sector. Investments that contribute to staying below the baseline level could then receive the difference between the baseline level and the achieved level in the form of CERs. Policy-based CDM would promote national or local policy initiatives by rewarding the government with credits.

[6] See, for example, the United Kingdom's CCS Competition, which advocated capital and operational support (United Kingdom Department for Business, Enterprise and Regulatory Reform, 2007).

Under sectoral CDM, a baseline is established for a sector and GHG emission reductions below the baseline are eligible to receive credits. Sectoral baselines could be in absolute terms or as intensity baselines. Sectoral approaches partly avoid the counter-factual and hypothetical assessment of the motivation of private entities to demonstrate additionality; the main challenge is the uncertainty of the GHG emissions projection (Schneider, 2007).

Sectoral CDM that includes policy-based projects could help to solve the problem of governments being reluctant to implement climate protection policies and measures for fear of making future CDM projects non-additional. Instead, it would reward them for their efforts to mitigate climate change. Several methodological issues would need to be addressed to include sectoral crediting mechanisms, including: establishing boundaries; establishing baselines that encourage the sector to reduce GHG emissions; collecting robust data from several emitters over a period of time; and ensuring that GHG emissions reductions are measurable, reportable and verifiable (MRV). There is no easy way to determine additionality and it is difficult to get around the problem of punishing first movers by crediting only those that moved after the implementation of sectoral crediting.

While the focus of sectoral CDM has largely been on energy intensive industry to date, sectors that are either less energy intensive or do not produce goods that are traded competitively may be among the best candidates for sectoral CDM, including electricity generation, aviation, international marine and transport sectors. Sectoral CDM may also have a large role in the agricultural sector, for such activities as soil carbon sequestration, where costs and fragmentation are high.

4.0 Country Views on Market Mechanisms: Submissions to the LCA

Several countries have made submissions to the AWG-LCA, expressing their views and proposing text for a post-2012 international climate agreement. [7] Many support the expanded use of market mechanisms, with several supporting a REDD market mechanism, including: Algeria, on behalf of the African Group; Columbia; India; Indonesia; Lesotho, on behalf of Least Developed Countries (LDCs); New Zealand; Norway; Panama, Paraguay and El Salvador; and Papua New Guinea. Many note the need for a phased approach for REDD, as well as grant funding in addition to a market mechanism. Some, including Bolivia and Brazil, support only a fund, seeing no role for a REDD market mechanism.

Many countries support using market instruments to finance NAMAs, including Belarus, Indonesia, New Zealand, Norway, Panama, Paraguay and El Salvador, and South Korea. The Czech Republic, on behalf of the European Community and its Member States, proposes that a sectoral crediting mechanism and sectoral trading, in addition to CDM, incentivize the implementation of NAMAs. Japan puts forward that the CDM can promote NAMAs. Uruguay promotes the use of market mechanisms to implement NAMAs in the agriculture sector. China proposes that GHG emission reduction credits generated from NAMAs not be used by developed countries as offsets, indicating that a private sector approach and market-based mechanism can only play a complementary role in addressing climate change.

Other ideas include a technology crediting mechanism with two different submissions from Ghana and Turkey. Argentina calls for market mechanisms that encourage a fair regional distribution of project activities and eligibility criteria that include co-benefits. The U.S. notes that resources will need to flow through a variety of sources for mitigation, including the carbon market. Canada calls on countries to cooperate as appropriate to enable mitigation at the least economic cost through the use of environmentally effective market-based instruments.

An important issue under discussion in the negotiations is the use of market mechanisms to raise funds for actions in developing countries. Under a precedent established for this under the CDM an adaptation "share of proceeds" is payable to the UNFCCC when CERs are issued by the CDM Executive Board. A 2 per cent levy (applied to all projects except those hosted in LDCs) is used to support the Adaptation Fund (AF), which assists developing countries in adapting to the adverse effects of climate change. Many country submissions to the AWG-LCA have proposed that the share of proceeds be extended to JI and IET. Lesotho, on behalf of the LDCs; Panama, Paraguay and El Salvador; and Singapore suggest that at least a 2 per cent levy apply to all Kyoto mechanisms.

[7] See "Submissions by Parties" on the UNFCCC website, which can be accessed at: http://www.unfccc.int/meetings/ad_hoc_working_groups/lca/items/4578.php.

Indonesia; and Nicaragua, on behalf of Guatemala, Dominican Republic, Honduras and Panama propose that a share of proceeds from ERUs and AAUs support the AF. Columbia calls for a 4 per cent share of proceeds from JI and IET, while the Philippines suggests that at least 10 per cent of proceeds from JI and IET be allocated to the AF.

Norway proposes auctioning a share of AAUs from national quota allocations, where a share of allowances could be auctioned directly or through a tax on issuance of the allowances (noting that a tax on transactions creates inefficiencies and should, therefore, not be an option). A 2 per cent auctioning of the asset (similar to the CDM levy) would generate an annual income of between US$ 15 and 25 billion. The proposal does not rule out the possibility of raising funds for purposes other than adaptation, such as technology development and efforts to reduce deforestation in developing countries. Indonesia and the Philippines support Norway's auctioning proposal in their submissions to the AWG-LCA.

Norway also proposes that a share of allowances be kept in a set-aside reserve. This set aside could be accessed by developing countries if they implement cost efficient measures nationally that establish an incentive structure for reducing GHG emissions. To get access to the set aside, countries would agree to introduce a cap-and-trade system or a carbon tax by an agreed date with agreed specified sector coverage. This could be done in combination with proposals to introduce GHG emissions trading based on sectoral targets or on the basis of NAMAs. This would move beyond project-based mechanisms by supporting developing countries in setting policies as a minimum at a sectoral level.

5.0 Moving toward Copenhagen

Most countries envision an important role for the CDM or other MMSD in a post-2012 regime. Coming to agreement in Copenhagen will require that several issues and concerns related to international market mechanisms are addressed, including: accounting for the different circumstances of developing countries, addressing the issue of additionality and ensuring demand for a greatly increased supply of credits.

5.1 Accounting for the Different Circumstances of Developing Countries

Developing countries see an MMSD as an important means for supporting sustainable development, and are careful to safeguard their sovereign right to define what constitutes sustainable development in the national context. Equity of access and the regional distribution of projects under the mechanism is particularly a concern for LDCs. Developing countries also want an MMSD that keeps demand robust. While this is dependent on governments reaching agreement on further GHG emission reduction targets, the structure of the mechanism will have a bearing on supply and demand post-2012. As well, they are conscious of the fact that the integrity of the mechanism will also have an impact on demand from developed countries, CERs being only one of several options for Annex I compliance via trading.

The international negotiations include a highly contentious discussion of possible graduation of some developing countries to a state of target- or action-based commitments. A post-2012 climate regime that includes graduation of some developing countries will have perhaps the most interesting impacts on the function of any MMSD. An option would be to involve graduating countries with targets in IET and JI-like mechanisms, perhaps providing incentives for their participation by giving them large amounts of surplus allowances. The CDM would probably become more oriented to development than mitigation, serving the needs of lesser developed countries and comprising a portfolio of projects that achieve high development dividends.

While the CDM is explicitly aimed at fostering sustainable development in the host countries, IET and JI have no such explicit aim. If the starting point is the need for an MMSD focused on both low-cost GHG emissions *and* sustainable development, then one option would be to "green" AAUs in a development-friendly manner or to amend the JI to include sustainable development requirements for host country approval. This could be made effective exclusively for recently graduated developing country hosts or more broadly for all host countries.

A transition period or transition mechanism for graduating countries will be required. Ongoing CDM projects in graduating countries will be generating CERs for GHG emission reductions and these same credits might be counted against national targets. Possible solutions are to allow "double

counting" to ensure continuity to existing CDM investments (University of Sao Paulo, 2006), or require graduating countries to simply augment their obligations by the amount of CERs generated.

5.2 Additionality

Many developed countries are interested in an MMSD that provides access to low-cost credits to meet compliance targets. As noted previously, there are growing concerns about the additionality of international offsets with some viewing them as a wealth transfer, arguing that the current CDM market does not reflect actual reductions in GHG emissions. Political sentiment in developed countries requires robust additionality processes to ensure the environmental integrity of credits under an MMSD. Several suggestions have been forward to address the additionality question, including the development of positive or negative lists of project activity types, and moving away from project-based mechanisms to sectoral or allocation-based mechanisms.

5.3 Ensuring Demand for an Increased Supply of Credits

A consideration in the discussion of allowing the sale of credits from an expanded CDM, a REDD mechanism or a new MMSD is the risk of flooding the carbon market. One of the key benefits of expanding market mechanisms under the new post-2012 agreement is a larger quantity of GHG emission reductions. But the question is whether the resulting flow of credits from developing countries would find buyers or to what extent the price of carbon would reach disastrous lows. A clear implication for a post-2012 regime that includes credits from an expanded MMSD is the need for ambitious targets for developed countries that will fuel demand for these credits and agreement in developed countries to purchase credits generated under these mechanisms.

There will also need to be consideration of who will buy the credits. Developed countries are putting restrictions on the use of CDM by limiting the percentage of CDM and JI credits that can be used by firms and not allowing the use of credits generated by sink projects. The EU-ETS excludes forestry CDM credits and in Phase II of the EU-ETS the United Kingdom will limit a firm's use of credits from CDM or JI to 8 per cent of its obligation. The proposed Lieberman-Warner bill in the U.S. would allow companies regulated under the national cap-and-trade program to meet up to 15 per cent of their compliance obligations with allowances from a foreign GHG trading market, likely including the CDM. The proposed Canadian framework, *Turning the Corner*, limits the use of CDM credits to 10 per cent of a firm's regulatory obligation and refuses to accept credits from forest sink CDM projects for compliance with Canadian regulations.

Expanding the CDM or introducing new MMSDs means that developed countries will need to be willing to purchase these credits. Agreeing to expanded and new MMSDs will create expectations in developing countries and developed countries must be sure they are willing to fulfill those expectations.

5.4 Concluding Comments

Effective international market mechanisms are needed to help countries meet their targets in a cost-effective manner and to encourage the participation of developing countries in meeting the goal of the UNFCCC. It is important to note that the more attractive an MMSD becomes in a post-2012 regime, other things being equal, the less incentive any developing country has to take on targets that entail lost access to the mechanism. [8] If the post-2012 regime includes a radically expanded MMSD that covers sectoral and NAMA initiatives, it is offering governments the opportunity to fund a variety of policies and programs that they might have as current priorities, but for which they lack the requisite resources. This clearly counts as a more attractive MMSD.

Several questions need to be answered over the next eight months as the world comes closer to elaborating a post-2012 regime for international action on climate change, including:

1. Which market mechanisms offer the greatest potential for developing country participation in a post-2012 regime?

2. What types of transition mechanisms might encourage large developing country emitters and advanced developing countries to take on meaningful actions and/or commitments?

3. Should developed countries be encouraged to allow greater access to international credits within their regulatory regimes? What steps should be taken to improve the integrity of such credits? What are the best approaches for dealing with additionality?

4. What is the best way to deal with the permanence issues in crediting mechanisms for REDD or soil carbon sequestration to encourage increased developing country participation in the carbon market?

5. How do we ensure that LDCs, small island developing states and African nations become involved in and benefit from carbon markets?

[8] The assumption of other things being equal is important. It is of course possible to imagine a regime involving targets and emissions trading for all, with tough enough developed country targets and generous enough allowances for developing countries to overcome the disadvantage of losing the CDM as a mechanism.

6.0 Glossary

AF – Adaptation Fund
The AF finances adaptation projects in developing countries that are particularly vulnerable to the adverse effects of climate change. The AF is financed by a 2 per cent levy on credits issued through CDM projects.

Additionality
According to the Kyoto Protocol, GHG emission reductions generated by CDM and JI project activities must be additional to those that otherwise would occur. Additionality is established when there is a positive difference between the GHG emissions that occur in the baseline scenario and the GHG emissions that occur in the proposed project.

AWG-KP – Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
This group, agreed to at COP 11 in Montreal in 2005, is discussing future commitments for industrialized countries under the Kyoto Protocol. Membership includes all countries that have ratified or approved the Kyoto Protocol. Most notably, the U.S. is not a member of this group.

AWG-LCA – Ad Hoc Working Group on Long-term Cooperative Action under the Convention
This group, formed under the BAP, is undertaking a dialogue to analyze approaches for long-term cooperative action to address climate change, including mitigation, adaptation, technology, and financing and investment. Membership includes all nations that have signed the UNFCCC.

Annex B Countries
These are developed nations, as well as countries in Central and Eastern Europe, that committed to GHG emission reductions at Kyoto. "Annex" refers to an appendix to the Kyoto Protocol document. Canada is one of the Annex B countries. The U.S. has not ratified the Kyoto Protocol.

Annex I Countries
These are the Organization of Economic Cooperation and Development countries (except for Mexico and South Korea) and those making the transition to a market economy, such as Russia and the former Eastern Bloc countries, that are signatories to the UNFCCC.

Anthropogenic GHG Emissions
GHG emissions that result from the activities of human beings, such as burning of fossil fuels.

AAU – Assigned Amount Unit
Annex I Parties are issued AAUs up to the level of their assigned amount, corresponding to the quantity of GHGs they can release in accordance with the Kyoto Protocol during the first commitment period. One AAU is equal to 1 tCO_2e.

Carbon Credits
Several units have been defined for the various market mechanisms, all equivalent to 1 tonne of CO_2e, to encourage fungibility:

- AAU – Assigned Amount Unit – IET
- ERU – Emission Reduction Unit – JI
- CER – Certified Emission Reduction, including tCER – temporary CER and lCER – long-term CER – CDM
- RMU – Removal Unit – LULUCF
- VER – Verified Emission Reduction – Voluntary market outside the Kyoto Protocol compliance regime
- EUA – European Union Allowance – EU-ETS

CER – Certified Emission Reduction
A credit for GHG emission reductions achieved by a CDM project. The credit is registered and can be used by developed countries to count toward their GHG emission reduction commitments.

CDM – Clean Development Mechanism
A market-based mechanism under the Kyoto Protocol where a project or program of activities to mitigate climate change in a developing country can generate credits (certified emission reductions or CERs) that can be used by an Annex I Party to help meet its GHG emission reduction commitment.

EU-ETS – European Union Emission Trading
The largest multinational GHG emissions trading scheme in the world and a cornerstone of EU climate policy.

GHG – Greenhouse Gas
Gases that accumulate in the earth's atmosphere and trap heat contributing to the greenhouse effect. The six greenhouse gases covered under the Kyoto Protocol are CO_2, methane, nitrous oxide, HFCs, perfluorocarbons and sulphur hexafluoride.

IPCC – Intergovernmental Panel on Climate Change
A body made up of the world's leading climate experts, established in 1988 by the UNEP and the

World Meteorological Organization, to assess the scientific research on climate change and its environmental and economic impacts. Most notably the IPCC publishes at regular intervals Assessment Reports on the latest knowledge on climate change.

IET – International Emissions Trading
A market-based mechanism under the Kyoto Protocol that allows Annex B countries to buy and sell parts of each country's allowed GHG emissions, which are divided into AAUs. This increases the allowable GHG emissions in the recipient country and reduces those of the seller country.

JI – Joint Implementation
An international project, involving joint action by Annex B countries, that results in a real, measurable reductions in net GHG emissions in a host country.

Kyoto Protocol
The protocol is an international agreement linked to the UNFCCC that sets binding targets for 37 industrialized countries and the EC for reducing GHG emissions. These targets amount to an average 5 per cent reduction from 1990 levels over the five-year period 2008-2012. The protocol was adopted in 1997 and entered into force in February 2005.

LULUCF – Land use, Land-use Change and Forestry
A GHG sector that covers GHG emissions and removals of GHGs generated from land use, land-use change and forestry activities that result from human activities. Examples of activities in the land-use sector include increasing removal and storage of carbon from the atmosphere by planting trees or introducing reduced-tillage agricultural practices or reducing GHG emissions by curbing deforestation.

lCER – Long-term CER
A CER that is issued for an afforestation or reforestation project activity under the CDM and expires at the end of the crediting period for which it was issued. These credits are considered to be non-permanent or temporary and must be replaced by permanent GHG emission reductions sometime in the future.

tCER – Temporary CER
A CER issued for an afforestation or reforestation project activity under the CDM, which expires at the end of the commitment period following the one during which it was issued. Like lCERs, these credits are considered to be non-permanent or temporary and must be replaced by permanent GHG emission reductions sometime in the future.

UNFCCC – United Nations Framework Convention on Climate Change

The agreement signed by 192 countries at the Earth Summit in Rio in June, 1992 under which climate change is monitored and addressed globally.

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